Landscape Research Helmond

Geo-processed

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Preface

The Landscape Research Helmond -Geo-processed- report has been made as a thesis Geo-Information Science of 16 credit points. The thesis is a re-assessment of the Helmond research methodology that has been published exactly 30 years ago! It was a great challenge to digitize the model of analysis as it was used in the Landscape Research Helmond in 1974. It was not only because it had to be found out how they calculated the maps and defined the legends back then, but also because of the differences in result that would show up with the digitized version because of 30 years of development that lie between this version and the Landscape Research Helmond. This thesis formed the finishing part of an interspecialisation on GIS in the M-Sc course of Landscape Architecture at Wageningen University.
In the past four months I have worked with great enthusiasm to get the model up and running in the computer. I was really glad when the action-model of the measurement of spaces was able to deal with the influence of relief on the size of spaces.
This report could not have been written without the help of my supervisor Ron van Lammeren, the geodesk, who provided all necessary datasets and John Stuiver, who helped me with calculation-problems in ArisFlow and ArcInfo. Apart from that the other students in the M-Sc room and the coffee machine helped to keep enough energy to bring the thesis to a good result.

Wageningen, January 19th, 2004

Martijn Blaas

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1 Introduction

1.1 Landscape research Helmond

In 1969 the board of the Helmond-municipality asked three experts of the former Communal University of Amsterdam and the former Agricultural High School of Wageningen for advise regarding the intention of making a master plan for the community. Interesting for those days was the intention to start with an elaborate research of the landscape structure of this community. The objectives of this new plan were based on the development of a high quality living-environment in the new to be built residential areas, by using the available qualities of the landscape. In relation to this objective research was necessary to check the possibilities and restrictions of the landscape regarding the intended urbanisation process. As a third point the conclusions of the master sketch for the region of Helmond, that had already been created, had to have a higher level of detail, because of the scale of the master plan. In consideration with the community, it was made a project for M-Sc students of the department of landscape architecture of the former Agricultural High School of Wageningen.

The original problem was defined by “which landscape factors should have influence on the choice of the location for new residential, commercial and leisure areas, regarding the wish to save the existing landscape qualities and values.” When factors have been selected, in what way will they influence? The goal was to find a solution that results in a new form of harmony on the long run, by means of the accepting and guiding of changes in the existing patterns and processes.

The research took place by two perspectives, the ecological and the spatial-visual perspective.

As results an early warning map and a potential residential areas development map were included in this ‘Helmond’ report. By the original report the full analysis was compiled and conclusions were drawn regarding the advice for the master plan of the community.[1]

The general version of the methodology of analysis used can be seen in figure 1.1.

1.2 Problem definition

The traditional intensive way of making an inventory and analysis seems to be no longer in use. The GIS computer programs are very capable of producing reliable landscape analyses these days, provided that one knows how to use the programs and if acceptable data is available. However, the making of analyses in the domain of landscape architecture is still mostly handwork. Reasons for it could be the lack of predefined analysis methodologies (models of analysis) in these GIS-programs. This is, when dealing with the complete landscape analysis on a regional level. With this kind of models it would be very easy to do different types of landscape analyses, without the need to go through complex and time consuming analysis procedures within the program.

1.3 Objective

The contemporary means, geo-data and geo-data processing software, have been developed so extensively that even the complex analyses of the landscape could be supported.

This thesis has the objective to run such kind of complex landscape analysis, based on the original Helmond study, by using the current geo-data and geo data processing software.

To realize this, the following questions should have to be answered:

- Is the original methodology used in the Helmond report understandable and can digital calculation steps be easily extracted from the report;
- What were the original data and can these data be replaced with generic geo-data;
- Is the original methodology translatable into a model of analysis using data-action models;
- Because the goal is to create a generic model of analysis, there is need to implement the relief in the model. The landscape morphological model of Wassink gives a cause for implementing relief because this model deals with volumes, networks and terrainforms.[2] Also in 'The visual and spatial structure of landscapes'[3] appears the need to deal with relief, because in some cases relief will be experienced as mass and in some cases not. This leads to the question whether the influence of relief is calculateable or not;
- Can the results be presented like the Helmond report did;
- Can this way of analysis be compared to the contemporary ways of analysis?

Apart from implementing relief in the model of analysis the original Helmond methodology has not been changed, but only translated into a computer-based model of analysis.
One thing you can't compute is the reality in the field, one will still have to go there and see whether the maps the computer came up with match with the real situation. Of course it is a utopia to think that the model will replace all the hand drawing of maps, but the digital model of analysis will be a great step ahead.
Apart from a check in the field the maps that have been produced with the digital model will also be compared to the maps in the Helmond report. As was to be expected a lot of things happened in the landscape over the last thirty years.

1.4 Outline of the report

When one looks at the analysis-diagram (figure 1.1) all parts of the landscape analysis model of the Helmond report seem to be logically connected. The second chapter explains how the analysis in the Helmond report has been realized and gives information about the translation into a digital environment. It also gives a solution for the integration of relief data. Apart from that the availability of the input-data will be discussed. The paragraphs have been put in the same order as the chapters in the Helmond report. This has been done to make it easy to compare this report with the original Helmond report.
In the third chapter the implementation of the action-model in ArisFlow and ArcInfo will be discussed. It will give the information about decisions made and show relevant tables and maps to explain the implementation in ArcInfo. The complete build-up of the ArisFlow-model can be found in the appendixes 1-5. As mentioned ArcInfo, Arc 8.3 [A], has been used as the program in which all calculations have been done and ArisFlow 2.1 [B] has been used as the dataflow management program. The order of paragraphs is corresponding to the order in the second chapter and in this way to the order of chapters in the Helmond report[1].
In the fourth chapter links with the actual field situation have been made. By means of taking 360 degrees photos, the map of the measurement of spaces has been checked with the real situation. It also gives a direction in how to interpret the maps, which, almost all of them, have been based on grids. The photos are also

evidence for the great differences in results between the output maps of the original Helmond report and the maps created with the ArisFlow-model, because of the 30 years that lie between them. The final chapter will reflect on the model of analysis and give some ideas of what to do next. There, one can also find the link between this model of analysis, which dates from the seventies, and the ‘model’ of analysis as it is used today. This chapter also gives some explanation on the differences that can be seen on the maps of the Helmond report and the maps created with the digital model of analysis. In addition to what has been done in chapter three, the model of analysis for the measurement of spaces has been checked on an area in Limburg, in order to check, whether mass-forming slopes have been dealt with properly.

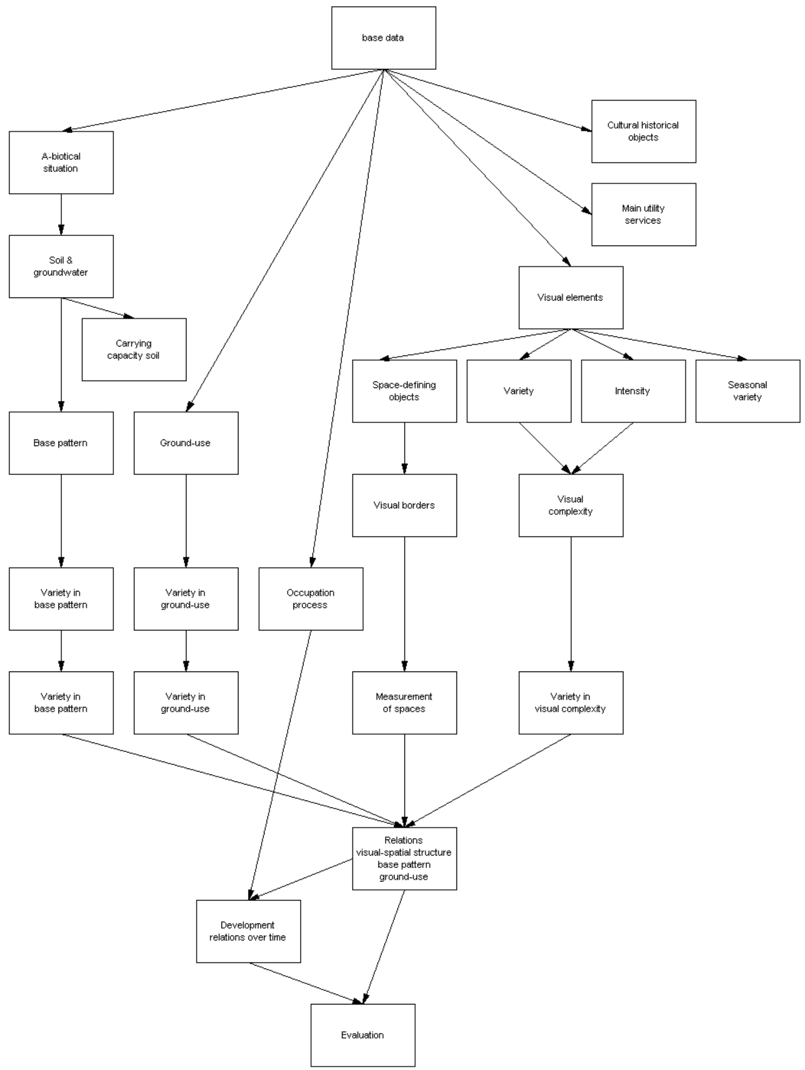


Figure 1.1 model of analysis Helmond

2 Landscape research Helmond

2.1 Introduction

This chapter will give an answer to the question about the existence and availability of input data and the actions to be taken to come to more or less the same result as the Helmond report[1] did. The order of topics in the next paragraphs is corresponding to the order of chapters used in the Helmond report[1]. As far as it seamed logical for this report, the titles of the paragraphs are the same as the titles of the chapters in the Helmond report[1].

2.2 The study area

2.2.1 Relief and geomorphology

The study-area is descending from the southeast to the northwest. The height differences are not very obvious: about 10 metres over a distance of 10 kilometres. The change of the brook valleys to the higher grounds is most of the times very hard to distinguish in the landscape, because the relief is just smoothly sloping. The relief of the surface-sand landscape is just weakly undulating. On some places sand dunes have been formed because of deforesting in former days. They have been reforested with pine forest, but they are still recognizable by the micro relief. The old crop fields are more or less bowler shaped because of they have been fertilized for ages.
For use in the model of analysis, use can be made of the geomorphologic dataset[C] provided by Alterra. It is a polygon-file with per area information about relief, genesis and age in the form of a describing code. For handling the relief there is the AHN[D] (Current Height-data of the Netherlands) provided by the geometrical service of Rijkswaterstaat, which is a part of the Ministry of Transport, Public Works and Water Management. The data consists of grid-cells representing 16 m^2 each with the height in centimetres in respect to the NAP (the Dutch zero-level).

2.2.2 Soil and groundwater

When one looks at the soil map, there is a clear pattern to be discovered. The peat soils and the brook earth soils are in the brook valley. The relatively high-situated areas consist of large connected areas of vague soils, podzolic soils, and earth soils. In between those two there is a transitional area with a great diversity of soil types. There are dryer less fertile soils as well as moistly earth soil types.
The old croplands and the forested podzolic and vague soils have constant very deep groundwater levels throughout the year. The lower grounds have a groundwater table of II or III and form, most of the time, connected strips. This pattern is matching the position of the brook valleys. In the transition zone between the brook valleys and the higher grounds there are very fluctuating groundwater levels, of which some are caused by a lime layer in the ground.
For the model of analysis use can be made of the soil-map 1:50,000[E] provided by Alterra. This map, consisting of polygons, gives spatial information about the build-up of the soil up to a depth of approximately 1 meter below surface and the groundwater table that goes with the soil.

2.2.3 Occupation-process

In this paragraph of the Helmond report[1], the development of the landscape around Helmond is explained, also compared to the present (1974) situation. It is possible to analyse the development over the last century by means of comparing geo-data. The maps that are available for this are the HGN[F] (Historical Land-use of the Netherlands around 1900), which is brand new, the LGN1[G] of 1986, the LGN4[H] of 1999/2000 and the TOP10 vector[I] of 2002. The HGN and LGN are grid-based maps and have a simplified legend in comparison to the TOP10 vector[I], because they have been created from satellite photos. To be able to say something about the development of the landscape over the years it is required to have more or less equal intervals of years between the maps. The problem is, that there is a gap in time between the HGN and the LGN1. The only solution therefore, that is available at the moment, are the forest-statistics 1[J] of 1939-1942. The 'problem' is that this dataset only deals with the forests and nature areas only. Therefore the development of land-use will only be compared for the forests and nature areas of the forest-statistics 1. Datasets for the years 1930 and 1960 are under construction at the moment and will become available in a few years. All maps mentioned have different legends so conclusions cannot be drawn directly. All maps will have to be reclassified to create datasets that should be comparable to one another.
The HGN[F] has been provided by Alterra. It is a raster-based dataset with a resolution of 50 metres. The dataset is based on the topographical Bonne-maps from around 1900. The LGNs 1[G] and 4[H] (National Land-use map of the Netherlands) are also provided by Alterra. The first one is a raster-based dataset with a resolution of 25 metres and 16 legend-categories based on satellite images of 1986. The LGN4 has the same resolution, but has the advantage of a more accurate legend with 39 categories based on satellite images of 1999 and 2000 and other relevant information. The raster-based dataset of the Forest-Statistics 1[J] has also been produced by Alterra. This dataset has been aggregated from images of the First Forest-Statistics (1939-1942) with a resolution of 2.5 metres and 18 legend-categories. Those categories are most about tree species and some nature types. Apart from the forests and some other nature areas also avenues, tree rows and hedges have been taken into account. They have been classified according to the tree-species present.
Because there are some differences in categories, apart from the LGN4 the TOP10 vector will be used. This will be done just to identify which of the two is the most suitable for comparison with 'historical' datasets. The TOP10 vector[I] has been produced by TDN (Topographical Service of the Netherlands). It is a vector-based dataset of the Netherlands on a scale of 1:10.000.

2.3 Special aspects

2.3.1 Carrying capacity of the soil

This carrying capacity had been added to define, where there are limitations for the foundation of constructions on steel in the project area. The carrying capacity has been derived from three parameters, which are the carrying capacity under the 'dirty' top-layer up to a depth of 2.8 metres, the average highest groundwater-level (GHG) and the thickness of the 'dirty' top-layer. For the first parameter, the booklet that goes with the soil-map[4]

only gives the carrying capacity for the very top-layer. Further research or fieldwork has to be done before this map can be completed. The GHG is easily derivable from the groundwater-table, which is on the soil-map. The thickness of the 'dirty' top-layer can be looked up in the booklet[4] where there are tables and explanations about the different soil-types. The word 'dirty' means in this case the organic top-layer of the soil and any other layers that consist of a mixture with organic material.
The soil-map including the booklet[4] will provide the information wanted for this map. Except for the carrying capacity of the layer under the 'dirty' top-layer up to 2.8 metres, which needs further research.

2.3.2 Historical objects

This map shows the objects that are of cultural-historical importance and have to be preserved. In addition to this the known archaeological monuments will also be mentioned. These visible or not have to be preserved. As a background, there is nowadays the archaeological indication map that mentions for every area what the expectation is that something interesting of bygone times may be preserved in the ground.
The map that was available for use in this report was the indication map of archaeological values second generation[K], provided by the government service of archaeological soil-research. This map gives an indication whether something archaeological interesting may be hidden in the soil. There is also the map of archaeological monuments[L] provided by the same government service, which indicates all known archaeological terrains that are worth keeping.
For information about cultural-historical monuments one has to rely on the local, provincial and national government and this information will not necessarily be in a GIS-based format. Because there is no uniform country-covering map for this purpose it will not be taken into further account in this report.

2.3.3 Main utility services

Not the least important is to know where the national and regional pipeline infrastructure, high-tension infrastructure, drinking water pumping areas and garbage dumps are when you want to develop an area. Most of the times there are restrictions for building, digging and planting in the neighbourhood of these elements.
If one has a project somewhere and one has to know the location of pipeline and cable infrastructure one can contact the Klic foundation (www.klic.nl), this is a foundation that has an overview over which cable and pipeline companies have where properties in the ground. Because there is no general geo-data that gives this information this map will be skipped in this report.

2.4 Ecological aspects

2.4.1 Introduction

The model of analysis (diagram 1.1), as described in the Helmond report, seems quite simple, but that is not really true. The model of analysis works with different base maps. It makes that there is an obvious difference between the ecological and the visual-spatial part.

2.4.2 The a-biotic situation

The ecological part is based on the land-use map and the soil-map. This part starts with two general maps about acidity and the fertility of the soil, the information of which can be found in the booklet that goes with the soil-map[4].
Plants cannot live without water, so that is why the relative presence of moist in the soil has been calculated. In that time it was done by means of the groundwater level, thickness of the fertile top-layer of the soil and the capillary rise of groundwater. An assumption made for this map is that the rooting zone of plants is the same as the thickness of the fertile soil layer. With the soils and groundwater tables present around Helmond a table has been made for the relative presence of moist in the soil. If one wants to make this analysis applicable for every place in the Netherlands, then all soil types and linked groundwater levels should be classified like has been done in the Helmond report[1].
To see how the land-uses link to the a-biotical situation the variety in the relative presence of moist in the soil has been calculated. In this way one can decide in which way the human use links with the rough- or fine granulation of the a-biotic factors.
The use of the soil has in the Helmond report[1] been very focused on the biotic situation.
In addition, the map of the watersheds has been put into the report, to give an idea about the hydrologic situation. The map has been constructed by comparing the brook-system with the relief, stating that the surface draining direction is according to the hydrological situation. One adds that for a more detailed picture, fitting with the scale of 1: 25,000, of the groundwater flow, adapted research has to be done.

2.4.3 Land-use

The variety in land use is next to be calculated, to be able to determine in what way the variety in a-biotic factors has led to variety in the land-use by man. This map will be based on both the LGN4[H] and the TOP10 vector[I].

Table 2.1 Intensity and stadium of succession

land-use	intensity of ground-use	stadium of succession of the ecosystem
- build-up area	high	young
- cropland	high	young
- pasture	high	young
- orchard	high	young
- meadow	average	moderately young
- poplar plantation	average	moderately young
- coppice	average	moderately young
- moor	low	ripe
- pine productionforest	low	moderately young
- other pineforest	low	ripe
- coppice, not in use	low	ripe
- alder marsh-forest	low	ripe
- other deciduous forest	low	ripe
- fen	low	ripe

The intensity of the land-use determines the possibilities for ecological development. A high intensity of land-use always accompanies a young stadium of succession, but a low intensity of land-use does not guarantee a ripe stadium of succession. By hand of the present ground-uses in the report a division is made in high, average and low intensity of use, by which also has been searched for the stadium of succession of the accompanying ecosystem. This table will also be used to create the computer-versions of these maps (table 2.1).

2.4.4 Variety in a-biotical factors versus variety in land-use

By means of combination of the variety in the relative presence of moist in the soil and the variety in land-use has been looked to the amount of congruence between the two maps. For this, the legend of the map of the variety in the relative presence of moist in the soil will be taken apart. In this way three maps will be created, representing one of the legend-categories each, which show the variety of land-use present in this category. Whether the result of today will match the conclusions drawn in 1974 will be explained in chapter five.

2.5 Visual-spatial aspects

2.5.1 Introduction

The action model for the visual-spatial aspects has been divided into visual complexity and the measurement of the spaces, for they have somewhat different approaches of the topographical information. The visual complexity deals with all visual elements present in the landscape, while the measurement of the spaces deals with the mass forming elements including relief, which was not accounted for in the Helmond report[1].

2.5.2 Visual complexity

The part of the visual complexity starts with an inventory of the visual elements in the landscape. This is quite easy with the Top10 vector[I], because it only consists of visual elements. Though the legend will have to be checked to exclude small-scale elements, which do not attribute to the complexity of the landscape. Also the legend will be reclassified to combine similar elements (appendix 6). After that the map will be transformed into a raster-based map, which will be divided into variety and intensity. Intensity gives the number of elements present per cell, while variety gives the number of different types of elements per cell. When these values are multiplied with one another one gets the value for visual complexity. This doesn't show a representative map of the truly present visual complexity, because the surrounding raster cells have got a very big influence on the experience of complexity. The map with the visual borders points out which surrounding raster cells are of influence on this. In the report one thinks further research necessary to find out whether and how the influence of the visual borders changes with the distance. By defining the variety in complexity one can get a better insight in the complexity of the landscape anyway. This will be done by means of definition of the amount of different classes of complexity in the cells surrounding the centre cell and has a different class then the centre cell.

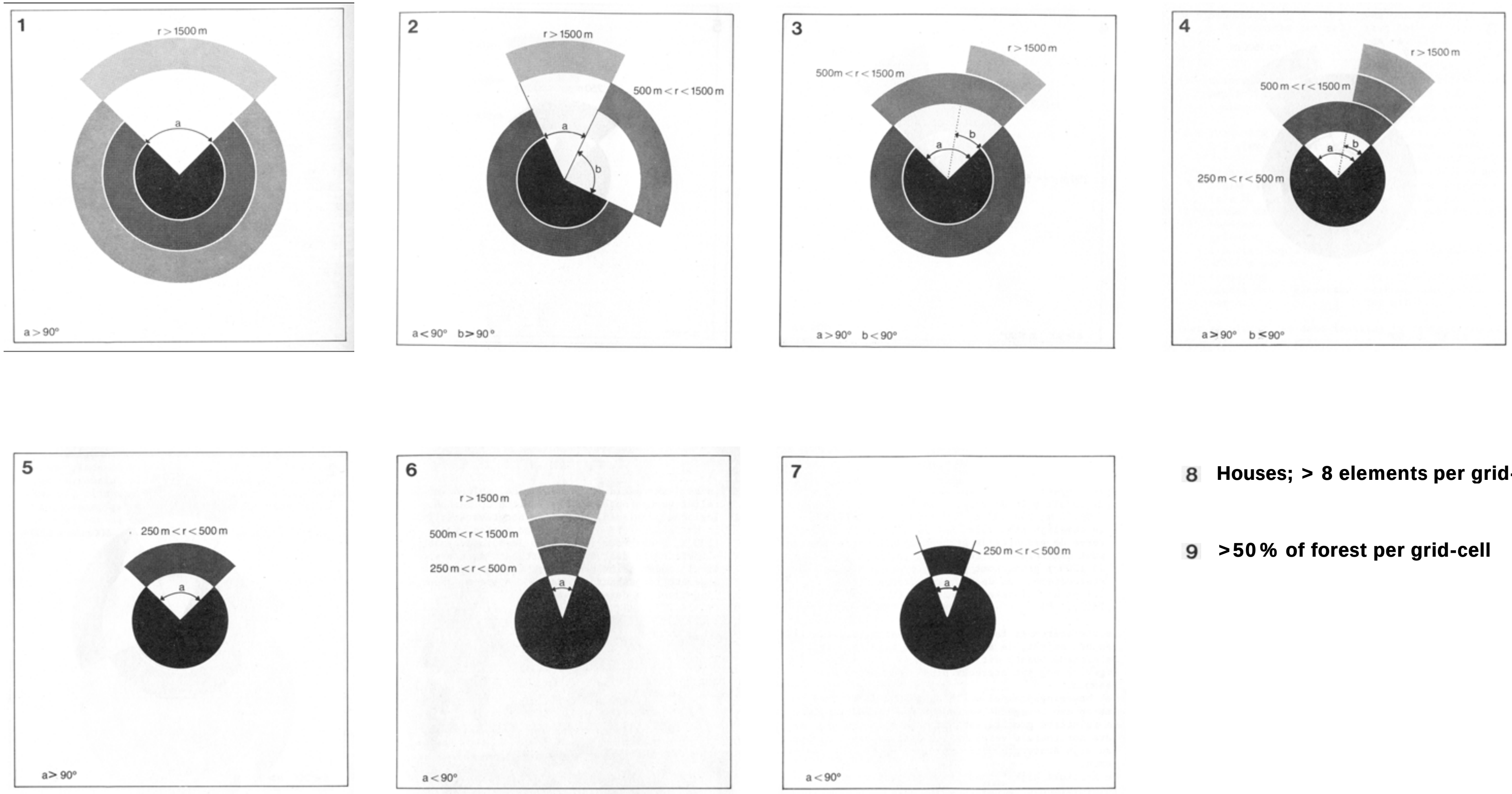
Apart from studying the visual complexity also has been looked to the seasonal variety. This means, research for the spread of through the seasons changing landscape elements like deciduous trees and crops has been done. In the Helmond report[1] one assumes that the seasonal variety is an important aspect of the experience of the landscape, but the report doesn't decide anything on this, neither will this one do.

2.5.3 Measurement of spaces

As a base for this the analogue method, as has been developed by Van de Ham and Iding[5], has been used. As criteria for the categorization of the spatial types therefore, use has been made of:

- The distance on which, seen from the observer's point, the space has its boundary;
- The angle by which the boundary, on a certain distance, is covered;
- The all then not presence of vistas.

The difference between the Helmond report[1] and the research by Van de Ham and Iding is that the Helmond report[1] has based the definition of the types of space purely on map study. This was more or less a try-out, in which one assumed that when the computer technology was ready to handle this it would save an enormous amount of time. But apart from that, it also had a practical reason. The project area was about 10,000 hectares and one used a raster cell-size of 125 x 125 metres, with which a sheer unmanageable amount of fieldwork would have to be done. As a result one first looked which visual barriers were present and in what way they influenced the viewing distance.
In the landscape research of Helmond only the mass forms that really occur in the area are counted for. For this model of analysis the legend of the TOP10 vector[I] will have to be recategorized to define the visual boundaries and the amount of viewing penetration they allow. When one applies the analysis to the TOP10 vector[I] one gets a map that clearly shows the forest and building complexes and also the tree rows, wood rows and lines and clumps of buildings. By means of this result one has defined the measurement of the spaces, using the adjusted viewing-circles of Van de Ham and Iding (figure 2.1). In these viewing circles a buffer has been added, the one of 0 to 250 meters, to be able to define the variety that is present in small-scale landscapes. For the forest and building complexes one has just taken the categories out of the visual boundary map. The relief hasn't been processed, because in the surroundings of Helmond this is of no relevance, but one adds that research is recommended.
Because the idea behind this model is, that it will be applicable for the whole country the relief will be implemented in the model. When one looks at the relief, one has to figure out how relief is being experienced. Based on Dreyfuss's 'The measure of man: human factors in design'[6] the report 'The visual and spatial structures of landscapes' of Tadahiko Higuchi[3] mentions a few things about relief. According to that report The Japanese office of Economic planning classifies inclines of 15 degrees and more as steep slopes. Slopes of more than 15 degrees but less than 35 degrees are regarded as quasi cliffs, and those of more than 35 degrees are classed as cliffs[7]. Tadahiko Higuchi translates this into the following. A slope of less than 15 degrees appears more horizontal than vertical and performs the function of adding depth; inclines of more than 15 degrees begin to function as vertical planes and those of more than 30 degrees might for all particular purposes be considered as vertical.
In the same report there are also some statements about mountains. When the elevation angle of a mountain is in the range of 8 to 10 degrees, the mountain is valued because of its



8 **Houses; > 8 elements per grid-cell**

9 **>50 % of forest per grid-cell**

Figure 2.1 The viewing circles, based on Van de Ham and Iding

appearance as a mountain. In cases where the elevation angle is lower than 5 degrees, it functions more as a variation in the skyline. If the elevation angle is much more higher than 15 degrees, the mountainside becomes a more important element than the mountain as an entity.
For the action model will be counted with the fact, that ascending slopes of more than 15 degrees function as a mass (figure 2.2A). For descending slopes counts, that when the slope is more than 15 degrees descending and there is no mass within 125 meters (one cell size) the view is considered to be infinite. In the model, this will be changed into the buffer 0-250 metres be able to handle the data with more accuracy. Provided that the relief doesn't rise with the same height difference or more within the 1500 meter that forms the outer buffer (figure 2.2B).

2.5.4 Analysis of the visual-spatial build-up

The aim of this analysis is to determine the relations between the visual-spatial build-up of the landscape on the one hand and the landscape developing factors on the other hand and how these relations are linked in time.
In this way the visual complexity and the measurement of spaces are related to the a-biotic pattern, in form of the relative presence of moist in the soil, the variety in this and the variety in land-use. This doesn't mean that these are all the relations, but for the Helmond report it was sufficient. One stated that when computers became able to handle this analysis, it could be done more thoroughly. The relations have been visualized with frequency diagrams and give an impression how the visual-spatial aspects are related to the a-biotical and ground-use aspects. ArcInfo has got a histogram-function, which should be able to handle these frequency diagrams. Another option is to use Excel to create the diagrams.
The next item is a comparison of the situation of 1850 to the situation in 1972. This has been done by means of the comparison between the visual complexity and the a-biotic pattern of both years. Also the measurement of spaces has been compared with the a-biotic pattern.
Currently there is still the problem that useful datasets of 1850 nor in grid neither in vector are present. Besides, the HGN, which is grid-based, lacks the information about avenues, tree rows and hedges, which are important space definers, so it will be skipped.

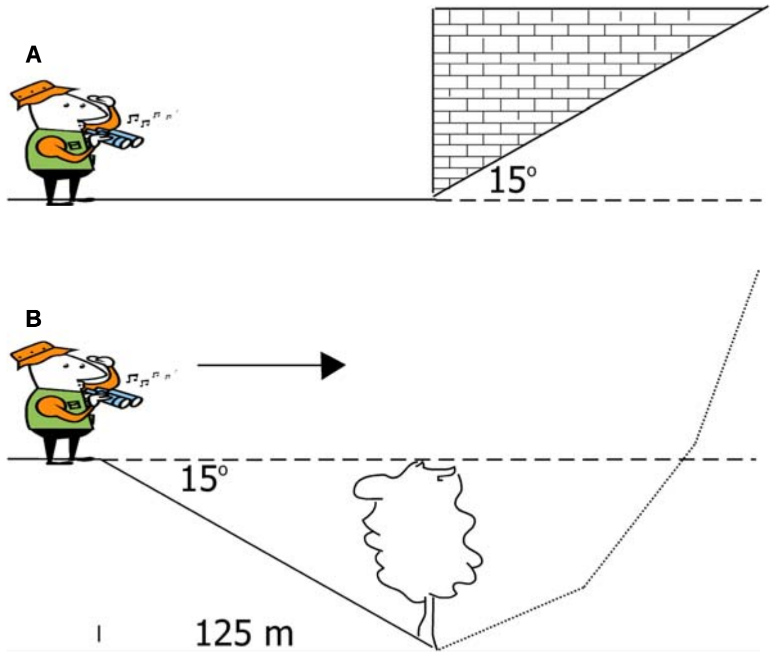


Figure 2.1 How we look at or over relief

2.6 The early warning map

In the Helmond report chapter 8 (Conclusions), two maps are present, the early warning map and the potential residential areas indication map. Only the first one has been digitised, because this one is still part of the analysis, while the second map gives conclusions regarding the building-possibilities. The digital model of analysis should concentrate on analysis, to prevent that maps will be seen as blueprints for the future situation.
As a base for the early warning map the Helmond report states on the ecological base, to prevent that levelling takes place from the a-biotical environment, the difference in a-biotical factors has to be affected as little as possible and it has to be the same for the variety in intensity of land-use. From this point of view the allocation of functions was to be examined by the following:

- The groundwater level: differences in the groundwater level are the main carriers of the variety in ecotypes;
- The fertility of the soil: this is also an important factor considering the variety in ecotypes;
- The age of the present ecosystem: older ecosystems are hard to replace;
- The location in relation to the water-system: in relation to the possible pollution in the ecosystem;
- The variety in a-biotic factors: if the variety in a-biotic factors is high, there is a potential for a high variety in ecotypes.

Based on the visual-spatial criteria the aim is at least to preserve, but preferably to strengthen the identity of the area. From the analysis came forth, that there was a certain congruence between the granulation in the a-biotic pattern and the granulation in the visual-spatial pattern. The Helmond report[1] therefore used the variety in the a-biotic pattern as an examination point for new developments. This, combined with the points of attention of the ecological aspect has led to the creation of the early warning map. Each cell in the area shows which examination points have to be dealt with when developing new residential, commercial, recreational, or nature areas.
The location in relation to the water system comes straight out of the blue. The only map present in the report that should have a link with it is the map of the watersheds, but in the text nothing explains why the division between up and down stream should be there. Because this is such a debatable division it will be kept out of the digital version of the early warning map.

2.7 Conclusions

After examining the whole Helmond report it appears that almost everything is translatable into a digital model of analysis. Only five datasets resulting in maps cannot or can partly be created due to missing input datasets and above all generic input datasets.
Regarding the map 'carrying capacity of the soil' one parameter is not present. Further research or fieldwork has to be done on the carrying capacity of the soil under the 'dirty' top-layer up to a depth of 2.8 metres, which will hopefully result in a generic dataset for use in this model of analysis. The map of the cultural historical objects lacks the presence of generic data about monuments in the area. Only the archaeological aspects can therefore be displayed in this map. The map with the main utility services will not be created, because there is no generic dataset present. Information about pipeline and cable positions can be claimed at the Klic foundation.

The fourth dataset that cannot be created completely is the early warning map. The reason for it is the debate about the division of the brook system in up- and downstream and, which is therefore left out of the calculations behind this map.
A comparison that cannot be made in this report is the one between the current map and the map of 1850 regarding the measurement of spaces. A topographical dataset of 1850 is not yet existing and the HGN[F] (1900) is not detailed enough to give a representative result of the situation at that time.
The maps that will be presented in this report are a visualisation of available generic datasets or are a visualisation of datasets that have been calculated from available generic datasets. For some calculations reclassifications will have to be done on the input-data. The mayor reclassifications have been added as appendixes to this report. For some of the maps from the visual-spatial part of the Helmond report it is the trick to find out how the divisions between the legend-categories had been made in order to be able to reproduce this digitally.
The next chapter will deal with the way the maps of the Helmond report have been changed into digital versions. It will give a clear view of the decisions that had to be made and problems that had to be overcome.

3 The landscape analysis model

3.1 Introduction

In this chapter the creation and implementation of the action-model will be explained. The flowcharts that have been used for this purpose can be looked up in the appendixes 1-5. The order of paragraphs is the same like the previous chapter in order to keep this report clear and easily comparable to the Helmond report.
To create the action-model, ArcInfo, Arc 8.3 [A], has been used as the program in which all calculations have been done and ArisFlow 2.1 [B] has been used as the dataflow management program.

3.2 The study area

The maps op the relief, geomorphology, soil and groundwater tables are quite easy to create, because the datasets don't need analysis to be displayed. The only thing is to find the right column in the table of the dataset in order to display the things one wants in a correct way. For the map of the relief only the legend has to be divided in a certain number of height-ranges. This makes it clearer that the relief is descending towards the northwest.
For the occupation-process some analysis has been done. Where in the Helmond report the process has been told in the text here there will be a more graphical analysis. This has been done by means of comparing the Forest-Statistics 1[J], which only deals with forest and nature, with the HGN[F], LGN1[G], LGN4[H] and the TOP10 vector[I]. First, this is done as a whole. In this way the complete changes in area per legend-category can be seen (figure 3.1). Apart from that also the changes per reclassified legend-category of the Forest-Statistics 1 have been analysed. To be able to compare the maps some reclassification had to be done (appendix 7). This does not mean that the legends are now completely

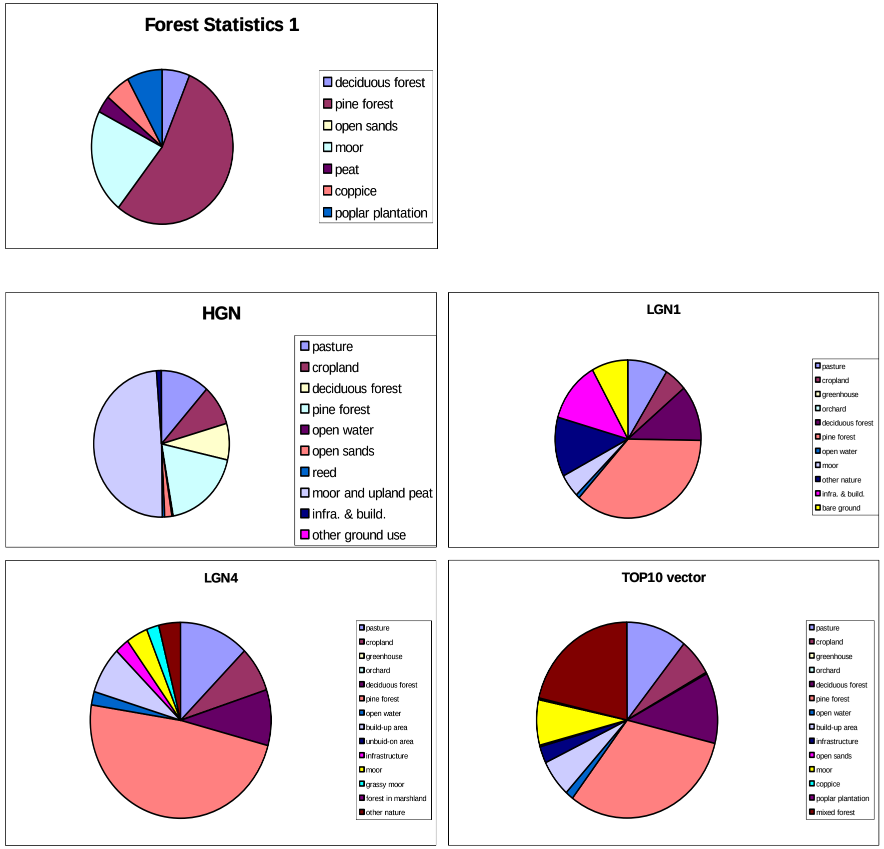


Figure 3.1 Changes in the division of topographical elements over the years over the area defined by Forest Statistics 1

comparable, but it makes comparison more easily to be done.
The input datasets, HGN[F], LGN1[G], LGN4[H] and TOP10 vector[I], have been combined with Forest Statistics 1[J]. The data that results from the combine functions has been copied to excel and changed into pie charts (appendix 8).

3.3 Special aspects

The map of the carrying capacity of the soil cannot be created yet, because the information about the carrying capacity of the soil-layer under the 'dirty' top layer up to a depth of 2.8 metres is not there yet. The action-model has already been created (appendix 5). The only thing that has to be added is the information about this carrying capacity. The other two parameters that form the carrying capacity of the soil together with the previously mentioned parameter have already been implemented into the action-model. How this has been done and the way the thickness of the 'dirty' top-layer and the GHG (average highest groundwater level) is linked to the soil-units has been displayed in appendix 1 and 9. The term 'dirty' top-layer means in this case the organic top-layer of the soil or the part of the soil that contains a mixture with organic material.
For the map with the historical objects three input maps should be used. For this project only the archaeological datasets have been available. The map is just a matter of displaying the different datasets.

3.4 The ecological component

3.4.1 Introduction

This paragraph deals with the implementation of the maps mentioned in paragraph 2.4. The flowcharts that have been created in order to do this can be looked up in appendix 1. An overview of the general flowchart can be seen in figure 3.2. If one is reading this report as a pdf-document one can use the hyperlinks to go to the different flowcharts and one can also run them.

3.4.2 The a-biotical situation

The first map to be created is the map that displays the acidity of the soil. A reclassification of the soil-map according to the table that is given in the Helmond report (table 3.1) has been enough to create the map. The next thing is the amount of nutrients in the soil. In the Helmond report one used a vegetation field survey in comparison with the acidity-map, which led to some differences

Table 3.1 Division of soil-groups according to the acidity

pH	3,5 - 4,5	4,5 - 5,5	5 - 6
soilgroup	vague soils, Z podzolic soils, H peaty earth soils, Zn	thick earth soils EZ	brook earth soils, Zg peat soils, V peaty sand soils, W

Table 3.2 The old and new system of groundwater tables

Gt	GHG-old	GLG-old	GHG-new	GLG-new
I	-	<50	-	<50
II	-	50-80	-	50-80
III	<40	80-120	<25	80-120
III*			25-40	80-120
IV	>40	80-120	>40	80-120
V	<40	>120	<25	>120
V*			25-40	>120
VI	40-80	>120	40-80	>120
VII	80-120	>160	80-120	>160
VII*			>120	>160
VIII	>120	>160		

between the two maps. The map that is given here has been created according to the table (appendix 9) that is derived from the booklet that goes with the soil-map[4].

Apart from the presence of nutrients in the soil the Helmond report also gives a map with the relative presence of moist in the soil. One derived the map from the groundwater tables present in the area and the thickness of the organic top-layer. At that time the division of the groundwater tables was from I (the wettest) to VIII (the driest). A few years after the Helmond report had been made one changed the categories of the groundwater-tables. The Helmond report already gives an idea of what changes were to be expected. Because for the creation of the map of the relative presence of moist in the soil one divided the groundwater-levels V VI and VIII into a dry one (Vd VId VIIId) and a moistly one (Vv VIv VIIIv). The groundwater-tables are somewhat changed as can be seen in table 3.2. The * sign points out the dry version of the groundwater-table. The table in the Helmond report (table 3.3) has been used to classify the soils. For the combined soil-types the item of 'eerste_gwt' has been used out of the table that goes with the soil-dataset. The whole is converted to the grid-environment on a 5x5 m cell basis. Next the focalmajority-function has been used to define the future value of the 125x125 m cells that form the final map.

To create the map of the variety in relative presence of moist in the soil the focalvariety-function has been used and a reclassification has been made of the output-data to keep the same legend like the

Table 3.3 Relative presence of moist in the soil

class	II	III/III*	IV	Vv/V*v	Vd/V*d	VIv	VId	VIIv/VII*v	VIId/VII*d
soilunit	Vc	EZ g21	Hn 21	c Hn 21	Hn 21	c Hn 21	Hn 21	EZ 21	Hd 21
	Vz	EZ g23	Hn 30	c Hn 23	Hn 23	c Hn 23	Hn 23	EZ 23	z Hd 21
	a Vc	Hn 21	p Zn 21	z EZ 21	p Zg 21	EZ 21	Hn 30	z EZ 21	Hn 21
	a Vz	Hn 23	p Zn 30	z EZ 23	p Zg 23	EZ 23	Zn 21	z EZ 23	z Hn 21
	z Vz	p Zg 21			Zn 23	z EZ 21	Zn 23		Zd 21
	v Wz	p Zg 23			p Zn 21	z EZ 23	p Zn 23		Zn 21
	z Wz	p Zn 21			p Zn 23				
	p Zn 21	p Zn 23							
		z Vp							

Helmond report. The legend-categories have been defined by means of counting the variety in the map in the Helmond report, because no mentioning has been made about the definition of the legends of the maps that deal with variety.
The first try to create the map of the watersheds has been done with use of the watershed function. The canals make it a bit troublesome to decide about the source-points to be defined, but eventually the weirs and siphons have been taken. The watersheds calculated appeared to be no more then spots on the map while the rest of the project area remained ‘no data’. It appears that there is no clear flow-direction to be detected and the area only consists of basins. It also made no difference whether one used 125x125 grid-cells, which are a resample of the 5x5 grid-cells, or the 5x5 grid-cells themselves. With the flowaccumulation-function this had been checked, but the result showed that the maximum distance of continuous flow was only 1 or 2 kilometres, while the area has a width of 12 kilometres with a brook that is passing through.
To get a solution for watersheds the borders between the basins were defined with the focalvariety-function. The idea behind this action was that the boundaries between the basins might be the local watersheds. When one combines this result with the brook and canal structure from the TOP10 vector[1], it results in a map that is comparable with the one in the Helmond report[1]. In addition the watershed-cells in the areas of the groundwater tables II, III and

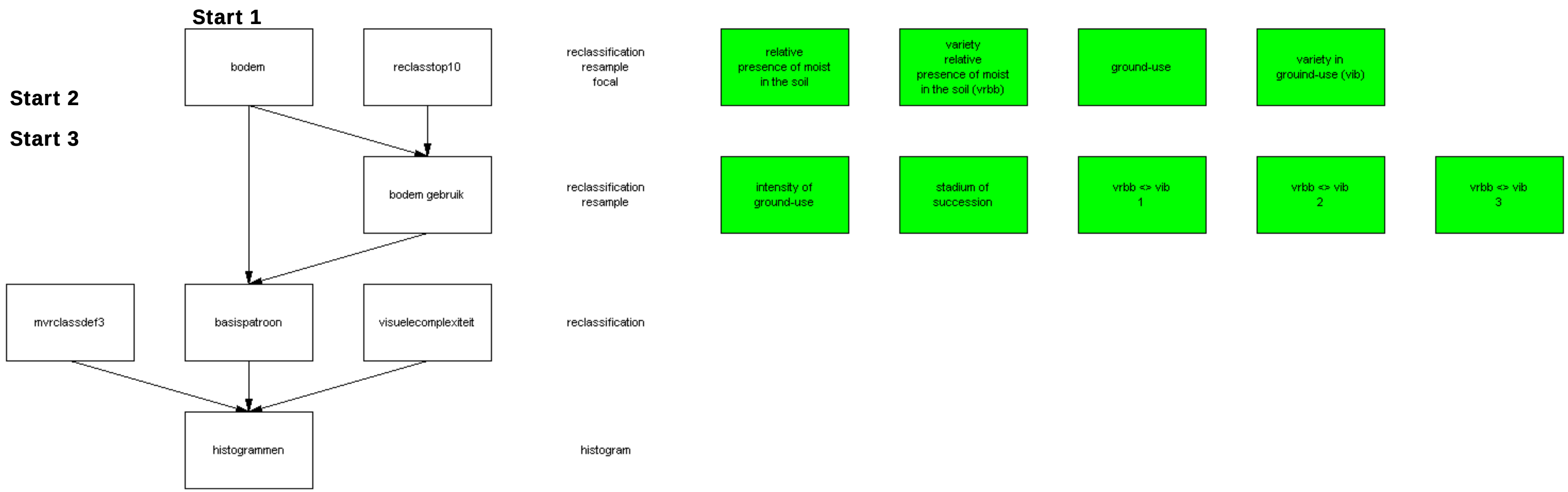


Figure 3.2 Flowchart of the ecological aspects, which contains the different ArisFlow flowcharts and how they are linked together

III* have been removed, because these are the actual brook-valleys and it is not likely to have a watershed in these areas.

3.4.3 Land-use

The first map to be created here is the ground-use map. For this purpose is the LGN4[H] about land-use in the Netherlands. It is a grid-based dataset so the only thing was to resample it to a 125x125 m cell-based map and to do some reclassification to reduce the amount of categories (appendix 7). Like the map of the variety in relative presence of moist in the soil a map of the variety in land-use has been created by means of the focalvariety-function. Because this chapter focuses on ecological aspects, a comparison has been made between the LGN4[H] and the TOP10-vector[I]. The legends of these maps are slightly different from one another in a thematic way, so there should be some difference in the output-maps.
A comparison has been done for the map of the stadium of succession. There are differences as can be seen in figure 3.3. These differences occurred, because the reclassification depends on the legend-categories. For the big red/brown spot, the difference is there because in the top10 vector[I] the legend-category is 'mixed forest' while in the LGN4[H] the legend-category is 'pine forest'. In the reclassification-table, pine forest is considered to be of a moderately young stadium of succession, because no distinction can be made between pine forests meant for production of softwood or pine forest that is no longer meant for production (table 2.1). Mixed forest on the contrary marks clearly that the pine forest has no longer production of softwood as a main function. That is why according to the TOP10-vector[I] the forest has been reclassified into an old stadium of succession.

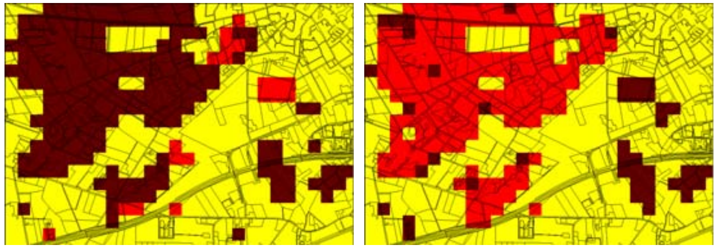


Figure 3.3 Detail from the map of the stadium of succession; Comparison between the LGN4 (r) and the TOP10 vector (l)

Because of the emphasis on the ecological aspect a map of the intensity of the land-use and a map of the stadium of succession have been added. Both maps are related to one another, because a high intensity of ground-use goes with a young stadium of succession, while a low intensity of land-use goes with a riper stadium of succession (table 2.1). On this last statement the pine production-forest is an exception. Although it has a low intensity of land-use, the succession-stadium is considered to be moderately young instead of being in a riper succession-stadium, according to the Helmond report[1].

3.4.4 Variety in a-biotical factors versus variety in land-use

By means of selecting, each of the three legend-categories of the map of the variety in the relative presence of moist in the soil is taken apart. Next, the data has been changed to zero and then combined with the variety in land-use with the maximum-function. From the results one can now draw conclusions regarding the relation between the variety in relative presence of moist in the soil and the variety in land-use.

3.5 *The visual-spatial component*

3.5.1 Introduction

This part deals with the visual complexity and the measurement of spaces. The flowcharts that go with this part of the digitalisation can be found in the appendixes 2 (visual complexity), 3 and 4 (measurement of spaces). The general flowcharts have been displayed throughout paragraph 3.5. These flowcharts have, when one is reading this report as a pdf-document, hyperlinks to the actual flowcharts.

3.5.2 Visual Complexity

The complexity is defined by the intensity of and the variety in visual elements, out of which the actual landscape is build. According to the list of elements used in the Helmond report a selection and simplification has been made of the units of the legend present in the TOP10 vector[I]. Some elements of the report are split into several elements, because in the field one can clearly see a difference between those elements, for instance the element paved roads in the report has been split into highway, quarter connection road, local road >4m, local road > 2m and country road (appendix 6). The elements that have been used for defining the visual complexity of the project area are listed in appendix 6. For the next step in calculating the visual complexity one column has been added to the tables of the huis, lijn, symb and vlak component of the reselection files of the top10 vector[I], named var.

