

The impact of restrictive spatial policy in the Dutch Randstad area

A spatial analysis of regional differences in land-use change

Date: July 8, 2011

Course: Bachelor thesis Aarde & Economie

Code: 450254

Name: Frank van Oosterhout

Studentnumber: 1717790

First thesis supervisor: Eric Koomen

Second thesis supervisor: Peter Mulder

Abstract

Since there is still no consensus on the success of spatial planning, this study hopes to contribute to the debate by investigating the impact of spatial restrictive policy in the Randstad area between 1995 and 2008. Non-restricted zones are compared to several kinds of restricted zones and differences in land-use change patterns are pointed out. Furthermore, changes in urbanization rates over time are determined and explained. After putting the observed differences and trends in the light of the history of the Dutch spatial planning, several conclusions are drawn. It seems that spatial restrictive policy has a great impact on the current land-use configuration and the change patterns within the different types of restricted and non-restricted areas.

Acknowledgements

The Netherlands Environmental Assessment Agency (PBL) is thanked for providing the necessary data sets for this analysis. This research contributes to the Dutch National Research Program 'Knowledge for Climate' (<http://www.climate-research-netherlands.nl/>).

Table of contents

1. Introduction	4
2. Methodology.....	5
3. Results.....	7
3.1. An overview of the recent spatial planning policies and the differences between them.....	7
3.2. Comparison of the land use change of restricted areas and non-restricted areas in three periods between 1995 and 2008.....	8
3.3. Changes of the urbanization rate over time.....	13
3.4. The observed changes in the context of the restrictive policies.....	16
5. Conclusion and Discussion.....	18
6. Reference list	20
7. Appendices.....	22

1. Introduction

The Netherlands is amongst the countries with the highest population density in the world, at the 14th place to be specific (Worldatlas, 2010). With over 16 million inhabitants in an area of about 40.000 km², land is a precious good. Everyone needs a place to live, a place to work, food and recreation possibilities. All these demands are claiming a piece of the precious and scarce good; land. To control this situation the Dutch government has implemented spatial planning about half a century ago.

Spatial planning is a very costly business. Maintaining just one type of restricted area, the 'national landscapes', costs 418 million euros each year (Rijksoverheid, 2011). This indicates that the total amount spent each year is way higher. There is no consensus on the usefulness of spatial planning. Because this is not the goal of this study, arguments in this debate can be found in Rouwendal and van der Straaten (2007).

Although serious amounts of money are involved, evidence of the exact effects of restrictive spatial planning is scarce. Proof of the effects of spatial restrictive policy might help to justify these high investments. Koomen et al. (2008) tried to prove the success of the Dutch spatial planning by observing the land use change between 1995 and 2004 over two periods. Since this is a short period on the timescale of spatial planning, it would be interesting to extend the research period by at least one more period. Because recently new datasets were released it is now possible to do this.

In this research I will try to improve our understanding of the effects of restrictive spatial policy. To do this, I will answer this question:
'What was the impact of restrictive spatial policies on land-use patterns in the Dutch Randstad area between 1995 and 2008?'

I have used a stepwise method to answer this question. Four sub questions were designed:

Sub question #1: What are the current and recent restrictive spatial planning policies in the Netherlands and how do they differ?

Sub question #2: How did the land use within the restrictive zones change, compared to the non-restrictive zones in the period 1995-2008?

Sub question #3: What was the rate of urbanization change over time in the observed period?

Sub question #4: How can the observed changes be seen in the context of the restrictive policies?

When all of the sub-questions are answered I will draw the conclusions by answering the stated main question.

2. Methodology

Literature study

For the first and last sub-question I performed a literature study on the history of the Dutch restrictive spatial policy. Therefore I collected and read several recent spatial planning reports that introduced the various policies which were implemented over time. Furthermore I performed a literature study on the phenomenon of 'National landscapes'.

GIS-Analysis

In order to answer the sub-question #2 and #3 I did a GIS-Analysis, which is the pith of the matter. There are several methods to analyze the success of spatial policy. Many studies, like Nelson (1999; 2004) are using indirect statistics like miles traveled and population density. Since these studies lack a component which exactly measures the urbanization, this study uses a different method. Like Pena et al. (2007) this study uses remotely sensed, rasterised datasets as base for the analysis. The advantage of this method is that the actual land-use can be observed in several different time steps.

The research area is the Dutch Randstad area as shown in Appendix A. Some of the areas are overlapping but since these overlaps are rather small compared to the total surfaces, this problem can be considered negligible. This study focuses on five of the 20 National Landscapes. Four of these areas are shown in yellow and the fifth is the Green Heart, shown in green because it is treated separately from the National Landscapes.

The main objective was to get a good overview of the land use changes in the three distinct periods. At the base of the analysis are the LGN (Landelijk Grondgebruik Nederland) datasets and the GIS-program ArcGIS. I used the following datasets; LGN 3 updated (1995), LGN 4(1999), LGN 5 (2004) and LGN 6 (2008). Every dataset originates from two years. Roughly said, the eastern side of the country contains data which is a year older then in the western side (Appendix G). Since this study focuses on the Randstad area, which can be found by no exception in the western part, this causes no problems. As can be seen, the length of the three periods differs. The first period is four years, the second four years and the third again four years. To correct for this, changes per year are calculated.

The used datasets have a very fine resolution with grid cells of 25x25 meters. Each grid cell is assigned to 1 of the 39 land use classes (Appendix B). To get a more clarifying view on the land use I reclassified the 39 classes into 7 main land use classes; built-up, urban green, greenhouse horticulture, agriculture, infrastructure, nature and water. The exact reclassification can be seen in Appendix D and E. With just seven classes left it was possible to make useful difference-over-time-maps. With the four different datasets I was able to produce three difference maps which each show the land use changes in the period between the releases of the different datasets.

With the ArcGIS tool 'Model builder' a model was created to produce the difference maps. In the following section the model is explained. At first I reclassified each of the four datasets. Now each grid cell has a value between 1 and 7, standing for the 7 different land use classes (i.e. Appendix C). After this process I used the ArcGIS tool 'Map Algebra' to multiply the reclassified 'LGN 3u' file by 10 (so the values are now 10, 20 up until 70) and add this up with the reclassified 'LGN 4' dataset.

This calculation provides a new map with values between 11 and 77. The first figure stands for the original type of land use and the second number of the land use after the first period. Each value stands therefore for a certain type of land use change. The grid cells with the values 11, 22, up till 77 experienced no land use change. Since land use change processes are usually relatively slow, this category is the largest one. This process is repeated two more times with other input datasets to get a difference map for every period. The data of each difference map was then exported to a Microsoft Excel sheet. In Excel I made some extra calculations of, for example, the speed of urbanization per year. So far I treated the Netherlands as a whole. For the GIS-analysis this was not sufficient. Information about restricted and non-restricted zones was needed to compare these two types of areas. Therefore I used the Raster Calculator of the Spatial Analyst extension to calculate the difference map within an overlay of, for example, the Green Heart area. The land-use changes of the same areas were calculated for all the three periods. All these calculations were exported to Excel to make some more calculations and get a clarifying overview of the differences in land use change over the years. When all the data was put together in an Excel sheet the GIS-analysis was finished. A flowchart of the GIS-analysis can be seen in Appendix F.

