DOORSTEP LANDSCAPE

Towards an inclusion of the space-pump in the design of a metropolitan food cluster in Venray

Master Thesis Landscape Architecture
Wageningen University
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Preface.

This thesis report is the result of my research to the possibilities to optimise the consequences of the space-pump related to the development of a metropolitan food cluster in Venray. I conducted this research as part of my Master study landscape architecture and planning at the Wageningen university. This report is the result of work executed between September 2012 and June 2013.

My interest for the agricultural sector in the Netherlands, origins from my youth, where I grew up at my parents small farm. I was surrounded by farmers, and experienced how they sometimes struggle with developing their sector in a world of prejudices, misconceptions, restrictions, rules, and regulations. I see the potential of concepts such as the metropolitan food cluster for the Dutch agricultural sector, but also for the Dutch landscape, and felt that more research was needed.

Working on this thesis was challenging, but also satisfying to see that large scaled agricultural developments might be possible, and at the same time provide an ecological, and recreational attractive landscape. This thesis can contribute to the discussion about the Dutch agricultural sector, and the livestock sector in specific. I hope this thesis reveals possibilities to include concepts as the space-pump in the planning and implementation of a metropolitan food cluster.

During the process of this thesis I have been supported by several people. I would like to thank Paul Roncken, and Peter Smeets for their critical, and motivating supervision. Many thanks for the advice, and expertise of all people who helped me during this thesis. Furthermore I would like to thank my colleague students, friends, and family for their endless help, and support.

Summary.

Dutch agriculture has a changeable relation with the landscape. Up till the nineteenth century the agricultural sector was harmonious interwoven with the landscape. While in the twentieth century this relation changed drastically. Accelerated by several innovations such as artificial fertilizer, the roughland was reclaimed in order to suit agricultural production. Large farms would arise in the middle of the rural landscape, which were still depending on this landscape. Nowadays many farms lost this direct relationship with the rural landscape partly, or complete. Farms import many of their raw materials, and are still growing bigger. Approximately 50 to 70 percent of these farmers will quit their production in the near future, while the other farms take over their productions, and grow to 'mega' proportions. For many reasons, including the prevention of a rural landscape full of these 'mega' farms, a metropolitan food cluster can be developed. Hereby the industrial activities of agriculture are clustered in one or more agroparks, which together with the productive land, are an important part of the metropolitan food cluster. By developing the agroparks as part of the urban landscape, the rural landscape can in the future be prevented of large-scaled agro-industrial activities scattered around the landscape.

The current research is mainly focussed on the agropark, and the metropolitan food cluster. As a side-effect of the development of these concepts several authors mention the concept of the space-pump. By clustering the industrial agricultural activities in an agropark, these activities will disappear from the rural landscape, and create space for other functions to develop. That the development of a metropolitan food cluster has an impact in the area where the cluster will be developed may be obvious. But, the occurrence of the space-pump implies that this development also might have a large impact on the current rural landscape. An impact which is currently just limited mentioned as a small side-effect of the cluster development. In order to explore the possibilities for landscape architecture to contribute to the concept of the space-pump, and to contribute to the discussion about the development of agriculture in the Netherlands, this thesis is focussed on: to what extend and in what way can a landscape design contribute to optimize the consequences of the space-pump concept related to a metropolitan food cluster?

The concept of the space-pump is never researched as an individual concept before. Therefore this thesis started with a small theoretical basis. Based on this theory, reference studies, and the comparison with other landscape processes, the space-pump is defined as: a process, starting with function decay caused by a trend in the form of land-use in a certain area, until the moment a new form of land-use completely occupies the same physical area. By using this definition of the space-pump, the concept is no longer exclusively linked to the development of a metropolitan food cluster. Also processes such as demographic shrinkage, or the arising of brownfields contain a space-pump. In the case of the metropolitan food cluster the space-pump can occur threefold. First in the form of physical land which is no longer essentially needed in the new system. Second, in the current stables, and third in the policy zones, such as odour circles, which will disappear and create space for other functions to develop. A process that shows many similarities with the framework concept of Kerkstra, and Vrijlandt (1990). Whereby a spatial separation of high-dynamic, and low-dynamic functions creates space for both develop in an optimal way. This opens the field for landscape architecture. By approaching the development of a metropolitan food cluster, and the space-pump as one regional transition, goals can be reached, which cannot be reached on an individual basis.

The area of Venray, is one of the possible regions where the transition to a metropolitan food cluster can take place, and thus also the space-pump. Venray contains a very vital livestock sector, and the local authorities are willing to consider the further development of this sector. Large parts of the landscape in Venray are reclaimed for large-scaled agricultural purposes. This provided Venray with many very large livestock farms which belong to the top of the world in

their field. This sector is economical, and social very important for the region, but has also some negative consequences. One of these negative consequences is the blurring of landscape characteristics. The large scaled agricultural developments provided Venray with a very monotone agricultural landscape, where the relation with the diverse abiotic systems is lost. Especially the stream valleys are disappeared, influenced by a range of interventions.

The reasoning around the metropolitan food cluster can be considered as profit oriented. In order to prevent also a profit oriented development of the space-pump in Venray, it is important to take also the ecological, and the social perspectives into account. An important notion is that the farmers have the essential power in this regional development. Only by giving them an (economic) desired perspective in the metropolitan food cluster, they can start the transition, and the space-pump. Whereas the economic perspective is important in the cluster, the ecological, and the social perspective can be represented in the space-pump. Important considerations for the location of the metropolitan food cluster in Venray are, the existing concentrations of livestock farms, and the infrastructural hotspots. While important considerations for the space-pump are ecological vulnerable areas, or the desired identity of the villages.

The 'doorstep landscape' in Venray is a design for the space-pump based on the three important perspectives. If the new functions in the space-pump of Venray need to compete with the region, Venray has a long way to go. But, the main advantage is that the space-pump is located almost at the doorstep of the inhabitants of all villages, who can reach this area by for example foot, or bike. By restoring the stream valleys as ecological, and recreational attractive zones, not only the lost relation between the village and the stream can be restored, but moreover the many farmers who quit, or move their intensive agricultural production, have an incentive to change their farm function, in a function ready for the future. On the one hand, the up-scaling farmers will be offered the possibilities to develop a metropolitan food cluster, a pull-factor, while on the other hand the diversifying farmers, and the inhabitants will be offered space to develop an desired landscape for them, a push factor. This chain process can offer possibilities for several groups of interest that are not possible on an individual basis.

A landscape design can contribute to the space-pump by integration of the metropolitan food cluster, and the space-pump as one regional development. Only than a broader range of profit types can be satisfied, economic, ecological, social. But, the space-pump always remains a consequence of a certain development, in this case the metropolitan food cluster, and the design should therefore not conflict this development. Moreover, the space-pump is no predetermined, and predictable process. Every space-pump is different, therefore a landscape design is essential to frame this process in a desired way in the current landscapes.

Content.

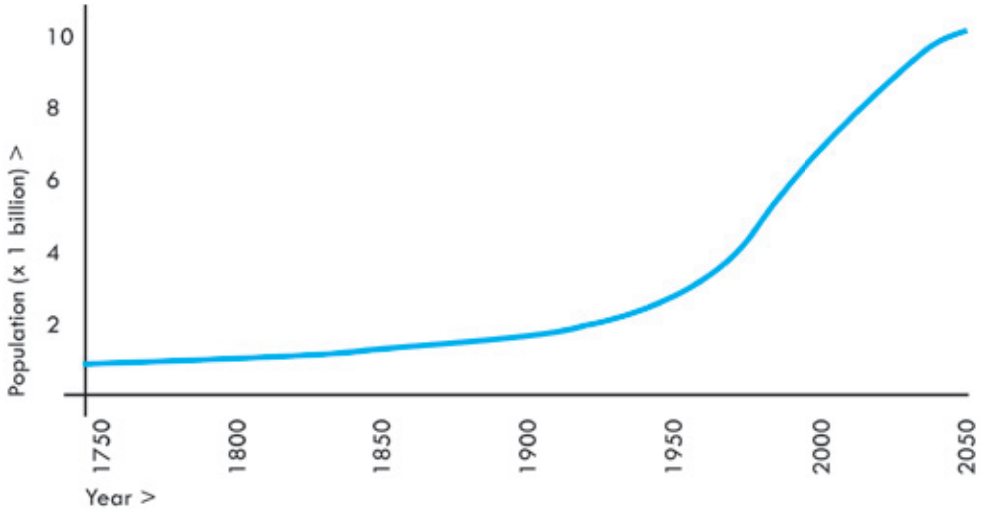
1

Context

Dutch agriculture has a changeable relation with the landscape. Up till the nineteenth century the agricultural sector was harmonious interwoven with the landscape. While in the twentieth century this relation changed drastically. Accelerated by several innovations such as artificial fertilizer, the rough-land was reclaimed in order to suit agricultural production. Large farms would arise in the middle of the rural landscape, which were still depending on this landscape. Nowadays many farms lost this direct relationship with the rural landscape partly, or complete. Farms import many of their raw materials, and are still growing bigger. Approximately 50 to 70 percent of these farmers will quit their production in the near future, while the other farms take over their productions, and grow to 'mega' proportions. For many reasons, including the prevention of a rural landscape full of these 'mega' farms, a metropolitan food cluster can be developed. Hereby the industrial activities of agriculture are clustered in one or more agroparks, which together with the productive land, are an important part of the metropolitan food cluster. By developing the agroparks as part of the urban landscape, the rural landscape can in the future be prevented of large-scaled agro-industrial activities scattered around the landscape.

1.1 Food a contested issue.

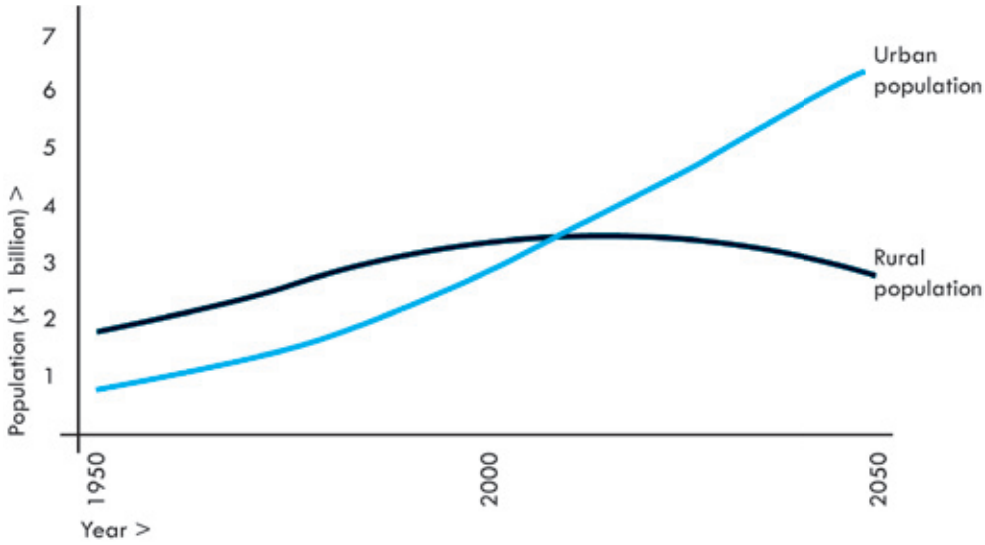
Food scarcity is one of the biggest threats for humanity on this planet. Food scarcity is together with infectious diseases, water scarcity, natural disasters, and population displacement by Myers and Patz described as the greatest public health challenge humanity has ever faced (Myers & Patz, 2009). Human, as a species have proven to be very well able to rearrange the natural world to meet our own needs. This transformation has caused trends such as rapid population growth, and rapid economic development in the last centuries (Myers & Patz, 2009). The supply and availability of food has proven to be a crucial factor in the persistence, development, and emergence of human civilization throughout the ages (Charles et al, pp. 2769, 2010). The earth's ecosphere is extensively modified by human activities to meet our present needs. At this moment one-third to one half of our planet is modified by human for production purposes (Myers & Patz, 2009). In the past decades food has become more readily available than ever before in human existence. This partly explains why food policy has become less prominent in national, and international policy-making (Charles et al, pp. 2769, 2010). This might become a huge threat for humanity. Although historical concerns that an increasing food consumption might outstrip planet earth's ecological resource base, there is just limited evidence that humanity is facing a Malthusian collapse (Myers & Patz, 2009). The extensively researched relationship between environmental change, and infectious diseases might not be the largest threat humanity is facing. It may turn out that scarcity of food, and water combined with a higher vulnerability to natural disasters, and people displacement will lead to a higher morbidity, and mortality compared to infectious diseases (Myers & Patz, 2009). The global food scarcity is, or will be caused by many factors, such as: population growth, urbanisation, land-use change, rising food prices, unequal distribution of food, and climate change.



1.1 Growth of world population.

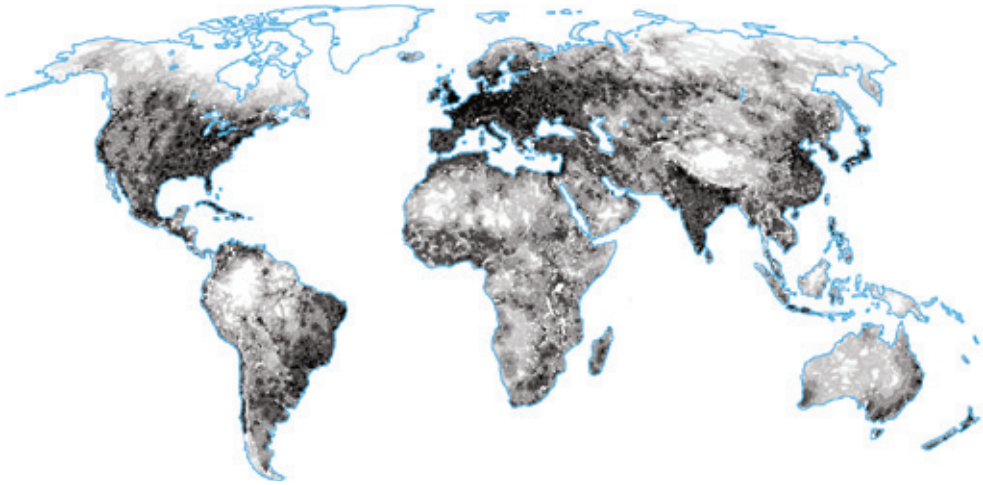
Till the year 2050 the world population is expected to grow with 2.3 billion people from 7 billion now to 9.3 billion (United Nations, 2012)(fig. 1.1). This growth of population has a two-sided effect of the demand of food worldwide. On the one hand this growth causes more people on this planet that need food. But, on the other hand, a trend in this same population is a growth of wealth, which causes an increasing food consumption per capita. Both put pressure on the global food production (Charles et al, 2010)(Lotze-Campen et al, 2008)(Myers & Patz, 2009). The main problem in this trend is not the raising amount of calories added per capita,

but the increasing share of animal calories in the diet (Lotze-Campen et al, 2008). This is the so called 'two dollar rule', when a family's income transcends the two dollar, people tend to consume more meat. This is not merely a exposure of wealth, while the most important cause of malnutrition is a shortage of proteins, which can easily be solved with a raise in meat consumption (Smeets et al, 2010). The 'protein malnutrition' is not only an important problem in third-world-countries, but also in the poor neighbourhoods of the western cities (Smeets et al, pp. 27, 2010).



1.2 Growth of urban population in contrast to the decrease of the rural population.

Related to the demographic, and economic growth of the world's population is the effect of urbanisation, which also put an important pressure on the world food production. People move to cities for reasons such as financial security, a better education for their children, and better job prospects, and people migrate to cities in great numbers (Smeets, pp. 38, 2009). Whereas the world's population is expected to grow with 2.3 billion people in 2050, the urban population is growing even faster. The united nations expect that till 2050 the urban population will grow with 2.6 billion people to 6.3 billion (United Nations, 2012)(fig. 1.2). Thus, in 2050 almost 70% of the world's population will live in cities. People in cities have a better access, or expect to have a better access, to a greater diversity of food with a higher quality (Charles et al, 2010). Precisely this urbanisation puts a pressure on the food production. There are less people producing food, while also the productive area is shrinking (Charles et al, 2010)(Smeets, 2009).



1.3 Worldwide urbanisation.

The form of land-use change, such as urbanisation, which puts a high pressure on food production is rising (fig. 1.3). A prominent example is China. "The population of China is growing, and is living mainly in the eastern part of the country. But, this is exactly where the fertile areas are. The western part is mainly mountainous, or desert. In total only 11% of the Chinese territory is suitable for agricultural production of food. These areas are put under high pressure of urbanisation. At this moment already China is importing large amounts of raw materials for livestock feed. When the economic growth of China continuous, it will become even harder to support their own needs for food" (Smeets et al, pp. 27, 2010). But, urbanisation is not the only change in land-use which put the food production under pressure. Other land-uses are for example: biofuels, or unnecessary production such as tobacco, and sugar. The biofuel production caused a raise of 75% in food prices (Choudhury, 2011). Although some countries, such as the United States, have often argued that the impact of biofuels on the world food-market is limited, this seems to be claimed from a self-serving perspective of interests in the biofuel industry (Holt-Gimenez & Peabody, 2008).

Land-use changes are generally considered as local environmental issues, but this is a factor of global importance. Global land-use changes to forests, farmlands, and waterways are driven by the need for food, water, and shelter for the world's population (Foley et al, 2005). Humanity has proven to be very good able to shape the world to increase the share of the planet's resources (Myers & Patz, 2009). But this trend is also undermining the capacity of earth's ecosystem. We are balancing between the needs of humanity on the one hand, and maintaining the biosphere's capacity on the other hand (Foley et al, 2005). The climate change can in this perspective be seen as simultaneously cause, and consequence of the tenuous relatonship between humanity, and its producing capacity. It is very likely that climate change will have a large impact on worldwide food production. One possible consequence of climate change is the increase of water scarcity in some parts of the world, such as the United States, or North-East Brazil (Myers & Patz, 2009).

Food scarcity can be considered as a worldwide problem. But certainly not every person on this planet experiences this treat equally. "A total of 80 percent of the world's production is consumed by the wealthiest 20 percent of the world" (Choudhury, pp. 96, 2011).We cannot state that our food distribution system is functioning appropriate when between 2 and 3.5 billion people suffer from micronutrient deficiency (Choudhury, pp. 100, 2011). More than one billion people worldwide suffer from hunger, while another over one billion people suffer from obesity

(Charles et al, 2010)(Choudhury, 2011). Therefore Fresco argues that we are not facing a food crisis, but a crisis in our way of thinking about food (Fresco, 2012).

Another effect related to unequal distribution is the waste of food. Food wastage happens everywhere along the food chain. From the moment of harvesting up to the consumer (Charles et al, 2010). Food wastage is an important cause of environmental destruction, and food shortages. In the United Kingdom, between 30 and 40 percent of the food is not eaten. In the United States, this amount raises up to 50 percent (Choudhury, 2011).

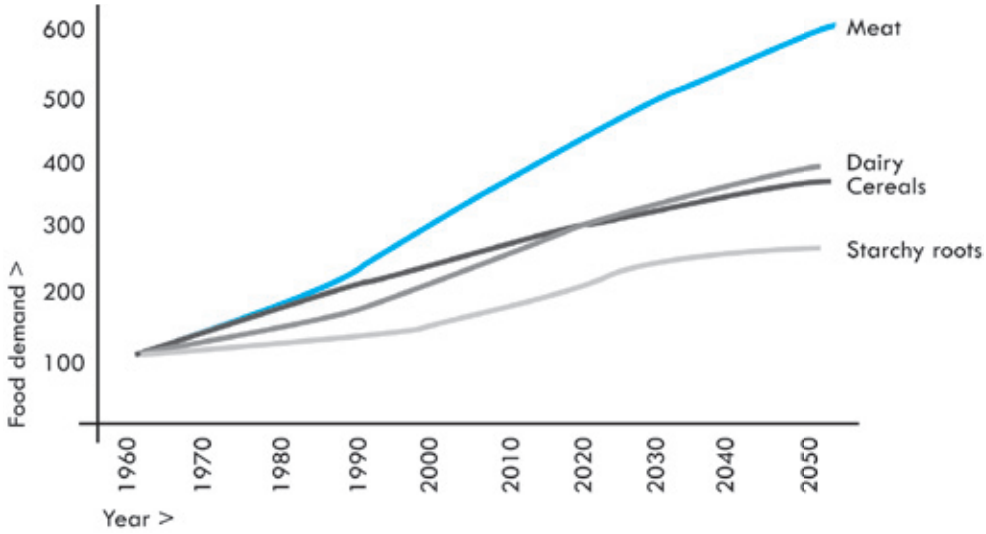
All effects mentioned in this paragraph have an influence on the worldwide food scarcity. Whether they influence the food production, or they influence the food consumption. Both are expecting to increase the food scarcity, and this will affect the food prices. Between 2005, and 2008 the food prices raise with approximately 60 percent (Trostle, 2008). It is unclear whether the rising food prices in itself have a consequence for worldwide food scarcity.

Food scarcity is a worldwide problem in 2012, and is strongly related to infectious disease exposure, water scarcity, natural disasters, and people displacement. How these problems interact, and how much suffering humanity will experience in the future is uncertain, and impossible to project without also having understanding of the effectiveness of mitigating factors that should protect humanity to these forces (Myers & Patz, 2009). "Will economic development occur in patterns that increase the capacity of the world's poorest people to access international food markets? What degree of responsibility will the wealthy countries and international community take for helping the poor reduce their vulnerability? How rapidly will technology and infrastructure proliferate to make more efficient use of water, soil, and fertilizers; produce energy more cleanly; break transmission cycles of infectious disease; or a host of other interventions? To a large extent, our global society will decide how much suffering results from large-scale environmental change by the way it answers these questions" (Myers & Patz, pp. 243, 2009). The inability to make realistic prospects of the development of trends in relation to human health impact should not be an excuse for complacency (Myers & Patz, 2009). Humanity is pushing earth's ecosystems to its limits to produce for the needs of our generation. The relationship between human population, and their resource base is already tenuous (Myers & Patz, 2009), and existing prospects forecast an even higher pressure on this relationship, whereby food scarcity can be seen as a cause, and an effect.

1.2 Agriculture's role.

Food scarcity, a global issue? The food scarcity as described in the previous paragraph is a phenomenon open for discussion. When 1.2 billion people worldwide suffer from hunger, while another 1.2 billion people suffer from obesity (Choudhury, 2011) we can in my opinion not state that there is per definition a food scarcity. The problem of food scarcity as we know it now, might be the consequence of a deeper, and more complex problem. Maybe, the food scarcity is not the problem, but the scarcity of 'equal distribution' of food among the world's population is the real problem. That parts of the world now, and in the future suffer from food scarcity is pretty obvious, but the degree of suffering, and the location is impossible to project. The problem therefore is too complex, and too interrelated with other trends (Myers & Patz, 2009). Thus, it is unclear what the problem is, and how it will develop, but also the possible solution can be sought in many directions. As Holt-Gimenez and Peabody discuss, is there a food-scarcity, or an overpopulation (Holt-Gimenez & Peabody, 2009)? There is a change in demand for food around the world, the world's population tends to consume ever more meat (Smeets et al, 2010)(fig. 1.4), but should we search a solution to adjust the supply to meet the changing demand? Or should we search for solutions to adjust the demand to the changing trends in supply? Probably the solution is somewhere in between all extremes, and in all kinds of disciplines. The biophysical limits of agricultural food

production are far from reached. When all suitable land would be used till its limits, and all food would be distributed equal, there would be an affluent diet of 4.2 kilograms grain equivalents per person a day, for almost 50 billion people (Penning de Vries et al, 1995). This is more than five times the expected world population by the United Nations in 2050 (United Nations, 2012). Although this seems to be the solution for the problem, Penning de Vries also determines this as a theoretical calculation, which can never be met (Penning de Vries et al, 1995). It is more realistic to prepare for expected trends like the triple of grain prices when China's demand for livestock products keeps rising (Koning et al, 2008). This shows that in the problem of food scarcity all field are involved, from politics to economics, and from agriculture to consumer. In short, the problem of food scarcity is extremely complex. One should not have the illusion that the discipline of agriculture alone, or even less this thesis would be able to solve the problem of food scarcity.

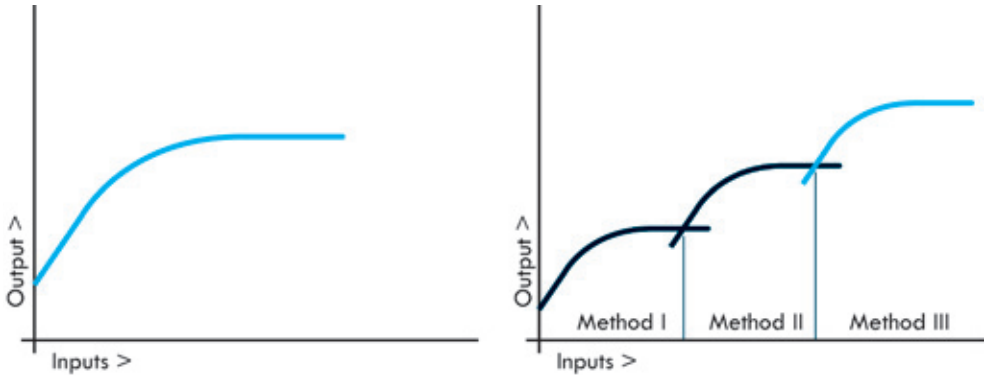


1.4 Projected global food demand till 2050.

From this moment the discussion about the problem of food scarcity in general will be left, and the focus will shift to the possible role of agriculture in contributing to solve this problem. Two important ways how agriculture can contribute to the solving of food scarcity is by changing its methods, and improving its productivity (Choudhury, 2011)(Foley et al, 2005)(Koning et al, 2008)(Myers & Patz, 2009). Whether this really results in reducing the food scarcity can be seen as beyond agriculture's power. When trends such as an increasing population, increasing urbanism, increasing unequal distribution, and change in diet continues, it is questionable to what extend agriculture can contribute to a solution. But it may certainly be considered as part of the solution.

To reflect on this problem in historical perspective, the problem of food scarcity, agricultural intensification, and population growth are historically all closely related. Already in 1817 English economist David Ricardo stated that "the additional mouths could only be filled by reclaiming les fertile lands or by using more labour-demanding soil management techniques" (Ricardo, 1817, quoted in Koning et al, pp. 230, 2008). In the late 19th century the introduction of several innovative developments broke these constraints. Modern transport, artificial fertilizers, electricity etc. have raised the supply of food with so much, that it outstripped the demand for food of that time (Koning et al, 2008). Nowadays the situation has changed. The situation now is more comparable to the situation of the beginning of the 19th century, where food scarcity, population growth, and agricultural intensification are closely related. Until 2050 the global demand

for food will probably more than double, while the total area to produce has to suffer from ever more competition of other land-use purposes (Koning et al, 2008). An important thing agriculture can do is increase their productivity, and use more effective methods (Choudhury, 2011)(Foley et al, 2005)(Koning et al, 2008)(Myers & Patz, 2009).



1.5 Agricultural methods. Left: improvement of input-output within one method. Right: improvement of input-output by different methods.

95 percent of the world's food supply is produced by farmers under the paradigm initiated by the Neolithic farmers 10.000 years ago. A small part comes from foraging, and a tiny part comes from industrial food production methods. Whereas some have reached their limits, such as foraging – natural fish stocks are already overexploited – especially the industrial production methods might gradually expand (Koning et al, pp. 232, 2008). Increasing productivity has its ecological limits, but it is an important method to raise the supply (Myers & Patz, 2009).

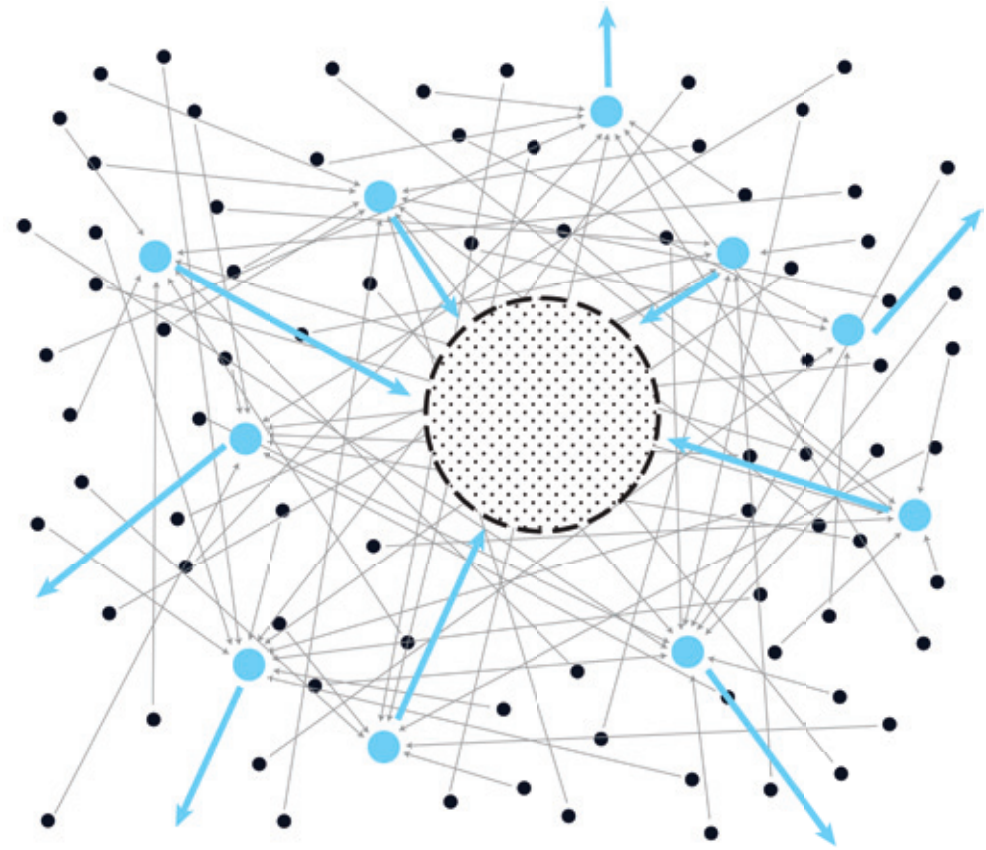
Increasing productivity has its limits. On a certain moment a higher input does not any more result in a significant higher output (fig. 1.5). At the moment the returns of input become marginal, the agro-production system needs to be replaced with a method that makes more productive use of a higher input (fig. 1.5) (Koning et al, 2008). One possible new agro-production method is the use of genetically modified crops. The aim of this method is to grow crops with higher yields in places with unfavourable conditions. Although this new method would technically be effective, there are concerns raised, with regard to the effect of genetically modified crops on aspects such as biodiversity (Holt-Gimenez & Peabody, 2008).

In summary, agriculture's role in the food scarcity problem can be increasing productivity, and introducing new, more effective methods. Humanity is nowadays expanding the agroproduction landscape to its limits, limits which are determined by our existing body of knowledge. What lies behind these limits is unknown. These limits may change, when new options to increase input-use efficiency are discovered that were hidden by the specific pathway that human knowledge has taken. Our knowledge about the limits might change slowly, or suddenly, as a consequence of new breakthroughs in human knowledge (Koning et al, 2008). But, we have to base our progression of agriculture on the basis of existing knowledge. "It would be highly speculative to attach any time horizon to the realization of the hypothetical options" (Koning et al, pp. 262, 2008).

1.3 The metropolitan food cluster.

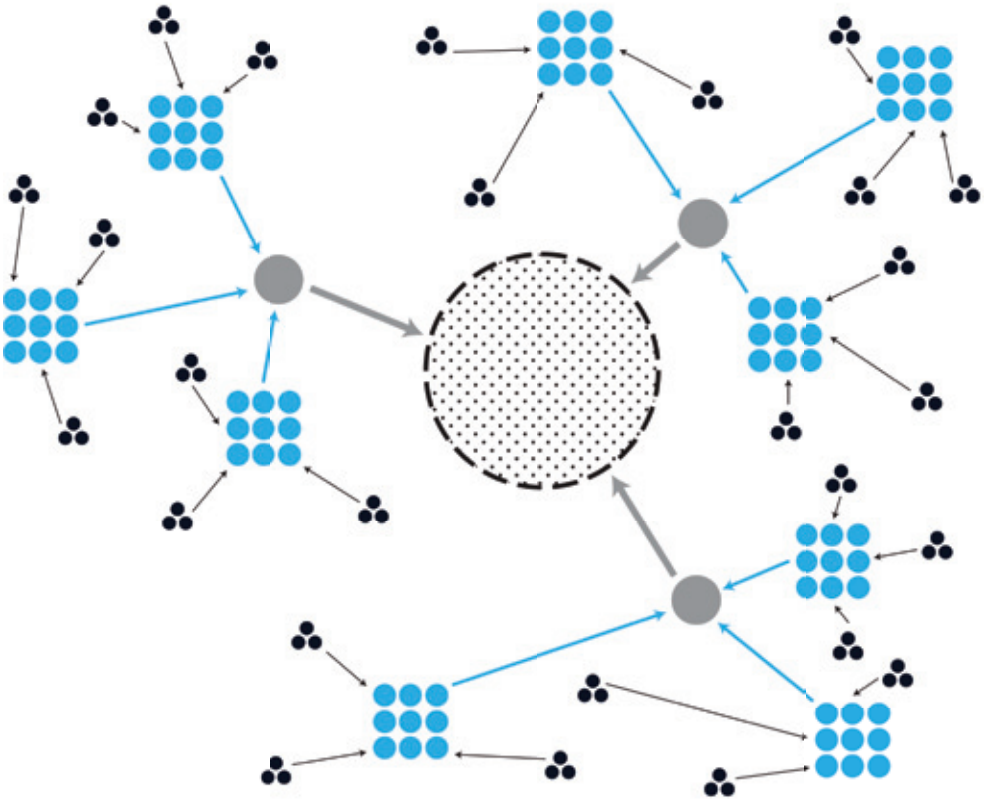
An important thing agriculture can do to contribute to a solution in the worldwide food scarcity, is increasing their productivity in a more sustainable way, and use more effective methods (Choudhury, 2011)(Foley et al, 2005)(Koning et al, 2008)(Myers & Patz, 2009). Koning argues that within a certain method a maximum productivity can be reached (Koning et al, 2008). For some forms of agriculture this point might be close. A higher productivity within the existing methods is hard in some cases. Smeets argues that in his opinion: "the productivity of agriculture can be increased to such an extent that good, sustainably produced food could be available for all people. Agroparks are put forward in [his] publication as a contribution to this goal" (Smeets, pp. 18, 2009).

An agropark is part of a metropolitan food cluster. The agropark, together with the productive land is an important part of a Metropolitan Food Cluster (MFC) (fig. 1.6 & 1.7). Through the years different terms, and definitions are used to describe the concept of agroparks, terms such as agroproduction-parks, or agroclusters. The concept of agropark is mentioned for the first time by Wilt et al, in 2000. Wilt defines an agropark as: "An agroproduction-park is



1.6 System of conventional agriculture, many individual companies a disorganized, inefficient system.

a purposeful clustering of (agro) production-functions in a certain region, on the basis of the concept of industrial ecology" (Wilt et al, pp. 9, 2000). Later other definitions arose, but most of them are based on the definition of Wilt. Bruere defines an agropark as: "the development of a cost-reductive, and value-adding combination of (agro, and non-agro) functions on, or around, one location"(Breure et al, pp. 13, 2007). Mager and de Wilt have a definition which is much more specific than the previous ones: "An agropark is essentially a regional cluster of agro businesses in which plant and animal production and processing chains are integrated and combined with other functions of society, including food and non-food industry, energy, water & waste management, education & training, recreation & leisure, trade, logistics & transport and spatial planning"(Mager & de Wilt, pp. 2, 2007). Smeets defines in 2009 an agropark as: "a cluster of agrofunctions and related economic activites on or around a location. Agroparks combine highly productive plant and animal production and processing in industrial mode with the input of high levels of knowledge and technology. The cycles of water, minerals and gases are skilfully closed within the cluster of different chains, and the use of waste products and by-products in the chains. Non-agricultural functions such as energy production and waste and water management can also be integrated in the industrial process. An agropark may therefore be seen as the application of industrial ecology in the agrosector. Agroparks are the outcome of a design process, in which



1.7 System of a metropolitan food cluster, co-operation between companies.

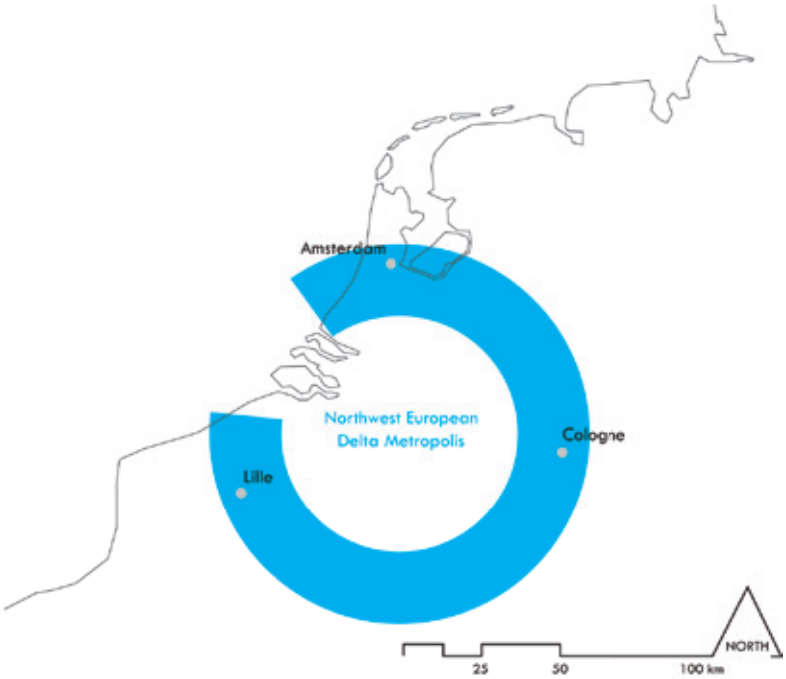
a new balance is sought between agriculture as it functions in global networks, and in the local environment of those same farms, especially in metropolises. An agropark is a systems innovation, i.e. not just the innovation of agricultural production itself but also of other relationships between the stakeholders concerned. In this regard the concept of sustainable development occupies centre-stage as a set of objectives that are simultaneously concerned with a reduction in environmental pollution, greater economic return and a better working and living environment for the people concerned" (Smeets, pp. 39, 2009). All definitions differ in specific phrasing, and level of specification. But, all definitions do not conflict each other. For the purpose of this thesis, the definition of Smeets will be used. Because of the high level of specification, and the most recent publication.

Wilt was the first who described the concept of agroparks, and made an important link between agriculture, and industrial ecology (Wilt et al, 2000). The concept of industrial ecology was mainly used in industry whereby methods were sought to use the waste materials of one process as raw material for another process (Frosch & Gallapoulos, 1989). The application of industrial ecology in the agro-sector is one of the main advantages of an agropark, for example by the re-use of waste-flows, water and energy, and the closure of production cycles. Among the advantages Smeets mentiones in the definition of an agropark, a second advantage is the logistics efficiency. A clustering of the agro-production chain provides less, and more efficient movements of logistics (Broeze et al, 2003). Third advantage is the spatial quality. By an efficient use of space, the landscape can be 'saved' from large building (Broeze, 2003). Fourth advantage is economical profit. The reduction of inputs, and transport provides a reduction of costs (Broeze, 2003).

A metropolitan food cluster is one of the new methods to increase productivity of agriculture, and a contribution to a more sustainable way of producing food, compared to the most existing agricultural methods methods (Smeets, 2009). Smeets calls this the industrialisation of agriculture (Smeets, 2009). The shift from the existing form of agriculture towards a form of metropolitan food clusters, requires a major shift in our way of thinking about food production. Many people like the (historical) image that food is produced by craftsmen on a local farm. This is not the reality. Maybe this way of food production suited the world decades ago, but the world, and its conditions have changed, and will continue to change (Fresco, 2009). The world is urbanising rapidly, the difference between rural and urban is getting blurred, the food demand of consumers is changing (Smeets et al, 2010). Humanity has taken for granted that farmers are able to provide a sustainable basis of food, now and in the future. But, "industrialisation of agriculture is barely taken into account in the spatial development of modern metropolises" (Smeets, pp. 38, 2009). The agricultural activities still take place in the rural landscape. It is the main land-user over there, and wants ever more space to grow. But the growing urban population wants to 'live' in these rural landscapes (Smeets, 2009). Further development of agriculture, even if this takes place in the countryside as it is used to, is becoming increasingly difficult to implement in most places in the metropolis (Smeets, pp. 38, 2009). Already since the 1960s there is being sought to expand the industrial activities into the urban landscape, into a spatial concentration of the most intensive forms of agriculture (Smeets, 2009).

1.4 Agriculture in the delta metropolis.

Although the Netherlands is just a small country, it is widely recognised for a large and innovative agricultural sector. But in this small country there is a continuous discussion going on about this sector. Think about subjects such as the 'mega-stables', the intensive livestock, the emission of greenhouse gasses. How could this sector develop to its actual state, and to the largest land-user in the rural landscape when there is so much friction, ?



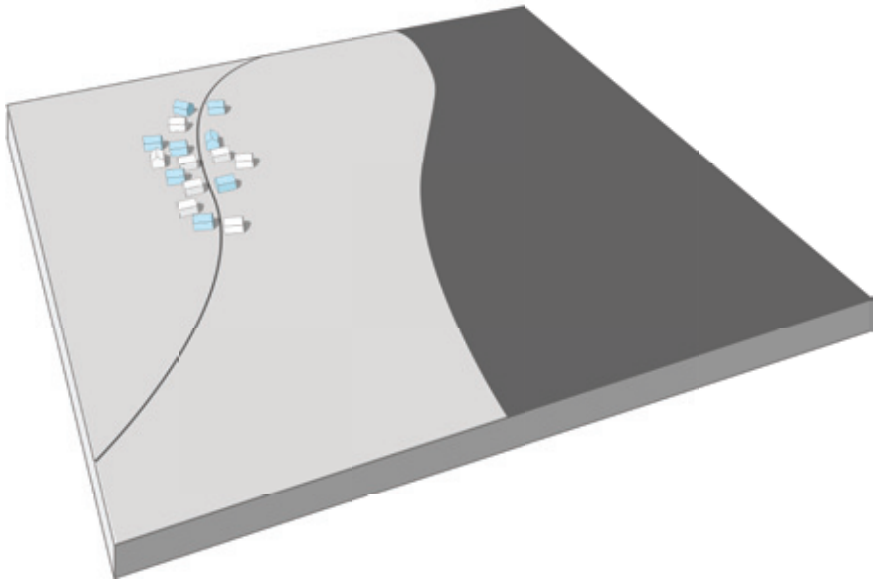
1.8 The northwest european delta metropolis, strongly related with high-class agriculture.

"There is a common misunderstanding that the pioneering role that a country as the Netherlands has played in the development of modern agriculture is linked to the rural areas. In fact it is linked to the urban areas" (Smeets et al, pp. 109, 2009). The global competition will take place in the great metropolitan areas, not in the countryside (Smeets, 2004). Two important types of metropolitan areas can be distinguished, the metropolitan areas that have developed around the centres of government, and the delta metropolis that has developed mainly in China, and Europe (Smeets, 2004). These societies could transport larger cargo on the river, and therefore grow larger cities. These metropolises would develop separately from the administrative centres, in the Netherlands Rotterdam, and Amsterdam could develop separately from Den Haag, in Belgium Antwerpen, and Brugge could develop separately from Brussel, and in China Wuhan separately from Bejing (Smeets, 2004). This urbanisation was the driving force for the success of the Dutch agriculture (Smeets, 2004).
The urbanisation lead to the development of the Northwest-delta metropolis, which includes the German Ruhr area, the largest part of the Netherlands, and the north-western part of Belgium (Tress et al, pp.12, 2004)(fig. 1.8). Because of circumstances like a delta, or more specific a harbour for transport, the Northwest-delta metropolis could develop, and parallel the (Dutch) agriculture could develop to a leading sector in the world. In the city live those people who need food, but are not able to grow it themselves. These people deliver labour, but not directly for agriculture. The city is a pool of purchasing power, of money to buy food, and partly be invested in agriculture. There is a flow of materials, and money between the city and the countryside.
The flow of materials is food for the city (Fresco, pp. 320, 2012). The development of the delta metropolis caused a large flow of food from the countryside to the cities, and from money from the cities to the countryside. The methods of the agricultural enterprises in this metropolis are to a large extend improved, and industrialised. But the spatial organisation did not develop parallel to this development due to a lack of collaboration between the agricultural sector, and the spatial planning organisation (Smeets, 2004).

1.5 Dutch agriculture and the landscape.

Till today many agricultural activities still take place in the rural landscapes. The possible emergence of metropolitan food clusters lead to the conclusion that core activities of the agricultural system become part of the urban system (Smeets, 2009). The relation between the agriculture, and the rural landscape on the one hand, and the conflict between agriculture, and the urban landscape on the other hand, might appear as very obvious for many people. But, historically agriculture and the living-environment of people was much more interwoven than today.

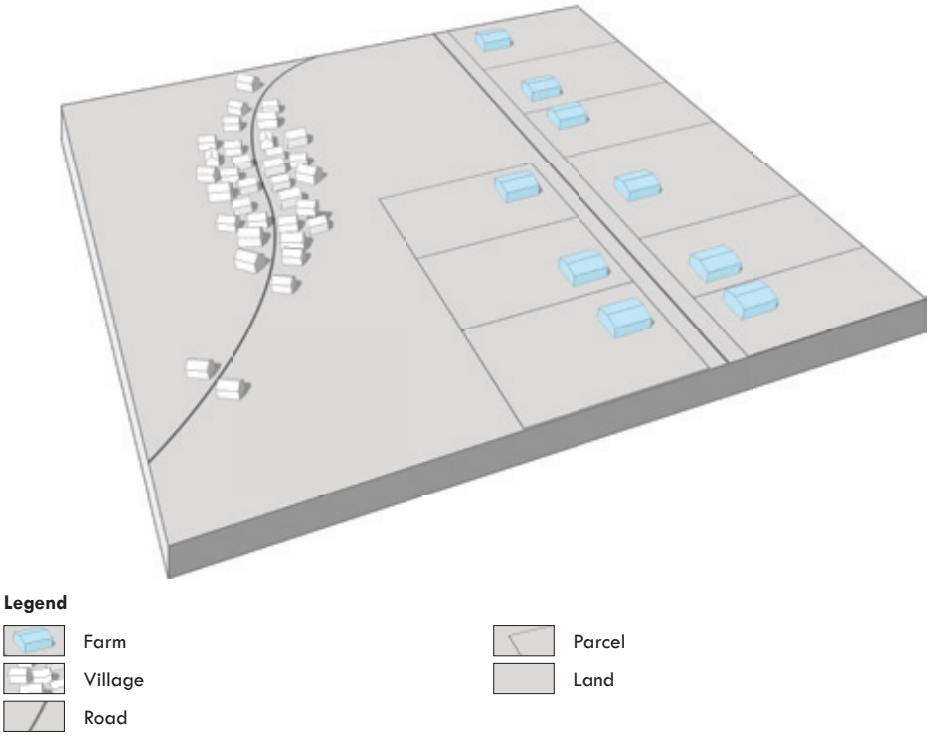
Until the late 19th century large parts of the Dutch sand-landscapes contained 'rough lands' of heather or peat. These lands were very important for the form of agriculture of that time. The farms were part of the villages. Livestock was held in the villages, and was moved for grazing to the rough lands (Thissen, 1993). The heather-land was an important source for the agriculture. Not only for grazing, but also the materials were used in the stables, the land was used for the agriculture, and many more functions. The stables were individual, but the management of the land was commonly. The amount of manure that the livestock of a certain farmer produced, determined the amount of land that could successful be used (Thissen, 1993). In this period of time there was a clear separation between the urban/built-up areas, and the rural landscape, but agriculture was highly interwoven with both (fig. 1.9).



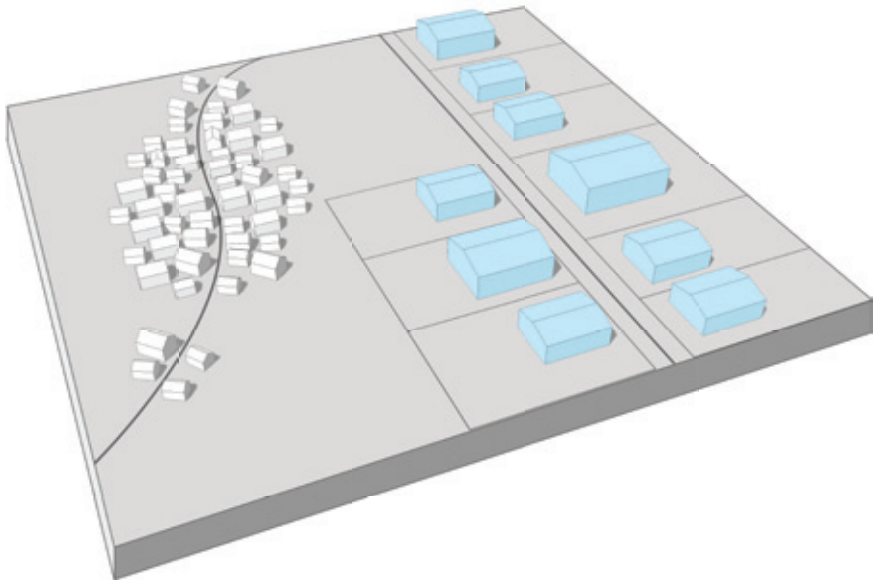
1.9 Relation of agriculture and the landscape in the 19th century. Agriculture highly interwoven with the urban, and the rural landscape.

At the end of the 19th century the existing form of agriculture changed rapidly. This change was mainly caused by a changing demand for agricultural products, the industrialisation in England, and Germany, and some spectacular innovations (Thissen, 1993). The introduction of artificial fertilizer was the most important invention. This invention had drastic consequences for the existing methods of agriculture. The laborious manure-distribution system could disappear. That immediately caused that the most important function of the rough lands disappeared. The importance of the collaborative maintenance of the land was not necessary anymore, and farmers started to focus on their own land (Thissen, 1993)(Rijksdienst voor het Cultureel erfgoed, 2011). This was the start of the large-scaled land reclamation in the sand-landscapes between 1880, and 1960 (Rijksdienst voor het Cultureel erfgoed, 2011).

The poor rough lands could be made fertile with the use of the artificial fertilizer (Thissen, 1993). Developments such as the construction of roads, railways, and canals speeded the process of land reclamation up, as also the growing market for agricultural products, and the developments in agricultural science (Rijksdienst voor het Cultureel erfgoed, 2011). In the situation with the rough lands, the farms were concentrated in the village, and the lands were scattered over the rural landscape. In the situation after the land reclamation farms moved to the rural landscape (fig. 1.10). For technical reasons the farms were located separately in the rural landscape. The land around the farms belonged to individual farmers. They used the land for the production of raw materials for the farm. This had a high impact on the social organisation of the farmers (Thissen, 1993). From this period on the agriculture became less interwoven with the urban landscape. Agriculture became totally part of the rural landscape. For the agricultural methods of that time, this was a very logical step.



1.10 Relation of agriculture and the landscape in the 20th century. Agriculture only interwoven with the rural landscape.



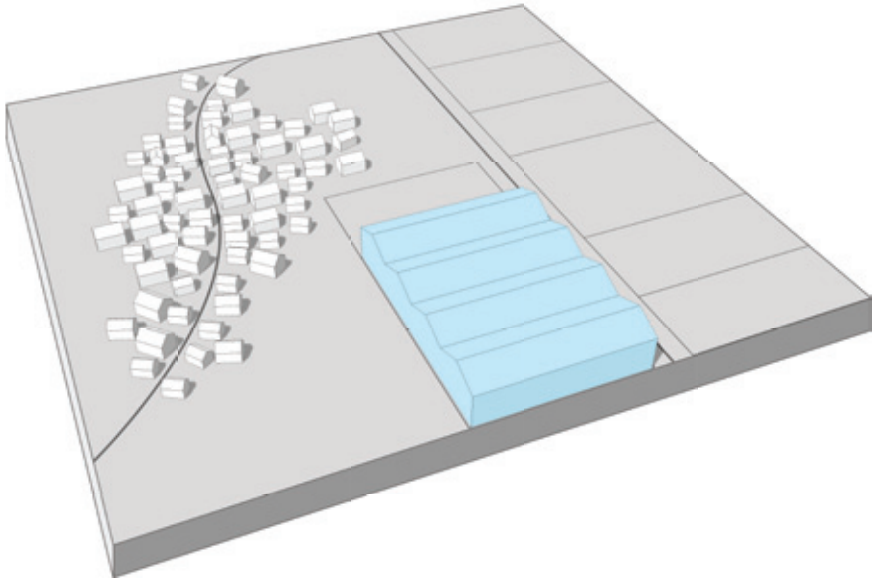
Legend

Farm
Village
Road
Parcel
Land

1.11 Possible relation of agriculture and the landscape in the 21th century. Agriculture highly interwoven with the rural landscape, causing the appearance of 'mega-stables'.

The reclamation of rough land for agricultural purposes was a quick developing trend. In 1885 the Netherlands contained still over 700.000 hectares of rough land, in 1940 just 250.000 hectares were left. After that time the speed of the process slowed down, and totally stopped in 1961 (Thissen, 1993). Thus the first decades the amount of agricultural land increased, but also the prices for agricultural products reduced drastically. From the 1950's on, many farmers were within the existing form of agriculture not able to provide a good income for their family. Increasing the amount of land was no possible option, and especially from 1963 this problem grew fast, a problem also known as the 'small farmers problem' (Witte, 2009).

The decrease of prices for agricultural products together with the increase of prices for raw materials and artificial fertilizer was the engine for a period of rationalisation, specialisation, mechanisation, and intensification, which started in 1963 (Witte, 2009). Farms started to specialise their functions, they started to focus on a specific agricultural product. It became easier for farmers to loan money to expand their farms, but not so much in terms of the amount of land. An important part of the fodder had to be imported. This was more profitable than using the products of your own land for your own livestock (Witte, 2009). The farms were not anymore depending on their own land. Till the 1960's farms were producing within the abilities of their own farmland. During later decades farms grew to large specialised companies that import almost all of their raw materials. The farms do not essentially need the landscape anymore. In this period, which still continues today, the agriculture is still part of the rural landscape, but the functional relation disappeared (fig. 1.11).



Legend

Agropark
Village
Road
Parcel
Land

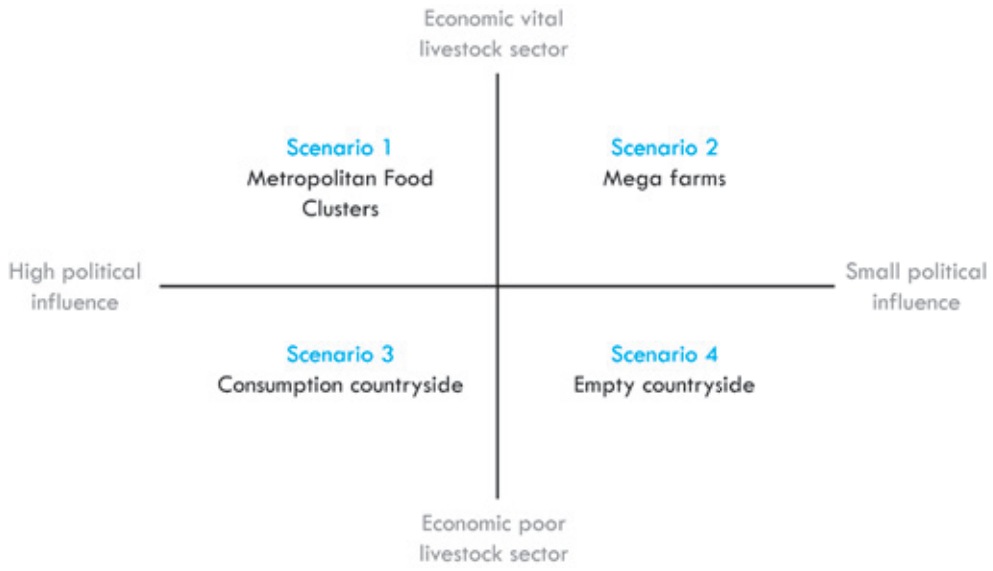
1.12 Possible relation of agriculture and the landscape in the 21th century. Agriculture highly interwoven with the rural, and the urban landscape, by the development of metropolitan food clusters.

In summary the relation between agriculture, and the urban or rural landscape is a variable one. Agriculture started as highly interwoven part of the urban, as well as the rural landscape. This continued till the late 19th century. From that time on, agriculture became totally part of the rural landscape, with an important functional relation. But, from the 1960's this relation became blurred. Agriculture is still located in the rural landscape, but does not have a functional relation anymore. A metropolitan food cluster would again change this relation (fig. 1.12). Smeets states that in the concept of metropolitan food clusters, important parts of agriculture become part of the urban space (Smeets, 2009). In this concept the not-land-dependent parts of agriculture will be spatially clustered, and become part of the metropolis, close to the people. The rural areas are only used for forms of agriculture that have a functional relation with these areas. One could argue that this new relation is a revised and up-to-date version of the period of agriculture till the late 19th century.

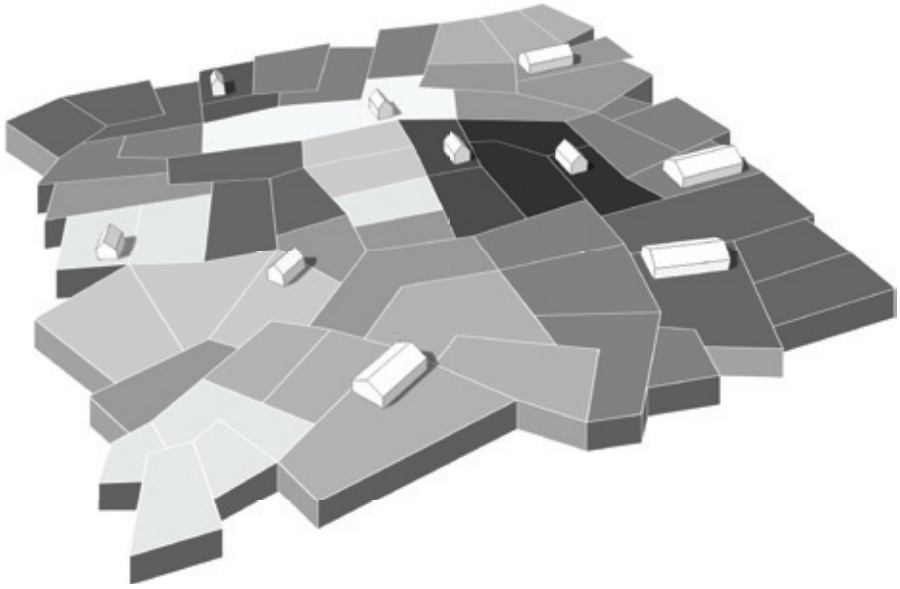
1.6 The future of the agricultural landscape.

Independent of de developments around a possible transition from the existing form of agriculture to metropolitan food clusters, the Dutch agriculture is going to change. Several changes in agriculture will have consequences for the sector itself, but also for the landscape, where the sector is situated (Agricola et al, 2010). The changes will gradually unfold, and consequences may vary per region (Agricola et al, pp. 13, 2010)(Koomen et al, 2005). One major trend, with important consequences is the shortage of successors in the agricultural sector. More than 58 percent of the labour-force is older than 50 years. 73 Percent of these 'older' farmers do not have a successor (LEI, pp. 42, 2011). Without any exception, every agricultural sector has shown an decrease of producers over the last decade, and it is highly probable that this trend will continue in the future (LEI, 2011). The decrease of producers does not mean a decrease of production. The producers that have a successor might take over the production of the producers without successor. Important related trends are the up-scaling, intensification, specialisation, crop-change, farm-diversification, and company termination (Agricola et al, 2010)(Koomen et al, 2005).

How these trends will develop in the future is uncertain. The actual development is depending on other macro processes, such as the economic vitality, the political situation, and the actual circumstances in the region (Agricola et al, 2010)(Koomen et al, 2005)(Huls, 2011). A possible trend related to economic vitality is: that the price paid for agricultural products will become under pressure (Huls, 2011). Possible political trends, that in a way also influence the economic situations, are: a fast reduction of European agricultural policy, what would mean that the Dutch agriculture should, more than ever before, compete on the world market (Koomen et al, 2005). Another trend is the abolition of milk-quota, what probably will result in larger dairy-producing farms (Huls, 2011). Higher requirements on animal welfare, and environment, might cause a reduction of intensive livestock farms (Huls, 2011).



1.13 Overview of the four scenarios of possible futures for the Dutch agricultural landscape.



Legend

Individual farm

Land belonging to individual farm

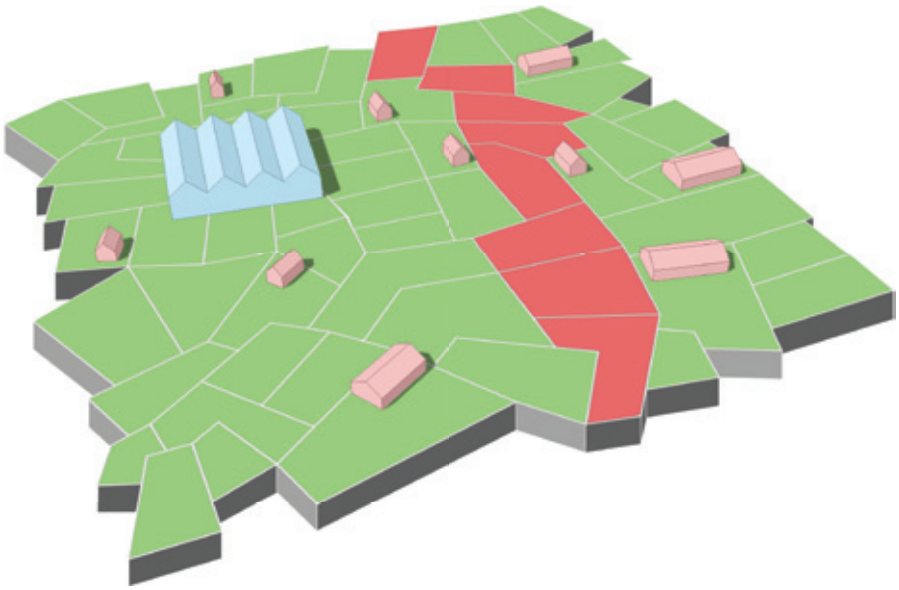
1.14 Schematic model where all scenarios will be projected on. Ten individual operating farms.

Whether the agricultural trends really occur as expected now is uncertain, even as the consequences of each trend. There is no unambiguous image of the agricultural future possible. In order to give an insight in the possible developments in agriculture, and its consequences for the landscape, the scenario method will be used to express a range of alternatives, and different futures (Cornelius, pp. 94, 2005). This method differs fundamentally from forecasting, as this method accepts the uncertainty. “Scenarios are not projections, predictions, or preferences. Rather, they are coherent and credible stories, describing different paths that lead to alternative futures” (Cornelius et al, pp. 94, 2005). For this method two processes with a high uncertainty, and high influence on the future livestock sector are projected against each other, resulting in four possible ‘scenarios’. For the Dutch agricultural future two important processes are the degree of economic vitality of the livestock sector, and the degree of political influence on the livestock sector (based on (Agricola et al, 2010)(Koomen et al, 2005)(Huls, 2011)). This results in four scenarios: metropolitan food clusters, mega-farms, consumption-countryside, and empty countryside (fig. 1.13). Each scenario will be described in the next paragraphs. Each scenario will be visualised by an schematic model. This thesis is focussed on the livestock sector, and therefore an average cross-section of ten Dutch livestock farms is taken to visualize the scenarios, six dairy farms, three pig farms, and one chicken farm. Each farm functions on an individual basis (fig. 1.14). They have their own stables, and their own land. See for a detailed calculation of the cross-section, and the related references appendix I.