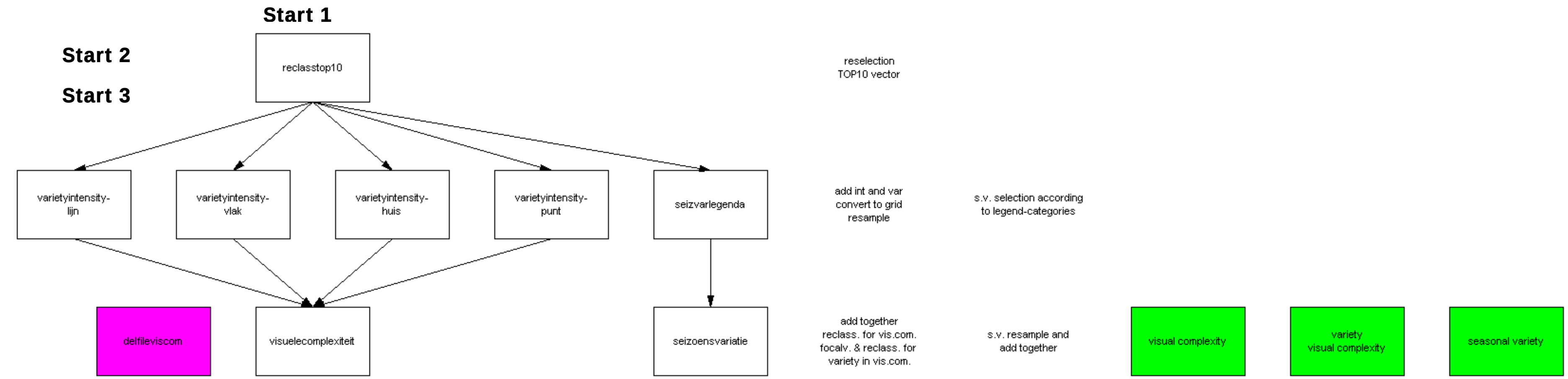


Figure 3.4 Flowchart of the visual complexity and seasonal variety

For the intensity the value of the filename#-column has been used. The values are in an ascending order of one to many. In this way the different elements are still recognizable in the grid. Also the values in the var-column are of a range of one to many, depending on the amount of different elements present.
To define the intensity and the variety per area of 125 x 125 meters, one is forced to use the raster-based environment of ArcInfo. Because the vat-tables, which go with the grids, only contain a value and the count of that value, it is necessary to run the conversion two times in order to create four grids with the filename# as value and four grids with the var-values as value. To prevent the loss of information the four covers have been converted to grids on a 5 x 5 meter cell basis. This makes it possible to define the variety and the intensity per future 125 x 125 meter raster cell. For defining the intensity and variety the focalvariety- function has been used on a 25 x 25 neighbourhood basis. After this the grids have been resampled to the 125 x 125 cell-size.

Table 3.4 Reclassification table visual complexity

low visual complexity	0-10
	11-20
	21-40
	41-80
high visual complexity	> 80

Now this has been done, it is possible to combine the four intensity grids and the variety grids to create one grid with the sum of the variety-values and one grid with the sum of the intensity-values. These multiplied with one another give the visual complexity. To compare the map with the map in the Helmond report[1] a simplification of the legend had to be made, table 3.4.
The same reclassification has been used as in the Helmond report[1].
Like the variety in land-use and the variety in relative presence of moist in the soil the variety in visual complexity has been calculated. The legend of this variety-map has also been defined by means of counting the variety that goes with each legend-category of the map in the Helmond report[1].
The seasonal variety has been calculated according to the table the Helmond report used (table 3.5). With the focalmean-function the division has been made between cropland, deciduous plantation or the combination of both.

Table 3.5 The legend for the map of the seasonal variety

high variety	- cropland + deciduous plantation (+ possible other elements)
	- cropland (+ other elements, except deciduous plantation)
	- deciduous plantation (+ other elements, except cropland)
	- pasture (+ other elements, except cropland and deciduous plantation)
low variety	- other elements (pine forest, buildings, etc.)

3.5.3 Measurement of spaces

The start off is to define the visual borders present in the area. Therefore the legend of the top10 vector has been reclassified (appendix 6). After that the coverages have been converted to grids on a 5x5 m cell-basis. Next, they have been reclassified according to the four legend groups namely: buildings, forest, non-transparent line-elements and transparent line-elements (table 3.6). From each one of the grids next, the legend category has been defined. With the focalsum-function the value of the 125x125 cell has been defined after which the grids have been resampled to that

Table 3.6 scheme for defining the visual borders

	forest	buildings	linear not transparant	linear transparant
lines		sewage-cleaner building, over a road	brick wall hedge dike	tree row
polies	pine forest mixed forest willow coppice poplar plantation orchard tree/shrub nursery fruit orchard deciduous forest	build-up area greenhouse		
houses		buildings high-rise silo		
symbols		windmill pumping-station religious building chapel tower religious building with tower railway station send/receive tower		

cell-size. After that the different grids of, for instance, buildings have been added together and have been reclassified to come to the final legend-categories (table 3.7).

Table 3.7 Reclassification table with the values per legend-category per cell representing the number of 5x5 grid-cells with the theme present in the 125x125 grid-cell

category	description (per gridcell)	statement
1	> 50% forest or other plantation	313-625
2	> 8 elements of houses	81-625
3	10-50% forest or other plantation	63-312
	non-transparant linear mass	14-101
4	5-8 elements of houses	51-80
5	> 1 transparant linear plantation	61-134
6	2-5 elements of houses	21-50
7	1 linear plantation > 100m	20-60
8	< 10% forest or other plantation	1-62
	linear plantation < 100m	4-19
	< 2 elements of houses	1-20
	symbols	4-20
	non-transparant mass < 100m	2-13

And finally the grids have been put together with the minimum-function. Map 1 shows the results.
The creation of the map of the measurement of spaces is somewhat difficult. It has been tried in two ways. The first attempt is a very rough one with the focalsum/annulus-function in combination with the visibility-function. This has been done for both height and mass. The second version is a more accurate one and has been done with the focalsum/wedge-function for mass and the

visibility-function for height. In this version both height and mass are treated with more accuracy regarding the viewing distance and the position of mass-forming slopes both ascending and descending.
The first attempt to create the map of the measurement of spaces starts off by running the visibility-function over the map of the visual borders. For this purpose the build-up areas and forests have been changed into outlines to get rid of noise in the output and because they already form the last two legend-categories of the map of the measurement of spaces. This visibility of the masses serves as a control-file for the focalsum/annulus. The problem of the focalsum-function is that it also counts mass behind mass. In the field there is the situation that one will rarely see the mass that is behind directly visible mass, except when the proportions of that mass are bigger then the mass that is in front of it.
That is why just like in the visibility only the outlines of the build-up area and the forests have been used. The focalsum/annulus-function has been ran four times with different annuli (buffers) according to the viewing distances mentioned in the Helmond report[1]. At the end of the run the cells that already form the last two categories of the legend have been taken out, because they need no further analysis.
The next thing that has been done is the definition of the mass-forming slopes in the relief. The height in the AHN[D] is given in centimetres, so a correction has to be made. When the slopes have been calculated, they have to be transformed from a floating-point grid to an integer grid. This has been done with the ceiling-function. This function has been chosen because the area is not level and there just are no slopes of zero degrees. Next the visibility-function has been run to define the cells that see the mass-forming slopes. In most situations in the Netherlands those

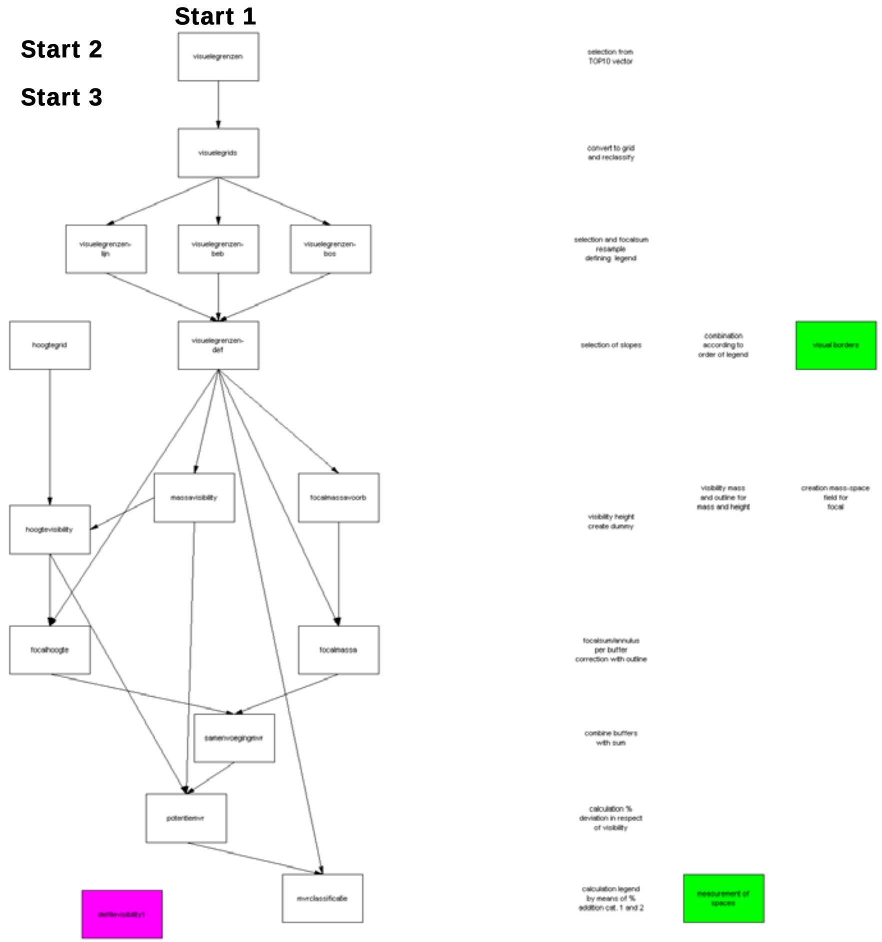


Figure 3.5 Flowchart of the creation of the map of the visual borders and the first map of the measurement of spaces

will not be present. For this reason a dummy-file has been created, in which the whole area has been given the value zero, so nothing changes when it is combined with the mass-values. The focalsum/annulus-function has been run in the same way as with the mass. Only one thing is different. If the selection-file of the slopes bigger than 15 degrees doesn't exist the dummy-file will be used.

Before categorizing the mass-files of the focalsum and the height-files of the focalsum have been added together, so only four files of the different buffers remain. Next, the buffers have been compared to the visibility results in an ascending order. And the percentage of difference with de visibility-values has been calculated. According to these calculated values the categories have been assigned. Because these values are very rough it was not possible to define each of the nine categories of the legend. This is also because the buffers where full circles so variations in viewing distances are very hard to find. The map created this way is not a reliable one (map 2), which can be seen when compared with the other attempt to create the map of the measurement of spaces later on (map 3).

The second version of the map of the measurement of spaces has been based on the focalsum/wedge. With this version of the focalsum-function it is possible to define the legend-categories with different viewing-distances under different angles. Because the viewing-circles of Van De Ham and Iding[5] (figure 2.1) show the angles of 90 and 270 degrees in almost every category the viewing-circle has been divided into four wedges of 90 degrees. Apart from that the starting angle has been put on 15 degrees (with the positive x-axis as 0 degrees counting counter-clockwise) because otherwise a number of grid-cell midpoints would be counted with in more than one wedge. With this starting angle none of the grid-cell midpoints is on the division-line between the wedges in at least the

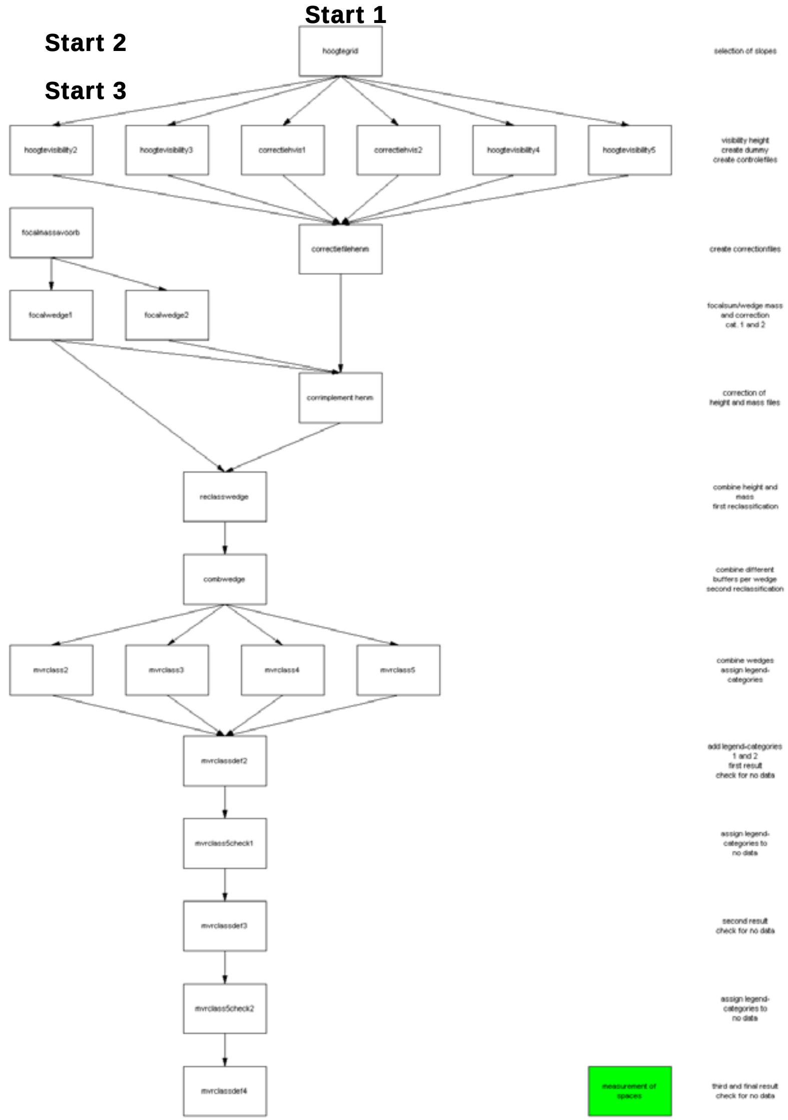
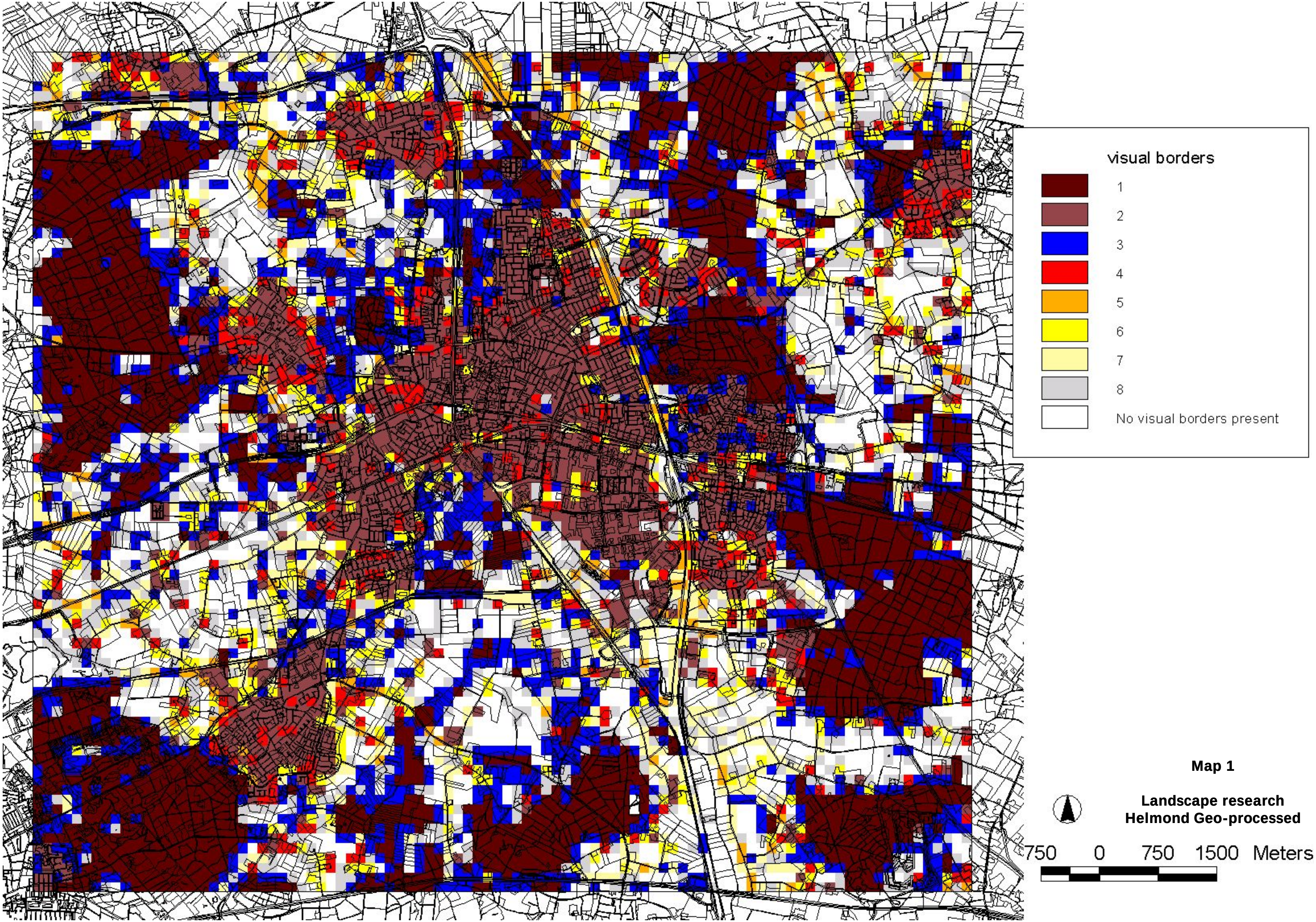


Figure 3.6 Flowchart of the creation of the second map of the measurement of spaces


visual borders
1
2
3
4
5
6
7
8
No visual borders present
Map 1
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters

first two buffers. For the visibility of the mass-forming slopes the visibility-function has been used including the creation of dummy-files. Because there are four wedges and four buffers, the total of files rises to sixteen. The visibility has been done with the resampled AHN^D, so the computer only finds those mass-forming slopes that are actually visible. Where the focalsum/wedge starts the first wedge on 15 degrees counting counter-clockwise, the visibility-function on the contrary has the zero degrees on 12 o'clock counting clockwise, which means that the first wedge is lain between 345 and 75 degrees instead of between 15 and 105 degrees.

Next to these visibilities also eight correction files have been created to detect the descending slopes with more than 15 degrees. This affects the experience of mass forming ascending slopes and the vegetation and housing that is situated in the area. For the creation of these correction-files a few statements have been made: (figure 3.8)

- If there is a descending slope of more than 15 degrees in the first buffer and within the first three buffers there is no ascending mass-forming slope that rises above the level of the descending slope, than the mass-forming slopes of all four buffers under that angle are considered to be of no influence on the visibility in that direction;
- If there is a descending slope of more than 15 degrees in the second buffer and within the second and third buffer there is no ascending mass-forming slope that rises above the level of the descending slope, than the mass-forming slopes in the second till the fourth buffer under that angle are considered to be of no influence on the visibility in that direction;
- In addition to the first statement, mass present in the second till the fourth buffer will be considered to be of no influence, because one can view over it into the very far distance;
- In addition to the second statement, mass present in the third and fourth buffer will be considered to be of no influence, because one can view over it into the very far distance.

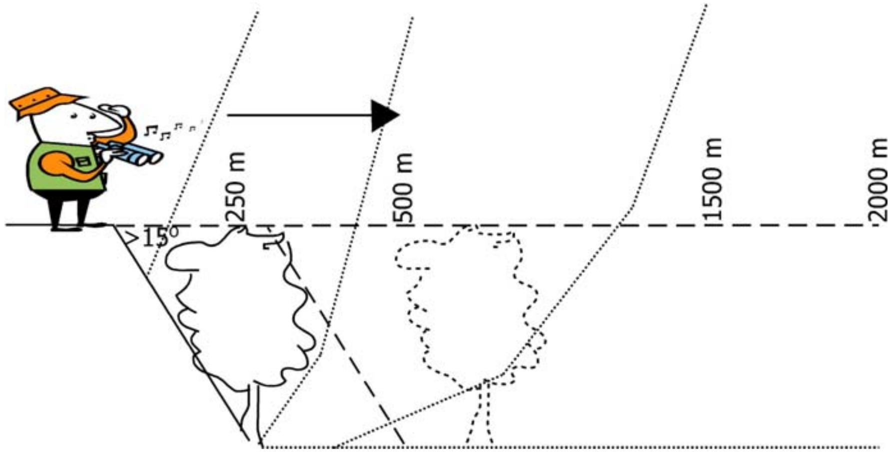
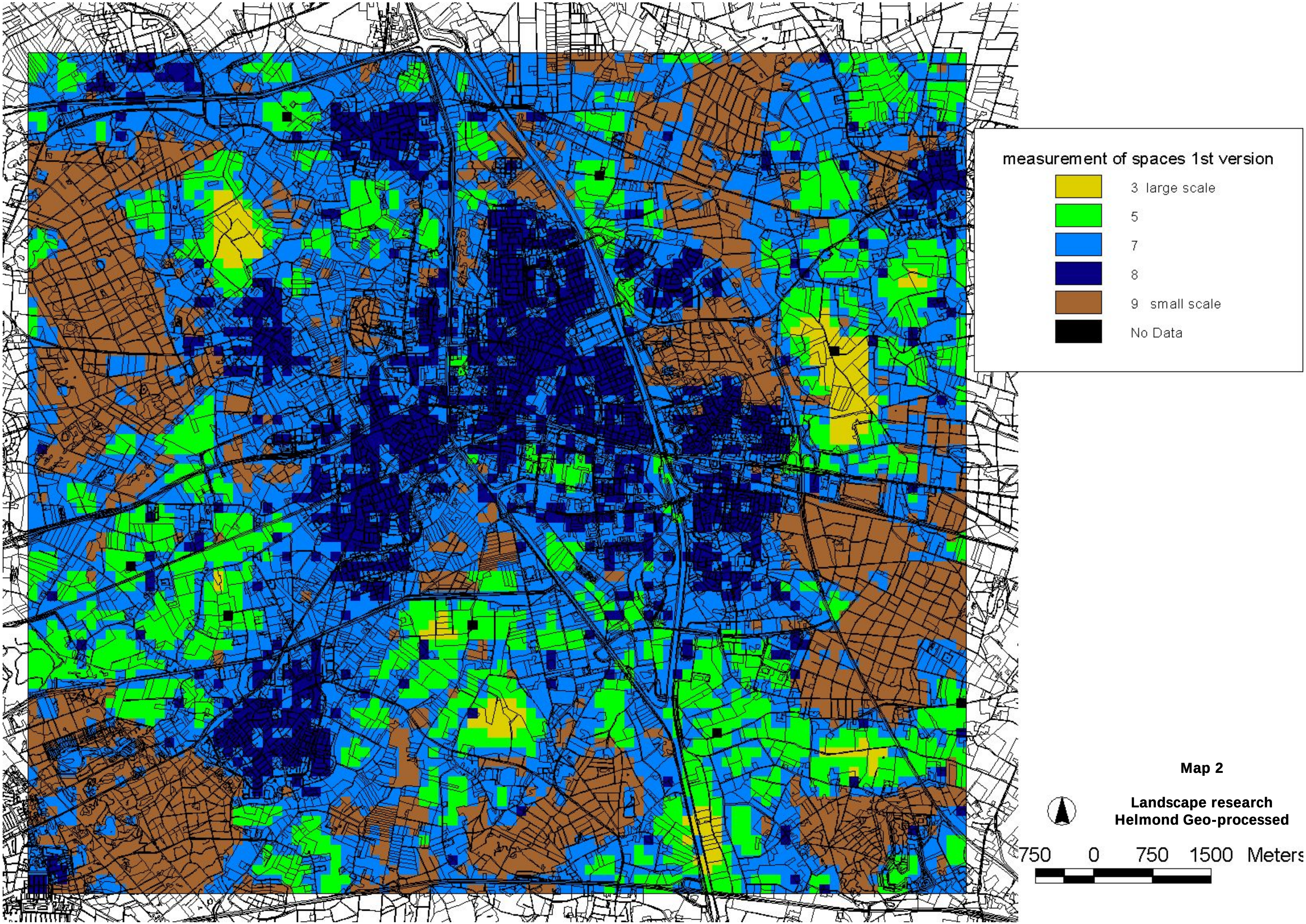


Figure 3.7 Relief, mass and viewing distances


measurement of spaces 1st version
3 large scale
5
7
8
9 small scale
No Data
Map 2
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters

The visibility-function for the correction-files of the height and mass has been carried out on a selection with the mass-forming slopes in a one and zero grid situation. With the files that result from this visibility action the sixteen height-visibility files have been changed into eight correction-files according to the given statements. With these correction files the height and the mass have been corrected. But first, the files with the masses have been created. This has been done by means of the focalsum/wedge-function. This action also results in sixteen files. Each of these files corresponds to one of the height-files so they can be put together in a later stadium. To make these files ready to categorize, the height- and mass-files have been added together per buffer and per wedge and then reclassified. The reclassification has possible outcomes per buffer, namely open, half-open and closed. Only per buffer a different number is used (table 3.8). The next step is, that for every wedge the different buffers are added together, just by adding the different values of each cell. Because of the reclassification the situation in each buffer can still be read from the value of the new grids, which are four in total. Another reclassification has been done to get an order in the different values. That order ranges from 1 to 21 with the 0 reserved for the no data value (table 3.8). Some generalisation has been made in this second reclassification. The position of mass in areas, which have been stated to have transparent mass, is not known, so the viewing distance can only be guessed. That is why the statement has been made that if one wedge contains two buffers of transparent mass, the mass or space that is the next buffer(s) doesn't influence the viewing distance anymore. Now, the four remaining files have been combined into one file, which has all the possible combinations of the values of the four wedges.

Table 3.8 Reclassification table for the wedges that define the measurement of spaces

buffer	mass count	code
buffer 1 0-250m	0	0
	1-3	1000
	4	2000
buffer 2 0-500m	0-4	0
	5-9	100
	10-13	200
buffer 3 0-1500m	0-13	0
	14-81	10
	82-111	20
buffer 4 0-2000m	0-111	0
	112-139	1
	140-198	2

reclass 1	reclass 2	250	500	1500	2000
0	1				
1	2				
2	3				
10	4				
11	5				
12	6				
20-22	7				#
100	8				
101	9				
102	10				
110-112	11				#
120-122	12				#
200-222	13			#	#
1000	14				
1001	15				
1002	16				
1010-1012	17				#
1020-1022	18				#
1100-1122	19			#	#
1200-1222	20			#	#
2000-2222	21		#	#	#

transparent mass
non-transparent mass
type of mass considered to be of no importance for the wedge

At this point the selection procedure starts to assign every combination to a legend-category (table 3.9). It has taken a lot of selecting and a lot of files to get to the different categories. After the first selection-round and the addition of the categories 8 and 9, which are in fact the categories 1 and 2 out of the map of the visual borders, there was still a lot of no data. But after a second and a third selection-round the map has been completed.

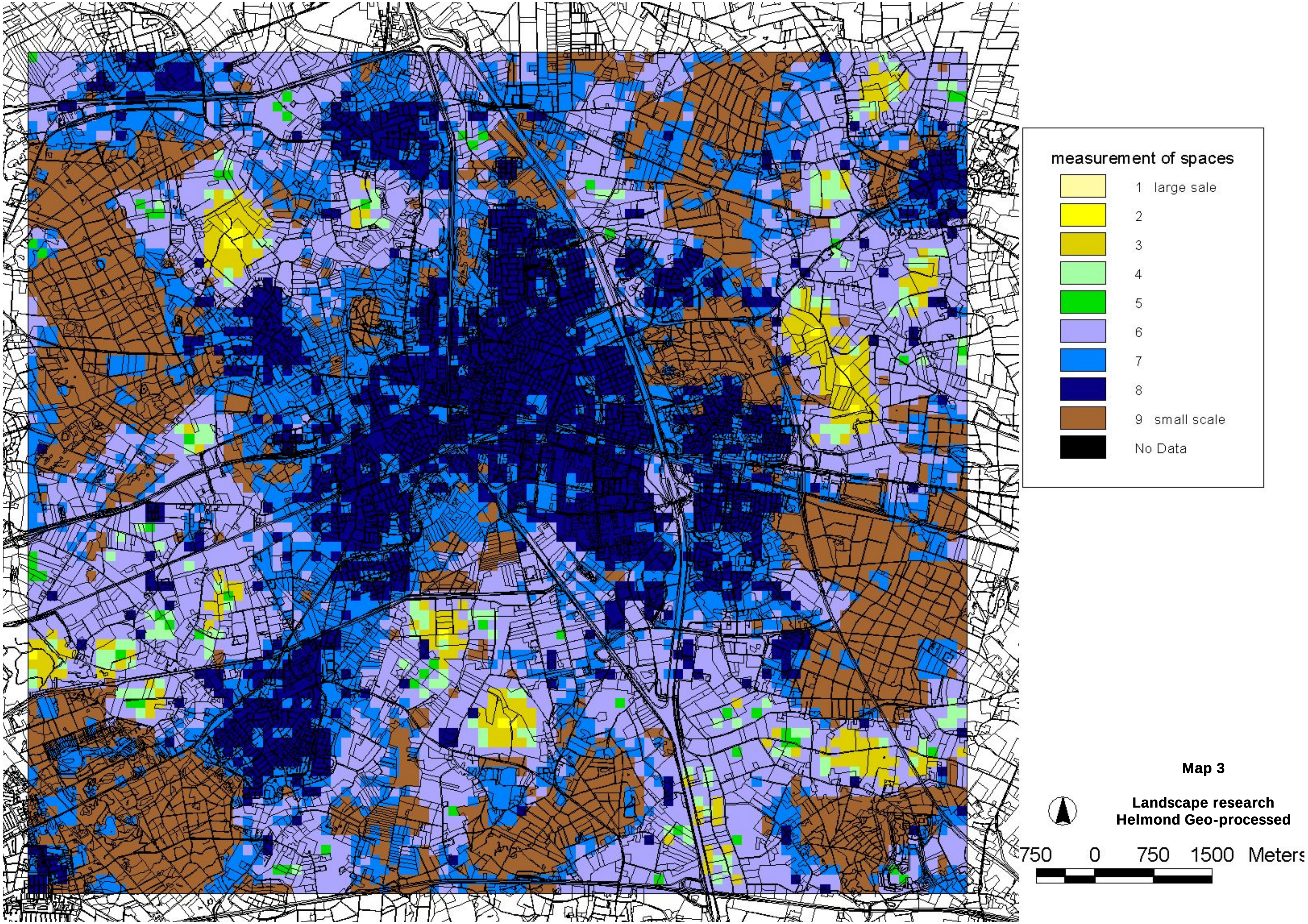

measurement of spaces
1 large sale
2
3
4
5
6
7
8
9 small scale
No Data
Map 3
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters

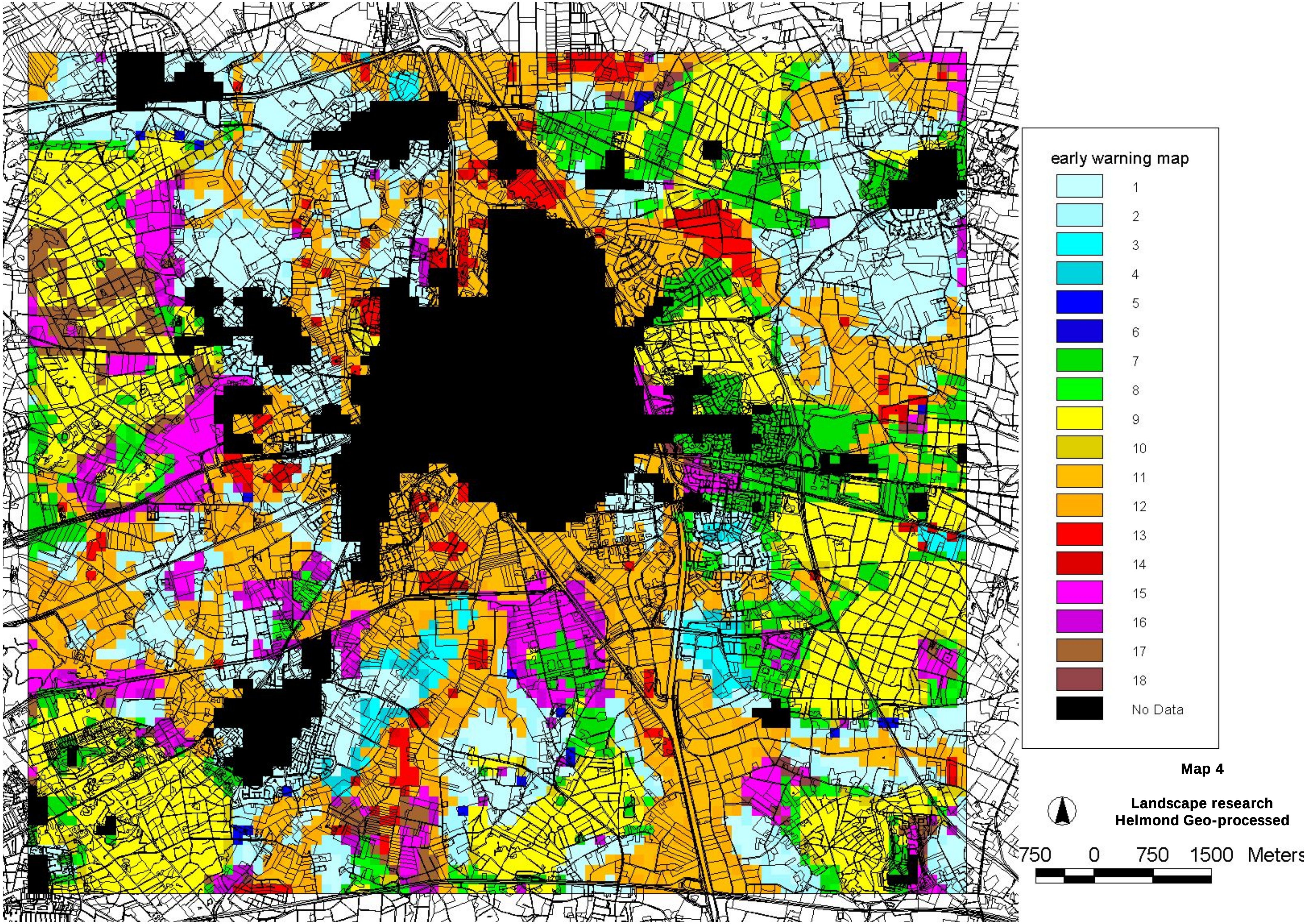
Table 3.9..The list of possible wedge-combinations per legend-category of the measurement of spaces

category	statements per legend-category
1	4x 1-3
	3x 1-3 & 1x 4-21
	2x 1-3 & 2x 4-21
2	1x 1-3 & 2x 4-7 & 1x 8-21
	1x 1-3 & 3x 4-7
	4x 4-7
3	2x 1-7 & 2x 8-21
	3x 4-7 & 1x 8-21
4	1x 1-7 & 2x 8-13 & 1x 14-21
	1x 1-7 & 1x 8-13 & 2x 14-21
	1x 1-7 & 3x 8-13
	4x 8-13
5	2x 8-13 & 2x 14-21
	3x 8-13 & 1x 14-21
6	1x 1-13 & 3x 14-21
	2x 14-19 & 2x 20-21
	3x 14-19 & 1x 20-21
	4x 14-19
	1x 14-17 & 3x 20-21
7	1x 12-13 & 3x 20-21
	1x 18-19 & 3x 20-21
	4x 20-21
8	legend-category 2 of the visual borders
9	legend-category 1 of the visual borders

When one compares this map to the one of the first attempt it is clear that there are major differences. Parts of category 7 of the first map have changed in category 6 and parts of category 5 have changed to category 6, 4 and 3 (map 3). The new map also has more correspondence with the map in the Helmond report[1]. One thing is getting perfectly clear and that is that the scale of the landscape has changed a lot over the last thirty years.

3.6 The early warning map

The early warning-map that has been created is a combination of the map of the groundwater tables, the map of the fertility of the soil, the map of the succession-stadium and the map of the variety of relative presence of moist in the soil, in this case called base-factors. Some reclassification had to be done, because like in the Helmond report[1] the legend had to be generalized. The colours used in the map (map 4) are the same like the map in the Helmond report, although there are less legend-categories. The dots have been left out and have been replaced with a colour a little different from the ones without dot. The table that served as a legend in the Helmond report can be found as table 3.10 on the back of the next page.



Map 4

Landscape research Helmond Geo-processed

Table 3.10 The composition of the early warning map

legend number	groundwater	II-Vv	Vd	VI-VII*	nutrient level	relative low	relative high	ecosystem	old	young	variety in base-factors	much	little
1				*			*			*			*
2				*			*			*		*	
3			*				*			*			*
4			*				*			*		*	
5				*			*		*				*
6				*			*		*			*	
7				*		*				*			*
8				*		*				*		*	
9				*		*			*				*
10				*		*			*			*	
11		*					*			*			*
12		*					*			*		*	
13		*	*				*		*				*
14		*	*				*		*			*	
15		*	*			*				*			*
16		*	*			*				*		*	
17		*	*			*			*				*
18		*	*			*			*			*	

3.7 Conclusions

The digitalisation of the model of analysis has turned out to be complicated but not impossible. In addition to the conclusions of the second chapter can be said, that, although the digitalisation of the visual-spatial aspects was somewhat complicated, now a digital working model of analysis for landscape analysis has been created. The model of analysis needs some adjustment to be able to use it; especially the anthropogenic level will have to be added to the model of analysis. Some aspects of the developed model still need some attention, like the measurement of spaces, the occupation process and for datasets like the seasonal variety one has to think about the meaning of this dataset and the way in which it can help in drawing conclusions for the creation of the design.

4 Comparison with the real world situation

4.1 Introduction

To get an idea whether the data the computer produced were true, a two-day cycle trip has been made. On this trip a series of 360° photos has been made (map 29, appendix 12). The main reason for this was, to check whether the map of the measurement of spaces was correct. There will always be differences, because with the grids, one has got some generalisation of the data. With this generalisation it may become clear that the data that is lost will be crucial for the analysis that has to be made. That is why there will always be the need to go out into the field and see what is really there and compare that with the maps the computer produced.
In the case of the situation in the field around Helmond, this is true. Although the TOP10 vector[I] map of 2002 has been the base for the map of the visual borders and for the map of the measurement of spaces, there are major changes to be discovered in the field. In this case a big new residential area, named Brandevoort, is being built on the west side of Helmond and a new industrial area is being built on the southeast side of Helmond.
The 360° photos have not only been taken to check the data from the computer, but also the get an idea about the different legend-categories of the map of the measurement of spaces and how they can be recognized in the field. This is the topic of the next paragraph apart from comments about computer-data to be right or wrong.

4.2 The 'scale' of spaces

During the fieldtrip, photos have been shot from the legend-categories 3, 6, 7 and 9 of the map of the measurement of spaces. At first the photos covered more categories, but a mistake had been discovered in the action-model afterwards, so the map of the visual borders and the map of the measurement of spaces had to be recalculated. The consequence was that there was a little shift in output-data, which meant that some photos where linked to another legend-category.
Both legend-category 3 photo-series (pictures 4.1 and app. 12.18) have been taken on cropland-complexes. This kind of space is getting rare, compared to the map of the measurement of spaces in the Helmond report[1]. The space seems to be very open, but one still notices that the viewing circle is bordered on different distances. Because in this legend-category there will be mass between the 500 en 250 metre buffer or even within the 250 buffer, the sense of depth is very clear. This can be noticed when viewing the height of the trees.
The photo-series taken from legend-category 6 spaces are well matching. In three or four of the four wedges, there has to be mass within the 250-metre buffer. It is largely depending on the distance between the viewer and the mass in this buffer how the space will be experienced. In this legend-category and the categories 5 and 7 the computer also counts with mass not visible to the viewer. The result is that spaces can very well be thought of as smaller spaces, although the computer has calculated otherwise, especially when there are houses or patches of forest within the 250-metre buffer. In the case of avenues it can well be that one thinks the space is bigger. It largely depends on the type and the age of the trees, the season and whether one is standing in an avenue glancing out or standing outside and glancing at an avenue. The transparency of an avenue is also depending on the angle under which one is looking at the avenue. On the map of the visual borders (map 1), avenues have been categorized as legend-

category 5 or 7, which means that they only obstruct the view to a certain level. For the map of the measurement of spaces cells with mass have been counted with, independent from which legend-category of the map of the visual borders they were previously. It was the count that mattered per wedge.

Legend-category 7 deals with the smallest calculated spaces, which is a mixture of build-up mass and green mass. There are huge differences between the one and the other space. It matters a lot, whether this space is dominated by buildings, forest or just by avenues.

Most of the photo-series that have been taken belong to this category. They show very great differences and for some it seems clear that they serve better in another category. In this category, at least three of the wedges should have mass within the 250-metre buffer in such a way that one cannot look further than 250 metres in those directions. For the fourth wedge there is the rule that one should be able to see something of the mass present between the 250-metre and the 500-metre buffer.

If one compares the photo-series 1, 14 and 20 (app. 12.1, 12.14 and picture 4.2), one can see the different types of spaces this legend-category includes. On the first series the houses are located at a distance of approximately 125 metres of the viewer. The nearest houses on photo-series number 20 are located at a distance of approximately 50 metres from the viewing point. The trees nearest to the bridge in photo-series 14 are situated on a distance of approximately 10 metres from the viewing point. In this photo-series the feeling of enclosure also plays a role. In photo-series 20 the width-to-height ratio is 5:1 to the closest buildings, which means, that the space seems unenclosed[8]. In photo-series 14 the width-to-height ratio is between 1:2 and 1:1 over the short cross-section of the canal, which means, that the space seems to be partially or fully enclosed. According to Lynch and Hack[9], with this size, this space has a human scale. The other two photo-series can be identified as public scaled spaces, according to Lynch and Hack[9]. The size of these spaces lies between the 25 and 150 metres, which one defined as public scaled spaces.

Photo-series 19 (app. 12.19) has been taken in a legend-category-9 area. This means that this area (grid-cell) consists for over 50% of forest. The appearance can easily be that of a category-7 space, because it is taken for granted that when there is more than 50% of forest in a grid-cell one cannot look out to the neighbouring cells, while it really depends on the type of forest, the season and the lay-out of this forest. In this photo-series the scale of the space can be described as intimate.

4.3 Conclusions

According to the map and the photos that were made one can say, that the computer-model is quite reliable, although it is recommendable to run the model on a number of different landscape types first before saying whether the model is really useable. For this scale the legend-categories 7 to 9 are sufficient to define the smallest spaces, but from a designers point of view a scale-jump should be made to get a more precise division in categories for the three categories mentioned, dependent on the area of interest.

Picture 4.1 Panorama 12 Neerheide, category 3
For position on map, see: map 29 in appendix 12

Picture 4.2 Panorama 20 Dierdonk, category 7
For position on map, see: map 29 appendix 12

5 Reflection and evaluation

5.1 Introduction

In this chapter attention will be paid to this model of analysis in comparison to other models of analysis. In addition to this, hints will be given about what to do next with this model. The model of analysis from this report will form the base and future additions will make it a model of analysis that will enhance the designing process.

In paragraph 5.4 the results that were created with the digital model will be compared to the maps in the Helmond report[1]. Doing this, one gets an idea about the reality of the output-data and about the changes the landscape has gone through.

But first the check of the map of the measurement of spaces regarding relief will be discussed. Also an idea for a maybe better version of the measurement of spaces will be given.

5.2 Measurement of spaces and height

The project-area around Helmond does not contain this much relief that slopes have influence on the calculation of the measurement of spaces. To check, whether the part of the action-model that compensates the mass-forming relief actually works, the model has been used on an area in Limburg with mass-forming relief (app. 13.30). On the west side of the map one can see the city of Maastricht, to give some orientation. To see any difference in the output, the model has been run two times. One time the model has been run with compensation on the mass-forming relief and one time the model has been run without compensation on the mass-forming relief. If one compares both output-maps (app. 13.31 and 32), one can see some clear differences in the central area with the concentration of legend-categories 7, 8 and 9, the left circle on the map. An area with legend-category 7 changed into an area with legend-category 6 and a central spot with legend-category 5. These differences have not been checked in the field, although there is a good reason to do so. Another change that can be seen on the map is the spot with legend-categories 3 and 4 to the northeast of the centre of the maps, the right circle on the map. The difference in legend-categories on this spot has been caused by the way of calculating. The frequency the visibility-function calculates for the relief is namely added to the value the focalsum-function calculates for the mass. This may influence the results of the categorization, as can be seen.

After the map of the measurement of spaces had been calculated for Helmond another way of using table 3.8 came into mind. The idea for this calculation is to make better use of the transparent mass while calculating the measurement of spaces. There was no time left to create the flowchart for it, so the way to do it is shown in appendix 10. If it is more accurate than the final one used in this report cannot be said, but the idea is that this one deals better with avenues and scattered mass.

5.3 On the model of analysis

When one compares this model with analysis-methods from the last three decades, one discovers that in the late seventies, early eighties a digital analysis-system had been set up. It was called ‘Het Informatiesysteem Landschapsbeeld’[10]. This system of information has been used for selecting and classifying procedures. The map of the measurement of spaces has also been created with this system. The only difference is that in that version it was created interactively. An advantage of interactive classifying is that the influence of avenues on the viewing distance can be defined according to the angle under which the viewer looks at it[11]. If the avenue is situated perpendicular to the viewing-direction, the transparency may reach the 100%. When the avenue is closer to being parallel to the viewing-direction, the transparency may reach the 0%. In this report, the avenues have been stated to be mass. With the size of the grid-cells used, it is not easy, not to say impossible, to deal with the avenues to be transparent/non-transparent. For design purposes it would be interesting to be able to calculate with this transparency, but in that case the grid-cell size should be adjusted.

In comparison to the model of analysis used in the Helmond report[1], the model used in '3 over 30'[12] has a more anthropogenic point of view. Where in the Helmond report[1] new developments are supposed to be strongly related to the biotic and a-biotic situation in the landscape, 3 over 30 shows that the anthropogenic part is equally spread, indifferent from the biotic and a-biotic situation, and also develops this way. A balanced combination of the anthropogenic network and the natural patterns that lie under it seems to be the best expression of the relationship between mankind and nature, as stated in 3 over 30[12]. Because of this, more attention should be paid to these anthropogenic structures.

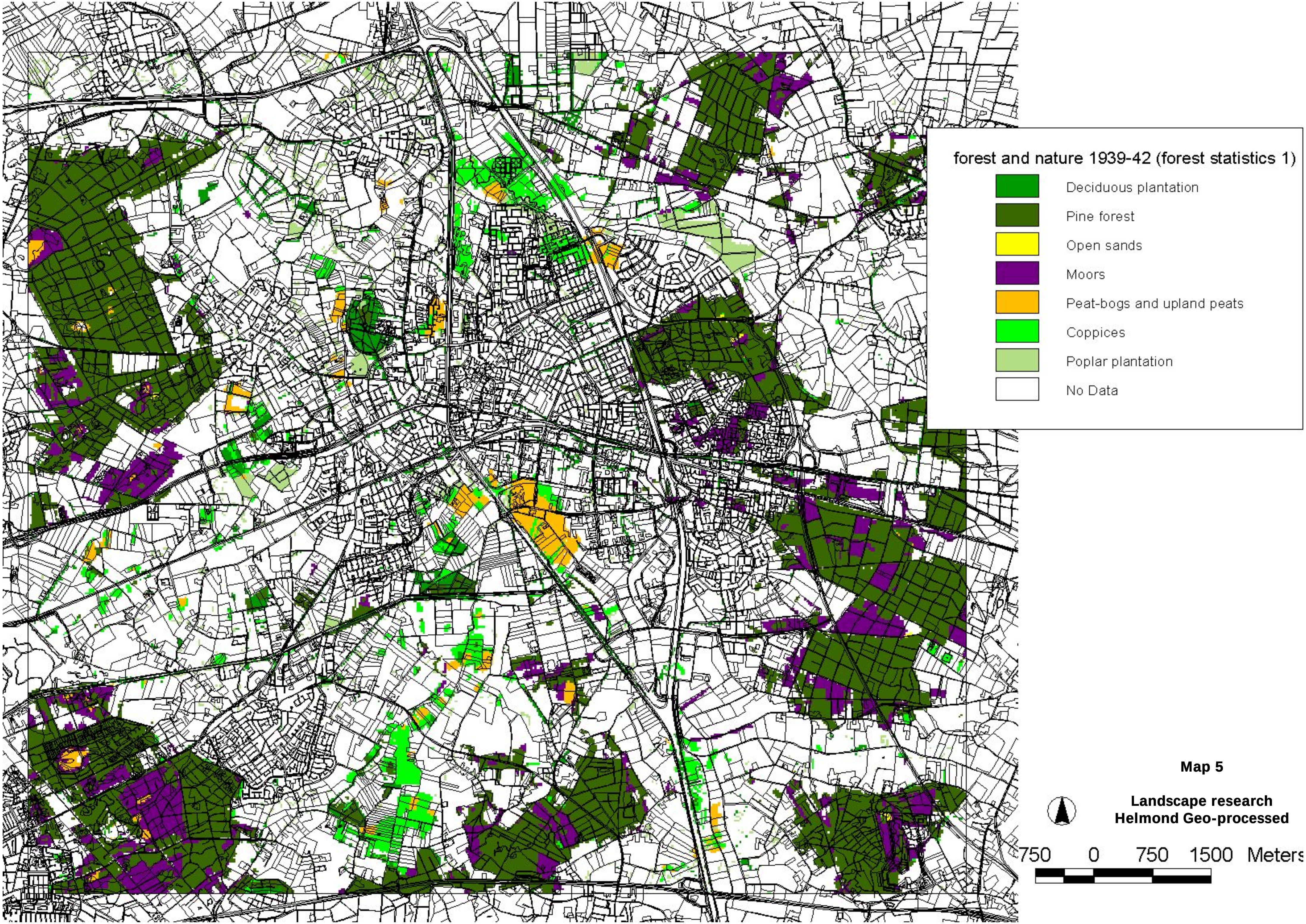
In addition to the maps the Helmond report[1] provides, more information should be given about the infrastructure network and the pattern the build-up areas form. For this last remark the map of the measurement of spaces already gives a clue, just by analysing the way the legend-categories 7 and 8 seem to be related to one another.