3. Results

3.1. An overview of the recent spatial planning policies and the differences between them.

The Netherlands has a tradition of spatial planning which goes back to as far as 1958. The first report on spatial planning (RNP, 1958) is followed by not less than eight reports. The last report (VROM et al., 2004) is called 'Nota Ruimte' and is the one which is still in business. Over time there were many changes in the spatial planning but the goal of maintaining the specific urban configuration in 'the Randstad' is at the essence of every single report. This configuration is so specific because 'even the most densely populated western part of the country can be characterized as a cluster of towns and open spaces'. (Koomen et al., 2008) In the 'Eerste nota ruimtelijke ordening' (V&B, 1960) and the 'Tweede nota ruimtelijke ordening' (V&RO, 1966) the idea of a central green place (Green Heart) surrounded by clusters of cities which are in turn divided by 'open' patches of land (Bufferzones) to prevent the cities to grow into one big metropolis, were formalized. As said this way of spatial planning is, with some minor changes, still in use.

Next to similarities there are a lot of differences in the spatial planning reports over the years. I will now briefly discuss the main points of the most important spatial planning reports. Besides the previous discussed ideas, the 'Tweede nota ruimtelijke ordening' in 1966 came up with the idea of 'bundled de-concentration'. At the time when it was written, population was expected to grow to 20 million in 2000, which would mean an enormous growth compared to the 12.3 million (CBS statline, 2011) inhabitants of 1966. This enormous expected increase of inhabitants would have a devastating effect on the Randstad and her 'open' characteristics were the thoughts at the time. To prevent this, there were some 'growth centers' assigned (groeikernen) outside the original ring of cities where a large part of the expected growth could take place. This is known as bundled de-concentration. (Informatie- en Kenniscentrum Ruimtelijke Ordening, 2011)

At the time of the 'Derde nota ruimtelijke ordening' (V&RO, 1973-1983) the phenomenon of sub-urbanization was at full speed. To prevent a widespread of new small towns there were, in subsequence of the Tweede Nota Ruimtelijke Ordening, 11 growth centers assigned.

In 1988 the 'Vierde nota ruimtelijke ordening' (VROM, 1988) was planned to be formalized. This report contained a vision on the next century for the first time. Since the Dutch administration went down just before the formalization of the report, this formalization never happened. Instead there was a new report formed by the next administration; 'Vierde nota ruimtelijke ordening extra' or VINEX (VROM, 1994). Due to environmental issues people started thinking of the consequences of the spatial configuration for the environment. The growing distance between the places where inhabitants lived and worked contributed to environmental issues and therefore the aim was to decline this distance. Space for new residences and companies should be found inside or at the edge of existing cities. Only if this was not possible there could be urban expansion outside these areas (IKCRO, 2010).

This idea has led to the assigning of multiple locations for new residences (called 'Vinex wijken') for as far as 2005. The actualization of these locations for the period 2005-2010 was formalized in the 'Vierde nota ruimtelijke ordening actualisatie' or VINAC (VROM 1999).

As said, the current spatial planning policy is documented in Nota Ruimte (VROM et al. 2004). Compared to the previous reports there is a sort of concept change, in the report noted as follows: Less governmental rules, more space for de-central decision making, less 'permitting planning' and more 'developing planning'. Koomen et al. stated: 'The latest planning report has shifted its attention from restriction to stimulation, offering regional and local governments, private organization and enterprises more freedom to commonly reach their goals.'

Besides the mentioned shift in the most recent spatial planning report there is another interesting point; the introduction of 'National landscapes'. Natural landscapes are 'internationally rare landscapes which include especially specific types of cultural landscapes' (Rijksoverheid, 2011). At this moment there are 20 areas assigned as National landscape, an area of about 20% of the Netherlands (Rijksoverheid, 2011).

Very recently (June 14th, 2011), the minister of Infrastructure and Environment, presented the design for a new spatial policy: 'Structuurvisie Infrastructuur en Ruimte' (IM, 2011). Within years this will be the formalized policy and will therefore cause some changes. This document shift even more responsibilities from the National government to the local governments. National Landscapes are no longer a National issue but become an issue of the provinces. Furthermore guidance on urbanization like agreements on percentages of building inside current urban area and the agreements on the bufferzones will be stopped.

3.2. Comparison of the land use change of restricted areas and non-restricted areas in three periods between 1995 and 2008.

The pixel by pixel comparison of the four datasets shows that a total of 129,000 ha changed between 1995 and 2008, this is about 4% of the total surface of the Netherlands. The speed of land use change is decreasing. The first period contained an average of 0.43% change per year, the second period 0.33% and the third period only 0.16%.

These are average figures for the Netherlands as a whole but there are big differences between regions. The Green Heart for example, encountered changes in just 2.2% of its surface. As Koomen et al. already stated: 'the vast majority of the converted land had an agricultural function and it mainly changed into potential urban uses (urban green), actual urban uses (built-up) and nature. This points at the dominant trends in recent land-use changes: an increase in (potential) urban areas and nature at the expense of agricultural land'. This premise still holds after considering the new period.

Tables 1 and 2 show the land use transitions for the Green Heart and the non-restricted parts of the 'Randstad'. A comparison of these two areas could give good insights of the effectiveness of the restrictive policies. Since the Randstad is the most

densely populated area in the Netherlands, the non-restricted areas of it are a null-hypothesis if the Green Heart (restricted zone) is compared to it.

Non-restricted zones of the Randstad

I will start with an analysis of the land use change in the non-restricted zones of the Randstad and follow up with the analysis of the various restricted zones and discuss the differences between them. The non-restrictive area of the Randstad has a total surface of about 364,000 ha. The total changed surface in the three periods together is about 6.8%. Just as the Netherlands this particular area shows a declining rate of change per year. In the first period there was an average speed of change of 0.64% per year. In the second period this average is about 0.62% and in the last period it drastically declined to 0.29%. The largest contributors to this change are actual and potential urbanization. The most drastic change in speed can be observed for the actual urbanization category; this category is slowed by factor 10 in the third period compared to the second period. The total urbanization rate (potential + actual urbanization) is 4.6%. Nature development contributes 1.16%, which is 0.09% each year.

Table 1, the most important land-use transitions in the non-restricted areas of the Randstad

Land use change		Non-restricted area								
		Period 1			Period 2			Period 3		
From	To	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)
(1) Actual urbanisation		1,482	0.407%	0.102%	3,568	0.981%	0.245%	326	0.089%	0.022%
Agriculture	Built-up	514	0.141%	0.035%	462	0.127%	0.032%	11	0.003%	0.001%
Nature	Built-up	45	0.012%	0.003%	105	0.029%	0.007%	0	0.000%	0.000%
Urban green	Built-up	507	0.139%	0.035%	2,219	0.610%	0.152%	7	0.002%	0.000%
Agriculture	Infrastructure	77	0.021%	0.005%	138	0.038%	0.009%	32	0.009%	0.002%
Agriculture	Greenhouse horticulture	340	0.093%	0.023%	644	0.177%	0.044%	276	0.076%	0.019%
(2) Potential urbanisation		4,792	1.317%	0.329%	4,292	1.180%	0.295%	2,334	0.641%	0.160%
Agriculture	Urban green	4,634	1.274%	0.318%	3,995	1.098%	0.274%	2,235	0.614%	0.154%
Nature	Urban green	158	0.043%	0.011%	297	0.082%	0.020%	99	0.027%	0.007%
(3) Nature development		1,652	0.454%	0.114%	1,898	0.522%	0.130%	655	0.180%	0.045%
Urban green	Nature	10	0.003%	0.001%	115	0.032%	0.008%	6	0.002%	0.000%
Agriculture	Nature	1,633	0.449%	0.112%	1,657	0.455%	0.114%	639	0.175%	0.044%
Water	Nature	8	0.002%	0.001%	126	0.035%	0.009%	11	0.003%	0.001%
(4) Minor green transitions		1,339	0.368%	0.092%	1,602	0.440%	0.110%	873	0.240%	0.060%
Agriculture	Water	172	0.047%	0.012%	209	0.057%	0.014%	124	0.034%	0.009%
Nature	Water	21	0.006%	0.001%	103	0.028%	0.007%	0	0.000%	0.000%
Nature	Agriculture	0	0.000%	0.000%	67	0.018%	0.005%	0	0.000%	0.000%
	Other changes	1,146	0.315%	0.079%	1,224	0.336%	0.084%	749	0.206%	0.051%
Total change (ha)		9,265			11,360			4,187		
Total surface (ha)		363,834			363,834			363,834		
Land-use dynamics (change/surface in %)		2.55%			3.12%			1.15%		
Period length(years)		4			5			4		
Change/year		0.64%			0.62%			0.29%		

Green Heart

The Green Heart has a surface of 187,000 ha. As said previously, the total changed surface is 2.2%. There is also a declining pattern of the speed of the total change. The first period encountered 0.21% change per year, the second period 0.20% and the last period 0.10%. Unlike the non-restricted areas of the Randstad the two forms of urbanization are not the largest contributors. Potential urbanization and nature de-

velopment are the main contributors to the change. Nature development contributes 0.70% change, which is about 0.05% per year. The total urbanization rate is 1.31%. This is an average of 0.1% urbanization each year, which is more than three times slower than in the non-restricted areas of the Randstad.