1.6.1 Scenario I Metropolitan food cluster.

With a strong political influence on the developments in agriculture, and a vital economic situation in the livestock sector, it is highly probable that the agriculture will develop towards a scenario of metropolitan food clusters. The concept of metropolitan food clusters is detailed described in paragraph 1.3. This concept is related to the trends of up-scaling, intensification, and specialisation. The transition to a metropolitan food cluster requires a strong role of the politics. Farms that want to grow move to a 'cluster area' (agropark) because of policy-regulations. The farms use closed, low-emission stables, this makes the farms not-land-dependent (Cormont et al, 2012). The location will be based on the availability of maize and grass, and the supply of roughage. A location nearby a harbour is therefore most suitable (Cormont et al, 2012). Especially national politic party D66 is a proponent of this scenario. In their election programme of 2012 they argue for a vital future perspective for the agricultural sector, subsidies for agricultural innovation, and a possibility to build very large farms if they meet higher criteria (D66, pp. 41, 2012).

The transition from livestock farms to a metropolitan food cluster will have significant different consequences on the landscape than an intensification of for example the horticulture. The transition to a metropolitan food cluster might become the most visible in large buildings with an industrial image, spatially clustered around one location (Koomen et al, 2005). But, on the other hand, in some areas where the intensive livestock is settled now, the influence will reduce, or maybe disappear (Koomen et al, 2005)(fig. 1.15). This reduction is based on two reasons, first the farmers will leave the existing buildings in favour of a building in the cluster, and second when the land will mainly be used to produce roughage for the animals in the clusters, there might be an overproduction on agricultural land (Cormont et al, 2012). This effect can develop in roughly two directions: there is a risk that the landscape gets messy under influence of a wide range of unintended, and undesired consequences, but on the other hand this provides chances to develop the landscape in a desired direction (Koomen et al, 2005).

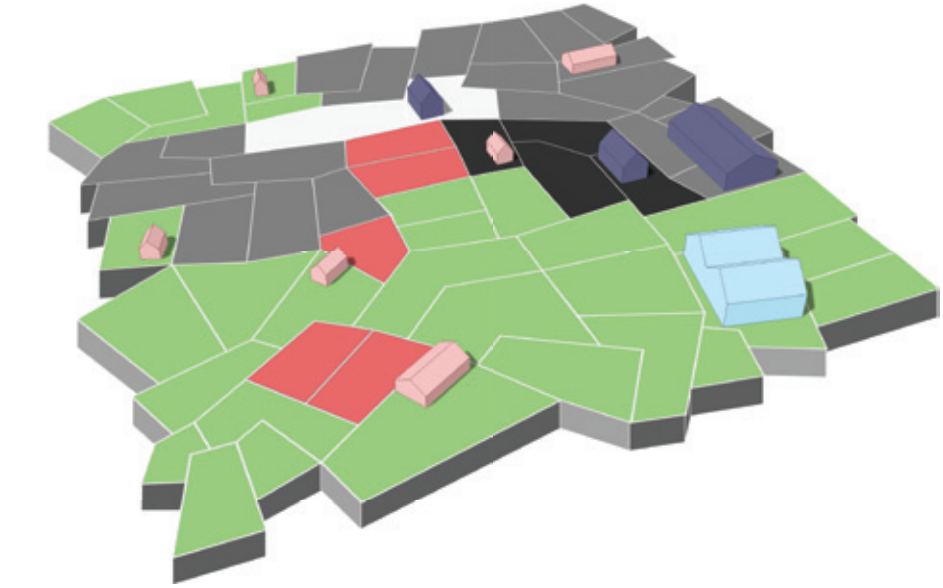


1.15 Schematic projection of scenario I metropolitan food cluster. Function decay in land, buildings, and policy zones.

1.6.2 Scenario II Mega farms.

When the economic situation in the livestock sector will be vital, and the political influence will be minimal, it is very probable that these areas will develop towards a scenario of 'mega-stables'. This scenario is closely linked to the scenario of 'autonomous development' as described by Cormont et al (2005). Here a calculation is made that it is highly probable that livestock farms with a successor expand on its existing location in the rural landscape when the politics do not trigger the farmers to move to a more desired location (Cormont et al, 2005). This development is related to the up-scaling in the agricultural sector, which is essential for the continuity of the farms (Vogelzang et al, 2010). Not all farms with successor will expand on their existing location. The 'entrepreneurs' of the farmers may be willing to develop a metropolitan food cluster on their own initiative. These cluster will in concept be the same as described in scenario one 'metropolitan food clusters', but they will be much smaller in scale (fig. 1.16). An example of this development is the 'New mixed farm' in 'Horst aan de Maas' (Kool et al, 2008). Dutch national political party VVD is a proponent of this scenario. In the VVD election programme of 2012 they argue for a strong, and vital agricultural sector that can compete on the world-market, and a reduction of the policy pressure in the favour of economic development of agriculture (VVD, pp. 37, 2012).

The developments in this scenario will have a large influence on the Dutch landscape (Agricola et al, 2010). The most important consequences will be the: compaction of the landscape by large buildings, the appearance of industrial mega-farms scattered over the rural landscape, the disappearance of characteristic parcel structure, and the disappearance of the cow out of the meadow (Agricola et al, pp.7, 2010). Because of the developments in this scenario, there might become some space available to develop for other functions. But, with a minimal political influence, this space will be much smaller, and more scattered than in a scenario of 'metropolitan food clusters'.

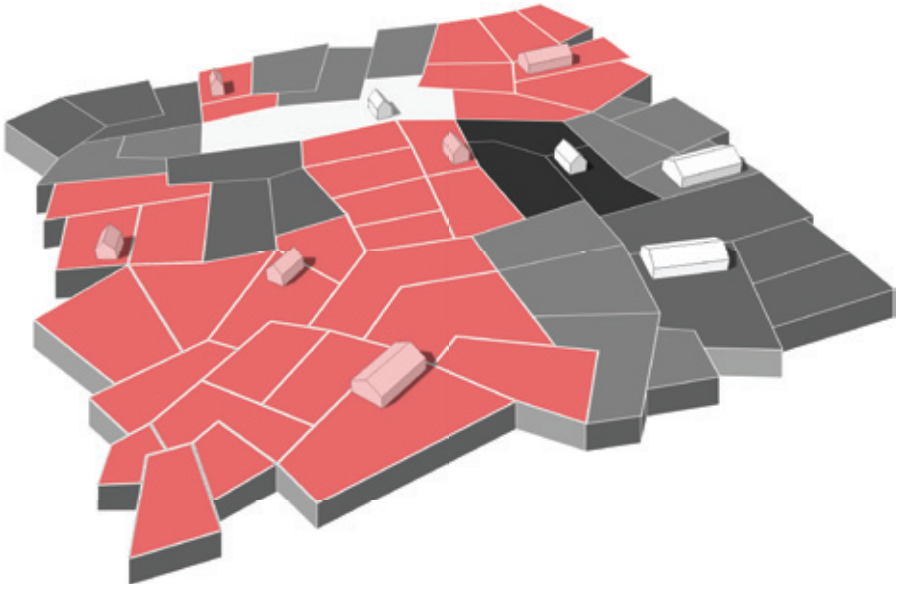


1.16 Schematic projection of scenario II Mega farms. Individual developments, mixture of metropolitan food clusters, mega farms, and function decay in buildings, land, and policy zones.

1.6.3 Scenario III Consumption countryside.

When the livestock sector gets economically weak, and the influence of the politics is high, there is a high chance that the scenario of a consumption countryside will unfold. In order to enhance the continuation of agricultural activity, to broaden the income base, and to enable steady farm development, the farmer might diversify their farm (fig. 1.17). “Diversification has always been an economic adaptation strategy in periods of farm business crisis” (Lange et al, 2012). It is a survival strategy of extending the on-farm business, and thus providing additional income resources (Lange et al, 2012). A high political influence will accelerate this transition, and may even turn out to be an essential factor. Policy interventions may play a positive role in farm diversification by offering funds or subsidies (Markantoni & Strijker, 2012). Dutch political party PvdA is a proponent of this scenario (PvdA, pp. 54, 2012), but the SP is even a stronger proponent. In their election programme they argue for a reduction of intensive livestock, a stop on ‘mega-farms’, and a political support to trigger farmers to produce biological food, or diversify their farm activities (SP, pp. 51, 2012).

The diversification of the countryside has an economic side, but also a cultural side. The countryside will slowly transform from a place merely for food production, to a place for food consumption, and recreation (Brandth & Haugen, 2011). Other more spatial consequences are the higher chance on a messy countryside caused by the many individual transitions, and the possible effect of agricultural nature maintenance (Agricola et al, 2010). The consequences will differ per region. In areas with a high urban pressure, agricultural functions might quicker diversify than in more remote areas (Koomen et al, 2005).

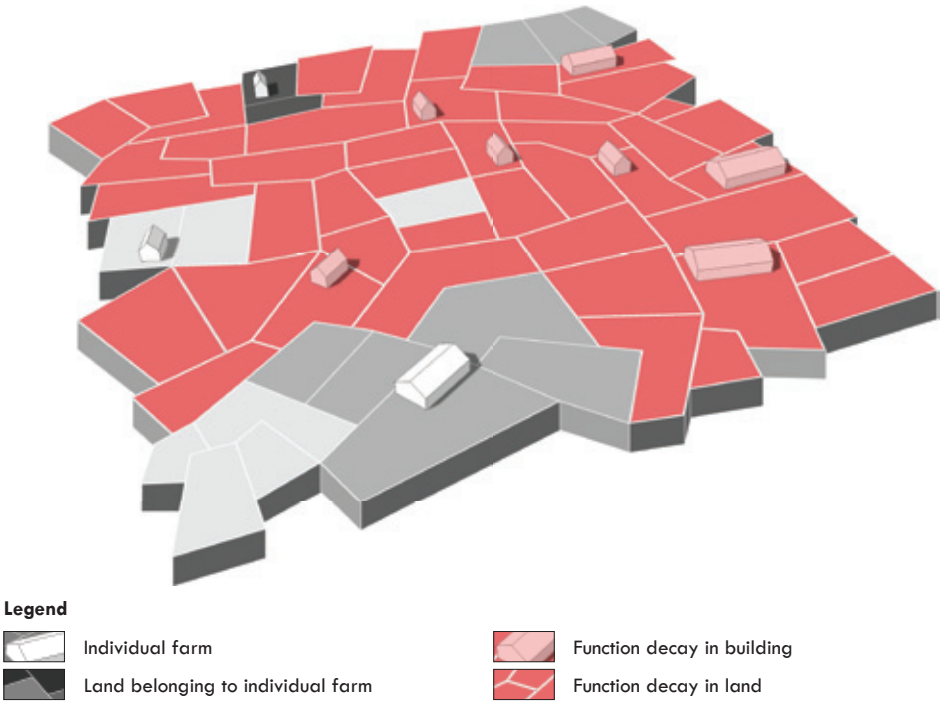


1.17 Schematic projection of scenario III consumption countryside. Continuation of regular farms, and function decay in buildings, land, and policy zones.

1.6.4 Scenario IV Empty countryside.

With a minimal political influence on the developments in agriculture, and a non-vital economic situation in the livestock sector, it is highly probable that the agriculture will develop towards a scenario of 'empty countryside'. When farmers cannot generate a full income from their actual agricultural activities, they can either diversify their activities, or quit (Pols et al, 2005). With a minimal political influence, farm-diversification is hardly an option. Large investments are not possible anymore in this economic situation, and the countryside will have to deal with a process of function decay (fig. 1.18). Only cheap forms of for example recreation, and living will have a future in the countryside (Pols et al, 2005). The Dutch national political party PVV is a proponent of this scenario. They argue in their election programme that in their opinion the Intensive livestock sector has no future in the Netherlands, but that the consumers should regulate this transition by stop buying the products of this sector. Politics should not have a large influence on this decision (PVV, pp. 43, 2012).

In this scenario the landscape faces different consequences, for example a reduction of financial investments in the countryside, and a demographic shrink of the countryside population. These consequences are associated with vacancy of buildings, more extensive use of land, and bad maintenance. Agriculture will remain the most important function in the countryside, because new functions are hardly able to develop. Existing landscape structures will be remained, but they will not be maintained, and may in the future become rougher (Pols et al, pp. 54, 2005). This scenario is not per definition related to demographic shrink of the population in a whole region, (urban and rural population). This type of shrinkage has a limited influence on the agricultural sector, and agriculture has just a limited influence on demographic shrink (Kuhlman, 2012).



1.18 Schematic projection of scenario IV empty countryside. Continuation of some regular farms, much function decay in buildings, land, and policy zones.

1.7 Conclusion.

This scenario-study shows that the future of the Dutch agricultural sector, and the livestock sector in specific, is uncertain. Not one of the before mentioned scenarios will turn out to be the absolute truth. As Agricola mentioned, "the transitions in agriculture will transcend slowly, and can vary largely per region" (Agricola et al, pp. 13, 2010). Economic vitality of the livestock sector is among other factors depending on local circumstances, are their possibilities to scale up for example. Also the political influence can vary per region, as the municipal politics play a major role in this type of transitions.

In the end it might turn out that all scenarios, or a combination of them, will arise in different regions. Signs for this development are already visible in parts of the Netherlands. First scenario of 'metropolitan food clusters' is not yet visible in the physical environment, but plans are being made to take this development into the local policy, for example in municipalities like Venray (Gemeente Venray, 2006), which have a very vital livestock sector. Second scenario of 'mega stables' is arising in many places in the Netherlands. Especially in Noord-Brabant this development is going on (van Os & Gies, 2010). On the very small scale initiatives are undertaken to transform to a metropolitan food cluster. The only example in the Netherlands that will contain livestock is the 'New mixed farm' in 'Horst aan de Maas' (Kool et al, 2008). Third scenario of 'consumption countryside' is especially going on in countrysides with a high urban pressure (Koomen et al, 2005) or in landscapes with recreational qualities that are less suitable for agriculture (Agricola et al, 2010). This scenario is for example going on at the hilly areas of southern Limburg (Agricola et al, 2010). The fourth scenario of 'empty countryside' is not visible on a large scale in the Netherlands, at least not yet, only areas such as the northern part of Groningen have to deal with this phenomena on a small scale.

This thesis is focused on the development, and effects of scenario 'metropolitan food cluster'. The other three scenarios will not be discussed further. This scenario-study serves as an exploration of possible futures. Metropolitan food clusters is a probable future in regions with circumstances such as a vital livestock sector, and a high political influence. Although this thesis is completely focussed on the metropolitan food cluster, it is not denied that there are more possible futures, which might also occur in several regions.

2

Research structure.

The current research is mainly focussed on the agropark, and the metropolitan food cluster. As a side-effect of the development of these concepts several authors mention the concept of the space-pump. By clustering the industrial agricultural activities in an agropark, these activities will disappear from the rural landscape, and create space for other functions to develop. That the development of a metropolitan food cluster has an impact in the area where the cluster will be developed may be obvious. But, the occurrence of the space-pump implies that this development also might have a large impact on the current rural landscape. An impact which is currently just limited mentioned as a small side-effect of the cluster development. In order to explore the possibilities for landscape architecture to contribute to the concept of the space-pump, and to contribute to the discussion about the development of agriculture in the Netherlands, this thesis is focussed on: to what extend and in what way can a landscape design contribute to optimize the consequences of the space-pump concept related to a metropolitan food cluster?

2.1 Landscape machine design lab.

This thesis is undertaken as part of the landscape machine design lab. A design lab founded in 2012 of students writing their master thesis in landscape architecture on a topic related to the concept of 'landscape machines', with supervision of Paul Roncken. The aim of the design lab is to discuss, and present the thesis work in progress in order to strengthen all individual researches, and thereby contribute to the overall body of knowledge about the concept of landscape machines. In this way all individual researches undertaken to this topic can profit from each other, and future research can be built upon this knowledge. This thesis has for example a strong relation with the thesis of Zwartkruis, undertaken in 2012 about the possibilities to combine the concept of agroparks with the concept of landscape machines (Zwartkruis, 2012).

Landscape machines is a concept to deal with productive landscapes. Productive landscapes are the issues that can affect society very rapidly. The concept of landscape machines results in sublime landscapes that are resilient, and have their value for landscape services. The definition of the landscape machine can be seen threefold, first, a landscape machine should be seen as a productive landscape, which addresses an existing malfunction in the landscape. Second, the natural processes in the landscape are stimulated, or enlarged in order to improve the input-output ratio. Third, a landscape machine is not 'made', it develops in different stages: an initial stage, a growth state, and a yield state (Roncken et al, 2011). These productive landscapes are driven by a certain amount of energy, and material input, and output. For example water and sediments as material input, and food, air and clean soil as output. The natural processes within the landscape machine are continuously interfering. Processes such as physical, chemical, and ecological processes (Roncken et al, 2011). Four types of landscape machines can be distinguished, the production type, the waste treatment type, the system-repair type, and the renewable energy type (Stremke et al, 2012). This thesis is also dealing with a productive landscape, and might come closest to the 'production type' landscape machine. In this way this thesis can contribute to the formation of a general body of knowledge about the landscape machines.

2.2 Knowledge gap.

The current research on metropolitan food clusters, and more general the future of agriculture, is dividable in two categories. The functioning of these metropolitan food clusters, and the development of agriculture in the past and future, but there has been done few research on a third category. A category of research what the effect of these food clusters actually is on the existing landscape, and what the optimal balance is between this new form of agriculture, and eventual other landscape functions. The research that has been done in this category is mainly a very limited part of the research to the development of the actual metropolitan food cluster.

The development of agriculture in the past, and its changing relation with for example the landscape, or society is been researched extensively by for example: (Brandt & Haugen 2011)(Collantes, 2007)(Curtis White, 2008)(Duffy et al, 2005)(Lobao, 2001)(Zaizhi, 2000)(Zhang, 2011). This category of research contains mainly qualitative studies. In contrast to the category of studies focussing on the future of agriculture, the studies in this category are not solely approached from an agricultural perspective, but there is a wide range of perspectives present.

Also the future-development of the agriculture has been researched extensively by for example ((Breure et al, 2007)(Broeze et al, 2003)(Ge et al, 2011)(Meerburg, 2009)(Renting, 2009)(Smeets, 2009)(Wilt et al, 2005)). The main part of these studies are written from the perspective of agriculture. This category of research has different topics, but the main focus is on

aspects such as the technical development of agriculture, the animal welfare, or the features of a metropolitan food cluster. What remains to be explored however, is how to frame these developments in an existing landscape, and the connection of these developments with the site-specific circumstances of the existing landscape. This deficiency in literature is partly confirmed by Ge et al, who argues that there might be a difference what fits the concept of a food cluster, and what fits the reality, for example with regard to the location of the agropark (Ge et al 2011). This deficiency in literature is also confirmed by Smeets in the discussion of his case-study. Many researched cases of metropolitan food clusters do not yet go beyond the functional cohesion of industrial ecology. They are based on functional working, and pay no, or limited attention to landscape values (Smeets, 2009).

Some research claims the working of a food cluster as 'space-pump' (for example (Smeets, 2009). The claim is that by clustering the industrial activities of the agriculture, the activities with a small direct, but a big indirect use of space (odour circles etc) disappear from the rural landscape, and thus create space for other functions (Smeets, 2009). This is one of all possible effects of a metropolitan food cluster on the rural landscape, and is just a marginal comment in comparison to the amount of research done on the topic of the cluster itself. The 'space-pump' effect is just limited researched, and it remains unclear what type of 'other functions' is optimal, desirable, and realistic in the areas of the 'space-pump', how the process of the space-pump will evolve, and what role landscape architecture can, or should take in this process.

2.3 Problem statement.

In the Dutch metropolitan areas there are many claims on the land such as urbanization, recreation, and infrastructure (Deelstra et al 2005 p. 23) The future of the existing form of agriculture in these areas is put under pressure. There has to be sought to forms of agriculture that contribute to the growing demands for food, develop a sustainable form of agriculture, and contribute to the demand for multifunctional land-use in these areas. For these, and other reasons an unbridled growth of the agricultural companies in the rural landscape is not desirable for the Dutch government (Ministry of economy, agriculture, and innovation, 2012).

The clustering of the industrial activities in a metropolitan food cluster is one of the scenario's that might provide an economic sustainable field of agriculture in the Netherlands, and not accommodate 'mega' stables scattered over the rural landscape (Cormont et al, 2012). This is not the only, or pure scenario that will turn out to be true in the future (see also paragraph 1.6), but this scenario foresees in a form of agriculture that might be profitable, sustainable, and accommodate a landscape without large agricultural developments scattered over the landscape (Cormont et al, 2012). Therefore this research will primarily focus on the scenario of agriculture developing towards a metropolitan food cluster.

The development of the agriculture towards a system of metropolitan food clusters is a very innovative development, with a large impact on the landscape, the agricultural sector, and (maybe indirect) society. As already mentioned in the paragraph 'knowledge gap', the past research is mainly focussed on the agropark, and less on the impact of the other parts of the metropolitan food clusters, for example the existing rural landscape. One of the principles in the scenario of metropolitan food clusters might be that the land in the rural landscape, which originally belonged to the individual farmers, will in the future only be used for the production of roughage for the grazing animals in the agropark. The development towards a metropolitan food cluster might in that sense cause an overproduction on the land. This area of overproduction can be used for other functions, such as nature, or energy crops (Cormont et al, 2012), this effect is an important part of the space-pump effect as described by Smeets 2009 pp. 279.

The 'space-pump' effect seems to be a concept that is under-developed. The metropolitan food cluster seems to be developed from a single perspective, namely the agricultural perspective. The space-pump is mentioned as a side-effect of this transition, these areas, buildings, or policy zones are in the metropolitan food cluster scenario no longer essentially needed for production purposes, thus provide space, or possibilities to develop functions such as nature. The metropolitan food cluster is a driver for change in the landscape. But, is the 'space-pump' effect, as it is approached now, really the most optimal, and desirable change in the landscape? Maybe approached from the perspective of the field of agriculture the answer might be: 'yes'. But agriculture is not the only actor in the landscape. The urban population for example is expanding, and willing to 'live' in the rural landscape (Smeets, 2009), there are many more perspectives such as biodiversity or energy. Landscapes are no longer solely the domain of agriculture. "Landscapes have become important resources that are claimed by different interest groups. Different perceptions and experiences of landscapes and different entitlements can result in misunderstandings and conflicts. This can be problematic if stakeholders do not recognise that their experience is one of many and that there is no such thing as an absolute view on landscapes" (Backhaus, pp. 193, 2011). What would be the ideal 'space-pump' effect when taking more viewpoints into account than just the agriculture? That will be the main focus of this research.

The presupposition in this thesis is that landscape architecture can contribute to the transition of the theoretical concept of metropolitan food clusters to the implementation in the Dutch rural landscape, by developing strategies how to deal with the space-pump effect. The whole concept of metropolitan food clusters can be considered as very much developed from the perspective of the agriculture, and how to keep this sector profitable, sustainable, and productive in the far future. For the implementation of this concept a one-sided approach will not work. Only by taking the multiple perspectives, and perceptions of the landscape into account, the space-pump effect, and the concept of metropolitan food clusters might have a successful implementation.

This problem is strongly related with my personal theoretical lens as landscape architect, as described in paragraph 2.7 'worldview', where I state that my personal focus lies on creating an environment that meets the desires of a globalising world, and has a connection with the local circumstances. In this sense 'the desires of a globalising world can be seen as the transition from regular agriculture towards metropolitan food clusters, and the 'connection with the local circumstances' can be seen as the optimal effect of this globalising concept seen from different [local] perspectives.

2.4 Contribution of landscape architecture.

Although some authors mention the space-pump as a positive side-effect of a development to a metropolitan food cluster, it might have an enormous effect on the landscape, which cannot per definition be determined as positive. The effects of the development of a cluster are widely mentioned by many authors, but the effects of the space-pump may be of the same size, and just limited mentioned. The profession of landscape architecture should explore their role in this process.

At this moment plans are being made to develop metropolitan food clusters. As several authors argue this development can be accompanied by the space-pump effect. Landscape architects should get involved in this process in an early stage. Lassus describes this intervening in an early stage in the case of a highway. According to Lassus the artistic design for a highway can be perfect, but the success of the design is depending on factors decided earlier in the process, factors like should you develop a highway at that place for example (Lassus, 1998). In other words, if the concept of metropolitan food cluster is developed with certain mismatches with regard to for example appearance, landscape architecture can impossible recover these mismatches. These mismatches should be prevented by involving landscape architecture already in an early stage.

Another reason why the profession of landscape architecture should contribute to the concepts of metropolitan food clusters, and the space-pump, is described by Fairbrother. According to Fairbrother a blind trust in preservation will not provide us with landscapes that meet our new desires. Also a blind trust in the future will not work because the conditions are too fast changing for a natural evolving landscape (Fairbrother, 1970). The development of metropolitan food clusters, and the space-pump effect can have an enormous impact on the landscape. It will imbue a drastic change in the way we think about agriculture, and the rural landscape. Landscape architecture should therefore take a role in the development of these concepts.

Corner argues that landscape architecture is distinguished from building architecture and other spatial art forms by the temporality of landscape (Corner, 1992). "The landscape is a living biome that is subject to flux and change by natural processes operating over time" (Corner, pp. 148, 1992). Structures, and patterns are continuously transformed by processes such as erosion, deposition, growth, and weather. The same landscape can be experienced different over time, engulfed in fog, or covered with snow. According to Corner the unique aspect of landscape architecture is to understand, and deal with this dynamic subject (Corner, 1992).

In landscape architecture, not only the subject 'landscape' is continuously changing, also the problems are unique. The space-pump might turn out to be a such a changeful concept. Therefore bleuprint solutions are not suitable, and every solution has to be designed for that specific problem. Designing is an important part of landscape architecture. Sasaki argues that designing essentially is a "process of relating all the operational factors into a comprehensive whole" (Sasaki, pp. 35, 1950). Sasaki argues that 'critical thinking' is important to understand, and solve a unique problem. Therefore the design process, and the critical thinking process should be combined at three stages. First, the research, "to understand all the factors to be considered". Second, the analysis, "to establish the ideal operational relationship of all factors", and third, the synthesis, "to articulate the complex relationships into a spatial organisation" (Sasaki, pp. 158, 1950).

This description of Sasaki does not yet state much about how to make a design, and what is the best design. Jones describes two extreme roles a landscape architect can take in the design process. First, the landscape architect as 'black box', a role who transforms an input by means of a mystified process into a design (Jones, 1970). Second, the landscape architect as 'glass box', whereby architects could function more as "a human computer, a person who operates only on the information that is fed to him, and who follows through a planned sequence of analytical, synthetic and evaluative steps and cycles until he recognizes the best of all possible solutions" (Jones, pp. 53, 1970). I would argue for a role of landscape architecture somewhere in between both extremes. The architect as glass box can be considered as impossible, and the architect as black box undesirable. A landscape architect should at least be able to make clear to others how a solution arose.

Designing is a process. In the design process of this thesis I will aim at reaching a design with a high quality. But when is the design of high quality, and what exactly is high quality? There are no predetermined rules in landscape architecture about this topic. Every situation, problem, and solution is different, and asks thus for a different type of quality. Another reason for this vagueness is given by Schön. Although Schön's book is not written for landscape architects specific, it reveals in my opinion an important issue in relation to quality of design: "we can recognize, and describe deviations from a norm very much more clearly than we can describe the norm itself" (Schön, pp. 53, 1987). This touches on an important part of landscape architecture, decisions always contain a value judgement. We are able to describe, and generalise the deviations from a norm, but we are not able to describe all possible deviations, and thus not able to describe a norm. Therefore it is for the sake of this thesis important to have clear research questions. That will create more clarity about the problem, the solution, and the quality of the solution.

In summary the profession of landscape architecture should contribute from an early stage on to the development of the concepts of metropolitan food clusters, and the space-pump effect for several reasons. First, mismatches within the concept cannot be recovered by landscape architects at a late stage. Second, a conservative preservation of the past, or blind trust in the future will not provide us with suitable landscapes for our future desires. Third, the profession of landscape architecture is the profession to connect the agricultural concepts to the concept of landscape, and fourth, design is an important part of landscape architecture, whereas solutions have to be designed for the continuously changing landscapes.

2.5 Research objective.

"Starting where it is the easiest" (Hough, 1990). This is a fundamental principle to achieve anything in the world. Through the media we are very aware of all kinds of global problems, from diminishing rain forest in Brazil, to poverty in Africa. In this time we have the tendency to be concerned with these global issues, and forget about the very places where many people live (Hough, 1990). The principle starting where it is the easiest has to do with intervene there where reasonably a certain measure of success can be made, no matter how small. According to Hough, successes in small things can be used to make connections with larger, and more significant problems (Hough, 1990). The small success of this thesis should be to contribute to the discussion about agricultural development in the Netherlands, but this is related to many large significant problems (large successes (Hough 1990)) such as global food production, food scarcity, and indirect aspects such as poverty.

The objective of this research is to explore the possibilities of landscape architecture to contribute to the concept of space-pump, and in that way, contribute to the discussion about agricultural development in the Netherlands. As mentioned in the problem statement, the agriculture is going to change in the future. It is highly probable that agricultural companies become larger in some areas (Cormont et al 2012). But, there is a high public resistance towards this development, for reasons such as impact on the landscape, and animal welfare (Ministry of economy, agriculture, and innovation 2012). By researching the relation between metropolitan food clusters, and its consequences as 'space pump' in an existing landscape, this research can contribute to this discussion.

Hereby my presumption is that landscape architecture can contribute to the concept of the space-pump, and that the concept of the space-pump can contribute to the discussion about the agricultural development in the Netherlands. I presume that the space-pump might change when this concept is approached from different perspectives, and that an approach which includes multiple perspectives will improve the possibilities of implementing the concept of metropolitan food clusters in the Dutch landscape.

This research will be an experimental design, that offers a perspective, and matter for the discussion about agricultural development. This research will in the end offer an image of how it could look, when multiple-perspectives are taken into account while shaping the space-pump.

2.6 Research questions.

This research makes mainly use of qualitative methods. Therefore the research questions should ask for an exploration of the central phenomenon in the study (Creswell, pp. 129, 2009). The research questions are open ended, and the central aim is to explore a certain phenomenon (Creswell, 2011), in this case the phenomenon of the space-pump in the area of Venray. The main research question for this study will be:

To what extend and in what way can a landscape design contribute to optimise the consequences of the space-pump concept related to a metropolitan food cluster?

The sub-research questions will be:

RQ1 What is the existing spatial, economic, and social situation of the agriculture and landscape in the study-area?

RQ2 What are the spatial possibilities, needs, and limitations of a metropolitan food cluster, and the space pump in the study area?

RQ3 Which different spatial models of the space-pump are possible within the possibilities and limitations of the study-area when agriculture develops towards a metropolitan food cluster?

RQ4 What is the optimal model, or combination of models to develop in the study area when agriculture develops towards a metropolitan food cluster?

2.7 Worldview.

With this self-reflection I will express my worldview which is highly influenced by my former education, and might be of influence for future research. My design education started at the vocational education for gardener, which was oriented to garden architecture with a very practical, and real-world focus. Later during my bachelor education at Larenstein, my education was shifting to landscape architecture, but still, my focus was on solving human-problems, and design for the real world. Therefore I have chosen to do a minor 'landscape and urbanism' which was focussed on developing possible futures for, and with the inhabitants of a small village in a metropolitan region. It was since 2011 that I studied at the Wageningen university, that my education is becoming more theoretical, but my personal focus is still to imply this knowledge on the real world, to solve human problems. Related to the six typologies described by Crewe, and Forsyth, I think the 'design as synthesis' (Crewe & Forsyth, 2003) fits me the best. "The approach involves design that brings together disparate elements and creates a solution that can resolve contradictions" (Crewe & Forsyth, pp. 42, 2003).

As described in the previous paragraph, my education had a very practical focus, and therefore my personal focus is also mainly real-world oriented, and problem centred. Therefore I consider my worldview as 'pragmatic' (Creswell, 2009). Considering research as always problem-centered, and about consequences of actions (Creswell, pp. 6, 2009). While the world, and the landscape are in my opinion no absolute unity, researchers should look to many approaches, and techniques that fits their needs, and purposes, instead of subscribing to only one way (Creswell, 2009).

In relation to the topic of metropolitan food clusters, and more general agriculture, it is important to state that I am grown up at a farm. Since a very young age I am influenced to see

the world from the perspective of an agrarian, whereas my parents, and many of my friends have agricultural companies. This background might influence me as a researcher.

My added value as a landscape architect, in comparison to other disciplines is to preserve a part of our spatial identity. Our environment is globalising, and a negative consequence, in my opinion, is that this globalisation creates many landscape elements that are 'footloose', they have no relation anymore with that specific landscape, they can, and will be placed everywhere. This creates that landscapes are getting more, and more comparable, and lose their own unique features. But, this is not a necessity. It can be done different. In my opinion here lies an important task for me as a landscape architect, to create an environment that meets the desires of a globalising world, and has a connection with the local circumstances.

2.8 Research focus.

The focus of this research can be seen in twofold. First, as already mentioned in the paragraphs 'knowledge gap' and 'problem statement', it is highly probable that the existing field of Dutch agriculture will change (Broeze et al, 2003), but the exact direction of development remains unclear. Cormont et al calculates with three different scenario's, but it is very probable that the development is not limited to just these three scenario's. For reasons such as a possible economic profitable agriculture, and developments in the rural landscape, this research will focus on the scenario of agriculture developing to metropolitan food clusters.

Second, the development of metropolitan food clusters seems to have two massive spatial implications. The industrialisation of the agriculture on the one hand, and the rural areas where several agricultural activities will disappear on the other hand. The industrialisation of the agriculture, and the development of metropolitan food clusters, could mean that the core activities of agriculture become part of the urban system (Smeets, 2009). "The most important parts of this agriculture and certainly those parts that are the most characteristic of Dutch agro-production, have become part of the urban space" (Smeets, pp. 115, 2009). Thus, the development of food clusters has a big effect on the urban space, where large-scale agricultural activities will take place, but on the other hand it has a big effect on the existing rural landscape, where large functions of the agriculture may disappear. This research will primarily focus on the effect of a food cluster on the existing rural areas, and secondary on the impact of the metropolitan food cluster, and the agropark on the landscape.

2.9 Research approach & strategy.

As already mentioned in the paragraph 2.4 landscape architecture deals with complex and unique problems, thus also this thesis. Therefore committing to a quantitative research approach would inadequately address the complexity of the problem (Creswell, 2009). For this thesis a qualitative approach will be used, to optimal utilize the ability to focus on individual meaning, and adapting to the complexity of the situation (Creswell, 2009).

The method used in this study is research for design, design with a research as end-product. In "research for design, research informs design to improve the quality of the designed artefact and to increase its reliability" (Lenzholzer et al, pp. 121, 2013). Doing interdisciplinary research, and design in order to create inventions, and interventions, which are necessary to find the connection between the developments in agriculture, and the existing landscape. The research in

this study is incorporated at two phases of the design process, before design, and during design (Milburn and Brown 2003). The first phase of the project with an emphasis on research will mainly use descriptive strategies (Deming & Swaffield, pp. 65, 2011), and the second phase, with an emphasis on design, will use projective strategies (Deming & Swaffield 2011, pp. 205, 2011). Landscape, and landscape architecture are expressed in everyday actions. Therefore they are accessible for empirical description (Deming & Swaffield, 2011). "Descriptive research strategies produce new knowledge by systematically collecting and recording information that is readily available to the investigator and does not require complex analysis in order for it to be understood" (Deming & Swaffield, pp. 65, 2011). One of the techniques that will be used in this thesis is a reference study to the space-pump in other land-uses, this is an example of a descriptive strategy.

Later in the process of this thesis projective strategies will be used, especially in the modelling and design phase. One important notion has to be made: "design only becomes an autonomous research strategy when it produces new generalizable knowledge about the world through its purposes, protocols, and outcomes" (Deming & Swaffield, pp. 206, 2011). According to Deming and Swaffield, calling design a research strategy is a contested definition, in order to shape design as research eight criteria have to be considered: truth value, applicability, consistency, transparency, significance, efficiency, organisation, and originality (Deming & Swaffield, pp. 207, 2011). Because the modelling, and design is an important, and large part of this thesis, the criteria of Deming, and Swaffield will be used to shape the design in the area of Venray in the perspective of research on the space-pump.

2.10 Significance.

This study will have significance for different fields. The research to the effect of the development of the space-pump by a metropolitan food cluster on the existing rural landscape, will have a clear academic, social, and architectural significance.

First, the results of this research will have an academic value, because by researching the knowledge gap of applying the concept of the space-pump as consequence of the development of a metropolitan food cluster in an existing landscape, this research may provide new clues, for refining the existing body of knowledge about the concept of the space-pump.

Second, this research will have a social value, the Dutch government underlines that the agriculture is on the edge of a new phase. On the one hand the agriculture needs to develop, in order to have a sustainable future. But, on the other hand, society is against large scaled development for reasons such as impact on the landscape, and animal welfare. Therefore the government started a social dialogue before taking any decision about this topic (Ministry of economy, agriculture, and innovation 2012). This research can contribute to this social dialogue, by examining the effects of a metropolitan food cluster with the space-pump on the rural landscape.

Third, the results of this research will have a landscape architectural value. The process of modelling, and designing will provide clues such as methods, and techniques that can be applied in landscape architecture for designing other developments of metropolitan food clusters with space-pump consequences.

2.11 Validity.

Validity and trustworthiness are important concepts for the significance of this research. Whereas this research will be carried out as a qualitative study. Qualitative, studies have specific connotations of the concepts of validity, and trustworthiness (Creswell 2009). Among others, four steps will be taken, in order to reach a valid, and trustworthy research.
First step is to clearly determine the definitions as used during the process. A drift of definitions during the process should be prevented by constantly comparing of the definitions with the data (Creswell 2009).

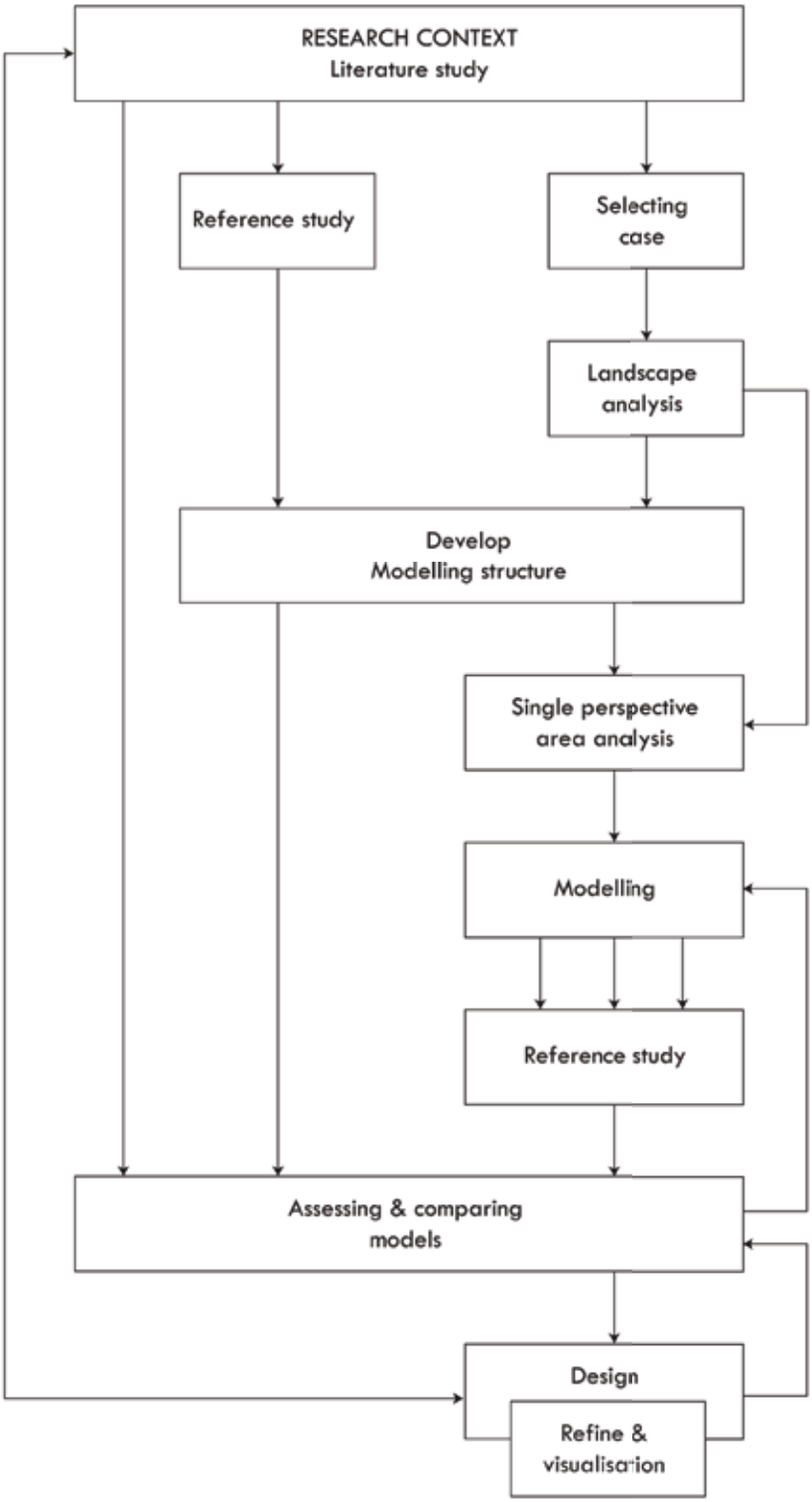
The second step is the triangulation of the data. By using evidence from different data sources of information, and using these to build up a coherent justification for the different themes, will contribute to the validity of the study. The themes have to be established based on converging several sources of data, or perspectives of participants (Creswell 2009 p. 191).

A clarification of the bias of the researcher is another step to improve the validity of the research (Creswell 2009). The pragmatic worldview (Creswell, 2009), and the strong relation with the agricultural sector, as elaborately described in paragraph 2.7 might be of influence on the results of this research. “This self-reflection creates an open and honest narrative that will resonate well with readers” (Creswell 2009 p. 192). In a qualitative-, or mixed methods- research, this self-reflection contains a detailed description of how the interpretation of the findings might be influenced by the researcher’s background, aspects such as: education, culture, history, etc. (Creswell 2009).

A fourth element to improve the validity of this research will be to also include negative, or contradictory information of the themes in the research. The real life is composed from different perspectives, that not always match. Adding a discussion of this contradictory information adds to the credibility of the research. By presenting this contradictory information, the research as a whole becomes more realistic, and thus more valid (Creswell 2009)

2.12 Research structure.

Taking the in the previous paragraphs described research objective, questions, focus, approach, and strategy, the overall research structure will be as projected in the flowchart figure 2.1 and in the tables in figure 2.2, 2.3, 2.4.



2.1 Flowchart of the research structure, as described in the previous paragraphs.

	STEP I OPERATIONALISATION	STEP II ANALYSIS
Objective	Operationalisation of the key concept: the space-pump. - Definition - Relation other land-uses - Relevance landscape architecture	Analyse the existing situation, and conditions for possible future developments.
Research questions	-	- RQ1 What is the existing spatial, economic, and social situation of the agriculture and landscape in the study-area? - RQ2 What are the spatial possibilities, needs, and limitations of a metropolitan food cluster, and the space pump in the study area?
Research strategy	Descriptive strategies (Deming & Swaffield, pp. 65, 2011)	Descriptive strategies (Deming & Swaffield, pp. 65, 2011)
Techniques	- Literature review (Martin & Hanington, pp. 112, 2012) - Reference study (Yin & Robert, 2002) - Expert input	- Literature review (Martin & Hanington, pp. 112, 2012) - Site inventory - Landscape analysis - Expert input

2.2 Overview of research step I and II.

	STEP III EXPLORATION	STEP IV SYNTHESIS
Objective	- Exploring the range of possible spatial futures each developed from different perspectives.	- Choose or combine the different models to one design for the space-pump.
Research questions	- RQ3 Which different spatial models of the space-pump are possible within the possibilities and limitations of the study-area when agriculture develops towards a metropolitan food cluster?	- RQ4 What is the optimal model, or combination of models to develop in the study area when agriculture develops towards a metropolitan food cluster?
Research strategy	Projective strategies (Deming & Swaffield, pp. 205, 2011)	Projective strategies (Deming & Swaffield, pp. 205, 2011)
Techniques	- Modelling (Deming & Swaffield, 2011) - Expert input	- Literature review (Martin & Hanington, pp. 112, 2012) - Reference study (Yin & Robert, 2002) - Design (Deming & Swaffield, pp. 207, 2011) - Expert input

2.3 Overview of research step III and IV.

STEP V CONCLUSION

Objective

Drawing conclusions based on the outcome of the research as conducted in step I to IV

Research questions

- To what extend and in what way can a landscape design contribute to optimise the consequences of the space-pump concept related to a metropolitan food cluster?

Research strategy

Descriptive strategies
(Deming & Swaffield, pp. 205, 2011)

Techniques

- Based on step I to IV

2.4 Overview of research step V.

3

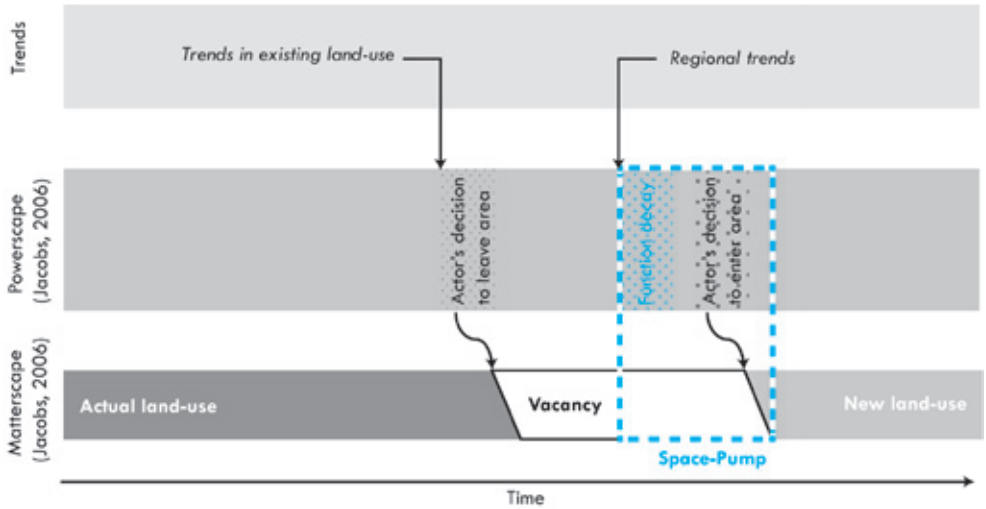
Theoretical context.

The concept of the space-pump is never researched as an individual concept before. Therefore this thesis started with a small theoretical basis. Based on this theory, reference studies, and the comparison with other landscape processes, the space-pump is defined as: a process, starting with function decay caused by a trend in the form of land-use in a certain area, until the moment a new form of land-use completely occupies the same physical area. By using this definition of the space-pump, the concept is no longer exclusively linked to the development of a metropolitan food cluster. Also processes such as demographic shrinkage, or the arising of brownfields contain a space-pump. In the case of the metropolitan food cluster the space-pump can occur threefold. First in the form of physical land which is no longer essentially needed in the new system. Second, in the current stables, and third in the policy zones, such as odour circles, which will disappear and create space for other functions to develop. A process that shows many similarities with the framework concept of Kerkstra, and Vrijlandt (1990). Whereby a spatial separation of high-dynamic, and low-dynamic functions creates space for both develop in an optimal way. This opens the field for landscape architecture. By approaching the development of a metropolitan food cluster, and the space-pump as one regional transition, goals can be reached, which cannot be reached on an individual basis.

3.1 Space-pump towards a definition.

The metropolitan food cluster does not only have a major impact on the agricultural sector. Also the landscape is influenced. This influence can be divided over two categories. First, the agroparks "redefine highly productive forms of agriculture as an urban activity, and spatially reorganise this into as compact an area as possible" (Smeets, pp. 279, 2009) thus the creation of agroparks as part of the metropolitan food clusters. Second, these "[agroparks] are the engine of the space-pump in the countryside: an increasingly productive agricultural production and processing industry is concentrated in a limited productive area, and as a consequence there is much less space needed for agricultural production" (Smeets, pp. 40, 2009). This thesis is, as mentioned before, primarily focussed on the second category: the space-pump.

The search for the exact definition of this phenomenon in literature did not end up with a clear statement. The literal term 'space-pump' is just limited used. A search for this term provides only a few documents related to metropolitan food clusters, such as: (Smeets, 2009), (Smeets et al, 2010), (Cormont et al, 2012), (Eck et al, 2002) or (Kool et al, 2008). But, none of them describes the phenomena 'space-pump' in detail. Mostly it is mentioned as a side-effect of the development to a metropolitan food cluster. The most detailed definition is mentioned by Smeets in 2009: "agroparks create a 'space pump', whereby industrial activities with a small direct but a big indirect use of space (odour circles etc.) disappear from the green areas, and thus create more space for other functions" (Smeets, pp. 279, 2009). While this can be considered as one of the most detailed descriptions of the space-pump, the theoretical basis for a definition, and further research is relatively small. Moreover there are no historical examples of the space-pump, and no specific research to the space-pump. Therefore the statement of Smeets is used as an important starting point. By reading this statement, three aspects can be extracted. First, the agroparks create the space-pump. Agroparks are an innovation in the land-use of agriculture, this trend can thus be seen as the essential condition, or 'engine' of the space-pump. Second, this trend causes that several activities of agriculture disappear from the green areas. This is a form of function decay in land-use. Third, "there is space for other functions to develop". This part of the statement implies that the old function disappears before a new function is determined. In conclusion, a certain trend in land-use causes a function decay of the existing form of land-use, before a new land-use is determined. With this in mind, the space-pump is defined as:



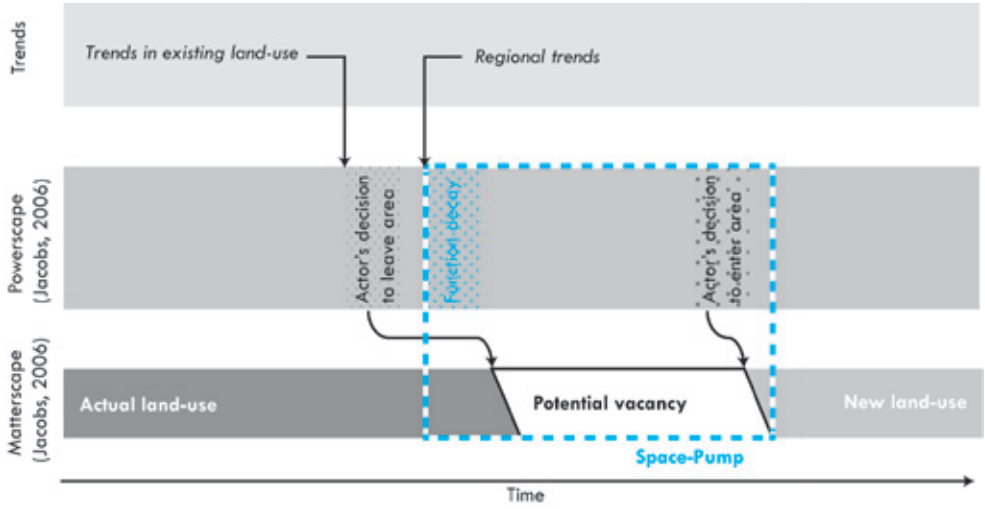
3.1 Schematic model of a possible variant of the space-pump. Function decay after a period of vacancy.

A process, starting with function decay caused by a trend in the form of land-use in a certain area, until the moment a new form of land-use completely occupies the same physical area.

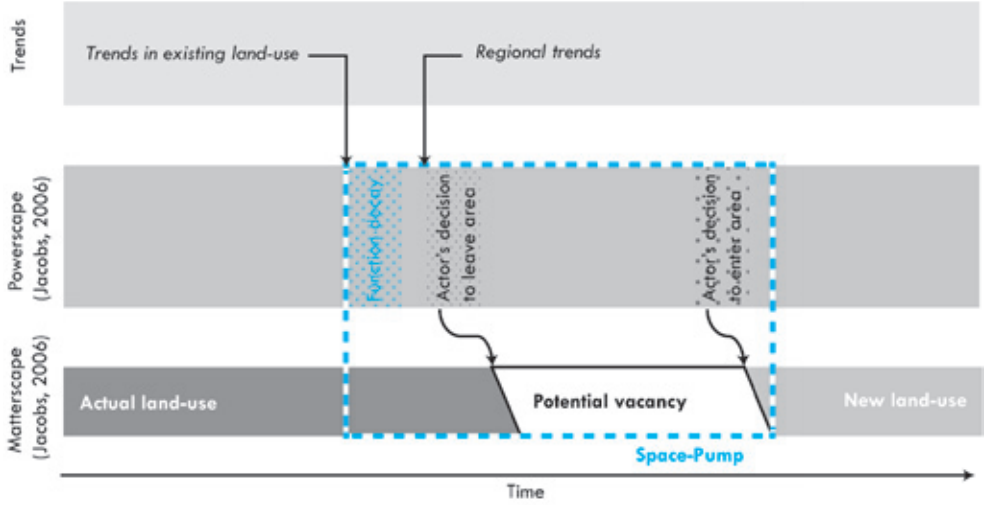
Whereby function decay is defined as:

Function decay is the moment the actor(s) within a certain area decide that the existing form of land-use will disappear from its location, before a new form of land-use is determined.

This definition implies that a space-pump can be recognised by the presence of three conditions. First a trend in a form of land use causing the space-pump, second the decision of function decay (powerscape (Jacobs, 2006)), and thirdly the occurrence of a new form of land-use in the physical environment (matterscape (Jacobs, 2006) which can occur in different orders (fig. 3.1, 3.2 & 3.3).



3.2 Schematic model of a possible variant of the space-pump. Function decay before a potential vacancy.

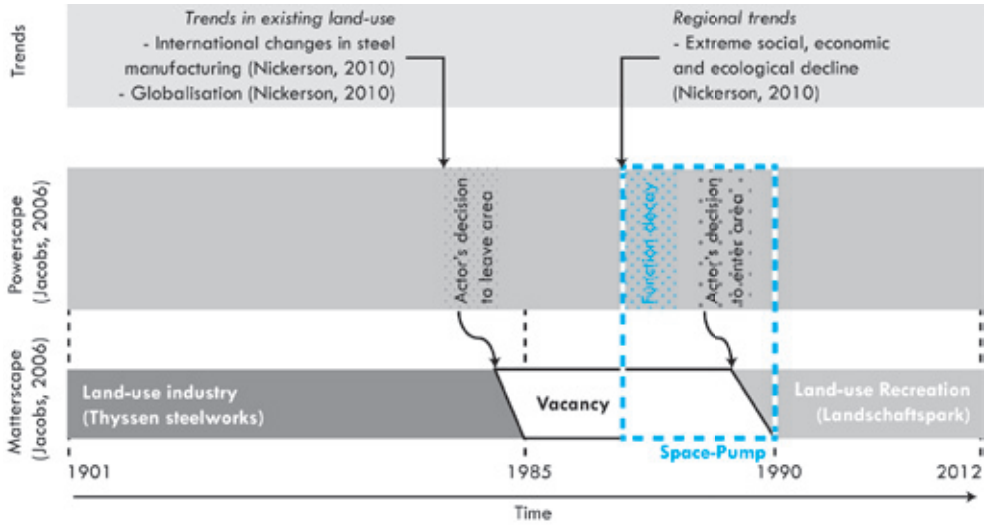


3.3 Schematic model of a possible variant of the space-pump. Function decay before any change in matterscape.

3.2 Space-pump and other land-uses.

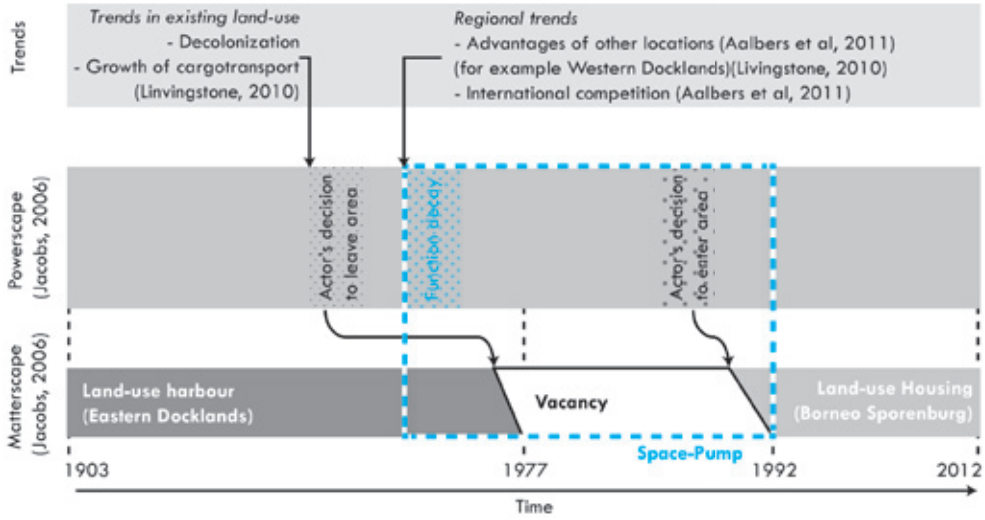
Till today the 'space-pump' phenomenon is only described as side-effect, or consequence of the development towards a metropolitan food cluster. With the before mentioned definition it is possible to separate the space-pump from the concept of metropolitan food cluster. The space-pump as phenomenon is a process which may occur by a metropolitan food cluster (Smeets, 2009) (Smeets et al, 2010)(Cormont et al, 2012)(Eck et al, 2002)(Kool et al, 2008), but which also might occur in other forms of land-use.

When taking eight large-scaled forms of land-use into account: industry, mining, infrastructure, defence, agriculture, housing, recreation, and nature, there can be explored whether the phenomenon of the 'space-pump' has occurred in these land-uses, or might occur in the future. Therefore the three essential conditions of the space-pump needs to be determined.



3.4 Schematic model the space-pump in the case of the Ruhr-area. Transition from industry to recreation.

Four forms of land-use have a similar outcome when they are examined on a relation with the space-pump, namely the industry, mining, infrastructure and defence. Important trends in these forms of land-use that might create a space pump are: deindustrialisation (Tang & Nathanail, 2012)(Franz et al, 2006), international competition, movement to low-wage countries, changes in sales market, advantages of other locations, technological innovation (Aalbers et al, 2011), globalisation (Feber et al, 2006), policy changes, and economic decline. Each of these trends, or a combination of several can cause that the existing form of land-use (industry, mining, infrastructure, or defence) will disappear from its actual location. The disappearance of these types of land-use results very often in brownfields. On a certain moment the space-pump will start. The actors will decide that the former land-use will not return because of one of the previous trends. The land-use of industry suffers from function decay, and therefore makes space for other functions to develop, before these new functions are determined. In these categories of land-use the space-pump is often related to a period of vacancy, and decay. Although this might often be the case, it is no essential condition for a space-pump. Examples of transitions in these types of land-use with the space-pump are the 'Emscher Landscape Park' (Sousa, 2004)(fig. 3.4), 'Leipzig Cole Mines' (Aalbers et al, 2011) or 'Borneo Sporenburg' (Livingstone, 2010)(fig. 3.5).



3.5 Schematic model of the space-pump in the case of Borneo Sporenburg. Transition from harbour to housing.

Another example is the land-use of housing. Trends such as people who migrate to other areas, people who get ever less children (Fontein et al, 2012)(Aalbers et al, 2011), a low employment (Aalbers et al, 2011) are trends that may cause a space-pump. The macro-process is demographic shrinkage (Breman & Vogelzang, 2012)(Breman & Doorn, 2011). But this demographic trend influences the physical environment. Comparable to industry, mining, infra-structure, and defence, is the space-pump in the land-use of housing strongly related to decay, and vacancy. Hereby the space-pump occurs mainly in the built-up areas, in neighbourhoods, and industrial areas (Breman & Vogelzang, 2012)(Fontein et al, 2012)(Aalbers et al, 2011)(Breman & Doorn, 2011). The trend of shrinkage is widely spread across Europe (Lauf et al, 2012) (Haase et al, 2012), also in the Netherlands areas deal with shrink, especially the southern part of 'Limburg', the north-eastern part of 'Groningen', and the southern part of 'Zeeland' (Fontein et al, 2012). But the space-pump did not yet occur on a large scale. Maybe, the process of the space-pump started already, but did not completely develop yet, when this trend continuous it might completely develop in the future.

The land-use of nature might be the only form of large-scaled land-use that is never related to the phenomenon of the 'space-pump, and probably also never will be in the future. There is no nature area found where the function 'nature' disappeared from a certain location under influence of trends in the same land-use, leaving an area behind which could be filled with any other function, but not nature. This could have several reasons. First, nature is not per definition related to monetary costs, whereby till a certain extend all other forms of land-use are. Even without money, the form of nature might change, but it will remain nature. Second, all areas are in a sense suitable for a certain type of nature, where all other forms of land-use ask for specific circumstances, and it is the lack of these circumstances that creates, or starts the space-pump. One can ask himself the question: would it even be possible to remove the land-use nature from a certain area? Which is an essential condition for the space-pump. Although this last statement depends on the exact definition of nature.

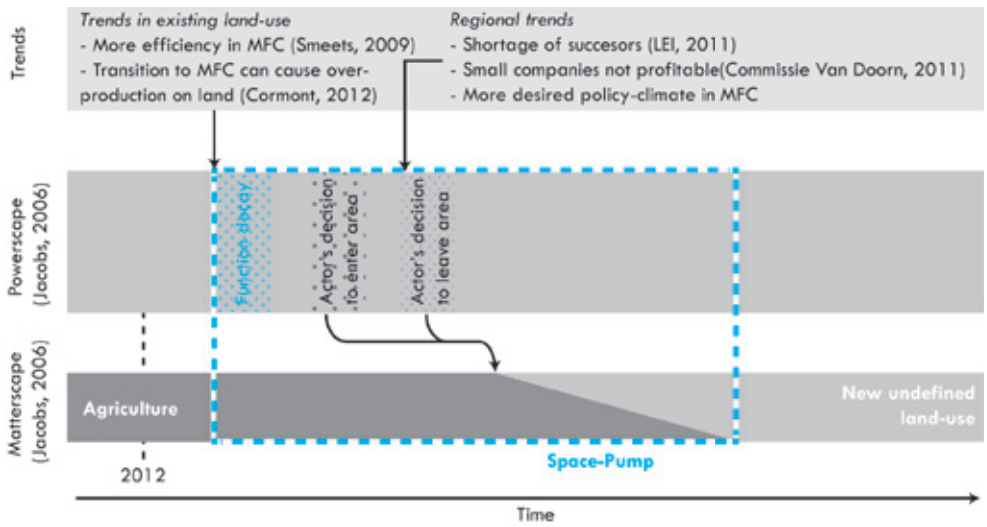
3.3 Space-pump and the MFC.

The relation between agriculture, and the space-pump is already described by several authors: (Smeets, 2009), (Smeets et al, 2010), (Cormont et al, 2012), (Eck et al, 2002) or (Kool et al, 2008). In the two previous paragraphs the space-pump is defined, and related to other forms of land-use than solely agriculture. But, what is exactly going on during this phenomenon. As mentioned before there needs to be a certain trend, or set of trends to cause a space-pump. In the case of agriculture this might be innovation (Stroming, 2002). For example because agriculture can produce much more efficient in a metropolitan food cluster (Smeets, 2009)(fig. 3.6), the sector might slowly transform to a system of clusters. More reasons for this transition are mentioned in paragraph 1.3. This is the essential trend, or engine of the space-pump.