5.4 Comparing output-data

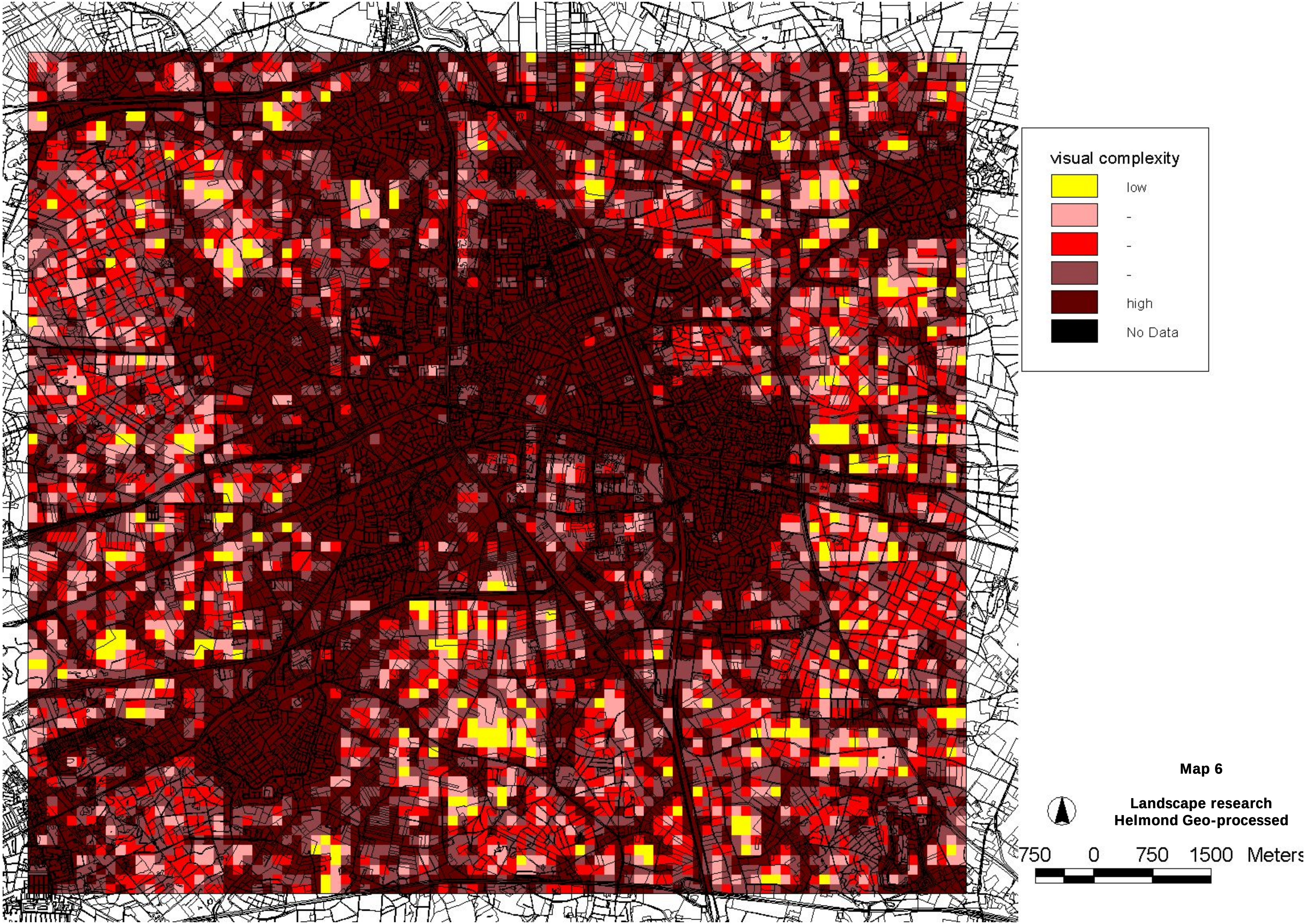
The output data this digital model of analysis has generated is different from the output from the Helmond report[1]. The maps from the Helmond report about the a-biotic situation are very similar to those created with the digital version of the model. Although the way of classification changed, the output still matches the original maps (appendix 11, maps 6-9 and 15).

The occupation-process has been calculated and changed into pie charts, instead of writing the process down, like in the Helmond report. In this case, due to lack of sufficient input-data, only the development process for forest and nature can be described and shown (appendix 8). Most of the moors have been planted with pine forest before the Second World War and are now gradually changing into a mixed forest. Of the moors that were still moors in the early forties, only half of them is still moor. The other half changed or has been changed into forest. Coppices are nowadays only in cultivation on a very small-scale basis. That is why one can see the change into deciduous forest, cropland and pasture. Because they were partly close to Helmond, parts have changed into residential or industrial areas. The maps that were used are map 5 and the maps 11-14 in appendix 11.

The map of the fertility of the soils (map 17 in appendix 11) is the first map that has a kind of different output. Where in the Helmond report one used a field-survey in comparison with the map of the acidity of the soils, for this version the booklet of the soil-map[4] has been used. In the booklet a table is given, which deals with the nutrient level of the soils. The greatest difference is that now there are four nutrient-levels instead of the three that were present in the Helmond report.


forest and nature 1939-42 (forest statistics 1)
Deciduous plantation
Pine forest
Open sands
Moors
Peat-bogs and upland peats
Coppices
Poplar plantation
No Data
Map 5
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters

For the map of the relative presence of moist in the soil (map 18 in appendix 11), not much has changed. The only thing that is quite obvious is that some generalisation in the spread of the groundwater tables has taken place. Because of this there is not as much variety any more in the relative presence of moist in the soil (map 19 in appendix 11).
The map of the watersheds (map 20 in appendix 11) a lot more watersheds than the map in the Helmond report. This is due to calculation problems in ArcInfo, which resulted in a map with all local watersheds without any form of generalisation.
The Helmond report continues with the map of the land-use, which is hard to read because of the colour combinations. The new one is represented by the LGN4 (map 13 in appendix 11). Comparison of the two gives a good idea about the changes over the last thirty years. Especially the growth of Helmond is remarkable. The variety in land-use (map 21 in appendix 11) shows, that the greatest variety can be discovered around the main infrastructure, groups of houses at the edge of forests and on the borders of Helmond, while in the Helmond report the greatest variety can only be found at the edges of the forests.
The map of the intensity of land-use (map 22 in appendix 11) has not much changed. The areas with a low intensity of land-use are still the forests and they did not change a lot in area over the last thirty years. The map with the stadium of succession (map 23 in appendix 11) shows a somewhat different story. Although the area of the forest did not change a lot, the stadium of succession did. The reason for this is that the pine forests, which were originally planted here, are gradually changing into deciduous forests.
The Three maps (maps 24-26 in appendix 11), that show a comparison between the map of the variety in relative presence of moist in the soil and the map of the variety in land-use are next. What is most important is that there seems no relation between the two maps, because most of the areas with much variety in land-use have little variety in relative presence of moist in the soil. This makes clear that the variety in land-use is mainly based on the spread of the anthropogenic network, which is not based on the a-biotic situation any more, like one concluded in the Helmond report[1].
In the visual-spatial part, the map of the visual complexity (map 6) shows an increase of visual complexity throughout the study-area. Partly this has been caused by the amount of different elements that were taken into account to create the variety and intensity that form the base of this map and partly by an increase of elements in the study-area over the last thirty years. The variety in visual complexity (map 27 in appendix 11) also shifted. On the new map, Helmond and the surrounding villages have very little variety in visual complexity, caused by the size of the build-up area, which is mainly categorized as having a high to very high visual complexity. The seasonal variety (map 28 in appendix 11) also changed because of the growth of Helmond and surrounding villages. As one can see, there are no big areas with pastures any more.
The map of the visual borders (map 1) shows that legend-category 3, 20-50% forest and non-transparent linear plantation, has expanded in the project-area, especially along the edges of the forests. Apart from that, as to be expected, Helmond and the surrounding villages have grown. In contrast with the Helmond report, the computer is now able to calculate the values for Helmond itself. In this way one also gets an idea about the greater public/non-public open spaces in the city. Also the map of the measurement of spaces (map 3) has now been created for the area


visual complexity
low
-
-
-
high
No Data
Map 6
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters

as a whole. Here one can clearly see that there is some connection between the legend-categories 7 and 8.
Apart from that, legend-categories 2 and 3 are slowly disappearing from the map. It seems that Helmond and Mierlo like to build on spots that have these two categories. Comparing the old and the new map it is clear that on the east and southeast side of Helmond and on the south and north (not yet visible, but that is where they are building the residential area of Brandevoort) side of Mierlo the open areas have completely vanished. The computer has minimized legend-categories 4 and 5, but that may be caused by the way of calculating. In 1974 the classification of the measurement of spaces had been done completely manually.
The next part has been formed by a series of comparisons between maps and has resulted in a number of charts. The first comparison is between the base-pattern, which more or less represents the relative presence of moist in the soil, and three maps of the visual aspects, visual complexity, variety in visual complexity and the measurement of spaces (figure 5.1). A high visual complexity can be discovered in the areas of groundwater tables II/III, V and VI. For the groundwater tables II/III this is due to the great variety in landscape-elements, while for groundwater tables V and VI it is due to the amount of certain elements, like houses. If one looks at the measurement of spaces it seems that groundwater table IV has the most open spaces in its domain. This is a result of the border-effect. What is not visible on the maps in this report but present in the data is a two-kilometre zone around the project area. This has been done to prevent presentation-data of being influenced by the border of the project-area. As a result croplands with groundwater table VII house, in proportion, most of the legend-category 3 and 4 spaces. Because the other areas of groundwater table VII mainly consist of forest, legend-category 9 is the dominant size of space.

Unfortunately legend-category 8 cannot be compared, because the most of the build-up area consists of No Data in the map of the relative presence of moist in the soil.
When the map of the variety in relative presence of moist in the soil is compared to the three maps mentioned, a pattern can be discovered (figure 1 in appendix 11). Both the visual complexity and the variety in the visual complexity increase when the variety in relative presence of moist in the soil increases. Legend-category 6 of the measurement of spaces is a constant factor independent from the variety in relative presence of moist in the soil. If there is little variety in the relative presence of moist in the soil, legend-categories 7 and 9 are well represented. When the variety of relative presence of moist in the soil increases the presence of legend-categories 7 and 9 decreases, which cannot really be explained because of the small amount of grid-cells that represent a high variety in relative presence of moist in the soil.
A third comparison is the comparison between the variety in land-use and the visual complexity, variety in visual complexity and measurement of spaces (figure 2 in appendix 11). The visual complexity increases when the variety in land-use increases, but the variety in visual complexity is maximal when the variety in land-use has not yet reached its maximum. The probable cause for this is the way the data for the maps of the land-use and the visual complexity have been gathered. The measurement of spaces shows some remarkable outputs. In the first and second value of the variety in land-use, legend-category 7 is completely absent. This value only shows up when a high variety of land-use is present, which leads to the statement, that according to this data a high variety in land-use goes together with a legend-category-7 space. Which means that these can help to define the ‘stadsrandzone’, the zone, which forms the edge of the city.

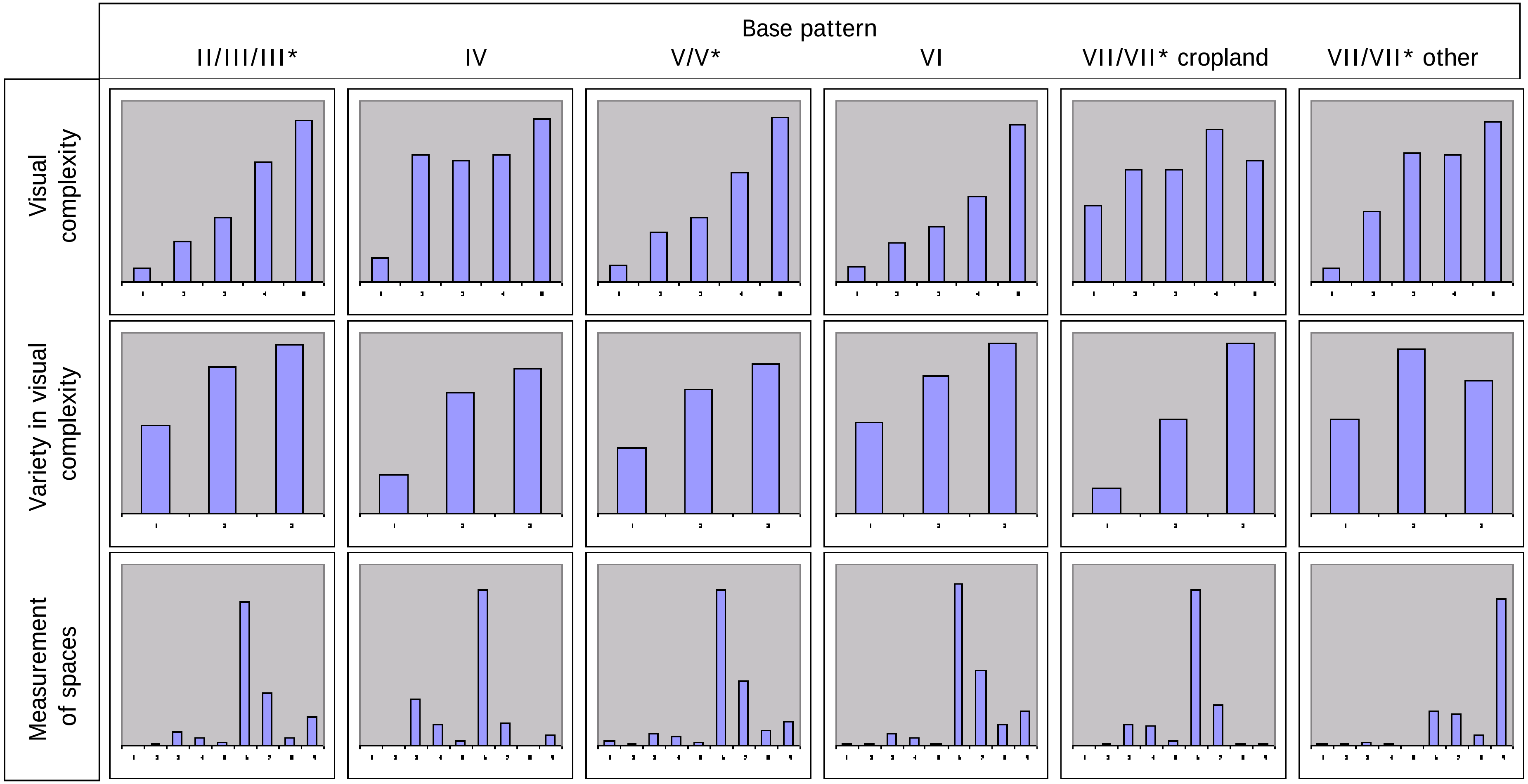


Figure 5.1 Comparison between the base pattern and the visual complexity, the variety in the visual complexity and the measurement of spaces

The last map created with the digital model of analysis is the early warning map (map 4). When compared with the same map in the Helmond report[1] one discovers a remarkable switch between the colours yellow and green. According to the table next to the map, yellow should represent areas with an old ecosystem, which, as one examines the map, is not the case. Green on the other hand does, while it should not according to the legend. That is, why the colours have been changed. There are some differences between the two maps, but that is due to the change in the soil-map. The global position of the areas of the different legend-categories however, remained the same.

5.5 Conclusions

The model created can be used as a base to create an up to data model of analysis for designing on a regional level. Especially the anthropogenic part of the analysis should be developed and added to this model. One should check whether the maps that are a comparison between two or more maps are really useable. For the measurement of spaces a scale-jump to 1:25.000 would be practical for areas in or around a city, to have a better idea of the size of and differences in public spaces. Also some fieldwork has to be done to get an idea, whether the implementation of the relief has been done the right way, or adjustments have to be made.
The model has the potency to serve as the digital replacement of the hand drawing of analysis maps and because of that, it is a first step into the future way of landscape design practice.

Summary

In 1969 the board of the Helmond-municipality asked three experts of the former Communal University of Amsterdam and the former Agricultural High School of Wageningen for advise regarding the intention of making a master plan for the community.
The original problem was defined by " which landscape factors should have influence on the choice of the location for new residential, commercial and leisure areas, regarding the wish to save the existing landscape qualities and values." When factors have been selected, in what way will they influence? The goal was to find a solution that results in a new form of harmony on the long run, by means of the accepting and guiding of changes in the existing patterns and processes. The result was the Landscape Research Helmond report of 1974[1], which forms the base for this report.
In those days everything had been hand drawn, also the grid-maps. Even nowadays, the making of analyses in the domain of landscape architecture is mostly handwork. Reasons for it could be the lack of predefined analysis methodologies (models of analysis) in these GIS-programs. The contemporary means, geo-data and geo-data processing software, have been developed so extensively that even the support of more complex analyses of the landscape could be supported.
This thesis that resulted in this report had the objective to run such kind of complex landscape analysis, based on the original Helmond study, by using the current geo-data and geo data processing software.
To realize this, the following questions had to be answered:

- Is the original methodology used in the Helmond report[1] understandable and can the calculation steps be extracted from the report;
- What was the original data used and can this data be replaced with existing country-covering geo-data;
- Is the original methodology translatable into an model of analysis using data-action models;
- Because the goal is to create a generic model of analysis, there is need to implement the relief in the model. The landscape morphological model of Wassink gives a cause for implementing relief because this model deals with volumes, networks and terrainforms.[2] Also in 'The visual and spatial structure of landscapes'[3] appears the need to deal with relief, because in some cases relief will be experienced as mass and in some cases not. This leads to the question whether the influence of relief is calculateable or not;
- Can the results be presented in the way they did in the Helmond report;
- Can this way of analysis be compared to the contemporary ways of analysis?

Apart from implementing relief in the model of analysis the original Helmond methodology has not been changed, but only translated into a computer-based model of analysis. The general build-up of the model as it was in the Helmond report can be found in figure 1.1. The complete build-up of the ArisFlow-model can be found in the appendixes 1-5. For the digitalisation, ArcInfo, Arc 8.3 [A], has been used as the program in which all calculations have been done and ArisFlow 2.1 [B] has been used as the dataflow management program.

After examining the whole Helmond report it appears that almost everything is translatable into a digital model of analysis. Only five datasets resulting in maps cannot or can partly be created due to missing input datasets and above all generic input datasets.

Regarding the map 'carrying capacity of the soil' one parameter is not present. Further research or fieldwork has to be done on the carrying capacity of the soil under the 'dirty' top-layer up to a depth of 2.8 metres, which will hopefully result in a generic dataset for use in this model of analysis. The map of the cultural historical objects lacks the presence of generic data about monuments in the area. Only the archaeological aspects can therefore be displayed in this map. The map with the main utility services will not be created, because there is no generic dataset present. Information about pipeline and cable positions can be claimed at the Klic foundation. The fourth dataset that cannot be created completely is the early warning map. The reason for it is the debate about the division of the brook system in up- and downstream and, which is therefore left out of the calculations behind this map.
A comparison that cannot be made in this report is the one between the current map and the map of 1850 regarding the measurement of spaces. A topographical dataset of 1850 is not yet existing and the HGN[F] (1900) is not detailed enough to give a representative result of the situation at that time.
The maps that will be presented in this report are a visualisation of available generic datasets or are a visualisation of datasets that have been calculated from available generic datasets. For some calculations reclassifications will have to be done on the input-data. The mayor reclassifications have been added as appendixes to this report. For some of the maps from the visual-spatial part of the Helmond report it is the trick to find out how the divisions between the legend-categories had been made in order to be able to reproduce this digitally.

The digitalisation of the model of analysis has turned out to be complicated but not impossible. Although the digitalisation of the visual-spatial aspects was somewhat complicated, now a digital working model of analysis for landscape analysis has been created. The model of analysis needs some adjustment to be able to use it; especially the anthropogenic level will have to be added into the model of analysis. Some aspects of this model still need some attention, like the measurement of spaces, the occupation process and for maps like the seasonal variety one has to think about the meaning of this map and the way in which it can help in drawing conclusions for the creation of the design.
The hyperlinked flowcharts of the diverse parts of the model of analysis can be found in the figures 3.3, 3.5, 3.6 and 3.7 or the flowcharts can be looked up in the appendixes 1 to 5.

According to the map of the measurement of spaces (map 3) and the photos that were made (figure 4.1 and 4.2 and appendix 12) to check this map, one can say, that the computer-model is quite reliable, although it is recommendable to run the model on a number of different landscape types first before saying whether the model is really useable. For this scale the legend-categories 7 to 9 are sufficient to define the smallest spaces, but from a designers point of view a scale-jump should be made to get a more precise division in categories for the three categories mentioned, dependent on the area of interest.

The model created can be used as a base to create an up to data model of analysis for designing on a regional level. Especially the anthropogenic part of the analysis should be developed and added to this model. One should check whether the maps that are a comparison between two or more maps are really useable. Also some fieldwork has to be done to get an idea, whether the implementation of the relief has been done the right way, or

adjustments have to be made. The maps that resulted from the new model of analysis (map 1 to 6 and appendix 11 and 13) show clearly how the landscape around Helmond changed over the last thirty years. These comparisons in time are also an advantage of this new model.
The model has the potency to serve as the digital replacement of the hand drawing of analysis maps and because of that, it is a first step into the future way of landscape design practice.

Literature and datasets

Literature

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I TDN, Topographical map 1:10.000. 2002.
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Appendixes

Landscape Research Helmond

Geo-processed

Appendixes

January 2004

Thesis GRS 2004-01

Martijn Blaas

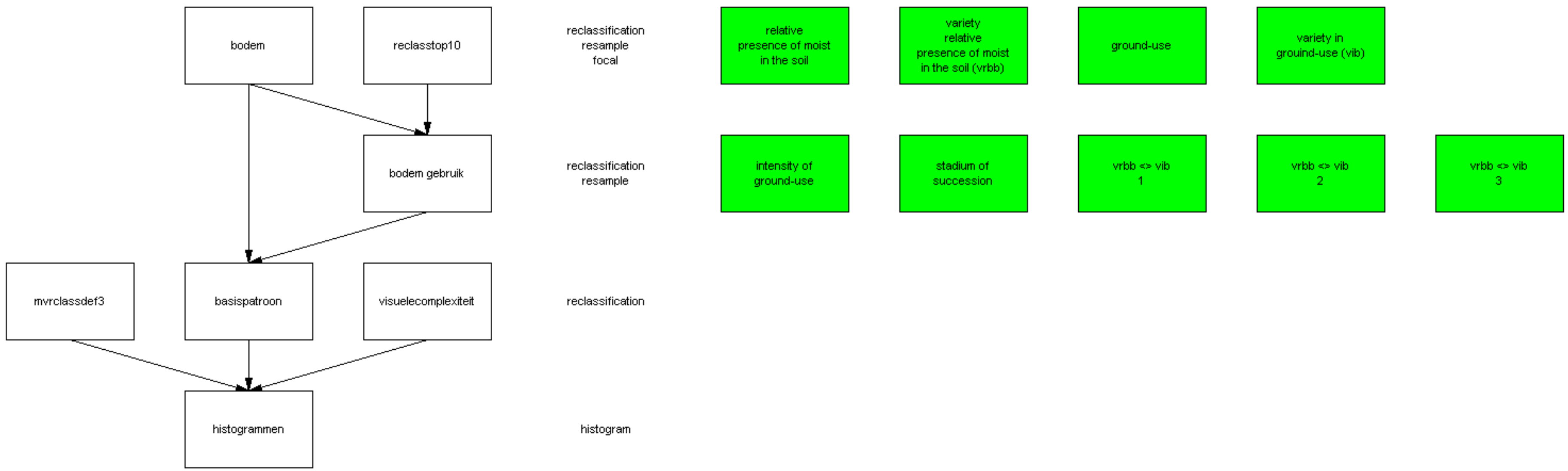
Under supervision of dr ir RJA van Lammeren

WAGENINGEN UR

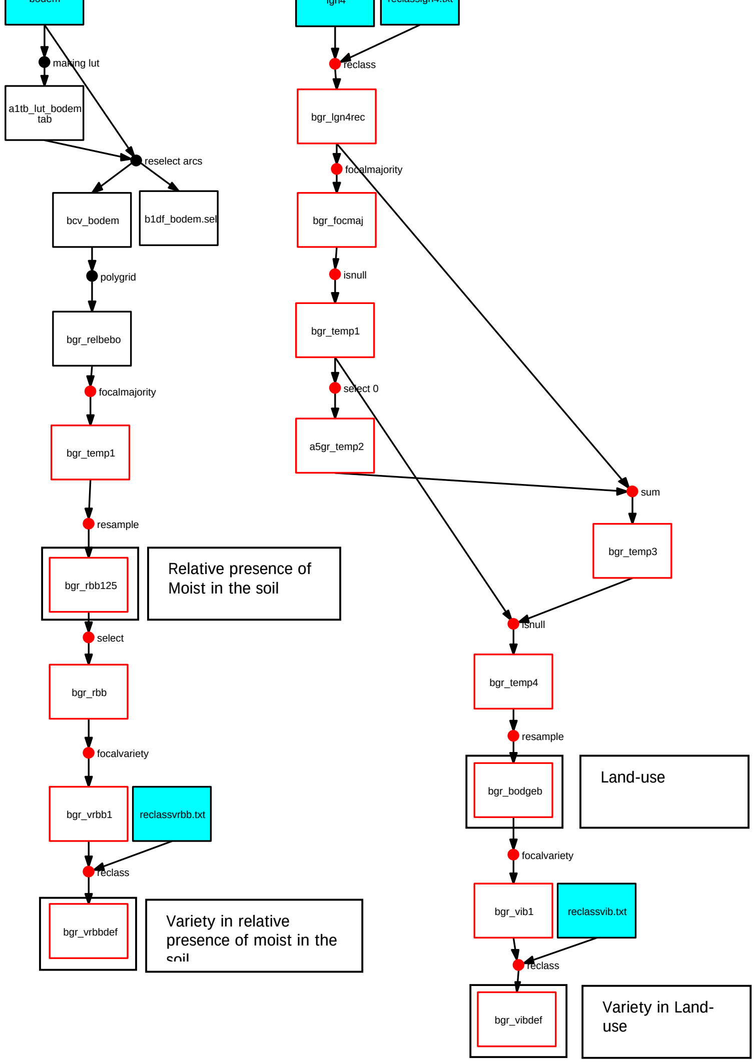
Table of contents

6 Action-model soil and land-use

This is the main structure of the digitalisation of the soil and land-use related subjects. To the right in green are the output-maps that have been created with the white box that is to the left in the same row. The text without a box explains in short statements what happens in the boxes. On the next pages all the boxes have been displayed, to get an idea what is going on during the calculation. In contrast with the diagrams in the report itself, these have not been hyperlinked to AriFlow and ArcInfo. The boxes of Reclasstop10 and Visuelecomplexiteit will be shown in appendix two and the one of mvrclassdef3 in appendix 4.



Bodem



Reclasslgn4.txt

1 : 1
2 : 2
3 : 2
4 : 2
5 : 2
6 : 2
8 : 3
9 : 4
10 : 2
11 : 5
12 : 6
16 : 7
17 : 7
18 : 8
19 : 8
20 : 5
21 : 6
22 : 8
23 : 1
24 : 9
25 : 10
26 : 8
30 : 11
31 : 12
32 : 13
33 : 14
34 : 15
35 : 16
36 : 17
37 : 18
38 : 18
39 : 19
40 : 20
41 : 21
42 : 22
43 : 23
44 : 24
45 : 25
46 : 25

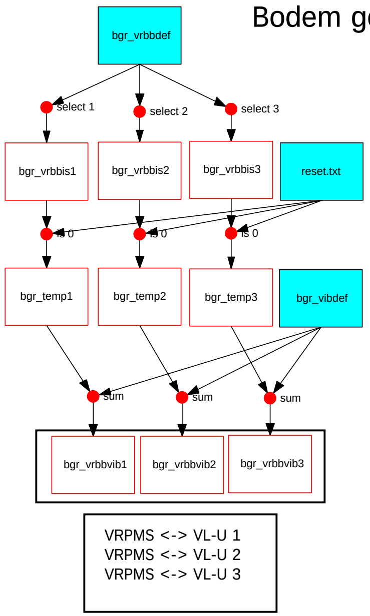
Reclassvrbb.txt

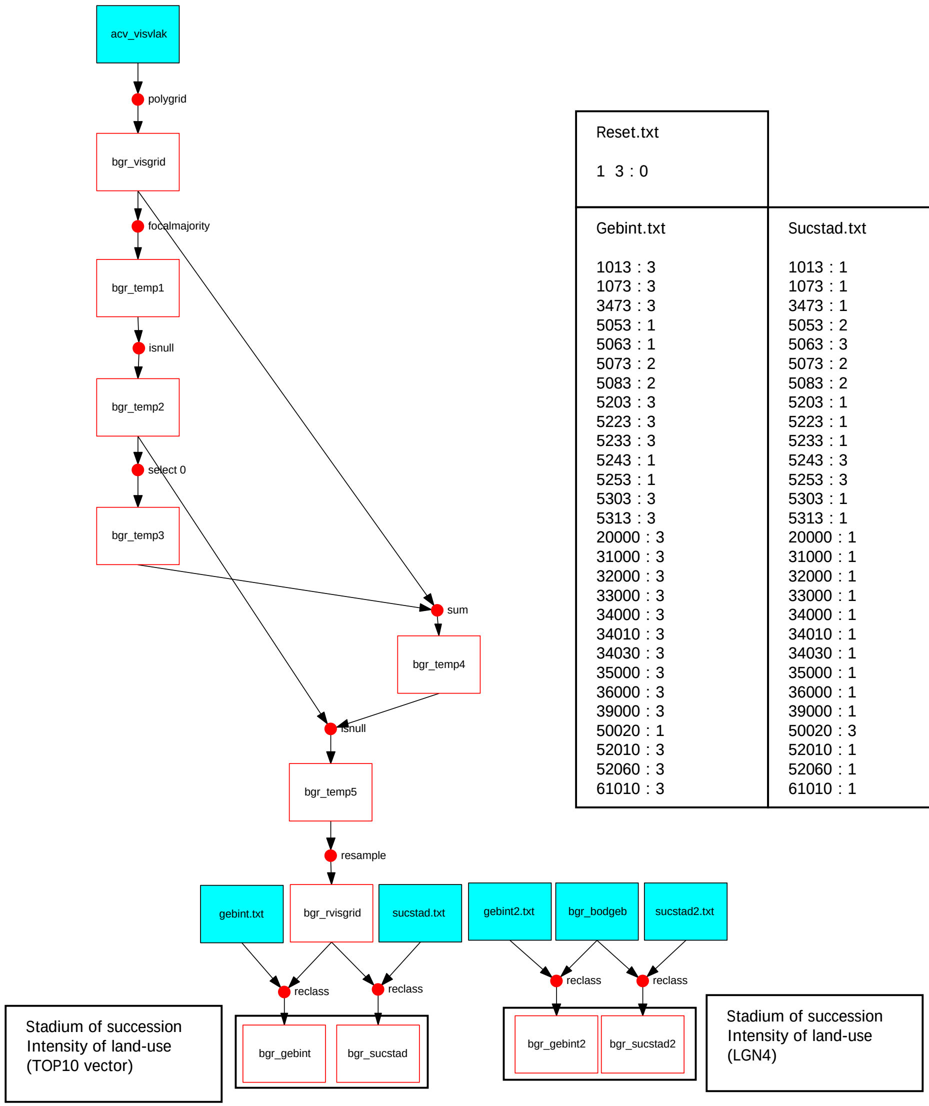
1 2 : 1
3 3 : 2
4 10 : 3

Reclassvib.txt

1 1 : 1
2 2 : 2
3 3 : 3
4 10 : 4

Bodem gebruik



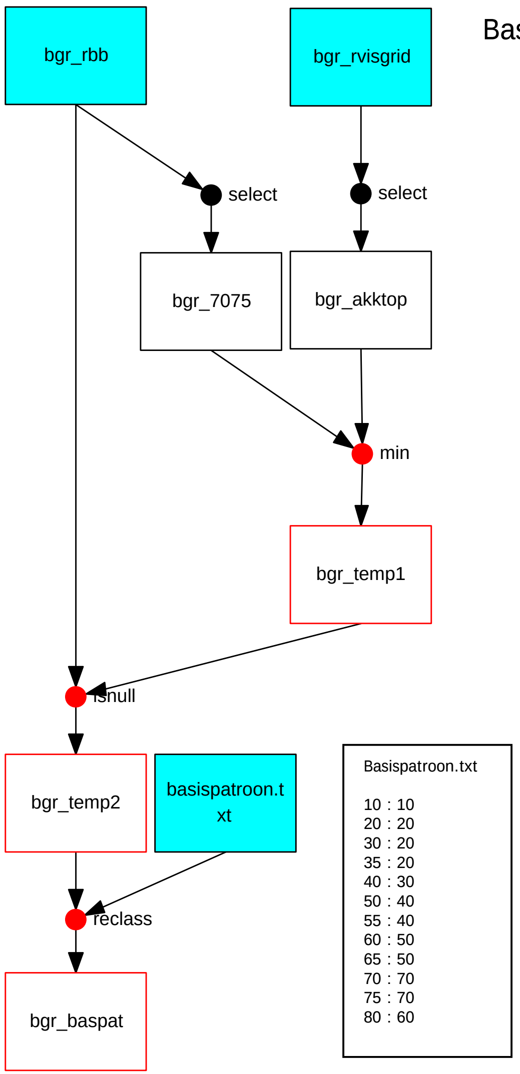


Reset.txt

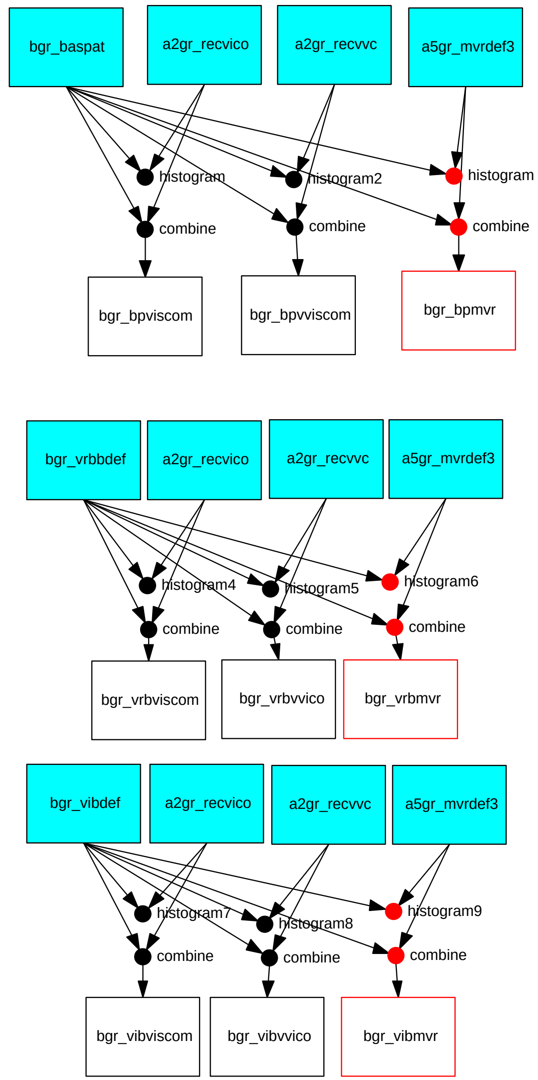
1 3 : 0

Gebint.txt	Sucstad.txt	Gebint2.txt	Sucstad2.txt
1013 : 3	1013 : 1	1 : 3	1 : 1
1073 : 3	1073 : 1	2 : 3	2 : 1
3473 : 3	3473 : 1	3 : 3	3 : 1
5053 : 1	5053 : 2	4 : 3	4 : 1
5063 : 1	5063 : 3	5 : 1	5 : 3
5073 : 2	5073 : 1	6 : 1	6 : 2
5083 : 2	5083 : 2	7 : 3	7 : 1
5203 : 3	5203 : 1	8 : 3	8 : 1
5223 : 3	5223 : 1	9 : 3	9 : 1
5233 : 3	5233 : 1	10 : 3	10 : 1
5243 : 1	5243 : 3	11 : 1	11 : 3
5253 : 1	5253 : 3	12 : 1	12 : 3
5303 : 3	5303 : 1	13 : 1	13 : 3
5313 : 3	5313 : 1	14 : 1	14 : 3
20000 : 3	20000 : 1	15 : 1	15 : 3
31000 : 3	31000 : 1	16 : 1	16 : 3
32000 : 3	32000 : 1	17 : 1	17 : 3
33000 : 3	33000 : 1	18 : 1	18 : 3
34000 : 3	34000 : 1	19 : 1	19 : 3
34010 : 3	34010 : 1	20 : 1	20 : 3
34030 : 3	34030 : 1	21 : 1	21 : 3
35000 : 3	35000 : 1	22 : 1	22 : 3
36000 : 3	36000 : 1	23 : 1	23 : 3
39000 : 3	39000 : 1	24 : 1	24 : 3
50020 : 1	50020 : 3	25 : 1	25 : 3
52010 : 3	52010 : 1		
52060 : 3	52060 : 1		
61010 : 3	61010 : 1		

Basispatroon

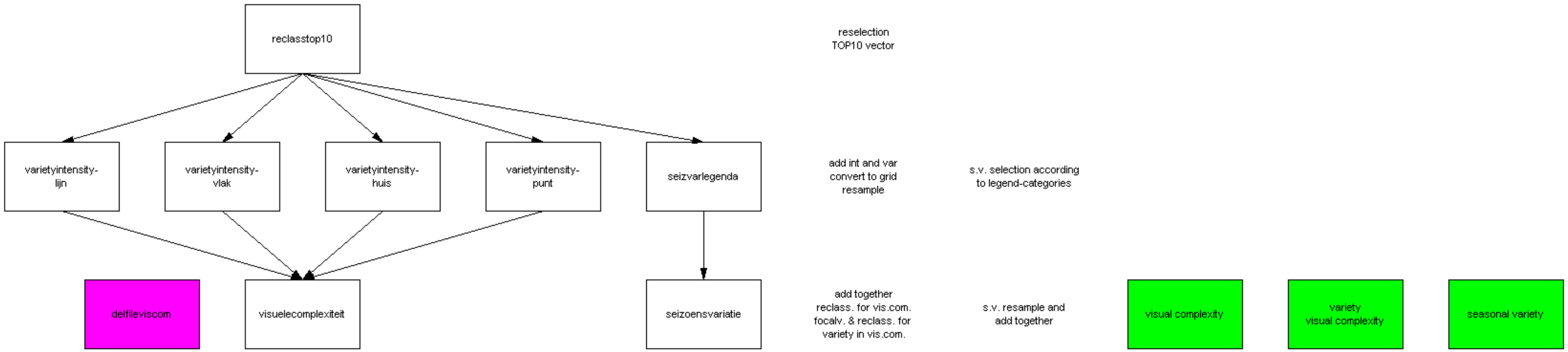


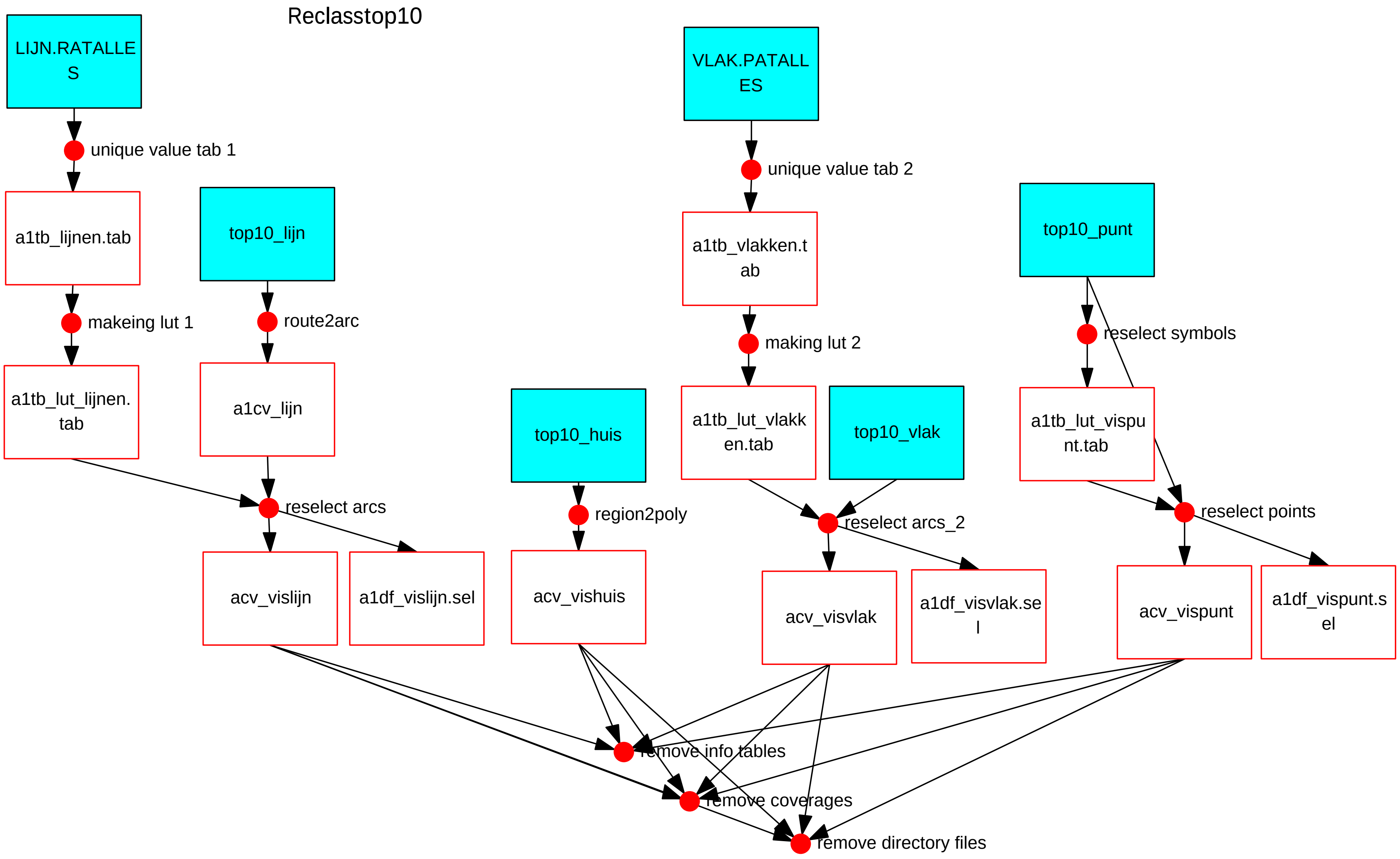
Histogrammen



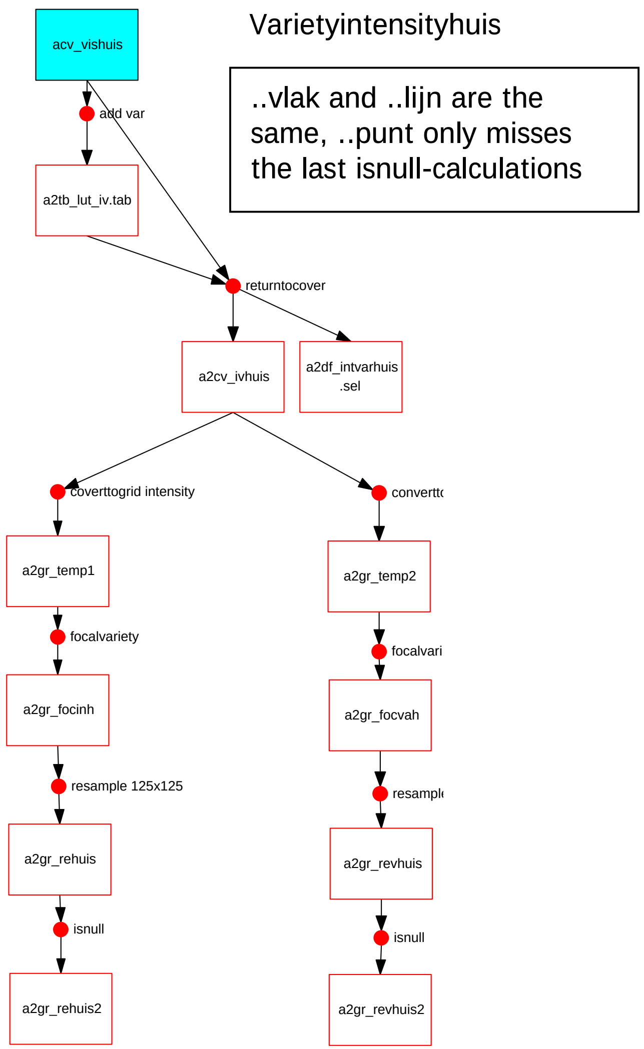
7 Action-model visual complexity

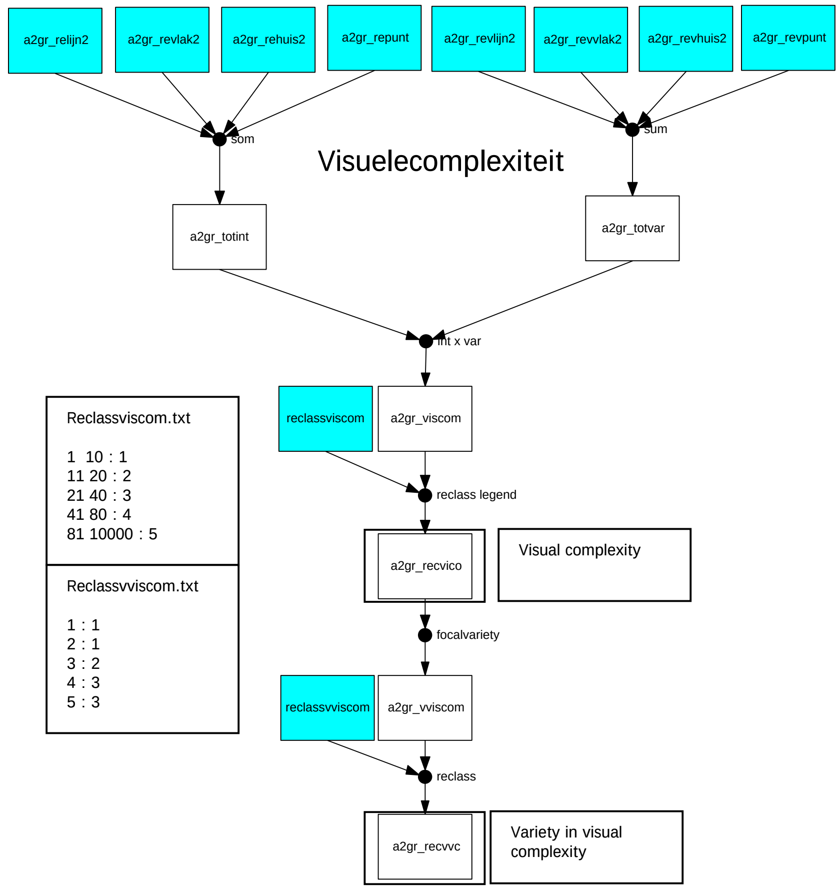
This is the main structure of the digitalisation of the visual complexity and the seasonal variety. To the right in green are the output-maps. The texts without the boxes are a few statements about what happens in the white boxes. The pink box at the bottom left is the delete-file with which all the files that have been created between input and output have been deleted. On the next pages the white boxes will be displayed to give some overview over what happens during calculation.