Table 2. The most important land-use transitions in the Green Heart.

Land use change		Green Heart								
		Period 1			Period 2			Period 3		
From	To	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)
(1) Actual urbanisation		167	0.089%	0.022%	748	0.400%	0.080%	186	0.099%	0.025%
Agriculture	Built-up	55	0.029%	0.007%	93	0.049%	0.010%	4	0.002%	0.000%
Nature	Built-up	4	0.002%	0.000%	18	0.010%	0.002%	0	0.000%	0.000%
Urban green	Built-up	65	0.035%	0.009%	220	0.118%	0.024%	0	0.000%	0.000%
Agriculture	Infrastructure	10	0.005%	0.001%	144	0.077%	0.015%	77	0.041%	0.010%
Agriculture	Greenhouse horticulture	34	0.018%	0.005%	274	0.146%	0.029%	105	0.056%	0.014%
(2) Potential urbanisation		548	0.293%	0.073%	452	0.242%	0.048%	351	0.188%	0.047%
Agriculture	Urban green	544	0.290%	0.073%	432	0.231%	0.046%	341	0.182%	0.046%
Nature	Urban green	4	0.002%	0.001%	20	0.011%	0.002%	10	0.005%	0.001%
(3) Nature development		657	0.351%	0.088%	491	0.262%	0.052%	154	0.082%	0.021%
Urban green	Nature	0	0.000%	0.000%	11	0.006%	0.001%	3	0.002%	0.000%
Agriculture	Nature	656	0.351%	0.088%	480	0.257%	0.051%	148	0.079%	0.020%
Water	Nature	0	0.000%	0.000%	6	0.003%	0.001%	3	0.001%	0.000%
(4) Minor green transitions		170	0.091%	0.023%	187	0.100%	0.020%	40	0.021%	0.005%
Agriculture	Water	63	0.034%	0.008%	66	0.035%	0.007%	28	0.015%	0.004%
Nature	Water	3	0.001%	0.000%	2	0.001%	0.000%	9	0.005%	0.001%
Nature	Agriculture	0	0.000%	0.000%	40	0.022%	0.004%	2	0.001%	0.000%
	Other changes	104	0.056%	0.014%	78	0.042%	0.008%	99	0.053%	0.013%
Total change (ha)		1,542			1,879			731		
Total surface (ha)		187,201			187,201			187,201		
Land-use dynamics (change/surface in %)		0.82%			1.00%			0.39%		
Period length(years)		4			5			4		
Change/year		0.21%			0.20%			0.10%		

Bufferzones

Another form of restricted area in the Randstad are the 'Bufferzones'. These zones have (as shown in table 3) a total surface of 75,000 ha and the total changed surface is 4.6%. Again the declining speed of changes can be seen; 0.50%, 0.46% and 0.09% change per year in the consecutive periods. Just as in the Green Heart the two most important contributors to the change are potential urbanization and nature development. Nature development counted for 1.79% of the change. Remarkable is the total drop of nature development after the second period. This means that the rate of nature development was in the first two periods 0.20% per year and 0.0% in the last period. The total urbanization rate of the bufferzones is 2.23%, an average of 0.17% per year.

Table 3, The most important land-use transitions for the bufferzones

Land use change		Bufferzones								
		Period 1			Period 2			Period 3		
From	To	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)
(1) Actual urbanisation		219	0.290%	0.072%	356	0.472%	0.094%	36	0.047%	0.012%
Agriculture	Built-up	26	0.034%	0.009%	47	0.062%	0.012%	0	0.000%	0.000%
Nature	Built-up	5	0.006%	0.002%	16	0.021%	0.004%	0	0.000%	0.000%
Urban green	Built-up	37	0.049%	0.012%	95	0.125%	0.025%	0	0.000%	0.000%
Agriculture	Infrastructure	17	0.023%	0.006%	56	0.075%	0.015%	1	0.001%	0.000%
Agriculture	Greenhouse horticulture	134	0.177%	0.044%	143	0.190%	0.038%	35	0.046%	0.012%
(2) Potential urbanisation		414	0.548%	0.137%	453	0.599%	0.120%	205	0.271%	0.068%
Agriculture	Urban green	404	0.534%	0.134%	446	0.590%	0.118%	184	0.244%	0.061%
Nature	Urban green	10	0.014%	0.003%	7	0.009%	0.002%	21	0.027%	0.007%
(3) Nature development		673	0.891%	0.223%	676	0.894%	0.179%	0	0.000%	0.000%
Urban green	Nature	4	0.005%	0.001%	80	0.106%	0.021%	0	0.000%	0.000%
Agriculture	Nature	642	0.850%	0.212%	584	0.773%	0.155%	0	0.000%	0.000%
Water	Nature	28	0.036%	0.009%	12	0.015%	0.003%	0	0.000%	0.000%
(4) Minor green transitions		194	0.257%	0.064%	241	0.319%	0.064%	29	0.038%	0.010%
Agriculture	Water	71	0.094%	0.024%	23	0.031%	0.006%	2	0.002%	0.001%
Nature	Water	0	0.000%	0.000%	6	0.008%	0.002%	0	0.000%	0.000%
Nature	Agriculture	6	0.008%	0.002%	55	0.072%	0.014%	0	0.000%	0.000%
	Other changes	117	0.154%	0.039%	157	0.208%	0.042%	27	0.036%	0.009%
Total change (ha)		1,500			1,726			270		
Total surface (ha)		75,553			75,553			75,553		
Land-use dynamics (change/surface in %)		1.99%			2.28%			0.36%		
Period length(years)		4			5			4		
Change/year		0.50%			0.46%			0.09%		

National landscapes

National landscapes are a special category of restrictive area. There are 20 areas assigned as national landscape all over the Netherlands. This analysis is, for the sake of good comparison, focused on the landscapes in the Randstad. These include the following landscapes; 'Hoeksche Waard', 'Arkenheer-Eemland', 'Rivierengebied' and 'Laag Holland'. The exact locations of these areas can be seen in appendix A. Because there are relatively large differences between the landscapes I will first give an overview of the statistics of these four landscapes together and follow up with overviews of the four separate areas.

The total surface of the national landscapes is 280,000 ha. Of this surface 2.7% has been changed over the three periods, a total of 7,600 ha. The average speeds of the change are 0.24%, 0.24% and 0.15% per year in the three successive periods. The most important factors are again potential urbanization and nature development but in this case nature development is the most important. It counts for 1.24% change, which is 0.10% per year. The total urbanization rate is 1.23%, which means 0.09% each year.