In relation to the space-pump, the trend causes a form of function decay. In the transition from the existing form of agriculture to a form of metropolitan food clusters, the function decay can appear in three different ways. First, the farmers move their production from their existing farm to the metropolitan food cluster. This means the former buildings suffer from function decay, and remain empty. It is very improbable that these buildings will be occupied by other farmers. The former farmer has moved for a reason, for example the policy climate in the metropolitan food cluster is much more suitable than on its former location, or stables needs to be renewed. Another farmer would not occupy the old monofunctional buildings, but also settle in the metropolitan food cluster. The existing buildings will thus be subject of function decay. The function of agriculture is disappeared, before a new function is determined. The second way of appearing are in the form of the policy zones, such as odour circles, that will disappear (Smeets, 2009). The presence of a farm implies several policy zones around the farm, which cause restrictions with regard to the development of other functions. The disappearance of the farm-function implies also a disappearance of these policy restrictions, and thus create space for other functions to develop. Third appearance related to the space-pump is the roughage production. In the existing situation many farmers have a significant amount of land. An average Dutch dairy farm has 38.7 hectares land in use (Rienks et al, 2009), and even an intensive livestock farm has on average 8 hectares of land in use (Dienstencentrum agrarische sector, 2012). This land is not all in use for the production of fodder. Dairy farms import a large part of the fodder for their animals, and intensive livestock farms import often all their fodder. The land is partly used for the building-block, but the other parts are used for crops, and not always for their own use. The land is an important way to get rid of the manure of the animals, and the crops are in many cases seen as a by-product of the land. In a metropolitan food cluster it is profitable to use systems that are not profitable for individual farmers (Smeets, 2009), one of these systems could be the industrial processing of manure. In this case the amount of land is not anymore based on the manure production of the livestock, but the amount of land can be based on the production of roughage for the animals in the cluster. In many cases when the amount of animals in the cluster remains the same as in the existing situation, there is an overproduction of roughage. In the concept of metropolitan food clusters this overproduction can be considered as undesired, and the land can be used for other functions (Cormont et al, 2012). In conclusion the space-pump in relation to a metropolitan food cluster can appear in three different ways, in buildings, policy zones, and land.

A large-scaled space-pump, as described in the previous paragraph, did not yet occur in relation to a metropolitan food cluster with livestock. This effect is only predicted (Smeets, 2009), (Smeets et al, 2010), (Cormont et al, 2012), (Eck et al, 2002) or (Kool et al, 2008). Some of the above mentioned theoretical assumptions are open for discussion, or still unclear. Van de Klundert argues that the space-pump will only autonomous develop in areas with very poor soils, such as the eastern part of Europe. In the Netherlands the land is that suitable for agricultural production, that even when the agriculture develops to metropolitan food clusters, the overpro-

duction of roughage will be used in another way within the cluster, expand the amount of animals, or the growth of other crops. According to van de Klundert a Dutch space-pump can only be created when one is willing to create it, it will never develop autonomous (van de Klundert, 2012). Van de Klundert means with this statement only the space-pump in physical land, and not in buildings, or policy zones. But, this perspective opens the field for landscape architecture. The Dutch space-pump, as consequence of the transition to a metropolitan food cluster is guidable. The location, the size, and the contents of the space-pump is depending on several factors such as trends in land-use, but also on the spatial context, and the perspective of the transition.



3.6 Schematic model of the space-pump in the case of the metropolitan food cluster. Transition from agriculture to another form of land-use.

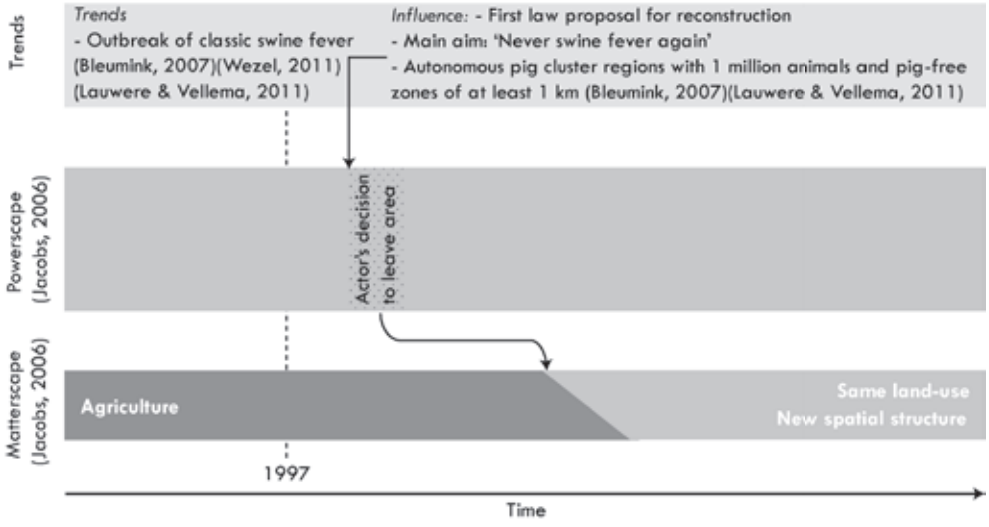
3.4 Reference - The reconstruction law.

A large-scaled space-pump did not yet occur in relation to the concept of metropolitan food clusters. But the process of the space-pump did partly occur very recently in Dutch agriculture. The Dutch 'reconstruction law' and the process related to this law is highly comparable to the future transition from agriculture to metropolitan food clusters. But the space-pump in the reconstruction law failed dramatically. The concept of metropolitan food clusters should not make the same mistakes, and learn from this process, therefore a review of the reconstruction law.

3.4.1 1997.

"Teusday the 4th of February 1997 the first case of classic swine fever is established on a pig-farm in Venhorst, Noord-Brabant. It was almost 'carnaval' and nobody could, or wanted to apprehend how deep the swine fever would intervene" (Bleumink, pp. 11, 2007). Two days later the second case of swine fever was established. From that moment on the disease spread rapidly. In total almost 1800 pig-farms were culled, and 11 million pigs were killed before the disease was banned in spring 1998 (Bleumink, 2007). This trend of the outbreak of classic swine fever can be considered as the trend that caused the space-pump.

'Never swine fever again' was the motto of Van Aartsen, the minister of agriculture, nature, and fishery at that time. He determined a first law proposal in 1997 with the main aim to prevent new outbreaks of livestock plagues in the future (Lauwere & Vellema, 2011)(Bleumink, 2007)(Wezel et al, 2011). The proposal consisted out of a plan to develop spatial livestock clusters, and pig-free corridors. The clusters should consist out of approximately one million animals, and should be able to operate autonomously with regard to slaughterhouses, and the support of roughage (Bleumink, 2007). This proposal should trigger, or maybe force the farmers to move into a new spatial structure. A change of land-use in some areas was not yet part of the reconstruction. Till this period the trend of swine fever should cause a restructuring of the sector, and this transition was not related to the space-pump (fig. 3.7).

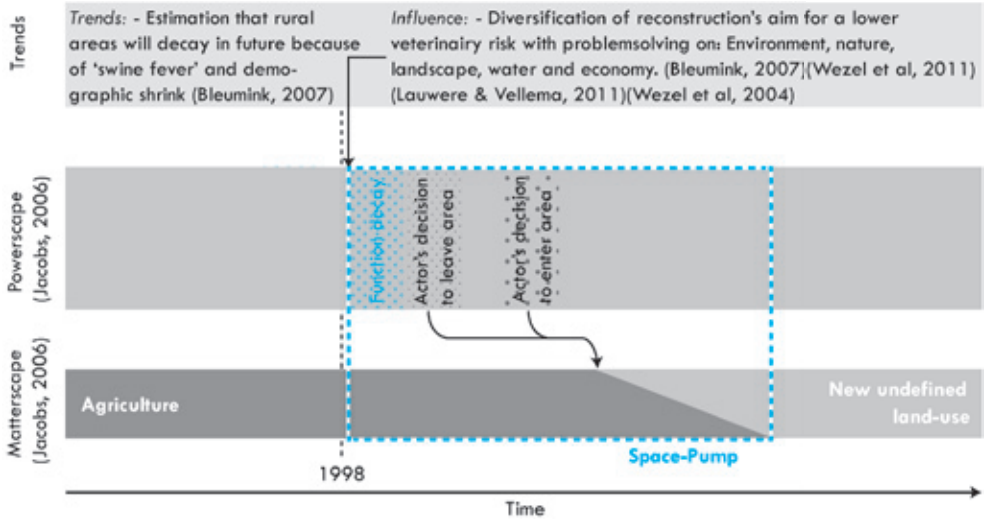


3.7 Schematic model of the reconstruction law in 1997. Process of rural transformation, without the occurrence of the space-pump.

3.4.2 1998.

In the beginning the main aim of the reconstruction was to prevent the outbreak of livestock plagues in the future. Very quick a diversification of aims occurred. The estimation at that time was that the countryside, under influence of the consequences of the swine fever, and demographic shrinkage, would suffer from social-economic problems, a high unemployment rate, and decay in the future (Bleumink, pp. 27, 2007). This estimation is a determination of function decay. In 1998 the government stated that certain trends would influence the land-use of agriculture, in a way that certain areas would no longer be suitable for agriculture, and be available for other functions. This is the start of the space-pump (see also paragraph 3.3)(fig. 3.8).

The first aim to prevent the outbreak of livestock plagues in the future remained, but was diversified with aims for problem-solving on fields such as: spatial planning, environment, nature preservation, landscape, water, and economics (Lauwere & Vellema, pp. 113, 2011). The reconstruction is no longer a purely agricultural project, but a project of integral planning in the countryside (Wezel et al, 2011). The main problem of the diversification of aims is that in terms of possibilities to develop, the livestock does not go easily together with the land-uses of housing, working, recreation, and nature (Meulenkamp & Gies, 2012). Therefore the main thought of the reconstruction becomes to separate the livestock sector from conflicting land-uses (Meulenkamp & Gies, 2012). This idea is still not in conflict with the original aim of reducing the veterinary risk.



3.8 Schematic model of the reconstruction law in 1998. Original aim diversified with several other aims, the space-pump became part of the process.

The reconstruction law used the zoning of functions as an important instrument. In the countryside three zones were established:

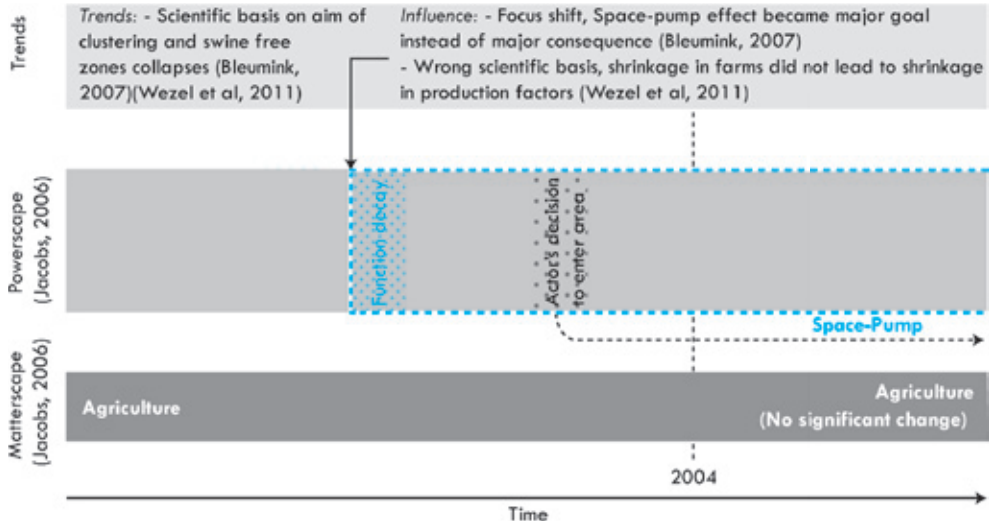
- areas for agricultural development (AAD) where enlargement and (re-)establishment of intensive livestock [farms] is possible;
- areas for function combination (AFC) of agriculture, housing and nature, where reestablishment or enlargement of intensive livestock [farms] is possible if in accordance with the spatial quality and functions in the area;
- areas for extensive agriculture (AEX), with nature or housing as primary function where enlargement or (re-) establishment of intensive livestock [farms] is impossible. (Wezel et al, pp. 1, 2011)

The zoning in the countryside was just limited based on the desires from the livestock sector, for an important part the aims of the zoning were based on desires from other functions. One aim was for example to defragment the nature areas in the countryside (Wezel et al, 2004). From the perspective of the livestock sector it became a 'negative' process of planning. The reasoning was based on were they would cause the most negative consequences for other functions, then the areas left would be most suitable for the areas for agricultural development (AAD). This instead of a 'positive' planning process where the livestock sector would fit best. But, still the original aim of the reconstruction to reduce the veterinary risk would be met.

3.4.3 2004.

Already from the beginning the effectiveness of clusters, and pig-free zones to reduce veterinary risks is broadly doubted. "A lower density, a reduction in contacts, and a regionalization of intensive livestock is inevitable on the long term" (Wezel et al, pp. 5, 2011). In 2004 the scientific basis for the reconstruction collapsed. The CIDC, and Alterra establish that there is no veterinary basis to develop clusters, and pig-free zones (Bleumink, 2007). Therefore minister Veerman of agriculture, nature, and fishery at that time, decided that the development of pig-free zones, and clusters, are no essential part of the reconstruction anymore (Bleumink, 2007).

This was not the only assumption, or decision that failed in that time. The expected decay of the countryside did not occur. Although there was a shrinkage in the amount of farms, this did not self-evidently lead to a shrinkage of production factors such as cattle, and land. The remained farmers would intensify, and enlarge their farms (Wezel, 2011). The collapse of the scientific basis, and the not occurring decay would be two important reasons for the failure of the reconstruction, and thus also the failure of the space-pump. The scientific basis was the main reason to force farmers to restructure the sector, and the expected decay of the countryside was the main reason to diversify the goals of the reconstruction (fig. 3.9).



3.9 Schematic model of the reconstruction law in 2004. Scientific basis collapsed, the farmers were not co-operating, and the process of the space-pump could not start.

3.4.4 Lessons from the reconstruction law.

The main problem of the reconstruction could be that the space-pump was part of the planning, but did not completely develop. Although some assumptions turned out to be false, the reasoning on these assumptions is understandable. Where did it go wrong then? This becomes clear when analysing the process with the space-pump model. Three aspects were essential to meet the definition of the space pump. First, a trend in the existing form of land-use is the cause, or engine of the space pump. Second, this trend causes function-decay in areas of the existing land-use. Third, the new function is undefined, at least till the moment of function decay. The trend in the existing form of land use was the aim of preventing the outbreaks of livestock plagues (Lauwere & Vellema, 2011)(Bleumink, 2007)(Wezel et al, 2011). This was the basis for the reconstruction law which should force the land-use of agriculture to spatially restructure their sector (Bleumink, 2007). This aim, together with the expected decay of the countryside caused a determination of function decay by the government. The function decay was determined before anything was happened on the level of decisions (powerscape, (Jacobs, 2006)), or on the level of the physical landscape (matterscape (Jacobs, 2006). This implies a higher risk than when the function decay is determined after a period of vacancy, such as in the transition from the industrial Ruhr area to the Emscher Landschaftspark (see also paragraph 3.2). The function decay caused a diversification of focus, not only the veterinary risk was the focus, also the spatial planning, nature, recreation etc. (Lauwere & Vellema, 2011). After this diversification of goals, the planning became 'negative' from the perspective of agriculture (the actual engine of the space-pump). The new functions of the space-pump became the major goal of the reconstruction, instead of a major consequence. The new functions were not determined after the function decay in agriculture, but they were determined before. In a way this would not be a problem in every scenario, it is not anymore a space-pump, but the process of transition could still work when the farmers were moving, or willing to move.

This was the major problem, the farmers were not moving, and could hardly be forced to move. The scientific basis to move was collapsed (Bleumink, 2007), and the intensification, and enlargement of farms meant that farms would not decay (Wezel, 2011). For different reasons the zoning strategy of the reconstruction plans had hardly any effect on the intention of farmers to move. Some farms already possessed permits to enlarge their farm, even if this farm was located in an area for extensive agriculture (AEX), this permit could be used. It would be too expensive for the government to invalidate the permits (Driessen & Gier, 2004). On the other hand farms without a permit in an area for extensive agriculture (AEX) were already locked in their development before the reconstruction law. The law did not change their situation (Boonstra et al, 2007). The farms do thus not have a significant advantage by moving to areas for agricultural development (AAD). Moreover it is in many cases hard for a farmer to move to an area for agricultural development (AAD), even when one is willing to. Local farmers are often not happy with 'newcomers' (Lauwere & Vellema, 2011), and although there is in theory enough space in the areas for agricultural development (AAD) for all livestock farms, in practice the space is much smaller because of nature- and environmental-laws (Boonstra et al, 2007). In conclusion, in theory the trend for the space-pump was there, this would cause a function decay in agriculture, and the new functions were determined. But in practice, the space-pump changed from major consequence to major goal of the reconstruction. The new functions were determined before the old functions would disappear. The trends changed, and the existing function of agriculture would not move at all. Over a decade of planning, and no significant result.

3.5 Types of space-pump.

Paragraph 3.1, where is searched to a definition of the space pump, and paragraph 3.4 where the space-pump is researched in the case of the reconstruction law, show that the phenomenon of the space-pump can differ over time. For example in the case of the Ruhr area (Sousa, 2004), the space-pump started after a period of vacancy, whereas the space-pump related to a metropolitan food cluster might start far before any of the actors left the physical area. But among the differences in the process how a space-pump can occur, there is a difference in what type of space-pump occurs. As stated in paragraph 3.1 the space-pump starts with a function-decay in a certain form of land-use. But a physical area may fulfil multiple functions at the same time in the same physical area, although not all functions may be clearly visible, and have the same importance.

"Most landscapes provide a multitude of functions" (de Groot, pp. 176, 2006). To determine which functions exactly is complex matter. But the function of a landscape can be translated into multiple ecosystem, or landscape functions, which each provide a wide range of services, and goods (de Groot, 2006). Think about functions such as: food production, recreation, water storage, nutrient cycling, providing wildlife habitat, and aesthetic values (Milestad et al, 2011), each of these functions, and many more do not necessary have to exclude each other (fig. 3.10). Jongeneel et al. relates this directly to agriculture, that specifically this form of land-use can simultaneously fulfil different combinations of functions, whereby the type of functions are dynamic, and for example related to the demands in society (Jongeneel et al, 2008). Therefore a variety of functions is very important for planning in these landscapes (de Groot, 2006).

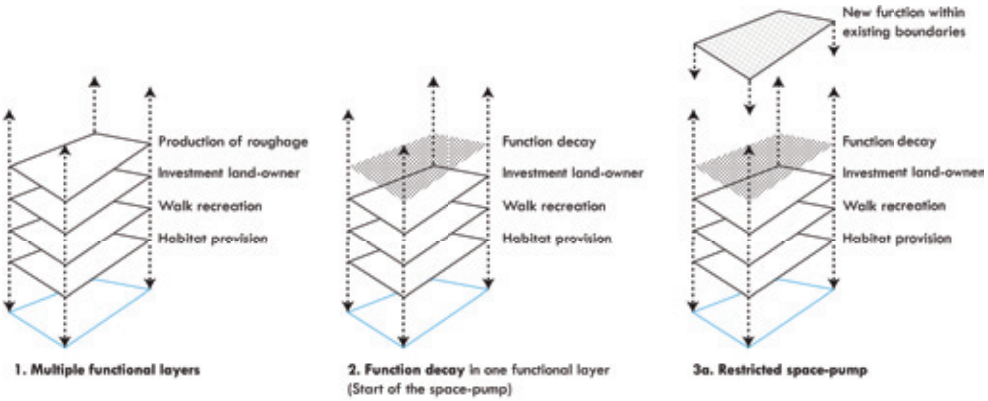
The landscape can be considered as an area with multiple functional layers. This is an important notion to understand the type of space-pump related to a metropolitan food cluster with regard to time. In paragraph 3.3 is described how the space-pump can occur by a metropolitan food cluster. In this process a function decay might occur, thus also a space-pump might start. But, this function decay does not imply a decay of all functional layers of a landscape.

When a space-pump occurs in the case of the metropolitan food cluster, the function decay might primarily be restricted to decay in one functional layer, the layer of food production, or policy zones such as odour circles may decay. The other functions, such as providing habitat, and scenic beauty may still function. Even other functions in the category of economic functions, such as the function of investment, may remain intact.

3.5.1 Restricted space-pump.

The fact that a space-pump might occur in just one functional layer, means that the land still contains many functions, even after the space-pump started. The functional layer that suffers from function decay can be replaced, but not by all random functions. The first type of space-pump is what in this research is called a 'restricted space-pump', whereby the decayed function can be replaced, but is restricted to the properties of the other still present functions (fig. 3.10). This type of space-pump may for example occur in an area where the production of roughage suffers from function decay, but the land is still valuable as for example an economic investment for the land-owner.

In the restricted space-pump the decayed function may be replaced with another function as long as it fits the existing functions. When this type of space-pump occurs in a productive landscape with a high pressure on land-use, the economic functions put up the most restrictions. According to the research of Berentsen et al, farmers for example indicate that the financial benefits are the most important reason to participate in a certain form of land-use (Berentsen et al, 2007). Other reasons are that a farmer is afraid of losing control on his own land (Clausman & Melman, 1991), and loose flexibility (Jongeneel et al, 2008). This shows that in a restricted space-pump the land-use might change, but many restrictions should be taken into account.



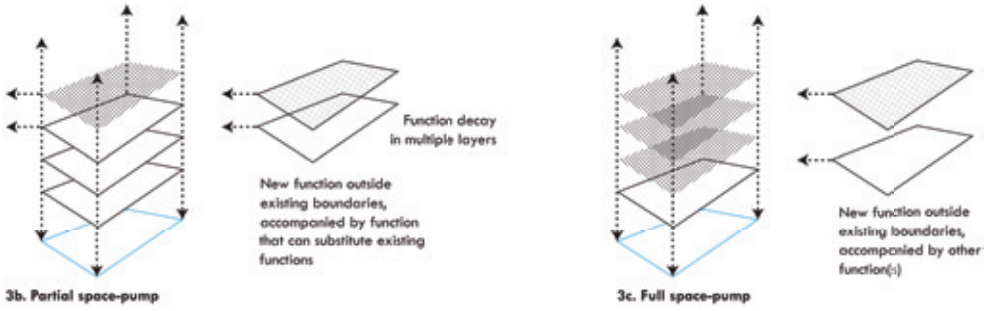
3.10 Schematic model of functional layers of an area and the space-pump. 1: the multiple functional layers of an area. 2: function decay in one functional layer. 3a: the restricted space-pump, new function should fit the existing.

3.5.2 Partial space-pump.

In the restricted space-pump, the new function is restricted to the boundaries of the other functions, but it could also be that the new function brings along other functional layers that substitute one or more existing functional layers, and in that way change the restrictions (fig. 3.11). For example a farmer might not be willing to change his productive land into nature, because of losing some of the property rights, and flexibility (Jongeneel et al, 2008). But when an external investor is willing to compensate for this loss, one existing functional layer may be substituted. In this research this process is defined as the partial space-pump, when the new functions substitutes the decayed function, and one or more existing functions.

3.5.3 Full space-pump.

The restricted space-pump, and the partial space-pump deal with function decay in just one functional layer. It can also happen that multiple functional layers suffer from function decay. This type of space-pump arose for example in areas that suffer from large-scaled demographic shrinkage. Because multiple functions suffer from function decay, multiple boundaries are removed. Therefore the freedom to introduce a new function, or functions is larger (fig. 3.11). This type of space-pump may be the least relevant in relation to a metropolitan food cluster, this type is more related to areas with a low pressure on land.

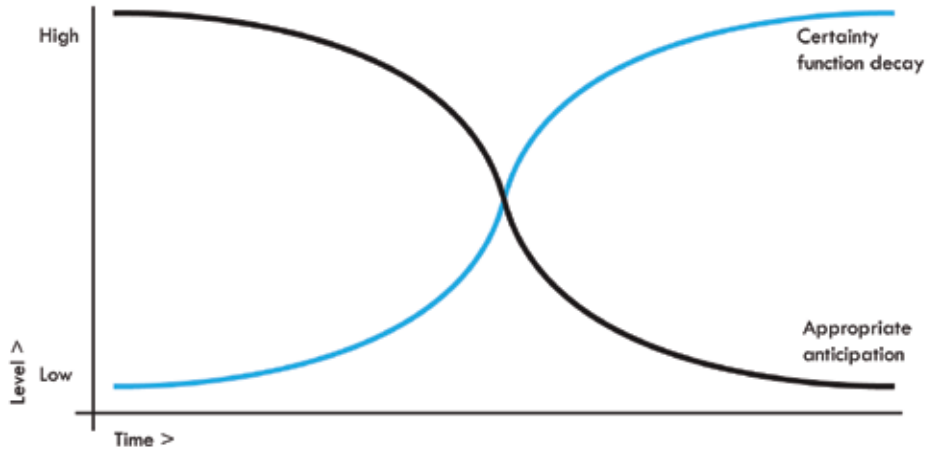


3.11 Schematic models model of functional layers of an area and the space-pump. 3b: the partial space-pump, multiple new functions that substitute the decayed and existing functions. 3c: full space-pump, multiple new functions.

3.5.4 Types of space-pump and anticipation.

The restricted space-pump, and the partial space-pump are two types that will mainly occur at the start of a space-pump process. Also both require a relative high pressure on land-use in order to remain the other functions in the same area. When the process of the space-pump takes longer, and, or the pressure on land-use becomes lower there are less competing claims (Breman & Doorn, 2011), and it is very likely that also other functional layers will decay under influence of the space-pump process. It is therefore very important to anticipate as fast as possible on this process (fig. 3.12).

The space-pump as defined in paragraph 3.3 is linked to other land uses, and therefore not exclusively related to the development of a metropolitan food cluster. The reference study on these types of space-pump revealed that there are different types of the space-pump. In land uses such as industry, or infrastructure it is very obvious when the space-pump occurs, for example in the case of 'Emscher Landscape Park' (Sousa, 2004). Here the space-pump occurred after a period of vacancy. Therefore the occurrence of a space-pump was quite certain, but the anticipation of planning towards a new land-use is limited. The space-pump effect linked to the concept of metropolitan food clusters is different. Here the function decay is determined far before the actor (farmer) decides to leave the physical area. Therefore the level of anticipation is higher, but the risk that the space-pump will not occur, or different than expected is also higher. This was the case in the reference study of the reconstruction law. A space-pump in relation to agriculture was predicted, there was an anticipation on to prevent undesired developments in the rural areas, but in the end the space-pump did not occur.



3.12 Anticipation on the space-pump in comparison to the certainty of function decay. Early in the process the level of anticipation is high, but the function decay is very uncertain.

3.6 Space-pump & landscape architecture.

In theory it is possible to calculate the occurrence of a space-pump in a certain case. Just calculate the amount of buildings, policy zones, and land that maximum may be affected by the space-pump. In theory the profession of landscape architecture can contribute to this process by making suitable plans for these areas. But, there are many uncertainties in this calculation. Is this transition really going to happen, at this moment the Dutch government stopped all developments of unbridled growth of livestock farms (Ministry of economy, agriculture, and innovation 2012),

thus maybe also the developments of a metropolitan food cluster in the future. Why would a farmer in a metropolitan food cluster only produce the amount roughage that his animals need? He can also raise the amount of animals to the amount of roughage he can produce on his land. How many farmers are actually willing to go to a cluster, all of them, half, or a few? And there are even more uncertainties.

Why should landscape architecture be involved in a process that knows so many uncertainties? At this moment of the process of metropolitan food clusters, and the related space-pump the level of anticipation is relatively high. When waiting until the moment the consequences of the space-pump become visible in the physical environment (matterscape (Jacobs, 2006)), it might lead to unintended, and undesired consequences, such as the vacancy of buildings. Another reason is given by Fairbrother (1970), she argues that a blind trust in the future, where al land-uses work out their own benefits in the landscape will not work. The new landscapes for our new lives needs to be achieved by consciously adaptation of our habitat to the new conditions. In her opinion there is no longer enough time to let a landscape evolve to suit our new land-uses (Fairbrother, 1970). This statement is closely related to the metropolitan food cluster, and the space-pump. This radical new form of land-use might change the landscape drastically. We should consciously plan this transition, even when it is as uncertain as the space-pump is now. In shaping this transition lays an important role for the profession of landscape architecture.

Another reason why landscape architecture should be involved with the space-pump by metropolitan food clusters today is: that the location of the space-pump is less directly related to geographical circumstances. In many other land-uses, the area which is affected by the consequences of the space-pump is for an important part determined by the geographical location of the land, or buildings. For example in the case of the industrial Ruhr area in Germany, the space-pump occurred there because some industries moved their production to low wage countries (Aalbers et al, 2011). Even when landscape architects would be involved in this process, the space-pump would still be situated in the same area of the Ruhr. The space-pump related to the metropolitan food cluster is less depending on geographical circumstances. The space-pump effect can be influenced by landscape architects, who can decide where this effect is the most suitable, and how this area should transform, both approached from different perspectives.

The profession of landscape architecture should take an important role in the process of the space-pump related to a metropolitan food cluster. But landscape architects need to deal with a high amount of uncertainty. Something what is inherent to the profession of landscape architecture, and certainly not exclusive related to the space-pump. Tress states: “the holistic nature of landscape, which integrates the complex reality of the physical environment with perception and psychological meaning, which combines different hierarchical scales of complexity of highly dynamical systems, is basically uncertain” (Tress et al, pp. 18, 2004). Although uncertainty might be inherent to landscape architecture, the uncertainty within the phenomenon of the space-pump is very obvious, as described in the previous paragraph. The landscapes where the space-pump might occur can be described as highly dynamical landscapes, and there processes of chaotic development, and self-organizing are likely to occur (Portugali, 1999). Many methods have been developed to assess the uncertainty, but all fail to assess the overall uncertainty (Tress et al, 2004). Therefore landscape architects need to use appropriate methods, and solutions to deal with the uncertain space-pump. This involves for example transparency about the risks, decisions, and responsibilities (Tress et al, 2004). The role of a landscape architect should fit to the by Jones described ‘designer as a glass box’ where transparency is provided how, and why a certain decision is made, and people can understand this line of reasoning (Jones, 1970). The transparency of the design process is also important for the implementation, and continuity of the design. In order to deal with this amount of uncertainty, the design should be open to the changing circumstances in the future. Therefore the people who adept the plan in the future to the changing circumstances should understand the important line of thinking, to make decisions in

the same reasoning as the design is meant. A landscape architectural plan for the space-pump should be flexible, and therefore an adequate provision of accessible information is essential (Carmona et al, 2009).

3.7 The framework concept as basis for the space-pump.

It is never mentioned as such, and never researched as such, but the framework concept shows many potential similarities with the space-pump. The framework concept is originally developed by Kerkstra, and Vrijlandt (1990). One of the motives to develop this strategy was the uncertain development of the agriculture (Sijmons, 1991). The field of agriculture would develop in short, unpredictable planning cycles, focused on adapting to the technological, and economic developments (Sijmons, 1991). Therefore agriculture has a different planning need, than other functions (Harsema, 1993). In the past these differences in needs have resulted in a decrease of non-agrarian processes in the landscape. The reclamation of rough land, the development of drainage systems, and the expanded infrastructure have marked the levelling of the Dutch landscape (Kerkstra & Vrijlandt, 1990).

In order to prevent a further decrease of non-agrarian processes in the landscape, Kerkstra, and Vrijlandt propose the framework concept (Kerkstra, & Vrijlandt, 1990). The main principle of this concept is to spatially segregate high-dynamic functions in a flexible layout, and low-dynamic functions in a stable framework (Kerkstra & Vrijlandt, 1990). The integration of intensive agriculture, and several non-agrarian functions has proven to provide conflicting situations (Kerkstra, & Vrijlandt, 1990. Here the comparison with the metropolitan food cluster, and the space-pump can be made. The metropolitan food cluster can be considered as one of the agricultural developments that require flexibility within the landscape, and has a relative short development cycle. This high dynamic development is the engine of the space-pump, and can therefore create space for the low dynamic functions in the landscape. Functions that disappeared over time, or cannot develop because of the strong forceful power of agriculture. The motives to develop both concepts, and the aim of both concepts is comparable, the hierarchy, and development process can be considered as different. The framework concept foresees in the development of a stable framework with low-dynamic functions, in order to provide space for the high-dynamic functions, such as agriculture, to develop (Kerkstra & Vrijlandt, 1990). While in the space-pump concept the development of a high-dynamic function, the metropolitan food cluster, creates space for the low-dynamic functions to develop. A different process with the same input, output, and aim. Therefore a further research towards the potentials of the framework concept for the concept of the space-pump can be valuable.

Designing with the framework concept involves the planning of: “a durable and stable framework, an interconnected pattern of zones in which nature management, forestry, outdoor recreation and water control is concentrated. This framework envelops large open areas in which optimal agricultural production is made possible” (Kerkstra & Vrijlandt, pp. 279, 1990). The framework concept will help to meet the demands in society, by achieving a functional, and visual differentiated landscape (Kerkstra, & Vrijlandt, 1990).

There are also criticasters of the framework concept, like van der Vlis. He argues that the framework concept contains weaknesses with regard to the exact division between high, and low dynamic functions, the difference between the sustainability of the spatial structure, and the processes itself, and the relation between the framework, and the current landscape (van der Vlis, 1991). The critics, and interpretations of the framework concept in relation to the space-pump will be discussed in chapter 6.

3.8 Modelling structure.

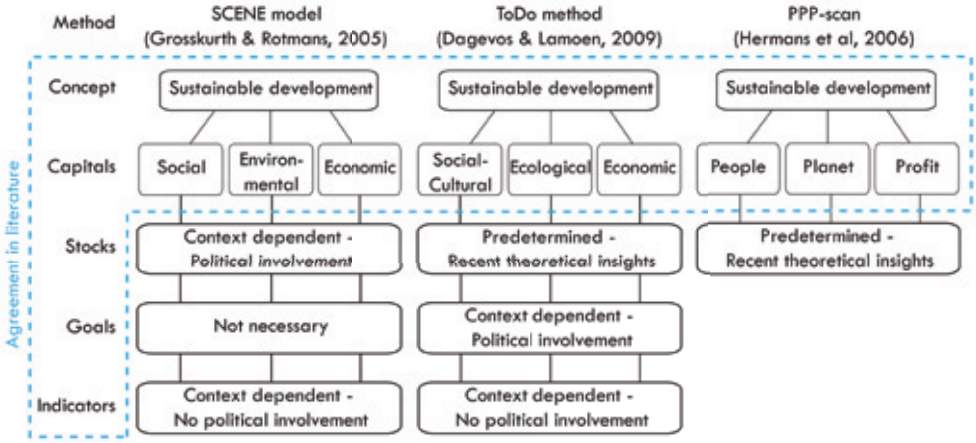
The claim of this research is that the concept of metropolitan food clusters is mainly developed from a one-sided perspective. Namely an agricultural, or economic perspective. To prevent also an economic perspective in the space-pump development, more of the perspectives that are present in the landscape will be taken into account by the model development. The exploration of multiple models at the same time can help to prevent the fixation on a certain design too early, and can lead to more effective design results (Dow et al, 2010). Different spatial models, each developed from a different perspective will provide an important exploration of possibilities, and consequences, as basis for the design of the space-pump.

There has to be sought for perspectives that are exclusive, equal, and cover a complete range of perspectives. These perspectives can be found in the concept of regional sustainable development. The concept of sustainable development is a response to the dominant rationality of economics in politics. Comparable to this research which will offer a response to the economic rationality by metropolitan food clusters. This caused a quest to make the relation of the economic reach and the social-cultural, and ecological transparent (Hermans et al, 2006). There are many different definitions of 'sustainable development', but the most widely accepted is the definition of the World commission on environment and development: "sustainable development meets the need of present without compromising the ability of future generations to meet their own needs" (World commission on environment and development, 1988). Although this definition is most widely used, it is also open for discussion. This definition of sustainable development is normative, subjective, ambiguous, and complex, and therefore impossible to measure objectively (Hermans et al, 2006)(Grosskurth & Rotmans, 2005)(Kraker et al, 2005)(Avelino & Rotmans, 2009). First, the definition is normative because it is an estimation that future generations should have the same needs as we have now (Hermans et al, 2006). Second, subjective, because it is a personal opinion what, and how many 'needs' this, and the future generation will have (Hermans et al, 2006). Third, ambiguous, because all capitals are equally weighted, but they could be weighted in different ways (Hermans et al, 2006). Fourth, complex, the concept describes developments in different time scales, geographical scales, and across domains in one definition (Grosskurth & Rotmans, 2005). Thus, in short, a critical opinion could immediately reject the concept. Norgaard is one of those criticasters, he argues that the combination of the concepts 'sustainable' and 'development' is per definition impossible. In his opinion it is like the peoples of two Chinas agree that there would be eventually one, without determining which one (Norgaard, 2002).

Although the critique on the concept of sustainable development is understandable, it should not immediately be rejected. It rather offers opportunities of using parts of this concept for the model developing. It is not the aim to measure how sustainable the phenomenon of the space-pump is, the aim is to explore the differences between the models when the space-pump is developed from a different perspective, moreover the aim is to synthesise these different perspectives in a more balanced way. Therefore the concept of sustainable development is still very useful.

Even though there are some criticasters in literature, such as Norgaard, who reject the complete concept of sustainable development, there is a more or less general agreement on the definition of sustainable development, and that in a sustainable development three concepts, or capitals should be present (Hermans et al, 2006)(Grosskurth & Rotmans, 2005)(Dagevos & Lamoen, 2009). Although there is some drift in terms, they all describe the capitals 'planet' (also: nature or ecology), 'people' (also: social or social-cultural), and 'profit' (also: economic). All three capitals are equally important in the concept of sustainable development (Hermans et al, 2006) (Grosskurth & Rotmans, 2005)(Dagevos & Lamoen, 2009). This will be the basis for the development of the different models of the metropolitan food cluster, and the space-pump.

There is a sort of general agreement in scientific literature about the concept of sustainable development, the three capitals (people, planet, & profit), and that each capital contains stocks, goals, and indicators. But about the content of the stocks, goals, and indicators, there are many different opinions (fig. 3.13). One point of discussion is whether the stocks (parts of each capital) are general, or context depended. Grosskurth, and Rotmans argue in their SCENE model for context depended stocks. The stocks should be determined by researchers, experts, politics, and/or a participatory process. Later in this process the researchers, or experts can determine indicators to measure the stocks in terms of quantity, quality, function, and spatial component (Grosskurth & Rotmans, 2005). Dagevos, and Lamoen argue for their ToDo-method, that the stocks are not context dependent, but should be based on recent theoretical insights. These stocks can slowly evolve, when theoretical insights change. Politics determine goals related to the stocks, and researchers determine indicators to measure these stocks (Dagevos & Lamoen, 2009). The PPP-scan (people, planet, profit-scan) is built on the theory of the ToDo-method. In the PPP-scan, the stocks are also based on the existing theoretical insights. But, in this method no goals, or indicators are used. Only a relative indication of improvement, deterioration, or neutrality is given (Hermans et al, 2006).



3.13 Overview of three methods about possible ways of using the concept of sustainable development of regions.

The main differences between all models to use sustainable development are: the level of political decision-making, and the context dependency of stocks. These differences are highly relevant in relation to this thesis, and the case of Venray. First, there is a difference in the level of political decission-making. This research aims at exploring the differences of the space-pump effect by exploring spatial models from different perspectives. Using a high level of political decision-making might exclude other perspectives. Second, the context dependency of stocks. When stocks are context dependent, who decides which stock is included, and for what reason. In a exploration of spatial models based on different perspectives, stocks should be determined on an abstract level.

Although the overview of the different models that deal with the concept of sustainable development, each show its shortcomings, there are certainly useful elements in this concept to use as basis for the spatial modelling. This approach is no new method, but is a slightly different way of using the existing method. Instead of making a plan, and assess it on three capitals with different stocks, the three capitals will be used as perspectives for the models to make them meet the stocks of each capital. The three main perspectives for the model development will be the people's perspective, the planet's, and the profit's. This covers a complete range of perspectives, are

equal, and for the main part exclusive. Each perspective will in the model-phase of this research only focus on the stocks belonging to that perspective, or capital. The stocks are the stocks from the ToDo method (Dagevos & Lamoen, 2009) and the PPP-scan (Hermans et al, 2006)(fig. 3.14). The stocks, and the definition is based on the recent theoretical insights (see for definitions, and references appendix II).

By using a part of the method in the previous described way, sustainable development cannot be measured. But, this is also no aim of this research. By using this this type of spatial modelling for this research, and carefully describing how choices from a certain perspective are made, this approach carefully maps out the subjectivity (Grosskurth & Rotmans, 2005). People are not confronted with a black-box tool for readymade strategies. The method might therefore also be seen as attempt to break down the black-white discussion in agricultural development. By describing each perspective, and each choice, there can be sought to understanding, or a common ground, as described in the common ground-dialogue (Jacksteit & Kaufmann, 1999).

In conclusion the concept of sustainable development provides a basis for the modelling structure of this study, but this study does not aim at measuring the degree of sustainable development. The three perspectives are people, planet, and profit, with each six to seven predetermined stocks based on the recent theoretical insights. Each perspective will be the basis for one line of spatial models.

PEOPLE	PLANET	PROFIT
- Social participation	- Soil	- Spatial settling conditions
- Health	- Air	- Capital
- Art and culture	- Nature	- Knowledge
- Live-environment	- Surface water	- Energy and raw materials
- Safety	- Groundwater	- Labour
- Education	- Landscape	- Economic structure
- Economic and political participation		- Infrastructure and accessibility

3.14 The three capitals of sustainable development as defined by Hermans et al (2006), with the stocks based on recent theoretical insights. (see for a definition of each stock appendix II)

3.9 Conclusion.

One important conclusion after this reference study to the space-pump is that it is an umbrella-term. The term space pump points at a certain process in land-use change. But the way, time-span, location, size, and content in which a space-pump occurs may differ. Three criteria are essential for a space-pump: first, a trend in the existing form of land-use is the cause, or engine of the space pump. Second, this trend causes function-decay in areas of the existing land-use. Third, the new function is undefined, at least till the moment of function decay. The moment one of these does not appear, or in a different order it is not a space-pump.

Another important conclusion based on the process of the reconstruction law is that the concept of space-pump is a consequence of trends in the existing form of land-use, and thus should be treated as such. The space-pump is not geographically restricted, and combined with the possibilities to anticipate early in the process, makes the space-pump guidable. But the guidance of the space-pump should not intervene with the original cause of the space-pump, this was the major weakness in the reconstruction law related to the space-pump. The actual appearance of the space-pump is depending on the context, and the perspective of the actors involved.

One difficult part of the space-pump is the determination of the function decay. Function decay is here defined as: the moment the actor(s) within a certain area decide that the existing form of land-use will disappear from its location, before a new form of land-use is determined. This definition still leaves space to interpret in different ways. Who are actually the actors who can decide this? In the reconstruction law the government determined this function decay for agriculture, but the actual power seemed to be in the hands of the farmers. Moreover can you really capture this moment, it is not something physical, what is actually the moment of decision? The moment it occurs in the minds of the actors? The moment they have a verbal unofficial agreement? Or maybe the moment they have signed a contract? This uncertainty exactly points out the uncertain, but important role the determination of the function decay plays in the concept of the space-pump. The earlier in the process the function decay can be determined, the better there can be anticipated on this phenomenon, but also the more uncertain this function decay is, see again the reconstruction law. In contrast, when the function decay is determined in a late stadium of the process, it is much more certain. For example in the industrial Ruhr area where the function decay was determined after years of vacancy (Nickerson, 2010). Here the function decay is pretty certain, but when determined earlier, a better anticipation would probably be possible, and maybe even a prevention of vacancy.

3.10 Reflection on research structure.

In this chapter the space-pump is defined, and thoroughly described. The research structure is designed before the research on the space-pump was started. Therefore in this paragraph will be reflected on the research structure. The most striking difference might be that the research structure is designed based on the idea that the space-pump could be researched in the case-area alone by analysing the spatial, economic, and social situation of the agriculture, and the landscape in that area. Partly this is still true, but this chapter reveals that the space-pump effect is for a large extend depending on trends that can be influenced by the stakeholders, and less by the spatial, economic, and social situation. The perspective of each stakeholder may differ, therefore a modelling structure based on different perspectives is composed in this chapter to overcome the difference between the research structure, and the research outcome. This approach should reveal a wide, and balanced range of spatial models that are possible from a certain perspective. These models are possible ideas for a certain location, and together with the landscape analysis the most important input for the design.

Another stiking misconception is related to the appearance of the space-pump. The space-pump is no process of drastic autonomous developing function decay, of large pieces of abandoned land, and decaying buildings. The appearance is much more subtile, and guidable. An importnat notion as basis for the design.

Another difference between the initial research structure, and the research on the space-pump is that the focus in the research structure initially is defined on the rural areas, but this chapter shows that the space-pump is the consequence of a certain trend, and cannot be seen loose from this trend. One needs to know how for example the metropolitan food cluster will develop, in order to understand the space-pump consequences.

The initial research objective still stands: to explore the possibilities of landscape architecture to contribute to the concept of space-pump, and in that way, contribute to the discussion about agricultural development in the Netherlands. This early in the process there is a relative high level of anticipation possible on the consequences. But there is just a small balance. Planning for the space-pump now will involve many uncertainties, and therefore asks for a high amount of flexibility, in the design, and in getting the stakeholders on board. Something what failed in the example of the reconstruction law (see paragraph 3.4).

4

Case Venray

Venray is an area that breaths agriculture, when one is passing through this landscape there is agriculture in every detail. The rural areas contain many, sometimes very large farms and crop-land. It is hardly possible to be at a certain spot in the rural landscape of Venray without seeing any farm. Still the farms are growing, on many places a building-site can be found where new stables are arising. The area of Venray, is one of the possible regions where the transition to a metropolitan food cluster can take place, and thus also the space-pump. Venray contains a very vital livestock sector, and the local authorities are willing to consider the further development of this sector. Large parts of Venray are reclaimed for large-scaled agricultural purposes. This provided Venray with many very large livestock farms which belong to the top of the world in their field. This sector is economical, and social very important for the region, but has also some negative consequences. One of these negative consequences is the blurring of landscape characteristics. The large scaled agricultural developments provided Venray with a very monotone agricultural landscape, where the relation with the diverse abiotic systems is lost. Especially the stream valleys are disappeared, influenced by a wide range of interventions.

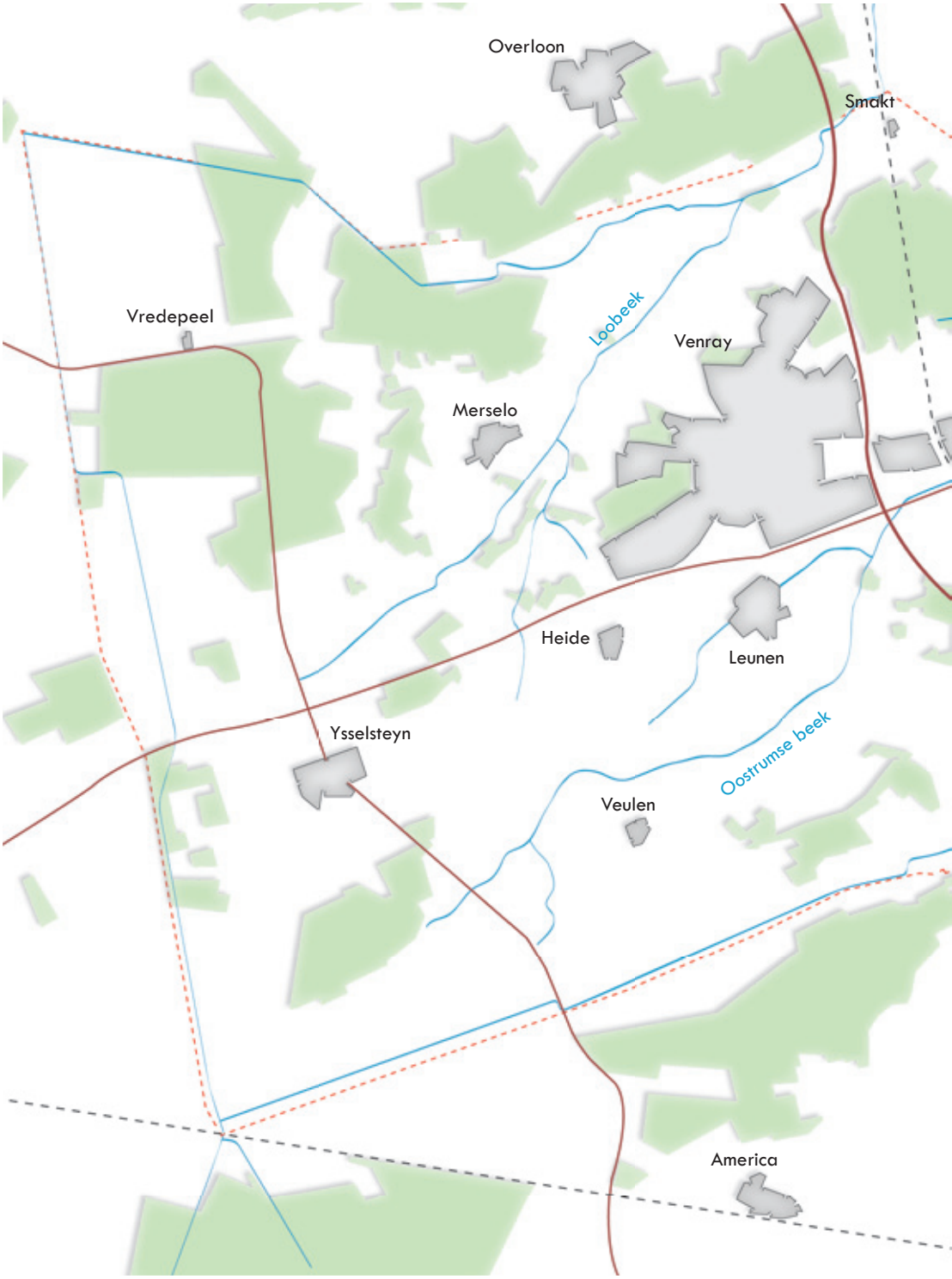
4.1 Farm with dairy cows near Merselo. One of the many large farms with livestock in Venray.

4.2 The livestock sector of Venray is highly interwoven with society, which is expressed by for example this 'agricultural childcare facility' near Leunen.

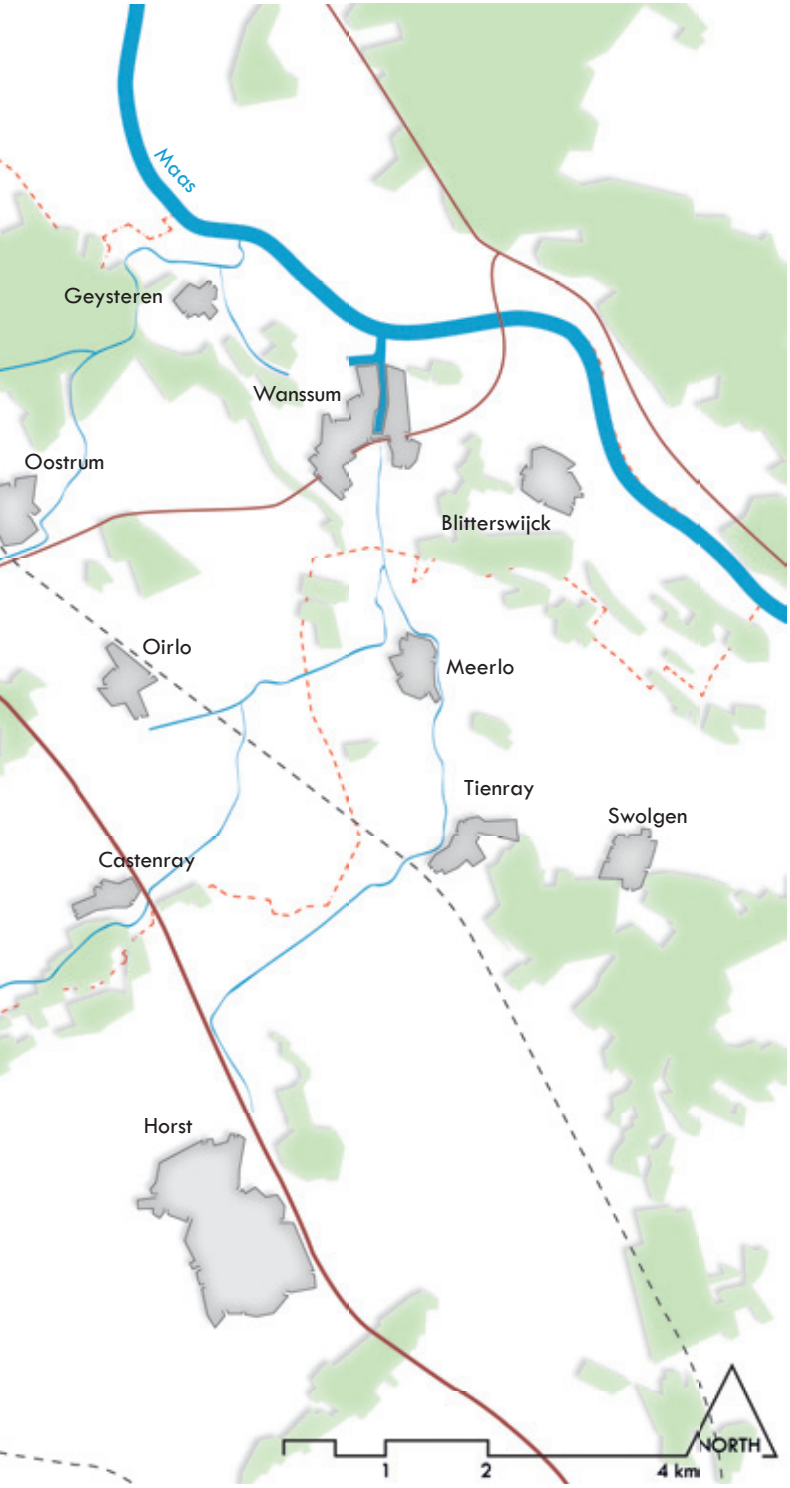
4.1 Venray.

This research does not solely concern the concept of metropolitan food clusters, and the consequences of the space-pump. But also the characteristics from the region of Venray. Venray is a region that might face the effects of a transition of agriculture to the concept of metropolitan food clusters. This municipality contains a large, and economic vital livestock sector, and the municipality is willing to think about this possible transition. This case is interesting because here a possible transition to metropolitan food clusters might take place, and therefore it is necessary to ask what the future of the region will be.
Venray is located in the north-west of the province of Limburg, on the edge with the province of Noord-Brabant (fig. 4.3). In the centre of the municipality the city of Venray is located, with approximately 30.000 inhabitants (Gemeente Venray, 2012). The remaining 13.500 inhabitants of the municipality are living in one of the 13 villages, with between 200, and 2000 inhabitants per village (Gemeente Venray, 2012)(fig. 4.4).

4.3 Venray, located in the north of the province Limburg.



4.4 Topography of Venray.



Legend

- Villages
- Motorway or N-road
- Railway
- River
- Stream
- Forest
- Municipal border

4.5 One of the many pig farms with an industrial appearance near Ysselsteyn.

At the east side of the municipality the 'Peel' is located, a former rough land which is reclaimed for agricultural purposes in the first half of the 19th century (Rijksdienst cultureel erfgoed, 2011). This provided Venray with a large area with land for agricultural use with a relative low quality. Therefore here a form of agriculture developed which was less depending on the land, intensive livestock. The villages of Vredepeel, and Ysselsteyn were founded in the twentieth century as model-villages for the new Dutch agricultural landscape. But, also the development of other villages is related to agriculture, for example the village of Leunen. Leunen arose around the location of the last farm before the 'Peel' would start. When the 'Peel' was reclaimed, and the agricultural sector grew in this area, also the village of Leunen grew.
At the west side the river 'Maas' is the border of the municipality. The village of Wanssum has a harbour with direct connection to the Maas. As project border the municipal border of Venray is taken. Venray is at this moment the only municipality in this region willing to think about the development of a metropolitan food cluster (Gemeente Venray, 2006). For the analyses a wider border will be researched to place the project in its regional context, and to make possible future connections with other municipalities.

4.1.1 Agriculture in the region.

In the province of Limburg there is a growing discussion between the government, the agricultural sector, and non-profit organisations about the relation between the rural landscape as productive space for agriculture, and the social demands in the same countryside (Vogelzang et al, 2010). The agricultural sector is still the most important land-user of the rural landscape. In Limburg almost half of the amount of land is in use for agriculture (Huls, 2011). But, there are also other claims on this land such as: nature protection, recreation, and water-management. According to (inter)national, and provincial policy, this asks for a function change, or combining of functions to guarantee a vital, and functional rural landscape, now and in the future (Vogelzang et al, 2010).

4.6 Canal in the young reclamations near Ysselsteyn. Large, rectangular parcels of productive land.

In 2008 there were approximately 5.000 agricultural companies located in the province of Limburg, this is 7% of total in the Netherlands (Vogelzang et al, 2010). The agricultural sector is very important for the province with regard to the economic perspective. Especially the sectors of horticulture, and intensive livestock are relatively important with an added value of 18 and 26% (LEI, 2011). The livestock sector offers an employment of over 13.000 full-time jobs (Baltussen et al, pp.17, 2010). This is comparable to the amount of jobs in a company like Philips in the Netherlands, Philips contains almost 14.000 jobs (NOS, 2012). The total agrocomplex in Limburg is responsible for almost 10% of the employment (Baltussen et al, pp.17, 2010). Because also the supplying- and service companies related to agriculture are located close to the primary sector. Especially the fodder industry is strongly settled in the northern, and middle part of Limburg. Only the processing industry is absent in Limburg, but located in the near surroundings of the province (Baltussen et al, 2010).

Although the province of Limburg has a flourishing agricultural sector, the amount of agricultural producers is decreasing. Between 2005, and 2010 the amount of producers decreased with over 12% (Huls, pp. 60, 2011). The highest decrease took place in the southern part of Limburg at relatively small companies (Huls, 2011). Overall the decrease of producers was higher than the Dutch average (Vogelzang et al, 2010). This decrease of producers does not automatically lead to a decrease of production-factors such as cattle, and land. The farmers who remain will take over the production of the farmers who stop (Wezel et al, 2011). In this light it might be logic that, Limburg contained in 2008 more than average large agricultural companies, 20% is larger than 150 NGE (Dutch Size Unit) compared to 15% as Dutch average (Vogelzang, et al, 2010). Moreover in 2005 Limburg contained over 160 farms larger than 300 NGE (Huls, 2011), which in some definitions already is considered as a mega-farm, and over 40 farms are larger than 500 NGE which in merely all definitions is considered as a mega-farm (Huls, 2011).

For the future Vogelzang et al considers the agricultural sector in Limburg as capable to compete with other areas. Up-scaling will be an important development in this process. This will continue to keep reducing the costs, and therefore guarantee the continuity of the sector (Vogelzang et al, 2010). Especially in the north-western part of Limburg (including Venray) there is a

trend to larger farms with more intensive livestock, and in the southern part there is a trend to smaller farms with a diversification of functions (Baltussen et al, 2010). The trend for larger farms in the region around Venray is accelerated by the fact that the minimal surface per animal in a stable will rise in the future, for all type of animals in intensive livestock systems, and dairy cows (Baltussen et al, 2010).

In conclusion the agricultural sector, and more specific the livestock sector is very important for Limburg, with regard to economy, and employment. The livestock-sector is growing in the region around Venray, and even when the numbers of animals would remain the same, the stables might grow because the minimal surface per animal is rising.

Although the livestock sector is important for the province of Limburg, the people are not merely positive about the developments towards an even bigger livestock sector. Research from Baltussen et al shows that people in the south of Limburg are more positive about a growing livestock sector than the people in the north of Limburg. According to Baltussen et al this might be the result of the fact that the south of Limburg is much less suitable for a growing livestock sector, and therefore this growth is less experienced as a threat by the inhabitants (Baltussen et al, 2010). Baltussen et al recognises a strong feeling of 'not in my backyard' towards a growing livestock sector among the population of Limburg (Baltussen et al, 2010).

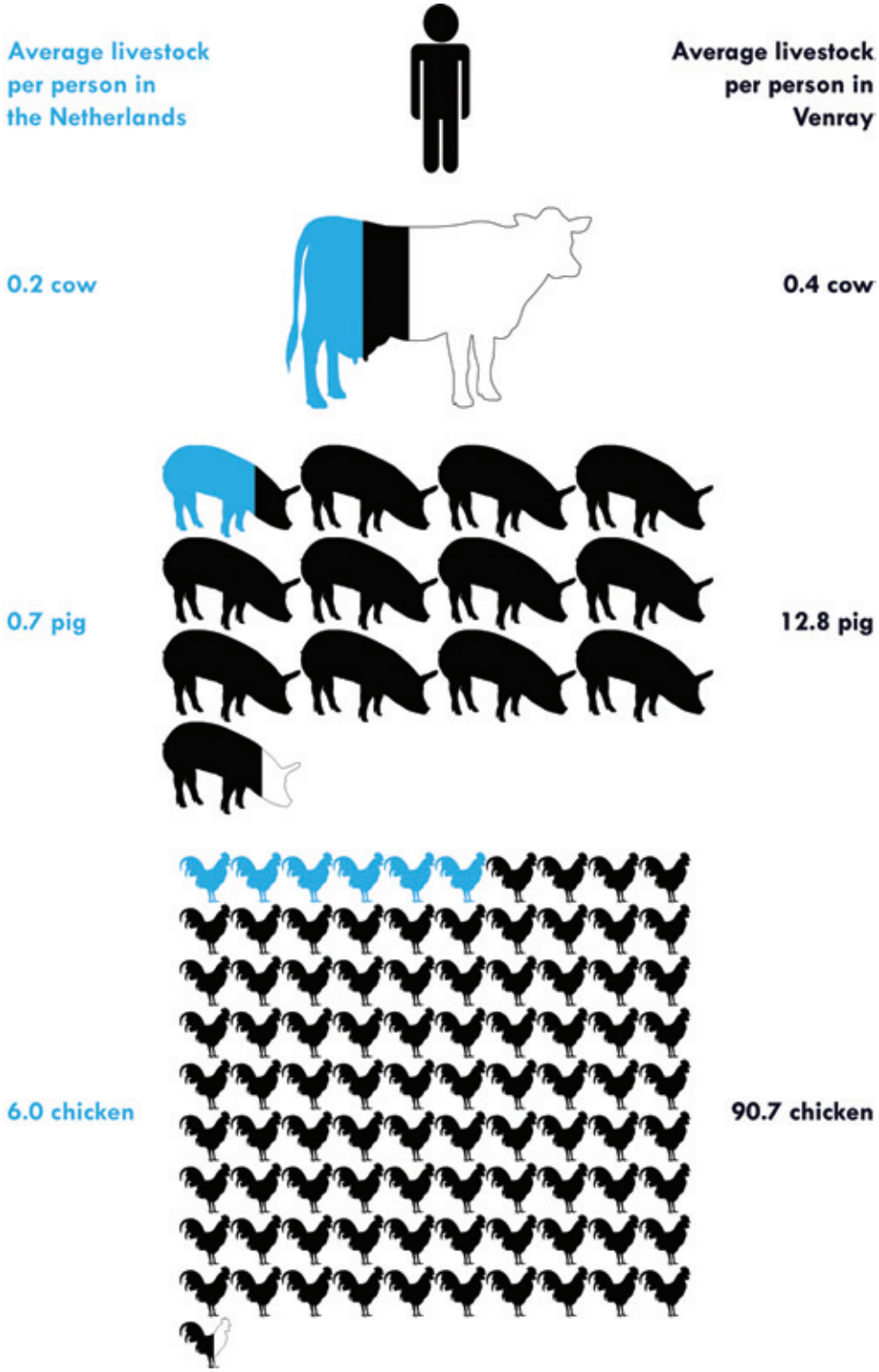
4.1.2 The livestock sector of Venray.

Venray wants to express their municipality as the centre of the intensive livestock sector (Smeets, pp. 5, 2012). Venray wants to express that the intensive livestock sector in an innovative economic sector, and moreover very valuable for the local economy (Smeets, pp. 5, 2012). Therefore the municipality of Venray has in their 'development-perspective' stated to do a feasibility test for a metropolitan food cluster (Gemeente Venray, 2006).