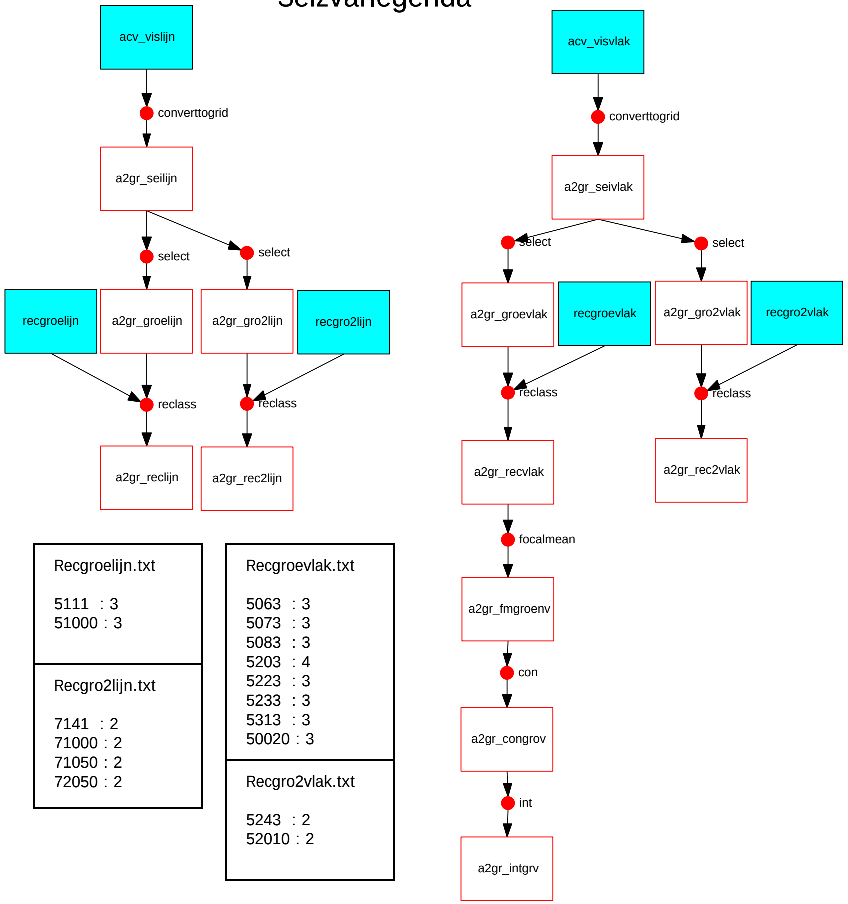


Reclasstop10
LIJN.RATALLES
unique value tab 1
a1tb_lijnen.tab
top10_lijn
makeing lut 1
route2arc
a1tb_lut_lijnen.tab
a1cv_lijn
reselect arcs
acv_vislijn
a1df_vislijn.sel
top10_huis
region2poly
acv_vishuis
VLAK.PATALLES
unique value tab 2
a1tb_vlakken.tab
making lut 2
a1tb_lut_vlakken.tab
top10_vlak
reselect arcs_2
acv_visvlak
a1df_visvlak.sel
top10_punt
reselect symbols
a1tb_lut_vispunt.tab
reselect points
acv_vispunt
a1df_vispunt.sel
remove info tables
remove coverages
remove directory files

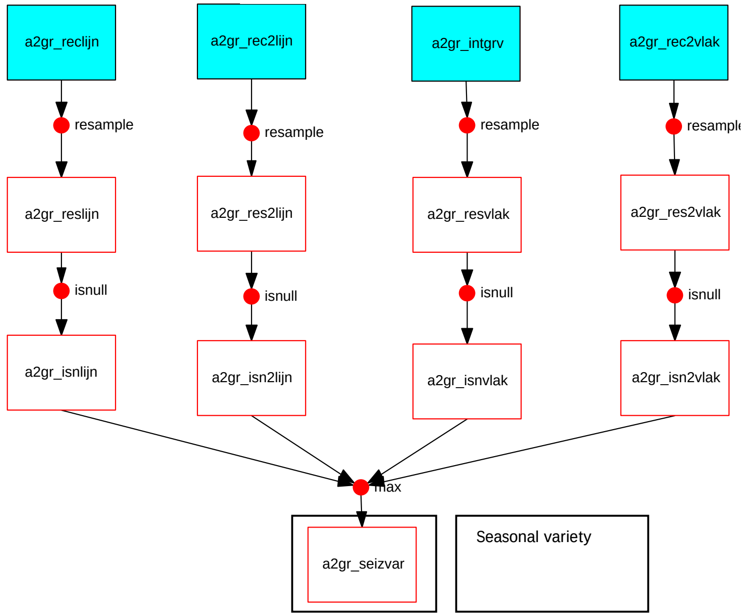

Varietyintensityhuis
..vlak and ..lijn are the same, ..punt only misses the last isnull-calculations
acv_vishuis
add var
a2tb_lut_iv.tab
returntocover
a2cv_ivhuis
a2df_intvarhuis .sel
coverttogrid intensity
a2gr_temp1
focalvariety
a2gr_focinh
resample 125x125
a2gr_rehuis
isnull
a2gr_rehuis2
a2gr_temp2
a2gr_focvah
a2gr_revhuis
isnull
a2gr_revhuis2


a2gr_relijn2
a2gr_revlak2
a2gr_rehuis2
a2gr_repunt
a2gr_revlijn2
a2gr_revvlak2
a2gr_revhuis2
a2gr_revpunt
som
sum
Visuelecomplexiteit
a2gr_totint
a2gr_totvar
int x var
reclassviscom
a2gr_viscom
reclass legend
a2gr_recvico
Visual complexity
focalvariety
reclassvviscom
a2gr_vviscom
reclass
a2gr_recvvc
Variety in visual complexity
Reclassviscom.txt
1 10 : 1
11 20 : 2
21 40 : 3
41 80 : 4
81 10000 : 5
Reclassvviscom.txt
1 : 1
2 : 1
3 : 2
4 : 3
5 : 3

Seizvarlegenda

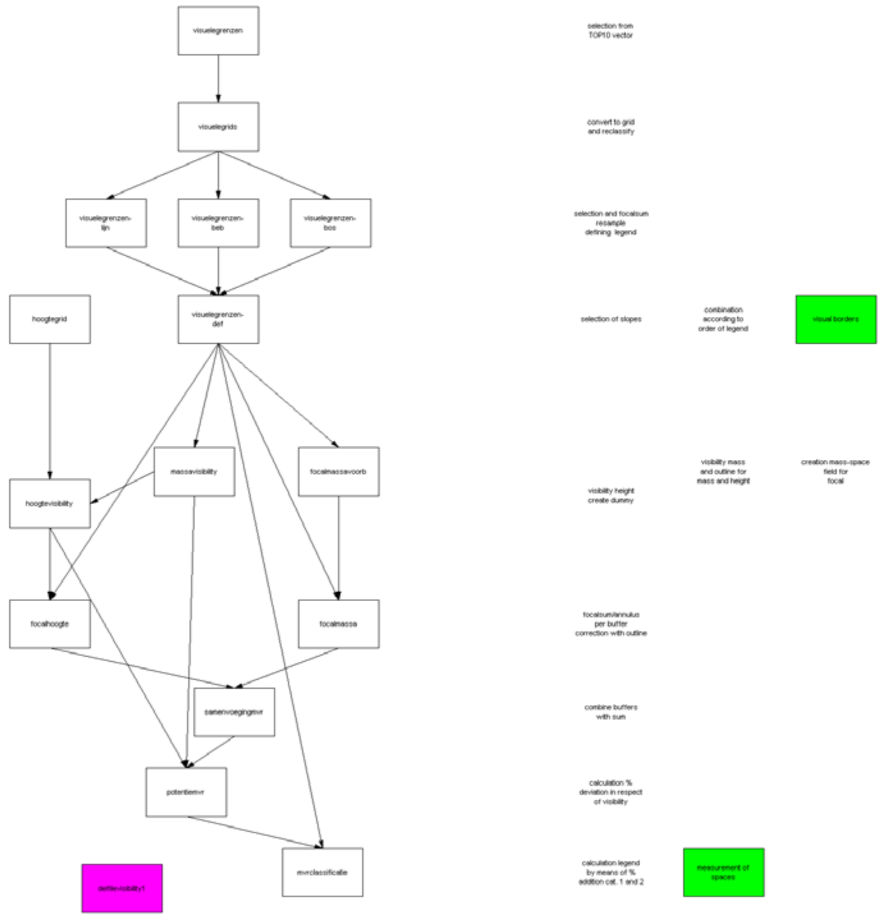


Seizoensvariatie

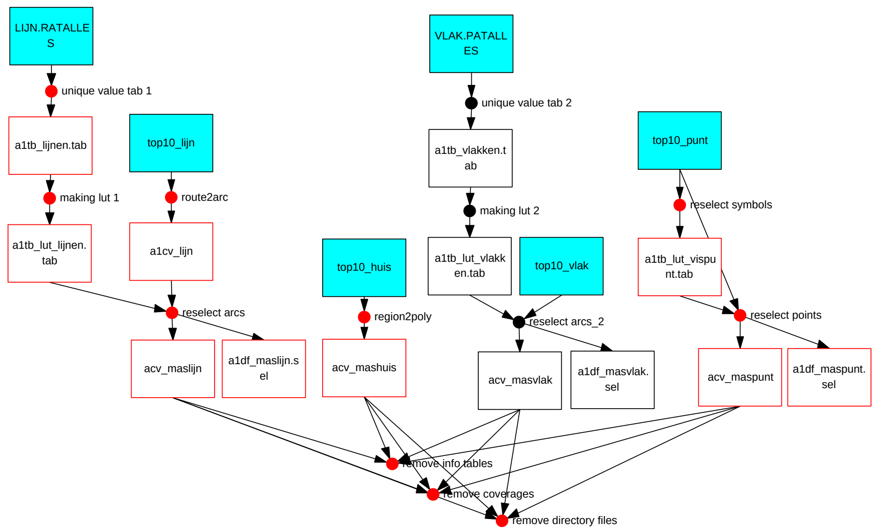


8 Action-model measurement of spaces 1

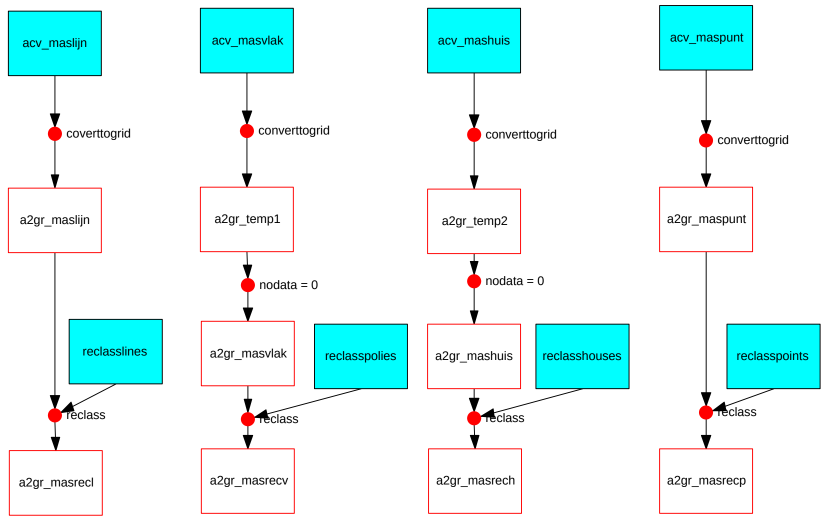
This is the main structure of the digitalisation of the visual borders and the first version of the measurement of spaces. To the right in green are the output-maps. The texts without the boxes are a few statements about what happens in the white boxes. The pink box at the bottom left is the delete-file with which all the files that have been created between input and output have been deleted. On the next pages the white boxes will be displayed to give some overview over what happens during calculation.



Visuelegrenzen

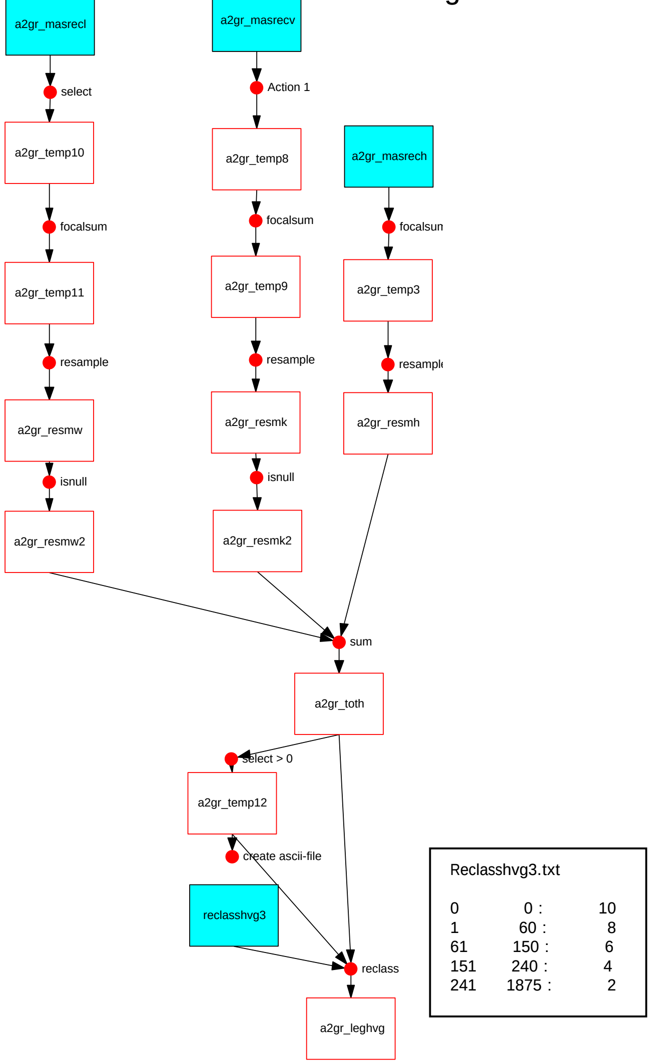


Visuelegrids

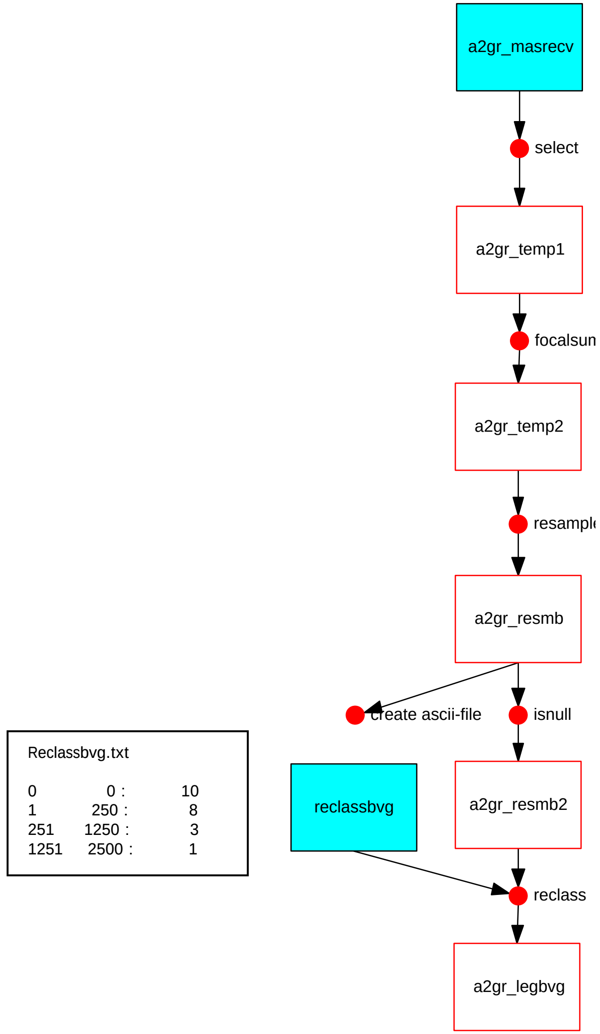


Reclasslines.txt	Reclasspolies.txt	Reclasshouses.txt	Reclasspoints.txt
0 : 0	0 : 0	0 : 0	0 : 0
1040 : 2	1012 : 3	1000 : 3	1420 : 3
1370 : 3	1013 : 3	1030 : 3	1500 : 3
3450 : 3	1073 : 3	1080 : 3	1510 : 3
5111 : 2	5022 : 4		1530 : 3
5112 : 2	5023 : 4		1550 : 3
5120 : 1	5053 : 4		1700 : 3
5121 : 1	5063 : 4		1750 : 3
5122 : 1	5073 : 4		1800 : 3
5130 : 1	5083 : 4		1810 : 3
5131 : 1	5223 : 4		4300 : 3
5132 : 1	5233 : 4		4730 : 3
5190 : 1	5313 : 4		4800 : 1
7100 : 2	50020 : 4		5000 : 1
7101 : 2			
7110 : 2			
7111 : 2			
7160 : 2			
51000 : 1			
71000 : 2			

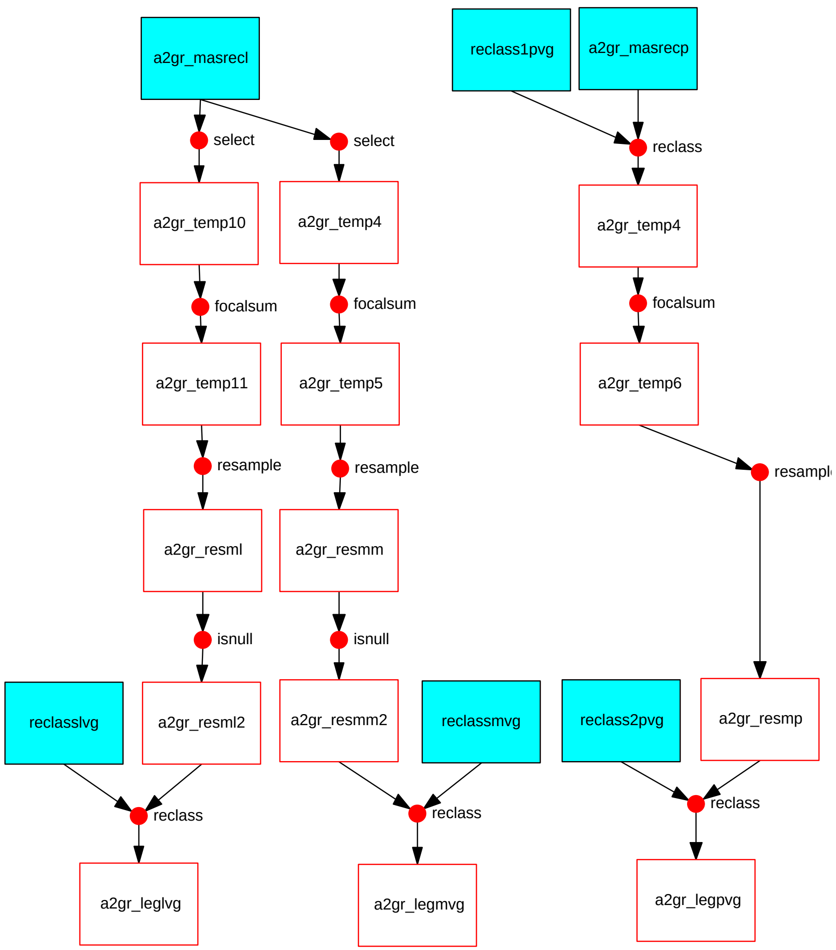
Visuelegrenzenbeb



Visuelegrenzenbos



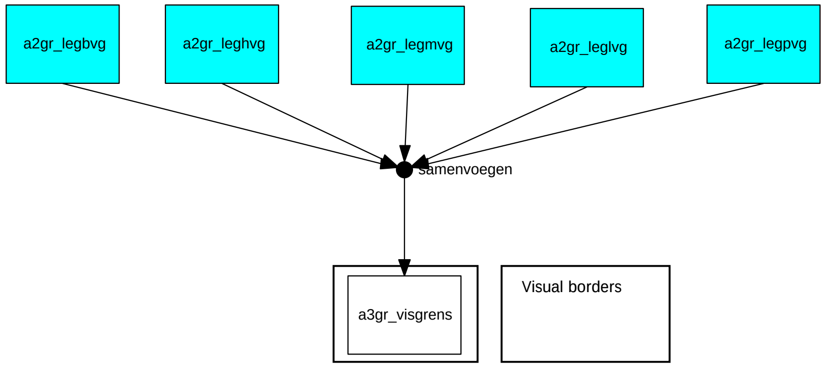
Visuelegrenzenlijn



Reclass1pvg.txt

0 0 : 0
1 4 : 1

Visuelegrenzendef



Reclasslvg.txt

0 3 : 10
4 19 : 8
20 60 : 7
61 134 : 5

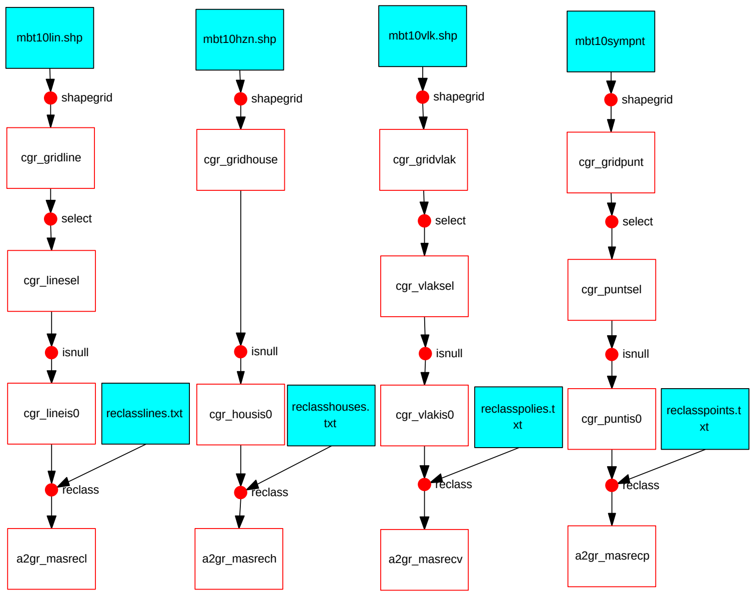
Reclassmvg.txt

0 3 : 10
4 27 : 8
28 202 : 3

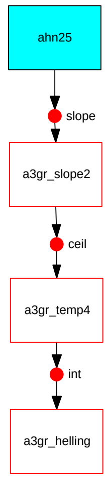
Reclass2pvg.txt

0 3 : 10
4 20 : 8

Visgrensshape

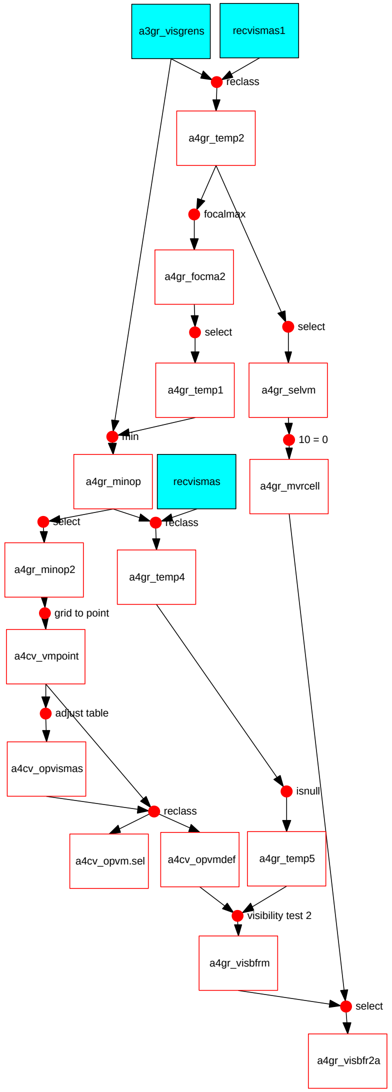


Hoogtegrid



If the input TOP10 vector-files are shapefiles, this flowchart can be used instead of visuelegrenzen and visuelegrids

Massavisibility



Recvismas1.txt

1 2 : 1
3 10 : 10

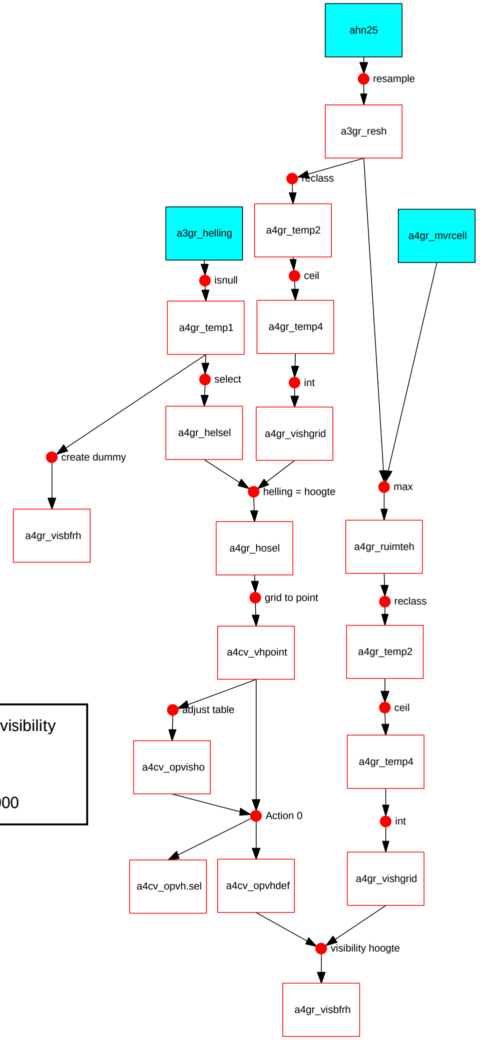
Recvismas.txt

1 7 : 18
8 10 : 0

Parameters visibility

Vert1 = -0.3
Vert2 = -30
Radius = 2000

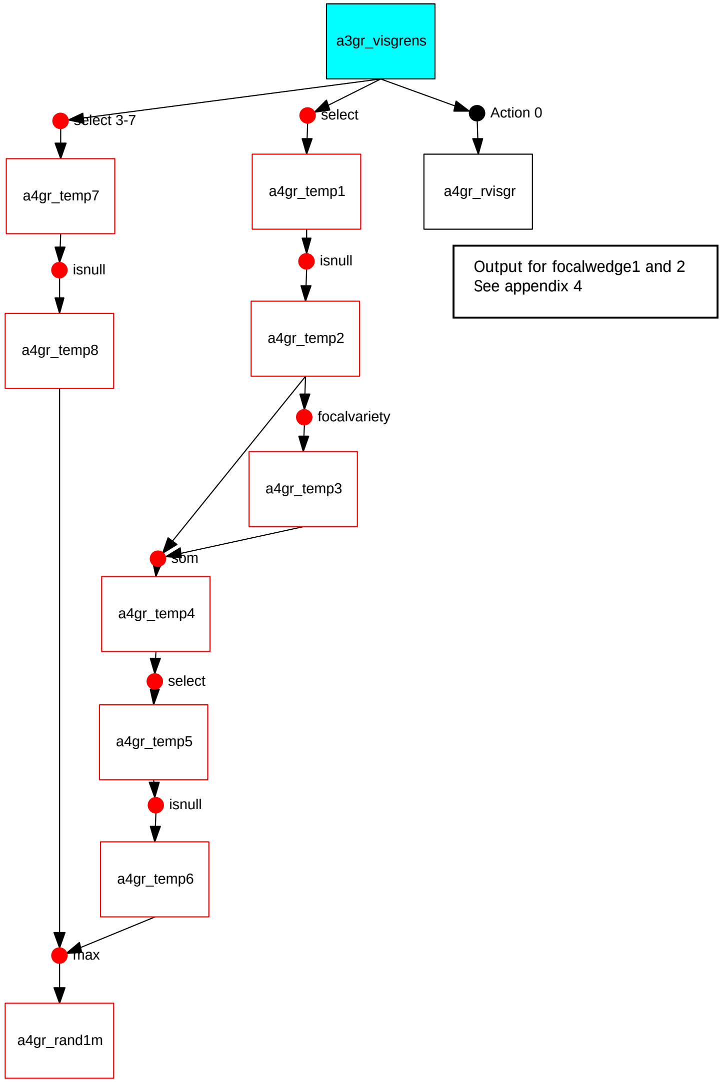
Hoogtevisibility



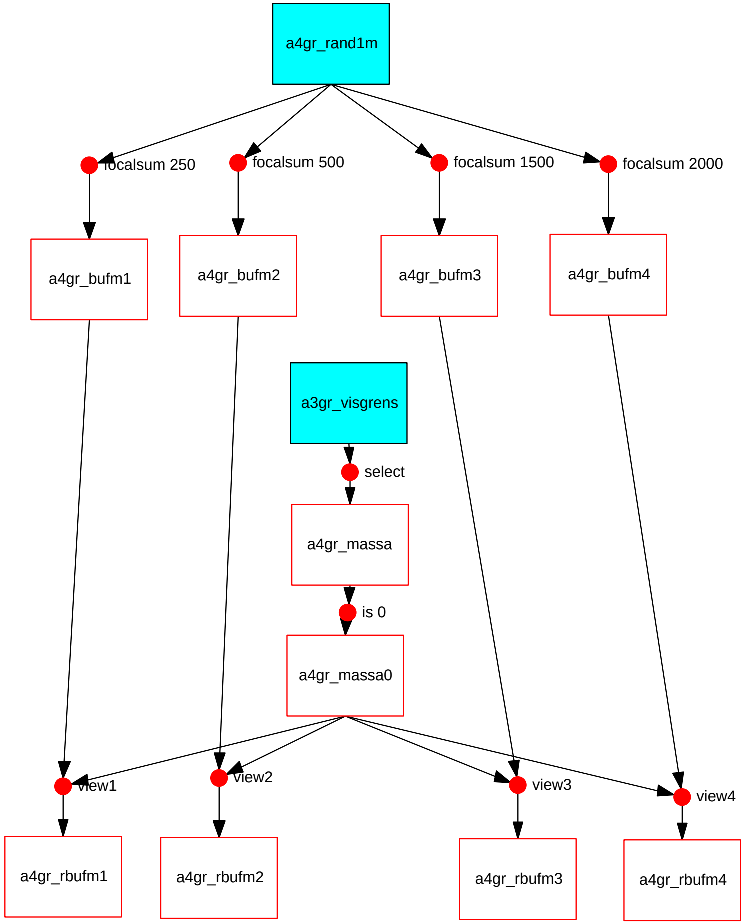
Parameters visibility

Vert1 = 0
Vert2 = -15
Radius = 2000

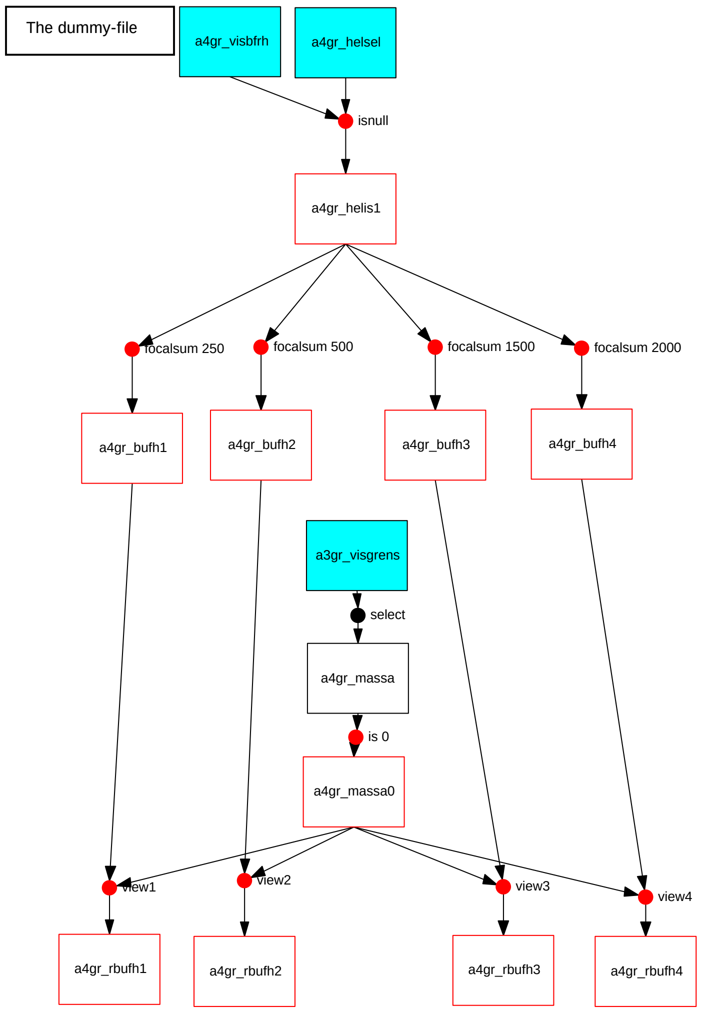
Focalmassavoorb



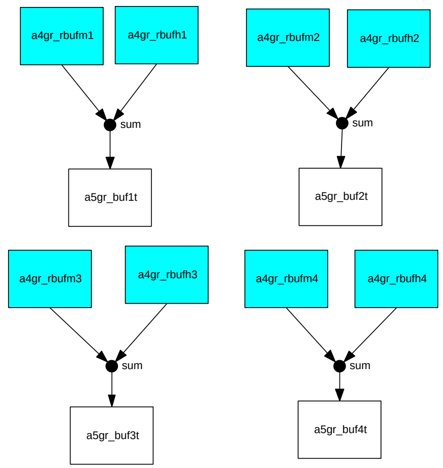
Focalmassa



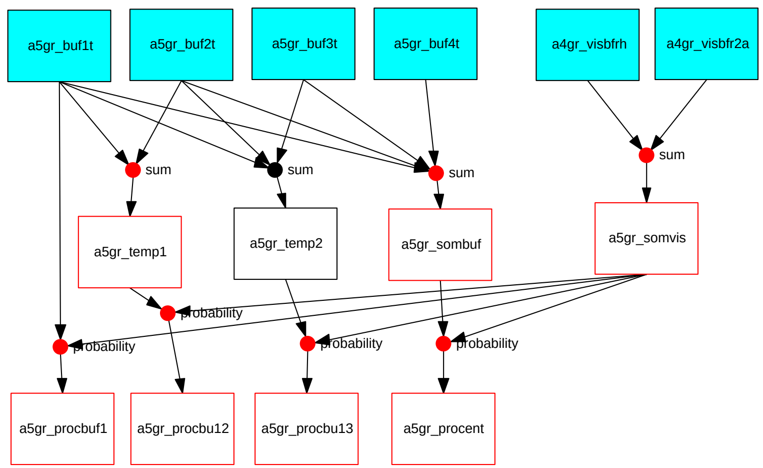
Focalhoogte



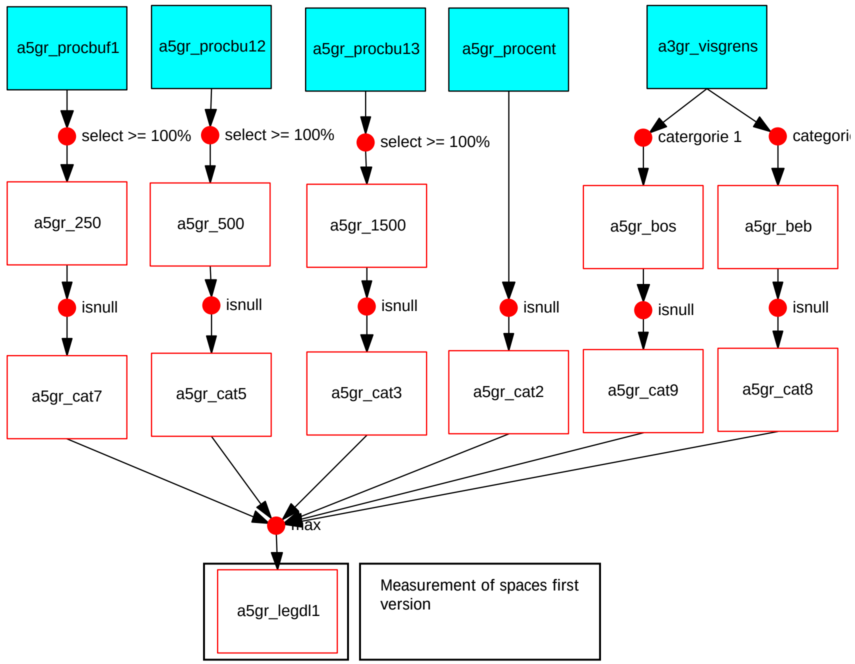
Samenvoegingmvr



Potentiemvr

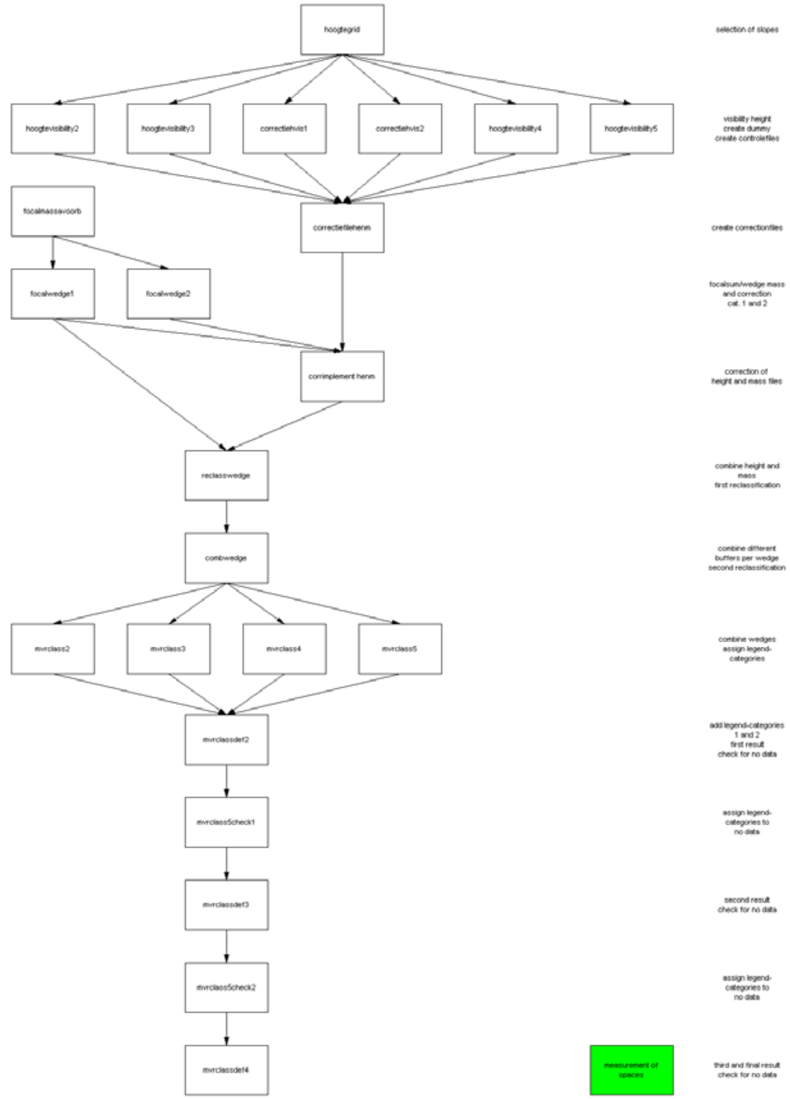


Mvrclassificatie

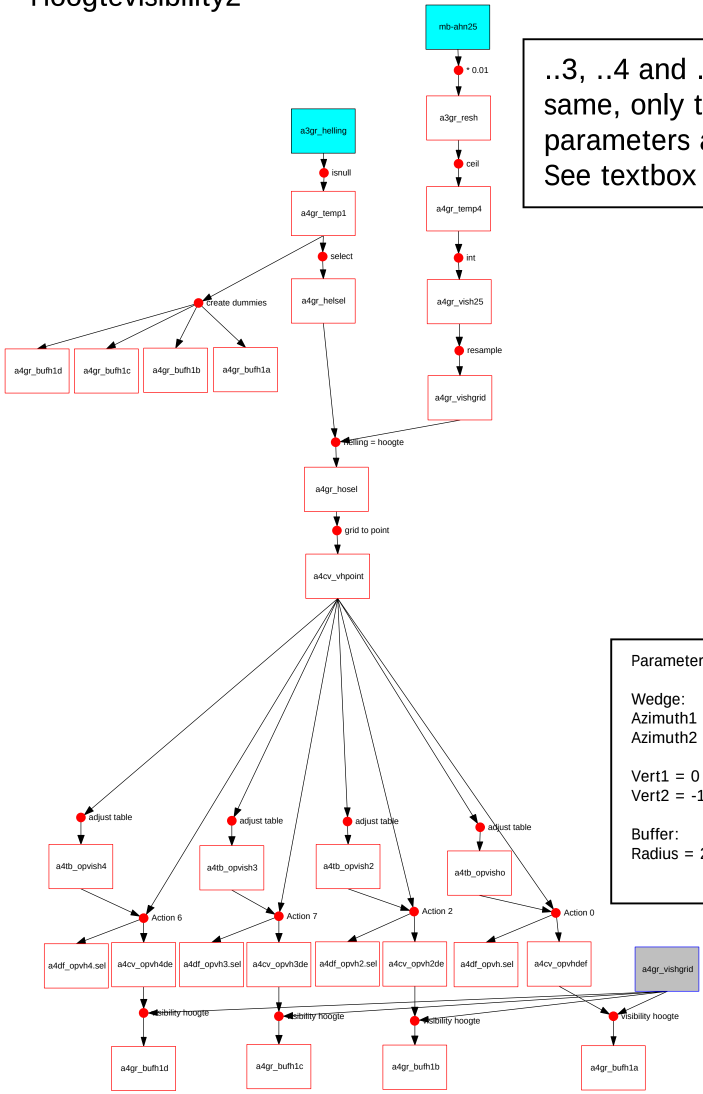


9 Action-model measurement of spaces 2

This is the main structure of the digitalisation of the second and up till now most accurate version of the measurement of spaces. To the right in green are the output-maps. The texts without the boxes are a few statements about what happens in the white boxes. On the next pages the white boxes will be displayed to give some overview over what happens during calculation. Hoogtegrid and focalmassavoorb have already been displayed in appendix 3 so they have been left out of this appendix.



Hoogtevisibility2



..3, ..4 and ..5 are the same, only the parameters are different. See textbox below

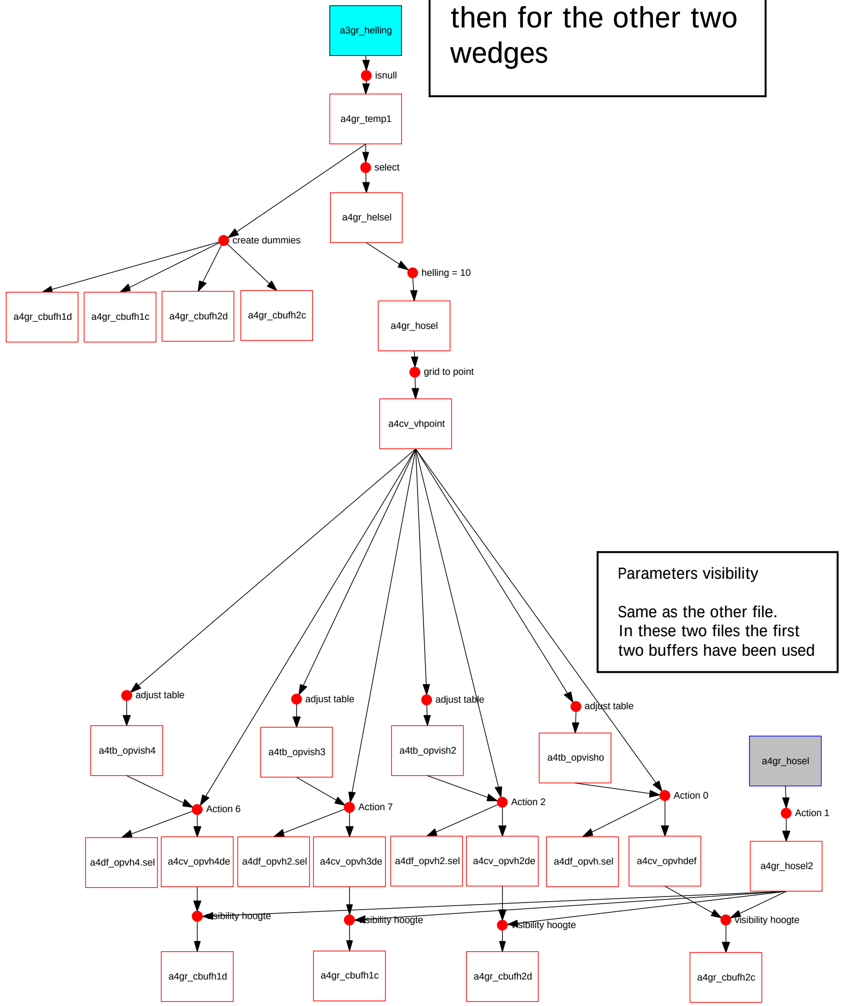
Parameters visibility

Wedge: a b c d
Azimuth1 = 345 255 165 75
Azimuth2 = 75 345 255 165

Vert1 = 0
Vert2 = -15

Buffer: 1 2 3 4
Radius = 250 500 1500 2000

Correctiehvis1

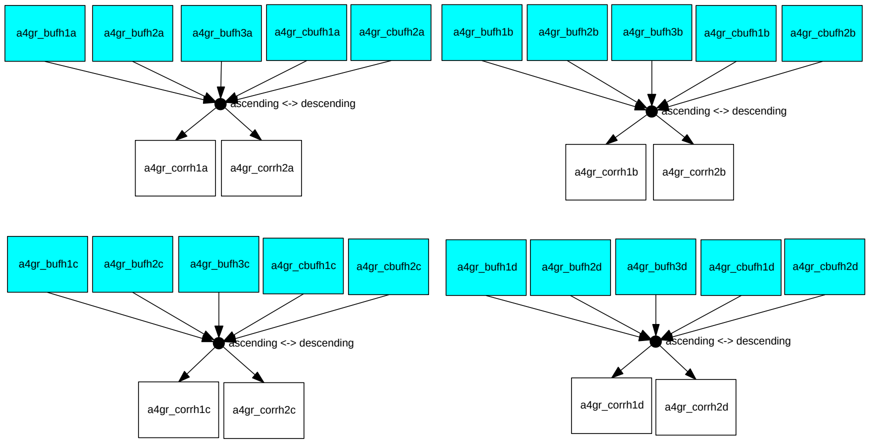


..2 is the same only then for the other two wedges

Parameters visibility

Same as the other file.
In these two files the first two buffers have been used

Correctiefilehenm



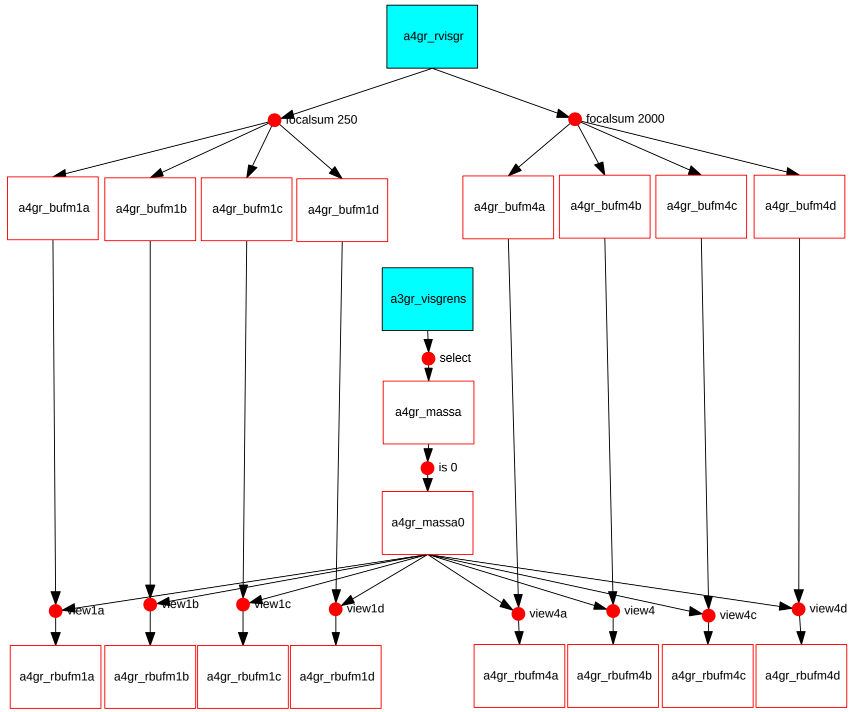
The if-statement

«a4gr_corrh1c.» = con(«a4gr_cbufh1c.» >= 2 * «a4gr_bufh1c.», con(«a4gr_bufh2c.» > «a4gr_cbufh1c.», ~
1000, con(«a4gr_bufh3c.» > 0, con(«a4gr_bufh3c.» > «a4gr_cbufh2c.», 1000, 0), con(~
«a4gr_bufh1c.» == 0 & «a4gr_cbufh1c.» == 0, 1000, 0))), 1000)

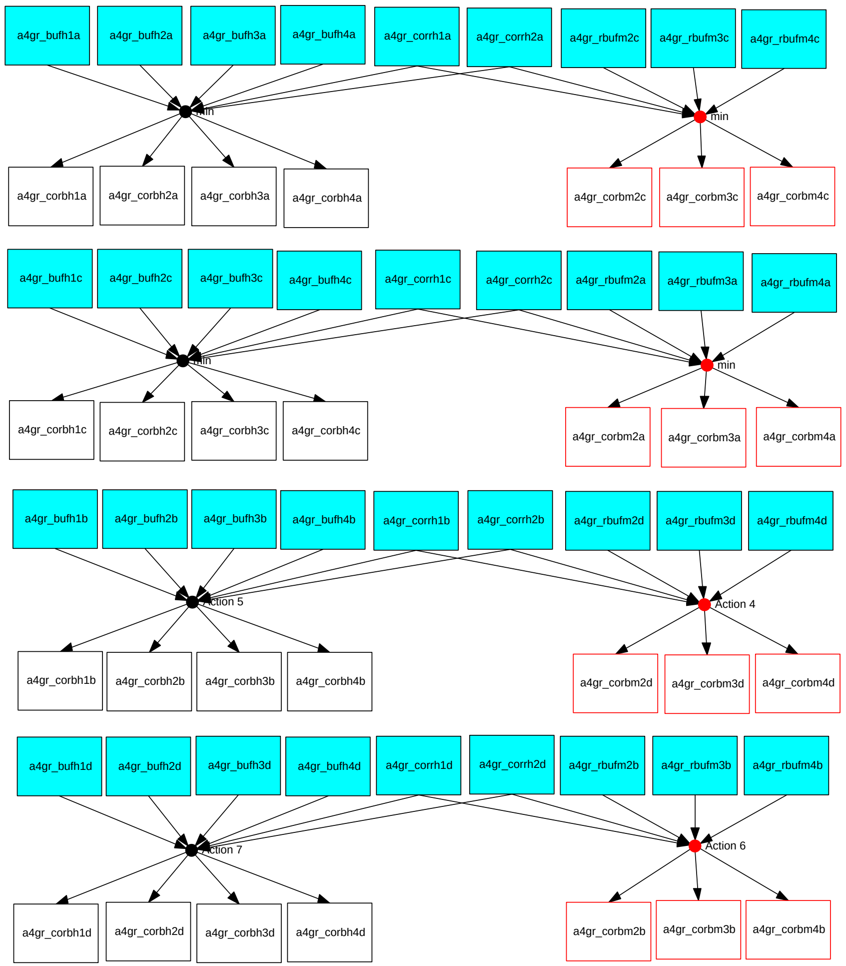
«a4gr_corrh2c.» = con(«a4gr_cbufh2c.» >= 2 * «a4gr_bufh2c.», con(«a4gr_bufh3c.» > 0, ~
con(«a4gr_bufh3c.» > «a4gr_cbufh2c.», 1000, 0), con(«a4gr_bufh2c.» == 0 & «a4gr_cbufh2c.» == 0, ~
1000, 0)), 1000)