I will now discuss the separate national landscapes starting with 'Hoeksche Waard'. On a total surface of 28,000 ha there has been a change of 1960 ha, which is 6.92%. The biggest contributor to this change is nature development. Nature development counts for 4.65%, which is 0.36% each year. Whereas in all the previous mentioned areas the nature development declines (drastically) in the last period, in the

‘Hoeksche Waard’ the percentage of nature development is rising in the last period. The total urbanization rate is 1.84% which means 0.14% each year. In the last period this is only 0.04%.

Arkenheen-Eemland is the next area which will be discussed. This is a small area with a surface of 8200 ha. Of this area 431 ha was changed, which is 5.25%. By far the most important factor in this change is nature development with 4.71% (0.36% per year). The total urbanization rate is 0.50% and thus 0.04% each year. Similar to Hoeksche Waard the urbanization rate diminishes in the last period, in this case to 0.007% per year. Actually, all changes (if there were any) are diminished in the third period.

The following national landscape which will be discussed is ‘Rivierengebied’. This area encountered a total change of 2.71% on a total of 12,000 ha. Here again nature development is the biggest contributor to the change with 1.87% (0.14% per year). Contrary to the former two areas there was a large decrease in the nature development in the third period. The total urbanization rate was 0.38, a yearly change of 0.03%.

The last national landscape in the Randstad is ‘Laag Holland’, with a surface of almost 40,000 ha, the largest area of the four. Laag Holland had a total land use change of 1.40%. The main contributor is rather surprisingly potential urbanization. Nature development is the second most important factor with 0.40%, 0.03% each year. Similar to Rivierengebied the percentage of nature development diminished in period 3. The total urbanization rate is 0.85% (0.07% per year).

Table 4. The most important land-use transitions for the National Landscapes.

Land use change		National Landscapes								
		Period 1			Period 2			Period 3		
From	To	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)	(ha)	(%)	(%/y)
(1) Actual urbanisation		291	0.105%	0.026%	823	0.296%	0.059%	136	0.049%	0.012%
Agriculture	Built-up	104	0.038%	0.009%	82	0.030%	0.006%	6	0.002%	0.001%
Nature	Built-up	6	0.002%	0.001%	26	0.009%	0.002%	0	0.000%	0.000%
Urban green	Built-up	122	0.044%	0.011%	311	0.112%	0.022%	1	0.000%	0.000%
Agriculture	Infrastructure	17	0.006%	0.001%	173	0.062%	0.012%	79	0.028%	0.007%
Agriculture	Greenhouse horticulture	42	0.015%	0.004%	231	0.083%	0.017%	50	0.018%	0.005%
(2) Potential urbanisation		893	0.321%	0.080%	770	0.277%	0.055%	517	0.186%	0.046%
Agriculture	Urban green	888	0.320%	0.080%	750	0.270%	0.054%	500	0.180%	0.045%
Nature	Urban green	5	0.002%	0.000%	20	0.007%	0.001%	17	0.006%	0.002%
(3) Nature development		1,280	0.461%	0.115%	1,403	0.505%	0.101%	751	0.270%	0.068%
Urban green	Nature	0	0.000%	0.000%	57	0.021%	0.004%	3	0.001%	0.000%
Agriculture	Nature	1,280	0.460%	0.115%	1,339	0.482%	0.096%	745	0.268%	0.067%
Water	Nature	0	0.000%	0.000%	7	0.003%	0.001%	3	0.001%	0.000%
(4) Minor green transitions		235	0.085%	0.021%	287	0.103%	0.021%	247	0.089%	0.022%
Agriculture	Water	113	0.041%	0.010%	102	0.037%	0.007%	118	0.043%	0.011%
Nature	Water	5	0.002%	0.000%	8	0.003%	0.001%	9	0.003%	0.001%
Nature	Agriculture	0	0.000%	0.000%	55	0.020%	0.004%	2	0.001%	0.000%
	Other changes	118	0.042%	0.011%	122	0.044%	0.009%	117	0.042%	0.011%
Total change (ha)		2,699			3,283			1,650		
Total surface (ha)		277,932			277,932			277,932		
Land-use dynamics (change/surface in %)		0.97%			1.18%			0.59%		
Period length(years)		4			5			4		
Change/year		0.24%			0.24%			0.15%		

To summarize this chapter I shall state the main differences between the land use change in the non-restricted areas and the restricted areas in the Randstad. At first, the total change in the non-restricted areas is, in general, much higher than in restricted areas. This is the same for the urbanization rates. In restricted areas the most important contributors to the land use change are potential urbanization and nature development. In the non-restricted areas the two forms of urbanization are the most important. This is exactly the big difference between those two areas. The restricted areas can be divided in bufferzones and national landscapes, of which I treat the Green Heart separately. These three areas have all distinct land-use change patterns. The bufferzones have a relatively high urbanization rate in comparison to the national landscapes. This also holds up for nature development. Even within the national landscape there are big differences. In Hoeksche Waard, for example, there is a nature development rate which is ten times higher than in Laag Holland.

3.3. Changes of the urbanization rate over time.

In the previous chapter I mentioned the total urbanization rates for every area. These numbers are the totals of the three periods. In fact, there are big differences between the urbanization rates of the different periods in a single area. I will now give a more specific overview of the urbanization rates of each type of area. To put things in perspective I start with the figures of the Netherlands. Table 4 shows a steady decline in the total urbanization rate (per year) in the Netherlands. This rate is the percentage of land which is converted from one of the other five 5 land use classes to urban green and built-up. Nevertheless there is an increase of the actual urbanization rate in period 2. In the last period there is a sudden drop of the actual urbanization whereas the potential urbanization remains constant.

Table 5. Urbanization rates for the Netherlands.

	The Netherlands		
	Period 1	Period 2	Period 3
Actual urbanization rate (Change/Year)	0.068%	0.088%	0.014%
Potential urbanization rate (Change/Year)	0.157%	0.094%	0.094%
Total urbanization (Change/Year)	0.225%	0.182%	0.109%

Non-restricted zones of the Randstad

Again, I will first discuss the figures of the non-restricted zones of the Randstad (Table 6), which can function as a kind of null hypothesis. The total urbanization rate remains constant in the first two periods and then drops to 0.18% per year. For the actual urbanization the same trend can be seen as for the Netherlands as a whole. The potential urbanization declines in a steady way.

Table 6. Urbanization rates for the non-restricted areas of the Randstad.

	Non-restricted areas of the Randstad		
	Period 1	Period 2	Period 3
Actual urbanization rate (Change/Year)	0.102%	0.196%	0.022%
Potential urbanization rate (Change/Year)	0.329%	0.236%	0.160%
Total urbanization (Change/Year)	0.431%	0.432%	0.183%

Green Heart

As can be seen in table 7, the urbanization rates for the Green Heart are way lower than the rates of the non-restricted areas within the Randstad. The differences between these two areas vary from factor 2 till factor 4. Remarkable is that in the last period the actual urbanization rate of the Green Heart turns out to be larger than in the non-restricted areas.

Table 7. Urbanization rates for the Green Heart.

	Green Heart		
	Period 1	Period 2	Period 3
Actual urbanization rate (Change/Year)	0.022%	0.080%	0.025%
Potential urbanization rate (Change/Year)	0.073%	0.048%	0.047%
Total urbanization (Change/Year)	0.096%	0.128%	0.072%

Bufferzones

The next type of restricted area is shown in table 8: 'bufferzones'. Again there is big decrease of the total urbanization rate in the third period. The decrease of the actual urbanization rate in this period is even more drastically. Practically the same pattern shows up as in the non-restricted areas of the Randstad since the actual urbanization rate rises in the second period and then drops in the third. This rate ends up half the size of the rate in the Green Heart.

Table 8. Urbanization rates for the bufferzones.