In the municipality of Venray almost 300 farms are located with intensive livestock, pigs or chicken, or dairy cows. The farms are located all around the municipality, but the highest concentration is in the western, and southern part (fig. 4.8). It is also in this part where the areas for agricultural development (AAD) are located. Many agricultural enterprises are still located outside these areas, and it is questionable whether the production of all companies would ever fit into these small areas. One of the reasons for this mismatch could be that there is much more intensive livestock within Venray than the Dutch average (fig. 4.7).

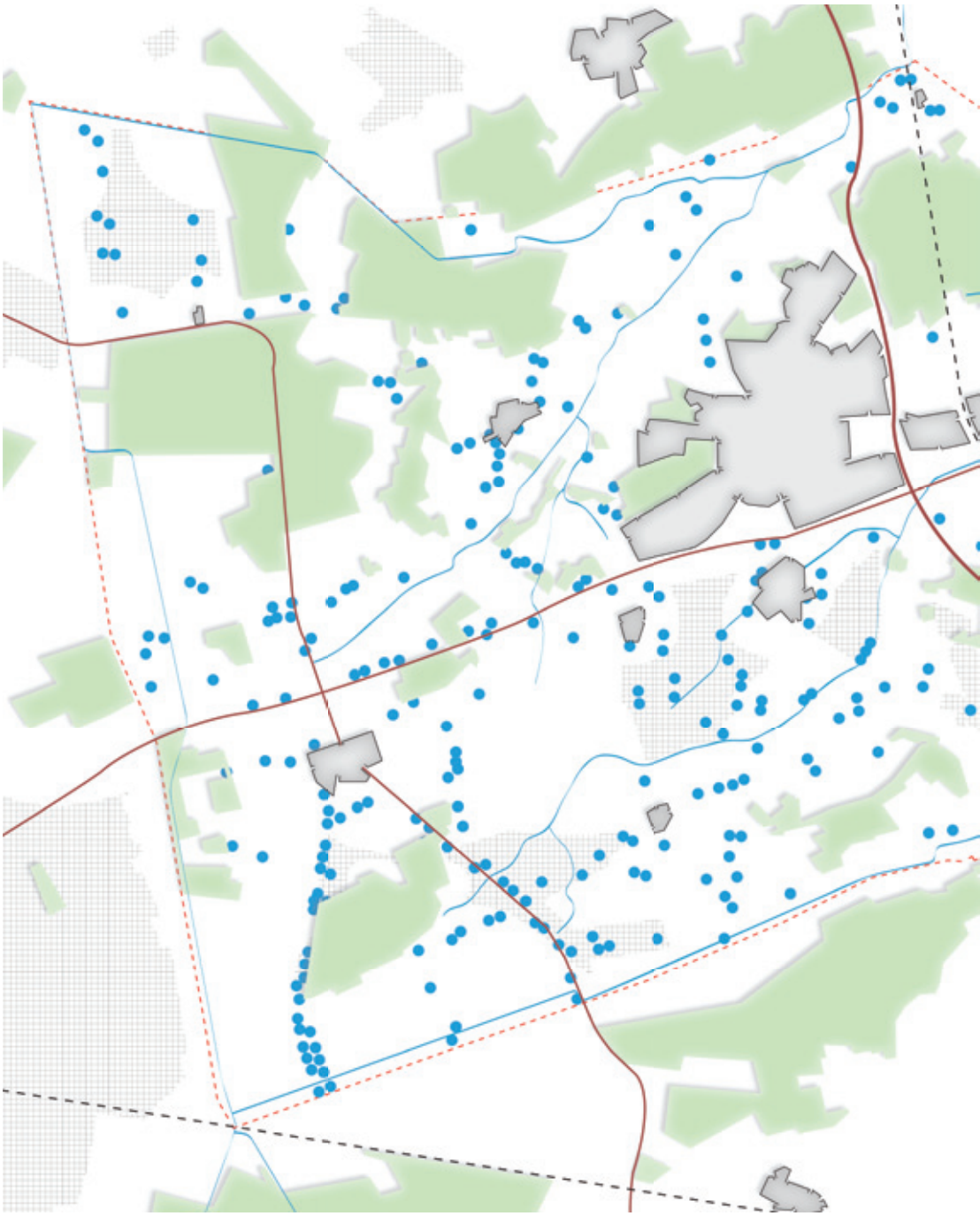
According to Smeets the "Dutch farmers are the best protein-producers in the world, and within the Netherlands several of the most successful enterprises are located in the Peel" (Smeets, pp. 5, 2012)(area for a part located in the municipality Venray). "People sometimes state that the agriculture will disappear from the Netherlands. If that would be the case, than certainly not around Venray, there are the leading companies located (Smeets, pp. 5, 2012).

Upon this information can be concluded that the municipality Venray has a strong livestock sector, and a municipality which is willing to develop the concept of metropolitan food cluster. The necessary conditions to start a research in this case (see also paragraph 1.6). But, although the conditions are there, and helpful, it will certainly cost a lot of time to fulfil this transition in agriculture. But enormous projects such as 'room for the river', moving industry from the city centre to industrial areas, and clustering in the greenhouse-sector, show that such large operations are possible (Smeets, 2012).

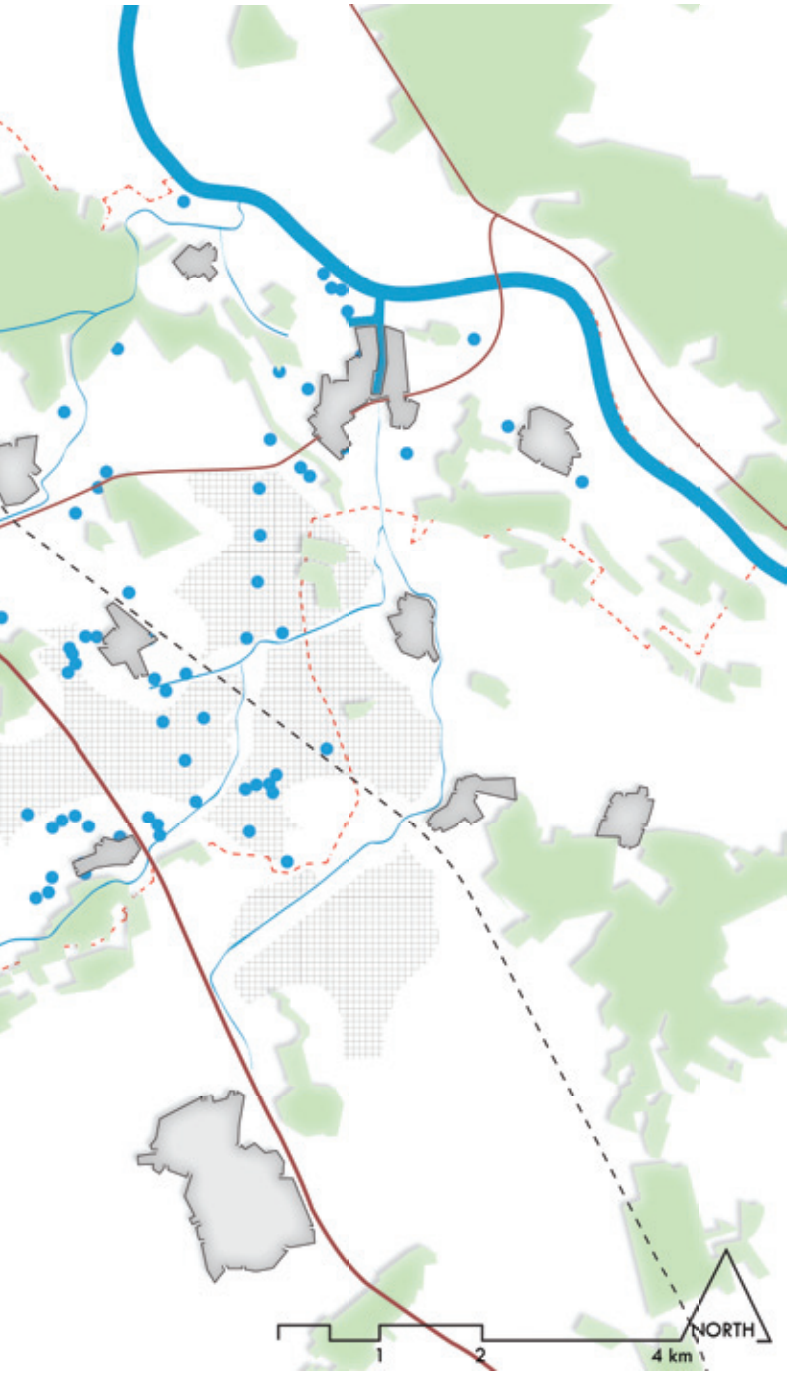


4.7 Average amount of livestock per inhabitant of the Netherlands compared to Venray.

Livestock farms & AAD areas.



4.8 The locations of the almost 300 livestock farms in Venray and the areas for agricultural development (AAD) (Dutch: LOG)



Legend

- Villages
- Motorway or N-road
- Railway
- River
- Stream
- Forest
- Municipal border
- Farm with livestock
- Areas for agricultural development

4.1.3 Space-pump potential.

The analysis of Venray shows that the municipality has a strong relation with agriculture, and has a relatively large livestock sector. This does not yet state anything about the potential size of the space-pump, when this livestock sector transforms into a metropolitan food cluster. When calculating with the existing number of animals, only the amount of pigs has to increase in order to reach the minimal size for a profitable metropolitan food cluster (Smeets, 2012). The potential space-pump size is based on four principles: first, all land in use for the livestock sector today will be included in the calculation of the metropolitan food cluster, and space-pump, independent of location, and land-ownership. Second, the land in the metropolitan food cluster will only be used for the production of grass, and corn for the animals in the metropolitan food cluster. Third, for all parcels will be calculated with the Dutch average of production per hectare. Fourth, calculated with a 100% transition from the current livestock sector to a metropolitan food cluster.

The space-pump can be seen threefold. First in the buildings of the current farms, of which there are approximately 300 in Venray. Second, the disappearance of policy zones, which will not provide physical space, but space by the removal of restrictions. Third, the space-pump can affect physical land, because this is not essential needed in the new agricultural system anymore. At this moment 67% of the surface of Venray is in use for agricultural purposes (Gemeente Venray, 2012). 21% or 3.520 ha is in use by the livestock sector. For the production of grass, and corn for the animals in the future metropolitan food cluster minimal a 1.782 ha is needed (Hogenkamp, 2012) and (Raamsdonk et al, 2007), this area together with 324 ha for the agropark (Smeets, 2012) is the minimal size, for a minimal profitable metropolitan food cluster. The difference between the size of the cluster, and the existing area is the potential maximum of the space-pump calculated in building blocks, and physical land, thus in the case of Venray the space-pump will be maximum 1.227 ha (fig. 4.9).

A few notes have to be made which affect the maximum potential of the space-pump. First it is highly probable that farms are located inside the borders of Venray, but that the land is partly located in another municipality, and also the other way around. Second, the land might be used by a farm, but the farmer may not be the owner, it is therefore questionable whether this land will become part of the concept of the metropolitan food cluster. Thirdly, the calculation is based on a minimal profitable size, but it is possible to raise the amount of animals, and thus also raise the amount of roughage needed. Fourth, the maximum potential will only be reached when all farmers will cooperate in the transition. All these factors make an determination of the size of the space-pump very uncertain, but it will be somewhere between 0, and 1.227 ha.

This calculation shows why Venray is a suitable study-area to fulfil a research towards the space-pump. Because of a relative low amount of grazing animals (cows), the space-pump is in potential extremely large, and worth planning for.

4.2 Landscape impression.

To understand how all developments around a metropolitan food cluster, and the space-pump should be framed in the existing landscape of Venray, a closer look to this landscape is needed. Multiple field trips resulted in the impression in figure 4.10

Especially at the western, and southern side of the city Venray two large areas are located with a very agricultural impression. The young reclamations in the former ‘Peel’ area, have the impression of a large-scaled agricultural landscape. This can be explained by the relative recent development of this landscape type. Here you can find very much large farms, and large areas of productive land. A bit more to the east, there is a large area of old ploughland. Here the impression of the landscape is more varied, the occupation has a much longer history

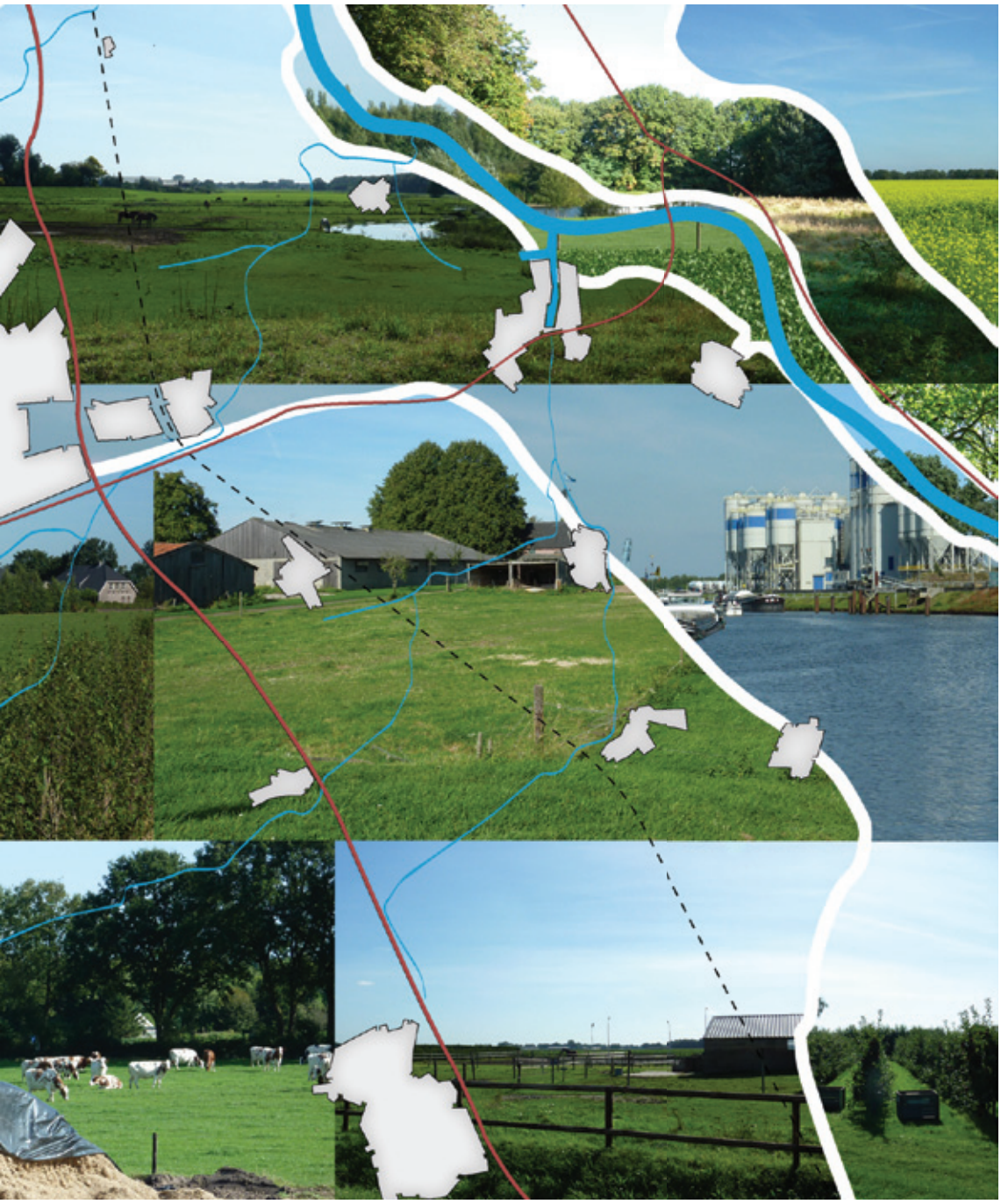
4.9 Space-pump potential of Venray. The maximum area of land, buildings, and policy zones that might be affected by te space-pump by the transition to a metropolitan food cluster.

over here, but still this landscape type has a very agricultural impression. Also here large farms are located, but in this area large farms alternated with small farms, and some non-agricultural functions.

Only the area around the river 'Maas' gives a more authentic impression. Here the landscape has a much smaller scale, and a higher variety of landscape characteristics, and functions, many of them leisure-related such as the golf-court, but also nature areas, orchards, the harbour of Wanssum, and here the estate of 'Geijsteren' is situated. Here in this area just a few livestock farms are located.

Landscape Impression.

4.10 Landscape impression of Venray.



Young reclamations

River bed

River area

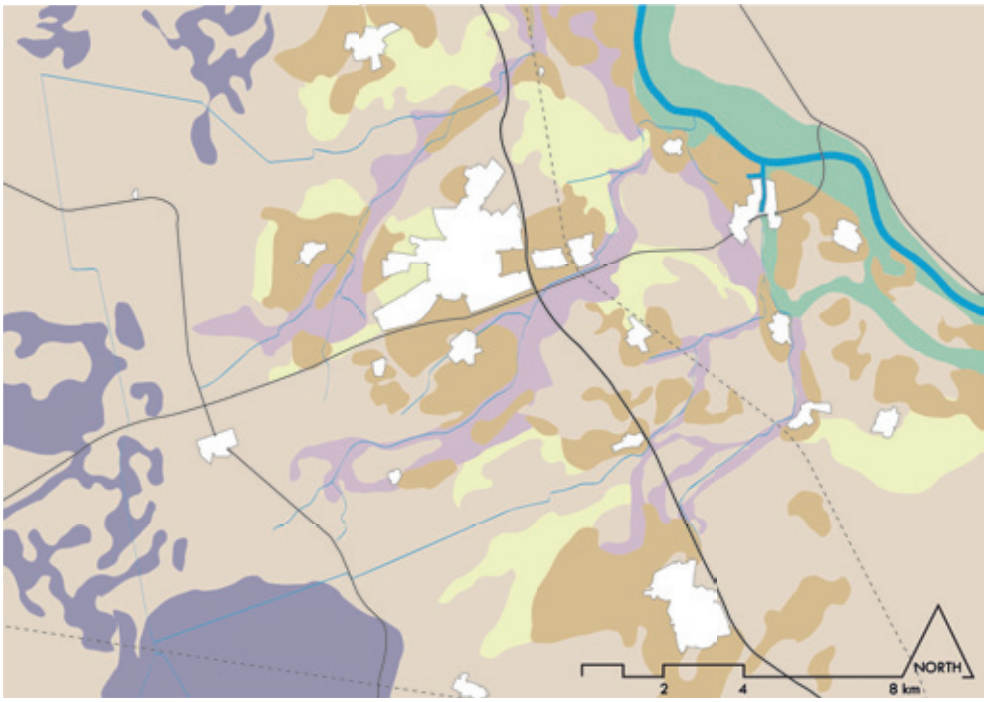
Old ploughland

4.3 Abiotic systems.

The visual appearance of the landscape of Venray gives a certain impression. Especially at the southern, and western side of Venray this landscape is relative monotone, it is much agriculture, and just very limited other landscape characteristics. When analysing the area in more layers than only the visual impression, some interesting relations can be revealed, and in the case of Venray many disappeared relations can be made. Relations between visual impression of the landscape, and for example soil, groundwater, and height.

4.3.1 Soil.

In the soil types of Venray more or less the same areas can be distinguished as in the landscape impression (fig. 4.11) but than with much more gradients. The area around the Maas contains much 'Ooivaaggronden', and 'Poldervaaggronden' (Alterra, 2010). Something that might be expected along a large river as the Maas. The area of 'old ploughland' is also clearly visible on the soil analysis, but contains in the soil much more gradients than the landscape impression. In the soil the stream valleys are clearly visible with its 'Meerveengronden' (Alterra, 2010), whereas



Legend

- Villages
- Motorway or N-road
- Railway
- River
- Stream
- Veldpodzolgronden
- Meerveengronden
- Enkeerdgronden
- Ooivaaggronden and Poldervaaggronden
- Duinvaaggronden
- Moerige podzol- or eerd-gronden

4.11 Analysis of soil types. Especially in the old ploughland many different soil types.

they are hardly findable in the landscape. Between these stream valleys areas with 'Veldpodzolgronden' can be found, which are in some areas changed in 'Enkeerdgronden' around the villages influenced by the very long agricultural use. These differences in soil, between the stream valleys, the 'enkeerdgronden', and the 'veldpodzolgronden' are hardly visible in the current landscape (fig. 4.11).

The area of 'young reclamations' contains mainly 'Veldpodzolgronden' with in some small areas the remnants of the peat area. This area is reclaimed in the first half of the twentieth century. Therefore the villages of Ysselsteyn, and Vredepeel are not surrounded by 'Enkeerdgronden'. In this area there is no 'Meerveengrond' visible because the stream, and the stream valley started on the edge of the 'Peel', and the 'old ploughland'.

4.3.2 Groundwater.

The division in three different zones is less obvious in the groundwater analysis (fig. 4.12). This is partly influenced by the fact that the zone around the Maas lacks data, therefore it could be that this area also with regard to the groundwater is clearly different than the other zones, but this cannot be concluded upon measurements. The other two zones are clearly recognisable in the analysis of the groundwater. The areas with the highest groundwater are the areas around the streams, the stream-valleys. Here the groundwater can be found at maximum 40 cm below the

Legend

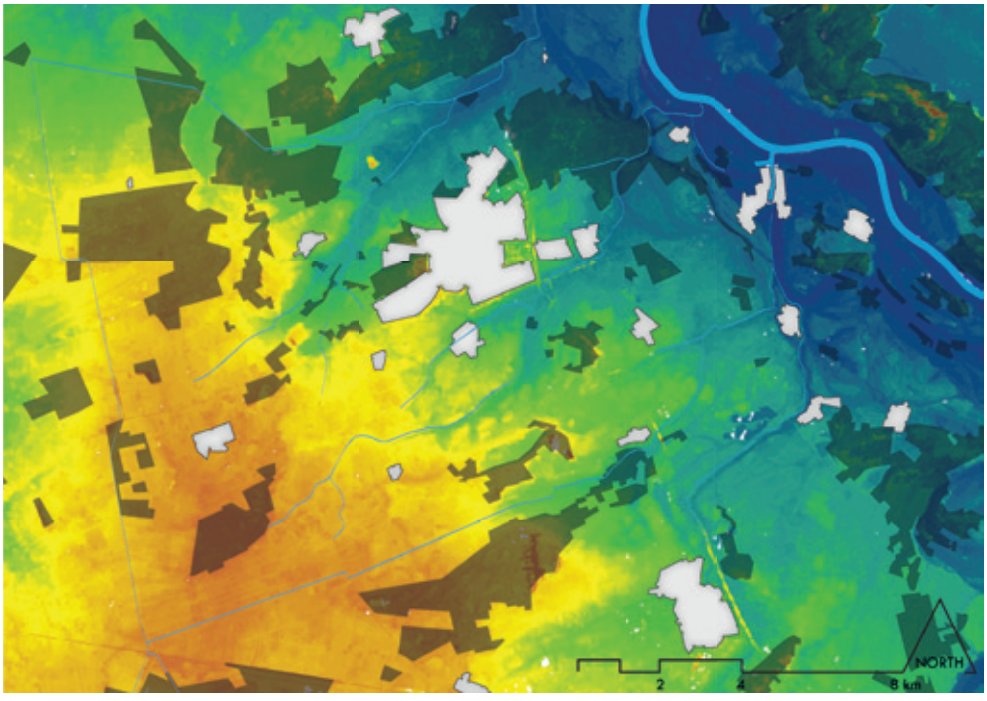
- Villages
- Motorway or N-road
- Railway
- River
- Stream
- Groundwatertable I-III (high)
- Groundwatertable IV-V (medium)
- Groundwatertable VI-VII (low)

4.12 Analysis of groundtwater-table. Stream valleys as areas with the highest groundwater-level.

surface, in periods with the highest groundwater (Alterra, 2010). Connected to these stream valleys, but in much larger zones the groundwater is much higher, and in the zones the furthest away from the streams the most dry zones can be found, with a level of 40-80 cm below the surface in the period with the highest level (Alterra, 2010). Here the relation between the surface water, and the groundwater is visible, but also the relation between the groundwater and the soil-type.

4.3.3 Height.

The last analysis in this abiotic analysis of Venray is the height analysis (fig. 4.13). Also in this analysis the three zones, the river area, the old ploughland, and the young reclamations are visible, and thus also a clear relation with the soil, and the groundwater is present. The river area around the Maas is the lowest area, which can be explained by the fact that this large river is the lowest area. The further away from the river, the higher the surface is. The average height around the Maas is 12.00 m above NAP, a difference of 18.00 m with the highest point in the south-west of the municipality of 31.00 m above NAP (Het Waterschapshuis, 2012). The only lower points in the area besides the Maas are the stream-valleys. All stream-valleys are recognisable in the height analysis, and flowing towards the Maas.



Legend

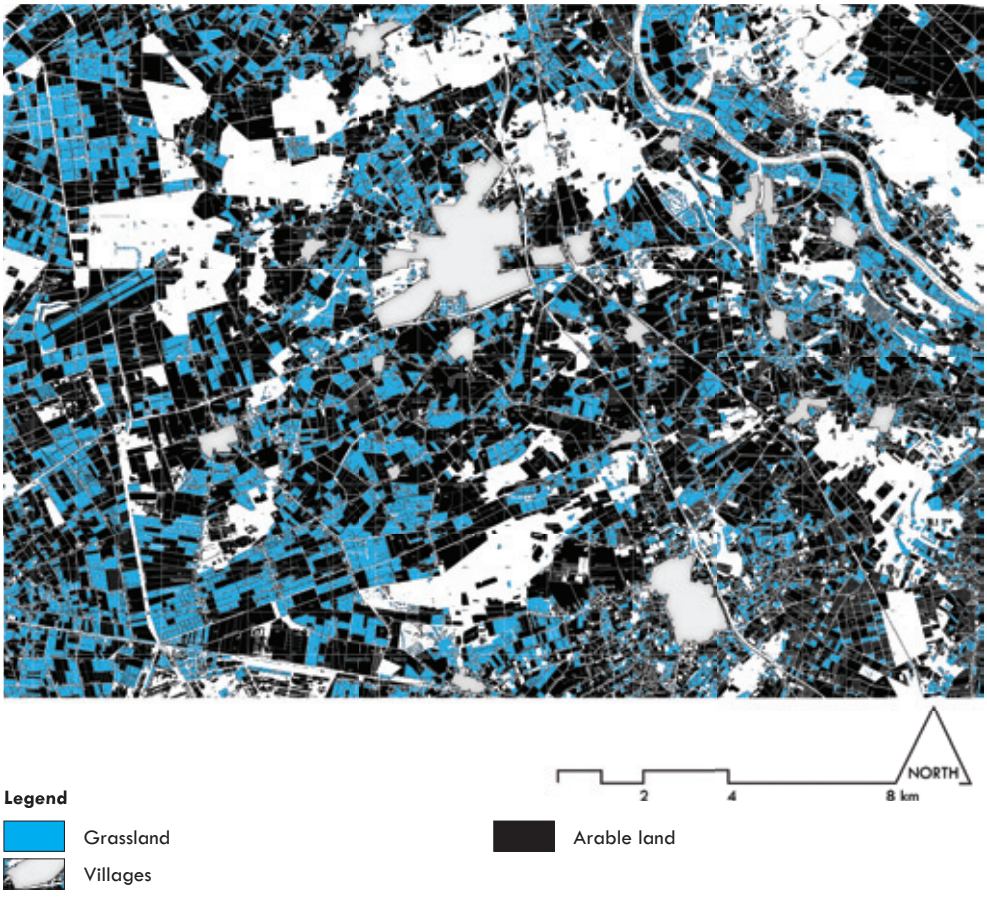
- Villages
- Forest
- River
- Stream
- + 30 m above N.A.P.
- + 25-30 m above N.A.P.
- + 20-25 m above N.A.P.
- + 15-20 m above N.A.P.
- - 15 m above N.A.P.

4.13 Analysis of the height. Transition from high in the west, to low in the east, with the stream valleys as lower zones.

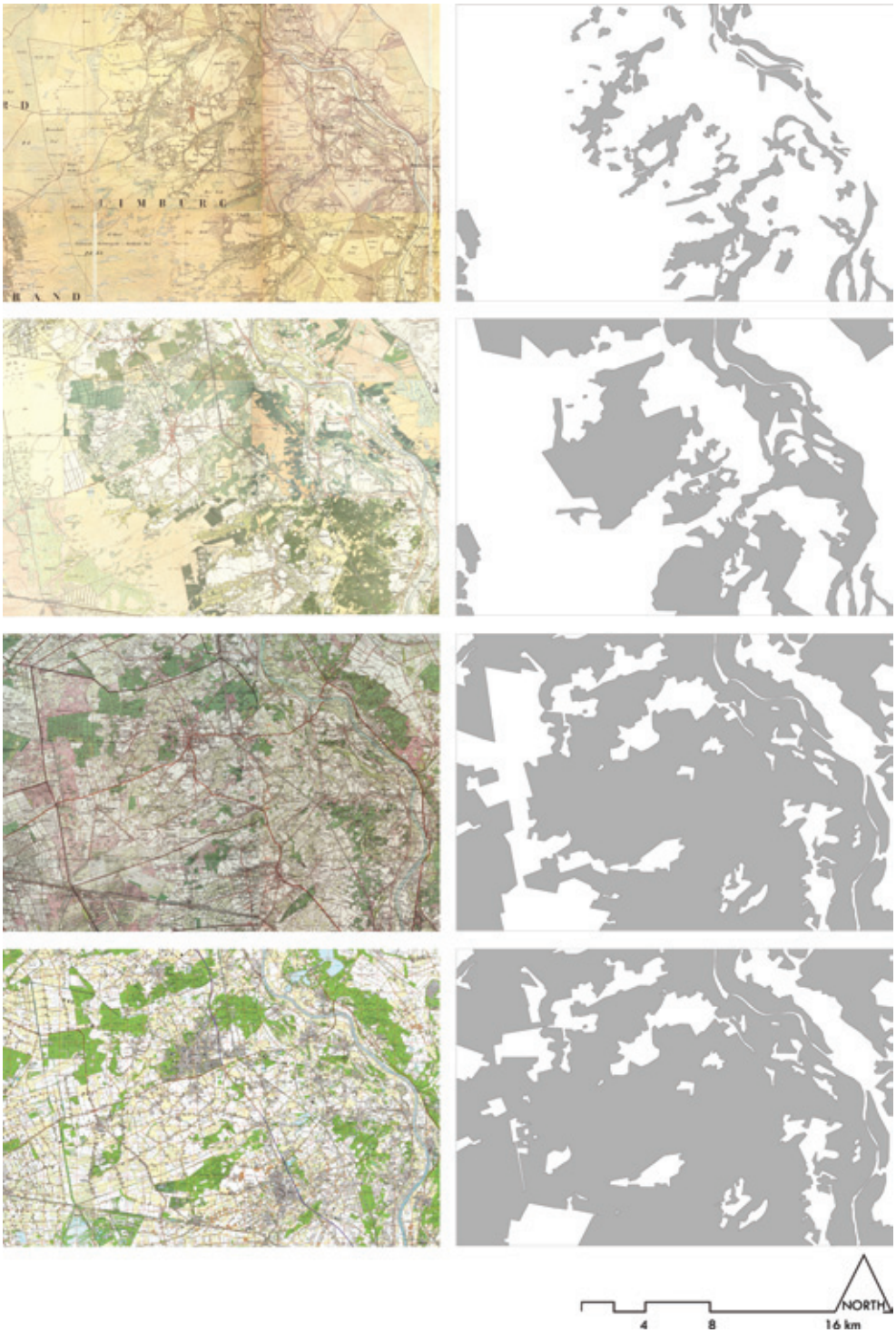
4.4 Occupation.

4.4.1 Historical development agriculture.

The abiotic analyses reveals a landscape full of gradients in Venray, but the current landscape does not show this same amount of gradients in its visual appearance. The analysis of the historical development of the agriculture in Venray partly explains how a landscape full of gradients disappeared in the favour of a monotone agricultural landscape (fig. 4.15).
The first area that was reclaimed for agricultural use was the most suitable area for agriculture, thus around the streams. Halfway the 18th century strips of land along the streams were in agricultural use. But, still many parts of the municipality were rough-lands, or heather, also these areas were in use for agriculture, but they were not cultivated yet. In the beginning of the 19th century the amount of the reclaimed areas increased rapidly, accelerated by inventions such as the artificial fertilizer (Thissen, 1993)(see also paragraph 1.5). Here the relation with the abiotic layer is already getting blurred, although the relation is still visible in the form of land-use, the areas around the streams are in use as meadow, and the areas at the higher, and drier lands are in use as ploughland. In Venray one of the latest large-scaled land-reclamation projects of the Netherlands took place that turned heather, and rough land into agricultural land. Therefore



4.14 Analysis of the agricultural land-use. No clear relation with the abiotic systems can be made.



4.15 Historical development of cultivated land in Venray. 1. around 1850. 2. around 1913. 3. around 1950. 4. around 2000.

the amount of agricultural land increased in the second half of the 19th century. This late land-reclamation is visible in the size of the parcels, the later reclaimed parcels are larger, and more rectangular shaped than the older parcels.

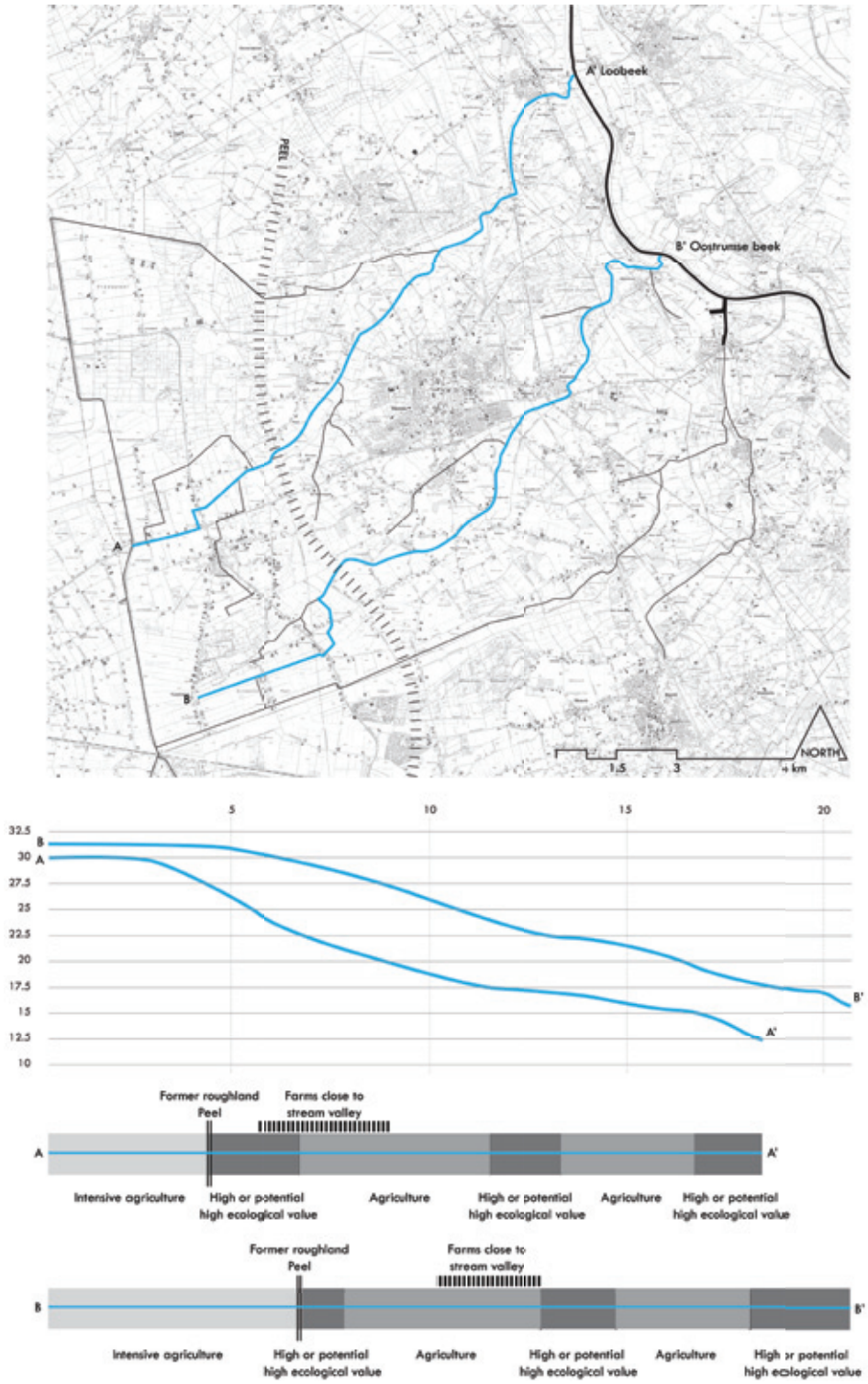
Whereas there is a relation between shape of the parcels, and the time of development, there is currently no, or little relation between the land-use on the parcels, and the abiotic factors. Figure 4.14 shows all parcels in Venray. Based on the shape of each parcel, separate zones might be visible such as the stream valleys, old ploughland, and the young reclamations. But on the basis of land-use certainly not. Based on the abiotic factors it would be most logical when the areas along the streams, with the highest groundwater would be used for grassland, and the other areas for crops, and corn. Although the abiotic factors provide a high degree of flexibility with regard to the choice for a certain crop, the relation between land-use, and abiotic factors is lost here. One possible explanation for this could be, that systems such as the water-system are artificial modified to serve the agricultural production.

4.4.2 Water-system.

A closer look to the water-system reveals for an important part how a landscape full of abiotic gradients could transform into a monotone agricultural landscape, especially at the western, and southern side of Venray. The water-system is modified to create optimal circumstances for the production of crops. Figure 4.16 shows the most important surface-water system. This system contains several streams, all flowing to the 'Maas'. The two most important streams are the 'Loobeek', north of Venray, and the 'Oostrumse beek', south of Venray.

In the water-system the former peat-area of the 'Peel' is still clearly visible. At the eastern side of this edge the streams are relatively meandering, but still much more straight than the original streams. At the western side of the 'Peel border' there are only very straight canals. These parts are in the twentieth century added to the original system of streams. This was the period when the 'Peel' was reclaimed, and the agricultural sector in Venray grew quickly. In this same period the original streams were canalised, the level was controlled by dams, and the parcels were drained to provide more optimal circumstances to grow crops in the stream valley. The system of canals in the young reclamations was added to the existing system, and to make sure that the crops are provided with a sufficient water level, this system of canals had an inlet from the 'Maas' to the backside of the streams. Therefore in dry periods the agricultural areas in Venray could be provided with water from the 'Maas'.

The cross-section of this water-system over the length of the two most important streams also reveals the connection with the 'Peel'. The parts of the water system at the 'Peel' are relatively flat, on the edge of the 'Peel' where the original stream started, the streams have a higher slope. There is some fluctuation in slope along the streams. Because of the lower slope especially the areas at the edge of the 'Peel', in the middle of the stream, and at the end near the 'Maas', contain high potentials to develop valuable nature.



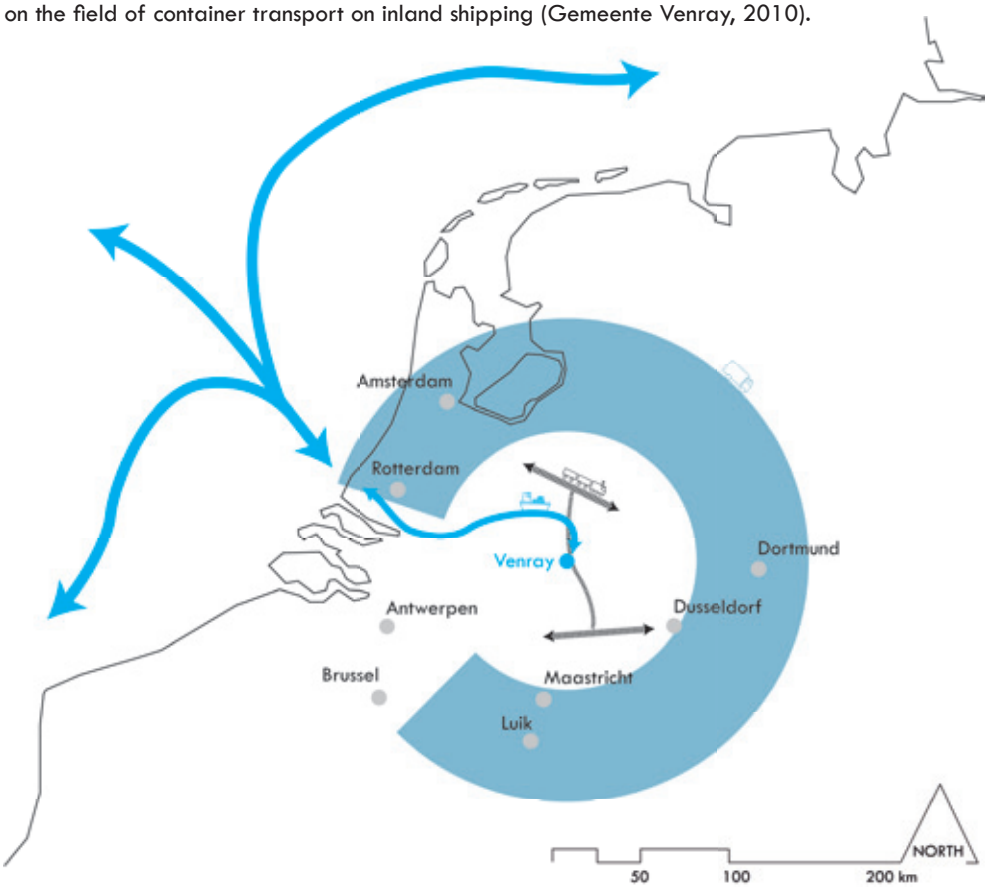
4.16 The water-system of Venray. Almost the whole system is modified, but still the former roughland of the Peel is clearly visible.

4.5 Networks.

4.5.1 Infrastructure.

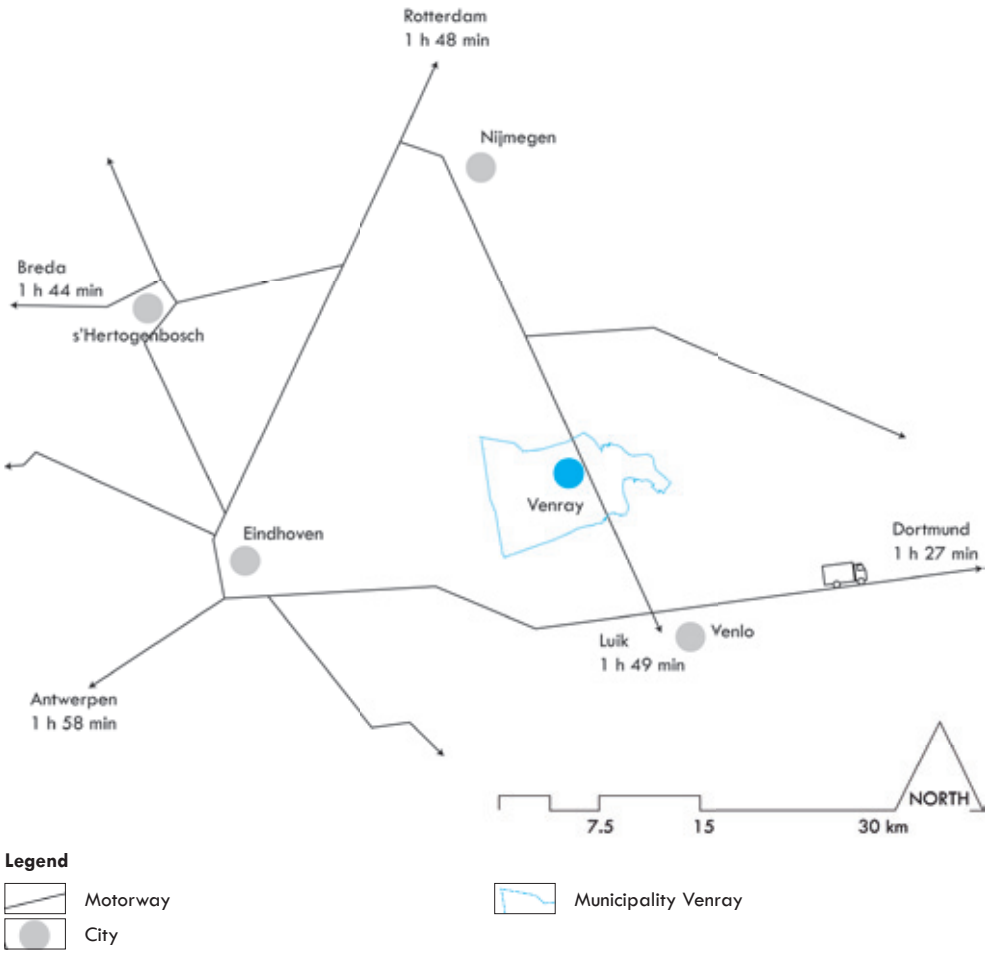
Venray is situated in the north of the province Limburg without any large city in its direct surroundings. This does not mean that Venray is a remote area. In contrast, Venray is connected to many large cities, and ports by road, train, and water networks. These networks are especially relevant for the development of the metropolitan food cluster, and thus also influence the space-pump.

One very important network with regard to the development of a metropolitan food cluster is the presence of a harbour in Wanssum. This harbour is a very important connection between the region of north Limburg, parts of Noord Brabant and Germany on the one hand, and Rotterdam plus the rest of the world on the other hand (fig. 4.17). Mainly sand, and stones are exported from the region, and all kinds of other goods (also fodder for livestock) are imported from the harbour of Rotterdam. The harbour of Wanssum is one of the ten largest Dutch harbours on the field of container transport on inland shipping (Gemeente Venray, 2010).



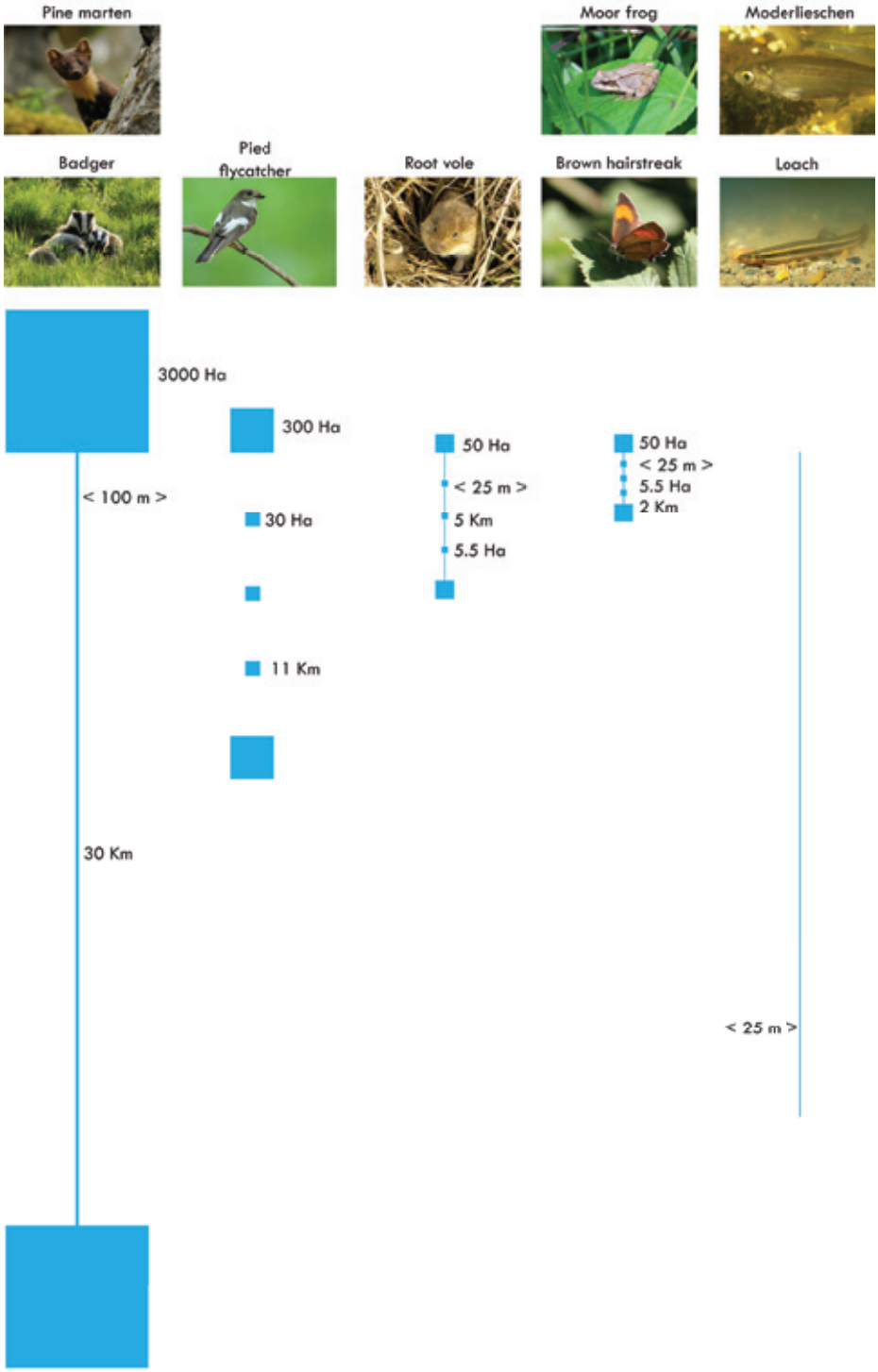
4.17 Large-scaled infrastructural network. The harbour as largest strenght, but the motorway as largest weakness.

Another important network is the railway network. One railway is crossing Venray, the rail connects Venray with nodes towards the Randstad, Antwerpen, and the Ruhr area. Also the roads form an important network, although this network shows one weakness. A strength of the network is that many large cities are located within a reach of a 1.5 to 2 hours ride by truck (fig. 4.18). A weakness is that some parts at the east of the municipality are remote of the entrance to the highway that it is shorter, and faster to drive a large part of the route to for example the harbour of Antwerpen on secondary roads. The location of an agropark at the east could in that case cause an extreme increase of large traffic on this small-scaled road-system.



4.18 National truck transport network, Venray in the middle of the north-west European delta metropolis.

4.5.2 Ecology.



4.19 Minimal demands for the living-area of a cross-section of the target-species in Venray.

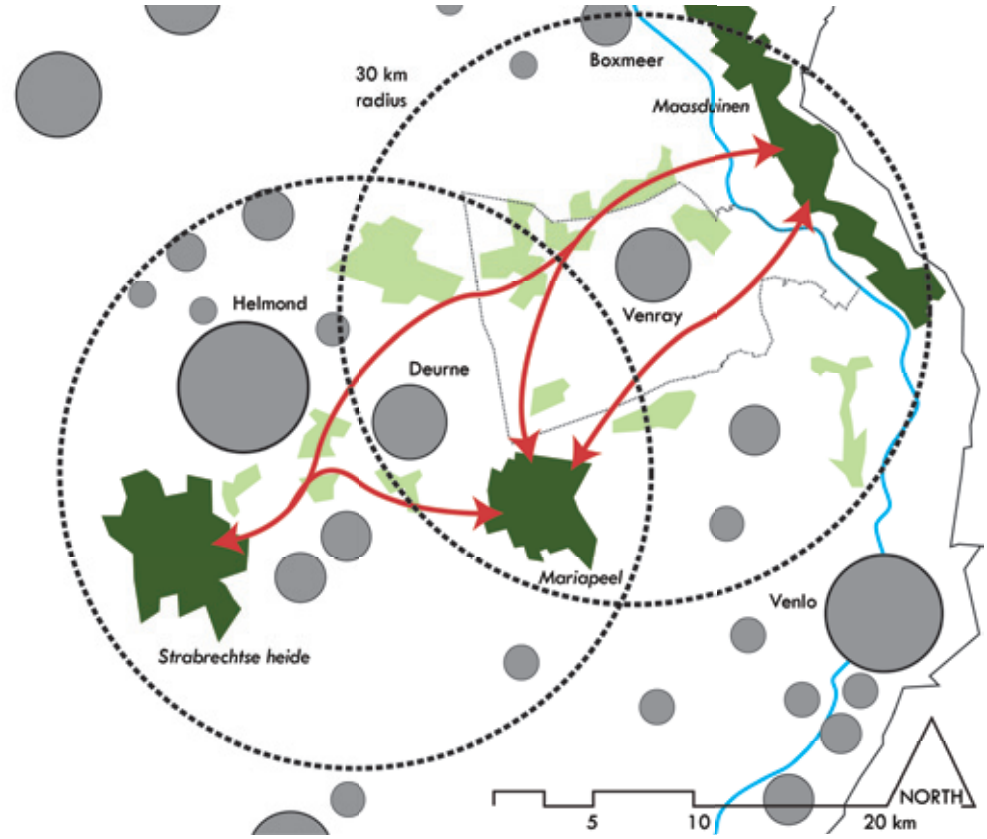
Although the municipality of Venray does not contain any very large nature reserves, the municipality is, or can be an important part of the ecological network. For the nature areas located in Venray, and the different agricultural areas, target-species are determined by the province of Limburg. This analysis of target-species contains numerous different species (see for a detailed list appendix IV). For the sake of this analysis, a cross-section is taken from this list, this cross-section contains a large mammal (Badger), a medium size mammal (Pine marten), a small mammal (Root vole), a bird (Pied flycatcher), a fish (Moderlieschen), a amphibian (Moor frog), and an insect (Brown hairstreak) (Provincie Limburg, 2010).

Each of the target-species has its own size of key-area, stepping stone, and corridor (fig. 4.19). For example the Badger, and the Pine marten have the largest area of all target-species, 3000 ha key-area, a corridor of 100 m wide, and maximal 30 km long (Alterra, 2001). The size of each habitat does not yet state anything about the type of habitat. Therefore figure 4.20 shows which type of habitat each target-specie needs. This analysis shows for example that the habitat of forest, bushes, and small water is very important in Venray, but also brushwood, and large water is important for several target-species (Alterra, 2001). This means that not solely the nature areas are suitable for the target-species, but also some types of agricultural areas may be important for the target-species in Venray.

As mentioned before in this paragraph, Venray does not contain any very large nature reserves. But, some target-species like the Badger ask for an area of at least 3000 ha (Alterra, 2001). Would it than be useful to focus on these target-species? In the direct surroundings of Venray there are several areas larger than 3000 ha that meet the requirements needed for species like the Das, for example areas like the 'Maasduinen', 'Mariapeel', and the 'Strabrechtse heide'. These areas are within a reach of 30 km from each other, when Venray would serve as a corridor, it would be possible to connect some large nature areas by developing the ecological network in Venray (fig. 4.21).

HABITAT > TARGET-SPECIES V	Forest	Bushes	Brushwood	Swomp	Small waters	Large waters
Badger	●	●	●			
Pine marten	●	●			●	
Pied flycatcher	●					
Root vole		●	●	●	●	●
Moor frog		●	●		●	
Brown hairstreak	●	●	●			●
Moderlieschen	●	●			●	●
Loach	●	●			●	●

4.20 The preferred biotopes of the cross-section of the target-species.



Legend

- Cities and villages
- Nature areas larger than 3.000 ha
- Nature areas smaller than 3.000 ha
- Possible connection
- Radius of 30 km
- River
- Municipal border
- National border

4.21 Possible ecological connections on the regional scale. There are possibilities to use Venray as part of the regional ecological network for the target-species.

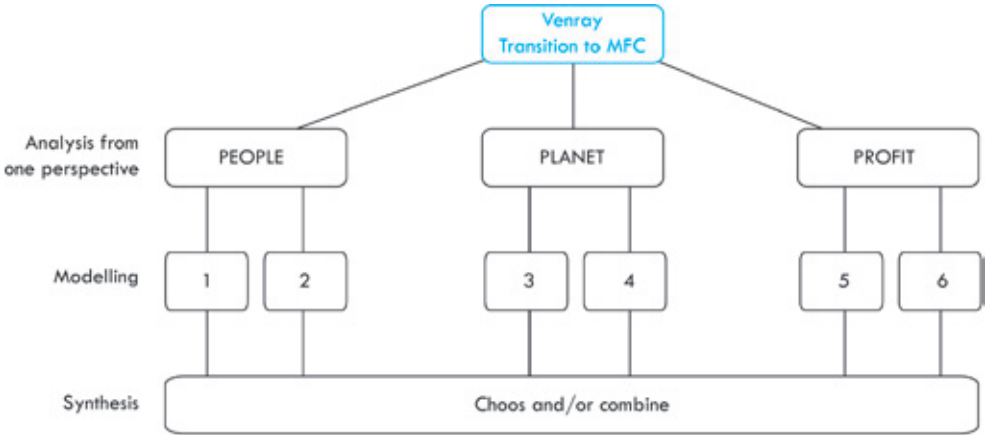
4.6 Design problem.

Because this thesis is focused on the development of a metropolitan food cluster, and the space-pump, the landscape analysis is for an important part focussed on agriculture, and its relation with the landscape in Venray. In terms of abiotic factors, and historical analyses, Venray has a varied landscape with much different gradients. But, especially in the twentieth century this landscape full of different gradients changed into a monotone agricultural landscape. Large interventions were taken to transform landscape units such as the stream valleys, and the peat area into areas that are highly suitable for agricultural production. This provided Venray with an economical, and social very important agricultural sector (see also paragraph 4.1), but also with a monotone, and mono-functional landscape. This landscape is adjusted to serve agriculture in its existing system, and it is therefore questionable how flexible this landscape is when the agricultural system changes. Can this landscape, at the west, and south of Venray serve another function than the current type of agriculture when the space-pump occurs?

5

Modelling

The reasoning around the metropolitan food cluster can be considered as profit oriented. In order to prevent also a profit oriented development of the space-pump in Venray, it is important to take also the ecological, and the social perspectives into account. The three perspectives (People, Planet, & Profit) will be applied in Venray as basis for the spatial modelling in this chapter. This approach contains three phases (fig. 5.1). First the area will be analysed from one perspective each time (people, planet, or profit) in his most pure form. Thus, how can a metropolitan food cluster, and the space-pump develop in Venray, when all choices would be made based on one perspective, and totally exclude the other two perspectives, even when a choice from a certain viewpoint would cause an extreme negative consequence for another perspective. Second phase is the model development based on the analysis. The analysis from a certain perspective does not result in only one possible solution. In this phase two important lines of thinking will be developed as spatial models in order to explore among other aspects the effect on the landscape. Third phase is the concluding phase, which conclusions can be based upon the process of modelling, and what can be their value for the design in Venray. The models should therefore not be seen as strict design proposals, but as an exploration of possibilities and their effects on the landscape.



5.1 Flowchart of modelling structure. Three phases, the analysis, the spatial modelling, and the synthesis.

5.1 Map tracking.

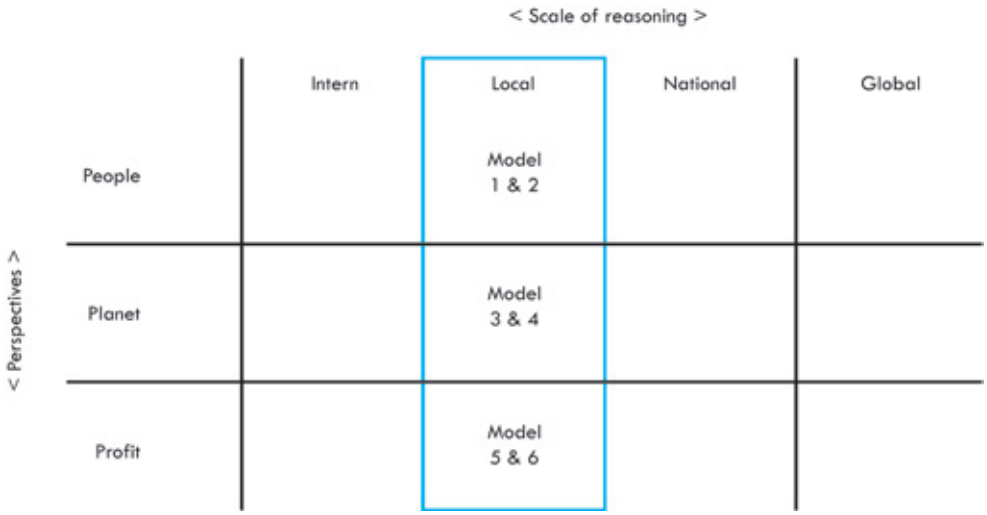
To translate the values of each stock to the area of Venray, a technique as described by McHarg (1969) will be used, McHarg does not provide a clear name for the technique, therefore in this research will be refered to this technique as 'map-tracking'. He argues that the "highway design is reduced to the simplest and most commonplace terms: traffic, volume, design speed, capacity, pavements, structures, horizontal, and vertical alignment" (McHarg, pp. 31, 1969). But, that the highway development should be considered as a multipurpose facility (McHarg, 1969). This situation is comparable to the situation of the metropolitan food cluster, and the space-pump. The concept of metropolitan food clusters is pretty much approached from an agricultural, or economical perspective, while it would be much more valuable when this would be considered from more perspectives (see also paragraph 3.8).

The main objective of the method of McHarg is to incorporate resource-, social-, and aesthetic values into the decision making by highway design. The method should reveal the project to have the maximum social benefit and the minimal social costs (McHarg, pp. 32, 1969). To visualise this aim, McHarg used the technique of map tracking. He mapped in a dark tone where the social cost of a highway would be high, for example areas with great scenic beauty, or areas with rich wildlife habitat. By putting all these layers together, the darker the tone the higher the social cost, preferably the highway should be located in an area with the lightest tone (McHarg, 1969)

In this case the technique of map tracking of McHarg will be used, with two different transparent colours, red, and green. Red will cover those areas that are very vulnerable with regard to a certain stock, thus where an agropark, and metropolitan food cluster is less desirable, and green the areas that are potentially valuable to locate an agropark, and metropolitan food cluster, which both have also important consequences for the space-pump.

5.2 Scale of decision-making.

All stocks have a definition (see appendix II), and the development of a metropolitan food cluster, and the space-pump have a positive, neutral, or negative influence on this stock. But a negative influence on the local scale, might cause a positive influence on the global scale. As Kool et al argues for the 'new mixed farm' the emission of fine dust of the development of this farm will cause a negative influence on the quality of the air on the local scale, because the livestock will be concentrated at one place, thus also the fine dust emission will be concentrated. On the other hand there are areas where this livestock disappears, thus also the fine dust emission will disappear, therefore this development has a positive influence on the national scale (Kool et al, 2008). In order to prevent the contradicting effects, the decisions from each perspective will be based on the effect on the local environment, thus the effect within the municipal boundaries of Venray (fig. 5.2).



5.2 All decisions for the spatial modelling will be based on the improvement for a certain perspective on the local scale.

5.3 Analysis People.

The capital 'people' contains seven stocks which together form the essential elements that determine the function, quality, and quantity of the capital (Hermans et al, 2006). The capital of people is 'multi-layered', it covers the individual, and the collective level. An important topic is the social interaction within the society. Keywords in this capital are participation, freedom, equal chances, easy accessible facilities, and safety (Hermans et al, 2006). The metropolitan food cluster, and the space-pump will have a large, or small influence on all of the seven stocks.

Although some researchers claim that it is possible to quantify every stock of the concept of sustainable development, such as (Grosskurth & Rotmans, 2005), this is highly doubtful (Zeijl-Rozema & Martens, 2010). It is impossible to measure what influence a metropolitan food cluster, and space-pump would have on for example health. Only a reasoning can be made based on what the people in a certain area, in this case Venray, consider as important in relation to a certain stock. For example what do the people in Venray consider as a chance, threat, strength, or weakness with regard to the stock health, and what role can a metropolitan food cluster, and the space-pump play in this process?