Focalwedge1

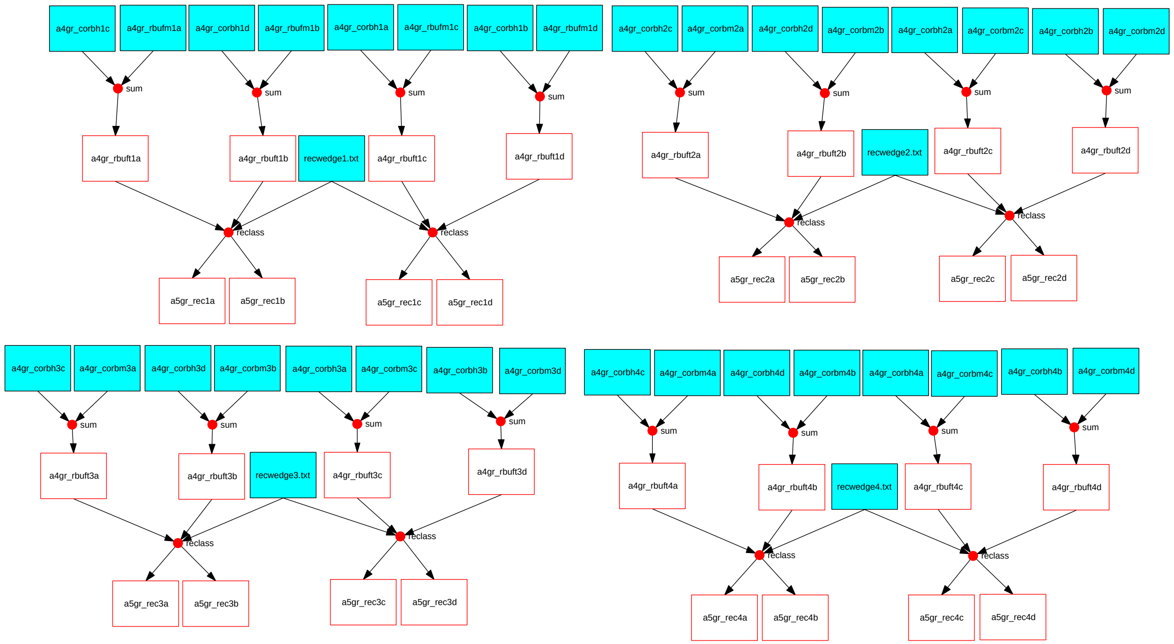
..2 is the same, but then for the other two buffers



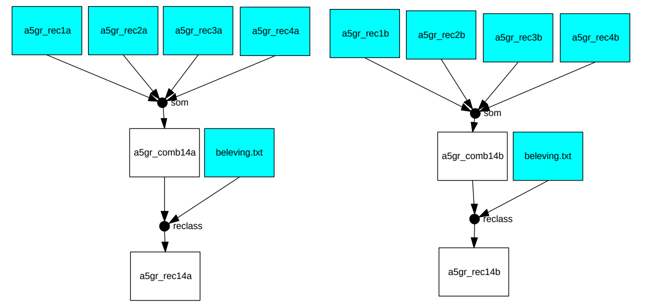
Corrimplement henm

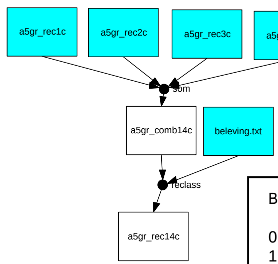


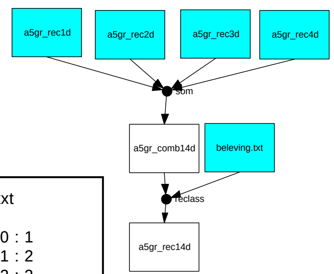
Reclasswedge



Combwedge





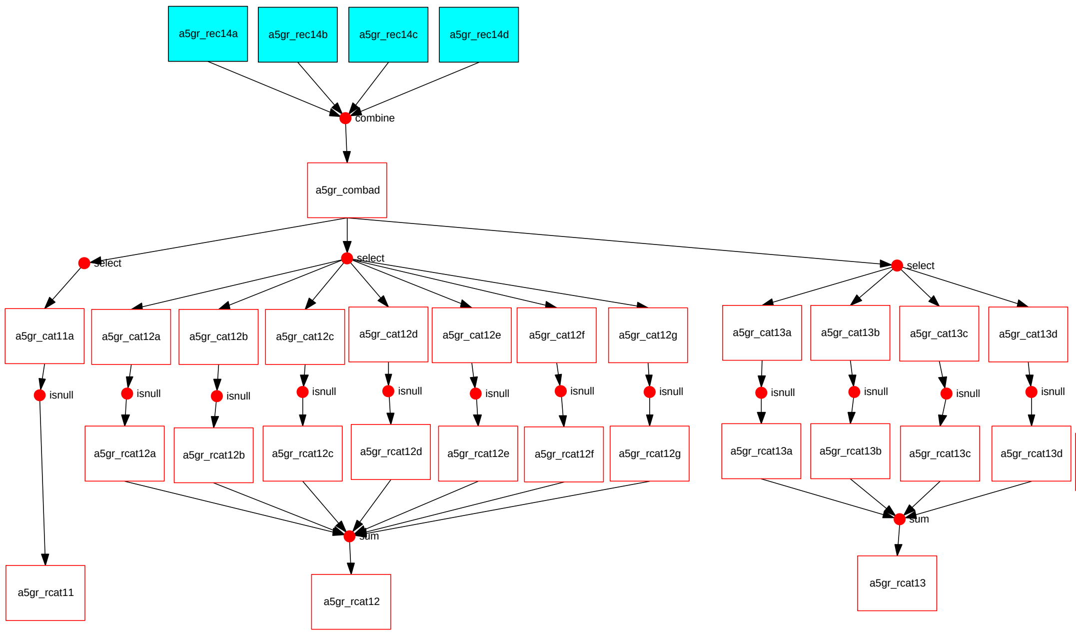


Recwedge1.txt		Recwedge2.txt		Recwedge3.txt		Recwedge4.txt	
0	0 : 0	0	4 : 0	0	13 : 0	0	111 : 0
1	3 : 1000	5	9 : 100	14	81 : 10	112	139 : 1
4	4 : 2000	10	13 : 200	82	111 : 20	140	198 : 2

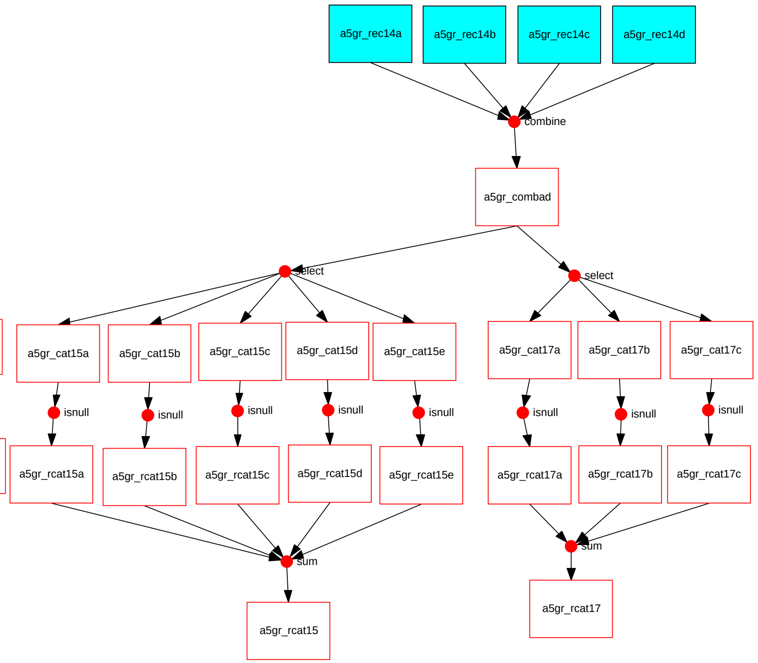
Beleving.txt

0	0 : 1
1	1 : 2
2	2 : 3
10	10 : 4
11	11 : 5
12	12 : 6
20	22 : 7
100	100 : 8
101	101 : 9
102	102 : 10
110	112 : 11
120	122 : 12
200	222 : 13
1000	1000 : 14
1001	1001 : 15
1002	1002 : 16
1010	1012 : 17
1020	1022 : 18
1100	1122 : 19
1200	1222 : 20
2000	2222 : 21

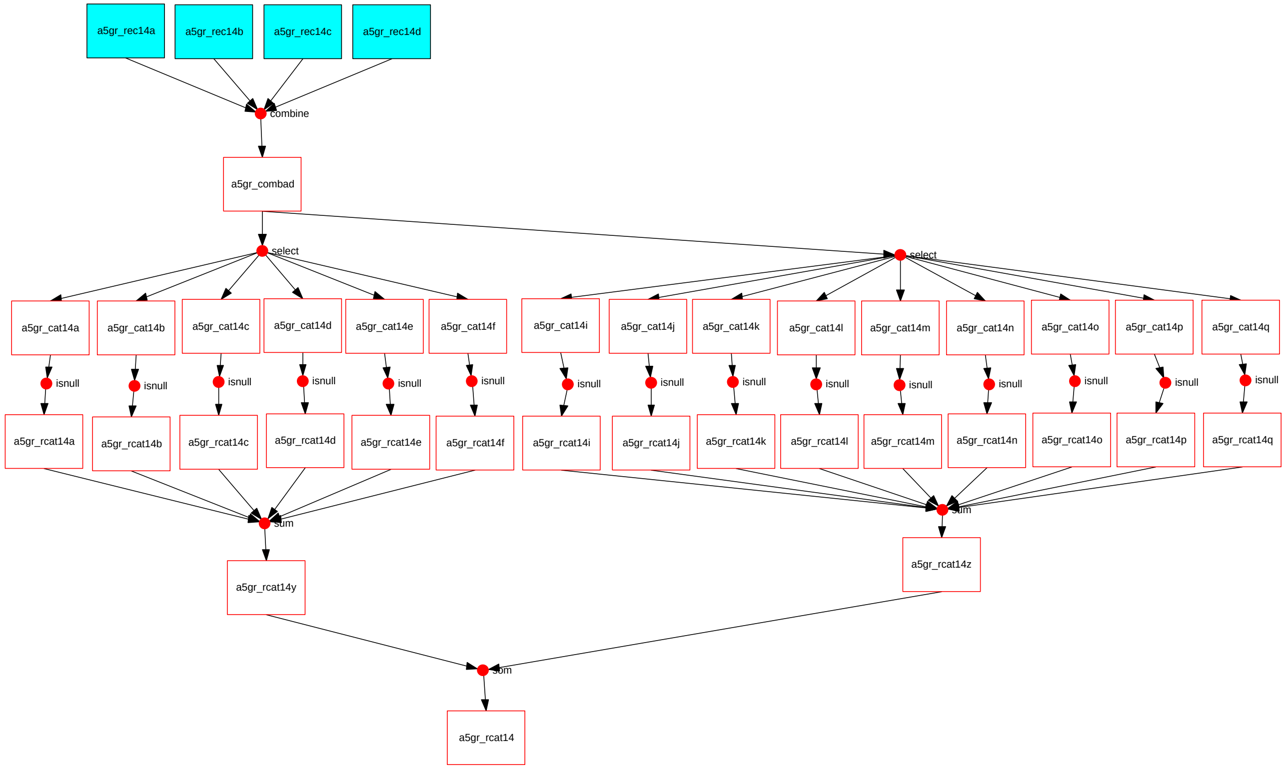
Mvrclass2



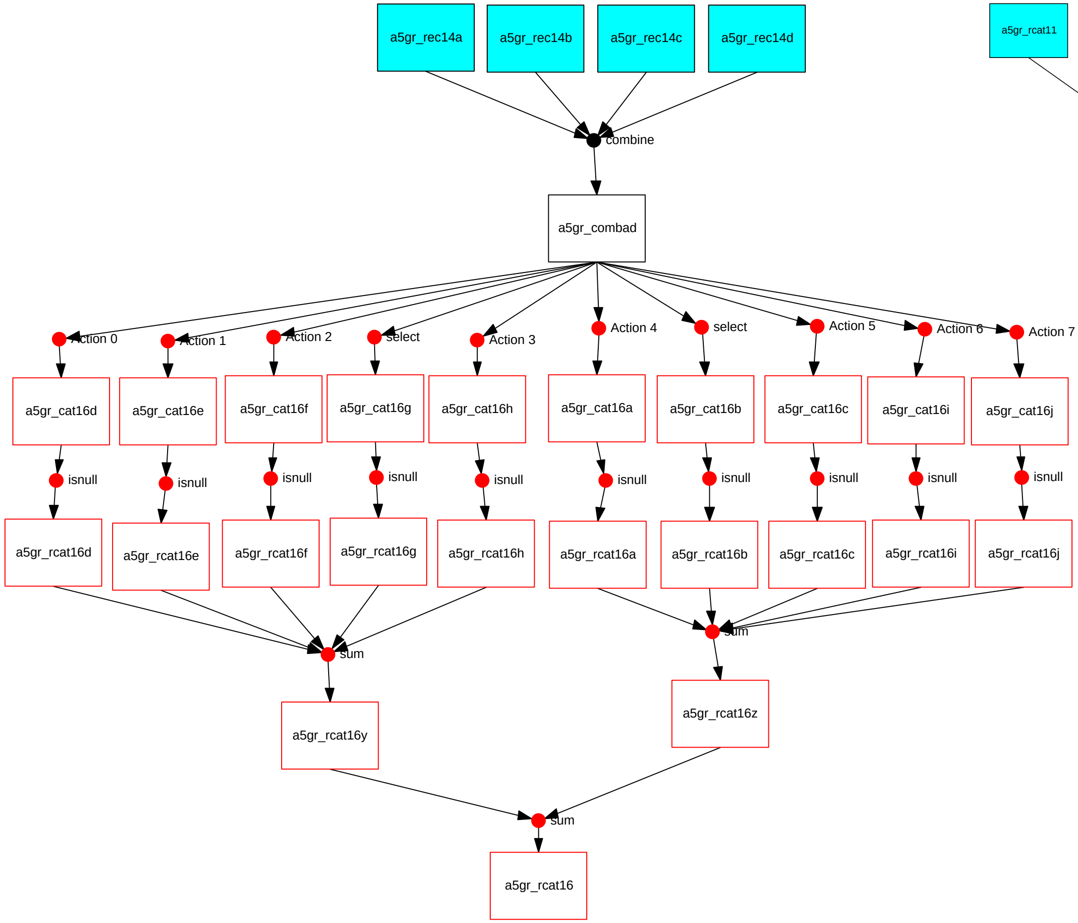
Mvrclass4



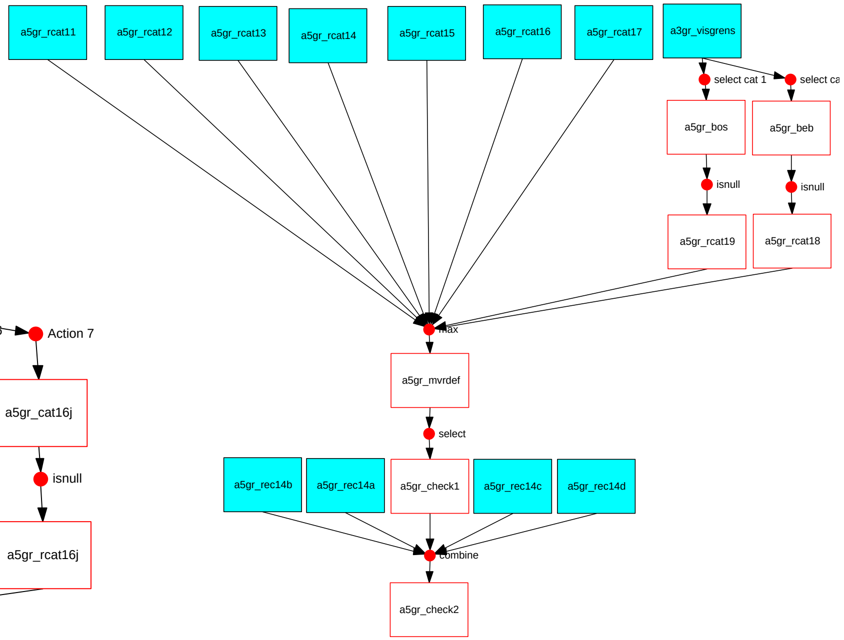
Mvrclass3


a5gr_rec14a
a5gr_rec14b
a5gr_rec14c
a5gr_rec14d
combine
a5gr_combad
select
select
a5gr_cat14a
a5gr_cat14b
a5gr_cat14c
a5gr_cat14d
a5gr_cat14e
a5gr_cat14f
a5gr_cat14i
a5gr_cat14j
a5gr_cat14k
a5gr_cat14l
a5gr_cat14m
a5gr_cat14n
a5gr_cat14o
a5gr_cat14p
a5gr_cat14q
isnull
a5gr_rcat14a
a5gr_rcat14b
a5gr_rcat14c
a5gr_rcat14d
a5gr_rcat14e
a5gr_rcat14f
a5gr_rcat14i
a5gr_rcat14j
a5gr_rcat14k
a5gr_rcat14l
a5gr_rcat14m
a5gr_rcat14n
a5gr_rcat14o
a5gr_rcat14p
a5gr_rcat14q
sum
a5gr_rcat14y
a5gr_rcat14z
sum
a5gr_rcat14

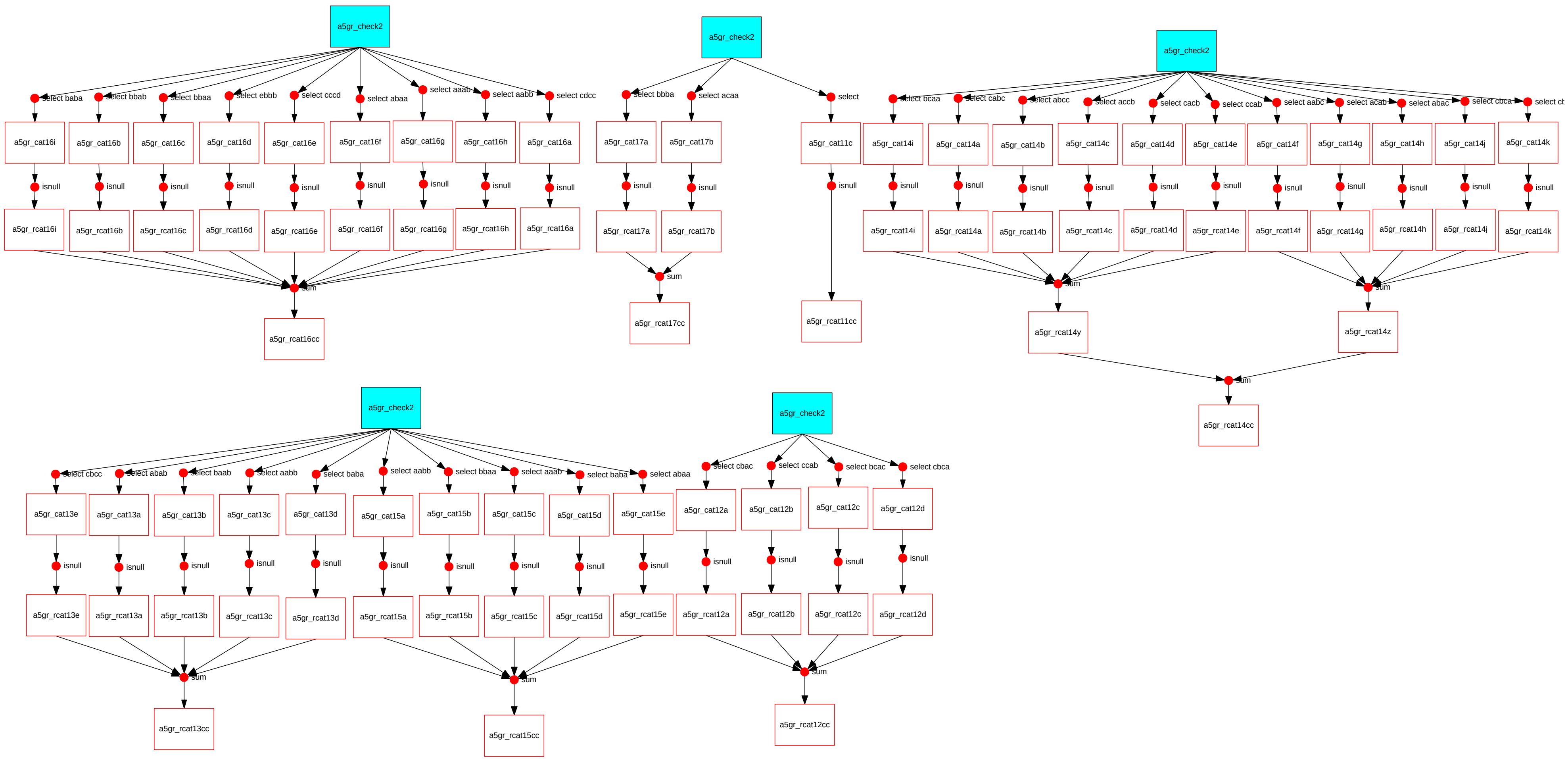
Mvrclass5



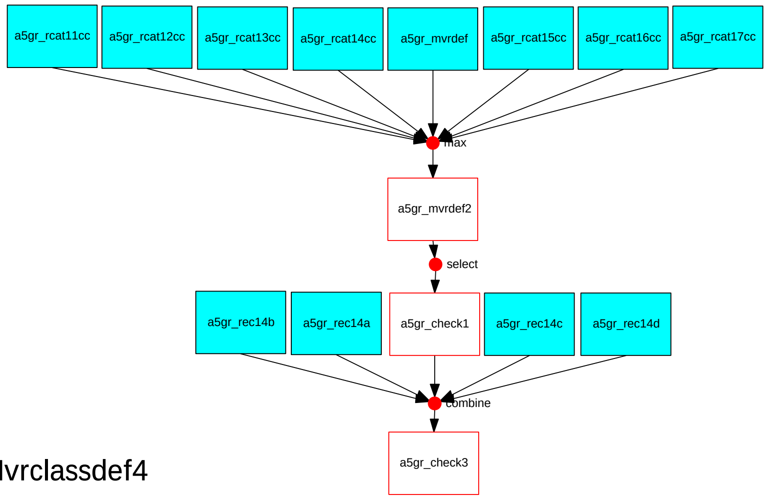
Mvrclassdef2



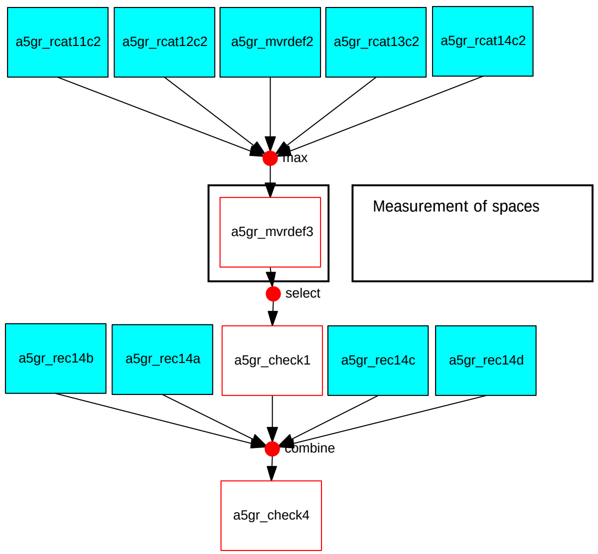
Mvrclass5check1



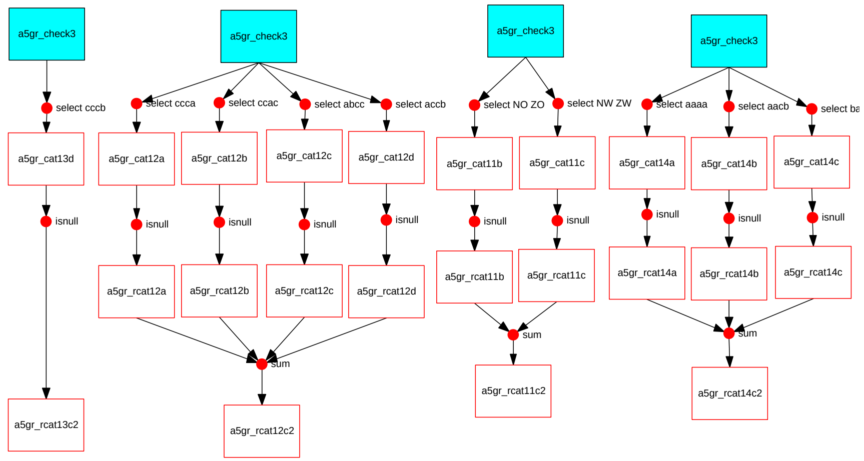
Mvrclassdef3



Mvrclassdef4



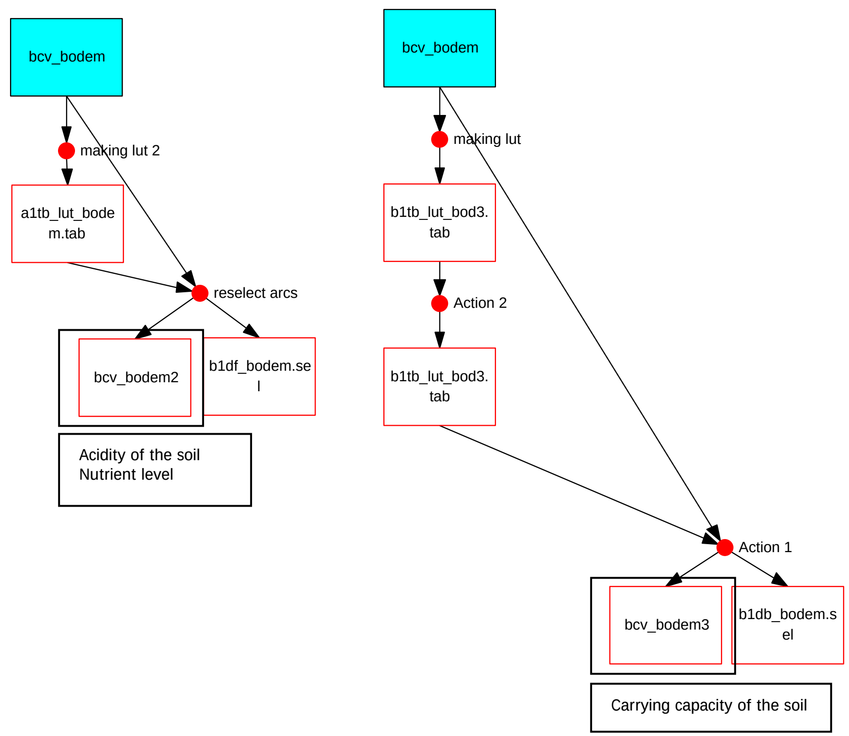
Mvrclass5check2



10 Action-model the other maps

This appendix deals with the maps that could not directly be put into one of the other action-models. The flowcharts on the next pages are not in a specific order, but can be run independently. The flowchart 'bodemkaarten' deals with the acidity and the nutrient level of the soils. 'Waarschuwingenkaart' deals with the early warning map and the map of the watersheds. 'Ontwikkeling' deals with the development process of the landscape, which can be found in paragraph 2.2.3, 3.2 and appendix 8.

Bodemkaarten



Reclassgwt.txt

0 : 0
10 : 1
20 : 1
30 : 1
35 : 1
40 : 2
50 : 1
55 : 2
60 : 3
70 : 3
75 : 3

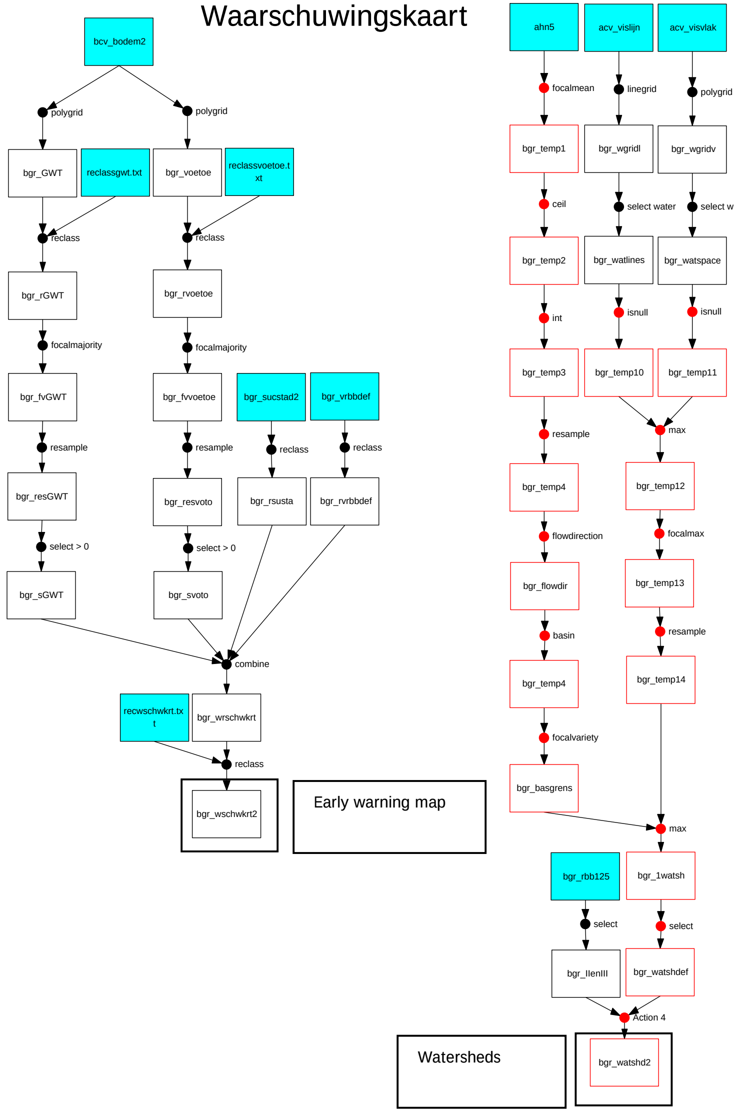
Reclassvoetoe.txt

1 2 : 1
3 4 : 2

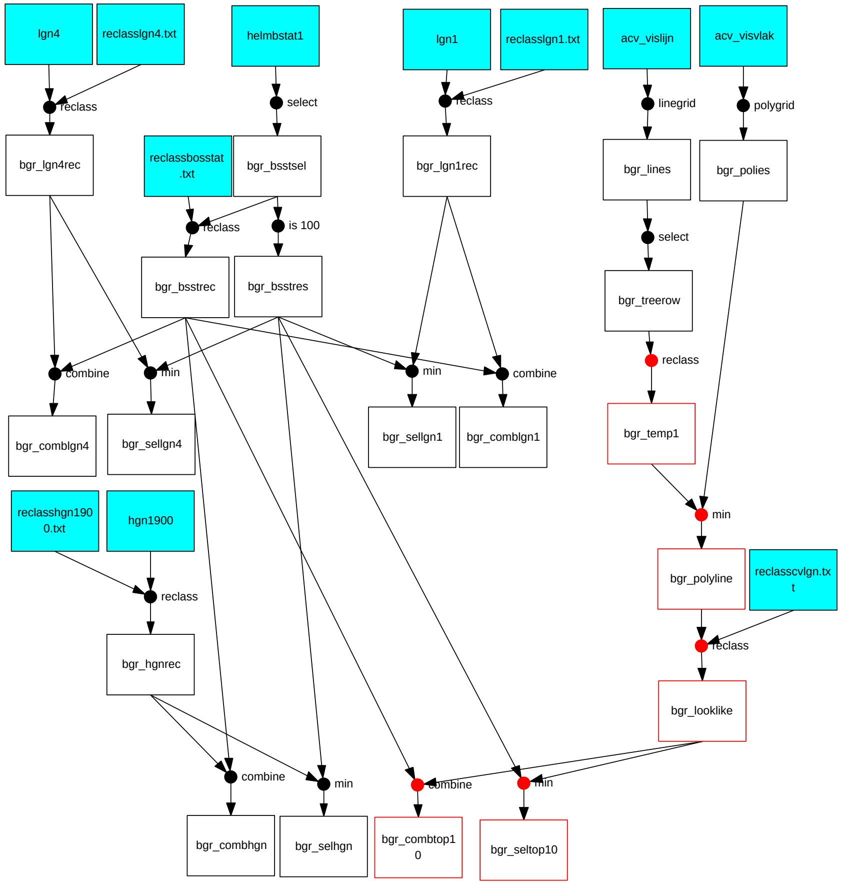
Recwschwkrt.txt

1 : 7
2 : 9
3 : 17
4 : 15
5 : 1
6 : 11
7 : 12
8 : 3
9 : 13
10 : 4
11 : 2
12 : 16
13 : 8
14 : 15
15 : 10
16 : 18
17 : 5
18 : 14
19 : 16
20 : 18
21 : 6
22 : 17
23 : 14
24 : 13

Waarschuwingskaart



Ontwikkeling



Reclassvlgn.txt
1013 : 8
1073 : 3
3473 : 10
5053 : 6
5063 : 56
5073 : 30
5083 : 40
5203 : 2
5223 : 4
5233 : 4
5243 : 17
5253 : 16
5303 : 8
5313 : 4
20000 : 10
31000 : 10
32000 : 10
33000 : 10
34000 : 10
34010 : 10
34030 : 10
35000 : 10
36000 : 10
39000 : 10
50020 : 5
52010 : 1
52060 : 8
61010 : 7

Reclasshgn1900.txt
1 : 1
2 : 2
3 : 70
4 : 5
5 : 6
6 : 80
7 : 7
8 : 22
9 : 16
10 : 100

Reclasslgn4.txt
1 : 1
2 : 2
3 : 2
4 : 2
5 : 2
6 : 2
8 : 3
9 : 4
10 : 2
11 : 5
12 : 6
16 : 7
17 : 7
18 : 8
19 : 8
20 : 5
21 : 6
22 : 8
23 : 1
24 : 9
25 : 10
26 : 8
30 : 11
31 : 12
32 : 13
33 : 14
34 : 15
35 : 16
36 : 17
37 : 18
38 : 18
39 : 19
40 : 20
41 : 21
42 : 22
43 : 23
44 : 24
45 : 25
46 : 25

Reclassbosstat.txt
1 : 6
2 : 6
3 : 5
4 : 5
5 : 40
6 : 40
7 : 5
8 : 5
9 : 5
10 : 5
11 : 5
12 : 5
13 : 22
14 : 4
15 : 17
16 : 30
17 : 24
18 : 30
19 : 16

Reclasslgn1.txt
1 : 1
2 : 2
3 : 2
4 : 2
5 : 2
6 : 2
7 : 90
8 : 3
9 : 4
10 : 2
11 : 4
12 : 17
13 : 5
14 : 6
15 : 25
16 : 7
17 : 80

11 Reclassification-table TOP10 vector

Lines					Polygones				
new code	old code	new name	old name	mass	new code	old code	new name	old name	mass
1040		brick wall		mass	1013		build-up area		mass
1370		sewage cleaner		mass	1073		greenhouse		mass
3450		building, partly or completely over a road		mass	3473		pedestrian area		
3640		path			5053		pine forest		mass
4810		high-tension line			5063		mixed forest		mass
5111		hedge		mass	5073		willow coppice		mass
6520		landing-stage			5083		poplar plantation		mass
7141		low dike for driving up the waterlevel			5203		cropland		
8190		fence			5223		orchard		mass
40000	4000	railway	single lane railwaytrack		5233		tree/shrub nursery		mass
	4040		double lane railwaytrack		5243		moor		
	4042		double lane railwaytrack		5253		open sand		
51000	5120	row of trees	row of trees	mass	5303		graveyard		
	5121		row of trees		5313		fruit orchard		mass
	5122		row of trees		20000	2002	highway	highway	
	5130		one row out of two			2003		highway	
	5131		one row out of two			2202		connection route with separate lanes	
	5132		one row out of two			2203		connection route with separate lanes	
	5190		row of trees on middle reserve			2302		connection route > 7m	
60010	6010	ditch (< 3m)	single ditch			2303		connection route > 7m	
	6012		single ditch			2342		100 km/h highway as connection	
60020	6020	ditch (3-6m)	ditch (3-6m)					route with separate lanes	
	6022		ditch (3-6m)		31000	2402	quarter connection road	connection route > 4m	
71000	7100	dike	dike > 2.5m	mass		2403		connection route > 4m	
	7101		dike > 2.5m			2873		local road with separate lanes	
	7110		dike 1-2.5m			3002		other routes with separate lanes	
	7111		dike 1-2.5m			3003		other routes with separate lanes	
71050	7150	bank/wharf	bank/wharf			3102		other routes > 7m	
	7151		bank/wharf			3103		other routes > 7m	
72050	7250	steep edge	steep edge			3142		local road > 7m	
	7251		steep edge			3143		local road > 7m	
					32000	3202	local road > 4m	other recommended route > 4m	
						3203		other recommended route > 4m	
						3242		local road > 4m	
						3243		local road > 4m	
					33000	3302	local road > 2m	other recommended route > 2m	
						3342		local road > 2m	
						3343		local road > 2m	
					34000	3402	country road	other road > 2m	
						3403		other road > 2m	
					34010	3412	partially paved road	partially paved > 2m	
						3413		partially paved > 2m	
					34030	3432	unpaved road	unpaved road > 2m	
						3433		unpaved road > 2m	
					35000	3532	street	street	
						3533		street	
					36000	3602	cycle track	cycle track	
						3603		cycle track	
					39000	3902	parking space	parking space	
						3903		parking space	
					50020	5022	deciduous forest	deciduous forest	mass
						5023		deciduous forest	
					52010	5212	pasture	pasture	
						5213		pasture	
					52060	5262	other ground-use	other ground-use	
						5263		other ground-use	
					61010	6112	small waterbody	small waterbody	
						6113		small waterbody	
Codes not taken into acount, but present in the area: 6000, 6001, 6002, 7220, 7221, 7267, 7268, 7271, 7272, 7277, 7278, 7291, 7297, 7298					These are all codes present in the area				

Houses					Symbols				
new code	old code	new name	old name	mass	new code	old code	new name	old name	mass
1000		building		mass	1510		windmill		mass
1030		high-rise building (height > 35m)		mass	1550		pumping-station		mass
1080		storage tank		mass	1700		religious building		mass
					1750		chapel		mass
					1800		tower		mass
					1810		religious building with tower		mass
					4300		railway station		mass
					4730		send/receive tower		mass
					4800		high-tension pylon		
					5000		tree		
these are all codes present in the area					Codes not taken into account, but present in the arount: 1100, 1120, 1110, 1410, 1540, 1760, 3850, 3860, 3870, 4390, 6300, 6604, 6740, 6764, 6774, 6794,				

12 Reclassification of the LGN4, LGN1, FS1, HGN and TOP10

LGN4 (original)

value	description	reclass value
1	grass	1
2	maize	2
3	potatoes	2
4	beets	2
5	cereals	2
6	other crops	2
7	-	-
8	greenhouse	3
9	orchard	4
10	bulbs	2
11	deciduous forest	5
12	pine forest	6
13	-	-
14	-	-
15	-	-
16	freshwater	7
17	saltwater	7
18	urban build-up area	8
19	buildings in suburban area	8
20	deciduous forest in build-up area	5
21	pine forest in build-up area	6
22	densely builded forest	8
23	grass in build-up area	1
24	bare ground in build-up area	9
25	main roads and railwaytracks	10
26	buildings in rural area	8
27	-	-
28	-	-
29	-	-
30	saltings	11
31	open sands in coastal area	12
32	open dune-vegetation	13
33	closed dune-vegetation	14
34	dune-moor	15
35	open sands	16
36	moor	17
37	moderately grassed moor	18
38	strongly grassed moor	18
39	upland peat	19
40	forest on upland peat	20
41	other swamp-vegetation	21
42	reed-vegetation	22
43	forest in marshland	23
44	peat-bog	24
45	other open grown nature area	25
46	bare ground in nature area	25

LGN4 (reclassed and base-legend)

value	description
1	pasture
2	cropland
3	greenhouse
4	orchard
5	deceduous forest
6	pine forest
7	open water
8	build-up area
9	unbuild-on area
10	infrastructure
11	saltings
12	beach
13	open dune-vegetation
14	closed dune-vegetation
15	dune-moor
16	open sands
17	moor
18	grassy moor
19	upland peat
20	forest on upland peat
21	other swamp-vegetation
22	reed
23	forest in marshland
24	peat-bog
25	other nature
additional values	
30	coppice
40	poplar plantation
56	mixed forest
70	moor and upland peat
80	infrastructure and buildings
90	bare ground
100	other

Forest Statistics 1

value	description	reclass value
1	pine < 25 yrs	6
2	pine > 25 yrs	6
3	oak < 40 yrs	5
4	oak > 40 yrs	5
5	poplar < 10 yrs	40
6	poplar > 10 yrs	40
7	other deciduous wood < 40 yrs	5
8	other deciduous wood > 40 yrs	5
9	beech < 40 yrs	5
10	beech > 40 yrs	5
11	elm < 40 yrs	5
12	elm > 40 yrs	5
13	reed	22
14	orchard	4
15	moor	17
16	coppice	30
17	peat	24
18	willow coppice	30
19	open sands and dunes	16

HGN1900

value	description	reclass value
1	pasture	1
2	cropland and bare ground	2
3	moor and upland peat	70
4	deciduous forest	5
5	pine forest	6
6	infrastructure and buildings	80
7	water	7
8	reed-swamp	22
9	open sands and sand-banks	16
10	other	100

LGN1

value	description	reclass value
1	grass	1
2	maize	2
3	potatoes	2
4	beets	2
5	cereals	2
6	other crops	2
7	bare ground	90
8	greenhouse	3
9	fruit orchard	4
10	bulbs	2
11	tree nursery	4
12	moor	17
13	deciduous forest	5
14	pine forest	6
15	other nature	25
16	water	7
17	infrastructure and buildings	80

TOP10 vector

value	description	reclass value
1013	build-up area	8
1073	greenhouse	3
3473	pedestrian area	10
5053	pine forest	6
5063	mixed forest	56
5073	willow coppice	30
5083	poplar plantation	40
5203	cropland	2
5223	orchard	4
5233	tree/shrub nursery	4
5243	moor	17
5253	sand	16
5303	graveyard	8
5313	fruit orchard	4
20000	highway	10
31000	quarter connection road	10
32000	local road > 4m	10
33000	local road > 2m	10
34000	country road	10
34010	partially paved road	10
34030	unpaved road	10
35000	street	10
36000	cycle track	10
39000	parking space	10
50020	deciduous forest	5
52010	pasture	1
52060	other ground-use	9
61010	small waterbody	7

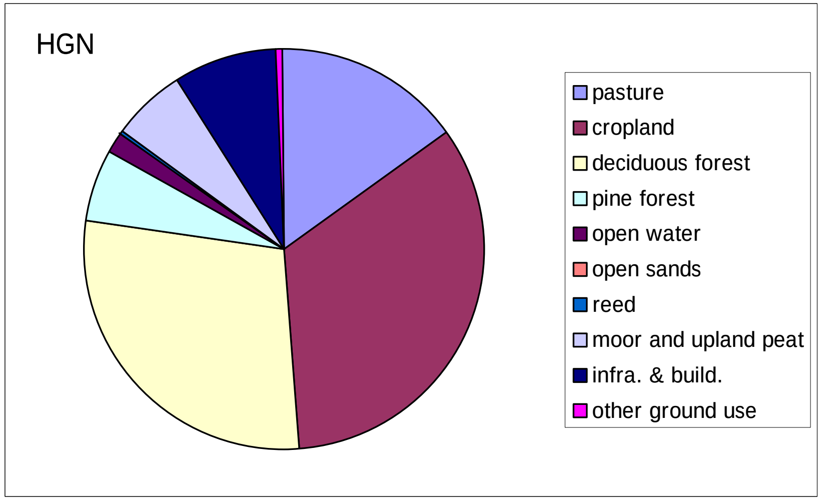
13 Comparison-table and pie-charts

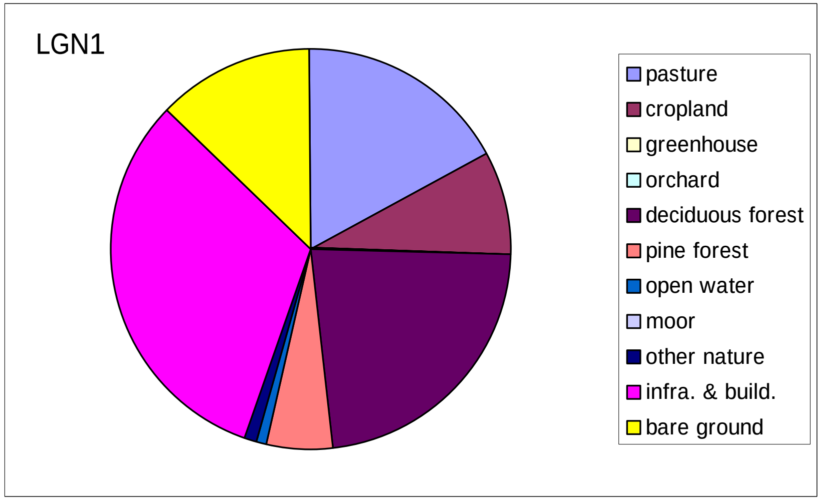
forest statisitcs 1		*1939-1942*	HGN		*1900*	LGN1		*1986*	LGN4		*1999-2000*	TOP10		*2002*
code	name	%	code	name	%	code	name	%	code	name	%	code	name	%
5	deciduous forest	6	2	cropland	33	80	infrastructure and buildings	33	1	pasture	24	5	deciduous	33
			5	deciduous forest	29	5	deciduous forest	22	5	deciduous	21	1	pasture	20
			1	pasture	15	1	pasture	17	8	build-up ar	19	8	build-up ar	16
			80	infrastructure and buildings	8	90	bare ground	13	2	cropland	17	2	cropland	11
6	pine forest	54	70	heather and peat	62	6	pine forest	53	6	pine forest	74	6	pine forest	45
			6	pine forest	26	25	other nature	15	1	pasture	6	56	mixed fore	32
			2	cropland	4	80	infrastructure and buildings	10	5	deciduous	6	1	pasture	5
			5	deciduous forest	3	5	deciduous forest	9	25	other natur	5	5	deciduous	5
16	open sand	<1	2	cropland	42	25	other nature	42	6	pine forest	48	6	pine forest	26
			70	heather and peat	34	6	pine forest	23	1	pasture	25	56	mixed fore	25
			16	open sand	19	90	bare ground	17	2	cropland	19	1	pasture	16
			80	infrastructure and buildings	5	2	cropland	8	8	build-up ar	5	2	cropland	16
17	heather	22	70	heather and peat	70	6	pine forest	32	6	pine forest	40	6	pine forest	31
			6	pine forest	17	17	heather	19	17	heather	16	17	heather	27
			5	deciduous forest	4	25	other nature	16	1	pasture	9	56	mixed fore	15
			2	cropland	3	90	bare ground	9	18	grassy hea	9	1	pasture	9
24	peat	4	1	pasture	63	1	pasture	25	1	pasture	34	1	pasture	27
			70	heather and peat	13	5	deciduous forest	16	5	deciduous	17	5	deciduous	20
			5	deciduous forest	12	80	infrastructure and buildings	16	8	build-up ar	14	8	build-up ar	18
			22	reedswamp	6	90	bare ground	13	7	water	11	17	heather	9
30	coppice	6	1	pasture	48	5	deciduous forest	31	5	deciduous	35	5	deciduous	39
			5	deciduous forest	33	1	pasture	28	1	pasture	30	1	cropland	27
			2	cropland	10	80	infrastructure and buildings	17	8	build-up ar	13	8	unbuild-on	11
			6	pine forest	5	90	bare ground	11	2	cropland	13	2	mixed fore	11
40	poplar plantation	8	1	pasture	43	1	pasture	30	1	pasture	37	1	pasture	30
			2	cropland	38	80	infrastructure and buildings	22	2	cropland	23	5	deciduous	30
			5	deciduous forest	14	5	deciduous forest	17	8	build-up ar	19	2	cropland	16
			80	infrastructure and buildings	3	2	cropland	17	5	deciduous	16	8	build-up ar	16

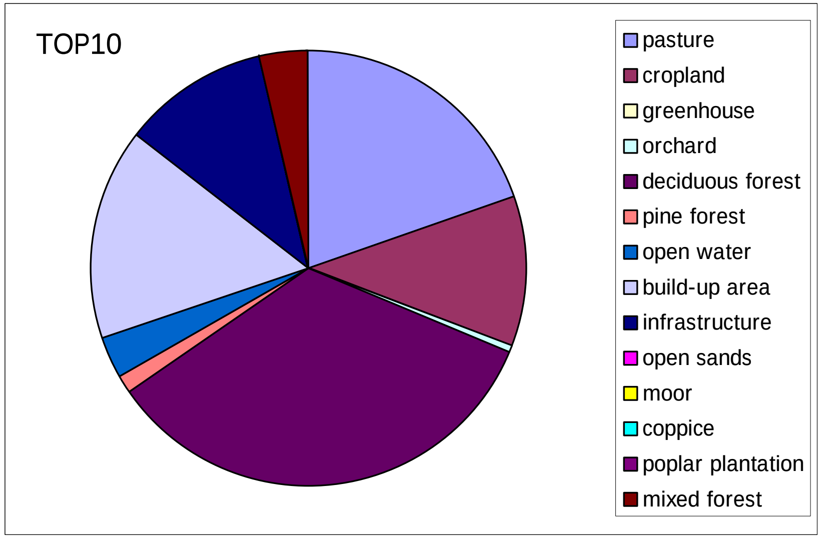
the code numbers are based on the legend of the LGN4
exceptions are:

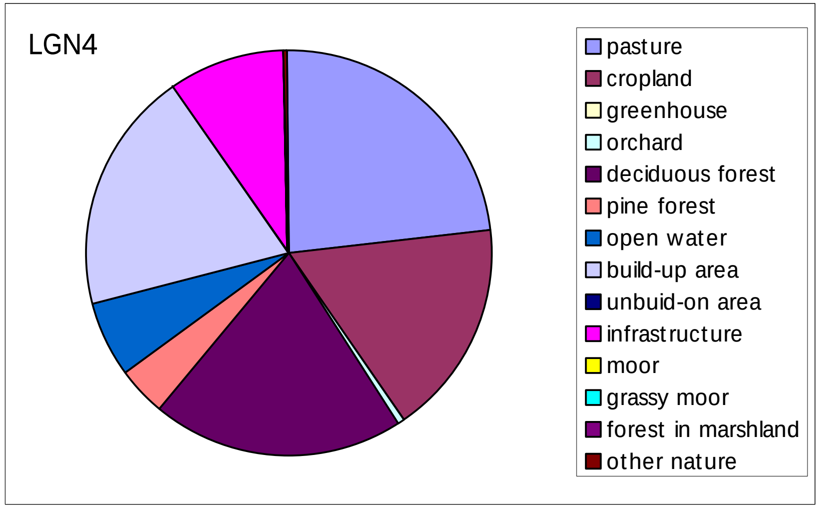
Forest statistics		included in LGN4-code:
30	coppice	5
40	poplar plantation	5
LGN1		
80	infrastructure and buildings	8 and 10
90	bare land	2 and 9
TOP10		
30	coppice	5
40	poplar plantation	5
56	mixed forest	6
HGN		
70	heather and peat	17, 18, 19
100	other ground-use	can be anything

Forest statistics 1 – deciduous forest

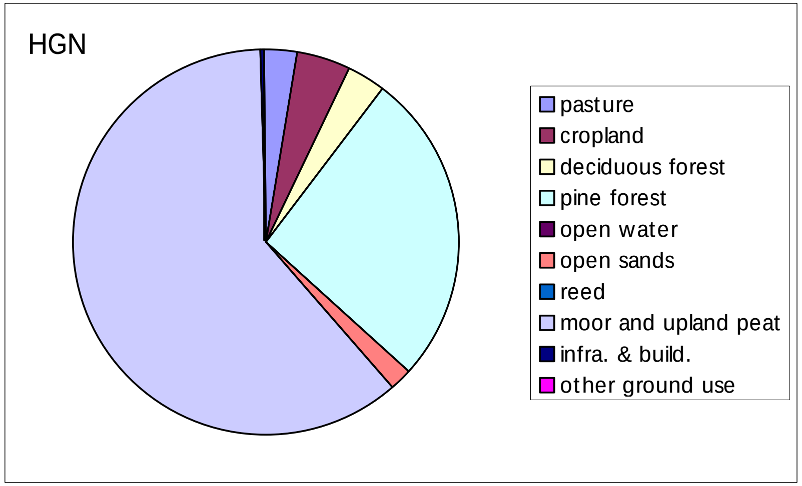


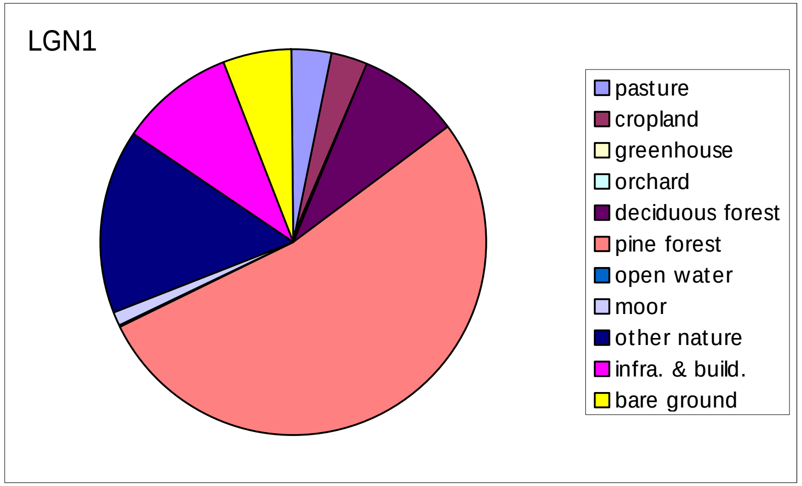


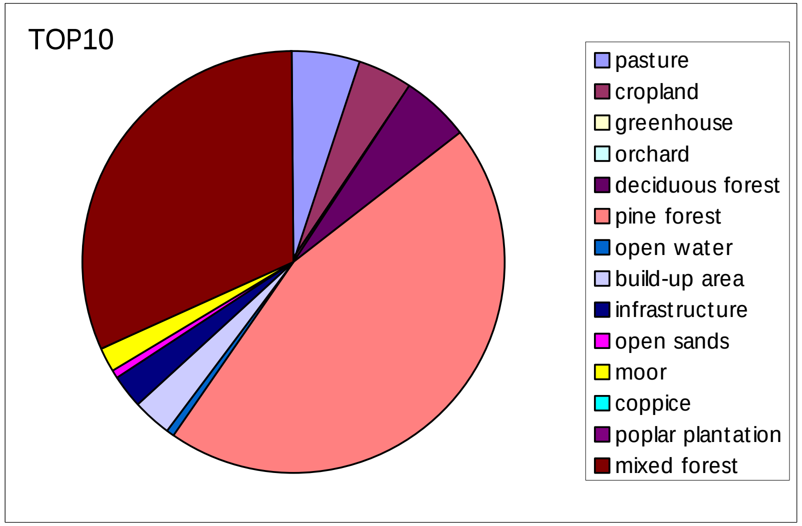


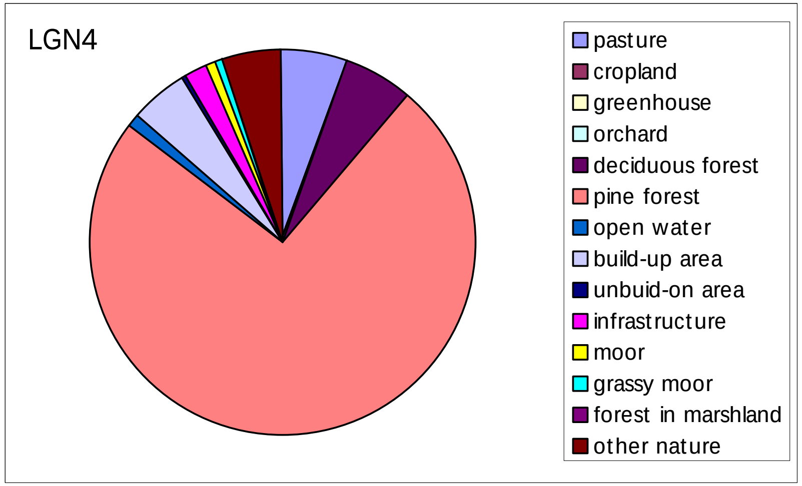


Forest statistics 1 – pine forest

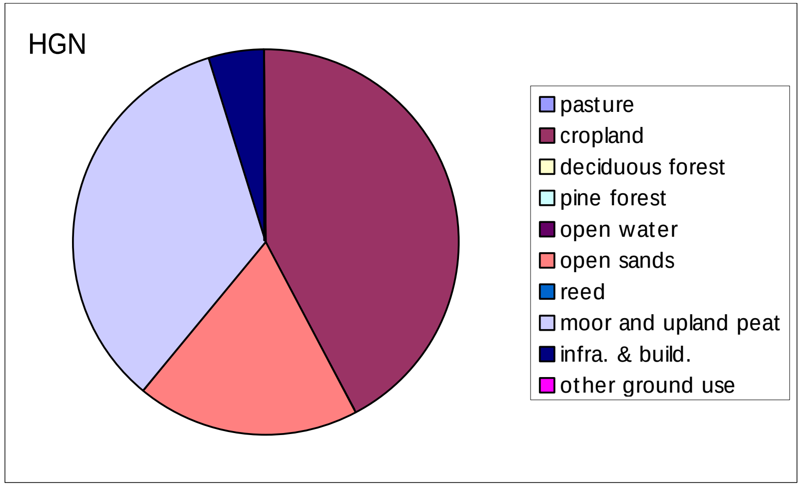


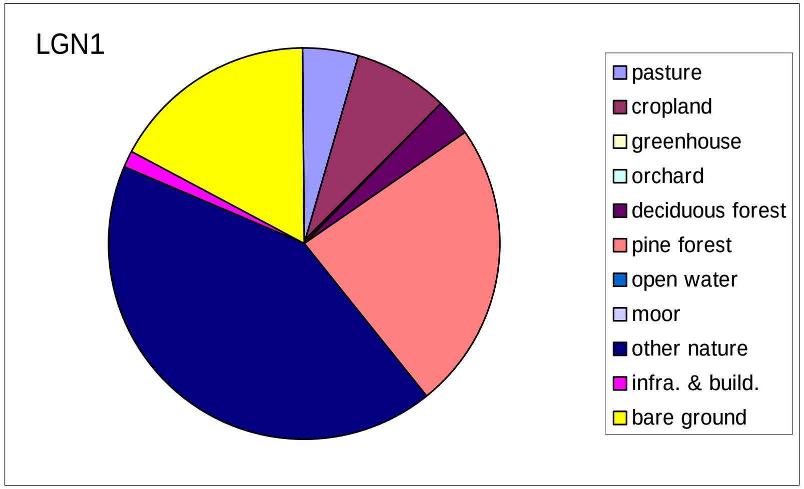


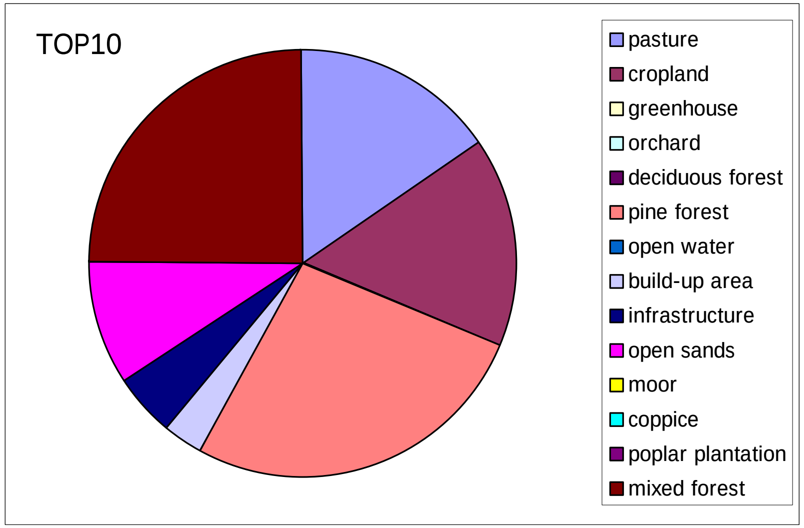


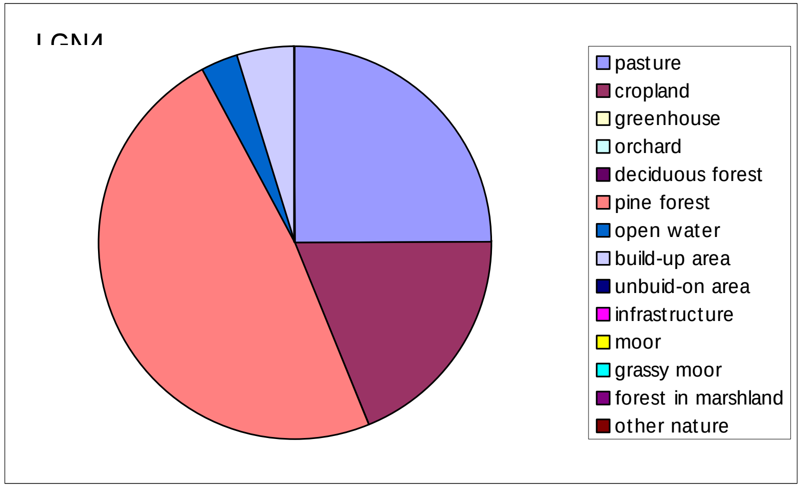


Forest statistics 1 – open sands

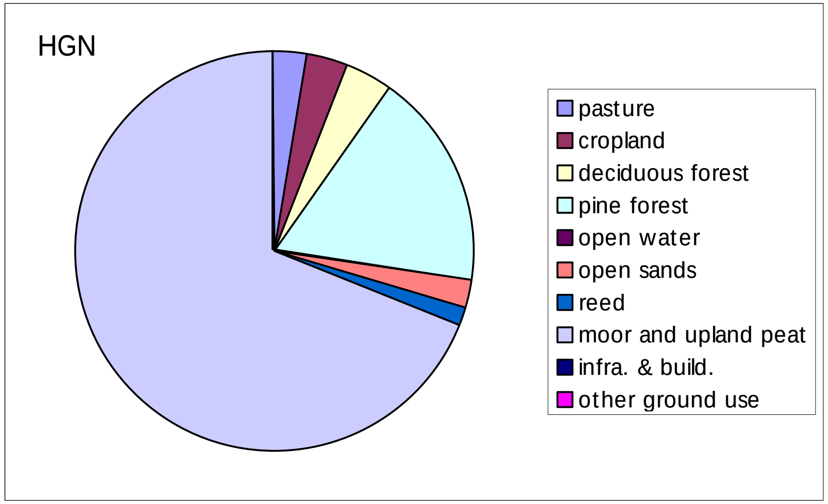


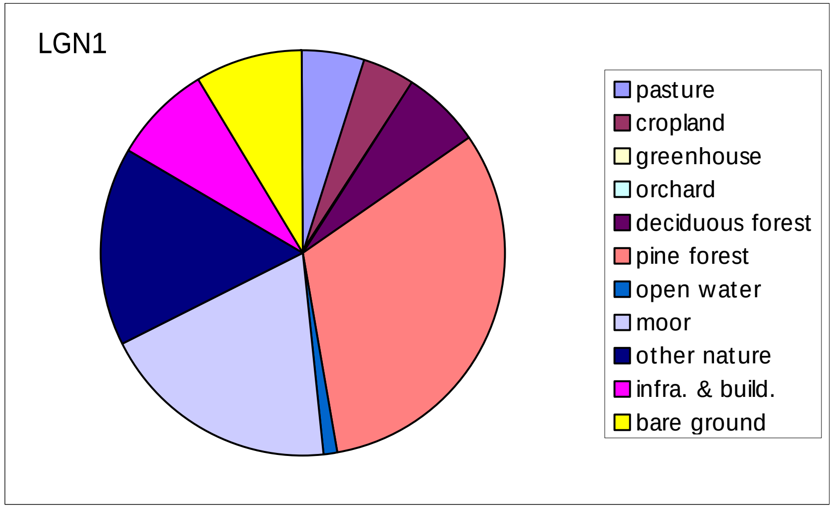


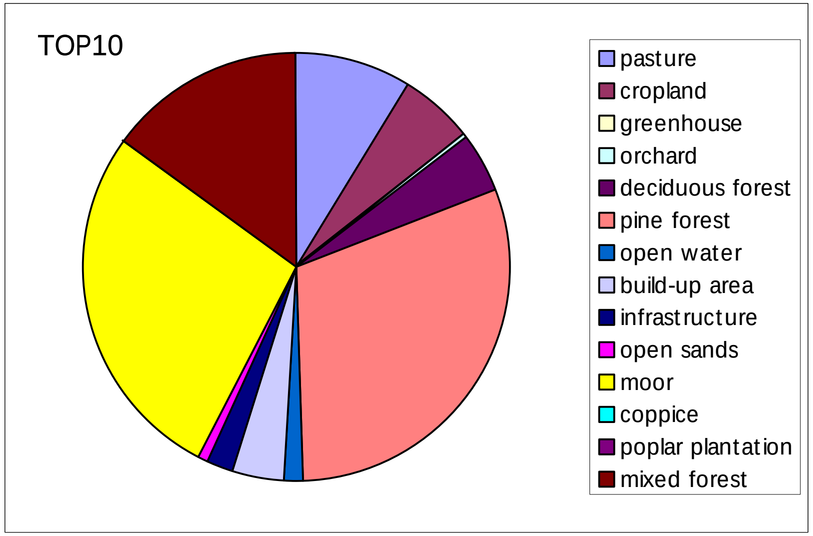


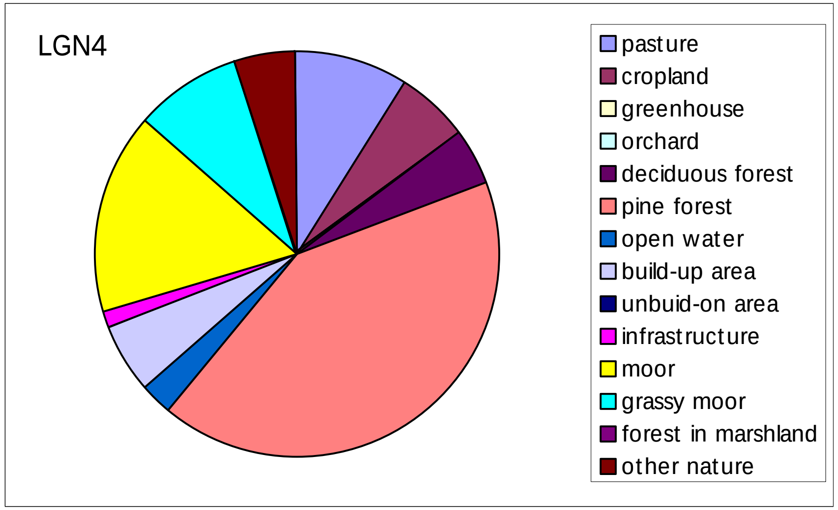


Forest statistics 1 – moors

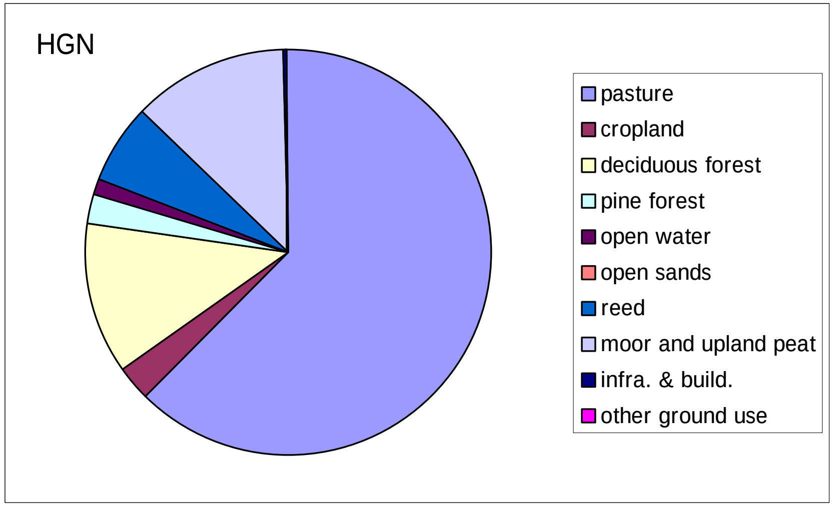


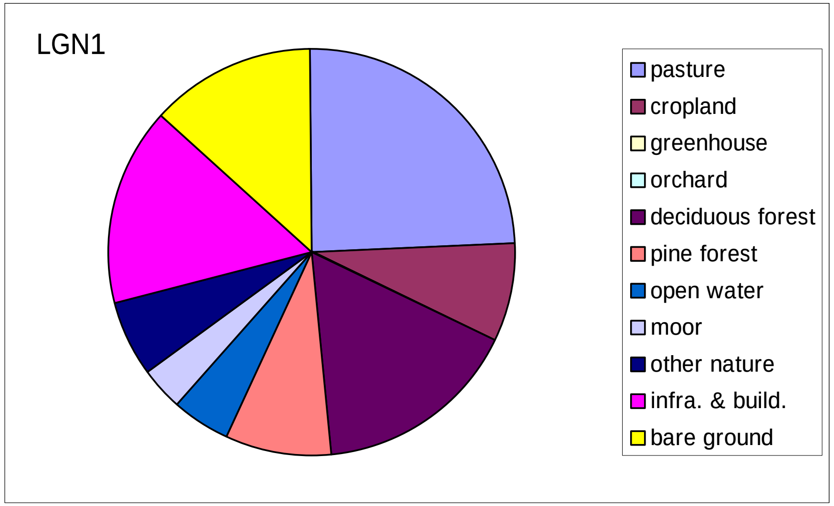


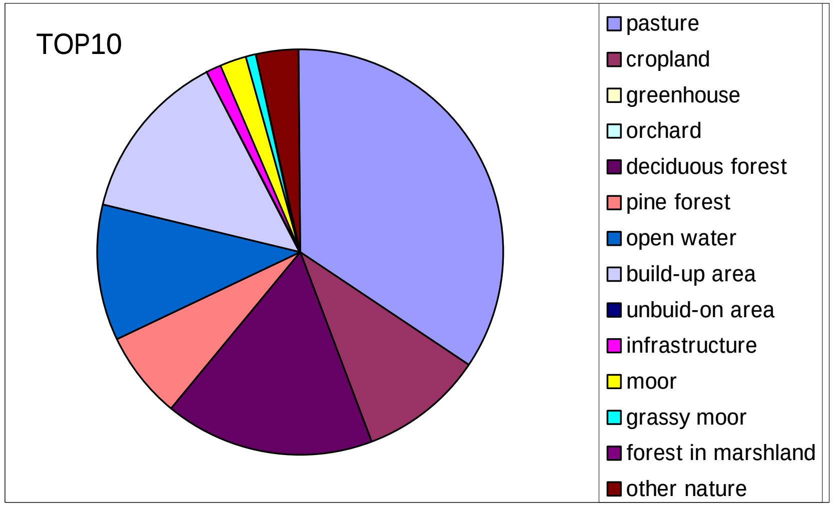


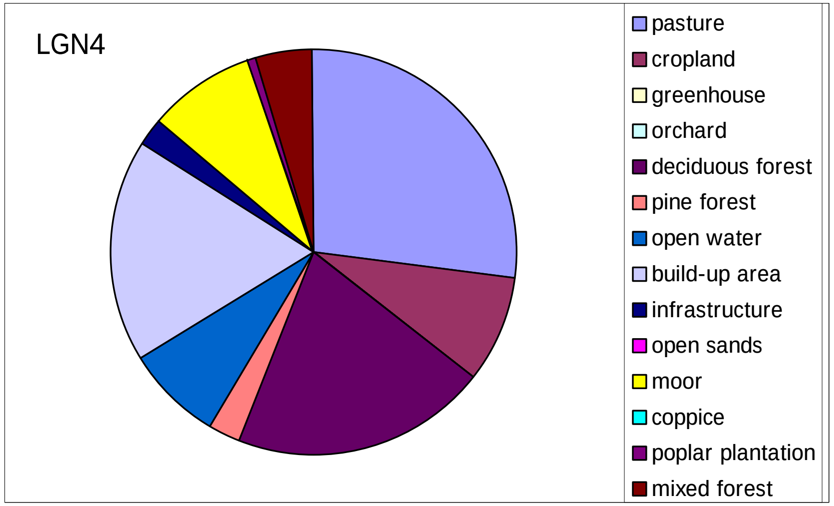


Forest statistics 1 – peat

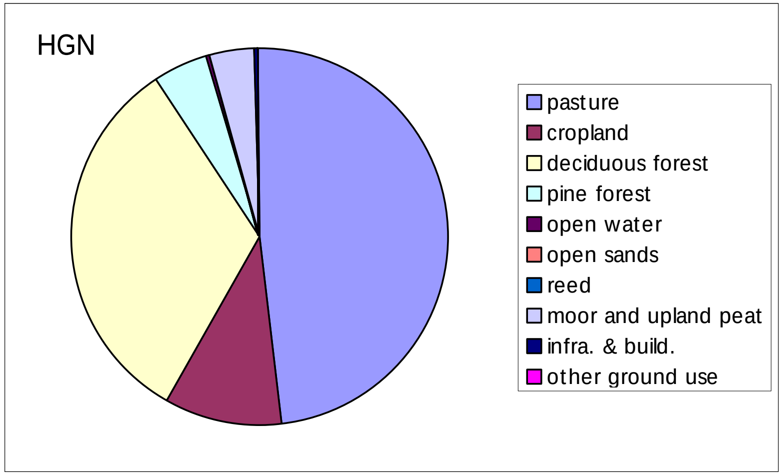


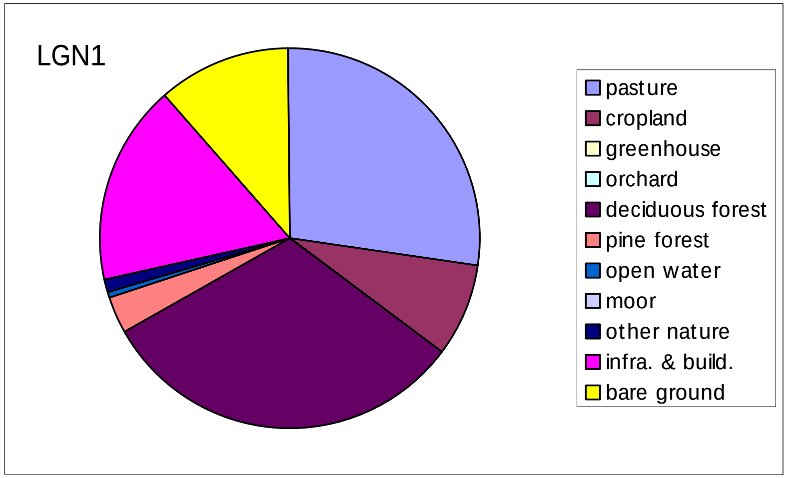


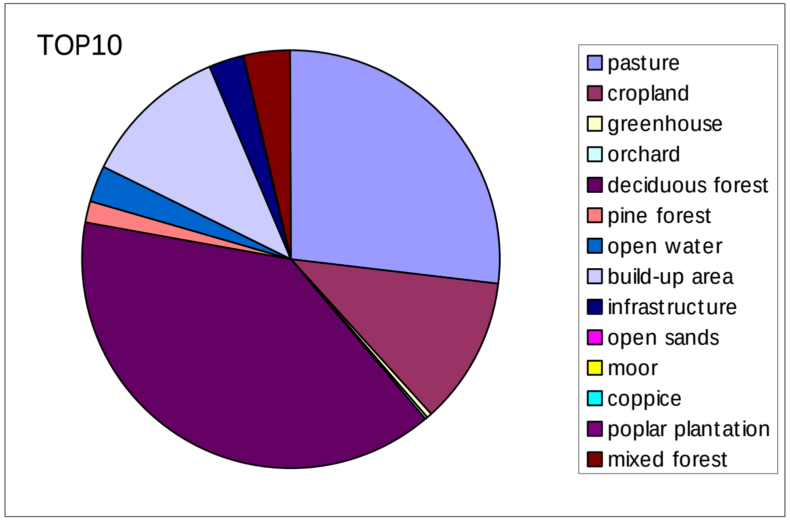


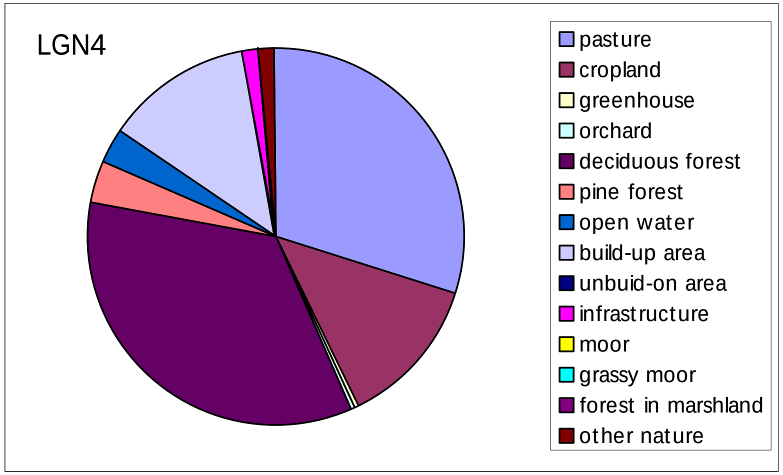


Forest statistics 1 – coppice

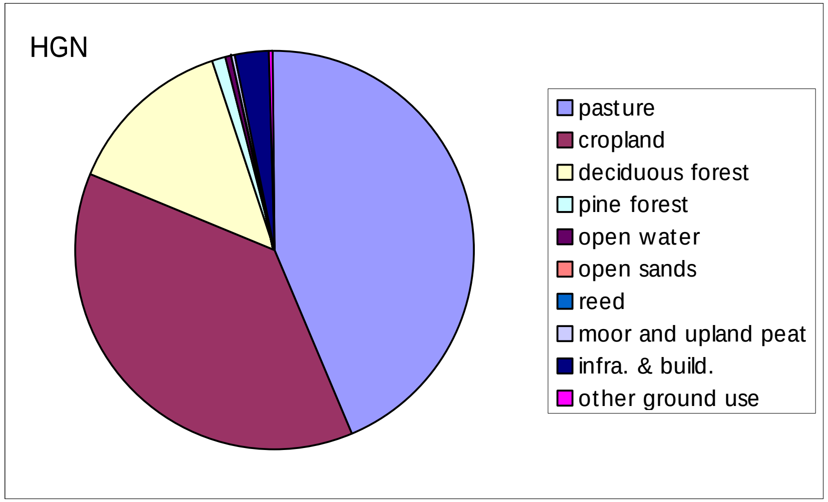


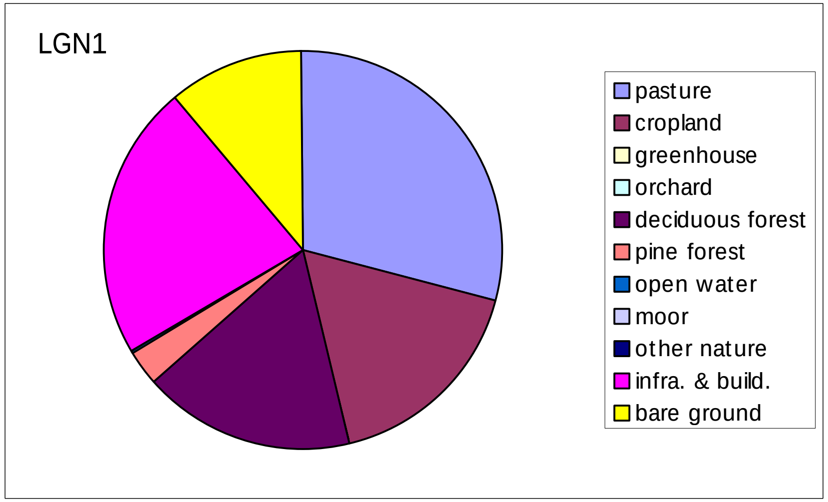


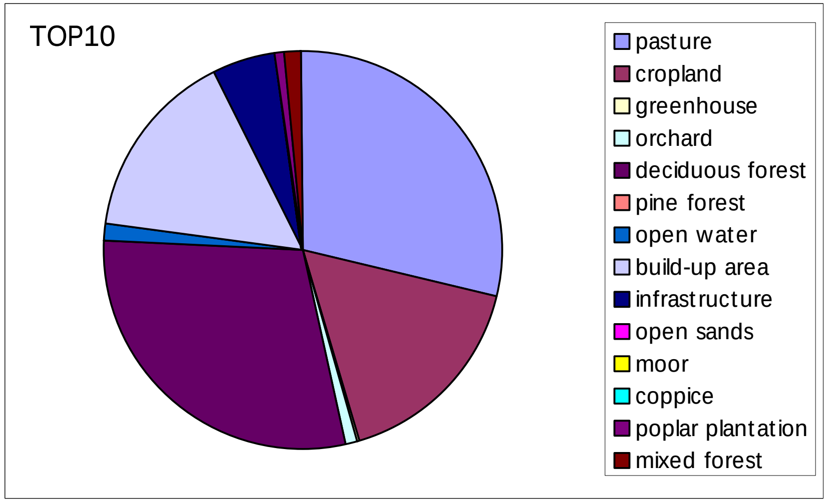


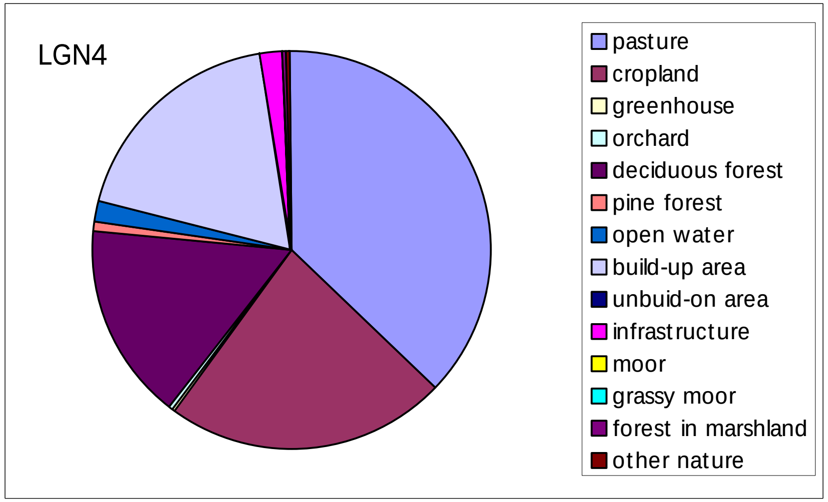


Forest statistics 1 – poplar plantation









14 Reclassification-table soils

soiltype incuding gwl	nutrient level	acidity	carrying capacity		relative presence of moist in the soil
			GHG	thickness of top layer	
EZg21-III	1	2	3	1	30
EZg21-III*	1	2	3	1	30
EZg21w-III	1	2	3	1	30
EZg23-III	1	2	3	1	30
EZg23-III*	1	2	3	1	30
EZg23w-III	1	2	3	1	30
Hd21-VII*	3	1	1	1	75
Hn21-III	3	1	3	1	30
Hn21-III*	3	1	3	1	30
Hn21-V	3	1	3	1	55
Hn21-V*	3	1	3	1	55
Hn21-VI	3	1	2	1	65
Hn21-VII	3	1	1	1	75
Hn21G-V	3	1	3	1	55
Hn21g-III	3	1	3	1	30
Hn21g-IV	3	1	2	1	40
Hn21g-V	3	1	3	1	55
Hn21g-VI	3	1	2	1	65
Hn21g-VII	3	1	1	1	75
Hn23-III	3	1	3	1	30
Hn23-V	3	1	3	1	55
Hn23-V*	3	1	3	1	55
Hn23-VI	3	1	2	1	65
Vc-II	2	3	3	2	20
Vz-II	2	3	3	2	20
Zd21-VII	4	1	1	1	75
Zd21-VII*	4	1	1	1	75
Zn21-VI	3	1	2	1	65
Zn21-VII	3	1	1	1	75
Zn23-V	2	1	3	1	55
Zn23-VI	2	1	2	1	65
aVc-II	2	3	3	2	20
aVz-II	2	3	3	2	20
bEZ21-VI	2	2	2	2	60
bEZ21-VII	2	2	1	2	70
bEZ23-VI	1	2	2	2	60
bEZ23-VII	1	2	1	2	70
cHn21-V	2	1	3	1	50
cHn21-V*	2	1	3	1	50
cHn21-VI	2	1	2	1	60
cHn23-V	2	1	3	1	50
cHn23-VI	2	1	2	1	60
gHn30-IV	2	1	2	1	40
gHn30-VI	2	1	2	1	65
gpZn30-IV	2	1	2	1	40
kpZg21-III	1	3	3	1	30
kpZg23-III	1	3	3	1	30
pZg21-III	2	3	3	1	30
pZg21-III*	2	3	3	1	30
pZg21-V*	2	3	3	1	55
pZg23-III	1	3	3	1	30
pZg23-III*	1	3	3	1	30
pZg23-V	1	3	3	1	55

soiltype incuding gwl	nutrient level	acidity	carrying capacity		relative presence of moist in the soil
			GHG	thickness of top layer	
pZg23E-III	1	3	3	1	30
pZn21-II	3	1	3	1	20
pZn21-III	3	1	3	1	30
pZn21-III*	3	1	3	1	30
pZn21-IV	2	1	2	1	40
pZn21-V	2	1	3	1	55
pZn21g-III	3	1	3	1	30
pZn21g-III*	3	1	3	1	30
pZn23-III	2	1	3	1	30
pZn23-III*	2	1	3	1	30
pZn23-V	2	1	3	1	55
pZn23-V*	2	1	3	1	55
pZn23-VI	2	1	2	1	65
vWp-III	3	3	3	2	30
vWz-II	2	3	3	1	20
vWz-III	2	3	3	1	30
vWz-III*	2	3	3	1	30
zEZ21-V	2	2	3	2	50
zEZ21-V*	2	2	3	2	50
zEZ21-VI	2	2	2	2	60
zEZ21-VII	2	2	1	2	70
zEZ21-VII*	2	2	1	2	70
zEZ21G-V	2	2	3	2	50
zEZ21G-VI	2	2	2	2	60
zEZ23-V	2	2	3	2	50
zEZ23-V*	2	2	3	2	50
zEZ23-VI	2	2	2	2	60
zEZ23-VII	2	2	1	2	70
zEZ23-VII*	2	2	1	2	70
zEZ23t-V	2	2	3	2	50
zHd21-VII*	3	1	1	1	75
zHn21-VII	3	1	1	1	75
zVp-III	3	3	3	2	30
zVz-II	2	3	3	2	20
zVz-III*	2	3	3	2	30
zWp-III	3	3	3	2	30
zWz-II	2	3	3	1	20
zWz-III	2	3	3	1	30
	1 = very high 2 = high 3 = average 4 = low	1 = pH 3,5 - 4,5 2 = pH 4,5 - 5,5 3 = pH 5 - 6	1 = very deep > 80 cm 2 = deep 40 - 80 cm 3 = undeep < 40 cm	1 = thinner than 80 cm 2 = 80 - 120 cm 3 = thicker than 120 cm	20 = II 30 = III/III* 40 = IV 50 = Vv/V*v 55 = Vd/V*d 60 = VIv 65 = VId 70 = VIIv/VII*v 75 = VIId/VII*d

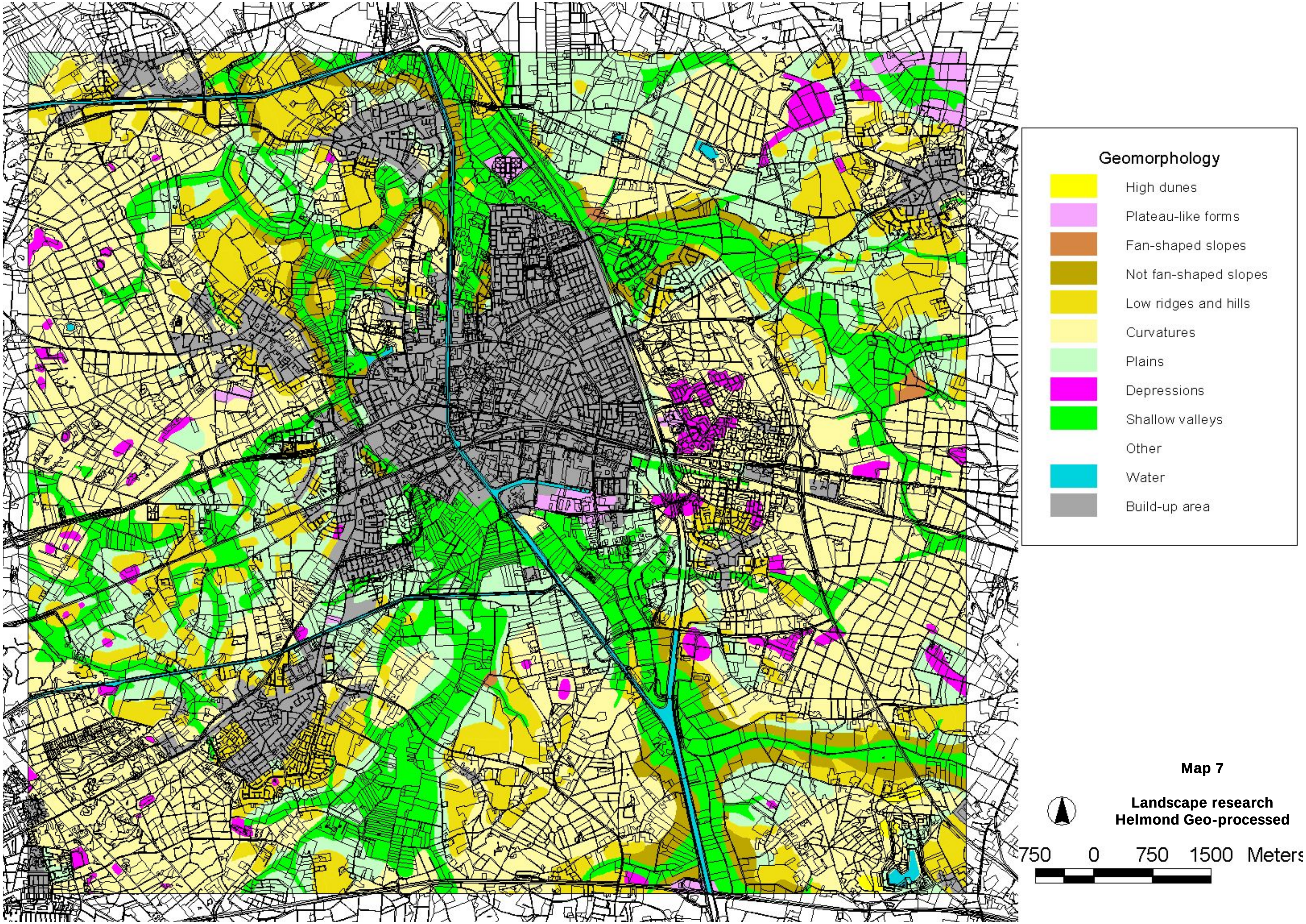
15 Another way to calculate measurement of spaces

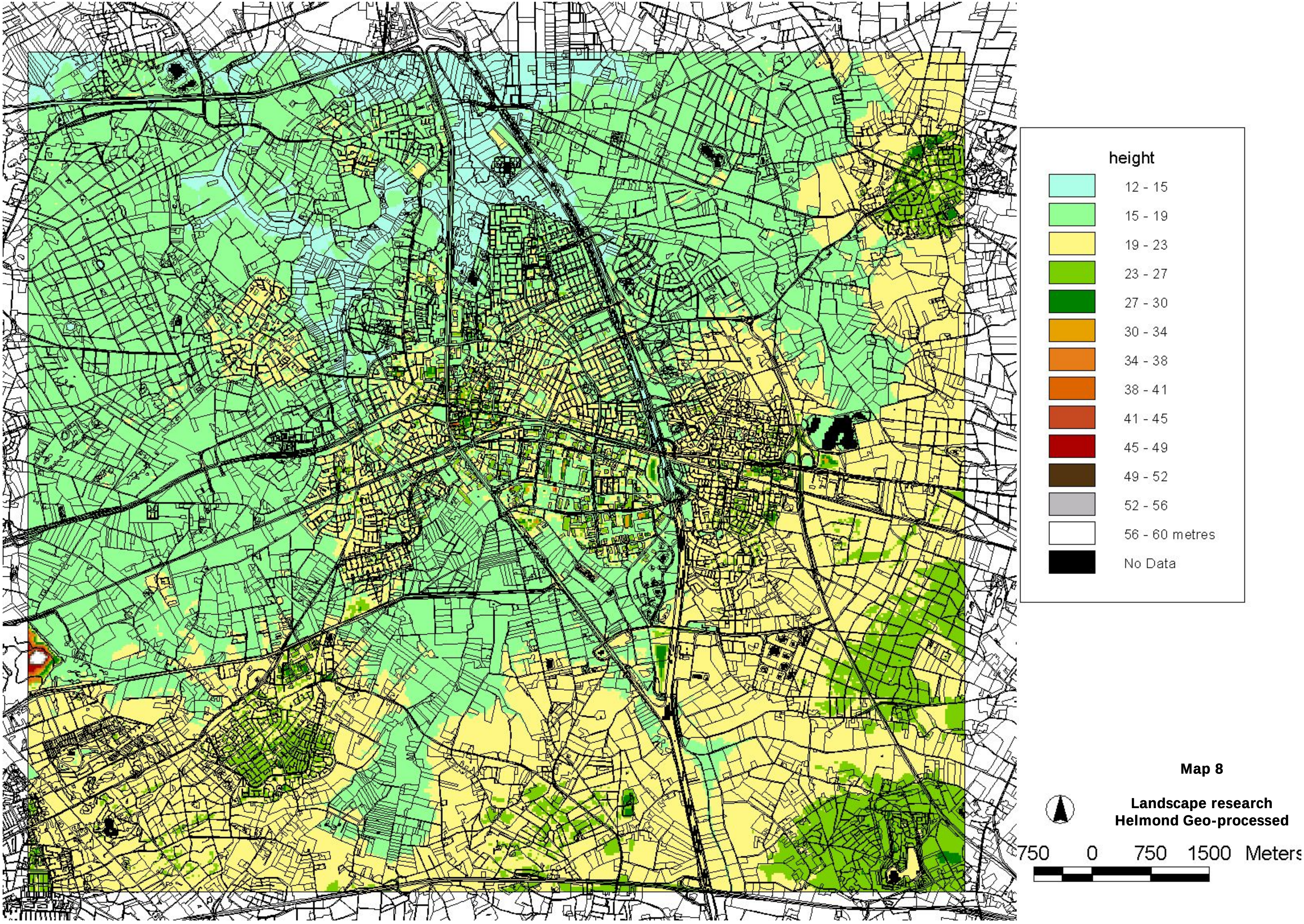
legend-category	statement	selection	nr of possibilities
1	1x com(1) + 1x ps(1) + 2x rest	abcc	12
	1x com(1) + 2x ps(1) + 1x rest	abbc	
	1x com(1) + 3x ps(1)	abbb	
	2x com(1) + 1x ps(1) + 1x rest	aabc	6
	2x com(1) + 2x rest	aacc	
	2x com(1) + 2x ps(1)	aabb	
	3x com(1) + 1x ps(1)	aaab	4
	3x com(1) + 1x rest	aaac	
	4x com(1)	aaaa	
2	1x ps(1) + 1x ps(2) + 1x com(2) + 1x (x)	bedf	24
	1x ps(1) + 2x com(2) + 1x (x)	eddf	12
3	1x com(1or2) + 1x ps(1or2) + 2x (x)	(ad)(be)ff	12
	2x ps(1or2) + 2x (x)	(be)(be)ff	
	2x com(1or2) + 1x ps(1or2) + 1x (x)	(ad)(ad)(be)f	12
	2x com(1or2) + 2x ps(1or2)	(ad)(ad)(be)(be)	
	2x com(1or2) + 2x (x)	(ad)(ad)ff	
	3x com(1or2) + 1x ps(1or2)	(ad)(ad)(ad)(be)	4
	3x com(1or2) + 1x (x)	(ad)(ad)(ad)f	
	3x ps(1or2) + 1x (x)	(be)(be)(be)f	4
	4x com(2)	(ad)(ad)(ad)(ad)	1
	4x ps(1or2)	(be)(be)(be)(be)	1
4	1x com(1-3) + 1x ps(1-3) + 2x com(4)	(adg)(beh)ii	12
	2x ps(1-3) + 2x com(4)	(beh)(beh)ii	
	2x com(1-3) + 1x ps(1-3) + 1x com(4)	(adg)(adg)(beh)I	12
	2x com(1-3) + 2x ps(1-3)	(adg)(adg)(beh)(beh)	
	2x com(1-3) + 2x com(4)	(adg)(adg)ii	
	3x com(1-3) + 1x ps(1-3)	(adg)(adg)(adg)(beh)	4
	3x com(1-3) + 1x com(4)	(adg)(adg)(adg)I	
	3x ps(1-3) + 1x com(4)	(beh)(beh)(beh)I	4
	4x com(3)	gggg	1
	4x ps(1-3)	(beh)(beh)(beh)(beh)	1
5	1x com(3) + 1x ps(3) + 2x com(4)	ghii	12
	2x com(3) + 1x ps(3) + 1x com(4)	gghi	12
	2x com(3) + 2x ps(3)	gghh	
	3x com(3) + 1x com(4)	gggi	4
	3x com(3) + 1x ps(3)	gggh	
	3x ps(3) + 1x com(4)	hhhi	4
	4x ps(3)	hhhh	
6	3x com(4) + 1x pb(4)	iiij	4
	2x com(4) + 2x pb(4)	iijj	6
7	3x com(4) + 1x (x)	iiif	6
	2x com(4) + 2x (x)	iiff	
	4x com(4)	iiii	

com	complete
ps	partly smaller
pb	partly bigger
a	com(1)
b	ps(1)
c	rest
d	com(2)
e	ps(2)
f	<500
g	com(3)
h	ps(3)
I	com(4)
j	pb(4)

buffer	complete	partly smaller	partly bigger	code
0-250	13, 20, 21	-	14, 15, 16, 17, 18, 19	4
250-500	'7, 12	18, 19	8, 9, 10, 11	3
500-1500	3, 6	10, 11,16, 17	4, 5	2
> 1500	1, 2	4, 5, 8, 9, 14, 15	-	1
<500	7,12, 13, 18, 19, 20, 21			x