	Bufferzones		
	Period 1	Period 2	Period 3
Actual urbanization rate (Change/Year)	0.072%	0.094%	0.012%
Potential urbanization rate (Change/Year)	0.137%	0.120%	0.068%
Total urbanization (Change/Year)	0.209%	0.214%	0.080%

National landscapes

At first I shall give an overview of all of the national landscapes within the Randstad together and afterwards I, just as in the previous chapter, look after the specific landscapes one by one. Table 9 shows that the total of the national landscapes has almost the same pattern as the Green Heart (which is also a national landscape). Even the magnitude is almost the same as in the Green Heart. The biggest difference

is the actual urbanization rate in the third period which is twice as slow in the national landscapes.

Table 9. Urbanization rates for the National Landscapes.

	National Landscapes		
	Period 1	Period 2	Period 3
Actual urbanization rate (Change/Year)	0.026%	0.059%	0.012%
Potential urbanization rate (Change/Year)	0.080%	0.055%	0.046%
Total urbanization (Change/Year)	0.106%	0.115%	0.059%

The national landscape Hoeksche Waard differs from the average because of the diminishing of actual urbanization in the third period. Besides this fact there are no remarkable changes observed (Table 10).

Table 10. Urbanization rates for Hoeksche Waard.

	Hoeksche Waard		
	Period 1	Period 2	Period 3
Actual urbanization rate (Change/Year)	0.070%	0.072%	0.000%
Potential urbanization rate (Change/Year)	0.112%	0.120%	0.040%
Total urbanization (Change/Year)	0.182%	0.191%	0.040%

Table 11 shows that in Arkenheen-Eemland the total urbanization rates are rather small. Just as in Hoeksche Waard the actual urbanization rate drops to zero (actually 0.001%) in the last period. Furthermore, in contrary to the mostly observed trend, there is a decrease in the total urbanization in the second period.

Table 11. Urbanization rates for Arkenheen-Eemland.

	Arkenheen-Eemland		
	Period 1	Period 2	Period 3
Actual urbanization rate (Change/Year)	0.012%	0.026%	0.001%
Potential urbanization rate (Change/Year)	0.064%	0.007%	0.007%
Total urbanization (Change/Year)	0.076%	0.033%	0.008%

In the landscapes 'Rivierengebied' and 'Laag Holland' almost the same patterns as in Arkenheen-Eemland can be seen, so it is unnecessary to treat these areas separately.

After seeing these figures it is clear that there are a few main trends in the rates of urbanization. First of all, in general, the urbanization rates in non-restricted areas are 2 till 4 times higher than in the restricted areas. Furthermore, the total urbanization rate, in general, steadily decreases. As can be seen, the rates clearly do change over the separate periods. The most obvious trends here are the increase of actual urbanization in the second period and the diminishing of it in the third period. In the national landscapes (minus the Green Heart) there is actually no more actual urbanization in the third period. This is certainly different than the periods before.

3.4. The observed changes in the context of the restrictive policies.

In the previous chapters it became clear that different kinds of restricted areas have different land-use change patterns. The question is if these differences might be a coincidence or if these are caused by the spatial restricting policies. In this chapter I shall try to put the observed land use changes and differences between different kinds of areas in the light of the (history of) the spatial restricted planning. I will treat all the observed facts and trends I noted in the last paragraphs of chapters 3.2 and 3.3.

Observations of chapter 3.2

The first facts which were noted are the following: the total change in non-restricted areas in the Randstad is way higher than in restricted areas and this is the same for the urbanization rates. As the name 'restricted areas' already suggests there are rules which intend to prevent some of the possible changes. It is no surprise then that the total change in the non-restricted areas of the Randstad is much higher. Since the idea of the Green Heart and the bufferzones (stated for the first time in the planning policies of the 60's) is to maintain the openness of the landscape in the middle of heavily urbanized areas and prevent this urban area to grow together to one big metropolis, it is not surprisingly that the urbanization rates are higher in the non-restricted than in the restricted areas.

The next observation is that in restricted areas the two dominant factors in the land use change are nature development and potential urbanization whereas in non-restricted areas the two forms of urbanization are dominant. This coincides with the explanation of the previous facts. In addition to that explanation it is important to note that especially for the bufferzones (where the nature development is the highest) the development of recreational possibilities is an intended goal (Rijksoverheid, 2011). Thus, this fact has two explanations; on the one hand the restrictions on urban development cause the absence of 'actual urbanization' in the restricted areas and on the other hand the stimulation of nature development, especially in the bufferzones.

The following fact states that bufferzones have a relatively high urbanization rate in comparison to the national landscapes, which is the same for nature development. Note that both these rates are much lower than for the non-restricted areas. The Bufferzones have by no means the intention to have a large urbanization rate so it seems that this fact is a case of location. Since the Bufferzones are originally designed to separate dense urban areas, the urban pressure is probably much higher in these areas. The difference in the amount of nature development is caused by the difference in intentions. The intention of the National Landscapes is to maintain the specific characteristic of these areas whereas the intention of the Bufferzones is to maintain open spaces and therefore often nature or woodland is developed. The different national landscapes are specifically chosen for a main 'core quality' (Rijksoverheid, 2011). Therefore it seems plausible that in these areas there is less incentive

to develop nature then in the bufferzones. See van Rij et al. (2008) for a more elaborate discussion on this topic.

The last stated fact of chapter #3 is that there are big changes between the different national landscapes. For example, the rate of nature development is ten times higher in Hoeksche Waard than in Laag Holland. In addition to the previous explanation it is possible that there are indeed big differences between the specifically chosen different types of landscapes which are assigned as national landscapes. Hoeksche Waard is well known for her creeks, rivers and delta (Kenniscentrum Nationaal landschap Hoeksche Waard, 2005). Laag Holland is known for a more cultural landscape of medieval agricultural origin (Nationaal landschap Laag Holland, 2011). These differences in core-values could indeed lead to big differences in the land use changes.

Observations of chapter 3.3

The first observation is that the urbanization ratios are about 2 till 4 times higher in non-restricted areas than in restricted areas. This can be interpreted as a clear success of the restrictive spatial policy as was discussed before.

The next observed trend is the decrease in urbanization over time. The most obvious trends here are the increase of actual urbanization rate in the second period and the strong decline of it in the third period. This trend does not match with the restrictive policies which are in business. The most recent spatial planning policy (VROM et al., 2006) awarded more freedom of decision making to the lower level authorities. Since the income of mayors and executive boards is dependent of the amount of inhabitants of the municipality, this can be expected to lead to an increase in, for example, actual urbanization in the Green Heart in the last period. There could be several reasons of the decrease; it might be the case that the time between the new legislation and the date of gathering the data is too short to see the influence of it. Another reason might be that the economical crisis caused stagnation in urbanization. In the discussion section I will elaborate on this issue.

The final observation is that there is no more 'actual urbanization' in the third period in the national landscapes (minus the Green Heart). The explanation is probably the much stricter rules with respect to these areas. The national landscapes were introduced in 2005, just when the last period started, so it is possible that the stop of actual urbanization is caused by the new legislation for these areas.

5. Conclusion and Discussion

Conclusion

As stated in the introduction, the main question is: 'What was the impact of restrictive spatial policies on land-use patterns in the Dutch Randstad area between 1995 and 2008?'

To answer this question I did a literature research on the history of spatial restricting policy in the Netherlands and a GIS-analysis of the land-use change in the Randstad in the mentioned period. To gain more insights, the results of these components were combined in the fourth chapter of the results. All this information provides a good view on the impact of spatial policies in the Randstad area.

Ever since the first Dutch spatial planning policy, it was a goal to maintain the special land-use configuration in the Randstad by assigning the Green Heart as a central green and open space in between urbanized areas. The cities in turn were prevented from growing together by assigning bufferzones. These ideas of how the Randstad should be organized are as fundamental to the land-use configuration of 1995 as to the current configuration.