What does the town council of Venray, which can be considered as a representation of the opinion of the local society, consider as important with regard to the capital people? One of the major themes in the vision for the future of the municipality of Venray is the support of the social cohesion. Although this theme also contains inter-municipal relations, the focus of the municipality is primarily within the municipal borders. The aim of the municipality is to take care of the integration, and cooperation between the different social groups, and between the different villages, and neighbourhoods within the municipality (Gemeente Venray, 2006). One means to do this is to activate, and maintain the diversity of facilities for all people (Gemeente Venray, 2006).

The development of the metropolitan food cluster, and the space-pump will primarily have consequences for the rural areas. The municipality of Venray contains one large built-up area, Venray and Oostrum, and a countryside with over ten small villages. The level of facilities in these villages is low, and decreasing. According to the municipality of Venray this could become a threat for the social cohesion, and the liveability of these villages (Gemeente Venray, 2006). The development to a metropolitan food cluster, and the space-pump could have an impact on the liveability of these villages. The livestock farms, and the families of these farmers are now scattered around the municipality, and are all part of the social community in a village. When these farmers, and their families would move because of the development of a cluster, it is questionable whether the other inhabitants of the village can remain the same level of facilities for much less people. On the other hand The level of facilities could raise around a possible location of a new agropark. It is important to have a clear vision where the essential facilities are, for example schools, healthcare, and shops.

The decreased level of facilities is interrelated to trends such as a decline, or aging of population, which could also have an effect on the liveability of the villages. According to the municipality of Venray it is impossible that every village will remain a sufficient level of facilities in the future. Therefore they determined six clusters of villages which together should be able to remain a sufficient level of facilities (Gemeente Venray, 2006).

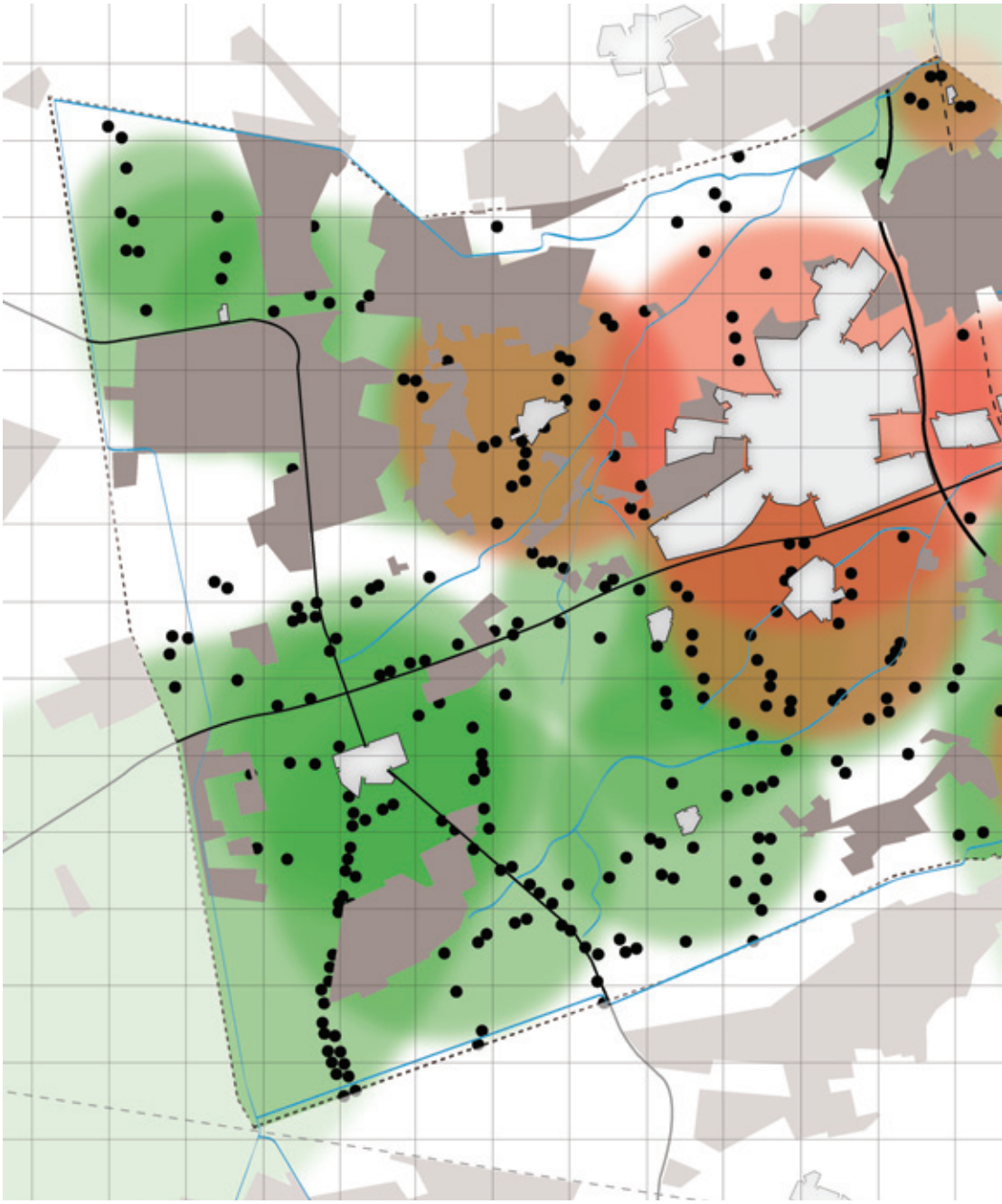
Among the vision of the municipality of Venray as a whole, every village council has created a development plan for the future. Where they also determine what they consider as important with regard to the capital people. For example the village council of Ysselsteyn, who determine that the traffic network is very important for the liveability of their village, the car traffic, as well as the public transport. Ysselsteyn is located relatively isolated, and these networks connect the village with the outside world (Gebiedspanel Ysselsteyn, 2011). Moreo-

ver each village council determines a vision, or focus how each village would like to express themselves in the future. Some villages would like to develop a more agricultural focus, such as Vredepeel, Ysselsteyn, and Heide ((Gebiedspanel Vredepeel, 2011)(Gebiedspanel Ysselsteyn, 2011)(Gebiedspanel Heide, 2011), while other village rather focus on functions like recreation, and tourism, such as Merselo (Gebiedspanel Merselo, 2011). Also these values are important to consider in the analysis of the capital people.

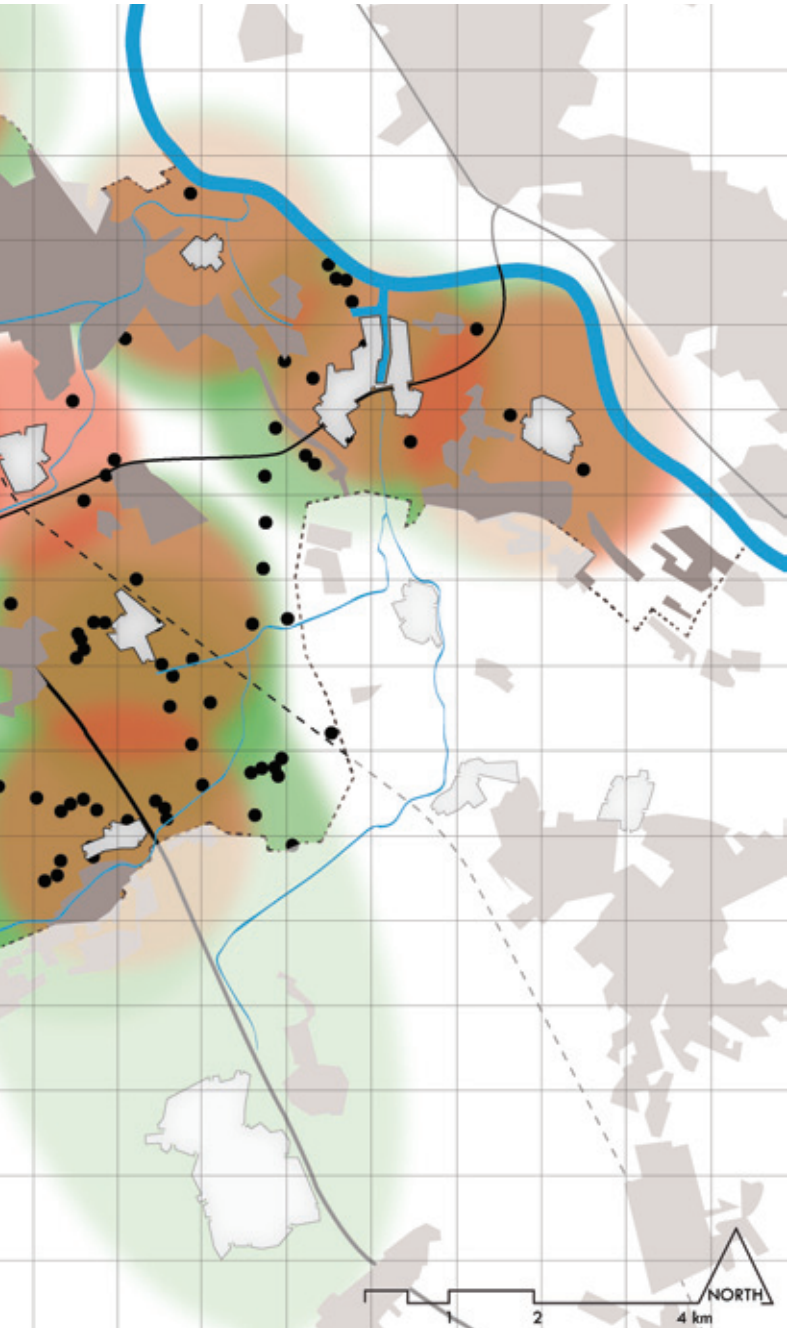
The analysis of the capital people is made with the technique of map tracking as described by McHarg 1969. See for a detailed description paragraph 5.1. Every important area with regard to the capital people will be represented by a transparent green area on the map, for example the area around an important healthcare facility. When two important values have overlap, the colour of green will be darker, and thus more urgent to develop a strategy to maintain the values for the capital people over there when developing to a metropolitan food cluster with space-pump (fig. 5.3). Some important values are: the clusters of villages which together should maintain a sufficient level of facilities and liveability, the healthcare facilities, primary schools, and other facilities such as a bakery, or supermarket. Areas where especially the metropolitan food cluster would have a negative influence are coloured red. This are mainly the areas in the north, and east of the municipality. Here the people would like to focus on other functions than intensive agriculture, according to the village councils.

This analysis will be the basis for the models later in the process. The models how the metropolitan food cluster, and space-pump ideally should develop seen solely from the perspective of the capital people. It should be mentioned that this analysis is for a large part based on political decisions. The analysis is based on policy-documents created by the municipality of Venray, and all the village councils. Zeijl-Rozema, and Martens argue that this is also important in this case. The scientist should be careful with intervening in decision-making about what is important, and what not (Zeijl-Rozema & Martens, 2010).

Analysis People.



5.3 Analysis of Venray from the perspective 'people'. The most positive influence at the south, and east of the municipality.



Legend

Areas where the development of the metropolitan food cluster will have a positive relation to one, or more of the stocks within the capital 'people'. The darker the tone the more positive the influence.

Areas where the development of the metropolitan food cluster will have a negative relation to one, or more of the stocks within the capital 'people'. The darker the tone the more negative the influence.

Villages

Existing livestock farm

Motorway, or N-road

Railway

River

Stream

Nature area

Municipal border

1 km square

(For a detailed description of the layers in figure 5.3 see appendix V).

5.4 Analysis Planet.

The determination of the capital planet is made with an ecosystem approach (Hermans et al, 2006). An ecosystem is a dynamic whole of components, and processes. Characteristic for a stable, and well-functioning ecosystem is the presence of a large number, and variety of species, with a relatively constant number of individuals. By the extinction of certain species the variety of an ecosystem decreases, becomes less flexible, and more vulnerable, for example to plagues (Hermans et al, pp. 25, 2006). The materials, including the nutrients, which the organisms need to live, can be re-used all the time. In a stable ecosystem the cycle of materials is almost closed, the waste material of one species is a nutrient for another (Hermans et al, 2006). Ecosystems encompass different scale levels, from very small bacteriologic communities, to the global ecosystem (biosphere) (Hermans et al, 2006, 2006). The focus of this analysis is merely on the ecosystems relevant for the municipality of Venray. The capital of planet is divided into biotic, and a-biotic stocks. Biotic elements such as plants, and animals are part of the stock nature, while a-biotic elements have separate stocks, such as soil (Hermans et al, 2006). The metropolitan food cluster, and the space-pump will have a large, or small influence on all of the six stocks.

In contrast to the capital people, the capital planet does not necessarily have to be based on political decisions. These stocks are more, but certainly not totally, quantifiable. Although one can argue that the development to a metropolitan food cluster will have a positive influence on many of the stocks compared to the existing situation in the livestock sector, such as Smeets (2009), the metropolitan food cluster has a negative influence on all stocks in absolute sense, compared to a situation without livestock sector. For example the emission of greenhouse gasses from a metropolitan food cluster is extremely much lower than in the existing situation, but still a metropolitan food cluster will have an emission of greenhouse gasses, and therefore have a negative influence on the stock air. By analysing where the most vulnerable areas are located with regard to the stocks, the location, or locations will be visible where the metropolitan food cluster will do the least damage to all stocks, and on the other hand where the space-pump can help to protect the most vulnerable areas.

The vulnerable areas with regard to the stock soil are dividable into two categories in Venray, the soils vulnerable for desiccation, and the soils vulnerable for acidification. The soils vulnerable for desiccation are located at the southern part of the municipality of Venray, around Ysselsteyn, and between Meerlo and the Maas (DLG, 2004). The effect of the development of a metropolitan food cluster on the stock air is everywhere the same. It depends on the type of development where, and how much consequences a certain development has on the stock air, but not on the air itself, as Kool et al (2008) argues for the 'New Mixed Farm' that the emission of fine dust might be concentrated with a cluster development, but thus has a positive influence on another area (Kool et al, 2008).

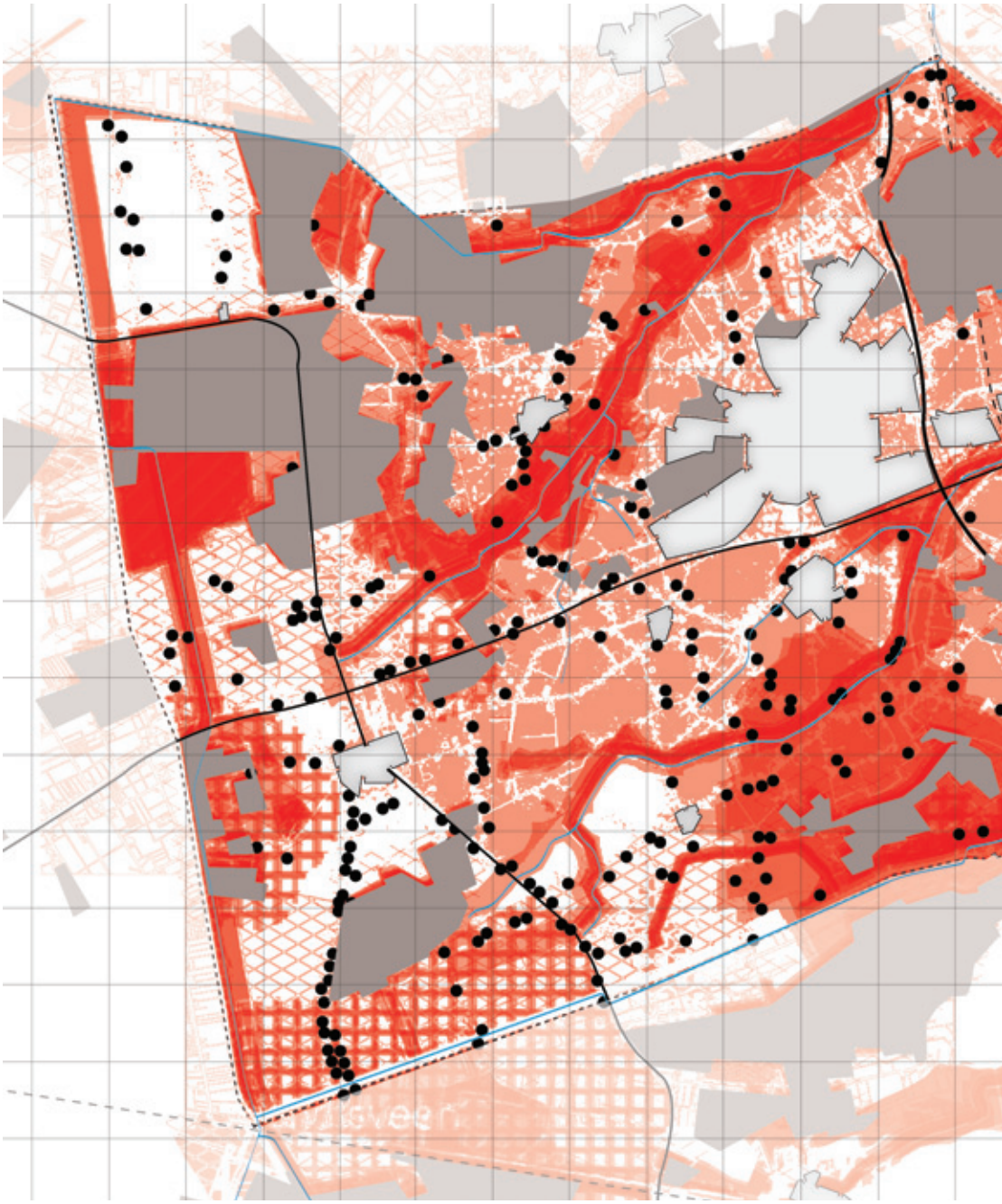
The vulnerable areas for the stock nature in this analysis contain the existing nature areas, and the required ecological connection zones to assure that the variety of species, and the number of individuals can be maintained. Many of these ecological connecting zones are located around the streams (DLG, 2004). The same streams are very vulnerable with regard to the stocks surface water, and groundwater (DLG, 2004). For example vulnerable with regard to seepage, water storage, and underground water-flows (DLG, 2004). Part of the definition of the stock landscape is that the existing identity of the landscape should be maintained, or strengthened (Dagevos & Lamoen, 2009). The large scaled agricultural development of a metropolitan food cluster should thus take place in the landscape type which comes closest to the identity of a large scaled agricultural landscape. In Venray this is the landscape type young reclamations. This landscape type is in Venray reclaimed in the first half of the 20th century, small parts even later, in order to make agriculture possible in this former rough lands. Therefore everything in this

landscape is created to suit agriculture best (Gemeente Venray, 2010), and a development to a metropolitan food cluster would damage the landscape identity the least here in Venray.

Again all these different vulnerable elements are displayed on a map with a transparency (fig. 5.4). The layers in this analysis are red because here the development would have the most negative consequences, the darker the tone, the more negative the consequences are from the viewpoint of the capital planet. The white, or lighter areas do not mean that the development would have no negative consequences here, but the least. This analysis therefore shows that a development to a metropolitan food cluster would have the most negative consequences in the existing nature areas, and around the streams. The least negative consequences would occur in the area of 'Vredepeel', around 'Ysselsteyn', and 'Wanssum'.

This analysis will be the basis for the models developed from the viewpoint of the capital planet. In contrast to the analysis of the capital people, this analysis is not based on political decisions. It is based on objective measurable indicators. It is still questionable whether this set of indicators is complete (Grosskurth & Rotmans, 2005). Moreover, the indicators can be measurable, but the exact effect of the development remains an reasoned estimation.

Analysis Planet.



5.4 Analysis of Venray from the perspective 'planet'. The least negative influence at the Peel area at the west of the municipality. The most vulnerable areas around the streams.

Legend

Areas where the development of the metropolitan food cluster will have a negative relation to one, or more of the stocks within the capital 'planet'. The darker the tone the more negative the influence.

Villages

Existing livestock farm

Motorway, or N-road

Railway

River

Stream

Nature area

Municipal border

1 km square

(For a detailed description of the layers in figure 5.4 see appendix V).

5.5 Analysis Profit.

According to Hermans et al. (2006) the two capitals people, and planet have an own intrinsic aim, to gain the highest profit for the social, and the ecological capital. The capital profit lacks an own intrinsic aim, and it has a neutral position compared to the other two capitals. Therefore it is hard to judge about what is a positive or negative consequence for the capital profit. Whether a certain choice is justifiable or not is a choice within the boundaries of the other two capitals (Hermans et al, 2006). In some cases the capital of profit is linked to the prosperity in his broad sense, but this definition of prosperity contains also a valuable living-environment, and a clean environment, elements that are clearly part of the capitals people, and planet. Because these two elements of prosperity are already covered in the other two capitals, the focus within the capital of profit is the prosperity in the small sense, thus economically (Hermans et al, 2006). This means that there should be a certain level of production of goods, and services to provide a certain level of income, for the collective, and the individual, in order to meet the needs of the individual, and the society as a whole (Hermans et al, pp. 169, 2006). The development of the metropolitan food cluster, and the space-pump causes large, or small consequences for each of the seven stocks.

By considering all the definitions of the stocks within the capital profit, the conclusion is that the most positive consequence on this capital will be caused by keeping the design of the metropolitan food cluster as close as possible to the theoretical concept. Infrastructure and accessibility is an important stock within this concept. The connections of the metropolitan food cluster with a harbour, and secondarily the connection with the motorways, and the railway is important for the success of the metropolitan food cluster. This good accessibility, in combination with a large metropolitan food cluster might have a positive influence on the stock economic structure, than the region will be more competitive to other regions. This would mean the sector makes more economic profit, which has a positive influence on the stock capital.

For the stock labour another thing might happen. The transition from the existing situation in the livestock sector to a metropolitan food cluster will primarily not create many jobs. One could argue that a larger metropolitan food cluster would create more jobs, but as Cormont et al (2012) argues it is uncertain what consequences a metropolitan food cluster has on the amount of jobs because the systems in a metropolitan food cluster will be more efficient, and less labour intensive (Cormont et al, 2012). The only important positive effect for jobs might be a secondary effect, that companies that supply the agricultural sector, or use products of them move to the cluster area. But still, this might be more of a job mover, than a creation of extra jobs. Part of the definition of the stock energy and raw materials is that less energy is consumed, and raw materials are re-used. This is one of the main aims of the concept of metropolitan food clusters. Moreover this aim can especially be reached inside the metropolitan food cluster.

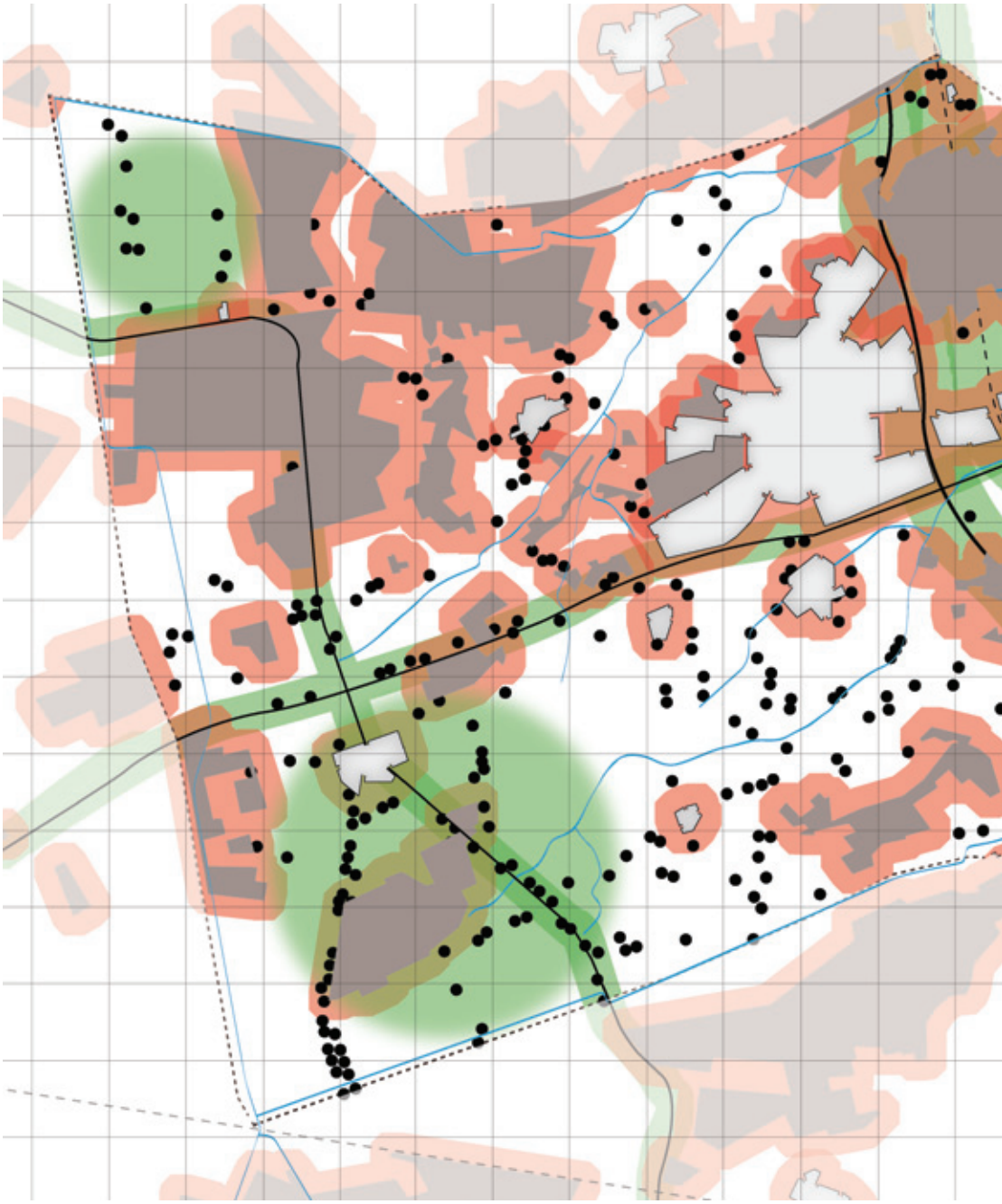
The above mentioned considerations projected on the area of Venray show a few important considerations. In the village of Wanssum a harbour is located connected to the Maas. This is an important condition for several stocks, such as infrastructure and accessibility. The motorway A73 connects Venray with cities like Nijmegen, and Venlo. For the stock spatial settling conditions it is important to have enough space to develop commercial activities, and that this space will be available, and adaptable for the changing demands in the future (Hermans et al, 2006). Therefore the agropark should not be located closer than 250 metres near a built-up area (Cormont et al, 2012). Also the land in use as nature will not be available for commercial activities.

In Venray there are already a few areas where some livestock companies are located close to each other. In terms of economic profit it might be considerable to improve these areas to metropolitan food clusters, instead of building complete new ones. The largest concentration of

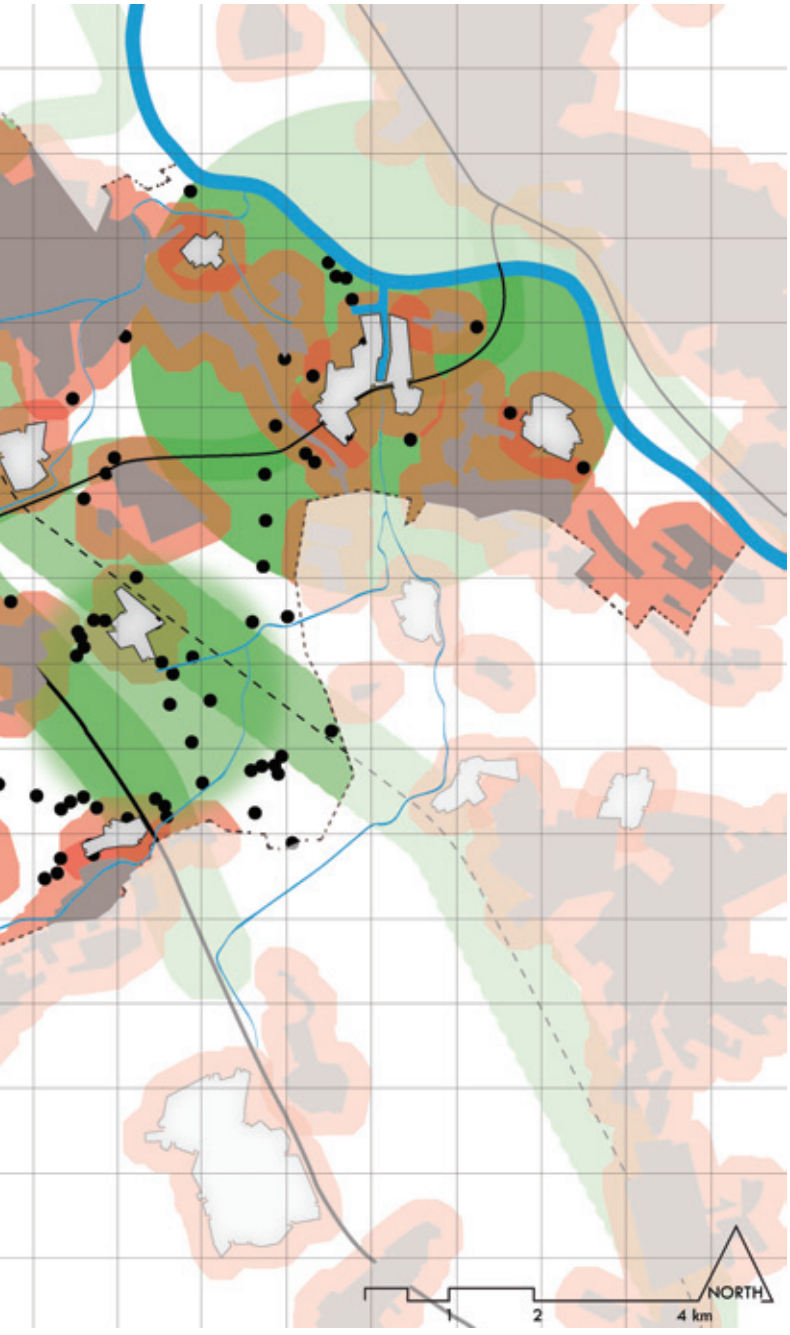
livestock farms in Venray is located at the Vredepeel, near Ysselsteyn, and near Oirlo.

Again for this analysis the technique of map-tracking is used as described by Mcharg (1969). The areas where the metropolitan food cluster could have a positive influence on a certain stock are transparent green, the areas where the metropolitan food cluster would have a negative influence are transparent red (fig. 5.5). Whereas the indicators in the analysis for the capital people are based on political decisions, and for the capital planet on measurable indicators, the indicators for the analysis for the capital profit are mainly based on the theoretical concept of metropolitan food clusters.

Analysis Profit.



5.5 Analysis of Venray from the perspective 'profit'. The most positive influence at the south, and east of the municipality, and near the harbour of Wanssum.



Legend

Areas where the development of the metropolitan food cluster will have a positive relation to one, or more of the stocks within the capital 'profit'. The darker the tone the more positive the influence.

Areas where the development of the metropolitan food cluster will have a negative relation to one, or more of the stocks within the capital 'profit'. The darker the tone the more negative the influence.

Villages

Existing livestock farm

Motorway, or N-road

Railway

River

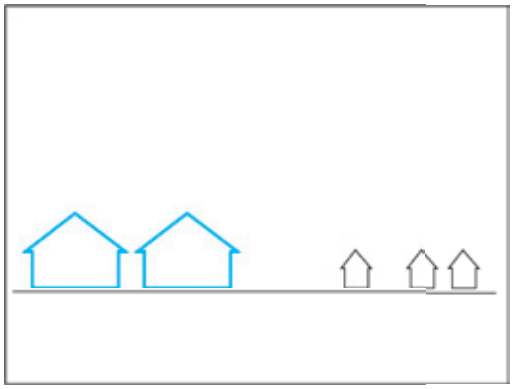
Stream

Nature area

Municipal border

1 km square

(For a detailed description of the layers in figure 5.5 see appendix V).



5.6 Principle behind the model 'separation of functions'.

Legend

- Possible suitable location for an agropark.
- Possible suitable location for the space-pump
- Villages
- Motorway or N-road
- Railway
- Existing livestock farm
- River
- Stream
- Nature area
- 1 km square

5.7 Spatial effects of the development of 'separation of functions'.

5.6 Spatial models.

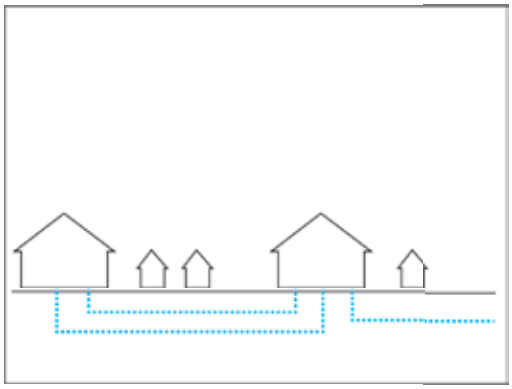
The first phase of modelling resulted in three analyses of the same area, each based on one single perspective. These analyses can still be interpret in multiple ways. Therefore in the second phase two spatial models will be developed based on each analysis, each with a different interpretation of the results of the analyses, in order to explore the range of possibilities, and consequences for the region.

5.6.1 Model I Separation of functions.

At this moment the intensive livestock sector, and other functions such as living, leisure, and nature can be considered as conflicting with each other. They are in an impasse, the livestock sector cannot develop because of the other functions nearby, and the other functions cannot develop because of the intensive livestock sector nearby (Meulenkamp & Gies, 2012). According to the 'village development plans' made by the village council of each village in Venray, every village has an image about how they want to develop in order to meet a pleasurable living-environment, and thus also related to the stocks of the capital people. Developments such as housing, agriculture, leisure, and nature, but these developments are frustrated by the presence of both, as described by Meulenkamp and Gies (2012).

This model explores a clear division of agricultural areas, read agroparks, and areas for other non-agricultural functions (fig. 5.6). According to the 'village development plans' of Vredepeel, Ysselsteyn, and Heide, these villages would like to strengthen their agricultural identity, and they consider the agricultural sector as an important value of their living-environment ((Gebiedspanel Vredepeel, 2011)(Gebiedspanel Ysselsteyn, 2011)(Gebiedspanel Heide, 2011)). In this model an agropark should therefore have a connection with all these three villages, thus three smaller agroparks (fig. 5.7). For the inhabitants of these three villages, this agropark should have a positive influence on the stocks of the capital people, the agropark will be the basis to maintain the level of facilities for example. In the other villages the intensive livestock sector will slowly leave. Therefore these villages can more easily develop in the by them desired direction, such as Merselo, where the village council determines the improvement of the touristic, and recreational functions as an important chance for the village (Gebiedspanel Merselo, 2011). This improvement should be easier when the intensive agriculture disappears from certain areas (Meulenkamp & Gies, 2012), moreover this chance should have a positive influence on the stocks of the capital people, more recreational functions should for example improve the quality of the living environment.

The transition of the current livestock sector towards the system of metropolitan food clusters, as proposed in this model, can be considered as an integral, and regional transition. Therefore there are possibilities to develop the space-pump to gain profit for the social capital. The area of the space-pump can in this model be used to strengthen the desired developments of each village. In the case of Merselo a desired development is the development of the Loobeekdal to an ecological, and recreational interesting area (Gebiedspanel Merselo, 2011). Therefore a part of the space-pump effect should take place around this stream.



5.8 Principle behind the model 'current social structure'.

Legend

- Possible suitable location for an agropark.
- Possible suitable location for the space-pump
- Villages
- Motorway or N-road
- Railway
- Existing livestock farm
- River
- Stream
- Nature area
- 1 km square

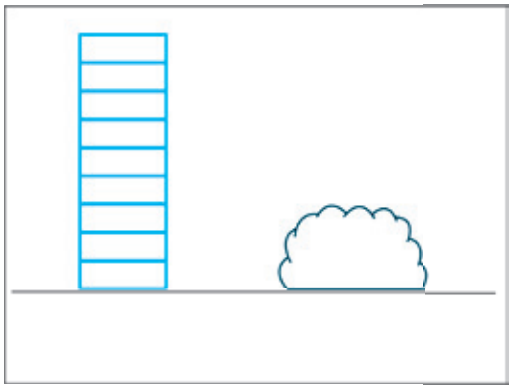
5.9 Spatial effects of the development of 'current social structure'.

5.6.2 Model II Current social structure.

As described in the analysis of the capital people, the development of a metropolitan food cluster will in Venray have the largest impact on the rural areas. Here all the small villages experience difficulties to remain a desirable level of facilities. With the existing social relationships, and the proposed clustering of villages on the level of facilities, it is expected by the municipality of Venray that level of facilities can be remained, and thereby the liveability (Gemeente Venray, 2006). This model is based on the idea to remain these social relationships as much as possible, and try to co-operate as a metropolitan food cluster as much as possible within the existing social structure. Corporations such as organizational collaborations, underground networks of energy re-use, or a sewer-system for animal manure (fig. 5.8).

By remaining the social relationships as much as possible, there are just limited possibilities to change much in the spatial structure (fig. 5.9). This spatial structure is among others developed for the current agricultural system, it is therefore questionable in how far this spatial structure provides possibilities to develop valuable collaborations, and whether one can call this a metropolitan food cluster. Moreover, this process will, in contrast to the model of separation of functions, lack an integral, and regional focus. This model will ask for a much smaller scaled, and individual approach. Therefore the space-pump may possibly not occur, or with very limited possibilities to develop an area valuable for the capital 'people'. When the space-pump occurs it should be used for the same goal as in the model 'division', thus to meet the desires of each village to meet a pleasurable living-environment.

The developments within this model might have a much more uncontrolled effect on the landscape. Farmers willing to co-operate develop modern, and large farms, relative independent of their location. This model lacks the possibilities for landscape architects to use the development of a metropolitan food cluster, and the space-pump to propose transformations that are really desirable for Venray.



5.10 Principle behind the model 'small footprint'.

Legend

- Possible suitable location for an agropark.
- Possible suitable location for the space-pump
- Villages
- Motorway or N-road
- Railway
- Existing livestock farm
- River
- Stream
- Nature area
- 1 km square

5.11 Spatial effects of the development of 'small footprint'.

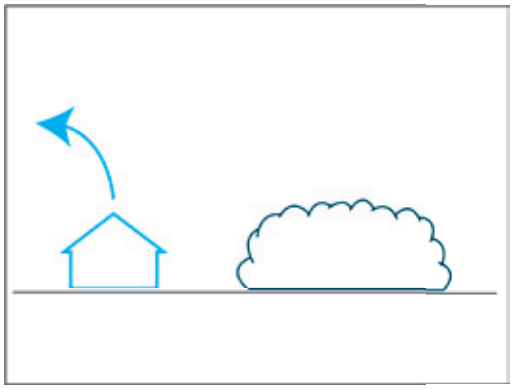
5.6.3 Model III Small footprint.

As described in the analysis of the capital planet, the metropolitan food cluster will in absolute sense always have a negative influence on most of the ecological stocks. Only the exact level of negative influence differs per location. This model foresees therefore in a small agropark with a small footprint (fig. 5.10). On the one hand this means that less land will be used for industrial agricultural activities, on the other hand this means that there is more land available by using the space-pump to protect other functions, in this case to better protect the most vulnerable areas that are not protected yet, thus around the streams.

This model would mean that ideally the buildings would have several floors, where possible aslo the buildings with animals. It is at this moment questionable whether this is allowed by law (Ministry of economic affairs, 2012). In the ideal picture of this model there would be one location for an agropark, that meets the minimal demands to function as an agropark, and not larger. Every enlargement could cause a higher negative influence for the capital planet within the municipality of Venray. The negative consequences for each stock are in this model highly concentrated, consequences such as air pollution, but this means that a large area does not suffer from these consequences, areas that are more vulnerable.

The most suitable location for the agropark in this model would be on the Vredepeel (fig. 5.11). Here is the largest area available which is the least vulnerable. On first sight a very logic location, but this area is far away from the important infrastructure. When this location would be chosen, the metropolitan food cluster would depend on truck transport over a small-scaled network to reach the harbour, or the motorway. The question is what will have a higher negative influence, depending on truck transport over a small-scaled network, or building the agropark near the harbour, in a more vulnerable area, but therefore get rid of much truck transport? Because this question is impossible to answer in the light of this thesis, both location will be taken into account further on in this process. Even areas that can be considered as more compromises between the two previous locations should not be excluded, namely around Ysselsteyn, and Heide. These areas are also not highly vulnerable, and already a more suitable infrastructural location.

Because this model proposes the transition of the livestock sector to one agropark, the focus of this model can be considered as very integral, and regional. Therefore the space-pump can be planned as a large development. The aim should be to plan the largest possible space-pump around the ecological most vulnerable areas, thus in the case of Venray the streams. This model asks for an important role for the profession of landscape architecture.



5.12 Principle behind the model 'outside boundaries'.

Legend

- Possible suitable location for the space-pump
- Villages
- Motorway or N-road
- Railway
- Existing livestock farm
- River
- Stream
- Nature area
- 1 km square

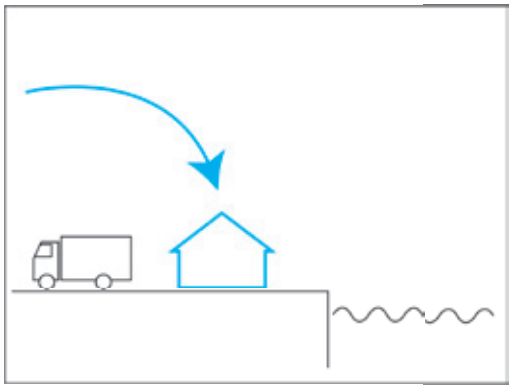
5.13 Spatial effects of the development of 'outside boundaries'.

5.6.4 Model IV Outside boundaries.

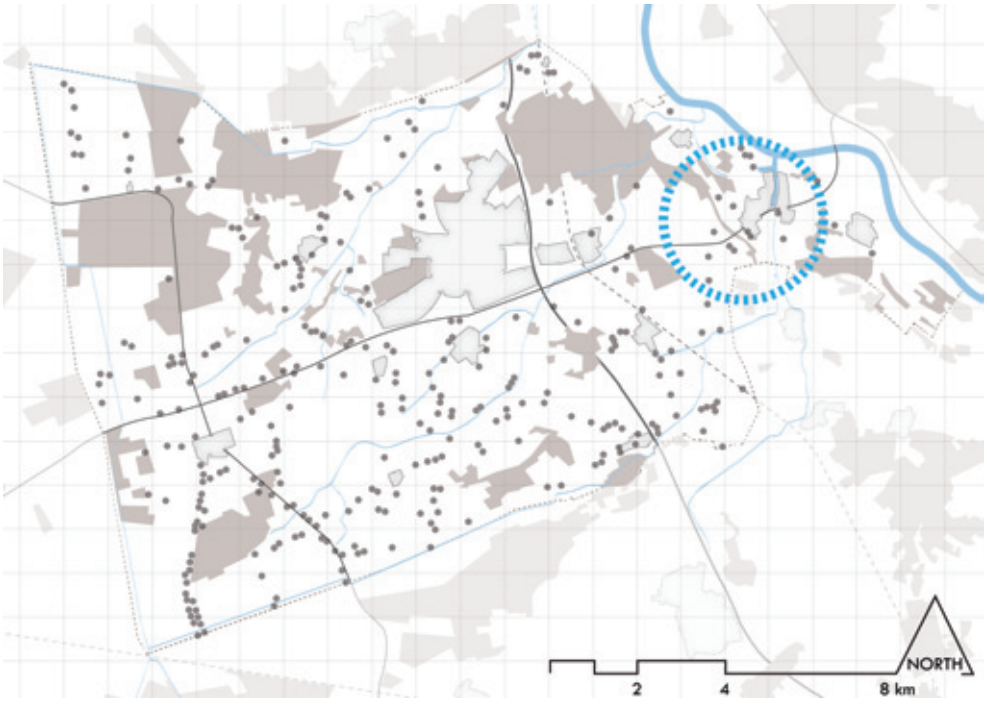
In paragraph 5.2 is described that the decisions in the analyses of each perspective in Venray are made in the light of the consequences on the local scale. When this line of reasoning is followed in the purest form, the stocks within the capital of planet would gain the most profit when the agropark would be built, on a more suitable location, somewhere outside the municipal boundaries of Venray (fig. 5.12). This would cause no negative influence on the stocks of planet, and provide possibilities to develop the largest possible space-pump to protect the most vulnerable areas, again as in model three the areas around the streams.

This model is solely based on the consequences within the municipal boundaries of Venray. The negative consequences for each stock do not take place in Venray now, but it will take place somewhere else, it could be that there are locations better suitable, with a lower negative impact than Venray, but it is questionable what the profit of this model is when the consequences for the stocks are considered on the national, of global level.

On many aspects this models is comparable to the third model of 'small footprint', only this fourth model is more taken into the extremes. The transition to develop an agropark outside the municipal borders for the farmers which are now located inside the municipal borders asks for an integral, and regional approach. Therefore the space-pump can be planned on the regional scale, and can therefore aim for a maximal area to protect the vulnerable areas (fig. 5.13).



5.14 Principle behind the model 'infrastructural location'.



Legend

- Possible suitable location for an agropark
- Villages
- Motorway or N-road
- Railway
- Existing livestock farm
- River
- Stream
- Nature area
- 1 km square

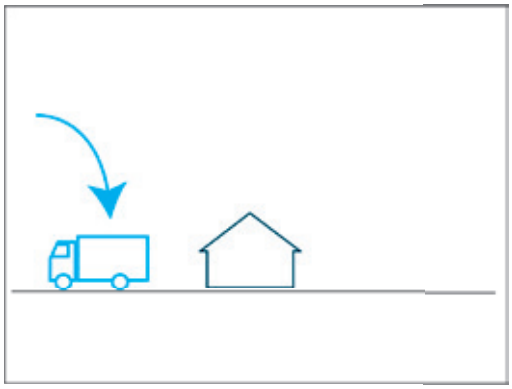
5.15 Spatial effects of the development of 'infrastructural location'.

5.6.5 Model V Infrastructural location.

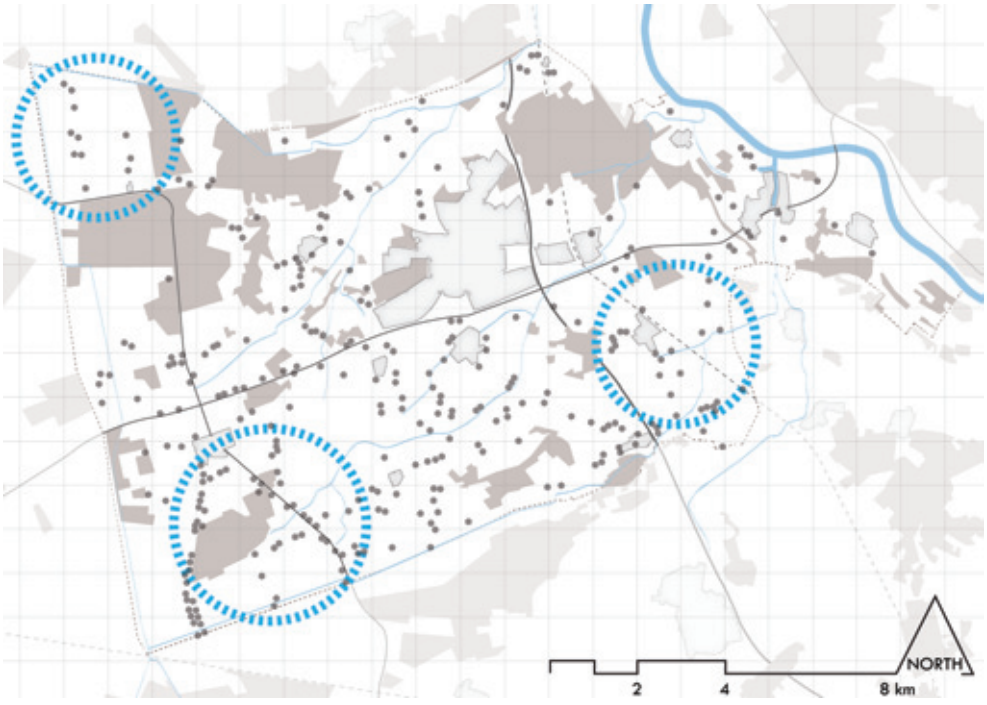
The harbour is an important condition for the agropark, in terms of stocks like infrastructure and accessibility, and economic structure. Except the grass, and corn, large amounts of fodder for the animals needs to be imported from outside the municipality, sometimes even from outside the Netherlands, or Europe. The most profitable way to import this fodder, and export products such as manure, is by boat. Therefore the ideal location for an agropark in this model is near the harbour of Wanssum, for an agropark to have profit from the harbour it should be located maximum two kilometres away (fig. 5.14 & 5.15). This location is still nearby a connection to motorway A73, and close to the railway between Nijmegen, and Venlo.

To meet the definitions of the stocks in the capital of profit, the agropark should become larger than minimal profitable, and have space to expand. Therefore there will be no space-pump effect. All the land that the intensive livestock sector uses at this moment should be available when the agropark expands in the future. One could only argue for a sort of temporarily space-pump effect, and even then the land could be used to produce for crops for other purposes within the agropark. In the first place this will be the land that is the least suitable to grow grass, or corn.

The municipality of Venray will serve as one large metropolitan food cluster. This will make Venray a very important place for the Dutch livestock sector, but will leave just limited space to develop other functions. Although this development asks for an integral, and regional approach, the role of the landscape architect in the space-pump is a marginal one. This model is mainly based on the principles of economic profit, and efficiency.



5.16 Principle behind the model 'current livestock sector'.



Legend

- Possible suitable location for an agropark
- Villages
- Motorway or N-road
- Railway
- Existing livestock farm
- River
- Stream
- Nature area
- 1 km square

5.17 Spatial effects of the development of 'current livestock sector'.

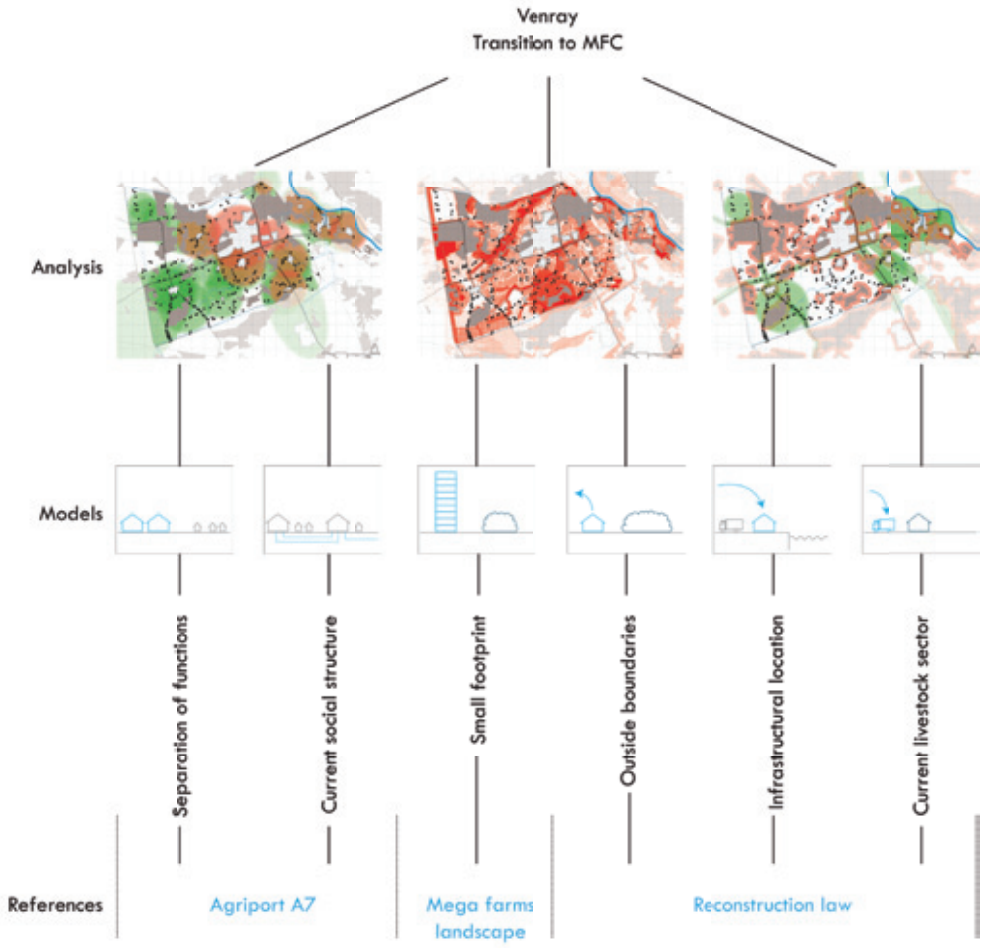
5.6.6 Model VI Current livestock sector.

The model 'infrastructural location' proposes to build the agropark near the harbour of Wanssum. But, this is also an area where at this moment just a few intensive livestock farmers are located. The highest concentrations of livestock farms are at Vredepeel, near Ysselsteyn, and near Oirlo. The question is: what would economically be more profitable, moving the whole sector to a complete new location, as proposed in model 'harbour', or building further on the existing concentration of farms, and try to get the facilities such as transport as good as possible over there (fig. 5.16)? Within this thesis it is impossible to calculate which of these two models is more profitable, therefore both will be taken into account.

The development of this model means that the three areas with the highest concentration of large livestock farms will be transformed in the agroparks of the metropolitan food cluster. The one near Oirlo might still have profit from the harbour, but the agroparks near Ysselsteyn, and Vredepeel will fully depend on road traffic (fig. 5.17). The space-pump effect will be comparable to the model 'harbour'. There will be no space pump effect in order to prevent obstruction of expansion of the agropark in the future. Comparable to the model 'harbour' the role of the landscape architect in the space-pump will be a marginal one while the principles in this model are mainly based on economic profit, and efficiency.

5.7 Chose or combine?

The six models as described in paragraph 5.6 are an exploration of possibilities, and consequences of the development of a metropolitan food cluster, and the space-pump in Venray. Should the best model of this exploration been chosen, and serve as basis for the design? Or should the best combination out of all, or a few models serve as basis? Based on the problem statement of this research the second option is preferable. The claim in the problem statement is that the metropolitan food cluster concept is now mainly approached from a single perspective, the agricultural perspective, or the economic perspective. The presumtion in this research is that the implementation of the metropolitan food cluster, and the space-pump would be more successful when multiple perspectives are taken into account. By choosing for only one model now would limit the design to one perspective again. Therefore a combination of models from all three perspectives would be favourable. This argument is also confirmed by literature about the sustainable development of regions ((Hermans et al, 2006)(Grosskurth & Rotmans, 2005) (Dagevos & Lamoen, 2009)).



5.18 Flowchart of the relation between the spatial models, and the researched reference projects.

In order to compare later in the process whether the combination of several models (and thus also a combination of perspectives) might lead to a more successful implementation of a metropolitan food cluster, and the space-pump, in this paragraph the models will be compared to reference projects which are developed based on a comparable line of thinking as the model. By developing some models in their purest form, a comparable outcome might occur. Therefore three different references have been researched (fig. 5.18). First the reference of Agriport A7 is researched as reference for the development of the models from the 'profit' perspective of economic capital, the models 'infrastructural location', and 'current livestock sector'. Second the reference of the mega-farm landscape is researched to compare with the development of the model 'current social structure', based on the perspective of the capital people. Third the reference of the reconstruction law is researched in order to compare with the development of the models 'small footprint', and 'outside municipal boundaries', based on the perspective of the capital planet, and the model 'separation of functions', based on the perspective of the capital people.

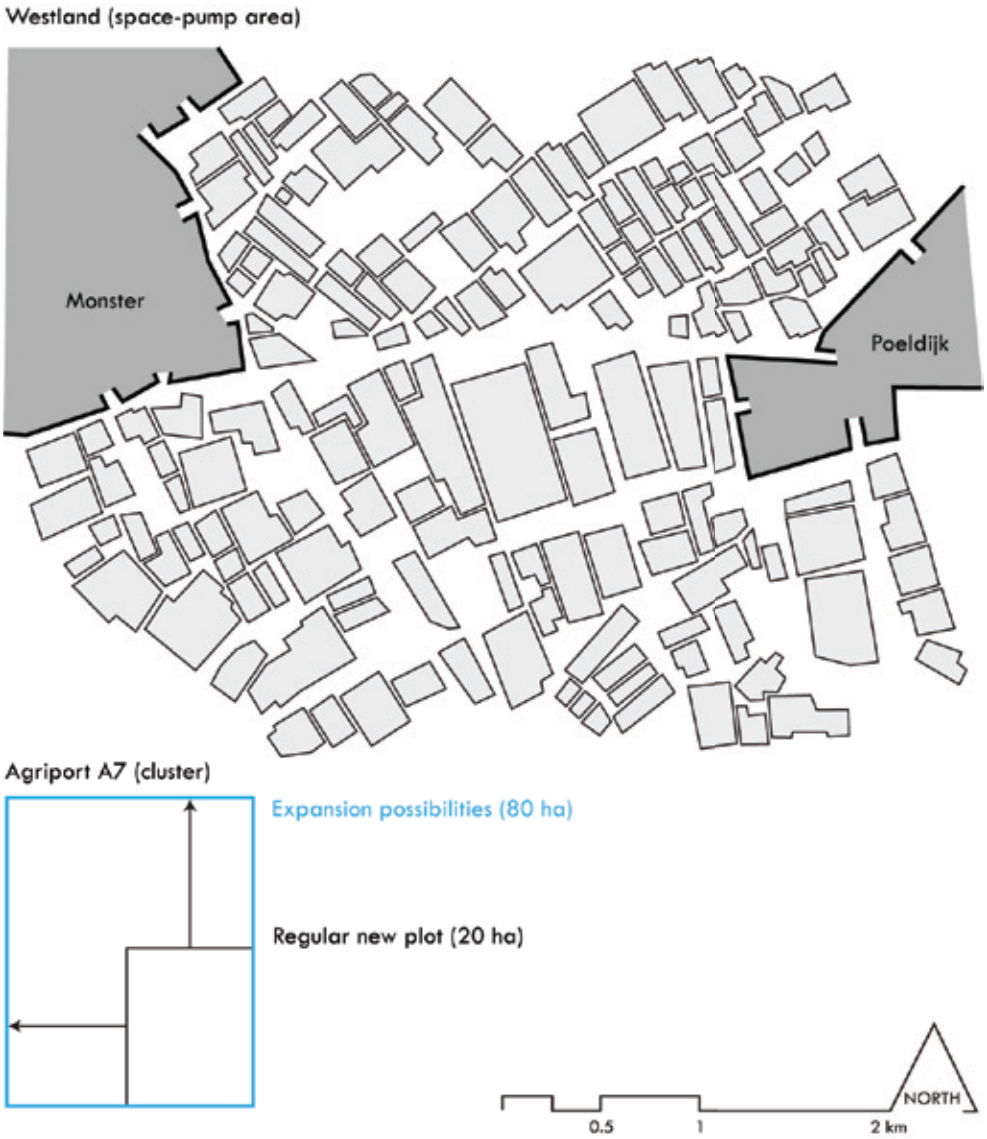
5.7.1 Agriport A7.

The main aim of the models 'infrastructural location', and 'current livestock sector' is to develop primarily a metropolitan food cluster that is economically profitable, and in that way provides improvements on stocks like labour, and economic structure. Effects such as the space-pump are, if they occur, of secondary importance. This situation is comparable to the process that is going on in the greenhouse sector. In the greenhouse sector clustering of activities is a much more common process, in contrast to the livestock sector. A reference is the cluster of greenhouses in the agropark 'Agriport A7' in Wieringermeer.

The agropark Agriport A7 is a complete new project location in the province of Noord-Holland. In 2006 the municipality of Wieringermeer provided a permit for a greenhouse cluster of 550 hectares, and an additional permit of 380 hectares in 2010 (Agriport A7, 2010). Because the agropark is built on a new location, the organisation had to attract greenhouse companies from elsewhere. The organisation of Agriport A7 did this by trying to provide the ideal circumstances for these companies. By a combination of large scale production of fresh vegetables, the processing, and logistics, Agriport A7 is one of the most modern agropark locations in the world. The location is well connected with north-Germany and the harbour of Rotterdam, has several possibilities for the re-use of waste flows, rectangular plots between 5 and 80 hectares, support of the municipality and the province, and permits to build high glasshouses (Agriport A7, 2011). Because of all these ideal circumstances, the greenhouse entrepreneurs see an important economic perspective in this project (Provincie Noord-Holland, 2012).

The situation in Agriport A7 can be compared to the models based on the perspective of the capital profit in Venray. When Venray would develop a metropolitan food cluster solely approached from this perspective, the circumstances inside this cluster would be much better than on other locations. Therefore livestock farmers would see an economic perspective in this project, and are willing to move to the cluster, which causes improvements on all other 'profit' stocks. This happened also at Agriport A7, this cluster can compensate for the decreasing commercial agricultural activities in the region of Wieringermeer, and strengthen the regional economy, and labour force (Gemeente Wieringermeer, 2006). Thus in short, seen solely from the perspective of the capital profit, the development of Agriport A7 had a positive influence for the region of Wieringermeer, as can be expected also in Venray by developing the models 'infrastructural location', or 'current livestock sector'.

But focussing purely on models based on the capital profit might have unintended, or undesirable consequences. For example with regard to the space-pump. In the case of Agriport A7 this was related to the constant scale enlargement in the greenhouse sector. Around 2003 a greenhouse company of 10 hectares was normal, but in 2006 new companies were developed of over 30



5.19 Comparison of a plot on Agriport A7 with the current glasshouse-area in the Westland. With regard to plot-size Agriport A7 offers very large advantages.

hectares (Gemeente Wieringermeer, 2006). This growth is in most cases not possible on the existing location of the greenhouse company (Gemeente Wieringermeer, 2006). For these companies the development of a complete new greenhouse cluster with plots up till 80 hectares like Agriport A7 offers a solution. Companies located in areas with less desirable circumstances will leave to Agriport A7, and leave an undesirable location behind, which suffers from function decay, thus the space-pump.

One of these undesirable locations in the Westland in the province of Zuid-Holland. Every year approximately 45 hectares of glasshouses will be demolished, or becomes vacant because of developments like scale enlargement which are not possible in the existing small-scaled spatial structure of the Westland (fig. 5.19)(Ecorys Nederland, 2004). In other words,

developments such as Agriport A7, and the accompanied space-pump effect provide problems in the most undesirable areas of the sector, in this case the Westland.

In order to remain competitive on the market, the Westland needs to restructure the area, to make scale enlargement of the greenhouses possible (Gemeente Westland, 2010). The Rabobank expects, as most important provider of capital for the sector, that the municipality of Westland will not be able to re-structure the area well enough to prevent large-scaled vacancy, the circumstances in the Westland can never compete with areas such as Agriport A7, or the polders of Zeeland (BNR, 2012).

This situation is comparable to both models of the metropolitan food cluster developed from the perspective of profit. The development of Agriport A7 has certainly provided improvements for the region of Wieringermeer with regard to the capital profit (Gemeente Wieringermeer, 2006), as the metropolitan food cluster will do for the region of Venray. But by focussing only on the profit for the region around the cluster, the space-pump might cause unintended, and undesirable consequences in regions where the circumstances are the poorest for the sector, as in the case of Agriport A7 happened in the area of the Westland (BNR, 2012)(fig. 5.20). Where this will happen in the case of Venray is hard to predict, but by purely focusing on economic profit for the own region, and thereby providing problems for other regions might be considered as undesirable.

5.20 By developing the cluster of Agriport A7 with an economic perspective, the space-pump occured in the area with the least ideal circumstances, in this case the Westland.