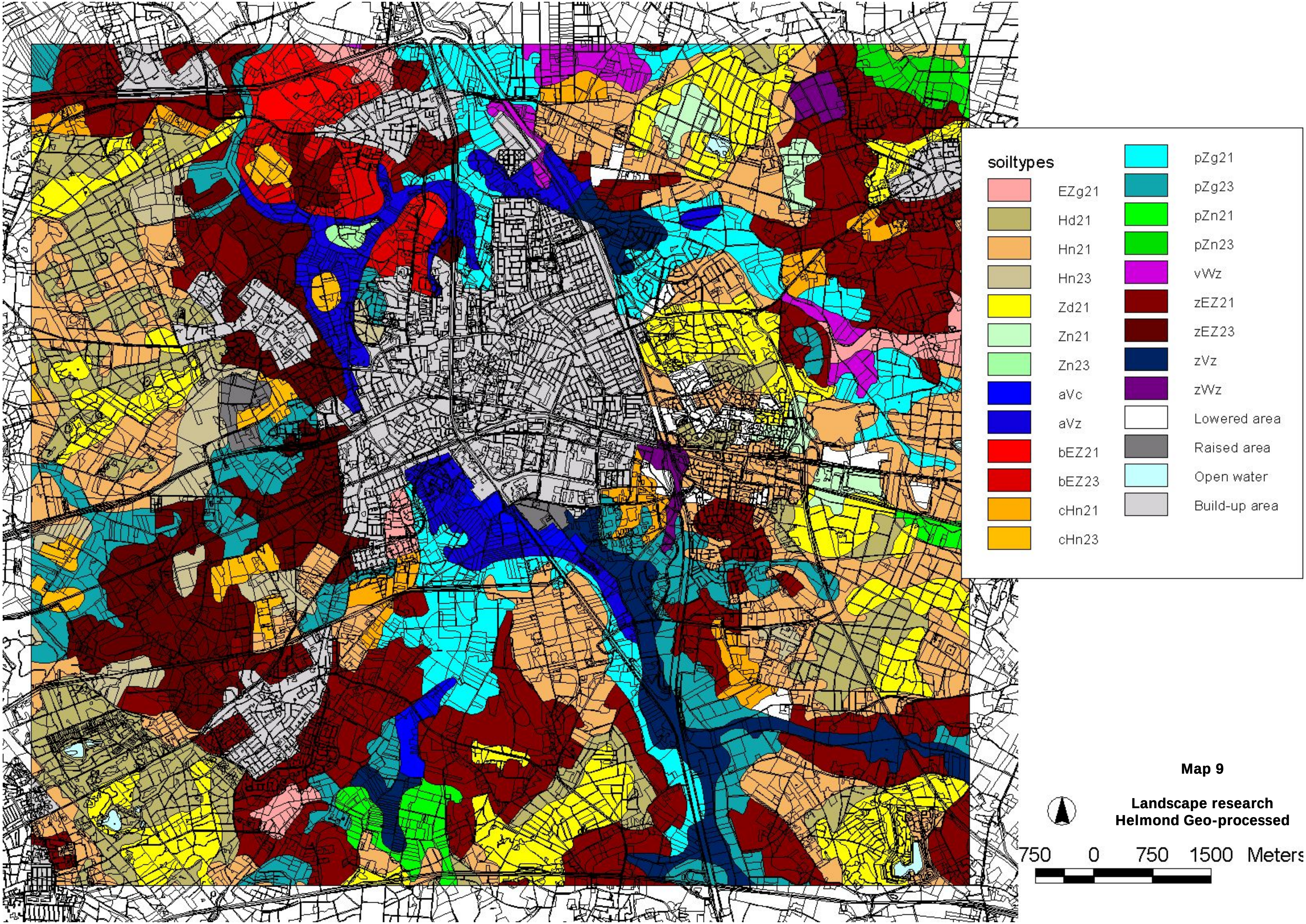
16 The maps


Geomorphology
High dunes
Plateau-like forms
Fan-shaped slopes
Not fan-shaped slopes
Low ridges and hills
Curvatures
Plains
Depressions
Shallow valleys
Other
Water
Build-up area
Map 7
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters



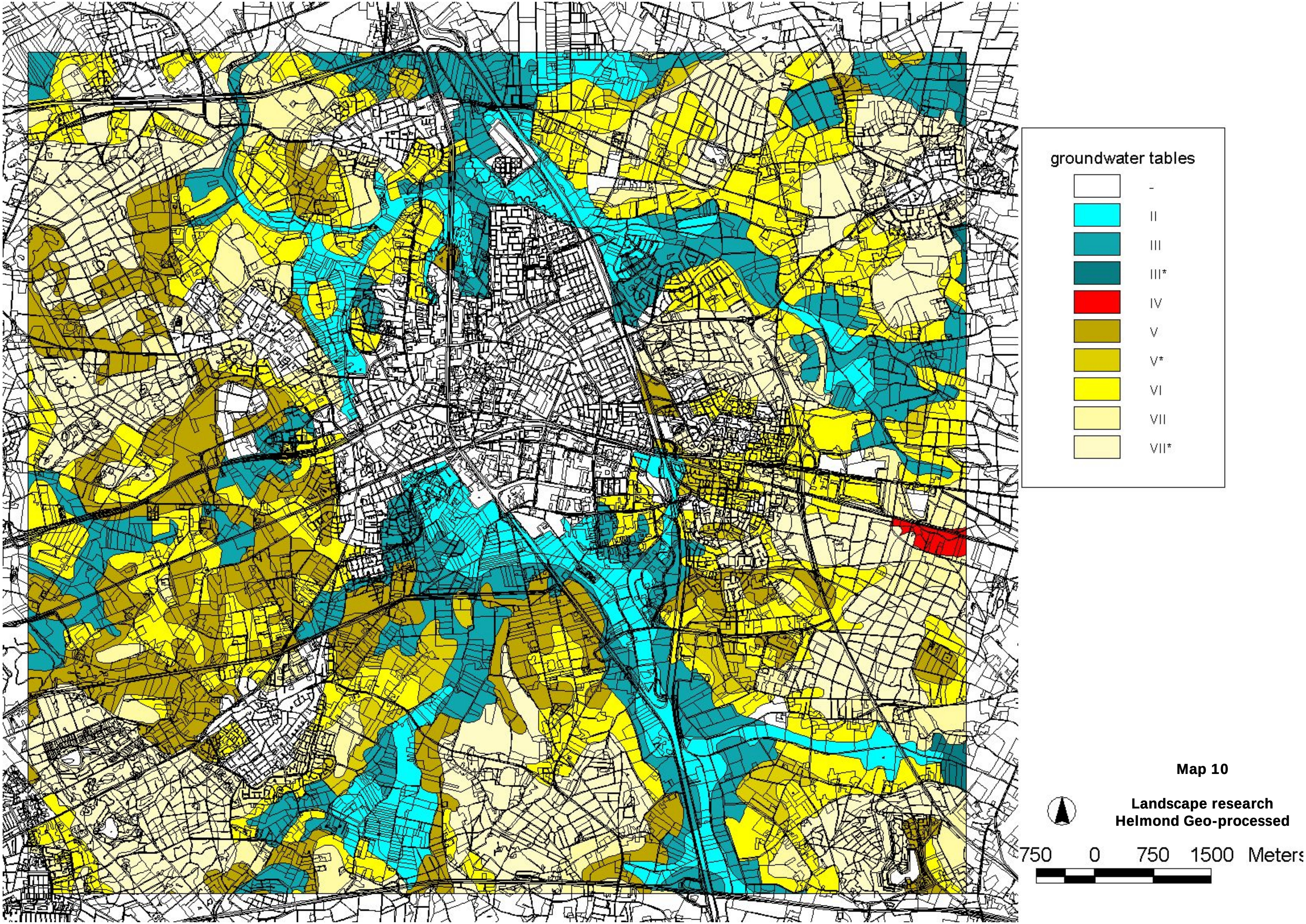
Map 8

Landscape research
Helmond Geo-processed



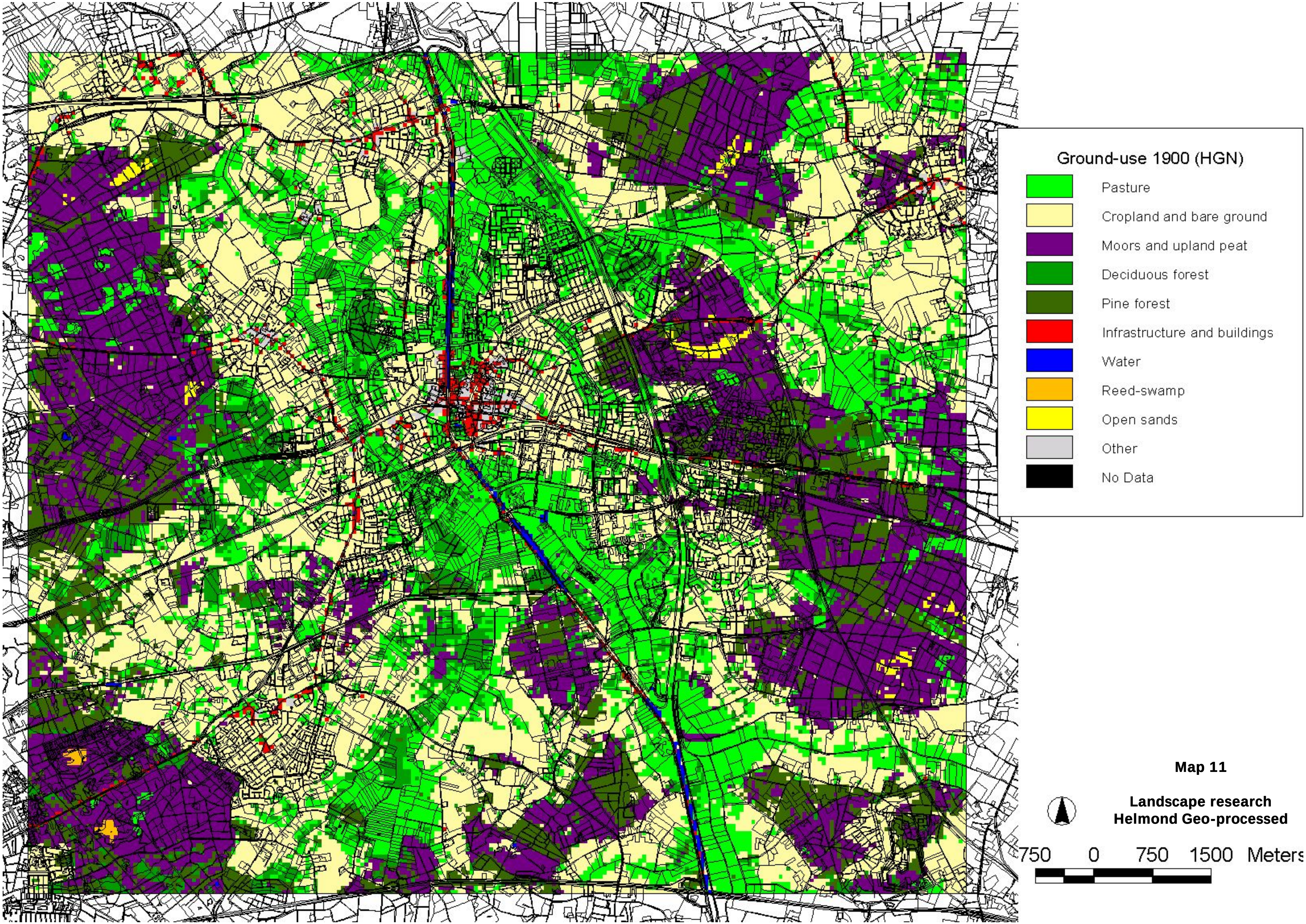
Map 9

Landscape research
Helmond Geo-processed



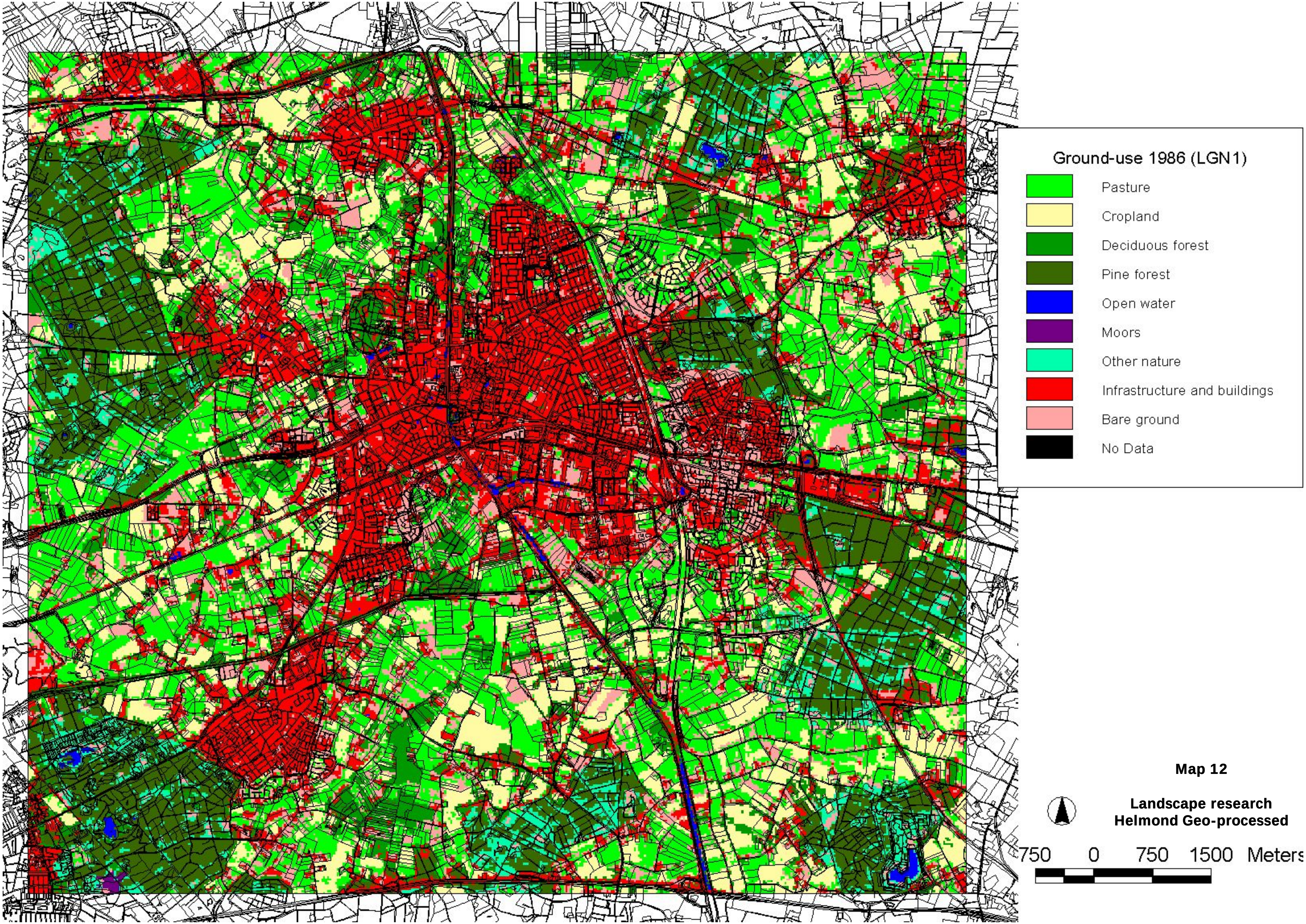
Map 10

Landscape research Helmond Geo-processed



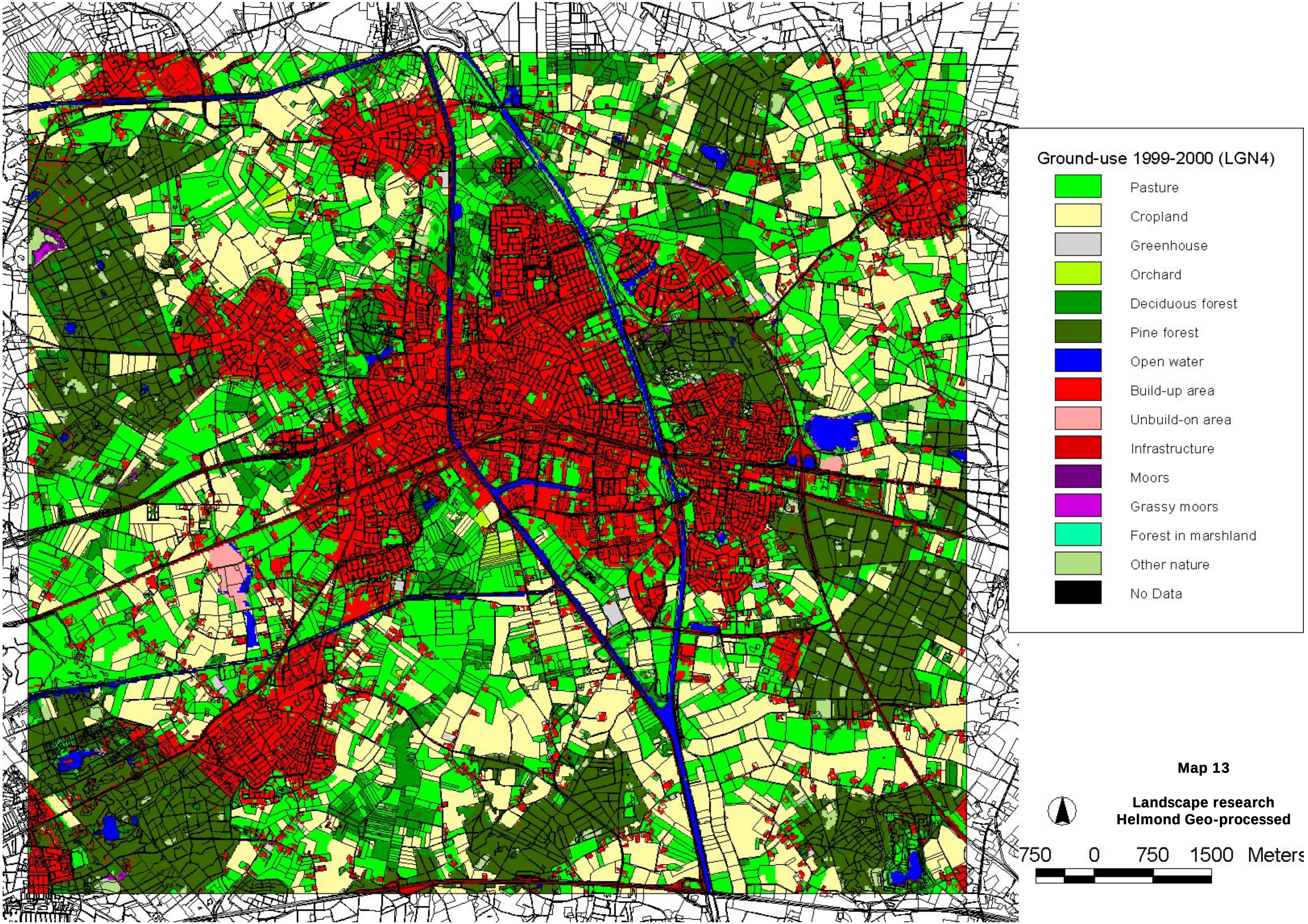
Map 11

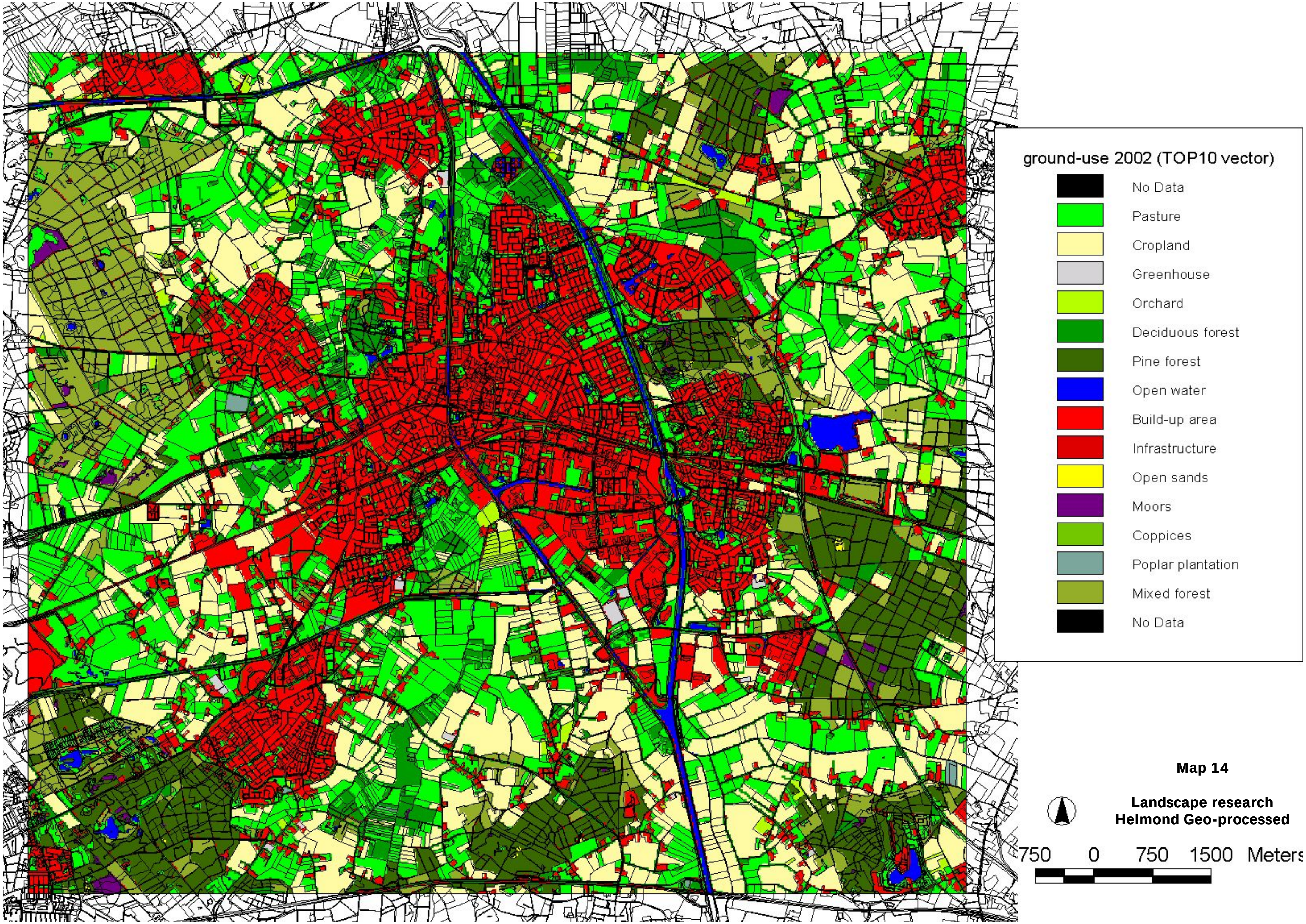
Landscape research Helmond Geo-processed



Map 12

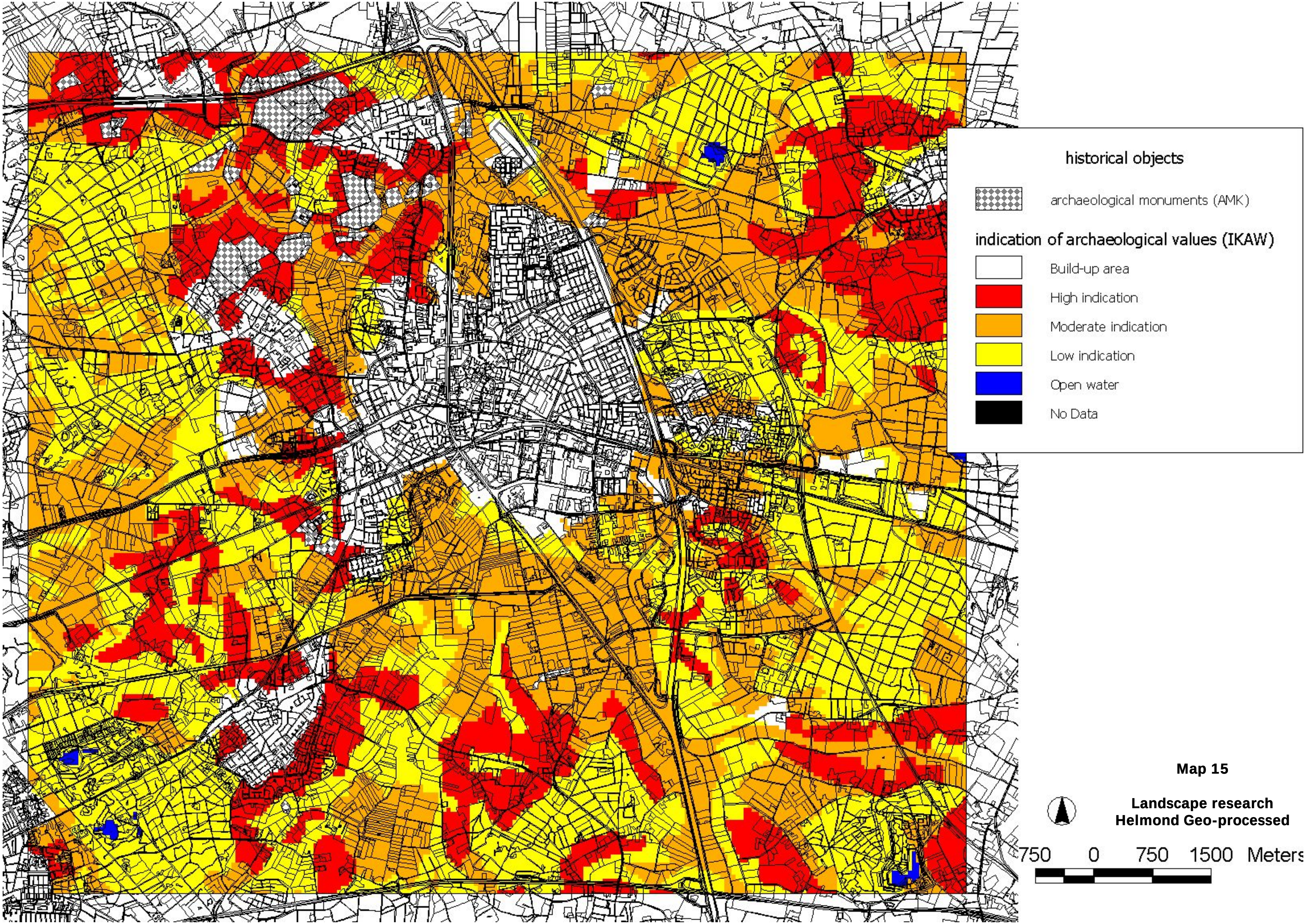
Landscape research Helmond Geo-processed

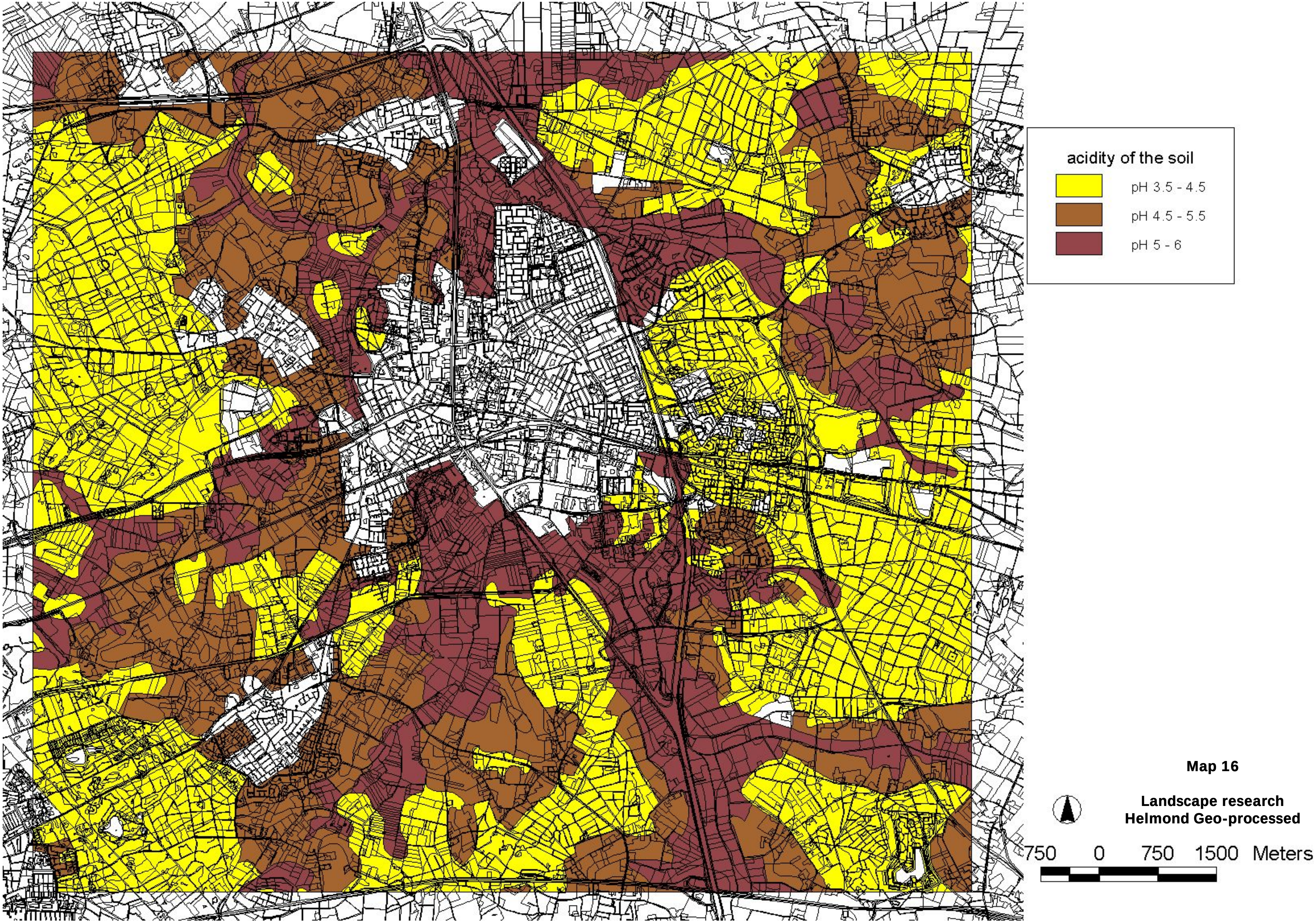

Ground-use 1999-2000 (LGN4)
Pasture
Cropland
Greenhouse
Orchard
Deciduous forest
Pine forest
Open water
Build-up area
Unbuild-on area
Infrastructure
Moors
Grassy moors
Forest in marshland
Other nature
No Data
Map 13
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters

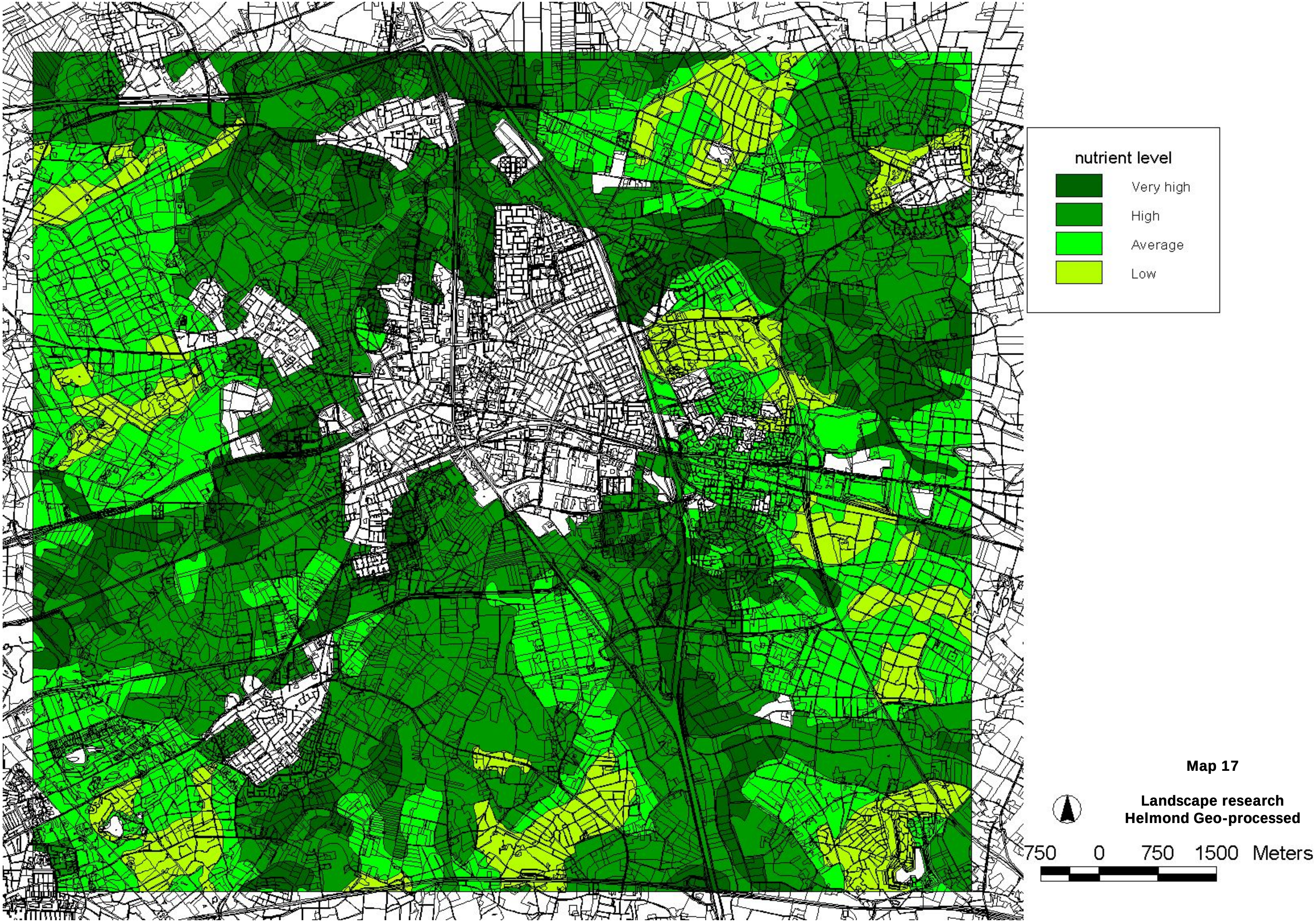


Map 14

Landscape research
Helmond Geo-processed

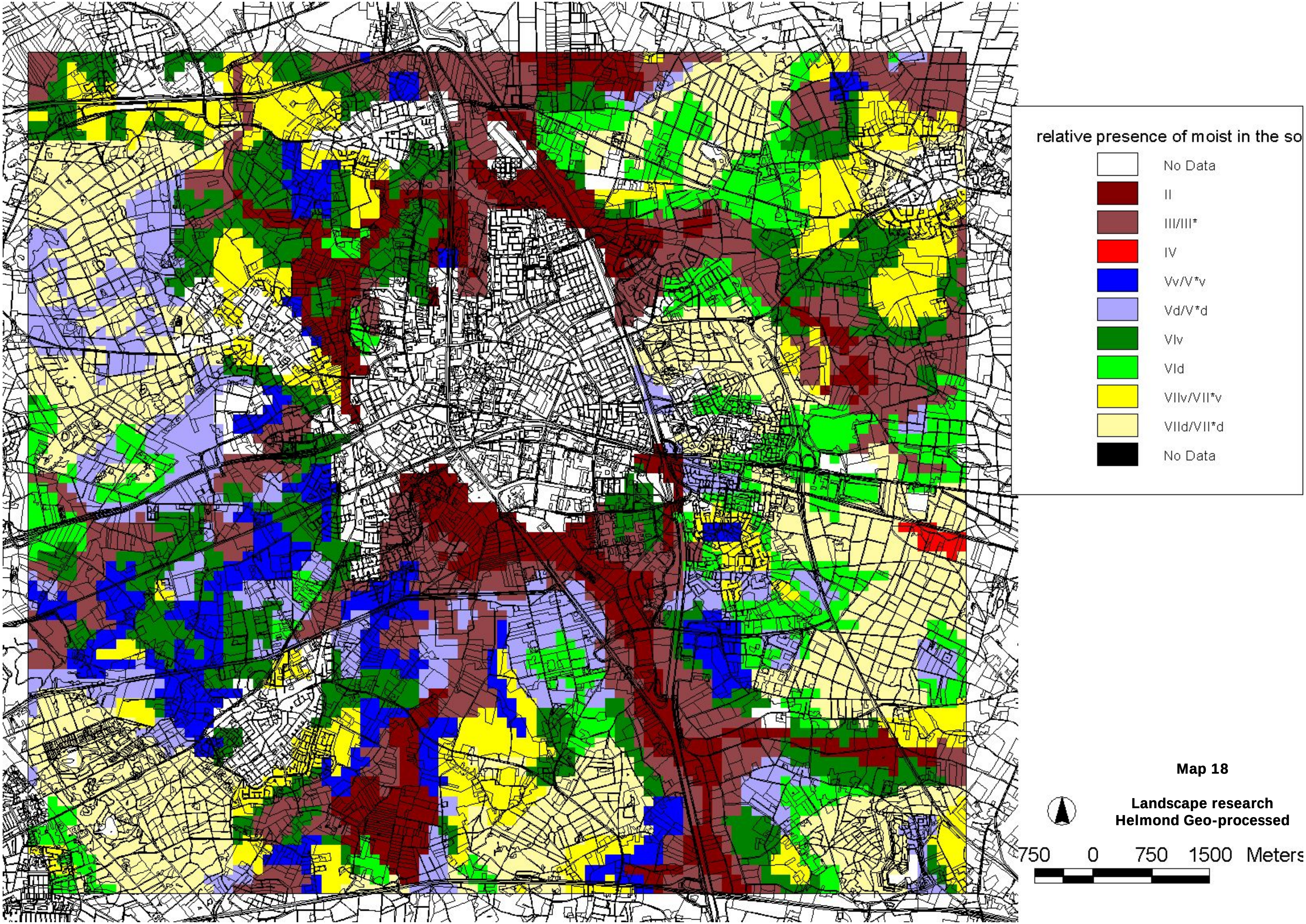

historical objects
archaeological monuments (AMK)
indication of archaeological values (IKAW)
Build-up area
High indication
Moderate indication
Low indication
Open water
No Data
Map 15
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters


acidity of the soil
pH 3.5 - 4.5
pH 4.5 - 5.5
pH 5 - 6
Map 16
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters



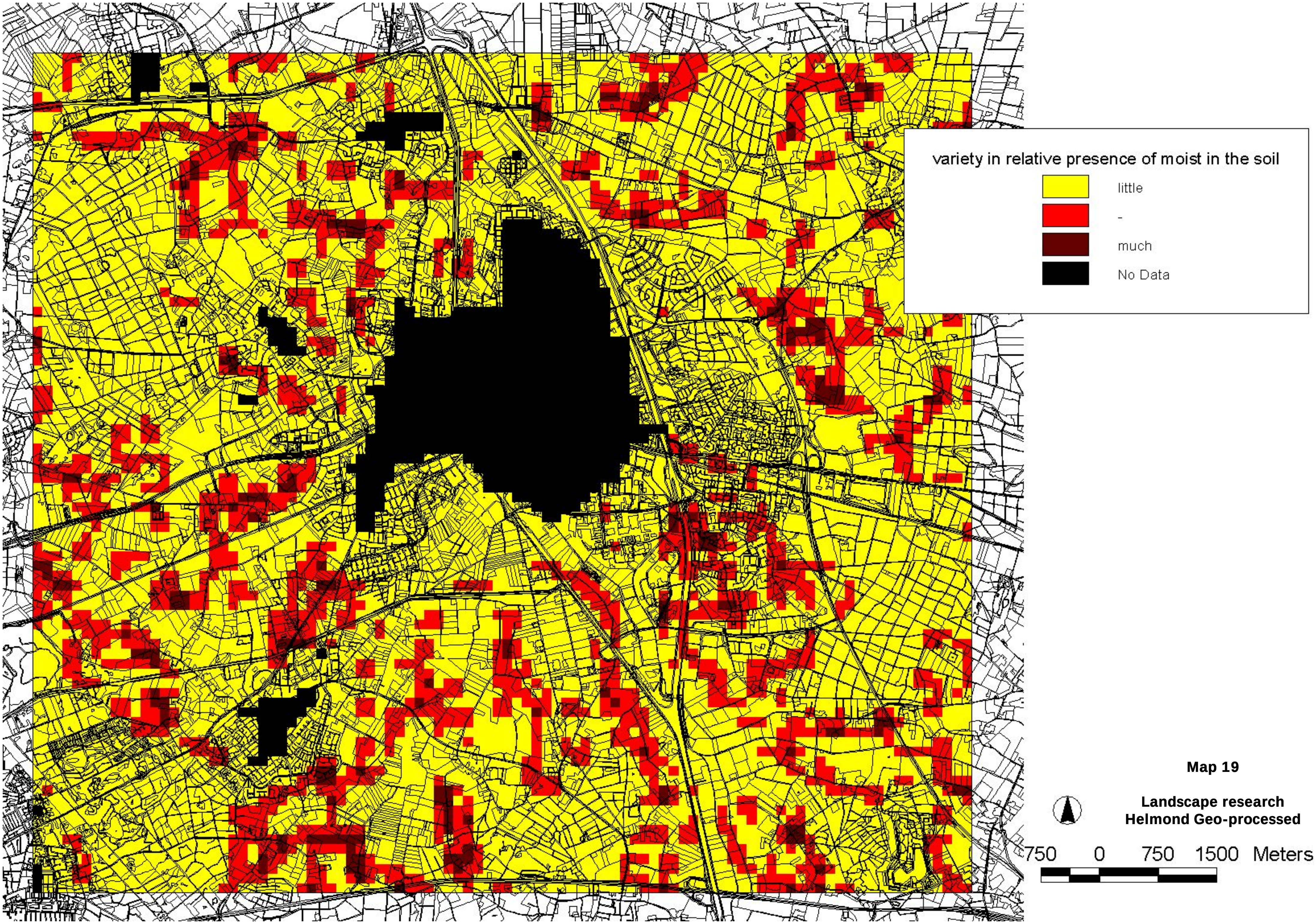
Map 17

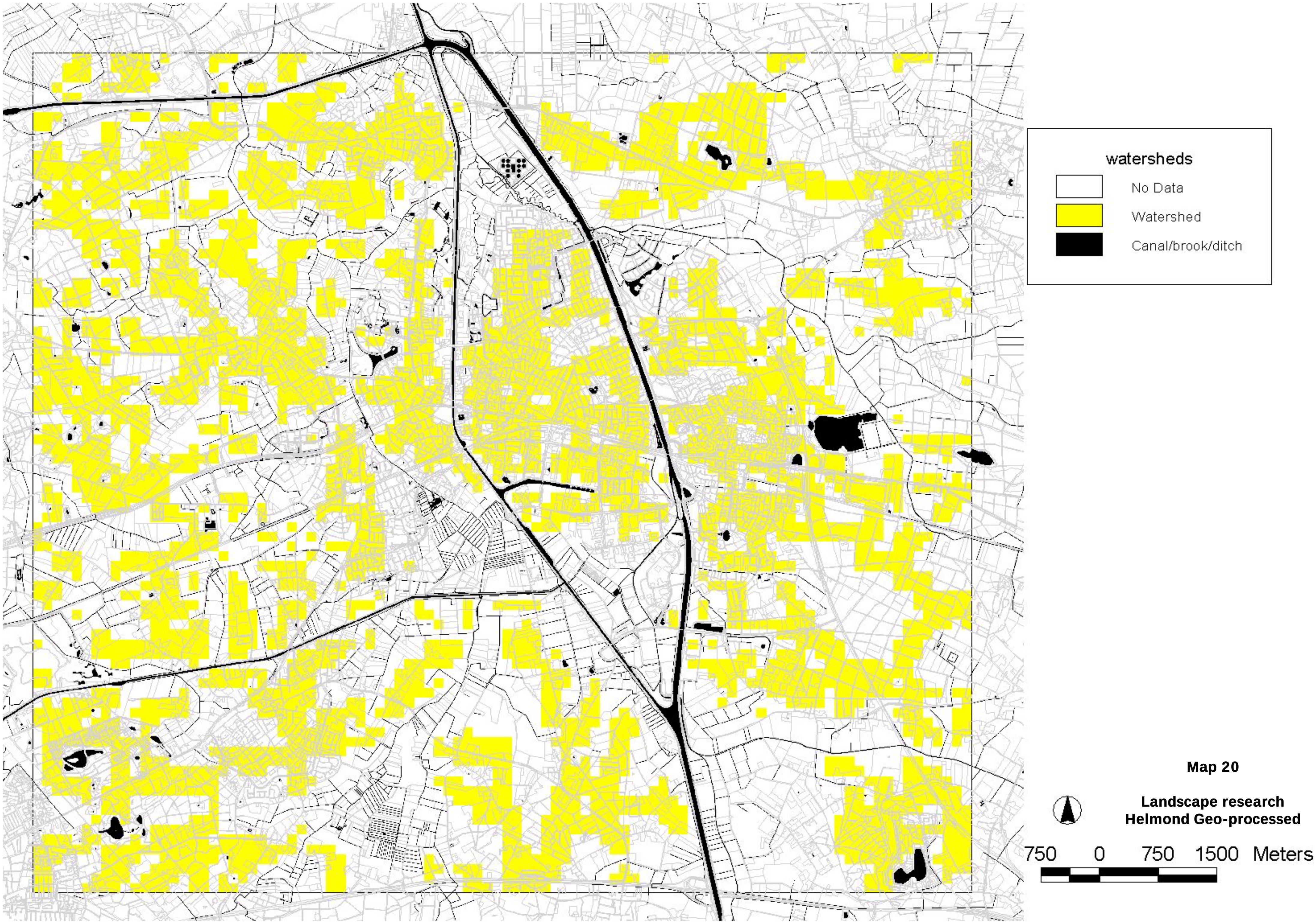
**Landscape research
Helmond Geo-processed**