In the period 1995 until 2008, the spatial planning policies remained the distinct land-use pattern by different restrictions and goals for the different types of area. By having no restricting policy the non-restricted area encountered heavy urbanization. The main goal of bufferzones is to prevent cities to grow together so there is less urbanization there then in non-restricted areas. Furthermore, nature development in the bufferzones is stimulated by the spatial policies. As a result, the nature development rate is relatively high. In the Green Heart the main goal was to maintain the open character of it and thus no heavy urbanization can be seen. Because of the agricultural character of it, which is open too, there was no need to stimulate nature development here.

In 2006 the national landscapes were introduced. The goal of these national landscapes is to maintain the special characteristics of the specific area (which can be very different for every area) and therefore urbanization is not wishful. As the results of the GIS-analysis shows, there was no actual urbanization in the national landscapes in period three. This suggests the spatial policy had a direct and desired effect.

In conclusion I can say that spatial restrictive policy had a great impact on the land-use pattern in the Randstad. It steered urbanization into the most desired areas, maintained the open character of the Green Heart and stimulated nature development in several strategic places. This altogether leads to the very distinct land-use configuration we currently see.

Discussion

In general, the quality of the data allowed for a detailed assessment of land-use change. But, as Koomen et al. (2008) stated, around 4% of the observed changes are considered doubtful. This is mostly due to the observation of more than one transition, which is unlikely and thus can be considered as data inconsistencies.

The first point of discussion is one about the type of land-cover data applied in this study. The used datasets provide for each grid cell the land use class which is most apparent in the 25x25 meters area. This type of dataset lacks a density component for urban areas. If for example a block of houses was demolished and replaced by an office building of 20 stages, this would have no consequence in the used dataset. In this way a part of urbanization can not be taken in consideration. More on this topic can be read in Bosma (2011).

The biggest point of discussion is the large difference between the amount of land-use change (especially actual urbanization) in the periods 1 and 2 on the one hand, and period 3 on the other hand. The decline is so large that it seems to be unrealistic. Therefore this decline is probably caused by several factors. In the first place I think of 'data issues'. Alterra, the provider of the LGN datasets, changed her methodology for the realization of LGN6. The themes and geometry are now, for example, based on the Top10vector map (version 2006). Furthermore, urban area is now linked to the files 'Bestand Bodem Gebruik (BBG2003) of CBS and 'Bebouwd Gebied' (BG 2003) of VROM. This resulted in changes compared to LGN5.

For a more detailed information of the datasets I recommend Wit (1999) and Hazeu (2005, 2010). I think these change in methodology caused a large part of the difference between the periods 1 and 2, and period 3.

A second possible factor is in line with the previous point of discussion. Since the Nota Ruimte (VROM 2006) stated the goal of building 27% of the new buildings inside existing urban areas. If this figure is severely higher than in previous periods this could partly explain the decline in the figures for actual urbanization.

Another possible factor could be the economical stagnation of recent years. Although CBS data shows that the development of new houses does not decline (Appendix I). The same holds for the increase of urban area according to CBS data (Appendix H). Since these indicators suggest an increase of urban area, economic stagnation seems less plausible as an explanation for the decrease of urbanization. This makes the first suggested explanation more plausible.

Finally, the upcoming change of policy will be discussed. As chapter 3.1 stated, there will be a major shift of responsibilities from the National government towards the more local governments. This includes the restricted National landscapes. Furthermore the bufferzones will be skipped, so as the percentage of new dwellings which had to be built inside already urban area. This will probably have big consequences for the future land-use patterns in these areas. Since the conclusion of this study was that the restrictive spatial policy had a major influence on the land-use of the future, the probable consequence is that the National landscapes and bufferzones will encounter a higher urbanization pressure then before.

6. Reference list

Bosma, A. (2011) Building within built-up area in the Haaglanden. In progress.

Informatie- en Kenniscentrum voor de Ruimtelijke Ordening (2011) Geschiedenis. Available at: http://www.ikcro.nl/geschiedenis_ro.htm (Accessed: June 2, 2011)

Kenniscentrum Nationaal Landschap Hoeksche Waard (2005) Ontstaan van de Hoeksche Waard. Available at: http://www.natlan.nl/index.php?option=com_content&task=view&id=55&Itemid=81 (Accessed: June 10, 2011)

Koomen, E., Dekkers, J., van Dijk, D. (2008) Open-space preservation in the Netherlands: Planning, practice and prospects, *Land Use Policy*, Volume 25, Issue 3, July 2008, Pages 361-377

Nationaal Landschap Laag Holland (2006) Kernkwaliteiten. Available at: <http://www.laagholland.nl/kernkwaliteiten> (Accessed: June 10, 2011)

Nelson, A.C., (1999) Comparing states with and without growth management: analysis based on indicators with policy implementations. *Land Use Policy* 16, 121–127

Nelson, A.C., (2004) Urban containment American style: a preliminary assessment. In: Richardson, H.W., Bae, C.-H.C. (Eds.), *Urban Sprawl in Western Europe and the United States*. Ashgate, Aldershot.

Peña, J., Bonet, A., Bellot, J., Sánchez, J.R., Eisenhuth, D., Hallett, S. and Aledo, A. (2007) Driving forces of land-use change in a cultural landscape of Spain, in *Modelling land-use change*, p. 97-116

Rijksoverheid (2011) Nationale landschappen. Available at: <http://www.rijksoverheid.nl/onderwerpen/landschap/nationale-landschappen> (Accessed: June 4, 2011)

Rijksoverheid (2011) Nota Ruimte. Samenvatting. Available at: <http://www.rijksoverheid.nl/documenten-en-publicaties/publicaties-pb51/nota-ruimte-samenvatting.html> (Accessed: June 4, 2011)

Rouwendal, J., van der Straaten, W., (2007) Measuring welfare effects of spatial planning. In: TESS

Van Rij, E., Dekkers, J. and Koomen, E. (2008) Analyzing the success of open space preservation in the Netherlands: the Midden-Delfland case, *Tijdschrift voor Economische en Sociale Geografie* 99 (1): 115-124

Worldatlas (2010) Countries of the world. Available at:
<http://www.worldatlas.com/aatlas/populations/ctypopls.htm> (Accessed: June 2, 2011)