5.7.2 Mega farms.

The model 'currrent social structure', developed from the perspective of the capital people is the model that stays the closest to the existing spatial structure of all models. In order to keep the social relations as much as possible as they are, there will be sought to possibilities to cooperate as livestock sector within the existing social, and spatial structure. As mentioned in the explanation of the model, this process is pretty much depending on the willingness of individual farmers to co-operate in this transition, and their current location. Therefore this process is more individual, and small-scaled oriented. This individual orientation has consequences which are pretty much comparable with the actual process that is going on in the intensive agricultural areas of the Netherlands. Many small farms quit their production, and the farmers who continue take over their production. This process will lead to larger farms, and very probable on locations that are not highly desirable, comparable to the current 'uncontrolled' development of 'mega farms' in some agricultural landscapes. This process is the largest in the provinces of Noord-Brabant, Friesland, and Limburg (Gies et al, 2007)(fig. 5.21). One side-note has to be made, that the term 'mega farms' as used commonly in the Netherlands, does not per definition state something about the dimensions of the stables, but instead about the amount of animals. A Dutch mega-farm can be a large stable, but also several small ones, which leads to much miscommunication in the Dutch society (Fresco, 2011)

By the transformation from regular livestock farms to mega farms, the farm expands at its existing location in the landscape. This transformation provides clear advantages, compared to the existing livestock sector, for example with regard to improved environmental management, improved animal welfare, and reduced veterinary risks. According to Smeets et al, these mega farms have just one major disadvantage, the choice of location. As long as every farm expands at the existing location in the landscape, every step of scale enlargement will suffer from the protest of society. According to Smeets et al, the only way to get rid of this disadvantage is to clusters these activities (Smeets et al, 2011).

There are several studies that confirm the opinion of Smeets et al (2011). For example Schaik, who researched the perceptions of scale enlargement in the intensive livestock sector. The respondents in this study experienced large buildings, together with large industry as the most disturbing elements in the landscape (Schaik, 2008). Another research to disturbing elements in the perception of the landscape by de Vries et al concluded that the respondents especially the combination of new, and old buildings in the landscape experience as disturbing. When all buildings are from the same age, either new or old less experienced as disturbing (de Vries et al, 2010). In the model of 'current social structure' in Venray the transition is quite large scaled, this means that the process will take long, and there will be young, and old stables next to each other. Something that is experiences as very disturbing. Wulp, and Koomen et al, conclude more or less the same, according to these researches people experience stables as disturbing when they are located centrally in the landscape (van der Wulp, 2009), or scattered around the landscape (Koomen et al, 2005). According to Agricola et al, the development of scale enlargement in the agriculture will lead to a more metalled landscape, more production supporting facilities, and adjustments on infrastructure for traffic of products, more and larger traffic on the undersized road-network (Agricola et al, 2010).

Already in the description of the model 'current social structure' in paragraph 5.6 is discussed whether this model meets the definition of a metropolitan food cluster. This model certainly has advantages, seen solely from the perspective of the capital people, and it is an improvement on production factors, as mention by Smeets et al (2011). But although the model has advantages from some perspectives, it has also disadvantages, such as the disturbed perception of the landscape as mentioned by several researches ((Schaik, 2008)(van der Wulp, 2009)(Koomen et

al, 2005)(Agricola et al, 2010)). Moreover, because of the dependence on individual farmers, the space-pump effect will be absent, or very small-scaled. The current spatial structure is for an important part based on the current agricultural system. Developing a new agricultural system in the existing spatial structure might provide an undesirable landscape image, while there is just limited space to develop other functions.

5.21 The individual development of the agricultural sector leads to 'mega-farms', especially in the southern, and the northern provinces.

5.7.3 Reconstruction law.

The models 'small footprint', and 'outside municipal boundaries', based on the perspective of the capital planet, and the model 'separation of functions', based on the perspective of the capital people do all show many similarities with the development of the Dutch reconstruction law. The reconstruction law is already described thoroughly in paragraph 3.4 The reasoning towards these three models is very comparable.

As described in the chapter 'theoretical context', the space-pump is always a consequence of a certain trend in a form of land-use. The main reason why the reconstruction law failed is that the space-pump in this law slowly changed from consequence to major goal. The first aim of the reconstruction law was to prevent new outbreaks of livestock plagues in the future ((Lauwere & Vellema, 2011)(Bleumink, 2007)(Wezel et al, 2007)). For the three models for metropolitan food clusters in Venray the main aim is to successful shape the transition from the existing form of agriculture to a form with clusters. In both cases, the reconstruction law, and the three models, the farmer is the person who should be convinced to co-operate in this transition. Already during the planning process the aim of the reconstruction law was diversified with aims on fields such as environment, nature, landscape, and water (Lauwere & Vellema, 2011). After this diversification of aims the scientific evidence for the original aim collapsed. The farmers would not move, and could thereafter hardly be triggered to move (Bleumink, 2007). Moreover the aims on other fields such as the environment, and nature frustrated this transition even more. The space-pump was no longer a consequence of a trend, which in some cases might work as a catalyst for this type of transitions, but the space-pump became a goal on its own, and frustrated the trend that originally caused this transition.

The same might happen with the three models of Venray. All three are based on perspectives whereby it is questionable in how far they provide profit for those who in the first place have to be convinced to co-operate, the farmers. Using the space-pump to improve the protection around the vulnerable streams in Venray is very justifiable from the viewpoint of the capital planet. But it is not primarily a reason for the farmer to co-operate, moreover by stating that the cluster should be as small as possible, and the space-pump as large as possible, it might even frustrate the aim of the farmer. By all of the three models from this perspective, the space-pump has become a goal that might frustrate the original process. How successful these models even might be, seen from the perspectives of planet, and people, they can only be reached when the perspective of the agricultural sector is part of the model, they are essential for the process.

5.8 Conclusion modelling.

After this exploration of possibilities in the case of Venray conclusions can be drawn as basis for the design. The previous three references: Agriport A7, the mega-farm landscape, and the reconstruction law show why it would be undesirable to use just one of the six models as basis for the design, and thus totally focus on one perspective. Something that is also confirmed by several studies on the topic of regional sustainable development, they argue that the economic, social, and ecological capitals are all equal important ((Dagevos & Lamoen, 2009)(Hermans et al, 2006)(Grosskurth & Rotmans, 2005)). Where exactly that balance lies is hard to determine, according to Zeijl-Rozema and Martens (2010) it is impossible to measure. The exact determination of the balance is more an well-educated decision. The theories, and the spatial modelling reveal two important bases to determine the balance between all types of profit. First, the aim to strive for pure equality between all types of profit in the development (the theoretical balance), and second to create a balance that will not frustrate the actual development (functional balance).

This functional balance was in imbalance in the case of the reconstruction law (paragraph 3.7), maybe there was a theoretical balance, but this caused that the farmers were not willing to co-operate, what meant that the whole development collapsed. In the case of the development of the metropolitan food cluster, and the space-pump in Venray it are in the first place the farmers who should be willing to co-operate, and especially the up-scaling farmers are essential. Only if they see an economic perspective in the metropolitan food cluster, they have a reason to co-operate, and thereby start the engine of the space-pump. The farmers should be willing to co-operate, but moreover able to co-operate. At his moment there is a high public resistance towards this development, for reasons such as impact on the landscape, and animal welfare (Ministry of economy, agriculture, and innovation 2012). This might mean that a solely economic perspective makes the farmers willing to co-operate, but the lack of an ecological, and social perspective makes that the farmers are not able to co-operate because of the public resistance.

The group of up-scaling farmers mainly reasons from an economic perspective for their company, therefore they are focussed on the agropark, and the metropolitan food cluster. In all spatial models, independent of their perspective, the size, and location of the agropark, and metropolitan food cluster differs, but the focus within the cluster is still very economical. It is partly the location, and size of the cluster, but mainly the location, size, and function of the space-pump that defines the amount of profit for a certain perspective in each model. This conclusion imbues that the balance between all capitals should not be sought inside the metropolitan food cluster, but that the space-pump might be the element to bring the balance for a sustainable development of Venray by also providing ecological, and social profit for the region.

The spatial models show that the size, location, and function of the space-pump can differ per perspective. But, the main factor which determines the size is the approach. As already mentioned in chapter 3 the space-pump in the Dutch context related to a metropolitan food cluster is planned with regard to land, and not autonomously developing. When the transition to a metropolitan food cluster is planned with a regional, and integral approach, there are better possibilities to develop a large, and well-functioning space-pump effect. The more individual, and small-scaled the approach of the transition is, the smaller the space-pump can be in land, only buildings and policy zones will suffer from the space pump in this case, as can be concluded upon spatial models such as 'current social structure'. Based upon the spatial models can therefore be concluded that the role of landscape architecture should not limit itself to the metropolitan food cluster, but that the space-pump should be seen as an important element in this regional transition to maintain the balance between the three types of profit.

Among the more general conclusions in the previous paragraph, the spatial models provide also important conclusions in relation to the area itself, that can serve as basis for the design, both for the metropolitan food cluster, as for the space-pump. The models based on the perspective of 'people', provide important clues about what people consider as important elements of their environment, such as the level of facilities in the villages. Moreover this model provided information about the desired identity each village. Some villages, especially at the west, and south side of Venray, like to see themselves as agricultural villages now, and in the future. On the other hand there are several villages, especially around the city of Venray and at the east side, where the villages would rather focus on other functions than intensive agriculture.

The second perspective, based on the capital 'planet', provided important information with regard to the ecological vulnerability of areas in Venray. Some areas are highly vulnerable, and certain developments can damage important ecological values over here, for example around the streams, or near the existing nature areas. Other areas are more robust, or lack important ecological values. These areas are located in the west, and south of the municipality, and are areas that are already in use by large-scaled agriculture. Therefore it is also plausible that these areas are now designated as ecologically robust because this form of intensive agriculture destroyed the important ecological values in the past.

The third perspective is based on the capital 'profit'. Conclusions of this model are mainly focussed on the agropark. Where are the ideal infrastructural locations, and where are currently the important concentrations of livestock farming. Unfortunately these locations do not overlap, but important locations are near the harbour of Wanssum, near Oirlo, Ysselsteyn, and Vredepeel.

5.8.1 Local interests.

The exploration of the models provided important information about how to design the development of a metropolitan food cluster, and space-pump in Venray. But, two other factors are of high importance to frame these conclusions in the situation of Venray. First the analysis of the current landscape as described in chapter 3, and second an analysis of the current interest in the rural landscape of Venray.

In relation to the development of a metropolitan food cluster, and space-pump, three important interests can be distinguished (fig. 5.22). First, the 'up-scaling farmer', a group of farmers that have large livestock farms at this moment, and are aiming at farm continuation, growth, better, and more efficient farms. According to Smeets this group of farmers in Venray belongs to the world-top in their field, and it is therefore not probable that their agricultural production disappears out of Venray in the near future (Smeets, 2012).

Up-scaling farmer
- Farm continuation, growth, better, more efficient farms
- Profit perspective

Diversifying farmer
- Live and work in the rural landscape, but not intensive agriculture
- People, planet & profit perspective

Recreational townsman
- Use the rural landscape as part of their living
- People & planet perspective

5.22 Three important groups of interest in the rural landscape of Venray, with a wide variety of aims.

Second group are the 'diversifying farmers'. A group of farmers that belongs to the group of 50-70% of the farmers where the LEI has calculated that it is very probable that they quit their production in the coming decades (LEI, 2011). This group lives, and works on a farm in the rural landscape now, and many of them are willing to keep on doing so in the future, but not on an intensive productive farm ((Gemeente Venray 2010)(Gemeente Venray, 2006)).

Third group are the 'recreational townsman', inhabitants who live in one of the villages, or city of Venray, have no direct relation with agriculture, but want to use the rural landscape as part of their living, for example for recreational purposes ((Gebiedspanel [village], 2011) (Gemeente Venray, 2006)).

The three groups of interests in the rural landscape, can be linked to a certain capital, as used in the modelling. The 'up-scaling farmer' can be linked to the perspective of 'profit'. This group should be willing to co-operate in the transition to a metropolitan food cluster, and important reasons to co-operate are profit related. The two other groups, the 'diversifying farmers' and the 'recreational townsman' are more related to the perspectives of 'people' and 'planet'. One conclusion for the design could therefore be to design the metropolitan food cluster based on economic profit, and develop the space-pump based on ecological, and social profit.

Design

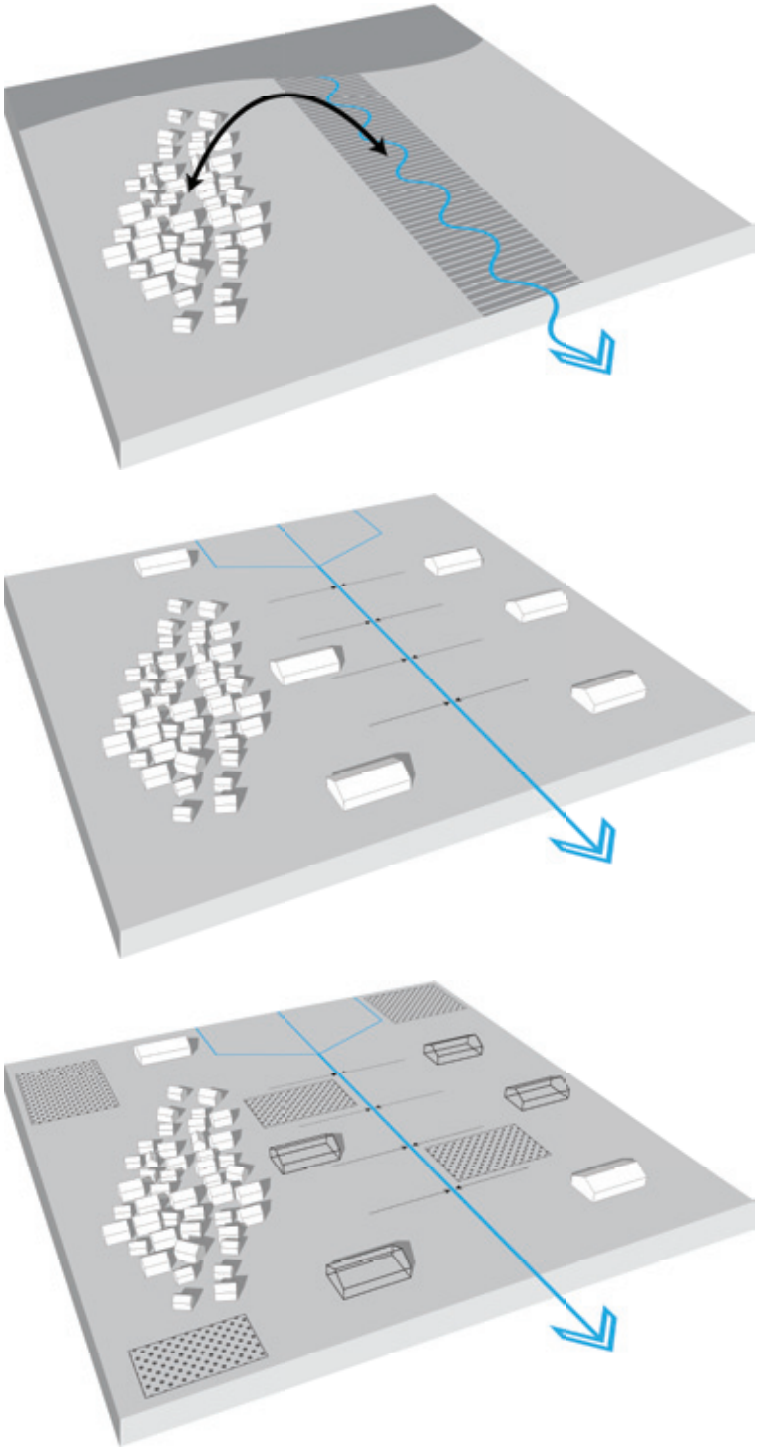
The landscape analysis provided an overview of the current state of the landscape, while the modelling provided an exploration of the possibilities, limitations, and consequences of certain types of developments within the situation of Venray. Both serve as an important basis for the design. The 'doorstep landscape' in Venray is a design for the space-pump based on the three important perspectives. If the new functions in the space-pump of Venray need to compete with the region, Venray has a long way to go. But, the main advantage is that the space-pump is located, almost at the doorstep of the inhabitants of all villages, who can reach this area by for example foot, or bike. By restoring the stream valleys as ecological, and recreational attractive zones, not only the lost relation between the village and the stream valley can be restored, but moreover the many farmers who quit, or move their intensive agricultural production, have an incentive to change their farm function, in a function ready for the future. On the one hand, the up-scaling farmers will be offered the possibilities to develop a metropolitan food cluster, a pull-factor, while on the other hand the diversifying farmers, and the inhabitants will be offered space to develop a desired landscape for them, a push factor. This chain process can offer possibilities for several groups of interest that are not possible on an individual basis.

6.1 Changing relations.

As already mentioned in the landscape analysis in chapter 4. Venray has a landscape full of gradients in terms of abiotic systems, but a relative monotone landscape in terms of visual appearance. This difference between abiotic systems on the one hand, and occupation, and networks on the other hand, arose over the last two centuries. In the nineteenth century there was still a strong relation between occupation, and abiotic systems. The 'Peel' was a large roughland, which provided water for the streams that meandered through the landscape, and ended in the 'Maas'. The areas along these streams, the stream valleys, had significant different landscape characteristics than other parts of the landscape, and in that time the village had a strong functional relation with the stream valley (fig. 6.1), for example for agricultural purposes (see for a more detailed description chapter 4, and paragraph 1.5.

In the twentieth century the agricultural methods changed. Among many other factors the introduction of the artificial fertilizer was a driver for a rapid change of the Dutch agricultural landscape (Thissen, 1993)(see also paragraph 1.5). Like in many parts of the Netherlands this had also an important effect on Venray. In that time the 'Peel' was reclaimed for agricultural purposes, the streams were canalised, the water-level controlled by dams, the parcels drained, and large farms would arise in the middle of the rural landscape (fig. 6.1). All these interventions provided Venray with a monotone agricultural landscape. The unique characteristics of the stream valley disappeared for an important part, to provide optimal conditions for agricultural production, especially at the south, and west side of the municipality. Which is in fact a beautiful landscape, but only seen from the perspective of intensive agriculture.

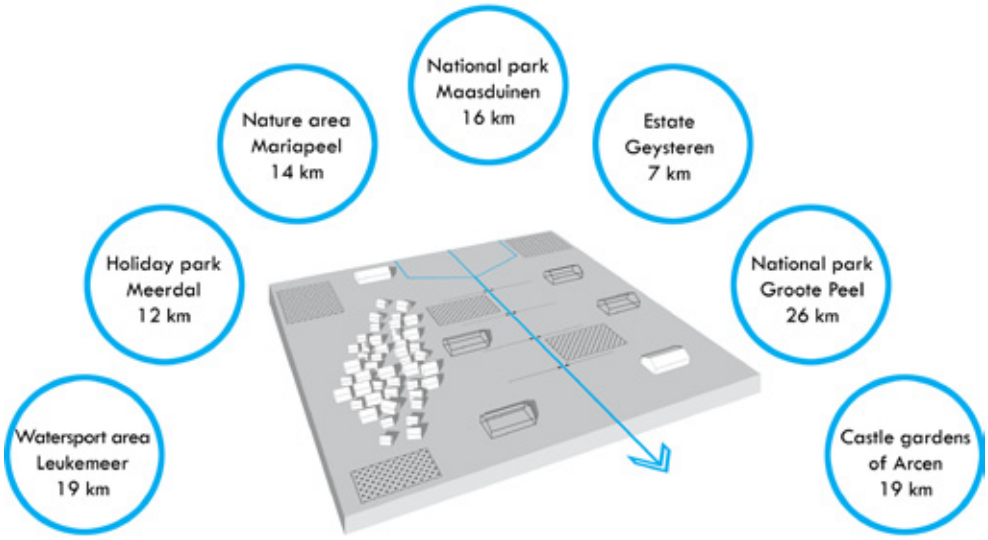
A problem in these intensive agricultural areas of Venray may occur when the space-pump starts to develop (fig. 6.1). When under influence of trends such as the development of a metropolitan food cluster, stables, policy zones, and land are not essentially needed anymore, another function can develop in these areas. But, which function fits in this monotone landscape, shaped to function only for agriculture?



6.1 Three phases in the development of the agricultural landscape in Venray. 1: nineteenth century, strong relation between the village and the stream valley. 2: disappearance of the stream valley in the favour of a monotone agricultural landscape. 3: problem when the space-pump occurs, and makes space for new functions in a mono-functional landscape.

6.1.1 Regional competition.

What function, or functions can develop best, or are needed instead of intensive agriculture in Venray, in places where the space-pump occurs? When analysing the current important functions on the regional scale there can be concluded that already several important non-agricultural functions take place in the region. Functions such as nature (i.a. national park Maasduinen, or nature area Mariapeel), or leisure (i.a. holiday park Meerdal, or watersport-area Leukemeer) (fig. 6.2). When the area that is affected by the space-pump in the future wants to compete with these functions, Venray has a long way to go, while this area now is a monotone agricultural landscape (see also chapter 4). But, the space-pump potential in Venray has one important advantage compared to all regional non-intensive agricultural functions, for all areas in the region the inhabitants of Venray need a car, or maybe a bike to go to these areas, while the space-pump is located very close to their house. This is an important advantage to use as basis for the further design.



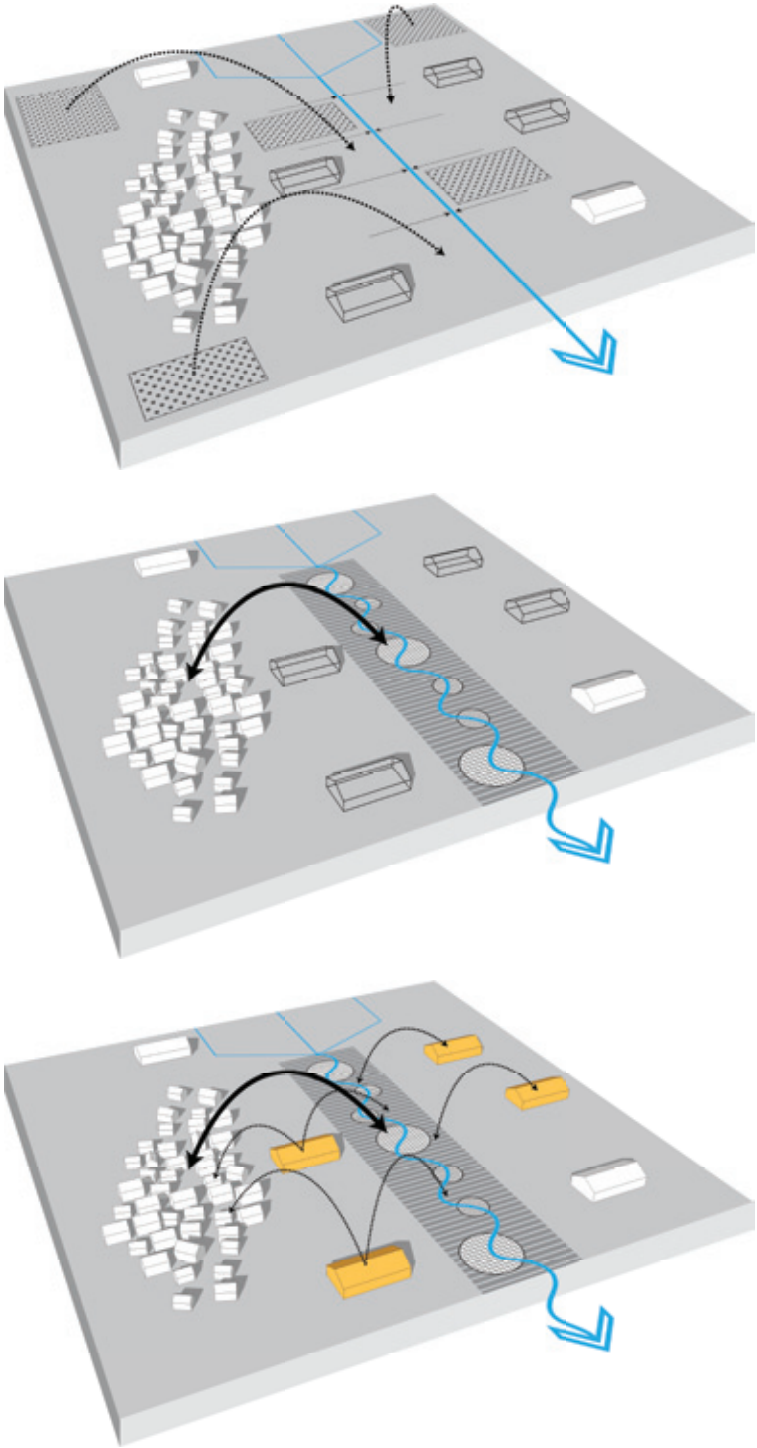
6.2 The new functions which can develop with the space-pump in Venray, suffer from hard regional competition.

6.1.2 Towards a sustainable framework.

In paragraph 3.7 the potential relation between the space-pump, and the framework concept is described. The framework concept is developed with as main aim to: “be an answer to the friction between agriculture and other land use claims, such as outdoor recreation, nature conservation and water supply. It is intended to help separate intensive and dynamic land use from extensive functions requiring more stability” (Kerkstra, & Vrijlandt, pp. 275, 1990). In this case the space-pump provides the space to develop this stable framework of low-dynamic functions, while the other areas can develop towards important agricultural functions.

The framework contains the important low dynamic functions. They should be located where they can provide the highest added value. Based on the landscape analysis (chapter 4), and the modelling (chapter 5), this are the areas along the streams. If all land, which is not essentially needed for the production within the metropolitan food cluster would be connected to a spatial framework at the stream valleys (fig. 6.3), they provide enough space to develop important low-dynamic functions (fig. 6.3).

The framework around the streams should be transformed into an ecological, and recreational interesting zone (fig. 6.3). This transforms the rural landscape in Venray from a



6.3 Three phases in the development of the space-pump in Venray. 1: cluster all land, which is not essentially needed for agriculture in the stream valleys. 2: develop a framework for ecological, and recreational functions, to restore the connection with the villages. 3. Farms have an opportunity to transform to a non-intensive agricultural function. Development of multifunctional rural landscape: the doorstep landscape.

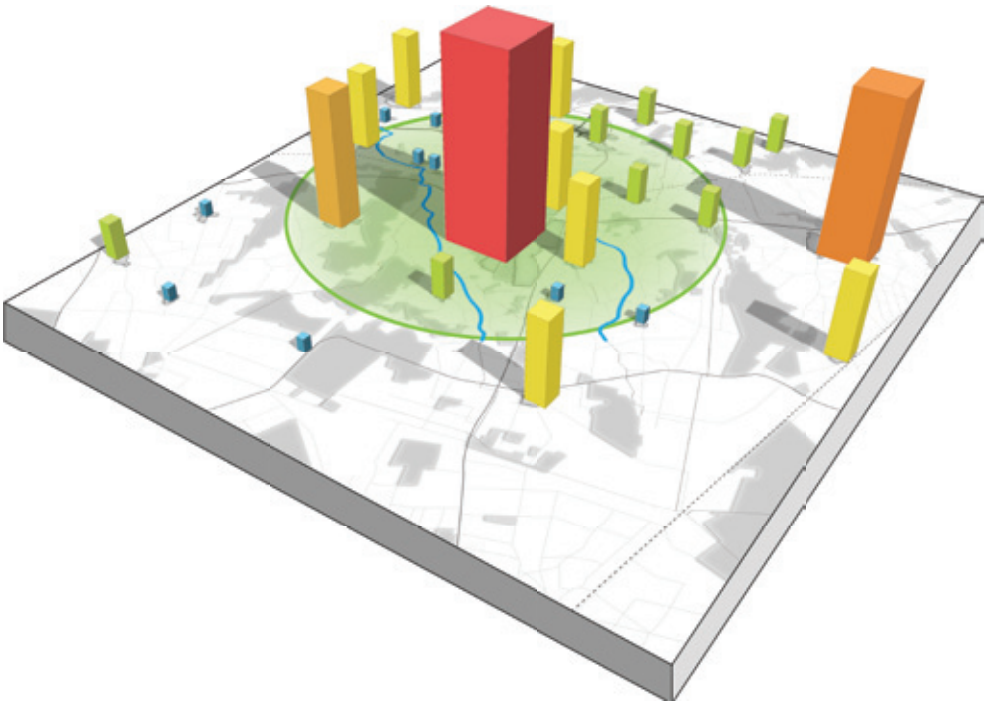
monotone agricultural landscape into a multifunctional landscape. It are not anymore mainly the intensive agricultural farms who can have profit of the landscape, but also other groups of interest can profit. The future stream valleys contains functions such as nature development, recreation, and non-intensive forms of agriculture. Therefore the connection between the villages, and the landscape can be restored. People have a reason to go into the rural areas again. Farms who quitted their production, or moved their production to the metropolitan food cluster, have in this case an opportunity to profit from this restored connection, and transform the function of the existing farm in a non-intensive agricultural function. By providing the stable framework in the stream valleys, and the flexible zones in the rural areas, the area around Venray can transform in a rural landscape with a variety of interesting places closely located to the villages, almost on the 'doorstep' of the inhabitants. The space-pump can in this way optimal use the advantage of their location with regard to the regional competition (paragraph 6.1) and slowly transform to the 'Doorstep landscape'.

6.2 Zoning.

In the chapter 'theoretical context' is described that the space-pump is always a consequence of a trend in a certain form of land-use, and should also be treated as such. In the case of Venray the space-pump is the consequence of the development of a metropolitan food cluster, therefore this cluster should be planned first. Based on the landscape analysis, and the modelling, the metropolitan food cluster should be located at the western, and southern side of the municipality (fig. 6.5). These landscapes are already large-scaled, and in use for productive agriculture. Here the most important concentrations of farms are located, these areas are ecologically the least vulnerable, and in these villages there is much social support for large-scaled agricultural developments, such as a metropolitan food cluster ((Gebiedspanel Vredepeel, 2011)(Gebiedspanel Ysselsteyn, 2011)). Mainly for reasons of animal welfare, transport, existing concentrations of farms, social support, it is important to develop three agroparks, one at Vredepeel, one near Ysselsteyn, and one near Oirlo/Wanssum. The area for the metropolitan food cluster has a relative flexible layout, here it should be possible to adept to future changes in economic, and political context.

By planning the metropolitan food cluster at the southern, and western side of the municipality, the space-pump will occur in the area where the most people live, the rural area which the most people can reach from their 'doorstep' by bike, or foot (fig. 6.4). Currently still a very monotone agricultural landscape. In order to bring the abiotic variation back in the landscape, provide an area for ecological development, a recreational interesting area, and an incentive for the 'diversifying farmer' to change their function of intensive agriculture, the stream valleys will be restored. The space-pump will be used to develop a stable framework for non-agricultural, or non-intensive agricultural functions.

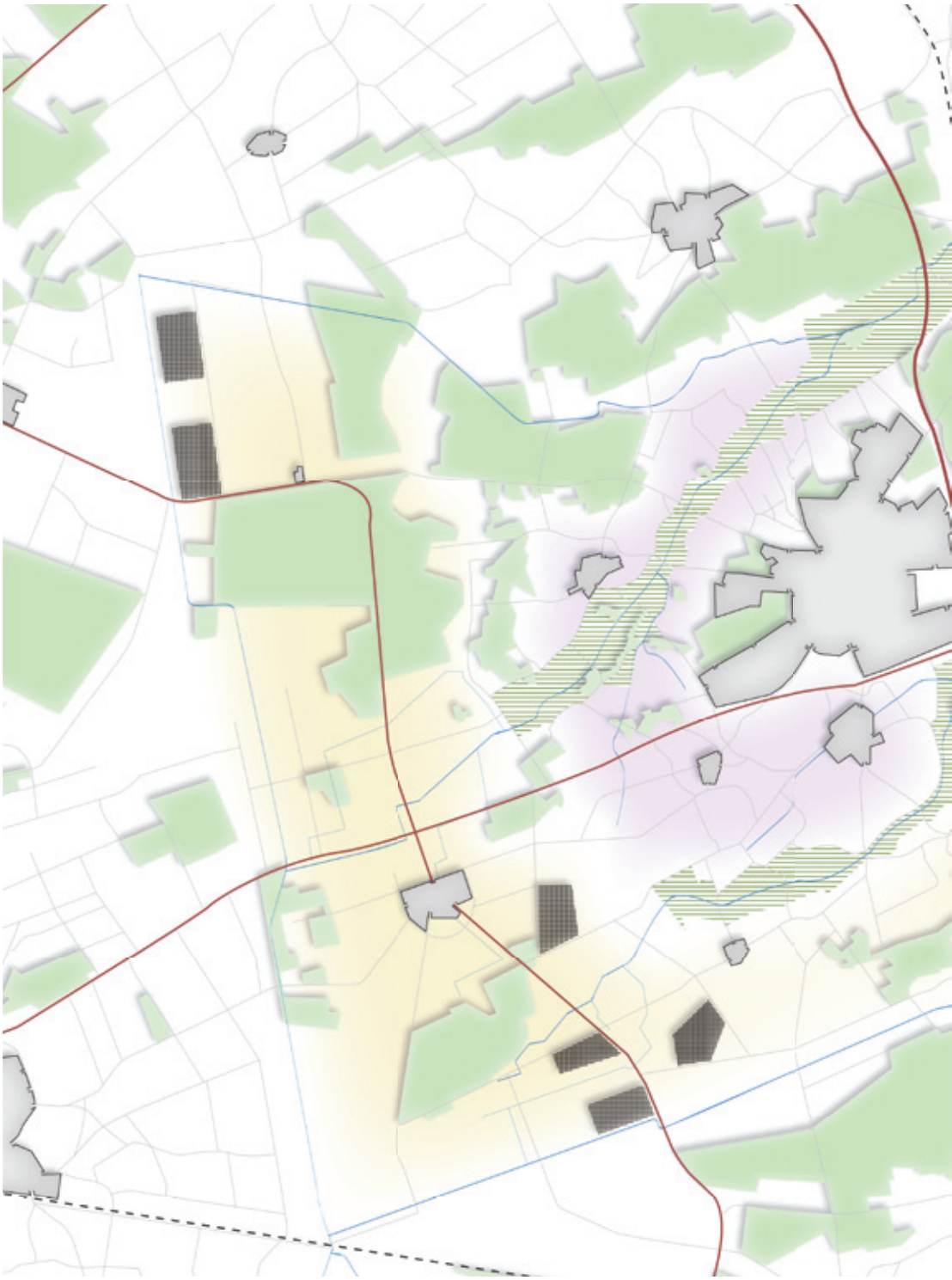
The areas directly around this framework of low-dynamic functions contain high-dynamic agricultural functions, but not the intensive agriculture. Here the, at this moment, mainly intensive agriculture will receive the space, and a reason to transform the function of their farm towards a more leisure-oriented function, such as rural living, non-intensive farming, rural leisure, or sale of local products. This area around the stream valleys has a flexible layout. But, this area will not totally transform to a leisure landscape. Many parts of the land are still essential to produce fodder for the animals in the agropark. They are thus part of the 'doorstep landscape', and the metropolitan food cluster. This combination of productive land, and leisure-oriented functions is a important element for the area of Venray, Buijs et al states: "it is not food production or pure nature, but beautiful, recognisable and accessible landscapes that people look for in their free time (Buijs et al, pp. 376, 2006).



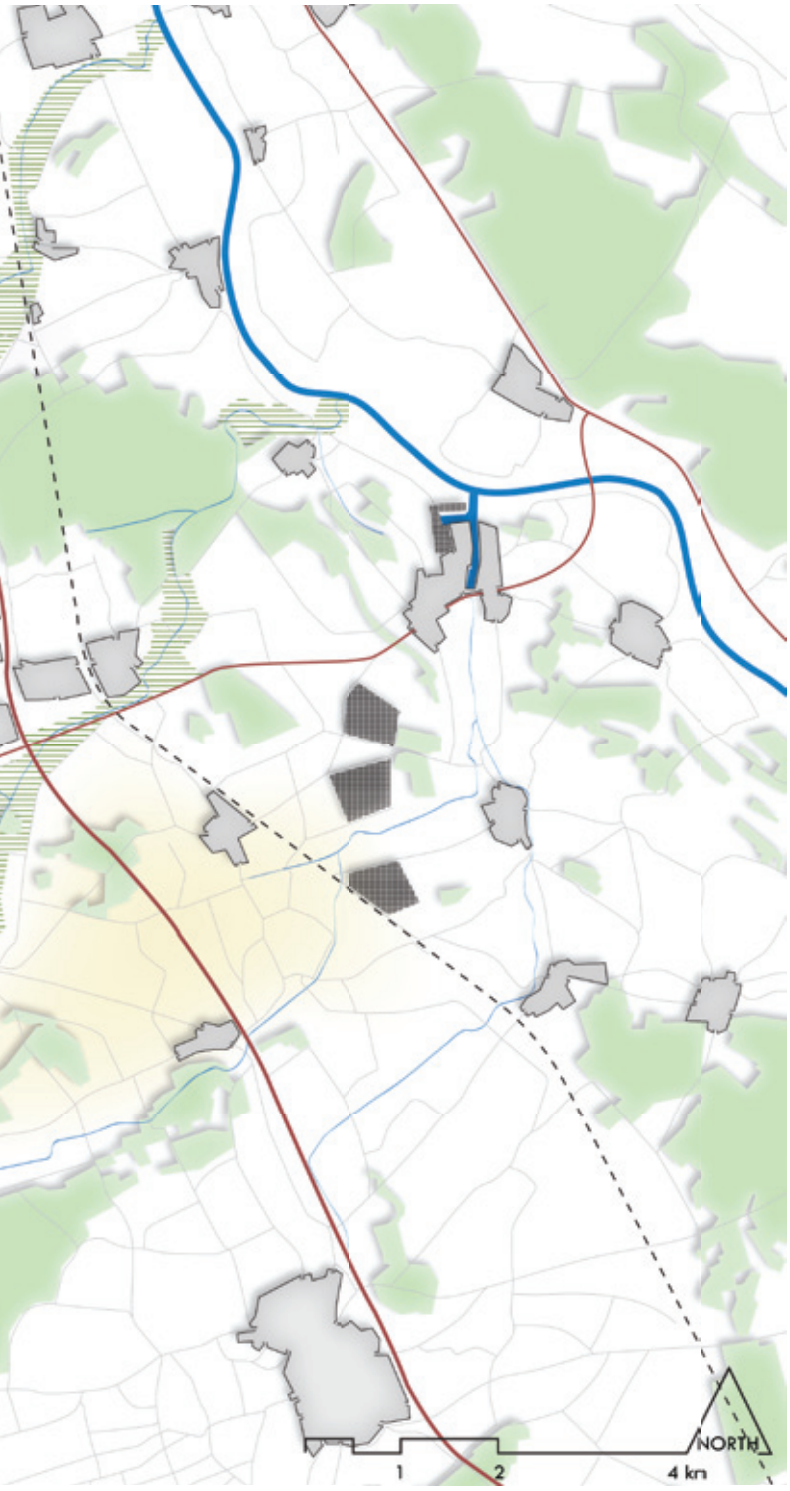
6.4 By developing the metropolitan food cluster at the west, and south of Venray, the space-pump can occur in the area where the most people live, who can reach this area by foot, or bike.

This design for Venray is based on the principles of the framework concept (Kerkstra & Vrijlandt, 1990). The potential link between the framework concept, and the space-pump is described in paragraph 3.7. In the case of Venray there are two types of flexible layouts, which contain the high-dynamic functions. First, the metropolitan food cluster, where the landscape should be able to adapt to future changes, in order to meet a high productive landscape. Second, the diversifying landscape, where intensive agriculture slowly evolves to a variety of non-intensive agricultural, and non-agricultural functions. The framework in the stream valleys can only develop because the metropolitan food cluster develops, by means of the space-pump, and this framework should accelerate the diversification of the landscape around Venray. This strategy is slightly different than the original framework concept as developed by Kerkstra, and Vrijlandt (1990). Although one regional plan is made, in the original framework concept, the actual framework seems to have the most prominent role, and should provide open spaces for high-dynamic functions (Kerkstra & Vrijlandt, 1990). In the case of the space-pump it is the other way around, here also one regional plan is made, but here the high-dynamic function, the metropolitan food cluster, should provide the possibility to develop the framework for the low-dynamic functions.

Another important aspect of this design, which is not in conflict with the original framework concept, but at least not as obvious described, is the co-operation, dependence, and importance of both the flexible layout, and the stable framework for each other. In the original framework concept this seem to be two relatively separated elements (Based on: Kerkstra &



6.5 Zoning plan for the metropolitan food cluster, and the 'doorstep landscape' .



Legend

- Projected stream valley
- Area for diversifying agriculture
- Area for intensive agriculture
- Agroparks
- Villages
- Motorway
- N-road
- Road
- Railway
- River
- Stream
- Nature area

Vrijlandt, 1990). Over time there are more critics on the original framework concept, such as van der Vlis, who argues that the division between high-, and low-dynamic functions is not clear in the original concept (van der Vlis, 1991). This critic is used in this design, the division of high-, and low-dynamic functions is not only based on the type of function, while agriculture for example is a function which appears in both the flexible layout, and the stable framework. Only the type of agriculture, and the type of appearance should in the stable framework be more fixed than in the flexible areas.

6.3 The Doorstep Landscape.

This thesis is focussed on the space-pump, and therefore also the design is focussed on the space-pump in Venray. In the previous paragraph also the metropolitan food cluster is located, but only because the space-pump is the consequence of this development, and among other factors the location of the metropolitan food cluster has consequences for the size, location, and function of the space-pump.

The most essential aspect of the design is the water system. The current water-system in Venray can be seen as one system, a system that is modified to function in an optimal way for agriculture. In the future the stream valleys will be restored, and interventions will be taken to restore a meandering stream. This imbues that the current system will be split in two functions, a high productive part, and a part for ecological, and recreational purposes. In order to prevent problems in the future, a water-buffer will be developed at the edge of the metropolitan food cluster with the 'doorstep landscape'. This intervention guarantees that the metropolitan food cluster can continue their activities in the future, but also that the stream valleys can be restored. A more detailed description of this water system is given in paragraph 6.5.

The water-buffers will provide possibilities to intervene in the canalised streams, and create meanders again. With a variety of profiles the streams will become more interesting for the target-species (paragraph 4.5) but also more interesting for recreational purposes. The meanders create circumstances that are more wet in the future, with more fluctuations in water-level (Gemeente Venray, 2009). These interventions create a landscape element that has connections with the abiotic circumstances, and is significant different that the surrounding landscape. With a variation of nature areas, and non-intensive agricultural areas the stream valleys become attractive areas to go to for animals, and people. By making these stream valleys accessible, the streams of Venray become visible for its inhabitants again, whereas they were 'hidden' for a long time. By connecting dead ending sand roads, the stream valleys can be connected with the 'doorstep' of the inhabitants, and the regional recreational network. (paragraph 6.4)

All the interventions in, and around the stream valleys provide a stable framework of ecological, and social functions, in a monotone agricultural landscape (fig. 6.6). This transition should work as an incentive for farmers near this framework to change their current function of intensive agriculture into a leisure-oriented function. This transition should firstly take place at those locations where the relation village-farms-stream valley is the strongest, thus near Leunen, and near Merselo. Here a wide variety of leisure-oriented functions should replace the current intensive agricultural function. Also other farms, where the relation between the village, and the stream valley is less obvious, should have the possibility to transform, only here the urgency is lower, and thereby also the variety of desired functions. (paragraph 6.7)

Among agriculture, and leisure, also ecology can have profit of this transition. The stream valleys are ecologically the most vulnerable areas that are not protected yet in Venray. But, by their locations, and abiotic circumstances they provide the ideal possibility for a regional ecological connection, between for example national park the 'Maasduinen', and nature area

'Mariapeel'. With their new increased variety of biotopes, the future stream valleys meet many of the requirements of the target-species. Therefore the ecological interventions are not restricted to the original area of the stream valley, but do continue into the metropolitan food cluster, in order to complete the connection. (paragraph 6.6)

All the proposed interventions are large changes, compared to the current landscape. Although these changes might offer many advantages, and the current type of agriculture, and landscape are not durable on the long term, it can be experienced as a drastic change by the inhabitants of Venray. The agriculture, and livestock sector is highly interwoven with every detail of this landscape, and this society. People are proud on their agricultural sector. Therefore this design pays respect to this desire. All interventions prepare the region of Venray for the future, but preserve the agricultural identity where possible, for example in the use of characteristic forms, landscape elements, or materials.

6.6 Design for the Doorstep Landscape in Venray.

Legend

- Village
- Motorway
- N-road
- Road
- Railway
- Agropark
- River
- Stream
- Canal
- Stream with projected meanders
- Projected inundation ponds
- Water-buffer
- Existing forest area
- Existing forest structure to expand
- Existing forest rows as part of the ecological network
- Existing nature
- Projected nature area
- Agriculture with chances
- Extensive maintained parcel edges
- Existing road, part of stream valley route
- Existing sand road, part of stream valley route
- Projected sand road, part of stream valley route
- Existing (sand) road, connection with villages
- Connection with regional recreational network
- Farms, projected diversifying, urgency 1
- Farms, projected diversifying, urgency 2
- Farms, projected diversifying, urgency 3
- Farms, projected diversifying, urgency 4
- Upgrading ecological passage
- Upgrading recreational passage
- Projected recreational passage
- Doorstep landscape
- Metropolitan food cluster

6.4 Routes.

For the functioning of the 'doorstep landscape' the recreational infrastructure is very important, while for the metropolitan food cluster the transport infrastructure is very important. In order to prevent conflicts between both systems, the aim of this design is to separate both systems as much as possible.

The recreational network contains three main types of routes, first the routes that connect the villages with the stream valleys, second the routes that are connected to the stream valleys, and third the routes inside the stream valleys.

The routes that connect the villages, or the doorstep, with the stream valley are a combination of existing roads with low traffic intensities, and sand roads, whereby many of them are dead ends, that will be connected with each other to develop a intensive network between the doorstep, and the stream valleys (fig. 6.9, 6.10 & 6.11). This network should prevent that people have to travel along the existing busy car roads into the rural landscape (fig. 6.7). Moreover this network should offer a wider range of possibilities to walk, cycle, skate, etc. a route through the rural landscape by a quiet, and green environment. This network also connects the villages, and the stream valleys with the regional recreational network.

6.7 Existing situation near Venray. Mainly busy car roads throught the rural landscape.

One important route is directly connected to the stream valley. This is mainly an existing car road with very low traffic intensities. Intensities that will further decrease when the metropolitan food cluster will develop, and prevent the high amounts of large traffic on the undersized roads. Over here the highest recreational activities can be expected in the future. This is the border between the stream valley, and the sandy rural area. The difference between both landscape units should be clearly visible from this route. At multiple places possibilities to enter the stream valley are offered, while on the other side of the road a variety of non-intensive agricultural functions on farms can be expected. Farms where you can buy local products, see livestock grazing in the meadow, drink a cup of coffee, or see a nice rural house.

The third type in the recreational network is located inside the stream valleys. Here the routes mainly consist out of sandy roads, sometimes a farm track, sometimes a small walking path. To stay close to the agricultural identity of the region, the paths are where possible located

on existing structures, such as cow paths, between the farm, and the meadow, by transforming them into a public pathway. On several locations this network leads to new bridges over the stream. The stream was for a long time 'hidden' in the landscape, and was not more than a small ditch. In the future situation the streams become much wider, and also the stream valleys much more visible. In order to enhance the visibility, and accessibility of the stream valleys, multiple bridges will complete the network. The type of bridge is related to the type of profile of the stream, as will be described in paragraph 6.5. But, because the stream was 'invisible' for such a long time, some of the bridges, at the most prominent locations will not only become places to cross the stream, but also a place to stay for a moment, and enjoy the stream, and its valley (fig. 6.13 & 6.14). To also stay close to the local agricultural identity with regard to the bridges, local materials will be used where possible. For example the concrete plates that are now in use to store grass, or corn, which will partly be redundant in the future, because of the decrease of animals in this area (fig. 6.8). In the region of Venray this type of plates is by many people directly related to their use for agriculture. By using this material for some bridges the area will have a function that is ready for the future, but with a strong link to the local identity.

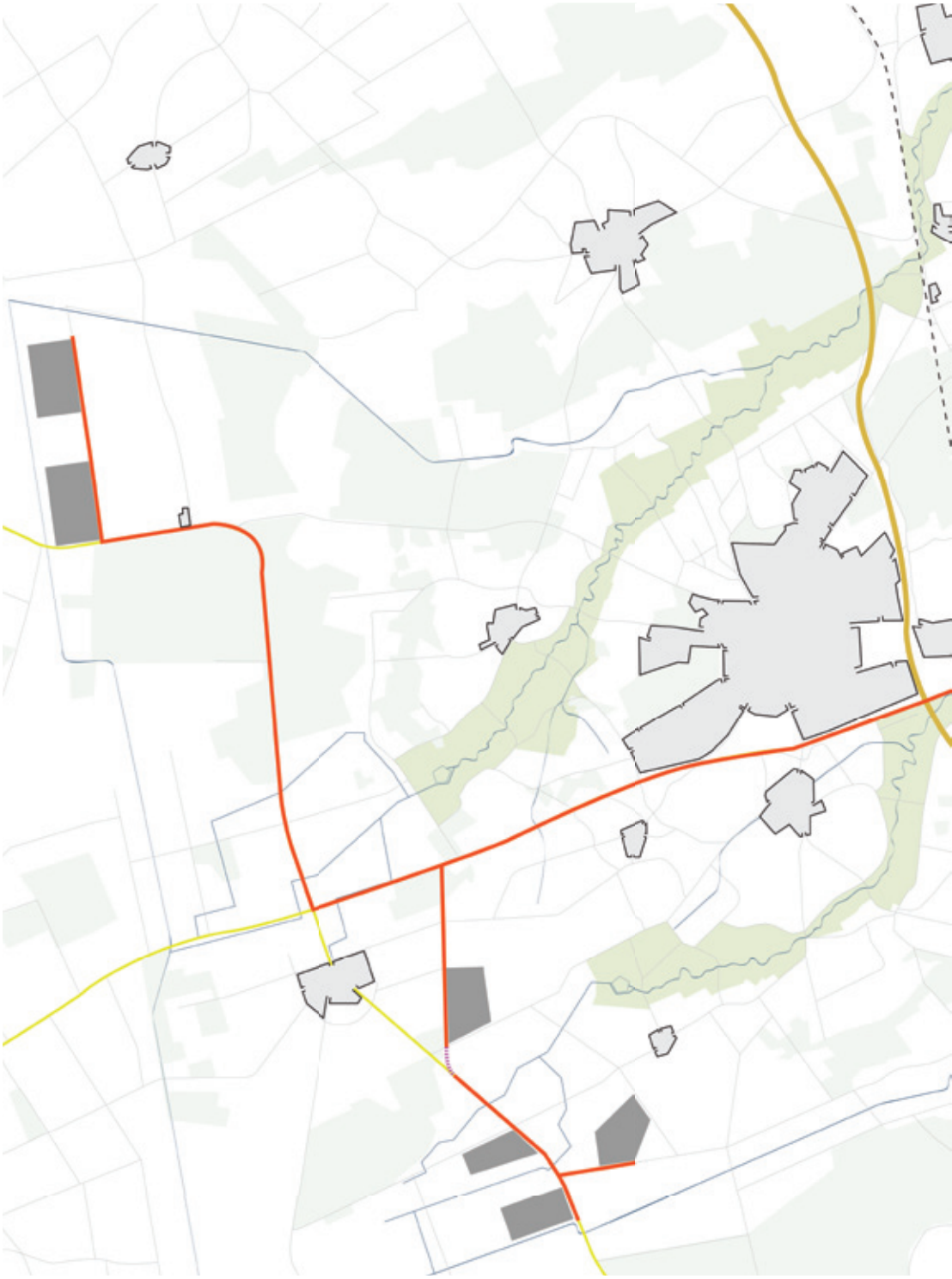
As mentioned before, the recreational network will as much as possible be separated from the transport network (fig. 6.12). The main barriers in the recreational network will be the A73, and the N270, which are crossing the 'doorstep landscape'. By focussing on improving the most important crossings the main problem should be prevented. The agroparks can mainly use the existing road infrastructure, only at some small places new connections need to be made. Connections such as near the harbour of Wanssum, a connection that is already planned by the local authorities (Gemeente Venray, 2010). Other connections, such as near Ysselsteyn, and Oirlo are mainly to prevent large amounts of traffic through the centre of the villages. But, with these small new connections, and the new planned road in Wanssum, it should be possible to prevent large amounts of traffic interfering with the recreational traffic.

6.8 Concrete plates, now used in agriculture to store grass, or corn. In the future this material can be used to link the new development with the current agricultural identity.

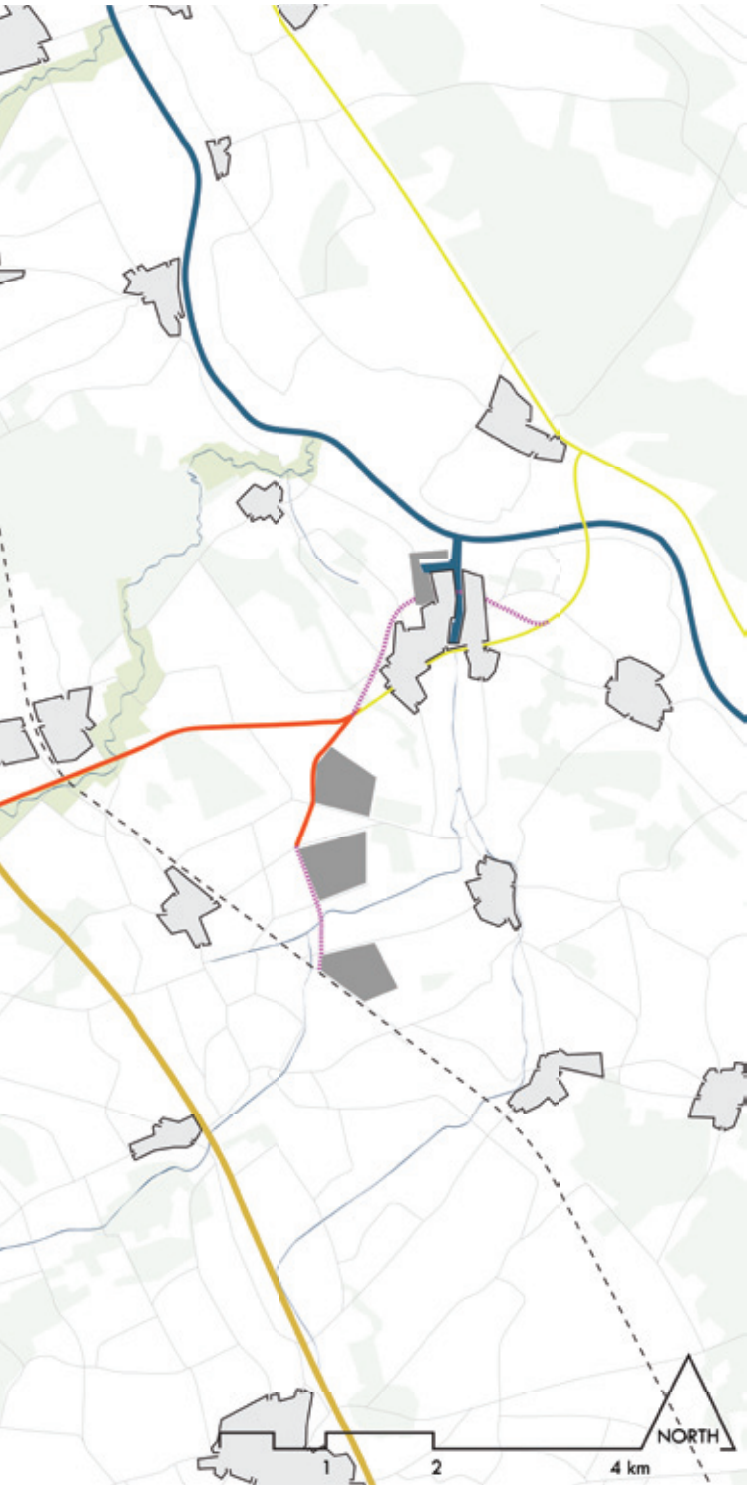
6.9 Current situation of a sand road for agricultural purposes, with a dead end in the direction of the stream valley.

6.10 Projected situation, connecting the dead ends, to make the stream accessible for recreational purposes by quiet, green routes.

6.11 Location of one projected connected sand road, as visualised in figure 6.9 and 6.10.



6.12 Theme map of important infrastructure for the MFC, as much as possible separated from the recreational network.



Legend

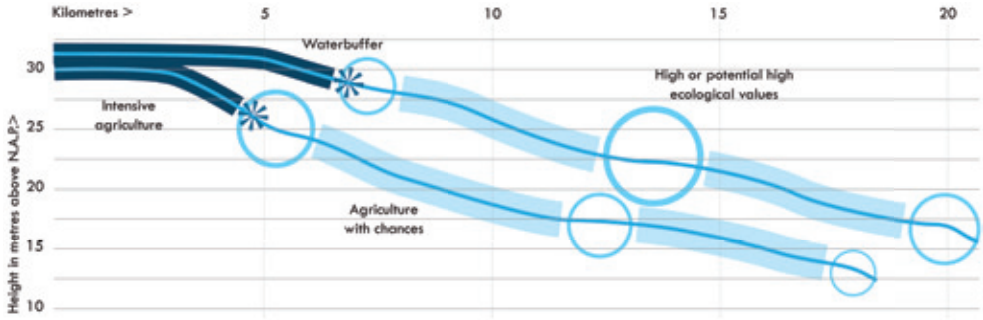
- Existing motorway
- Existing N-road, important infrastructure for the MFC
- Existing N-road
- Projected road, important infrastructure for the MFC
- Road
- Railway
- Village
- Projected agropark
- River
- Stream
- Projected stream valley
- Forest

6.13 Left: current situation at the stream near Merselo, a canalised stream with agriculture till the banks. Right: Location of one projected bridge over the stream as visualised in figure 6.14.

6.14 Projected situation, new bridge provides possibility to cross, and enjoy the new stream valley. The re-use of concrete plates offers a strong link with the current agricultural identity.

6.5 Water system.

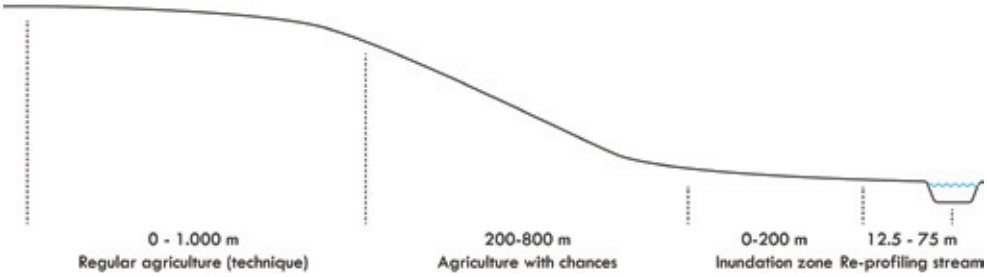
The water system will be split into one part that serves for high productive agricultural purposes, and one part that serves for ecological, and recreational purposes (fig. 6.15). The border between both is the former edge of roughland the 'Peel'. In history this was also the border between two types of water systems. The stream valleys would start at the eastern side of the 'Peel'. But, because of the many interventions that were taken, as described in chapter 4 these different types of water systems disappeared. In the future design the water system in the 'Peel' area will be remained as a system to serve high productive agriculture. The system in the sand landscape will be transformed in a system that serves also ecological, and recreational purposes. In order to be able to serve both divergent purposes a water-buffer needs to be developed between both systems.



6.15 Cross section over the length of the streams (see also figure 4.16) in relation to the future function.

The area around the water-buffer is not only a border between two types of water systems, but also a border between two types of landscapes. On the western side of this border the area is large-scaled, rectangular, with large pieces of productive land. At the western side of this border the landscape is much more small-scaled, varied, and natural. The water-buffer prevents too large fluctuations downstream. Because of the water-buffer the stream downstream can be transformed into a meandering stream with a variety of profiles (fig. 6.17).

Interventions such as these new meanders, the removal of dams, and drainage have consequences for the adjacent parcels (fig. 6.16). An area of maximum 75 metres is necessary for the re-profiling of the stream (Gemeente Venray, 2009). Because of the meanders the water level will rise, and have larger fluctuations. The zone directly connected to the stream will sometimes inundate, and therefore needs some ponds. In some areas the waterlevel will rise too much to do any form of agriculture, but these areas have high ecological values. These areas are located at the start of the stream valleys around the buffers, in the middle of the stream, and at the area where the stream flows into the 'Maas'. These areas are related to the type of slope (fig. 6.15). Some of them are already a form of nature, some should be devel-



6.16 Effect of the interventions at the stream on the stream valley, and its surroundings.

6.17 Detailed design of the transition from the metropolitan food cluster to the doorstep landscape, with as important feature the water buffer.

Legend

- Canal
- Stream with projected meanders
- Water buffer
- Dike as part of former farmers hiding place
- Original stream bed of stream
- Banks with regular inundation
- Projected inundation ponds
- Projected nature area
- Agriculture with chances
- Existing forest area
- Projected forest structure
- Projected trees/shrubs in stream valley
- Existing lane
- Projected rows of trees
- Extensive maintained parcel edges
- Parcels
- Existing road, part of stream valley route
- Existing road, important part of recreational network
- Road
- Projected sand road
- Sand road
- Projected sand walking path
- Sand walking path
- Sand walking path to expropriate
- Projected bridge, concrete plates
- Projected bridge, wood
- Buildings
- Function change: large scaled rural living, and parking
- Function change: non-agricultural company and parking
- Function change: rural living
- Function change: non intensive agriculture
- Function change: local sale
- Function change: rural leisure
- Function change: former farm house
- Demolished buildings
- Projected community yard
- Projected privat area
- Farmyard to transform
- Doorstep landscape
- Metropolitan food cluster

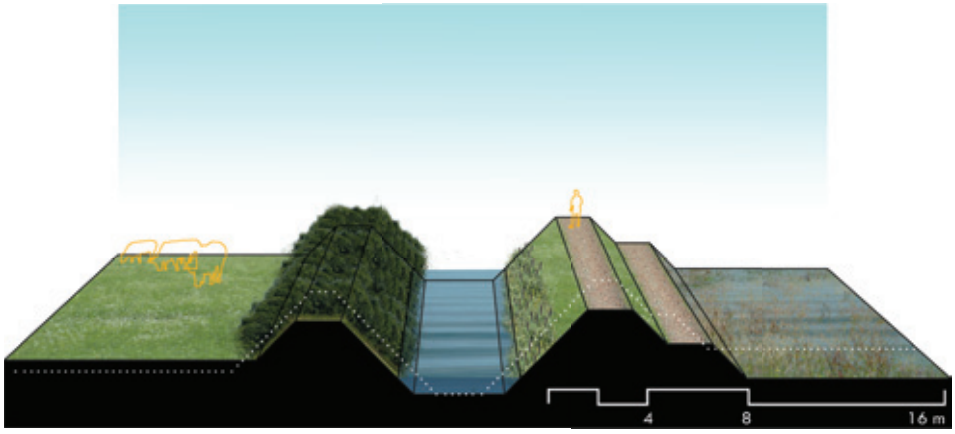
6.18 Current situation of the stream, canalised with agriculture till the banks.

6.19 Location of a part of the projected meanders in the stream, as visualised in figure 6.18 and 6.20.

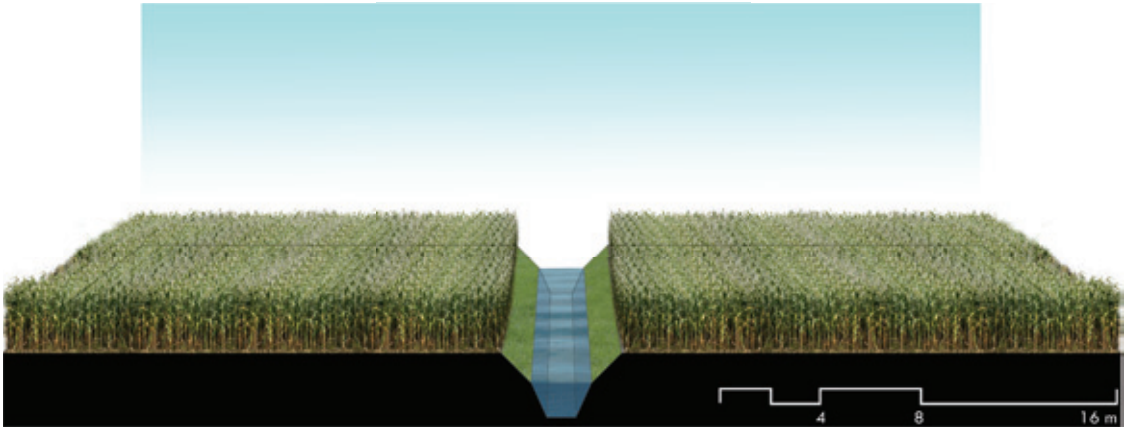
6.20 Projected situation, a meandering stream with a diversity of biotopes, still certain forms of agriculture are possible.