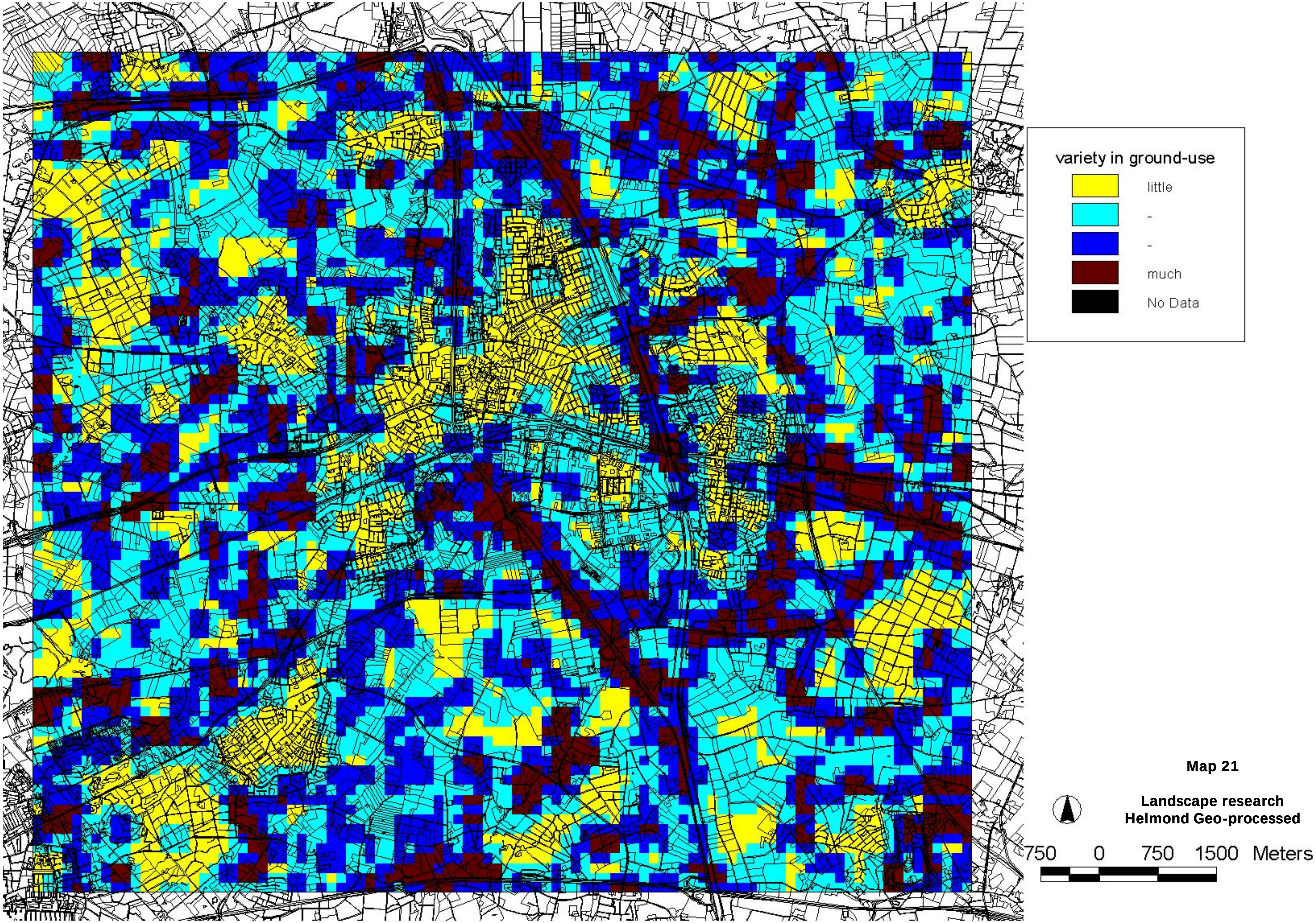


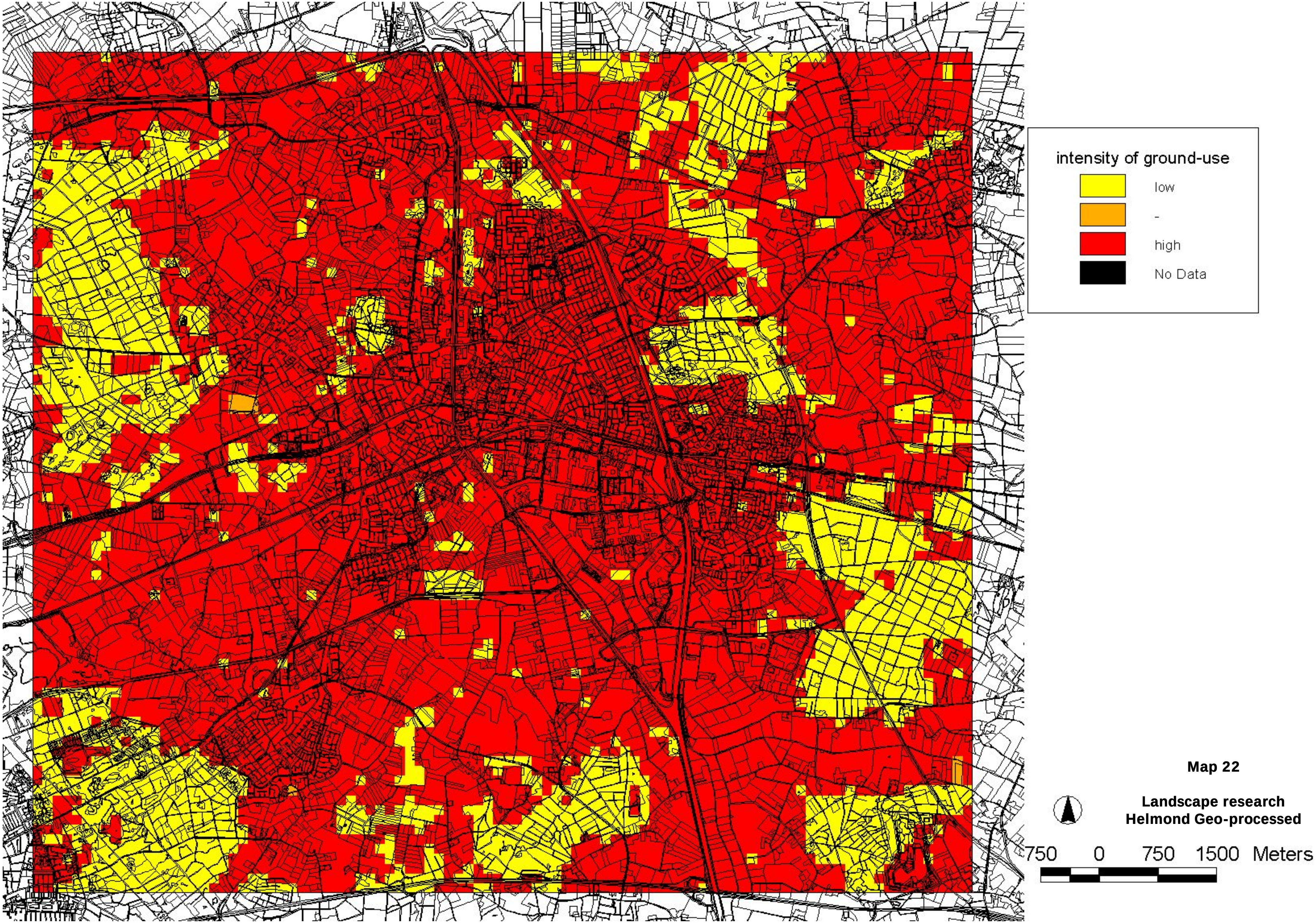
Map 18

Landscape research Helmond Geo-processed

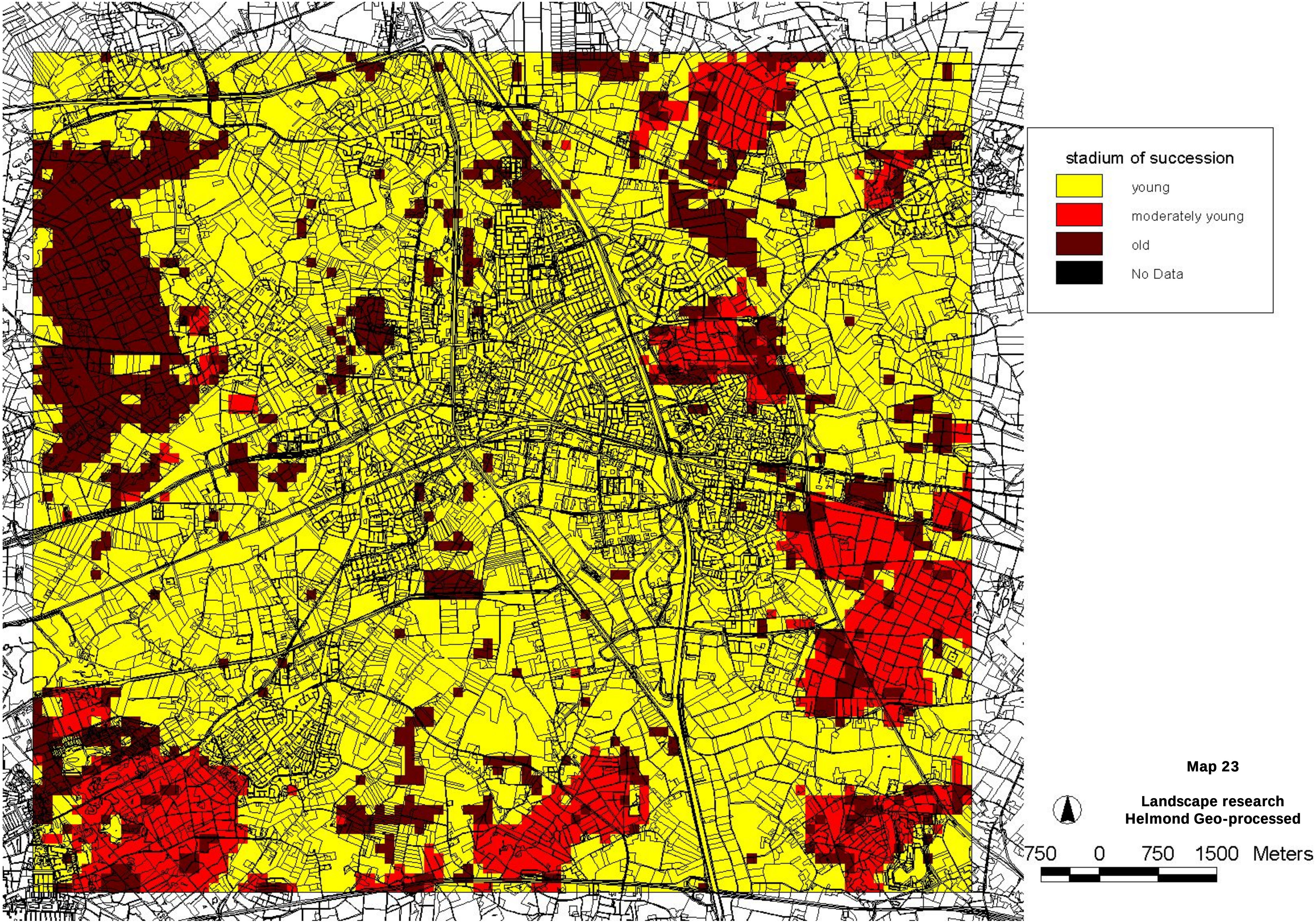

variety in relative presence of moist in the soil
little
-
much
No Data
Map 19
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters


watersheds
No Data
Watershed
Canal/brook/ditch
Map 20
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters


variety in ground-use
little
-
-
much
No Data
750 0 750 1500 Meters
Map 21
Landscape research
Helmond Geo-processed

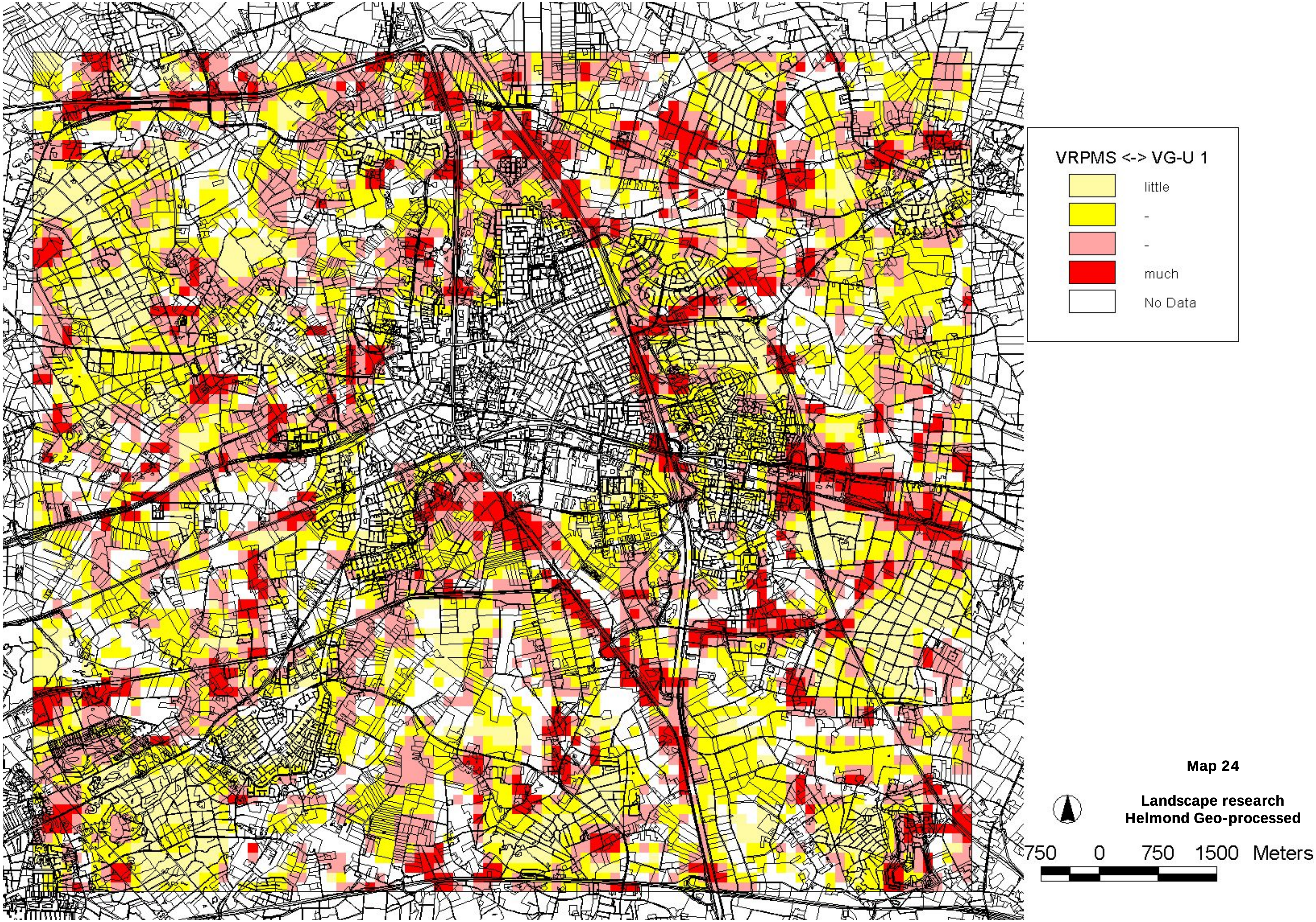


intensity of ground-use
low
-
high
No Data
Map 22
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters



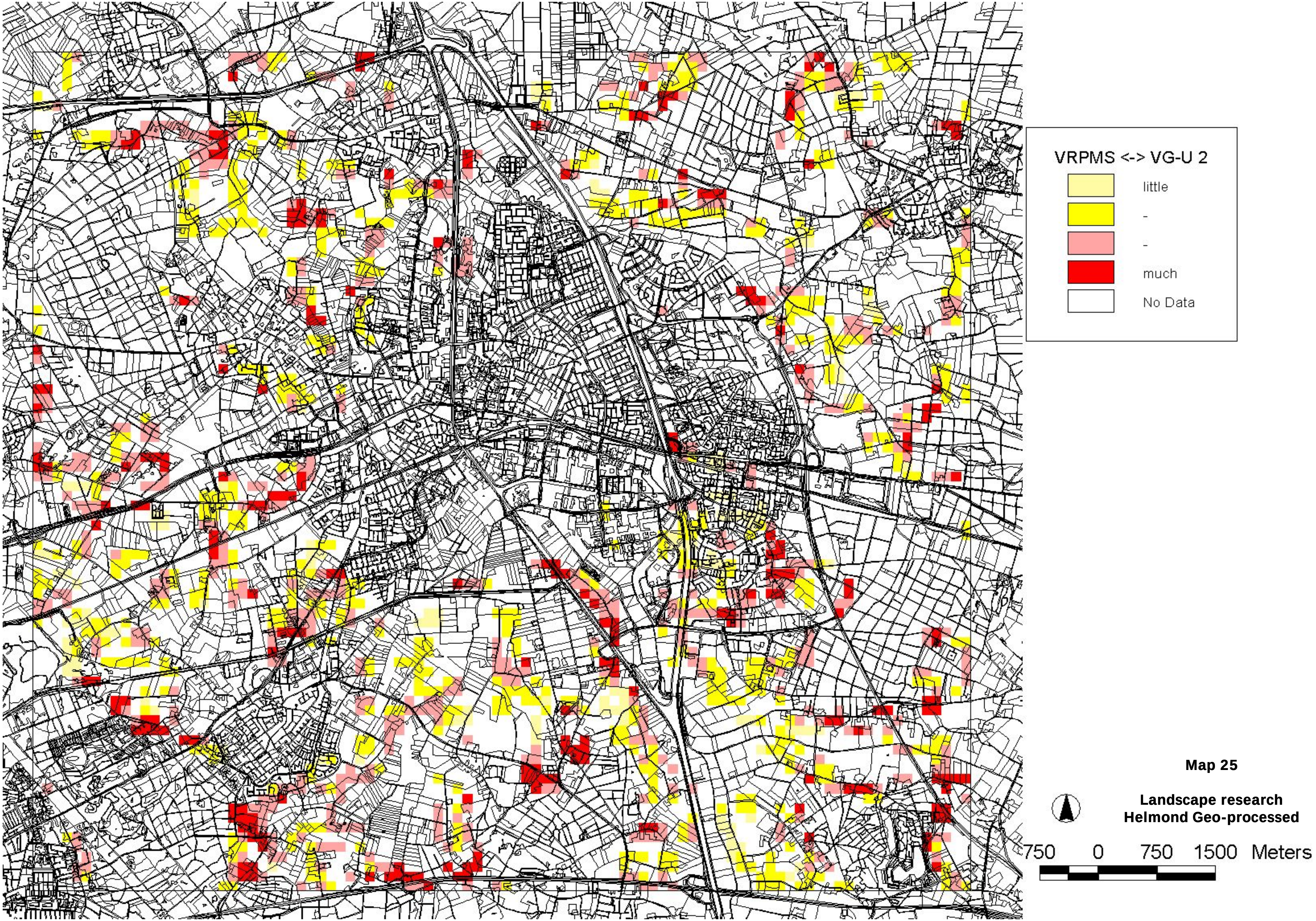
Map 23

Landscape research Helmond Geo-processed

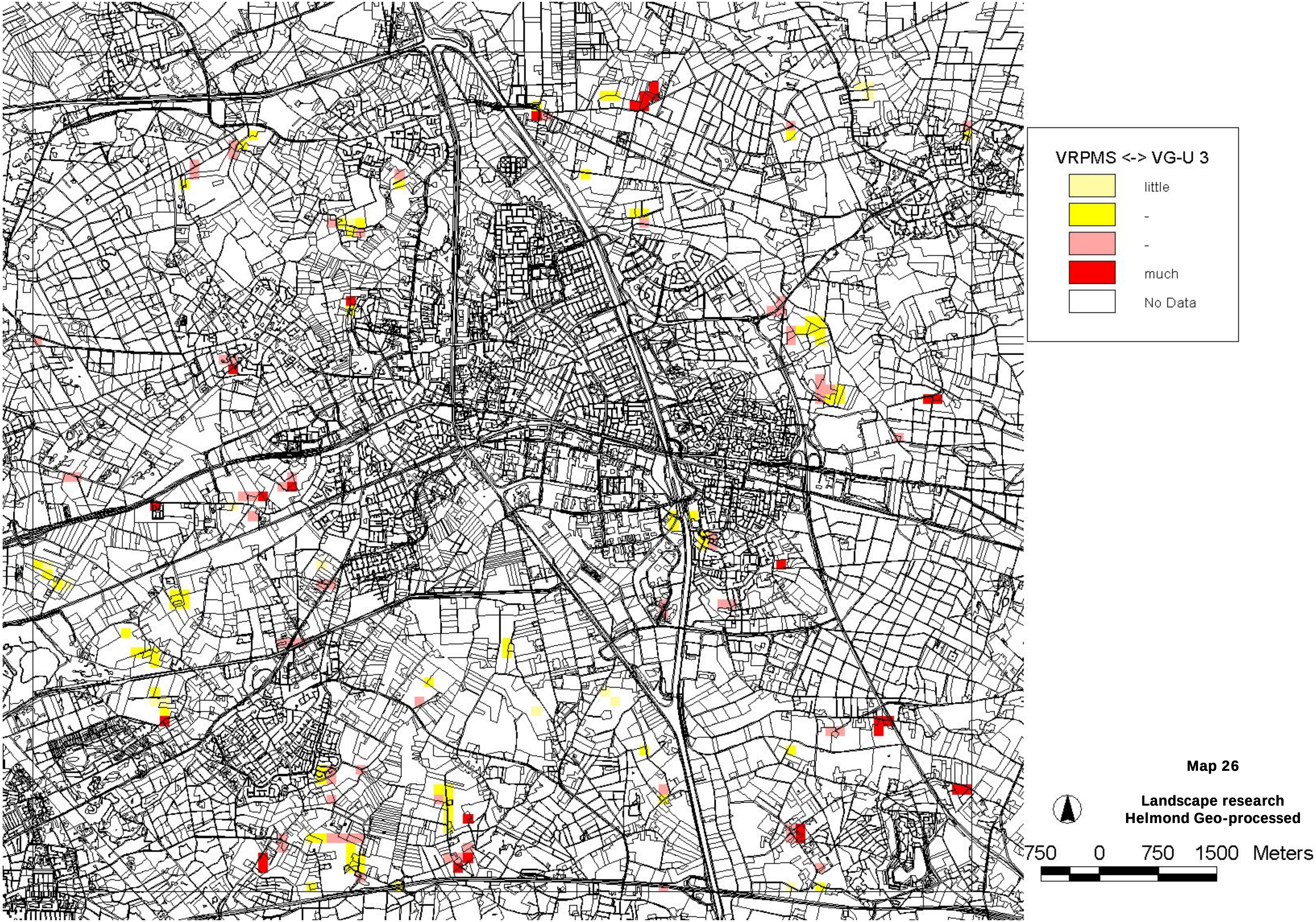


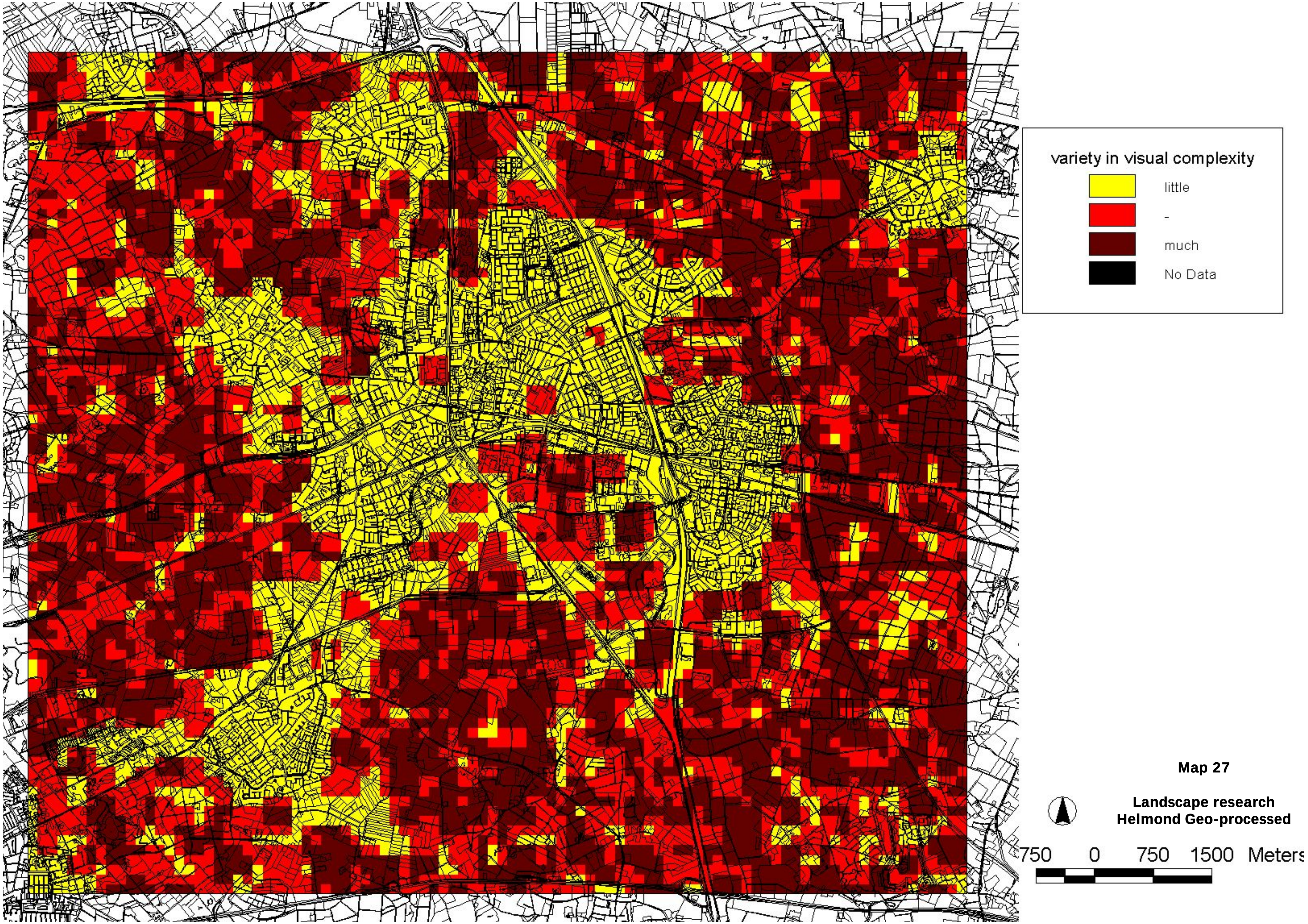
Map 24

Landscape research Helmond Geo-processed



VRPMS <-> VG-U 2
little
-
-
much
No Data
Map 25
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters


VRPMS <-> VG-U 3
little
-
-
much
No Data
Map 26
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters


variety in visual complexity
little
-
much
No Data
Map 27
Landscape research
Helmond Geo-processed
750
0
750
1500
Meters

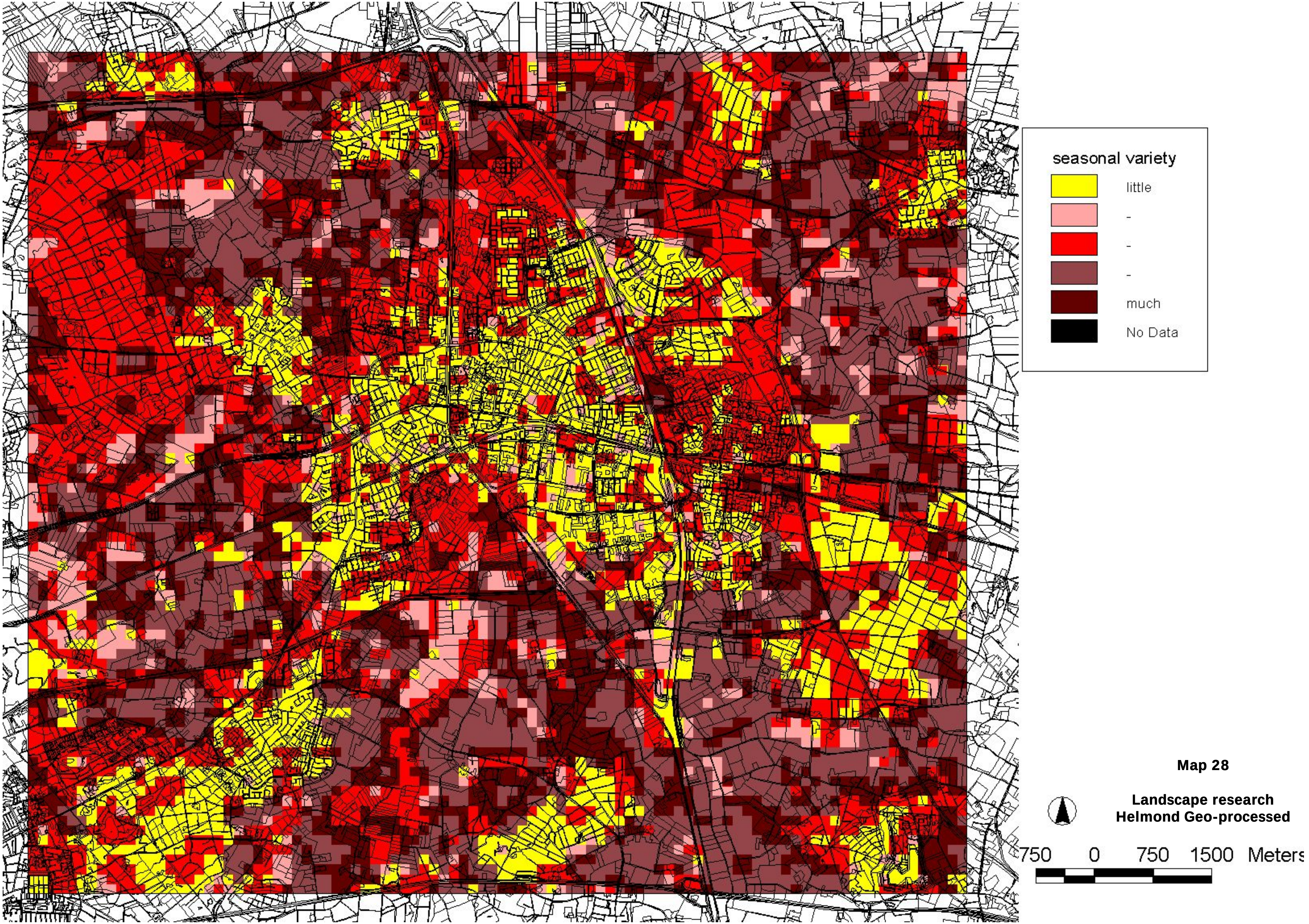

seasonal variety
little
-
-
-
much
No Data
Map 28
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters

Figure 16.1 Comparison of the variety in the base pattern with the visual complexity, the variety in visual complexity and the measurement of spaces

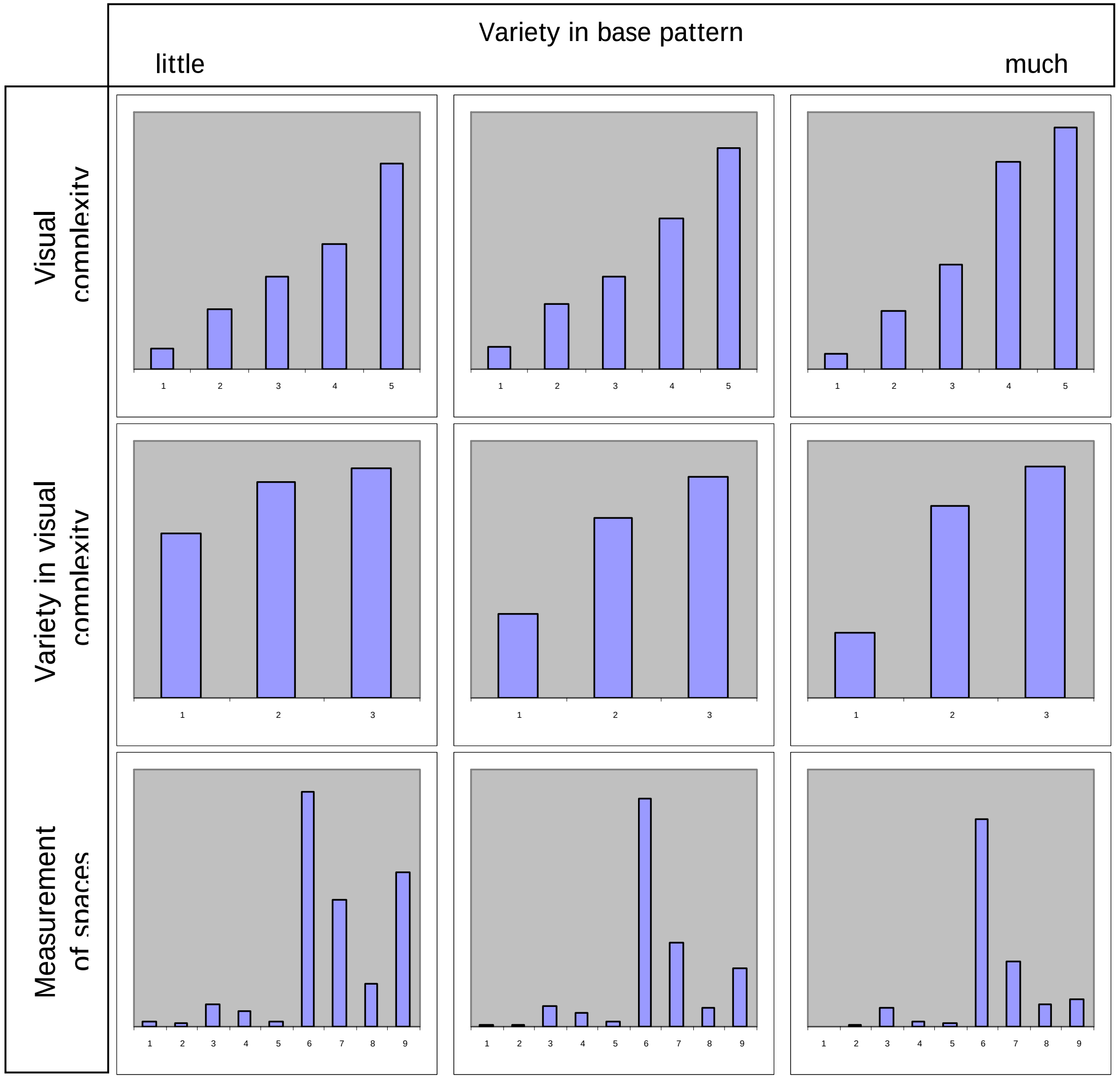
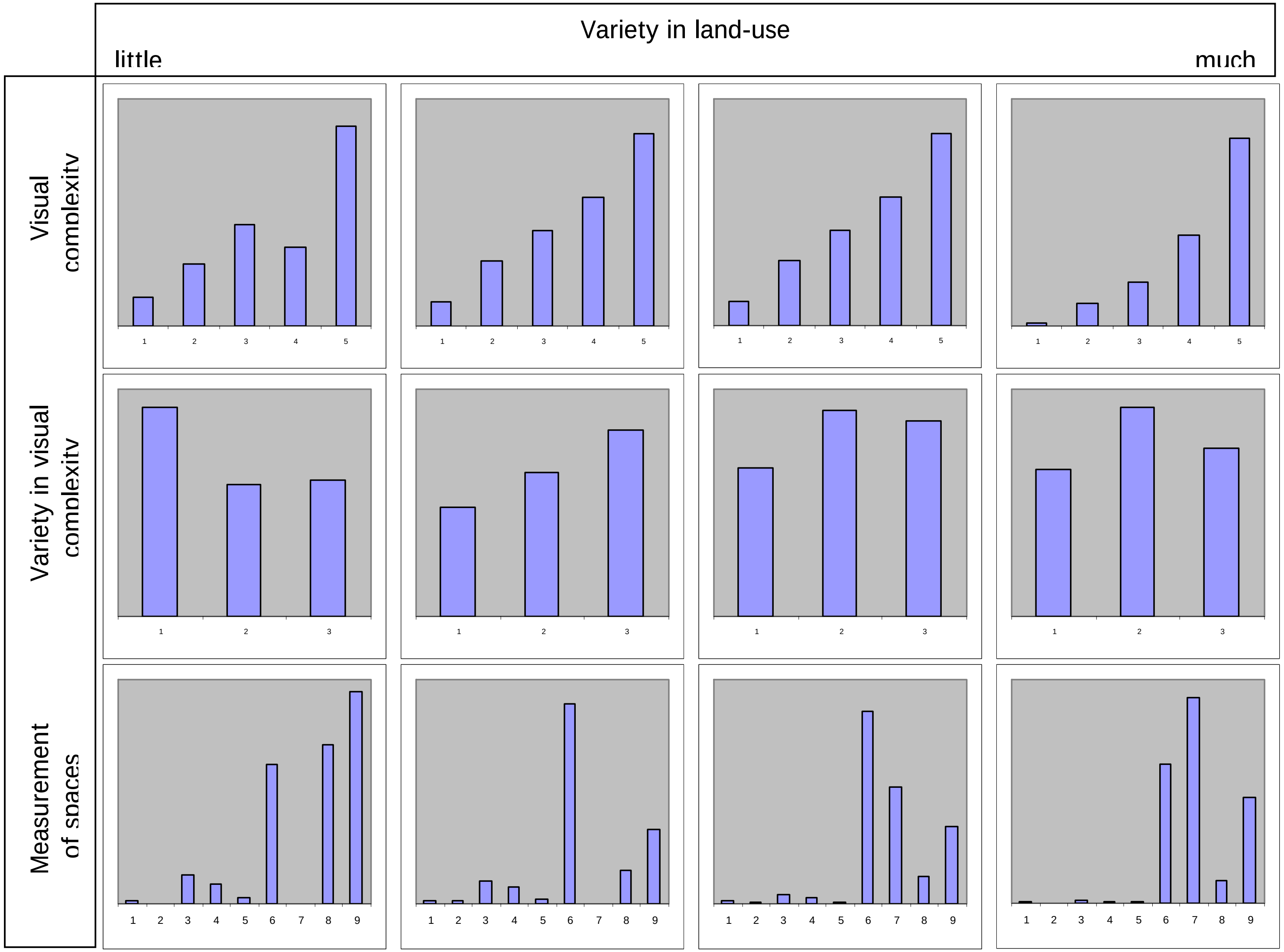
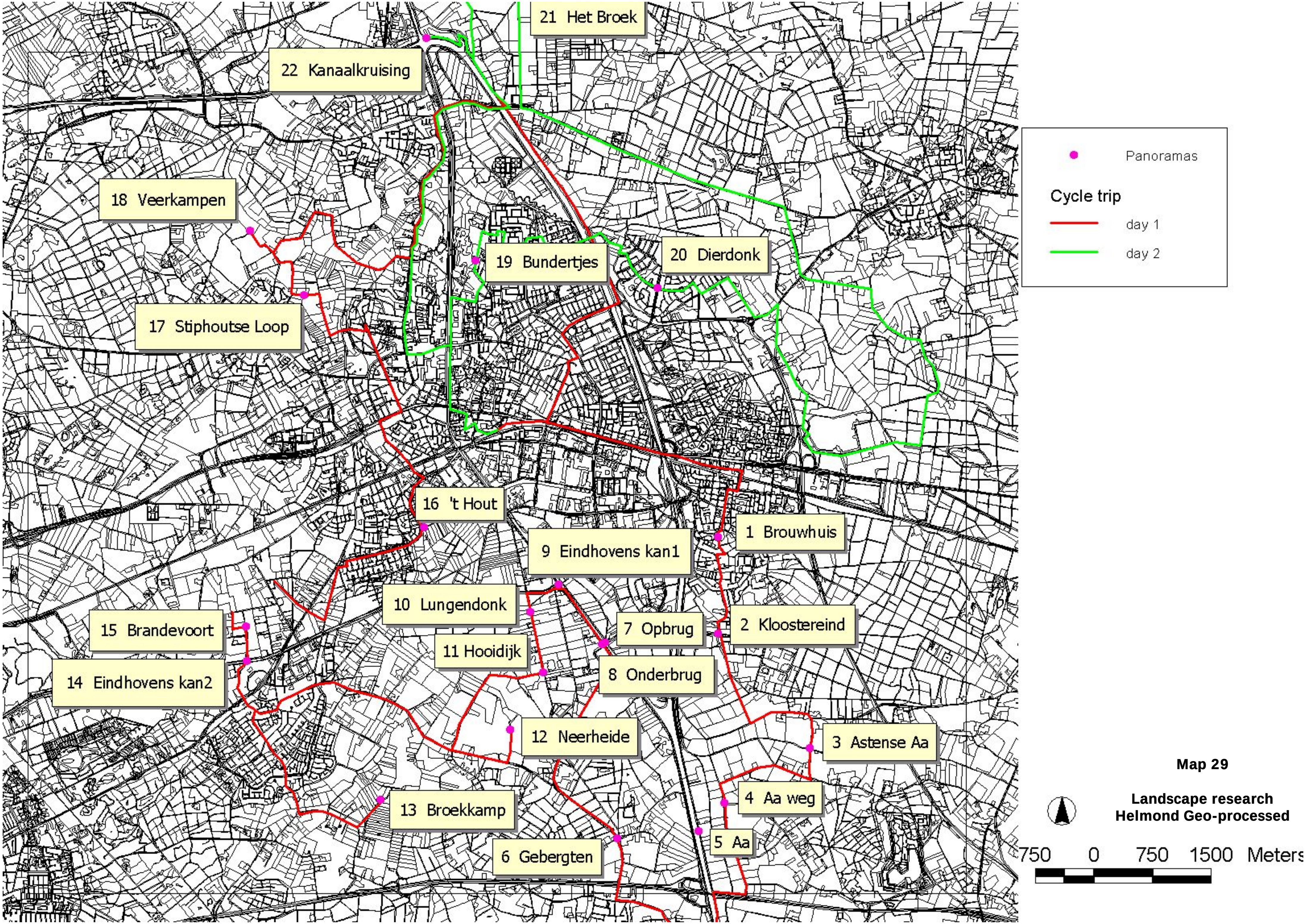


Figure 16.2 Comparison between the variety in land-use and the visual complexity, the variety in visual complexity and the measurement of spaces



17 Panoramas



Map 29

Landscape research
Helmond Geo-processed

Panorama 1 Brouwhuis, category 7

Panorama 2 Kloostereind, category 7

Panorama 3 Astense Aa, category 6

Panorama 5 Aa, category 6

Panorama 4 Aa weg, category 6

Panorama 6 Gebergten, category 6

Panorama 7 Opbrug, category 7

Panorama 9 Eindhovens kanaal 1, category 7

Panorama 10 Lungendonk, category 6

Panorama 11 Hooidijk, category 7

Panorama 13 Broekkamp, category 7

Panorama 14 Eindhovens kanaal 2, category 7

Panorama 15 Brandevoort, category 7

Panorama 16 ‘t Hout, category 7

Panorama 17 Stiphoutse loop, category 7

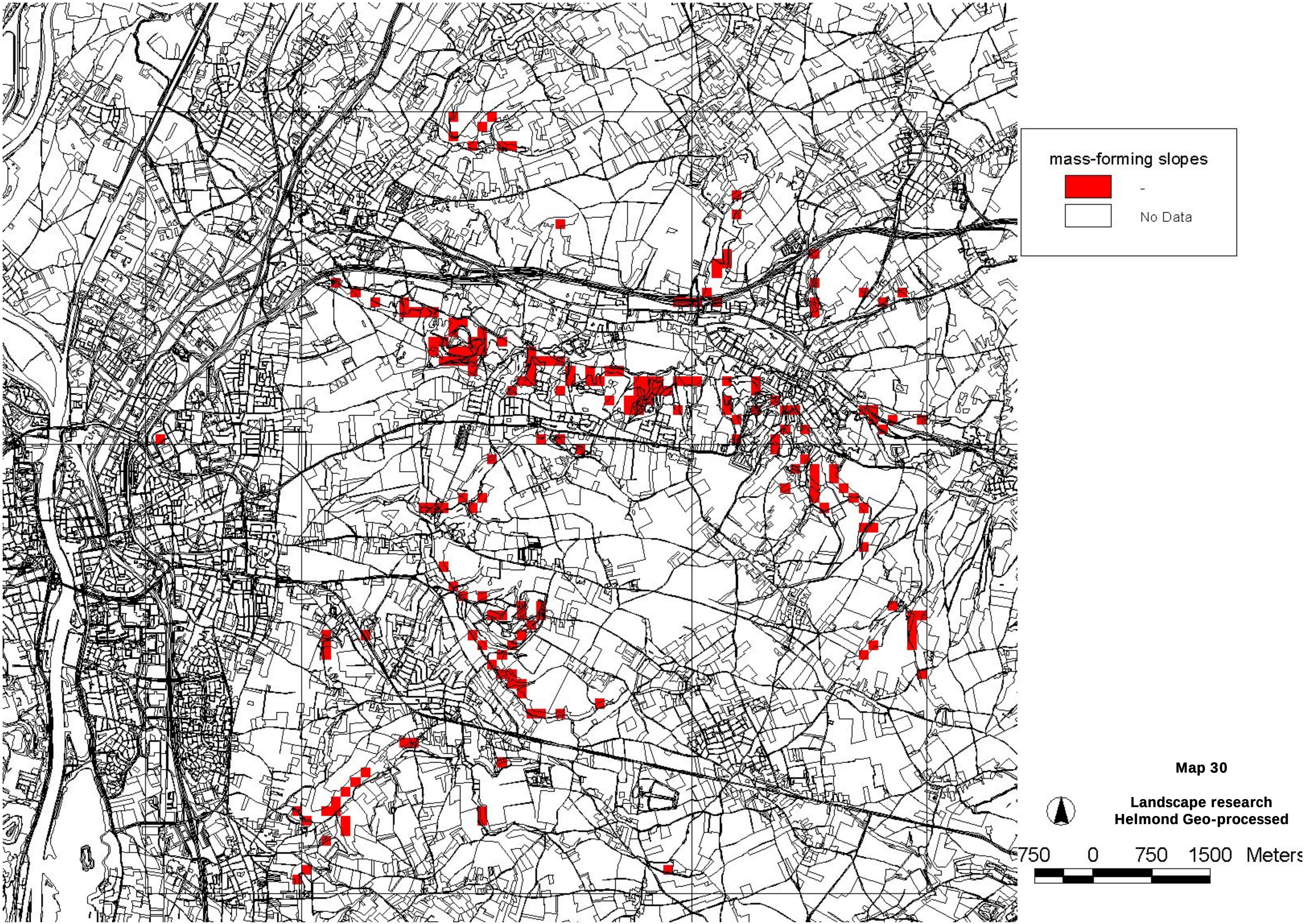
Panorama 18 Veerkampen, category 3

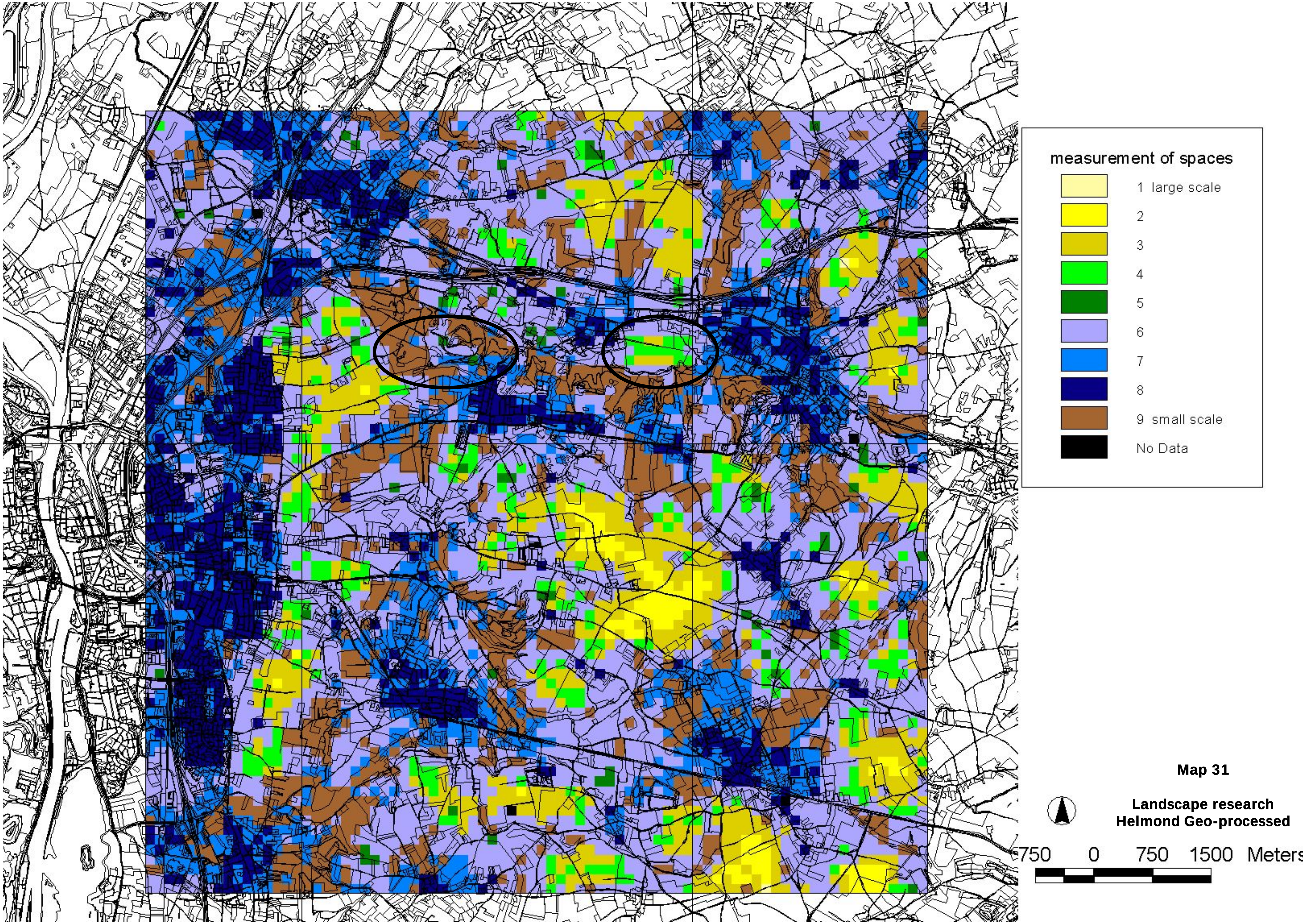
Panorama 19 Bundertjes, category 9

Panorama 21 Het Broek, category 7

Panorama 22 Kanaalkruising, category 6

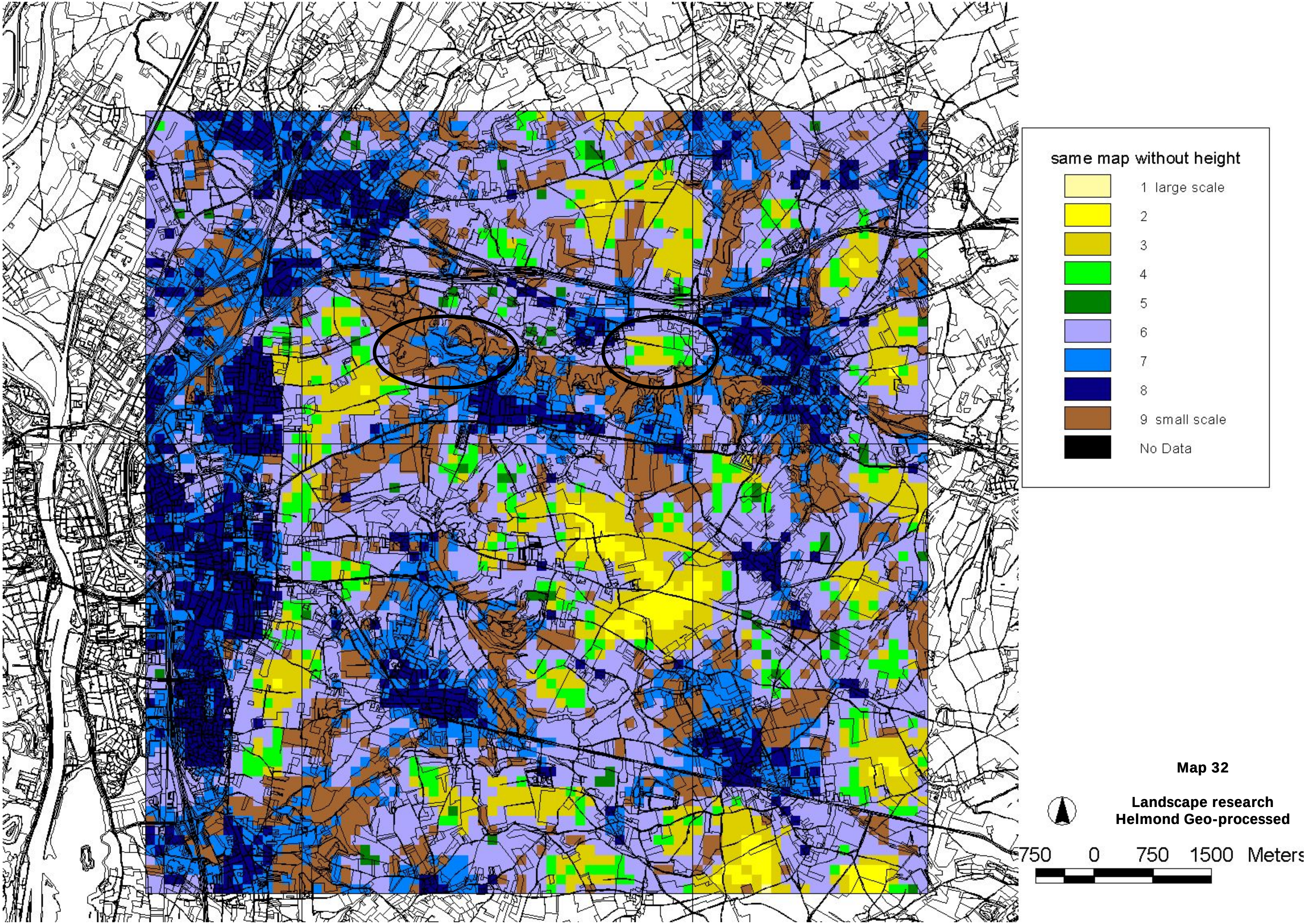
18 Limburg, the check on the relief


mass-forming slopes
-
No Data
Map 30
Landscape research
Helmond Geo-processed
750 0 750 1500 Meters



Map 31

Landscape research
Helmond Geo-processed


same map without height
1 large scale
2
3
4
5
6
7
8
9 small scale
No Data
Map 32
Landscape research
Helmond Geo-processed
750
0
750
1500
Meters