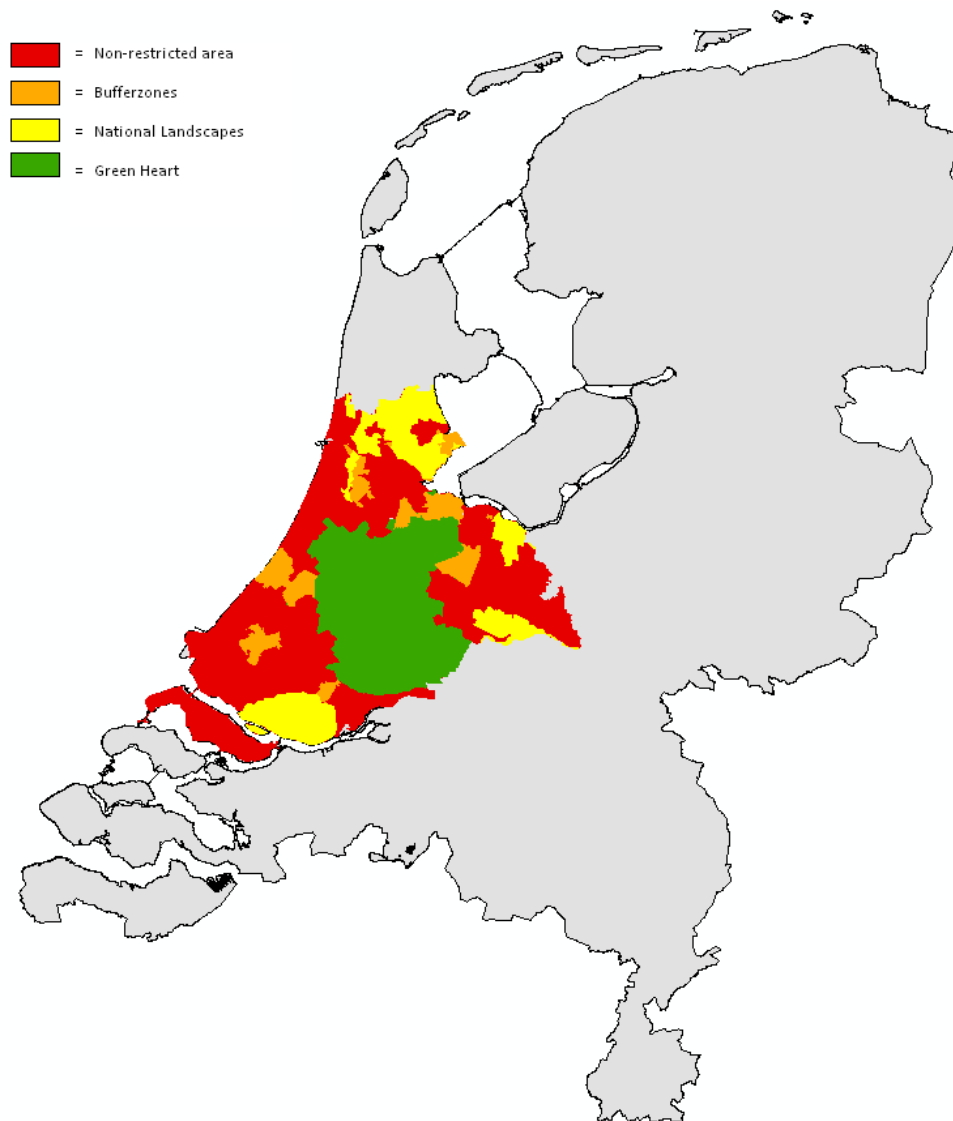
Hazeu, G.W., Schuiling, C., Dorland, G.J., Oldengarm, J. & H.A. Gijsbertse, (2010) Landelijk Grondgebruiksbestand Nederland versie 6 (LGN6). Vervaardiging, nauwkeurigheid en gebruik. Wageningen, Alterra. Alterra-rapport 2012, 132p., 20 figs., 9 tables and 15 refs.

Hazeu, G.W., (2005) Landelijk Grondgebruiksbestand Nederland (LGN5). Vervaardiging, nauwkeurigheid en gebruik. Wageningen, Alterra. Alterra-report 1213, 92p., 18 figs., 11 tables and 11 refs.

Wit, A.J.W. de, Heijden, Th.G.C. van der en H.A.M. Thunnissen, (1999) Vervaardiging en nauwkeurigheid van het LGN3-grondgebruiksbestand. Wageningen, DLO-Staring Centrum, Rapport 663.

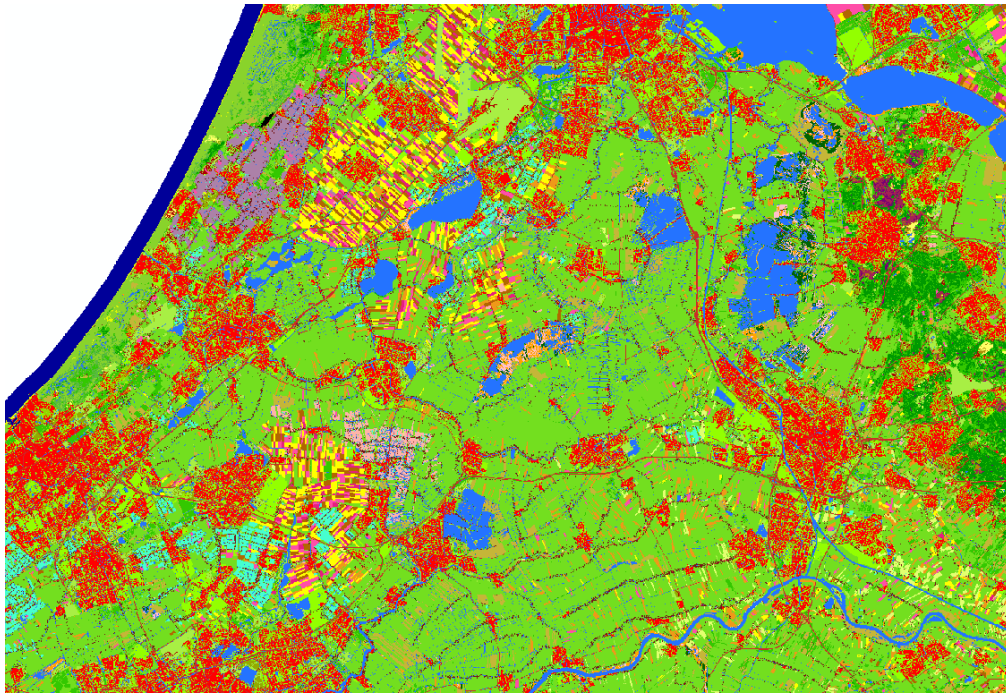
7. Appendices

A. Research area

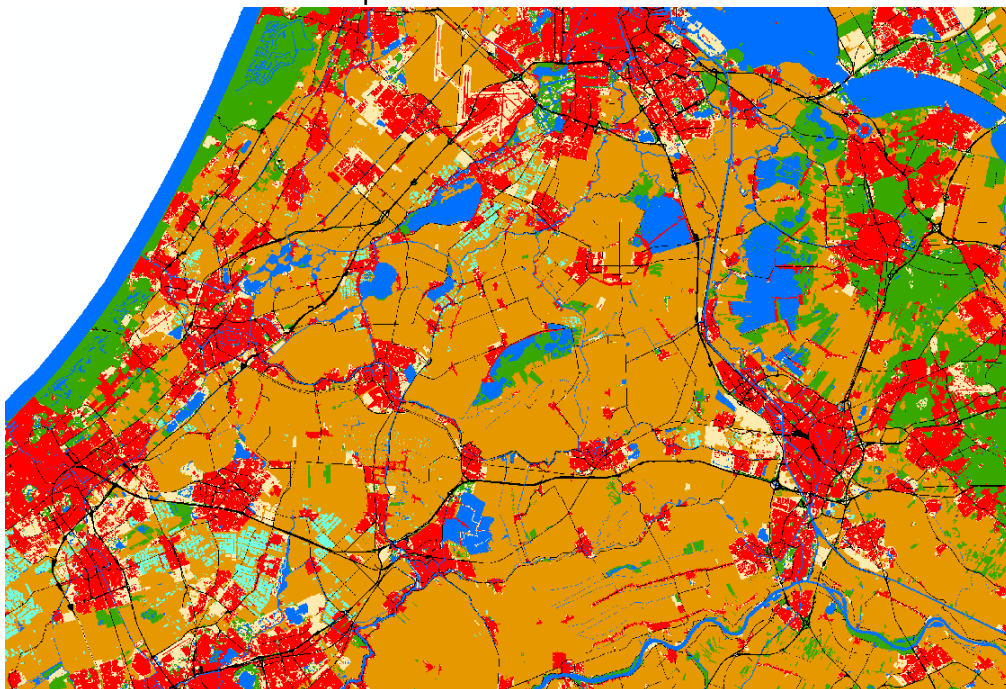


National landscapes from left to right: Hoeksche Waard, Laag Holland, Rivierengebied, Arkenheer-Eemland.