6.21 Location of one of the water buffers, as visualised in figure 6.22.

6.22 Projected situation,view from the inner dike of the waterbuffer into the landscape, experience the different landscape types, the metropolitan food cluster, and the doorstep landscape.



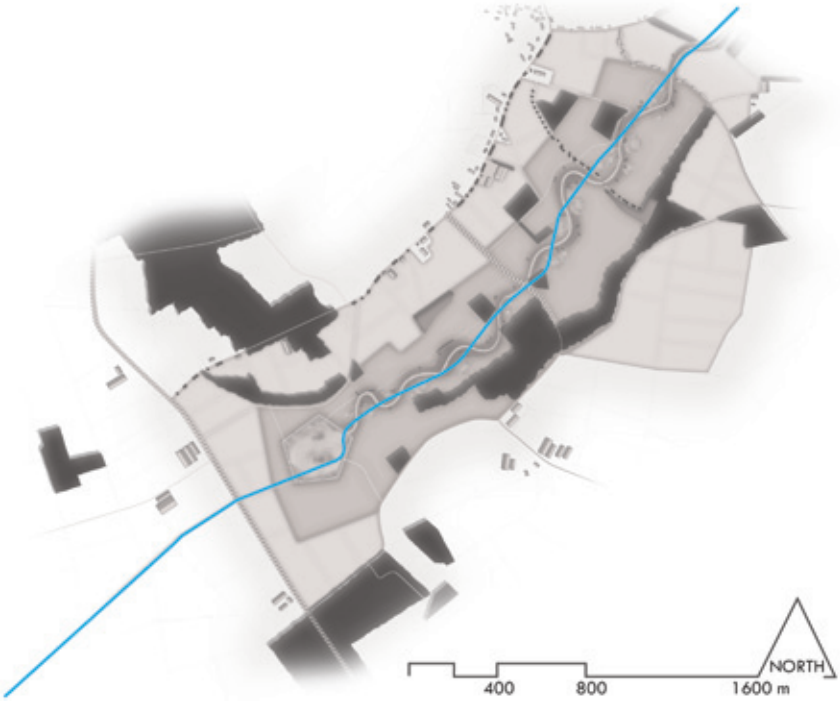
6.23 Cross section of the waterbuffer, shape based on a farmers hiding place from the middle ages.



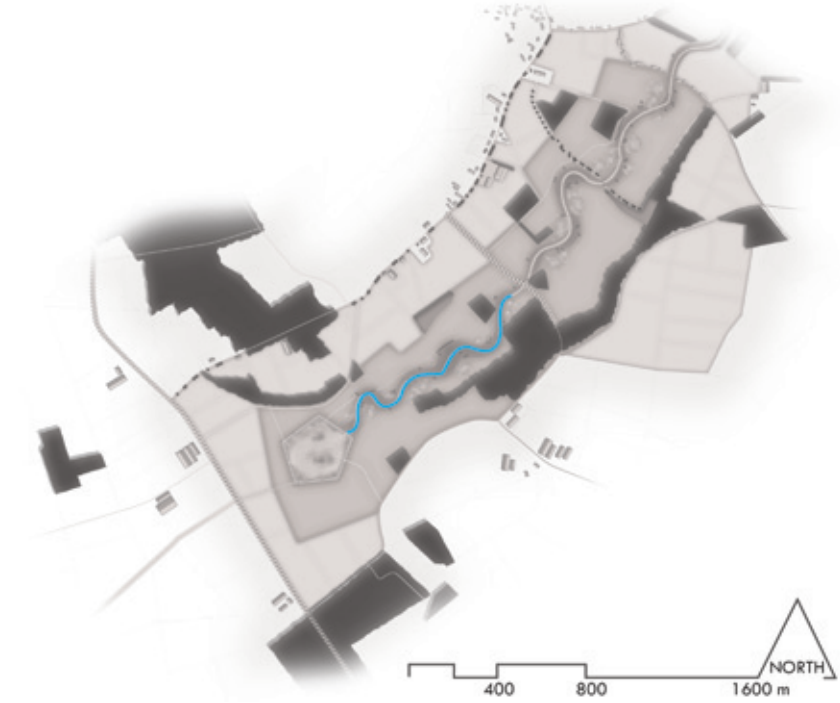
6.24 Cross-section of the current stream, canalised with intensive agriculture till the banks.

oped, mainly around the water-buffer. Also the other areas within the stream valleys will be affected by changing water circumstances. But, over here a form of agriculture is still possible. The municipality defines these areas as 'agriculture with restrictions' (Gemeente Venray, 2009), but this is mainly reasoned from a viewpoint of intensive agriculture. In the case of the 'doorstep landscape' it can also be considered as agriculture with chances. In these areas of the stream valleys a significant different form of agriculture is possible compared to the whole wider region of Venray. This form of agriculture is non-intensive, and more leisure, and ecology oriented. These areas can have a function related to the changing functions of the adjacent farms, but can also still have a function within the metropolitan food cluster. Whereas the older cows will stay in the agropark, the younger cows can still graze outdoor, or the ecological maintained grassland can still be fed to certain types of animals in the agropark. Only the new form of agriculture will cause a reduction of approximately 40% in production (Bouwman et al, 2011). Further away from the stream, approximately around one kilometre, the circumstances can be kept ideal for production pruposes by using technical solutions (Gemeente Venray, 2009)

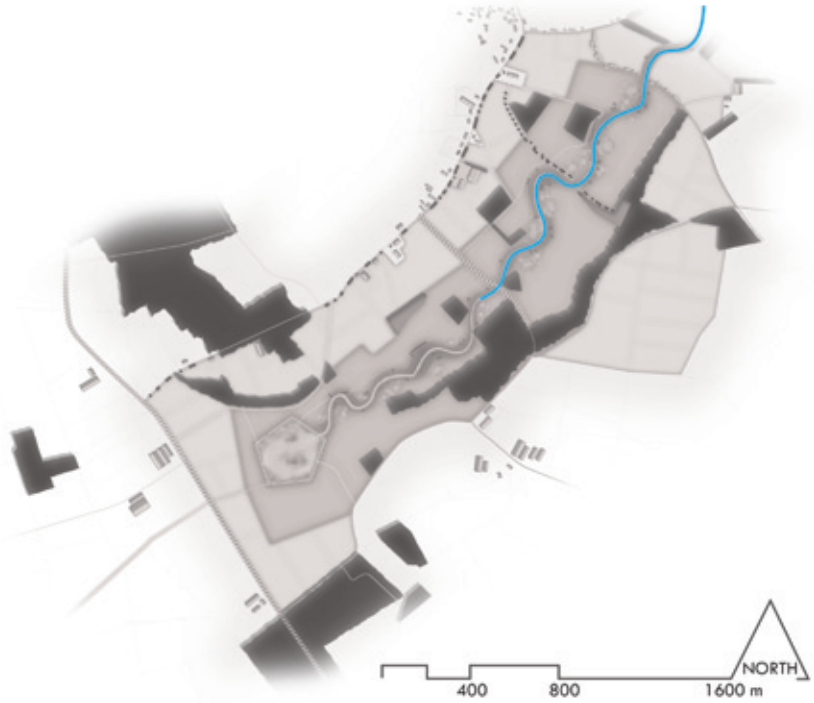
All the interventions in the stream valleys are made possible by developing a water-buffer. The water-buffer has a pentagonal shape, which is based on a historic 'Boerenschans', or farmers hiding place (Lamers et al, 2011). In the 16th century there were several of these 'farmers hiding places' in the stream valleys of Venray. A system of two dikes with the stream between both dikes would provide safety for the farmers, and livestock in this area (Lamers et al, 2011).



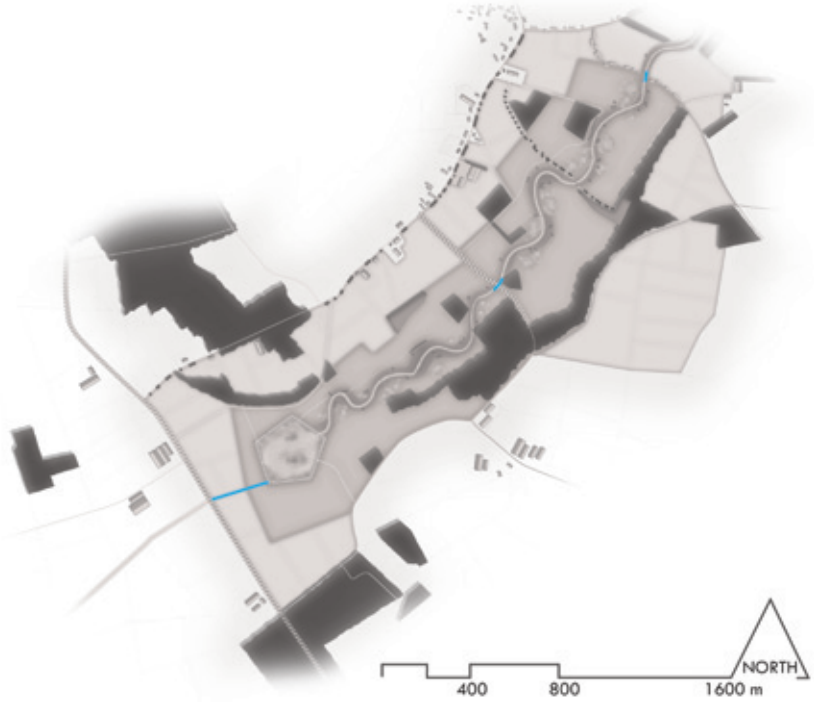
6.25 Current stream bed of the Loobeek, see figure 6.23 for a cross-section.



6.26 Projected part of the stream with mainly a variety of marshy profiles, see figure 6.28 for a cross-section.

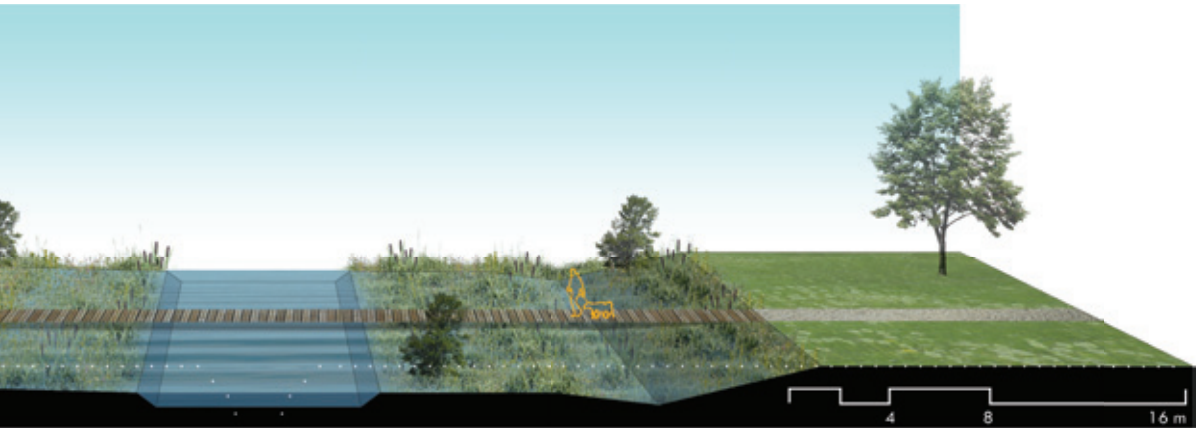


6.27 Projected part of the stream with mainly a variety of terraced profiles, see figure 6.29, 6.30 and 6.31.

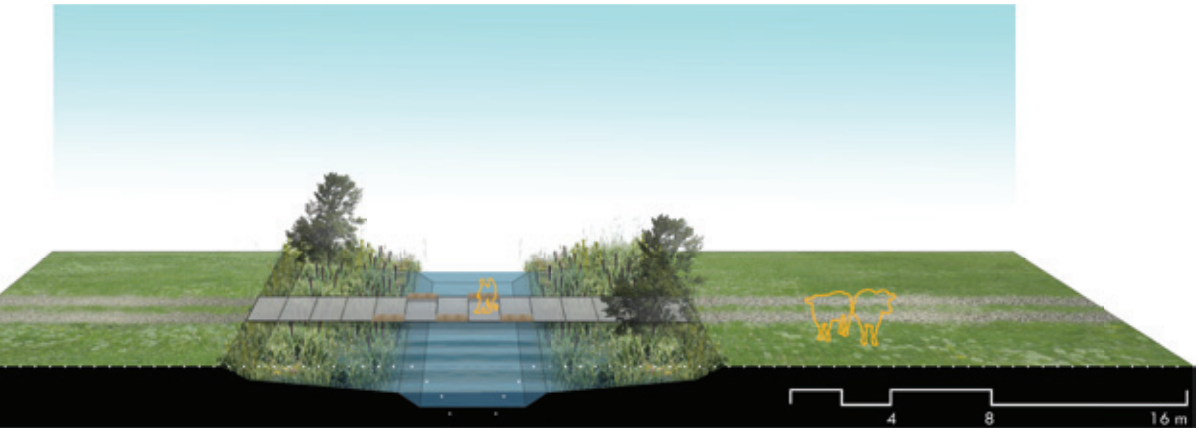


6.28 Projected part of the stream with a small terraced profile, see figure 6.31.

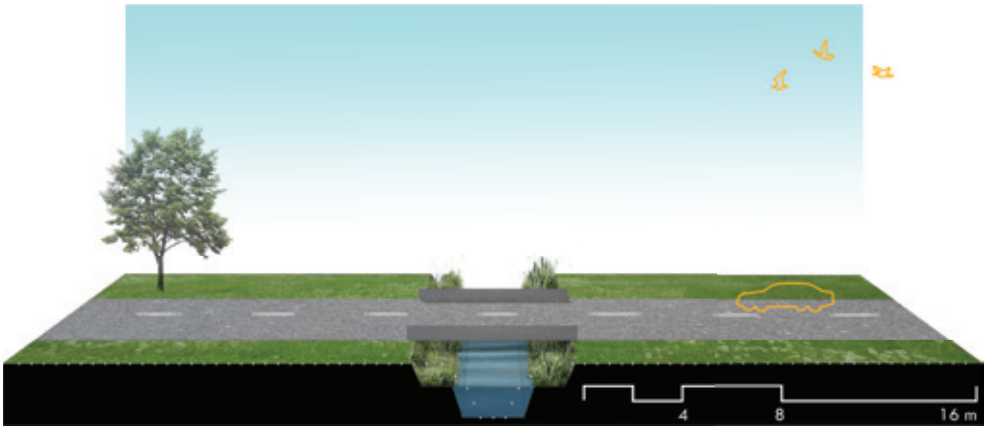
6.29 Cross-section of an example of the marshy profile, with a small bridge.



6.30 Cross-section of a wide example of the terraced profile, with a small bridge.



6.31 Cross-section of a middle-wide example of the terraced profile, with a bridge of concrete plates.



6.32 Cross-section of a small example of the terraced profile, with an existing car bridge.

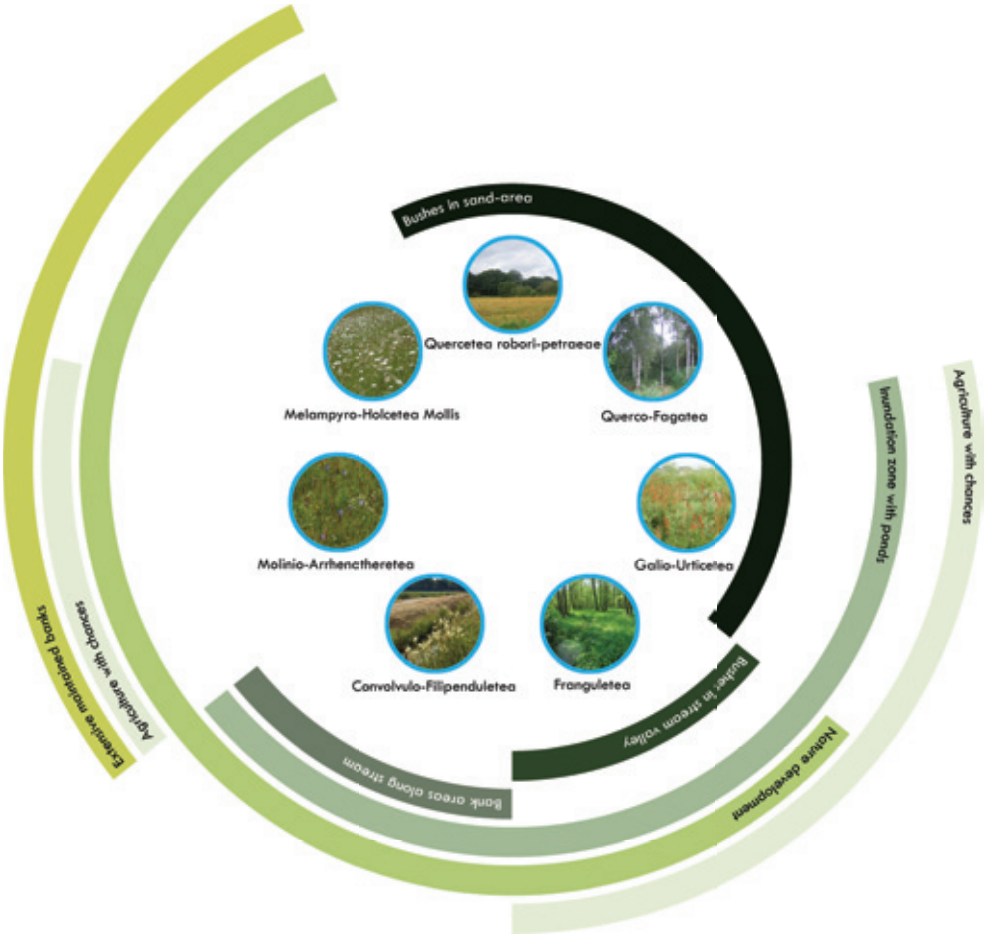
When the enemy was coming, in that time mainly the Spaniards, farmers, and their livestock would hide in the pentagonal structure. Here they were invisible for the enemy, but, standing on the inner dike, the farmer could see over the outer dike into the landscape, and see the enemy coming (Lamers et al, 2011).
In the future water system the 'farmers hiding place' will again provide a form of safety. But this time not as hiding place, but to store water in order to prevent too large fluctuations downstream. A buffer between three, and four hectares is large enough to provide the desired safety (Gemeente Venray, 2009). This means the structure will be approximately 25% larger than the original 'farmers hiding place'. The pathways on the inner dike have an important role in the recreational network (fig. 6.21, 6.22 & 6.23). Here one can not only experience this historic structure, but also the difference between both landscape types, on the one side of the pentagon the stream is meandering through a small-scaled, varied, natural landscape, while on the other side one is looking in the direction of the metropolitan food cluster, with a straight canal, large open areas of productive land, and some rows of trees. This view into the landscape is offered from the inner dike, just like the farmers in the 16th century would look into their landscape.

At the places where the stream valleys can be restored, the current canalised and small stream (fig. 6.24 & 6.25) will be transformed into a meandering stream (fig. 6.18, 6.19 & 6.20). The location of this meandering stream is depending on multiple aspects, which can only be determined in the field. The type of soil, the height, the original stream-bed, and the amount of adjacent parcels that are influenced by the interventions. In order to reach the highest potential ecological, and recreational value, a variety of profiles will be created. Especially in the nature areas the profiles can be transformed in wide shallow profiles, such as the marsh-profile (fig 6.26 & 6.29). Because of the shallow banks a wide variety of water depths will provide a variety of biotopes for animals, and vegetation (Alterra, 2001). In areas closer to houses, farms, or bridges, a variant of the terraced-profile will be developed. Here the stream is ecologically more valuable compared to the current situation, but the stream is still controlled (Verdonschot, 1995). The profiles as shown in the cross-sections (fig 6.27, 6.28, 6.29, 6.30, 6.31 & 6.32) are just a small part of all possible profiles, a wide variation on these profiles should be developed.

The type of bridge is related to the type of profile. The wider, and more natural a profile is, the smaller, and more natural a bridge will be. These bridges will deal with a lower intensity of passers. The smaller a profile is, the wider a bridge will be, and therefore also able to deal with higher intensities of passers. These bridges are designed with a strong relation to the current agricultural identity, as described in paragraph 6.4.

Not all interventions can be taken at once, and moreover, not all interventions will have an immediate effect (fig. 6.33). In order to get at some areas a quick result interventions will be accelerated, such as the digging of meanders instead of the natural arising.

6.33 Time to desired effect of the proposed interventions in the stream.



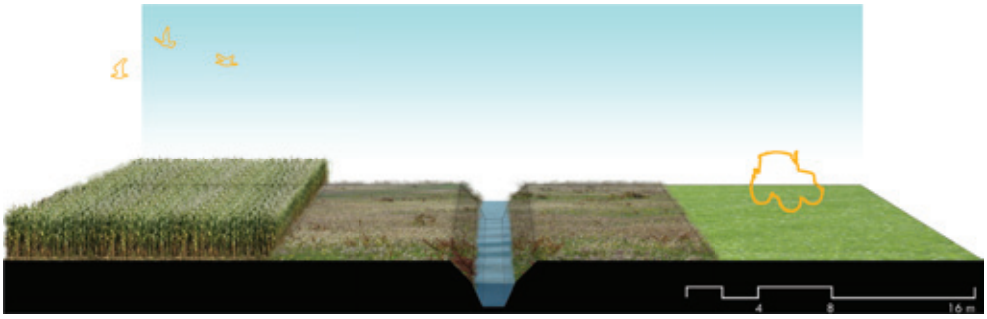
6.34 Relation between the projected zone, and the expected plant-communities. The colours correspond with the map in figure 6.35. (see for the most important species per plant community appendix VI)

6.6 Nature.

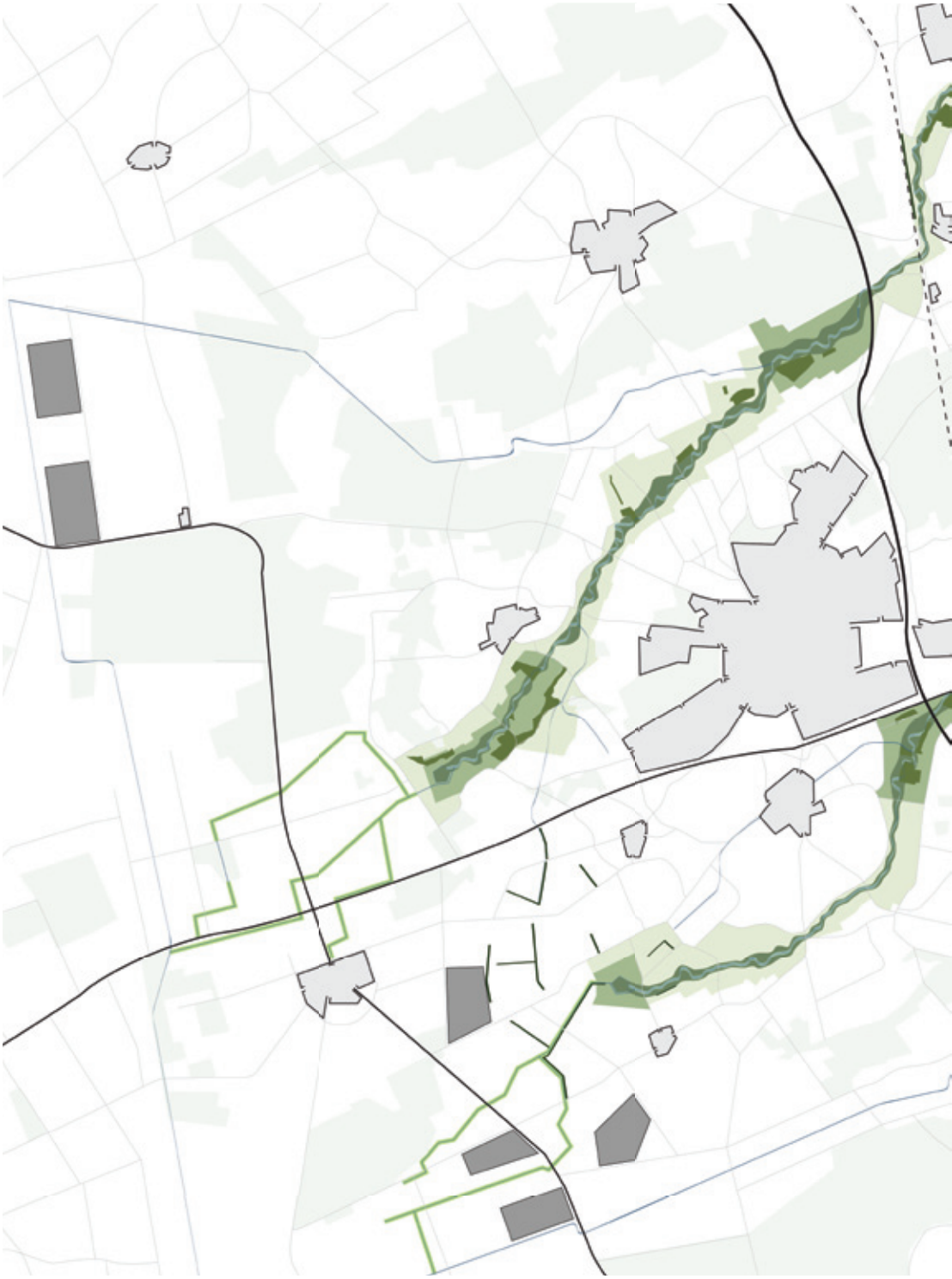
The variety in biotopes in the current stream valley is very limited. Although the variety in abiotic factors is quite high. The restoration of the stream valley, and especially the combination between an increased variety of water levels, and a new type of maintenance will reveal a higher variety of biotopes. This new type of maintenance is more directed towards this variety of biotopes, instead of reaching the highest agricultural production. An example are the parts of the stream valley where 'agriculture with chances' takes place. By quitting the overexposure of manure on these areas, grazing in spring, and late summer, and mowing in high summer, a meadow can arise with a high variety of plants (fig. 6.34). The plantation of shrub rows, the development of ecological banks, and ponds are other measures to develop other biotopes.

The variety of biotopes as shown in figure 6.36 is part of a regional ecological connection. A connection between nature areas such as the 'Maasduinen', and the 'Mariapeel', as described in paragraph 4.5. The analysis of the requirements for the target-species in this same paragraph show that the future biotopes meet these requirements. Moreover, for the target-species not only 'pure' nature should be considered as part of the ecological connection, because for many target-species, such as the 'Badger' or the 'Root vole', also certain types of agricultural areas can be part of their living-area (Alterra, 2001).

Whereas the recreational connection is for an important part focussed on the actual stream valleys, the ecological connection cannot be restricted to this area. Therefore further connections needs to be developed, such as the expansion of the existing structure of shrub-rows in the sand landscape, and as a new ecologically maintained zone around the most important water system of the metropolitan food cluster. As mentioned before, here the water system is focussed to serve agricultural purposes, the ecological desires should not conflict this aim. Therefore the minimal dimensions are taken to provide a suitable corridor for the target-species (Alterra, 2001), but not conflict the function of high productive agriculture. This corridor will be a zone of extensive maintenance along the stream (fig. 6.35).



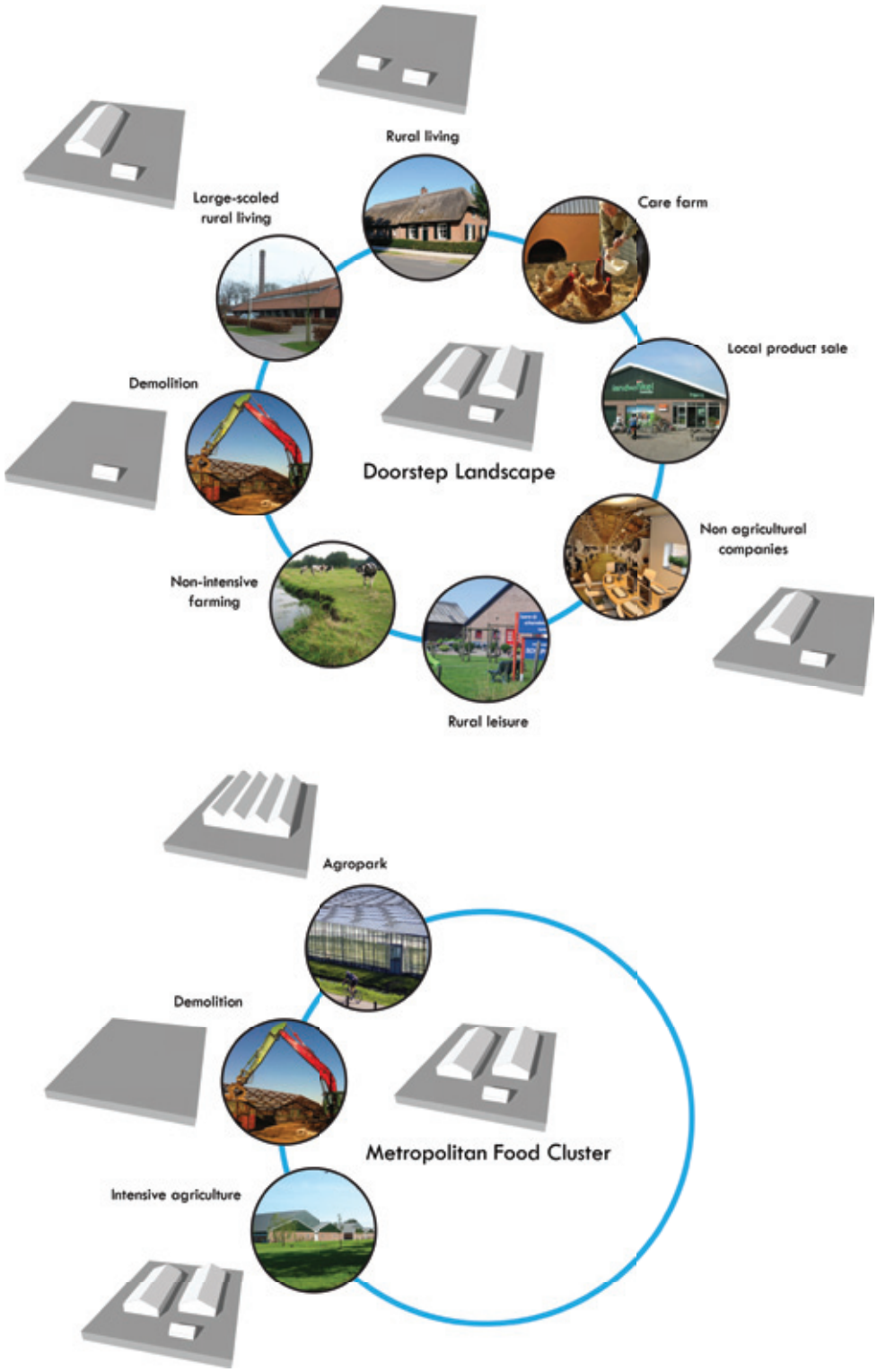
6.35 Cross-section of the continuation of the ecological zone into the metropolitan food cluster, by an extensive maintained zone along the most important canals.



6.36 Theme map of important biotopes for the target species in the future stream valley, as part of a regional ecological connection. Colours correspond with plant communities in figure 6.34.

Legend

- Bushes in sand areas
- Bushes in stream valley
- Bank areas along stream
- Inundation zone with ponds
- Nature development
- Agriculture with chances
- Extensive maintained banks
- Existing forest
- River
- Stream
- Canal
- Projected agropark
- Village
- Motorway
- N-road
- Road
- Railway

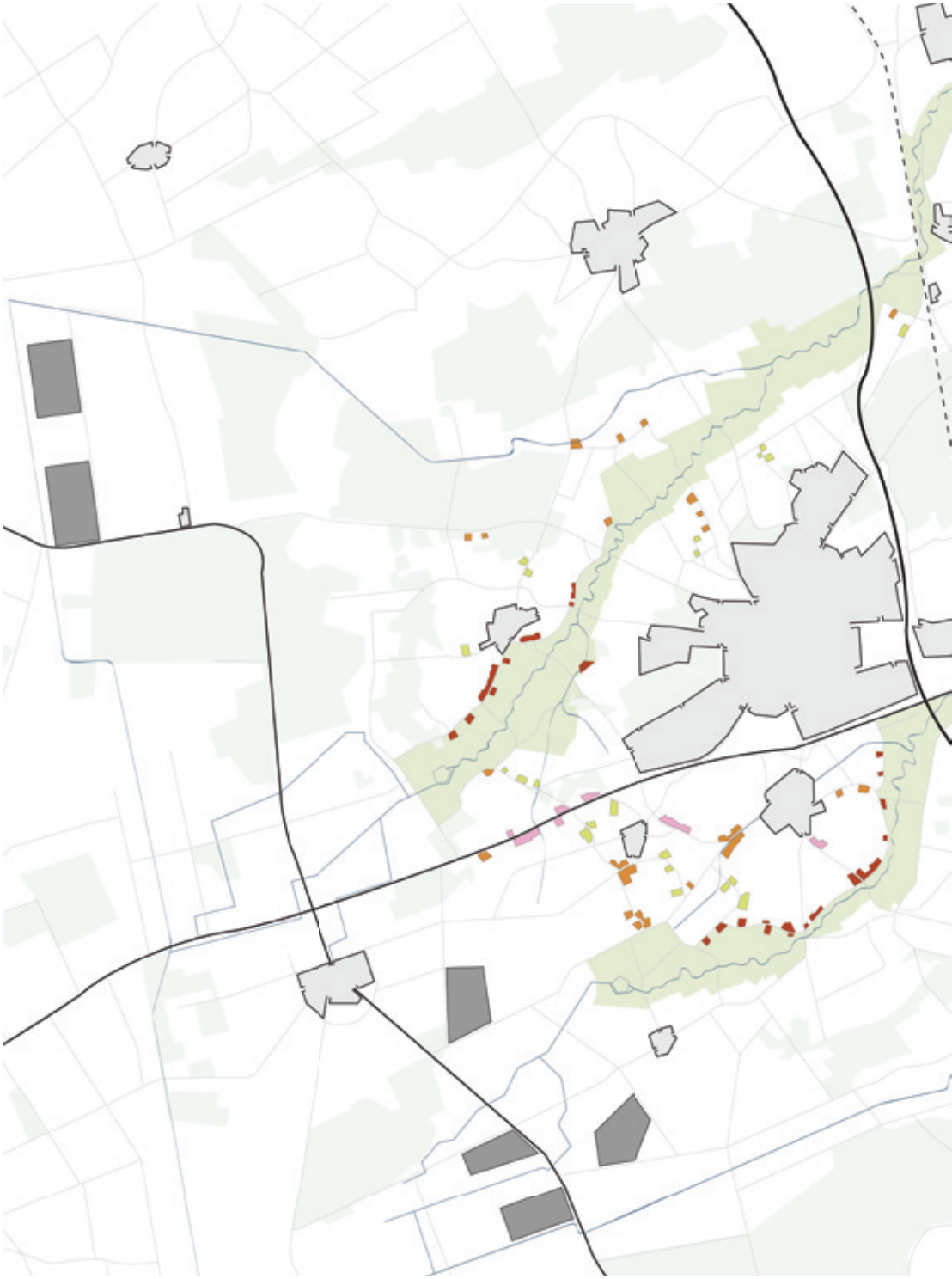


6.37 Possible types of farm function change in the doorstep landscape, and the metropolitan food cluster.

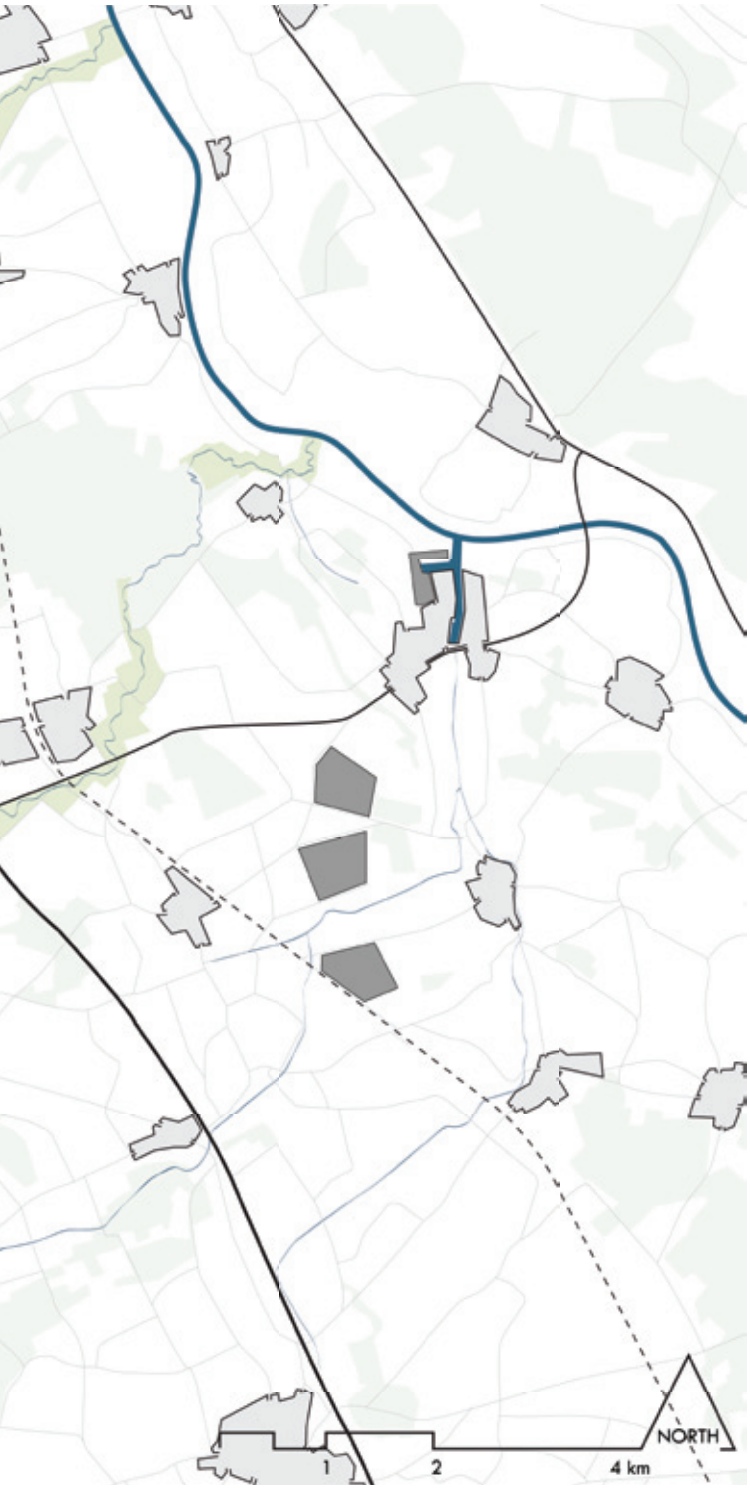
6.7 Farm function change.

The outcome of the previous described interventions should provide a stable framework for ecological, and recreational oriented functions. A framework that offers an incentive for the farmers near the stream valleys to transform the function of their farm into a more leisure-oriented function when they quit their intensive agricultural production, or move their production to the metropolitan food cluster. This transition takes place in one, of the two types of flexible layouts. One type is the metropolitan food cluster, where transitions are directed towards the development of a well-functioning cluster, with the ability to adept to future changes. The second type is part of the 'doorstep landscape' where the space-pump occurs, and the current intensive livestock sector slowly evolves to a varied sector (fig. 6.37). The type of function, and transition is in both areas relative flexible, farms are not forced to co-operate, but the final goal, and possibilities to reach that goal differ.

6.38 Relation between zones , and variety of desired function changes. Colours correspond with figure 6.39.



6.39 Theme map of zones in variety of farm function change. Colours correspond with figure 6.38.

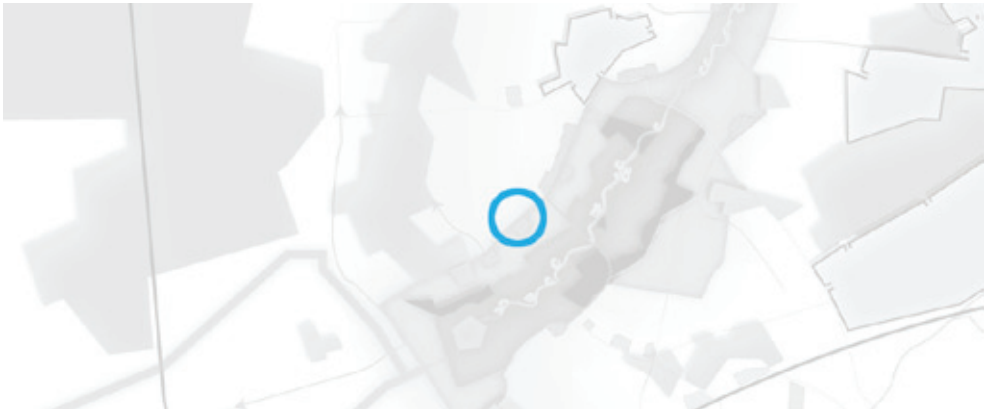


Legend

- Farm, projected diversifying, urgency 1
- Farm, projected diversifying, urgency 2
- Farm, projected diversifying, urgency 3
- Farm, projected diversifying, urgency 4
- Road
- Railway
- Village
- Projected agropark
- River
- Stream
- Projected stream valley
- Forest

6.40 Current situation of a farm with intensive livestock.

6.41 Projected situation, former intensive livestock farm, changed in local product sale.



6.42 Location of a farm with projected funtion change from intensive livestock to local product sale, as visualised in figure 6.40 & 6.41.

6.43 Current situation of a farm with intensive livestock.

6.44 Projected situation, former intensive livestock farm, changed in rural living. Form is still related to the former livestock fucntion.

6.45 Location of a farm with projected funtion change from intensive livestock to rural living, as visualised in figure 6.43 & 6.44.

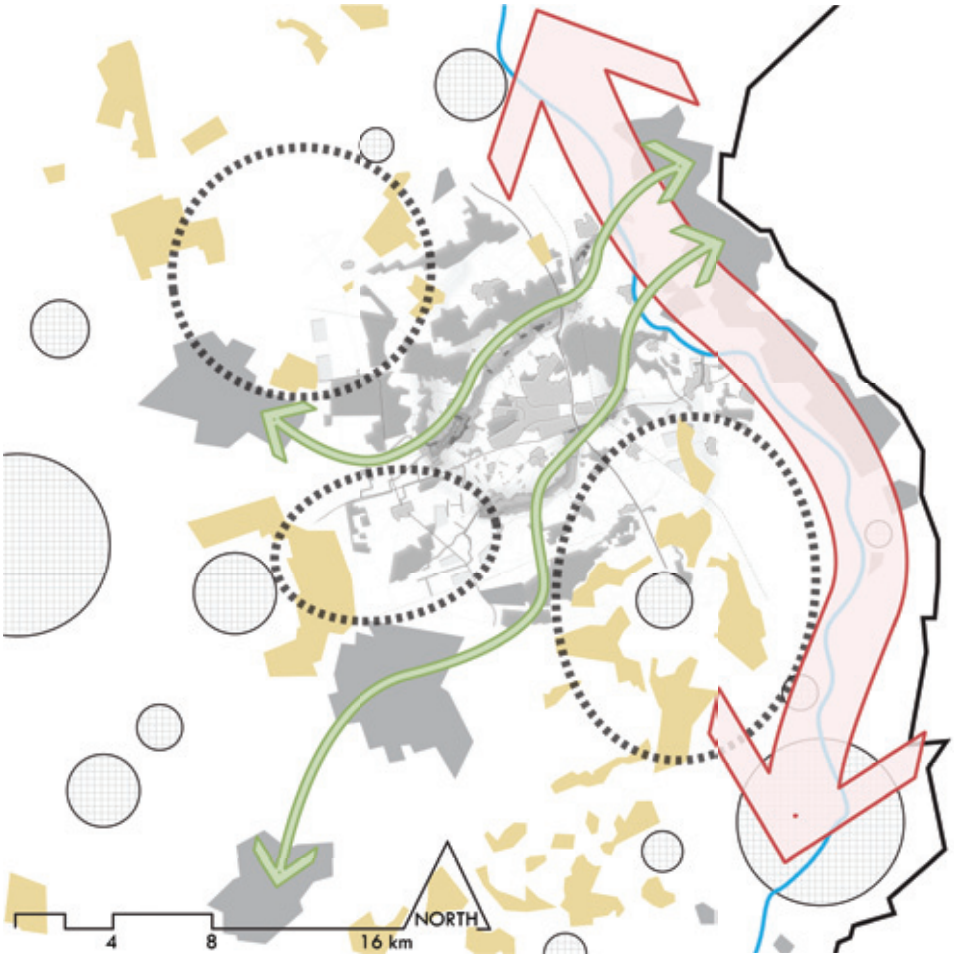
In this strategy farmers are not forced to co-operate. Many research has shown that a forceful strategy does not succeed. A complete non-agricultural function change, or a diversification of agricultural activities is for the farmers not only an economic consideration. This change contains also important social, and environmental aspects, farmers can experience the function change, or diversification as betrayal of the agricultural profession (Brandth & Haugen, 2011). On the other hand, historically the diversification of agricultural functions with tourism, like offering housing, and catering for the visitors was in the past a common phenomenon (Brandth & Haugen, 2011). "Traditionally, hosting guests was part of common rural hospitality and not necessarily a professional business (Brandt & Haugen, pp. 35, 2011).

Although the farmers will not be forced to co-operate, in some occasions they will be triggered to do so. Especially at those locations where a diversification of on-farm functions is essential for the success of the doorstep landscape. This is mainly the case at the locations where the relation village-farms-stream valley is the strongest, thus near 'Leunen', and 'Merselo', and in a lesser extend at the farms near the important recreational routes (fig. 6.39). These farms are triggered to co-operate in this transition by interweaving them in the recreational network, and offer them a wide range of possibilities to transform (fig. 6.38). To give them the possibility to transform in the for them desired direction, functions such as rural living, rural leisure, non-intensive agriculture, or the sale of local products. Hereby the highest variety of functions arises on the locations with the highest intensity of recreational use.

The process that will develop in the areas of diversifying agriculture is a process of replacement of agricultural functions by new economic activities. This process is mainly restricted to the buildings of the farm, while the productive land will remain productive. While this process is not always directly visible in the rural landscape, Daalhuizen et al refers to this process as 'hidden urbanisation' (Daalhuizen et al, 2003). While some buildings are designed for a mono-functional purpose, and not all buildings can be transformed for a new function, some buildings have to be demolished, to prevent a landscape full of decaying buildings. Moreover in order to prevent a urbanised impression of the rural areas of Venray, the agricultural identity of the farms will be remained by their form. A new function can take place in these farms, but seen from outside, it is clearly visible that this building once was a farm. A function ready for the future, with a strong relation to the current agricultural identity. An important link as mentioned in the beginning of this chapter.

6.8 Regional connection.

The plans for the metropolitan food cluster, and the 'doorstep landscape' are for several reasons mainly focussed on the municipality of Venray. The most important reason is that at this moment Venray is the only municipality in this region that is willing to think about the possibilities to develop a metropolitan food cluster (Gemeente Venray, 2006). The development of the metropolitan food cluster is therefore restricted to the boundaries of this municipality, and also the space-pump effect is planned as part of the municipality of Venray. In a certain way this is a questionable border because the farmers who develop the metropolitan food cluster do not



Legend

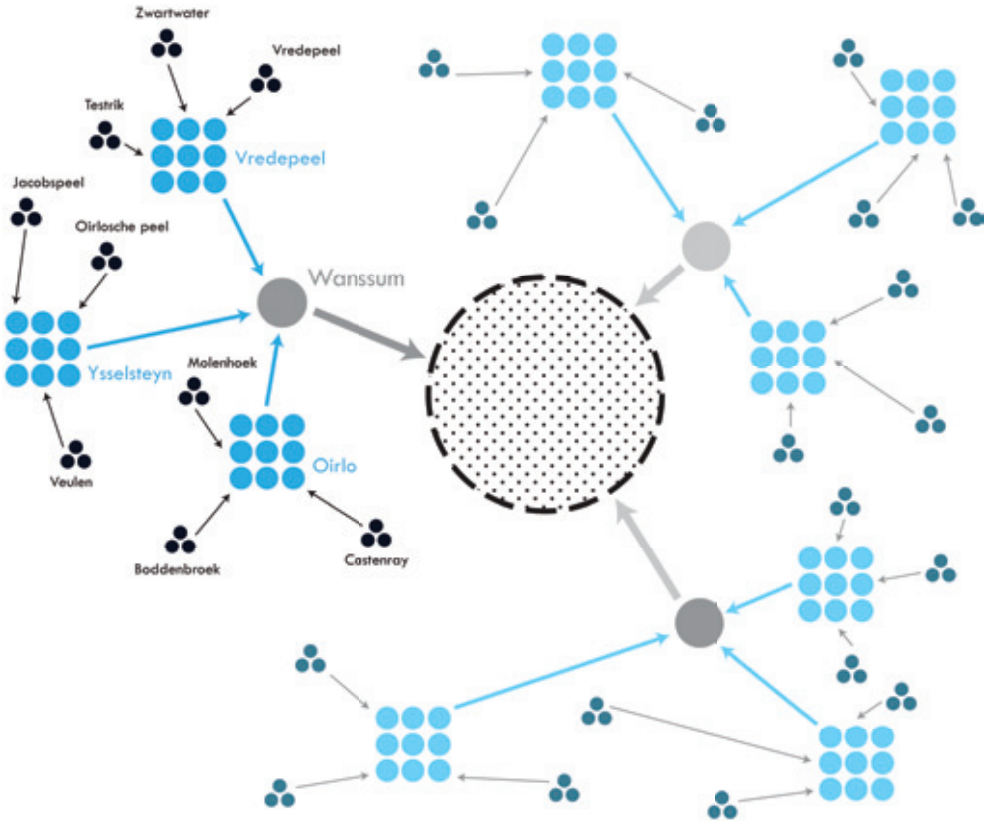
- City
- River
- National border
- Regional recreational connection
- Ecological, and recreational connection
- Area for agricultural development
- Economic connection

6.46 The doorstep landscape, and the metropolitan food cluster in their regional context. Several recreational, ecological, and economic connections can be made.

necessarily need to be a farmer located in Venray. This point of discussion will be elaborately described in the discussion of this thesis. Although the developments are focussed on the municipality of Venray, there are many regional connections possible, now, and in the future (fig. 6.46).

As the landscape analysis has shown, the most interesting ecological, and recreational functions are located in the zone around the river 'Maas'. In Venray this is also the case where this is the eastern part of the municipality. By developing the stream valleys, also the western side of Venray can be connected to this zone around the 'Maas', moreover, this framework can provide ecological, and recreational connections with areas further on the 'Peel'.

The ecological, and recreational connections are made possible by the development of the metropolitan food cluster. This cluster is located at the southern, and western side of the municipality for several reasons, but one of them is the possible regional connection. These locations near the municipal border are situated closely near areas of agricultural development in the adjacent municipalities. When these municipalities in the future want to introduce the concept of metropolitan food clusters also in their municipality (fig. 6.47), easily spatial connections can be made with the agroparks, and metropolitan food cluster in Venray. In this way also regional economic connections can be made.



Legend

- Co-operating farms
- Co-operation with agropark
- Agropark
- Transport to distribution industry
- Distribution industry
- Transport to the market
- Metropolis

6.47 Conceptual model of Venray as part of the metropolitan food cluster. Possibilities for other regions to connect to this network. See also figure 1.7.

Conclusion

A landscape design can contribute to the space-pump by integration of the metropolitan food cluster, and the space-pump as one regional development. Only than a broader range of profit types can be satisfied, economic, ecological, and social. But, the space-pump always remains a consequence of a certain development, in this case the metropolitan food cluster, and the design should therefore not conflict this development. Therefore a combination with the landscape machine design concept is a difficult one. Moreover, the space-pump is no predetermined, and predictable process. Every space-pump is different, therefore a landscape design is essential to frame this process in a desired way in the current landscapes. The framework concept offers more potential to co-operate with the space-pump concept. But, still the space-pump is a concept in development.

7.1 Conclusion.

The objective of this research is to explore the possibilities for landscape architecture to contribute to the concept of the space-pump, and in that way, contribute to the discussion about agricultural development in the Netherlands, researched in the case of Venray. As a result of this research objective the main research question is:

To what extend and in what way can a landscape design contribute to optimise the consequences of the space-pump concept related to a metropolitan food cluster?

In order to be able to answer the main research question, four sub-research questions were formulated. The first two research questions provide an overview about the current situation in the case of Venray, and thereby provide the boundaries for the development of a metropolitan food cluster, and the space-pump. The two last research questions explore the range of possibilities, and the optimal possibilities to come to a design. The first sub research question is:

RQ1 What is the existing spatial, economic, and social situation of the agriculture and landscape in the study-area?

Venray contains a very important livestock sector. According to Smeets this is an innovative, economic sector, and therefore very important for the local economy (Smeets, 2012b). Among this economic importance, the livestock sector in Venray is also very important for the social liveability of the rural areas. The livestock sector is highly interwoven with the society of Venray in different ways, such as agricultural childcare facilities, agricultural museums, and by the sponsoring of many sport clubs.

Among the large positive influence of the livestock sector in Venray, this sector provided also consequences that can be experienced as negative. Over more than a century the agricultural sector transformed a landscape full of gradients in abiotic systems into a relative monotone agricultural landscape. Landscape characteristics disappeared on a large scale, which resulted in a low readability of the landscape, especially at the southern, and western side of the municipality. In summary, the agricultural sector in Venray is of more than average importance for the municipality with regard to the economic, and social situation. But, this importance provided Venray with a monotone landscape, where many interventions were taken to make the landscape suitable for merely one function: the agriculture.

RQ2 What are the spatial possibilities, needs, and limitations of a metropolitan food cluster, and the space pump in the study area?

Based on the analysis of the current situation in Venray there is a large agricultural sector. Here are farmers located who belong to the top of the world in their field (Smeets, 2012b). If the agricultural sector is going to disappear, than certainly not in Venray (Smeets, 2012b). Here the critical mass, and willingness to develop a metropolitan food cluster is present (Gemeente Venray, 2006). From the current amount of animals only the amount of pigs needs to be raised in order to meet the minimal profitable size of a metropolitan food cluster (Smeets, 2012a). The amount of grazing animals (dairy cows) is relatively low, therefore the space-pump potential is relatively high. If the space-pump potential is based on the minimal amount of grass, and corn for the grazing animals, and that all other fodder is imported from outside the region a total of 1.227 hectares is not essentially needed for fodder production.

The space-pump in Venray can be seen threefold. First the physical areas that are not anymore essentially needed in the new agricultural system of the metropolitan food cluster, and

therefore provide space to develop other agricultural, or non-agricultural functions. Second the current stables that are useless in the new system, and third the disappearance of invisible policy zones, such as odour circles. The potential of 1.227 hectares does not represent the exact size of the space-pump, this is the maximum. The size is depending on the development of the metropolitan food cluster. The size, and location of the cluster are two important factors which determine the size of the space-pump. When the amount of animals in the agropark will be a factor 1.5 times minimal profitable, there will be more land needed for fodder production, and therefore less space for the space-pump, in the sense of physical land. For the category of stables, and policy zones, the variation is much less depending on the development of the metropolitan food cluster.

RQ3 Which different spatial models of the space-pump are possible within the possibilities and limitations of the study-area when agriculture develops towards a metropolitan food cluster?

The modelling revealed a wide range of possibilities, limitations, and consequences of the development of a metropolitan food cluster, and space-pump approached from different perspectives. Two models were based on how to provide the highest positive influence for the capital 'people' (social), two models were based on 'planet' (ecological), and two on 'profit' (economy). These models revealed that there is a wide variation possible with regard to the location, size, and type of agropark, and metropolitan food cluster, and that this variation has its effect on the space-pump.

A first conclusion is that the three perspectives have lead to models with a different basis. The models based on the capital 'people' were mainly based on political decisions, thus more qualitative. The models based on the capital 'planet' were merely based on quantitative measurements, and last the models based on the capital 'profit' were closely related to the theoretical concept of the metropolitan food cluster. The outcome revealed that the models not solely depend on the characteristics of the landscape in Venray, but for a more important part on the perspective that is taken.

Each model had its own line of reasoning, and therefore its own possibilities, and limitations. The models show that the range of possible locations for the agropark, but also the possibilities for the space-pump are large. There is some overlap between the possible locations in the different models, for example the agropark locations as 'Vredepeel', 'Ysselsteyn', and 'Oirlo-Wanssum' appear in multiple models, while the stream valleys appear in multiple models as possible location for the space-pump.

RQ4 What is the optimal model, or combination of models to develop in the study area when agriculture develops towards a metropolitan food cluster?

The reference projects: 'Agriport A7', 'mega-farm landscape', and 'reconstruction law', clearly show why it is important to bring balance between the three types of capitals (people, planet, and profit) in a regional development. A conclusion which is supported by several authors ((Dagevos & Lamoen, 2009)(Hermans et al, 2006)(Grosskurth & Rotmans, 2005)).

Another important basis for the design is the interests in the local rural landscape. Three main groups of interest are present in the rural landscape of Venray. First, the up-scaling farmers, this group is willing to use the rural landscape to improve, and expand their intensive agricultural activities. This is the group that is willing to start a development of a metropolitan food cluster, and thereby also start the space-pump process. But, this group should also be able to develop, and a key factor in this ability is the social support. Whereas the interest of the 'up-scaling farmer' can be considered as mainly profit oriented, interest groups such as the 'diversifying farmers', and the 'recreational townsman' are also more oriented towards 'people', and 'planet'.

The development of a metropolitan food cluster can be considered as a pull-factor to attract the 'up-scaling farmers' to co-operate in the metropolitan food cluster, mainly for profit reasons. By developing the space-pump for 'people', and 'planet' purposes for groups of interest like the 'diversifying farmers', and the 'recreational townsman', the space-pump can be considered as a push-factor for social support, and thereby facilitate an improved implementation of a metropolitan food cluster in Venray, by bringing balance between the three different capitals. Moreover by approaching the metropolitan food cluster, and the space-pump as one regional development, developments can take place which are hardly possible on an individual basis.

The separation of functions, high intensive agricultural functions in the metropolitan food cluster, and non-intensive agricultural, or non-agricultural functions in the space-pump area is based on the framework concept as originally developed by Kerkstra, and Vrijlandt (1990) in which they propose to develop a stable framework for the low-dynamic functions, and a flexible layout within the framework for high-dynamic functions. Hereby the high-dynamic functions have the opportunity to adept to future circumstances without threatening the low-dynamic functions (Kerkstra, & Vrijlandt, 1990). In the case of Venray the areas of the steam valleys can be considered as the framework, while they function as low-dynamic ecological, and recreational zones. The metropolitan food cluster can be considered as an important high-dynamic function, but also the diversifying agriculture is highly flexible.

The framework should in Venray be a reason for the inhabitants to restore the lost connection of the villages with the landscape. The stream valleys are easily reachable by foot, or bike for the inhabitants of Venray, and can with their abiotic characteristics develop to a significant different landscape zone. This is an important part of the concept of the 'Doorstep landscape'. An interesting rural landscape almost at your doorstep. This development brings variation in the monotone agricultural landscape of Venray, and therefore forms an incentive for the farmers to transform from intensive agriculture to a more leisure-oriented function. This development takes place in the dynamic layout around the framework, but both are highly depending on each other. Together they can provide the first metropolitan food cluster with livestock in the Netherlands, but at the same time the first 'Doorstep landscape'.

To what extend and in what way can a landscape design contribute to optimise the consequences of the space-pump concept related to a metropolitan food cluster?

Based upon the precedent research can be concluded that the space-pump concept is highly relevant for the field of landscape architecture. In this thesis the space-pump is defined as:

The process from the moment of function decay of land-use in a certain area, till the moment the new form of land-use is determined, and completely occupied the physical area.

This definition makes the space-pump to a process which can also be recognised in other processes, such as demographic shrinkage, and the arising of brownfields. Although the space-pump is a process which appears in several other processes, the space-pump related to the development of a metropolitan food cluster has some specific characteristics which make this process highly relevant for landscape architecture. First, in contrast to a space-pump related to demographic shrinkage, does the space-pump related to a metropolitan food cluster not autonomously develop in the form of physical land. This type of space-pump can, and should be planned to prevent unintended, and undesired consequences. Second, the space-pump related to a metropolitan food cluster is not as much geographically restricted, and offers therefore space to plan, and reorganise rural areas.

The process of the space-pump knows many uncertainties. Is the development of a metropolitan food cluster realistic in the current political context? Is the development of the space-

pump realistic in the current economic context? But these, and more uncertainties should not be a reason for landscape architecture to leave the field of the space-pump. The space-pump can have unintended, and undesired consequences, as can be concluded upon historic examples such as the reconstruction law, or Agriport A7. On the other hand, the space-pump provides many chances. By spatially separate agricultural, and non-agricultural functions (framework concept (Kerkstra & Vrijlandt, 1990)) both do not restrict each other, and can develop in a more desired direction.

Two important conclusions should be kept in mind while creating a landscape design for a space-pump. First, the space-pump is always a consequence of a certain trend in a certain form of land-use. The space-pump is no individual element, and should therefore also be treated as a consequence, and not interfere with the original trend. The space-pump in relation to the metropolitan food cluster will only occur when the cluster successful develops. Without a cluster no space-pump. Therefore the design for the space-pump should not be seen as an individual development, and moreover should not develop in a direction where it conflicts the development of the metropolitan food cluster. Moreover by connecting both, a chain process of pull, and push factors arises where several groups of interest can gain more profit than would be possible on an individual basis. By focussing the landscape design on the region as a whole, thus including the metropolitan food cluster, and the space-pump, a landscape design can contribute to an improved balance of economic, social, and ecological profit. A balance which is essential for the successful implementation of the metropolitan food cluster, and the space-pump.

Second, there are multiple types of space-pumps, in multiple forms of land use. An analysis of the exact type of each space-pump is a necessary understanding as basis for a design. Knowledge about what is exactly going on, and what are the possibilities, and limitations within these boundaries. Every space-pump is unique. Therefore no blueprint can be given to deal with this concept. Every time the space-pump occurs, there is a difference in for example landscape characteristics, trends in land-use, social, spatial and economic context. The profession of landscape architecture should take a role here, by developing a suitable, and desired implementation of every individual space-pump.

7.2 Discussion.

7.2.1 Concept in development.

The space-pump is clearly a concept in development. The current research is mainly focussed on the agropark, and the metropolitan food cluster, while the space-pump is mentioned as a side-effect of the transition to a cluster. This is the first time the space-pump as individual concept is thoroughly researched. The theoretical basis for this concept is therefore relative small. The current descriptions of the concept are short. In this research these short descriptions are taken as basis to define the space-pump, and provide the ability of comparing this process with other processes in the landscape, and thereby further refine the concept. It could therefore be that the definition of the space-pump as defined in this research slightly differs from the initial idea. As a comment the concept of the space-pump should be seen as a concept in development. The first description dates back from a time where the context was different. This research should therefore be seen as an update, and elaboration of the space-pump concept.

This thesis can serve as starting point for further research to the space-pump. It might be interesting to elaborate on the concept of the space-pump in general, but especially a focus on the relation of the space-pump with other concepts might be interesting.