B. Original LGN 6 map (Alterra)



C. Reclassed LGN 6 map



D. Reclass table LGN 4 and 5

LGN 5

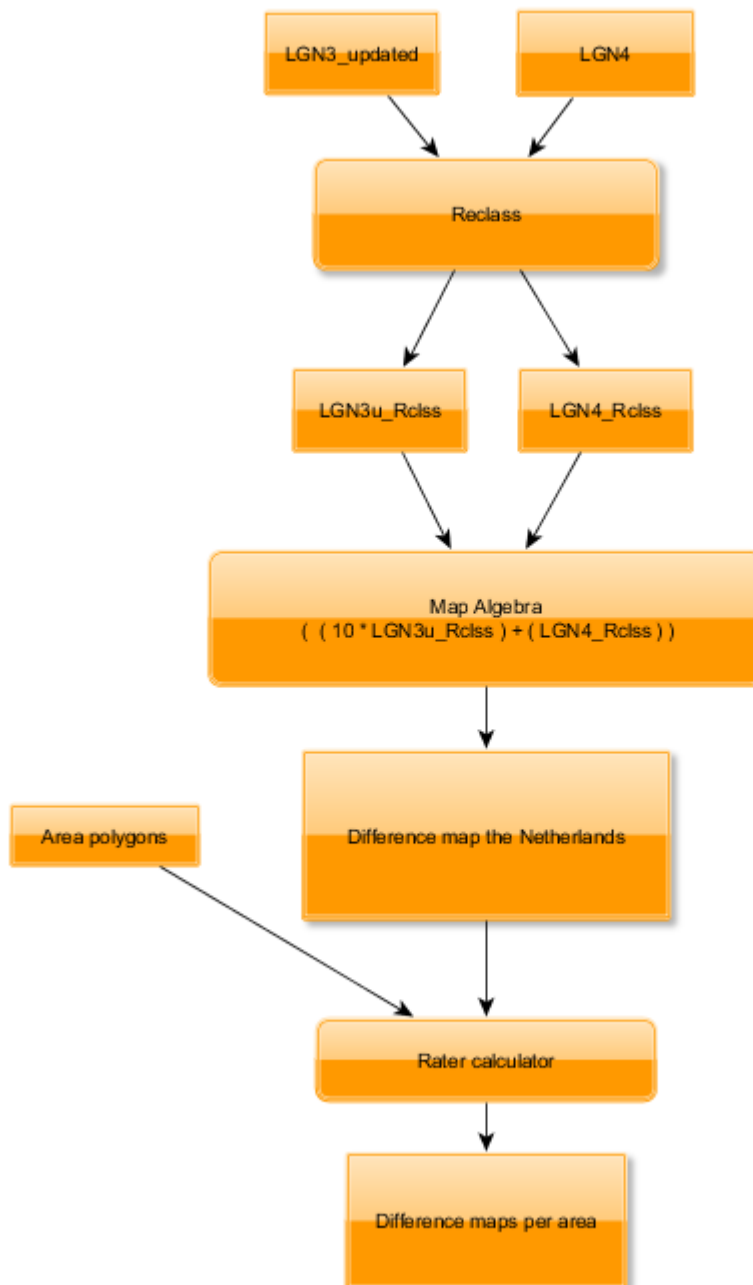
1 gras	4	Agriculture
2 mais	4	Agriculture
3 aardappelen	4	Agriculture
4 bieten	4	Agriculture
5 granen	4	Agriculture
6 overige landbouwgewassen	4	Agriculture
8 glastuinbouw	2	Greenhouse horticulture
9 boomgaard	4	Agriculture
10 bollen	4	Agriculture
11 loofbos	5	Nature
12 naaldbos	5	Nature
16 zoet water	6	Water
17 zout water	6	Water
18 stedelijk bebouwd gebied	1	Urban
19 bebouwing in buitengebied	1	Urban
20 loofbos in bebouwd gebied	5	Nature
21 naaldbos in bebouwd gebied	5	Nature
22 bos met dichte bebouwing	1	Urban
23 gras in bebouwd gebied	7	Urban green
24 kale grond in bebouwd buitengebied	7	Urban green
25 hoofdwegen en spoorwegen	3	Infrastructure
26 bebouwing in agrarisch gebied	4	Agriculture
30 Kwelders	5	Nature
31 Open zand in kustgebied	5	Nature
32 Open duinvegetatie	5	Nature
33 Gesloten duinvegetatie	5	Nature
34 Duinheide	5	Nature
35 Open stuifzand	5	Nature
36 Heide	5	Nature
37 Matig vergraste heide	5	Nature
38 Sterk vergraste heide	5	Nature
39 Hoogveen	5	Nature
40 Bos in hoogveengebied	5	Nature
41 Overige moerasvegetatie	5	Nature
42 Rietvegetatie	5	Nature
43 Bos in moerasgebied	5	Nature
44 Veenweidegebied	5	Nature
45 Overig open begroeid natuurgebied	5	Nature
46 Kale grond in natuurgebied	5	Nature

E. Reclass table LGN 6

LGN 6

1	Agrarisch gras	4	Agriculture
2	Mais	4	Agriculture
3	Aardappelen	4	Agriculture
4	Bieten	4	Agriculture
5	Granen	4	Agriculture
6	Overige gewassen	4	Agriculture
8	Glastuinbouw	2	Greenhouse horticulture
9	Boomgaarden	4	Agriculture
61	Boomkwekerijen	4	Agriculture
62	Fruitekwekerijen	4	Agriculture
10	Bloembollen	4	Agriculture
11	Loofbos	5	Nature
12	Naaldbos	5	Nature
16	Zoet water	6	Water
17	Zout water	6	Water
18	Bebouwing in primair bebouwd gebied	1	Urban
19	Bebouwing in secundair bebouwd gebied	1	Urban
20	Bos in primair bebouwd gebied	5	Nature
22	Bos in secundair bebouwd gebied	5	Nature
23	Gras in primair bebouwd gebied	7	Urban green
24	Kale grond in bebouwd gebied	7	Urban green
25	Hoofdwegen en spoorwegen	3	Infrastructure
26	Bebouwing in het buitengebied	4	Agriculture
28	Gras in secundair bebouwd gebied	1	Urban
30	Kwelders	5	Nature
31	Open zand in kustgebied	5	Nature
32	Duinen met een lage vegetatie (<1m)	5	Nature
33	Duinen met een hoge vegetatie (>1m)	5	Nature
34	Duinheide	5	Nature
35	Open stuifzand en/of rivierzand	5	Nature
36	Heide	5	Nature
37	Matig vergraste heide	5	Nature
38	Sterk vergraste heide	5	Nature
39	Hoogveen	5	Nature
40	Bos in hoogveengebied	5	Nature
41	Overige moerasvegetatie	5	Nature
42	Rietvegetatie	5	Nature
43	Bos in moerasgebied	5	Nature
45	Natuurgraslanden	5	Nature

F. Flowchart GIS-Analysis



G. Dividing of the date of data acquiring (LGN.nl)



H. Built-up area of the Netherlands (CBS statline, 2011)

Built-up(ha)	
1996	3048
1997	no data
1998	no data
1999	no data
2000	3183
2001	no data
2002	no data
2003	3289
2004	no data
2005	no data
2006	3379
2007	no data
	Data of just four provinces available. This shows an approximately equal increase as in the years before.
2008	

I. Amount of new dwellings in the Netherlands (SBC statline, 2011)

New dwellings	
1995	93,836
1996	88,934
1997	92,315
1998	90,516
1999	78,625
2000	70,650
2001	72,958
2002	66,704
2003	59,629
2004	65,314
2005	67,016
2006	72,382
2007	80,234
2008	78,882