In this thesis the framework concept developed by Kerkstra, and Vrijlandt (1990) is used as basis for the design, because of the many similarities between both concepts. It might be interesting to focus future research on the collaboration between both concepts. What is the potential of a combination between both, and are there possibilities to strengthen each other? In the case of Venray the process of the space-pump, and the metropolitan food cluster is designed with principles of the framework concept. In Venray the main idea with the 'Doorstep landscape' is that both the framework, and the flexible layout are for an important part interacting with each other, depending on each other, and even strengthening each other. An issue that is not as obvious defined in the original framework concept, but is worth researching.

Another important issue interesting for further research is the connection between the metropolitan food cluster, and the space-pump. This thesis proposes to approach both concepts as one development. The different reference projects reveal why the space-pump always should be approached as a consequence of a certain trend, in this case the development of the metropolitan food cluster. In order to get the most out of both, to get a balance between social, ecological, and economical profit, and to get a process that satisfies the multiple interests in the rural landscape. But, although there is argued for a planning connection, on the level of the design both are spatially separated. It might be interesting to research whether both can also strengthen each other when they are spatially connected.

7.2.2 Data.

The calculations for the space-pump, and the transition to a metropolitan food cluster are for an important part depending on the data of the agricultural sector in Venray. Some of this data is confidential, incomplete, or not available, therefore in many calculations regional, or national averages are used. The influence on the overall calculations might be minimal, but the analyses could be more specific when the data was more specific.

In order to calculate the space-pump potential some assumptions are made. The current area in use by the livestock sector in Venray is taken to calculate the space-pump potential, although not all areas have to be located within the municipality. Among this also exact land-ownership, and the quality of the soil is not taken into account. For example growing the right crop on the right place will raise the production, and thus also the space-pump potential, in this thesis these areas are calculated with regional averages. The space-pump potential is based on

the principle to only grow grass, and corn for the animals, and import all other fodder. One could also argue for more regional production, in that case the space-pump potential occurs mainly in the form of buildings, and the disappearance of policy zones. The final state of the plan foresees in a complete transition of the livestock sector into the system of a metropolitan food cluster, in practice it might turn out that the transition rate is lower, and therefore also the final result incomplete. On the other hand this does not mean that the plan can only be successful with a complete transition. The project should be seen as a development strategy of which a final image is shown in this project.

7.2.3 Development strategies.

In this thesis there is just limited attention paid to the development strategies. This thesis could also be more considered as a tool of communication, and inspiration to emphasise the importance for a strategic discussion about the desired development of the Dutch livestock sector, and the region of Venray in specific. The emphasis on seeing this development in a larger perspective, and what can be achieved by leaving the current paradigm of restrictions, bans, and limitations for the livestock sector.

This thesis does not lack every development strategy. An important starting point is the possibility to develop the metropolitan food clusters, which at this moment can be considered as problematic with regard to social support, and legislation. An important part of a development strategy for this project is providing the possibility to develop metropolitan food clusters with livestock in the Netherlands. A process which can be accelerated, and improved by revealing the ecological, and social profit for a region, in the case of Venray the 'Doorstep landscape'. Then in terms of a development strategy a pull-, and push-factor for the development arises. The up-scaling farmers are 'pulled' to the metropolitan food cluster, while on the other side other groups of interest create a 'push-factor' by willing to develop another type of landscape in the area where the 'up-scaling farmer' leaves. Therefore this development can be seen as a chain-development. An interesting example of a comparable development is the transition from the 'Millingerwaard' of a dairy cow area towards a successful nature, and recreation area. By integrating their interests in one regional project, a development is possible which cannot be achieved by each individual group of interest. But still further research to this process is needed.

7.3 Reflection.

7.3.1 Landscape machines.

This project is conducted as part of the landscape machine design lab (see also paragraph 2.1), but is it therefore also a landscape machine? And did this design-concept provide enough support to develop the design? This research revealed several significant differences between both, the concept of landscape machines, and the concept of the space-pump in relation to metropolitan food clusters. According to Roncken et al, the definition of the landscape machine can be seen threefold, first, a landscape machine should be seen as a productive landscape, which addresses an existing malfunction in the landscape. Second, the natural processes in the landscape are stimulated, or enlarged in order to improve the input-output ratio. Third, a landscape machine is not 'made', it develops in different stages: an initial stage, a growth state, and a yield state (Roncken et al, 2011). This definition of the landscape machine can be considered as too different, or conflicting for a successful collaboration with the space-pump concept for several reasons.

One important reason for a lack of potential collaboration is that the malfunction in the case of the development of a metropolitan food cluster, and the space-pump is not primarily related to landscape processes, but should be considered as a political, or economical malfunction. Another important reason is that the main aim of this project is not to improve the input-output ratio by using natural processes, because that could harm the development of the project, as can be seen by the example of the 'reconstruction law' (paragraph 3.4). Moreover, what should be considered as landscape machine in this project, only the 'doorstep landscape', or also the metropolitan food cluster? Both are part of one design, but an important principle of the metropolitan food cluster provides, a raise of import, and export of goods in sometimes worldwide cycles. Are those cycles considered as part of the landscape machine? The principles behind the landscape machine are certainly valuable, but should be considered as as too conflicting with the social, economic, and political background of this project. The landscape machine is a valuable concept, but the current paradigm in intensive agriculture, and livestock is not ready to take up a combination in a future project, because of too conflicting aims. The balance where is aimed for in the landscape machine concept is an important balance, approached from a certain perspective. But this perspective is not shared by the group who has the essential power in the development of a metropolitan food cluster, and start the space-pump, namely the farmers who aim for an economic, or productive balance. A conservative use of the landscape machine in projects like the metropolitan food cluster could therefore in this context of time lead to a collapse of the project, as also happened in the comparable case of the reconstruction law (paragraph 3.4).

If one is willing to design a landscape that meets the conditions of a landscape machine, the conditions provide enough grip to do so, but when something is not consciously designed with the conditions of the landscape machine in mind, the concept does not provide enough grip to determine whether this is a landscape machine or not. The concept only provides grip to determine to what degree a landscape functions as a 'machine'. This can also be the case with this project.

Although the concept of landscape machines is much more detailed, and complex than only the three conditions as mentioned in the first paragraph, they reveal an important aspect why it may be both hard, or easy to use this concept. The definition of the landscape machine is very much open for interpretation. For example when can a landscape be considered as productive? When the production of clean water, air, recreation, habitat and animals are considered as part of the production in a productive landscape, as stated in Roncken 2011, is in that case not every landscape till a certain degree a productive landscape? Also the malfunction as part of the landscape machine is open for interpretation, some malfunctions are very large, and obvious, but some are small, and maybe only a malfunction seen from a certain perspective. The 'defini-

tion' of the landscape machine can also be considered as a set of conditions, which a project or landscape can meet for a small, or large extend, but these conditions are present in many or maybe all landscapes, when one is consciously willing to find these conditions.

The definition of the landscape machine might be too open-ended to be able to state the difference between landscapes that are a landscape machine, and landscapes that are not. This is in my opinion not per definition a shortcoming of this concept. If the concept of landscape machines would be developed into a direction where is accepted that the conditions of the landscape machine are present in many, or all existing, and future landscapes. The landscape machine concept can serve in that case as method to assess whether there is a stable balance. Therefore the concept of landscape machines could be interpret rather as a method instead of a physical environment.

Although the principles of the landscape machine were not consciously used to create the design for the space-pump in Venray, it is therefore not obvious that this project is no landscape machine. As mentioned in the previous paragraphs, the conditions of a landscape machine can be analysed in a project, and therefore determine to what degree this project functions as a landscape machine. The most prominent malfunction used as motivation to start this project is more political, or economic, but when one is analysing this project, also malfunctions related to natural processes can be distinguished. For example the decades of overexposure of phosphates out of animal manure to the landscape. Moreover, an input-output ratio might be improved, depending on what is included, and several natural processes are used to restore the stream valleys in Venray. Thus, although this project is not consciously designed to meet the conditions of a landscape machine to a high extend, it is still possible that this project meets the conditions, whether or not to a high extend.

7.3.2 Framework concept.

Whereas the concept of the space-pump in relation with the metropolitan food cluster does lack potentials to find symbiosis with the concept of landscape machines, there are much potentials with regard to the framework concept. The conclusion that a spatial mixture of agricultural, and non-agricultural functions would provide conflicts, and that both can only develop in an optimal way when they are spatially separated, is an important motive for the development of both concepts, the framework concept (Kerkstra, & Vrijlandt, 1990) and the metropolitan food cluster with the space-pump (Smeets, 2009). Therefore the framework concept has provided an important basis to frame the space-pump in an existing landscape. Moreover, the basic principles of the framework concept provided enough grip to create the design.

Although the framework concept provided an important basis to develop the design, the concept showed also some shortcomings in relation to the development in this project. The framework concept is a relative old concept, developed in 1990. The economic, political, and social context was different than the current context. A very important issue is therefore: whether this concept also fits the current context? An aspect where in the original framework concept by Kerkstra, and Vrijlandt (1990) just limited attention is paid to, is the hierarchy between the functions. What if, in the case of the original concept, the high-dynamic, and the low-dynamic functions are in conflict in a certain area? This research to the space-pump, and the reference study has shown that although the non-agricultural functions may be of higher importance for certain reasons, the agricultural function is the engine of the regional development. One can design a perfect stable framework for the low-dynamic functions, but if, in this case the farmers, do not see the right perspective in this plan, the whole project collapses, as happened in the case of the reconstruction law. This difference, or point of concern might occur because of the changed economic context. The original concept (by: Kerkstra & Vrijlandt, 1990) may be developed in a time where authorities could solve certain conflicts between functions by economic compensation. In the

current economic context this might be much harder for authorities, what causes a higher dependency of groups such as in this case the farmers. The power in regional development is shifting, thus also certain rationales behind these developments should shift.

In the case of Venray the interaction between the flexible layout of the diversifying farmers, and the framework in the stream valleys is spatially clear. The spatial interaction between the framework, and the metropolitan food cluster is minimal, for earlier mentioned reasons. The theory of the framework concept did not provide enough grip to improve the spatial interaction on this aspect. Moreover, the potential links between both concepts are visible on a theoretical level, and also in the case of Venray, but still this link is premature, and needs further research.

Although some aspects in the relation between the framework concept, and the space-pump concept ask for further research, the framework concept offers a solid basis for a future collaboration. The framework can be considered as important concept to connect the metropolitan food cluster with the space-pump. An important combination where is argued for in the conclusion.

7.3.3 Space-pump.

As already mentioned several times in this thesis, the current research is mainly focussed on the metropolitan food cluster, and the agropark. While the space-pump is just limited mentioned as a side-effect of the transition to a cluster. Therefore the scientific basis of the space-pump concept was relatively small. The concept did not provide enough grip to immediately build a solid research structure around. First had to be sought to a more demarcated definition. It is notable that an important concept as the space-pump, is mentioned in multiple (scientific) publications, without a clearly defined rationale behind the term. The first descriptions of the concept date from another context in time, political, and economic situation. But therefore the original descriptions should not immediately be rejected, in the favour of a new concept, but slightly be refined to fit in the new context. A process that might, and should be repeated in the near future, the space-pump as a concept in development.

Because of the small theoretical basis the research structure of this thesis is composed around a preliminary hypothetical idea of the space-pump. The space-pump as a drastic process of large scaled abandoned land, and stables arising in the rural landscape, caused by the development of the metropolitan food cluster. This hypothetical idea turned out to be false during the research. Therefore the research, and the design needed to be adopted to the definition as determined in the theoretical context. The space-pump in relation to the development of a metropolitan food cluster does not provide large areas of abandoned land, and stables, but is an opportunity to carefully plan, and reorganise certain agricultural functions to preserve space for other functions to develop.

Among the appearance of the space-pump, as arose during the research, also a difference between type of effect arose. Where the space-pump in the current literature is mainly mentioned as a side-effect of the transition to a metropolitan food cluster, this project reveals why it is important to see the space-pump as essential part of the development of a metropolitan food cluster. Only by approaching both, the cluster, and the space-pump, as one regional development, results can be reached, which cannot be reached when both are approached on an individual basis.

Bibliography

References

A

Aalbers, C., Heutinck, L., & Visschedijk, P., 2011. Krimp en groene ruimte in stedelijke gebieden. Alterra, Wageningen.

Agricola, H.J., Hoefs, R.M.A., Doorn, A.M. van, Smidt, R.A., & Os, J. van, 2010. Landschappelijke effecten van ontwikkelingen in de landbouw. Wageningen UR, werkdocument 215, Wageningen.

Agriport A7, 2011. Huidige stand van zaken in Agriport. Available at: <http://www.agriporta7.nl/Agropark/NL/nl-a-welkom-bij-agriport-a7.html>, [Accessed on: 12 December 2012].

Alterra, 2010. Bodemdata. Available at: <http://www.bodemdata.nl>, [Accessed on: 12 February 2012].

Alterra, 2001. Handboek robuuste verbindingen; ecologische randvoorwaarden. Wageningen, Alterra.

Avelino, F., & Rotmans, J., 2009. A dynamic conceptualization of power for sustainability research. *Journal of cleaner production*, 19/8, pp. 796.

B

Backhaus, N., 2011. Landscapes, spatial totalities or special regions? *Procedia social and behavioral sciences*, 14/2011, pp. 193.

Baltussen, W.H.M., Smeets, P.J.A.M., & Tacken, G.M.L., 2010. Duurzame ontwikkeling van de veehouderij in Limburg. LEI Wageningen UR, Den Haag, Alterra-rapport 2094.

Berentsen, P.B.M., Hendriksen, A., Heijman, W.J.M., & Vlokhoven, H.A. van, 2007. Costs and benefits of on-farm nature conservation. *Ecological economics*, 62/3-4, pp.571.

Bleumink, H., 2007. De geschiedenis van de reconstructie. Achtergrondrapport van de evaluatie reconstructie zandgebieden. Alterra, Wageningen, Alterra-rapport 1441.2.

Bleumink, H., 2006. Een tweede jeugd voor boerderij en erf. Een handreiking voor organisaties en gemeenten die willen werken aan de versterking van het agrarische erfgoed in hun regio. Projectbureau Belvedere, Utrecht.

Blonk, H., Kool, A., & Luske, B., 2008. Milieueffecten van Nederlandse consumptie van eiwitrijke producten. Gevolgen van vervanging van dierlijke eiwitten anno 2008. Blonk Milieu Advies, Gouda.

BNR, 2012. Rabobank: 'Leegstand kassen Westland dreigt'. Hurkx, Available at: <http://www.bnr.nl/meernieuws/984289-1210/rabobank-leegstand-kassen-westland-dreigt>, [Accessed on: 12 December 2012].

Boonstra, F.G., Kuindersma, W., Bleumink, H., Boer, S. de, & Groot, A.M.E., 2007. Van varkenspest tot integrale gebiedsontwikkeling. Alterra, Wageningen, Alterra-rapport 1441.

Bouwman, L., Klein Goldewijk, K., Hoek, K.W. van der, Beusen, A.H.W., Vuuren, D.P. van, Willems, J., Rufino, M.C., & Stehfest, E., 2011. Exploring global changes in nitrogen and phosphorus cycles in agriculture induced by livestock production over the 1900-2050 period. *Proceedings of the National Academy of Sciences of the United States of America*, 10/1073, pp. 66.

Brandth, B., & Haugen, M.S., 2011. Farm diversification into tourism – Implications for social identity? *Journal or rural studies*, 27/1, pp. 35.

Breman, B.C., & Doorn, A.M., 2011. Ontwikkeling van de landbouw in krimpgebieden. Alterra, Wageningen, Alterra-rapport 2147.

Breman, B., & Vogelzang, T., 2012. Krimp! Synthese van beleidsondersteunend onderzoek voor het ministerie van EL&I 2010-2012. Wageningen university & research, Wageningen.
Breure, A.S.H., Smeets, P.J.A.M., & Broeze, J., 2007. Agrocentrum Westpoort: utopie of innovatie? Reflecties en leepunten rond een systeeminnovatief project. Alterra, Wageningen, Alterra-rapport 1394.
Broeze, J., Eijk, I.A.J.M., Greef, K.H., Groot Koerkamp, P.W.G. de, Stegeman, J.A., & Wilt, J.G. de, 2003. Animal care. Diergezondheid en dierwelzijn in ruimtelijke clusters. Innovatienetwerk Groene Ruimte en Agrocluster, Den Haag.
Buijs, A.E., Pedroli, B., & Luginbuhl, Y., 2006. From hiking through farmland to farming in a leisure landscape: Changing social perceptions of the European landscape. *Landscape ecology*, 21/3, pp. 375.

C

Carmona, M., Burgess, R., & Badenhorst, M., 2009. Planning through projects: moving from masterplanning to strategic planning.
CBS, 2012. Bevolkingsteller. Available online: <http://www.cbs.nl/nl-NL/menu/themas/bevolking/cijfers/extra/bevolkingsteller.htm>, [Accessed on: 14 January 2012].
CBS, 2011. Gemeente op maat Venray. Centraal bureau voor de statistiek, Den Haag, 11.
Charles, H., Godfray, J., Crute, I.R., Haddad, L., Muir, J.F., Nisbett, N., Lawrence, D., Pretty, J., & Whiteley, R., 2010. The future of the global food system. *Philosophical transactions of the royal society B: Biological sciences*, 365/1554, pp. 2769.
Choudhury, 2011. Some structural issues in demand and supply of global food production. *Journal of economic studies*, 38/1, pp. 91.
Clausman, P.H.M.A., & Melman, T.C.P., 1991. Instruments for combining intensive dairy farming and nature conservation in The Netherlands. *Landscape and urban planning*, 20/1-3, pp. 205.
Collantes, F., 2007. The decline of agrarian societies in the European countryside: A case study of Spain in the twentieth century. *Agricultural history*, 81/1, pp. 76.
Commissie Van Doorn, 2011. Al het vlees duurzaam. De doorbraak naar een gezonde, veilige en gewaardeerde veehouderij in 2020. D. Van Doorn, Den Bosch, Commissie Van Doorn: 24.
Cormont, A., Diepen, C.A. van, Hack-ten Broeke, M.J.D., Jansen, P.C., Janssen, S.J.C., Roelsma, J., Roest, C.W.J., Smeets, P.J.A.M., & Uiterwijk, M., 2012. Duurzaam landgebruik en prestatie-indicatoren. Een case studie voor de peel. Alterra, Wageningen, Alterra-rapport 2335.
Cornelius, P., Putte, A. van der, & Romani, M., 2005. Three decades of scenario planning in Shell. *California management review*, 48/1, pp. 92.
Corner, J., 1992. Representation and landscape. In: Theory in landscape architecture. A reader. University of Pennsylvania press, Philadelphia. 2002. pp. 144-164
Creswell, J.W., 2011. Designing and conducting mixed methods research. California: Sage Publications inc. Thousand oaks.
Creswell, J.W., 2009. Research design, qualitative, quantitative, and mixed methods approaches. 3rd edition, California: Sage publications inc. Thousand oaks.
Crewe, K., Forsyth, A., 2003. LandSCAPES: A typology of approaches to landscape architecture. *Landscape journal*, 22 (1), pp. 37-53.
Curtis White, K.J., 2008. Population change and farm dependence: Temporal and spatial variation in the U.S. Great Plains, 1900-2000. *Demography*, 45 (2), pp. 363-386.

D

D66, 2012. En nu vooruit. Op weg naar een welvarende, duurzame toekomst. Verkiezingsprogramma D66 voor de tweede kamer 2012/2017. D66, Den Haag.

Daalhuizen, F., Dam, F. van, & Goetgeluk, R., 2003. New firms in former farms: A process with two faces. Tijdschrift voor Economische en Sociale geografie, 94/5, pp. 606.

Dagevos, J., & Lamoen, F. van, 2009. Handboek toestsingskader duurzame ontwikkeling. Telos Brabants centrum voor duurzame ontwikkeling, Tilburg.

Deelstra, T., Boyd, D., Kras, M., Roodbergen, N., 2005. Agropolis – een symbiose tussen stad en land. Innovatienetwerk: Utrecht.

Deming, M. E., Swaffield, S., 2011. Landscape architecture research. Inquiry, strategy, design. John Wiley and Sons Ltd. Hoboken, New Jersey.

Dienstencentrum agrarische sector, 2012. Schaalvergroting zet onverkort door. <http://www.boerenbusiness.nl/plant/nieuws/akkerbouw/item/10807902/Schaalvergroting-zet-onverkort-door> [Accessed 28 september 2012].

DLG, 2004. Overzichtskaart zonering intensieve veehouderij. Kaart 1.

Dorpsraad Oirlo, 2008. DOP Oirlo 2004. Een DorpsOmgevingsProgramma voor Oirlo: "Zo verscheiden, toch een".

Dow, S.P., Glassco, A., Kass, J., Schwartz, D.L., & Klemmer, S.R., 2010. Parallel prototyping leads to better design results, more divergence, and increased self-efficacy. *ACM Transactions on Computer-human interaction*, 17/4.

Driessen, P.P.J., & Gier, A.A.J. de, 2004. Platteland in beweging? Enkele inhoudelijke, bestuurlijke en juridische aspecten van de voortgang reconstructie concentratiegebieden intensieve veehouderij. Milieu en natuurplanbureau, RIVM-rapport 500025001/2004, Bilthoven.

Duffy, R., Fearne, A., Healing, V., 2005. Reconnection in the UK food chain. Bridging the communication gap between food producers and consumers. *British Food Journal*, 107 (1), pp 17-33.

E

Eck, W. van, Ham, A. van den, Reinhard, A.J., Leopold, R., & Poel, K.R., 2002. Ruimte voor landbouw. Uitwerking van vier ontwikkelingsrichtingen. Alterra, Wageningen, Alterra-rapport 530.

Ecorys Nederland, 2004. Glastuinbouw in Noordwest Fryslan vanuit een economisch perspectief. Provincie Friesland.

F

Fairbrother, N., 1970. New lives, new landscapes. William Clowes & Son, London.

Ferber, U., Grimski, D., Millar, K., & Nathanail, P., 2006. Sustainable Brownfield Regeneration: CABERNET network report. CABERNET coordination team, University of Nottingham.

Foley, J.A., DeFries, R., Asner, G.P., Barford, C., Bonan, G., Carpenter, R., Stuart Chapin, F., Coe, M.T., Daily, G.C., Gibbs, H.K., Helkowski, J.H., Holloway, T., Howard, E.A., Kucharik, C.J., Monfreda, C., Patz, J.A., Prentice, I.C., Ramankutty, N., & Snyder, P.K., 2005. Global consequences of land use. *Science*, 309/5734, pp. 570.

Fontein, R.J., Arnouts, R.C.M., Kuindersma, W., & Breman, B.C., 2011. Leren van krimp. Vraagsturing in pilots Gebrookerbos (Heerlen) en Groen voor Rood (Delfzijl). Alterra, Wageningen, Alterra-rapport 2149.

Franz, M., Pahlen, G., Nathanail, P., Okuniek, N., & Koj, A., 2006. Sustainable development and brownfield regeneration. What defines the quality of derelict land recycling? *Environmental sciences*, 3/2, pp. 135.
Fresco, L.O., 2012. Hamburgers in het paradijs. Voedsel in tijden van schaarste en overvloed. Uitgeverij Bert Bakker, Amsterdam, derde druk.
Fresco, L.O., 2011. Megaproblemen. Column, NRC-Handelsblad, 2 maart 2011.
Frosch, R.A., & Gallapoulos, N.E., 1989. Strategies for manufactering. *Scientific american*, 261, pp. 144.

G

Ge, L., et al. 2011. The nature of agroparks: synergy versus risk. *Agribusiness*, 27 (4), pp. 509-523.
Gebiedspanel Blitterswijck, 2011. Structuurvisie dorpsontwikkelingsplan Blitterswijck. Gemeente Venray, Venray.
Gebiedspanel Castenray, 2011. Structuurvisie dorpsontwikkelingsplan Castenray. Gemeente Venray, Venray.
Gebiedspanel Geijsteren, 2011. Structuurvisie dorpsontwikkelingsplan Geijsteren. Gemeente Venray, Venray.
Gebiedspanel Ysselsteyn, 2011. Structuurvisie dorpsontwikkelingsplan Ysselsteyn. Gemeente Venray, Venray.
Gebiedspanel Leunen, 2011. Structuurvisie dorpsontwikkelingsplan Leunen. Gemeente Venray, Venray.
Gebiedspanel Merselo, 2011. Structuurvisie dorpsontwikkelingsplan Merselo. Gemeente Venray, Venray.
Gebiedspanel Smakt, 2011. Structuurvisie dorpsontwikkelingsplan Smakt. Gemeente Venray, Venray.
Gebiedspanel Veulen, 2011. Structuurvisie dorpsontwikkelingsplan Veulen. Gemeente Venray, Venray.
Gebiedspanel Vredepeel, 2011. Structuurvisie dorpsontwikkelingsplan Vredepeel. Gemeente Venray, Venray.
Gebiedspanel Wanssum, 2011. Structuurvisie dorpsontwikkelingsplan Blitterswijck. Gemeente Venray, Venray.
Gemeente Venray, 2012. Venray in cijfers. Available at: <http://www.venray.incijfers.nl/>, [Accessed on: 13 February 2013].
Gemeente Venray, 2010. Toekomstvisie haven Wanssum. Gemeente Venray, Venray.
Gemeente Venray, 2010. Ruimtelijk kwaliteitskader buitengebied Venray.
Gemeente Venray, 2009. Samen puzzelen voor de toekomst. Gemeente Venray, Waterschap Peel en Maasvallei, provincie Limburg, Staatsbosbeheer, LLTB.
Gemeente Venray, 2006. Ontwikkelingsperspectief Venray 2015. Gemeente Venray, Urban management consultancy, & VHP stedebouwkundigen + architekten + landschapsarchitekten BV, Venray.
Gemeente Wieringermeer, 2006. Bestemmingsplan Agriport A7. Grootschalige glastuinbouw. Grontmij, Wieringerwerf.
Gies, E., Os, J. van, Hermans, T., & Olde Loohuis, R., 2007. Megastallen in beeld. Alterra, Wageningen, VROM, Alterra-rapport 1581.
Groot, R. de, 2006 Function-analysis and valuation as a tool to assess land use conflicts in planning for sustainable, multi-functional landscapes. *Landscape and urban planning*, 75/3-4, pp. 175.

Grosskurth, J., & Rotmans, J., 2005. The scene model: getting a grip on sustainable development in policy making. *Environment, development and sustainability*, 7/42, pp. 135.

H

Haase, D., Haase, A., Kabisch, N., & Rink, D., 2012. Actors and factors in land-use simulation: The challenge of urban shrinkage. *Environmental modelling and software*, 35, pp. 92.

Haase, A., Herfert, G., Kabisch, S., & Steinfuhrer, A., 2012. Reurbanizing Leipzig (Germany): Context conditions and residential actors (2000-2007). *European planning studies*, 20/7, pp. 1173.

Harsema, H., 1993. De casco-benadering. Een nieuwe en constructieve aanpak in de landschapsplanning. Ministerie LNV.

Hermans, F., Knippenberg, L., Haarmann, W., & Dagevos, J., 2006. De Duurzaamheidsbalas van Brabant 2006. De verantwoording. Samenwerkingsverband Universiteit van Tilburg, Technische universiteit Eindhoven, Provincie Noord-Brabant & PON – instituut voor advies, onderzoek en ontwikkeling, Tilburg.

Het waterschapshuis, 2012. Actueel hoogtebestand Nederland 1. Available at: <http://www.ahn.nl/viewer>, [Accessed on: 1 February 2013].

Hogenkamp, W., 2012. Meer drogestof per hectare bij koeien en kansen. <http://www.boerderij.nl/Rundveehouderij/Nieuws/2012/8/Meer-drogestof-per-hectare-bij-Koeien-Kansen-1043846W/> [Accessed on 28 September 2012].

Holt-Gimenez, E., & Peabody, L., 2008. Global food crisis 2008. Online publication, Global issues, [Accessed on 29 October 2012], < http://www.globalissues.org/article/758/global-food-crisis-2008>

Hough, M., 1990. Out of place: restoring identity to the regional landscape. Yale university press, New Haven, pp. 179.

Huls, E., 2011. De Limburgse land- en tuinbouw in kaart. Overzicht van de huidige land- en tuinbouw met een terugblik tot 2005 en een beeld van de toekomst. Provincie Limburg.

J

Jacksteit, M., & Kaufmann, A., 1999. Common ground network for life and choice.

Jacobs, M., 2006. The production of mindscapes. A comprehensive theory of landscape experience. Wageningen university and research centre, Wageningen, 9-12.

Jones, J.C., 1970. Design methods: seeds of human features. Wiley & Sons Ltd., New York.

Jongeneel, R.A., Polman, N.B.P., & Slangen, L.H.G., 2008. Why are Dutch farmers going multifunctional? *Land use policy*, 25/1, pp. 81.

K

Kerkstra, K., & Vrijlandt. P., 1990. Landscape planning for industrial agriculture: A proposed framework for rural areas. *Landscape an urban planning*, 18/3-4, pp. 275.

Klundert, B. van de, 2012. Gegijzelde natuur. Presentatie KombiCop 16 October 2012, Wageningen, Programmamanager Nederland bij Wereld Natuur Fonds (WNF).

Koning, N.B.J., Ittersum, M.K. van, Becx, G.A., Boekel, M.A.J.S. van, Brandenburg, W.A., Broek, J.A. van den, Goudriaan, J., Hofwegen, G. van, Jongeneel, R.A., Schiere, J.B., & Smies, M., 2008 Long-term global availability of food: Continued abundance or new scarcity. *NJAS Wageningen journal of life sciences*, 55/3, pp. 229.

Kool, A., Eijk, I., & Blonk, H., 2008. Nieuw gemengd bedrijf. Duurzaam en innovatief? Blonk Milieu Advies.

Koomen, A.J.M., Klijn, J.A., & Nieuwenhuizen, W., 2005. Landschap in 'Kiezen voor Landbouw'. Mogelijke effecten van ontwikkelingen in de landbouw op het landschap. Alterra, Wageningen, Alterra-rapport 1247.

Kraker, J. de, M.F. van Laeken en R.J.M. Cörvers (2005), Over de mogelijkheid en noodzakelijkheid van een concept, in R.J.M. Cörvers en J. de Kraker (red), Milieuproblemen en duurzame ontwikkeling, Open Universiteit Nederland, Heerlen.

Kuhlman, T., Agricola, H., Blaeij, A. de, Hoop, J. de, Michels, R., Smit, B., & Vogelzang, T., 2012. Landbouw en recreatie in krimpregio's. Knelpunten en kansen. LEI Wageningen UR, Den Haag, LEI-rapport 2012-001.

L

Lamers, J., Theeuwen, T., & Weerts, P., 2011. Boerenschans en Volmolen in het Loobeekdal.

Lange, A., Piorr, A., Siebert, R., & Zasada, I., 2012. Spatial differentiation of farm diversification: How rural atractiveness and vicinity to cities determine farm households' response to the CAP. *Land use policy*, article in press.

Lassus, B., 1998. The landscape approach. University of Pennsylvania Press.

Lauf, S., Haase, D., Seppelt, R., & Schwarz, N., 2012. Simulating demography and housing demand in an urban region under scenarios of growth and shrinkage. *Environment an planning B: Planning and design*, 39/2, pp. 229.

Lauwere, C. de, & Vellema, S., 2011. The reconstruction of livestock farming in the Netherlands. Chapter 9 in Vellema et al, 2011. Transformation and sustainability in agriculture, Wageningen Academic Publishers.

LEI, 2011. Land- en tuinbouwcijfers 2011. LEI Wageningen and Centraal Bureau voor de Statisitiek, Den Haag.

Lenzholzer, S., Duchhart, I., & Koh, J., 2013. 'Research through designing' in landscape architecture. *Landscape and urban planning*, 113/(2013), pp. 120.

Livingstone, M., 2010. Landscape architecture study tour. Borneo Sporenburg Docklands. Available at: <http://courses.umass.edu/latour/Netherlands/livingstone/index.html> [Accessed 18 October 2012].

Lobao, L., Meyer, K., 2001. The great agricultural transition: Crisis, change, and social consequences of twentieth century US farming. *Annual review of sociology*, 27 (2001), pp. 103-124.

Lotze-Campen, H., Muller, C., Bondeau, A., Popp, A., & Lucht, W., 2008. Global food demand, productivity growth, and the scarcity of land and water resources: A spatially explicit mathematical programming approach. *Agricultural economics*, 39/3, pp.325.

M

Mager, S., & Wilt, J. de, 2007. Towards an international association for sustainable agroparks. Innovating agriculture in metropolitan areas. Transforum & Innovation network.

Markantoni, M., & Strijker, D., 2012. Side activities of non-farmers in rural areas in the Netherlands. *Urbani Izziv*, 23/2, pp. 76.

Martin, B., Hanington, B., 2012. Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions. Beverly, MA: Rockport Publishers.

McHarg, I.L., 1969. Design with nature. The American Museum of Natural History, The Natural history press, Garden City, New York, First edition.

Meerburg, B.G., Korevaar, H., Haubenhofer, D.K., Blom-Zandstra, M., & Keulen, H. van, 2009. The changing role of agriculture in Dutch society. *The journal of agricultural science*, 147/5, pp. 511.

Meulenkamp, W.J.H., & Gies, T.J.A., 2012. Effect maatregelen reconstructie zandgebieden. Pilotgemeente Gemert-Bakel. Wageningen UR, wettelijke onderzoekstaken natuur en milieu, werkdocument 299.

Milestad, R., Ahnstrom, J., & Bjrklund, J., 2011. Essential multiple functions of farms in rural communities and landscapes. *Renewable agriculture and food systems*, 26/2, pp. 137.

Ministry of economic affairs, 2012. Toekomstvisie veehouderij: duurzaam en passend. Rijksoverheid. Available at <http://www.rijksoverheid.nl/onderwerpen/veehouderij/toekomstvisie-veehouderij> [Accessed on 09 January 2013].

Ministry of economy, agriculture, and innovation, 2011. Bleker: geen ongebreidelde groei veehouderijbedrijven. Available at < http://www.rijksoverheid.nl/ministeries/eleni/nieuws/2011/11/23/bleker-geen-ongebreidelde-groei-veehouderijbedrijven.html> [Accessed on 13 June 2012]

Myers, S.S., & Patz, J.A., 2009. Emerging threats to human health from global environmental change. *Annual review of environment and resources*, 34, pp. 223.

N

Nickerson, T., 2010. Landscape architecture study tour. Landschaftspark Duisburg-Nord. Available at <http://courses.umass.edu/latour/Germany/tnickerson/index.html> [Accessed on 18 October 2012]

Norgaard, R.B., 2002. Optimists, pessimists, and science. *Bioscience*, 52, pp. 287.

NOS, 2012. Philips schrapt 2200 banen extra. Available at: <http://nos.nl/artikel/417191-philips-schrapt-2200-banen-extra.html> [Accessed on: 29 November, 2012].

O

Os, J. van, & Gies, T.J.A., 2011. Grootschalige veehouderij in Nederland. Bedrijven, locaties en milieuvergunningen. Wageningen, Alterra, Alterra-rapport 2243

P

Penning de Vries, F.W.T., Keulen, H. van, & Rabbinge, R., 1995. Natural resources and limits of food production in 2040. *Systems approaches for sustainable agricultural development*, 4, pp. 65.

Pols, L., Daalhuizen, F., Segeren, A., & Veeken, avn der C., 2005. Waar de landbouw verdwijnt. Het Nederlandse cultuurlandschap in beweging. Nai Uitgevers/Ruimtelijk Planbureau, Rotterdam/Den Haag.

Portugali, J., 1999. Self-organization and the city. Springer-Verlag, New York.

Provincie Limburg, 2010. Stimuleringsplan. Noord Limburg West.

Provincie Noord-Holland, 2012. Agriport A7. Available at: <http://www.noord-holland.nl/web/Projecten/Agenda-Landbouw-en-Visserij-1/Artikel-6/Agriport-A7.htm>, [Accessed on: 12 December 2012]

PvdA, 2012. Nederland sterker en socialer. Verkiezingsprogramma tweede kamerverkiezingen 2012. Partij van de arbeid, Den Haag.

PVV, 2012. Hun Brussel, ons Nederland. Verkiezingsprogramma 2012-2017. Partij voor de vrijheid, Den Haag.

R

Raamsdonk, L.W.D., Kan, C.A., Meijer, G.A.L., & Kemme, P.A., 2007. Kengetallen van enkele landbouwhuisdieren en hun consumptiepatroon. ASG & Wageningen UR, Wageningen.

Renting, H., Rossing, W.A.H., Groot, J.C.J., Ploeg, J.D. van der, Laurent, C., Perraud, D., Stobbelaar, D.J., & Ittersum, M.K. van, 2009. Exploring multifunctional agriculture. A review of conceptual approaches and prospects for an integrative transitional framework. *Journal of Environmental Management*, 90/2, pp. 112.

Rienks, W.A., Meulenkamp, W.J.H., Olde Loohuis, R.J.W., & Rooij, B.J.R. van, 2009. Landbouwatlas van Nederland. De Nederlandse agrosector op de kaart. Drukkerij Roelofs, Enschede.

Rienks, W.A., Groot, R., Olde Loohuis, R.J.W., & Poel, K.R., 2003. De boerderij voorbij?! Ontwerpopgaven voor de ontwikkeling van boerderijen in het landschap in het kader van het 'Jaar van de boerderij 2003'. Wageningen, Alterra, Alterra-rapport 536.

Rijksdienst voor het Cultureel erfgoed, 2011. Ontginningen uit de twintigste eeuw, Gids cultuurhistorie 19, Ministerie van Onderwijs, cultuur en wetenschap.

Roncken, P.A., Stremke, S., & Paulissen M.P.C.P., 2011. Landscape machines: Productive nature and the future sublime. *Journal of landscape architecture*, issue SPRING, pp. 68.

Roncken, P.A., 2012. Landscape machines – Design labaratory. Available at: <http://landscapemachines.com/about/>, [Accessed on 18 February 2013].

S

Sasaki, H., 1950. Thoughts on educationin landscape architecture: some comments on today's methodologies and purpose. *Landscape architecture*, 40/4, pp. 158.

Schaik, M., 2008. Percepties van schaalvergroting in de intensieve veehouderij. Wageningen universiteit, Dierwetenschappen.

Schön, D.A., 1986. The reflective practitioner: How professionals think in action.

Sijmons, D.F., 1991. Het casco-concept. Een benaderingswijze voor de landschapsplanning. H+N+S adviesbureau voor ruimtelijke planning en ontwerp. In opdracht van: Ministerie LNV.

Smeets, P.J.A.M., 2012. De beste landbouw van de wereld loopt vast op ruimtelijke ordening. Presentatie provinciale staten Overijssel, Februari 2012.

Smeets, P.J.A.M., 2012. Hier zitten wereldkampioenen. Kennis online, vol. 9, nr. feb., pp. 4.

Smeets, P.J.A.M., 2009. Expedition agroparks. Research by design into sustainable development and agriculture in the network society. 1st ed. Wageningen: Wageningen Academic Publishers

Smeets, P.J.A.M., 2004. Agriculture in the Northwest-European delta metropolis. In: The new dimensions of the European landscape, pp. 59.

Smeets, P.J.A.M., Harms, W.B., Mansfeld, M.J.M. van, Susteren, A.W.C. van, & Steekelenburg, M.G.N. van, 2004. Metropolitan delta landscapes. In: Planning metropolitan landscapes; concepts, demands, approaches. pp. 103.

Smeets, P., Mandsfeld, M. van, Bruinsma, A., Broeze, J., Galama, P., 2010. Haalbaarheid van Agroparken in Drenthe. Alterra Wageningen UR, Alterra-rapport 2030.

Smeets, P., Mansfeld, M. van, Diepen, K. van, & Kuikman, P., 2011. Agropark oplossing voor megastallen. NRC handelsblad, 5 April 2011, pp. 16.

Sousa, C.A. de, 2004. The greening of brownfields in American cities. *Journal of environmental planning and management*, 47/4, pp. 579.

SP, 2012. Nieuw vertrouwen. Verkiezingsprogramma SP 2013-2017. Socialistische partij, Amersfoort.

Stremke, S., Roncken, P., & Pulselli, R.M., 2012. Discussing landscape machines in the light of evolutionary thermodynamics. Symposium paper, Designing nature as infrastructure, TU Munchen.
Stroming, 2002. One Europe more nature. Stroming b.v., Nijmegen.

T

Tang, Y.T., & Nathanail, C.P., 2012. Sticks and stones: The impact of the definitions of brownfield in policies on socio-economic sustainability. *Sustainability*, 20/4, pp. 840.
Thissen, P.H.M., 1993. Heideontginning en modernisering: in het bijzonder in drie Brabantse peelgemeenten 1850-1940. Proefschrift universiteit Nijmegen, Uitgeverij Matrijs.
Tress, G., Tress, B., Harms, W.B., Smeets, P.J.A.M., & Valk, A.J.J. van der, 2004. Planning metropolitan landscapes: concepts, demands, approaches. DELTA series 4, Wageningen.
Trostle, R., 2008. Global agricultural supply and demand: Factors contributing to the recent increase in food commodity prices. United States department of agriculture, WRS-0801, approved by World agricultural outlook board.

U

United Nations, 2012. World urbanization prospects. The 2011 revision. The highlights. Department of economic and social affairs, united nations, New York.

V

Verdonschot, P., 1995. Beken stromen. Leidraad voor ecologisch beekherstel. Stichting toegepast onderzoek waterbeheer, subgroep beekherstel, 95-03 WEW-06.
Vlis, M. van der, 1991. Openbare ruimte: Het casco-concept is nog onvoldoende onderbouwd. Blauwe Kamer, 2/1991, pp. 12.
Vogelzang, T., Gies, E., Michels, R., Wisman, A., Hoefs, R., & Smidt, R., 2010. Puzzelen met de ruimte in Limburg. Ruimteclaims in het Limburgs landelijk gebied. LEI Wageningen UR, Den Haag, Alterra-rapport 1986.
VVD, 2012. Niet doorschuiven maar aanpakken. Verkiezingsprogramma VVD 2012-2017. VVD Algemeen Secretariaat, Den Haag.

W

Wezel, A.P. van, Franken, R.O.G., Dam, J.D. van, & Cleij, P., 2011. Anticipated effects of re-allocation of intensive livestock in sandy areas in the Netherlands. Environmental assessment agency, National institute for public health and the environment, Bilthoven.
Wilt, J.G., de, Oosten, H.J. van, & Sterrenberg, L., 2000. Agroproductieparken perspectieven en dilemma's. Innovatienetwerk Groene Ruimte en Agrocluster, Den Haag.
Witte, M., 2009. De opkomst en ontwikkeling van de niet-grondgebonden landbouw in de Nederlandse zandgebieden. Rijksuniversiteit Groningen, lopend onderzoek, available at: <http://www.rug.nl/let/onderzoek/onderzoekcentra/nahi/witte> [Accessed on: 7 November 2012].
Wulp, N.Y. van der, 2009 Storende elementen in het landschap: welke, waar en voor wie? Bijlage bij WOT paper 1 – Krassen op het landschap. WOt-Werkdocument 151, Wageningen.
Wageningen UR, 2012. Het wereld voedsel vraagstuk. Presentation-paper, november 2012.

World commission on environment and development, 1988. Our common future. Oxford, UK, Oxford University Press.

Y

Yin, I., & Robert, K., 2002. Case study research: design and methods. 3rd edition, Thousand Oaks, CA: Sage Publications.

Z

Zaizhi, Z., 2000. Landscape changes in a rural area in China. *Landscape and urban planning*, *47* (1-2), pp. 33-38.

Zeijl-Rozema, A. van, & Martens, P., 2010. An adaptive indicator framework for monitoring regional sustainable development: A case study of the INSURE project in Limburg, the Netherlands. *Sustainability: Science, Practice, and Policy*, 6/1, pp. 6.

Zhang, L., 2011. Farm dependence and population change in China. *Population research and policy review,* 30 (5), pp. 751-779.

Zwartkruis, E., 2012. An agropark as landscape machine. In search for symbiosis. Msc. Thesis, Wageningen University, Wageningen.

Images.

1

1.1 Adapted from: Wageningen UR, 2012. Het wereld voedsel vraagstuk. Presentation-paper, november 2012.

1.2 Adapted from: Wageningen UR, 2012. Het wereld voedsel vraagstuk. Presentation-paper, november 2012.

1.3 Adapted from: European commission, 2008. global urbanisation and accessibility map. Available at: <http:// http://ec.europa.eu/dgs/jrc/index.cfm?id=1410&obj_id=6670&dt_code=NWS&lang=en> [Accessed 12 December 2012].

1.4 Adapted from: Wageningen UR, 2012. Het wereld voedsel vraagstuk. Presentation-paper, november 2012.

1.5 Adapted from: Koning, N.B.J., Ittersum, M.K. van, Becx, G.A., Boekel, M.A.J.S. van, Brandenburg, W.A., Broek, J.A. van den, Goudriaan, J., Hofwegen, G. van, Jongeneel, R.A., Schiere, J.B., & Smies, M., 2008 Long-term global availability of food: Continued abundance or new scarcity. NJAS Wageningen journal of life sciences, 55/3, pp. 229.

1.7 Adapted from: Didde, R., 2012. De stad heeft honger. In Wageningen world, 2/2012, pp. 30.

1.8 Adapted from: Ministerie van volkshuisvesting, ruimtelijke ordening en milieubeheer, 2001. Ruimte maken, ruimte delen: vijfde nota over de ruimtelijke ordening 2000/2020. Ministerie van volkshuisvesting, ruimtelijke ordening en milieubeheer, Centrale directie communicatie, Den Haag.

1.9 Based on: Thissen, P.H.M., 1993. Heideontginning en modernisering: in het bijzonder in drie Brabantse peelgemeenten 1850-1940. Proefschrift universiteit Nijmegen, Uitgeverij Matrijs.

1.10 Based on: Thissen, P.H.M., 1993. Heideontginning en modernisering: in het bijzonder in drie Brabantse peelgemeenten 1850-1940. Proefschrift universiteit Nijmegen, Uitgeverij Matrijs.

1.11 Based on: Thissen, P.H.M., 1993. Heideontginning en modernisering: in het bijzonder in drie Brabantse peelgemeenten 1850-1940. Proefschrift universiteit Nijmegen, Uitgeverij Matrijs.

1.12 Based on: Smeets, P.J.A.M., 2009. Expedition agroparks. Research by design into sustainable development and agriculture in the network society. 1st ed. Wageningen: Wageningen Academic Publishers.

1.13 See appendix I

1.14 See appendix I

1.15 See appendix I

1.16 See appendix I

1.17 See appendix I

3

3.4 Based on: Nickerson, T., 2010. Landscape architecture study tour. Landschaftspark Duisburg-Nord. Available at <http://courses.umass.edu/latour/Germany/tnickerson/index.html> {Accessed on 18 October 2012]
- Sousa, C.A. de, 2004. The greening of brownfields in American cities. Journal of environmental planning and management, 47/4, pp. 579.

3.5 Based on: Livingstone, M., 2010. Landscape architecture study tour. Borneo Sporenburg Docklands. Available at: <http://courses.umass.edu/latour/Netherlands/livingstone/index.html> [Accessed 18 October 2012].
- Aalbers, C., Heutinck, L., & Visschedijk, P., 2011. Krimp en groene ruimte in stedelijke gebieden. Alterra research institute, Wageningen.

3.6 Based on: Commissie Van Doorn, 2011. Al het vlees duurzaam. De doorbraak naar een gezonde, veilige en gewaardeerde veehouderij in 2020. D. Van Doorn, Den Bosch, Commissie Van Doorn: 24.
- Cormont, A., Diepen, C.A. van, Hack-ten Broeke, M.J.D., Jansen, P.C., Janssen, S.J.C., Roelsma, J., Roest, C.W.J., Smeets, P.J.A.M., & Uiterwijk, M., 2012. Duurzaam landgebruik en prestatie-indicatoren. Een case studie voor de peel. Alterra-rapport 2335, Wageningen.
- LEI, 2011. Land- en tuinbouwcijfers 2011. LEI Wageningen and Centraal Bureau voor de Statisitiek, Den Haag.
- Smeets, P.J.A.M., 2009. Expedition agroparks. Research by design into sustainable development and agriculture in the network society. 1st ed. Wageningen: Wageningen Academic Publishers

3.7 Based on: Bleumink, H., 2007. De geschiedenis van de reconstructie. Achtergrondrapport van de evaluatie reconstructie zandgebieden. Alterra, Wageningen, Alterra-rapport 1441.2.
- Lauwere, C. de, & Vellema, S., 2011. The reconstruction of livestock farming in the Netherlands. Chapter 9 in Vellema et al, 2011. Transformation and sustainability in agriculture, Wageningen Academic Publishers.
- Wezel, A.P. van, Franken, R.O.G., Dam, J.D. van, & Cleij, P., 2011. Anticipated effects of re-allocation of intensive livestock in sandy areas in the Netherlands. Environmental assessment agency, National institute for public health and the environment, Bilthoven.

3.8 Based on: Bleumink, H., 2007. De geschiedenis van de reconstructie. Achtergrondrapport van de evaluatie reconstructie zandgebieden. Alterra, Wageningen, Alterra-rapport 1441.2.
- Wezel, A.P. van, Franken, R.O.G., Dam, J.D. van, & Cleij, P., 2011. Anticipated effects of re-allocation of intensive livestock in sandy areas in the Netherlands. Environmental assessment agency, National institute for public health and the environment, Bilthoven.

3.9 Based on: Bleumink, H., 2007. De geschiedenis van de reconstructie. Achtergrondrapport van de evaluatie reconstructie zandgebieden. Alterra, Wageningen, Alterra-rapport 1441.2.
- Wezel, A.P. van, Franken, R.O.G., Dam, J.D. van, & Cleij, P., 2011. Anticipated effects of re-allocation of intensive livestock in sandy areas in the Netherlands. Environmental assessment agency, National institute for public health and the environment, Bilthoven.

3.13 Based on: Dagevos, J., & Lamoen, F. van, 2009. Handboek toestsingskader duurzame ontwikkeling. Telos Brabants centrum voor duurzame ontwikkeling, Tilburg.
- Grosskurth, J., & Rotmans, J., 2005. The scene model: getting a grip on sustainable development in policy making. Environment, development and sustainability, 7/42, pp. 135.
- Hermans, F., Knippenberg, L., Haarmann, W., & Dagevos, J., 2006. De Duurzaamheidsbalas van Brabant 2006. De verantwoording. Samenwerkingsverband Universiteit van Tilburg, Technische universiteit Eindhoven, Provincie Noord-Brabant & PON – instituut voor advies, onderzoek en ontwikkeling, Tilburg.

3.14 Based on: Hermans, F., Knippenberg, L., Haarmann, W., & Dagevos, J., 2006. De Duurzaamheidsbalas van Brabant 2006. De verantwoording. Samenwerkingsverband Universiteit van Tilburg, Technische universiteit Eindhoven, Provincie Noord-Brabant & PON – instituut voor advies, onderzoek en ontwikkeling, Tilburg.

4

4.7 Based on: CBS, 2011. Gemeente op maat Venray. Centraal bureau voor de statistiek, Den Haag, 11.
- CBS, 2012. Bevolkingsteller. Available online: <http://www.cbs.nl/nl-NL/menu/themas/bevolking/cijfers/extra/bevolkingsteller.htm>, [Accessed on: 14 January 2012].
- LEI, 2011. Land- en tuinbouwcijfers 2011. LEI Wageningen and Centraal Bureau voor de Statisitiek, Den Haag.

4.8 Adepted from: Smeets, P.J.A.M., 2012. De beste landbouw van de wereld loopt vast op ruimtelijke ordening. Presentatie provinciale staten Overijssel, Februari 2012.
- Provincie Limburg, 2004. Overzichtskaart zonering intensieve veehouderij. Kaart 1.

4.9 Based on: See APPENDIX.

4.11 Adapted from: Alterra, 2010. Bodemdata. Available at: <http://www.bodemdata.nl>, [Accessed on: 12 February 2012].

4.12 Adapted from: Alterra, 2010. Bodemdata. Available at: <http://www.bodemdata.nl>, [Accessed on: 12 February 2012].

4.13 Adapted from: Het waterschapshuis, 2012. Actueel hoogtebestand Nederland 1. Available at: <http://www.ahn.nl/viewer>, [Accessed on: 1 February 2013].

4.15 Adapted from: Wolters-Noordhoff Atlasprodukties, 1990. Grote historische atlas van Nederland 1:50.000. 4 Zuid Nederland1838-1857. Wolters-Noordhoff bv, Groningen.
- Wieberdink, G.L., 1989. Historische atlas Limburg. Chromotopografische kaart des rijks 1:25.000. Uitgeverij Roblas Producties, Den Haag.
- Pater, B.C., & Schoenmaker, B., 2005. Grote atlas van Nederland 1930-1950. Uitgeverij Asia Maior, Zierikzee, 1st edition.
- Wolters-Noordhoff Atlasprodukties, 1997. Grote topografische atlas van Nederland 1:50.000. 4 Zuid Nederland. Wolters-Noordhoff bv, Groningen.

4.16 Adapted from: Het waterschapshuis, 2012. Actueel hoogtebestand Nederland 1. Available at: <http://www.ahn.nl/viewer>, [Accessed on: 1 February 2013].

4.19 Based on: Alterra, 2001. Handboek robuuste verbindingen; ecologische randvoorwaarden. Wageningen, Alterra, Research instituut voor de groene ruimte.

4.20 Based on: Alterra, 2001. Handboek robuuste verbindingen; ecologische randvoorwaarden. Wageningen, Alterra, Research instituut voor de groene ruimte.

5

5.2 Based on: Kool, A., Eijk, I., & Blonk, H., 2008. Nieuw gemengd bedrijf. Duurzaam en innovatief? Blonk Milieu Advies.

5.3 See appendix V

5.4 See appendix V

5.5 See appendix V

5.19 Based on: Agriport A7, 2011. Huidige stand van zaken in Agriport. Available at: <http://www.agriporta7.nl/Agropark/NL/nl-a-welkom-bij-agriport-a7.html>, [Accessed on: 12 December 2012].

5.20 Based on: Ecorys Nederland, 2004. Glastuinbouw in Noordwest Fryslan vanuit een economisch perspectief. Provincie Friesland.

5.21 Adapted from: Gies, E., Os, J. van, Hermans, T., & Olde Loohuis, R., 2007. Megastallen in beeld. Alterra Wageningen UR, VROM, Alterra-rapport 1581.

5.22 Based on: Gebiedspanel Blitterswijck, 2011. Structuurvisie dorpsontwikkelingsplan Blitterswijck. Gemeente Venray, Venray.
- Gebiedspanel Castenray, 2011. Structuurvisie dorpsontwikkelingsplan Castenray. Gemeente Venray, Venray.
- Gebiedspanel Geijsteren, 2011. Structuurvisie dorpsontwikkelingsplan Geijsteren. Gemeente Venray, Venray.
- Gebiedspanel Ysselsteyn, 2011. Structuurvisie dorpsontwikkelingsplan Ysselsteyn. Gemeente Venray, Venray.
- Gebiedspanel Leunen, 2011. Structuurvisie dorpsontwikkelingsplan Leunen. Gemeente Venray, Venray.
- Gebiedspanel Merselo, 2011. Structuurvisie dorpsontwikkelingsplan Merselo. Gemeente Venray, Venray.
- Gebiedspanel Smakt, 2011. Structuurvisie dorpsontwikkelingsplan Smakt. Gemeente Venray, Venray.
- Gebiedspanel Veulen, 2011. Structuurvisie dorpsontwikkelingsplan Veulen. Gemeente Venray, Venray.
- Gebiedspanel Vredepeel, 2011. Structuurvisie dorpsontwikkelingsplan Vredepeel. Gemeente Venray, Venray.
- Gebiedspanel Wanssum, 2011. Structuurvisie dorpsontwikkelingsplan Blitterswijck. Gemeente Venray, Venray.
- Gemeente Venray, 2010. Ruimtelijk kwaliteitskader buitengebied Venray.
- Gemeente Venray, 2006. Ontwikkelingsperspectief Venray 2015. Gemeente Venray, Urban management consultancy, & VHP stedebouwkundigen + architekten + landschapsarchitekten BV, Venray.
- Smeets, P.J.A.M., 2012. Hier zitten wereldkampioenen. Kennis online, vol. 9, nr. feb., pp. 4.

6

6.4 Based on: Gemeente Venray, 2012. Venray in cijfers. Available at: <http://www.venray.incijfers.nl/>, [Accessed on: 13 February 2013].

6.15 Adapted from: Het waterschapshuis, 2012. Actueel hoogtebestand Nederland 1. Available at: <http://www.ahn.nl/viewer>, [Accessed on: 1 February 2013].
Based on: Gemeente Venray, 2009. Samen puzzelen voor de toekomst. Gemeente Venray, Waterschap Peel en Maasvallei, provincie Limburg, Staatsbosbeheer, LLTB.

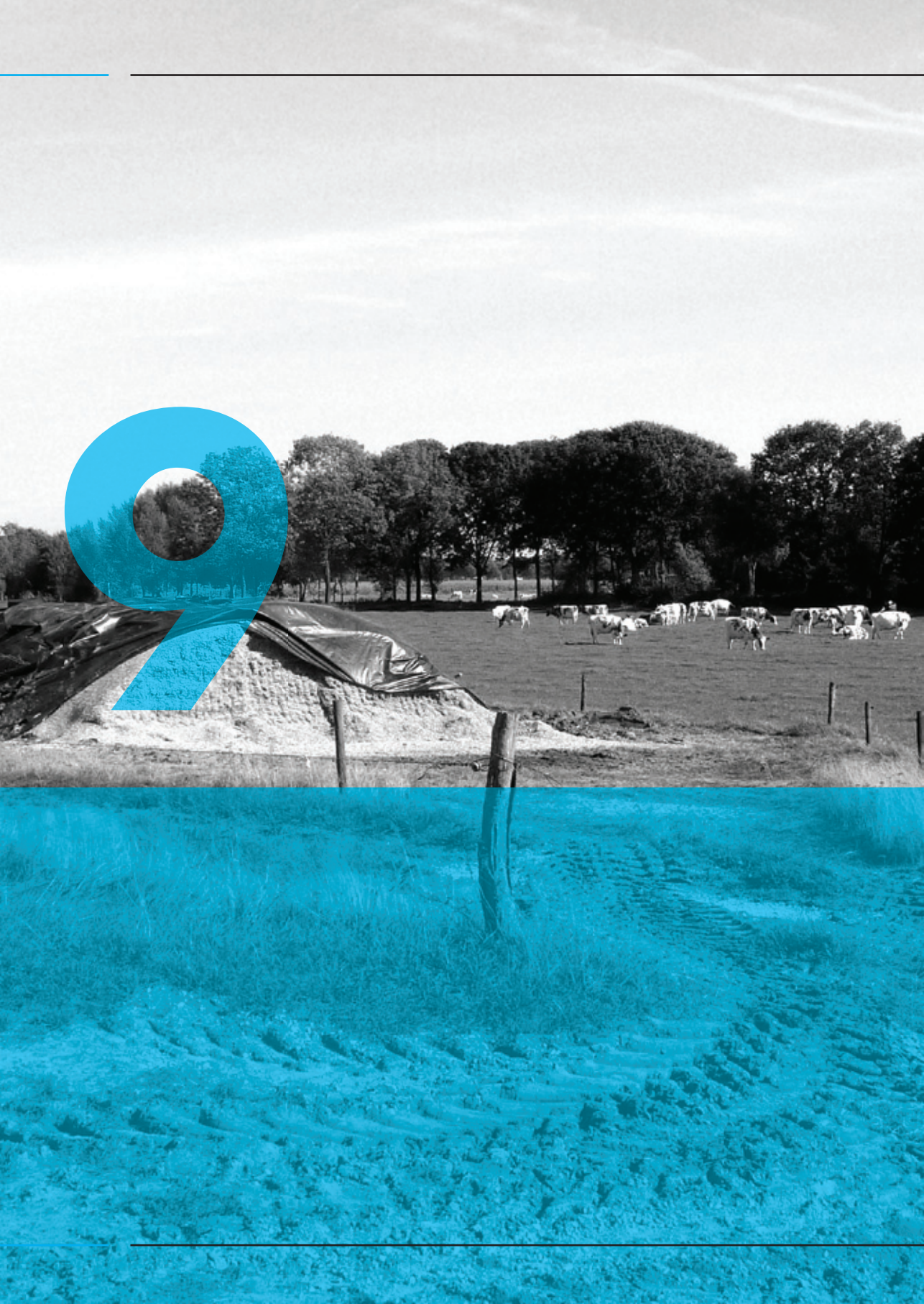
6.33 Verdonschot, P., 1995. Beken stromen. Leidraad voor ecologisch beekherstel. Stichting toegepast onderzoek waterbeheer, subgroep beekherstel, 95-03 WEW-06.

6.34 Based on: Schaminee, J.H.J., Stortelder, A.H.F., & Weeda, E.J., 1996. De vegetatie van Nederland. Deel 3. Plantgemeenschappen van graslanden, zomen en droge heide. Opulus press, Uppsala, Leiden.
- Stortelder, A.H.F., Schaminee, J.H.J., & Hommel, P.W.F.M., 1999. De vegetatie van Nederland. Deel 5 Plantgemeenschappen van ruigten, struwelen en bossen. Opulus press, Uppsala, Leiden.
- Weeda, E.J., Schaminee, J.H.J., & Duuren, L. van, 2005. Atlas van plantgemeenschappen in Nederland. KNNV Uitgeverij, Utrecht.

6.36 Based on: Schaminee, J.H.J., Stortelder, A.H.F., & Weeda, E.J., 1996. De vegetatie van Nederland. Deel 3. Plantgemeenschappen van graslanden, zomen en droge heide. Opulus press, Uppsala, Leiden.
- Stortelder, A.H.F., Schaminee, J.H.J., & Hommel, P.W.F.M., 1999. De vegetatie van Nederland. Deel 5 Plantgemeenschappen van ruigten, struwelen en bossen. Opulus press, Uppsala, Leiden.
- Weeda, E.J., Schaminee, J.H.J., & Duuren, L. van, 2005. Atlas van plantgemeenschappen in Nederland. KNNV Uitgeverij, Utrecht.

6.46 - Provincie Limburg, 2004. Overzichtskaart zonering intensieve veehouderij. Kaart 1.

6.47 Adapted from: Didde, R., 2012. De stad heeft honger. In Wageningen world, 2/2012, pp. 30.



Appendices

Digital appendices:

Appendix I	*Calculation of scenarios*
Appendix II	*Definition of stocks*
Appendix III	*Calculation space-pump potential Venray*
Appendix IV	*Target species*
Appendix V	*Layers in analysis models*
Appendix VI	*Plant communities*

DOORSTEP LANDSCAPE

The landscape of Venray is for an important part shaped by the presence of the livestock sector. This sector is important for the region, but faces drastic changes. Approximately 50 to 70 percent of the farmers will quit their production, and the other farms will take over their production. A transition resulting in numerous farms of mega proportions scattered over the rural landscape. The development of a metropolitan food cluster can prevent these consequences. By spatially cluster the industrial activities of agriculture, the rural landscape is prevented of many large industrial buildings. Moreover the disappearance of the industrial activities in the rural landscape offers space for other functions to develop. The concept of the space-pump occurs. This study searches for the possibilities to optimise the consequences of this space-pump by means of a landscape design. The availability of land, and stables which are not essentially needed in the new agricultural system, and the disappearance of policy zones, offer space for low-dynamic functions to develop. The inclusion of the space-pump in the regional design of a metropolitan food cluster is essential for the successful development of both in Venray.

The development of a large agricultural sector in Venray provided the region with a monotone landscape. A landscape that offers just limited possibilities to develop new functions by means of the space-pump. By restoring the stream-valleys as an ecological, and recreational attractive framework, possibilities are offered for a wider range of social, and ecological functions in the existing rural landscape. Functions that in this way can provide balance for the economic development of the metropolitan food cluster. An attractive rural landscape at your doorstep, developed by means of the space-pump offers Venray the possibility to be the first region with the 'Doorstep landscape', and the first metropolitan food cluster with livestock in the Netherlands.