

# A MULTISTEP METHOD FOR HISTORICAL CHARACTERISATION OF RURAL SETTLEMENTS IN BELGIUM, RESULTS FOR THE PROVINCE OF ANTWERP

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Rural settlements and their territories are the building blocks of the rural landscape. In Belgium, many different settlement types can be recognised (green villages, street villages, nucleated villages, planned villages, dispersed settlements), each referring to different environmental conditions and periods of foundation. Most of the landscape typologies and regional classifications of Belgium do not include a systematic settlement classification. For example, the landscape characterisation of Belgium is based on the urbanised settlement patterns and does not include historical features of the rural settlements. The presented research aims to complete the landscape typology with a historic characterisation of rural settlements. It includes the analysis of the site and the morphology of the initial settlement in relation to its territory, using a multi-step method at two scales. First, at the local scale, a sample area is defined by a settlement and its territory in relation to the adjacent ones. For each site, the morphology of the places is analyzed as well as their territories. Second, settlement types and characteristics are mapped at a regional scale. The method uses a holistic interpretation of historical and topographical maps and of aerial photographs, covering a period from the 18th to the 20th century. The results are discussed for one sample area in the Kempenland and the synthesis for the province of Antwerp.

## **Introduction**

Rural settlements are considered as the centres of the organisation of their surrounding territory, and can be seen as the building blocks of the landscape. The term 'settlement' is defined as a permanent human habitation with at least one or more houses (Uhlig and

Lienau, 1972; Egli, 1991; 1992), and refers both to the morphology and the function of the settlement, without considering its size and hierarchy (hamlet, (urbanised) village, town or city) (Van Eetvelde and Antrop, 2005). The individual settlements are differentiated by the distance between the settlements,

which varies in the rural areas from 100 m to a maximum of 150 m (Lienau, 1986). The initial settlement patterns are an important factor in the explanation of the actual landscape patterns and the characterisation of geographical regions (Antrop, 2000). However, most of the landscape typologies and regional classifications of Belgium did not use nor include any systematic settlement classification. The first comprehensive study of the rural settlements in Belgium was made by Dussart (1957), combining village forms and their spatial distribution. Based on the previous work by Dussart, Lefèvre published in the first National Atlas of Belgium of 1964 a map at scale 1 : 500 000, indicating the village morphology as represented on the topographical map at scale 1 : 100 000 (Lefèvre, 1964). Both the typologies of Dussart and Lefèvre have a rather poor quality and detail, use only morphological and structural properties, and no historical characteristics are included. These classifications are solely based on (population) size and the position in a hierarchical structure of urban places (Van der Haegen *et al.*, 1982; Van der Haegen, 1992).

Although most rural settlements in Belgium, more in particular in Flanders, have been completely transformed by urbanisation, their historical centres reflect the initial site characteristics and structure and they often have a particular significance as heritage. There is a strong link between the site of the initial settlement and the land and its surrounding territory. In the past, people were bound to the soil and the terrain (Roberts, 1977), and this relation between people and their physical environment causes different settlement types such as green villages, street villages, nucleated villages, and dispersed settlements. These settlement types refer to different environmental conditions (for example, soil, topography, availability of water) but also to different periods of land reclamation. They are often characteristic for

a geographical region and contribute to the landscape character. Fundamental work on typology and terminology of settlement geography in Europe was done by the "Internationale Arbeitsgruppe für die geographische Terminologie in der Agrarlandschaft" (Uhlig and Lienau, 1972) and most of the definitions of settlement types used in the current paper are based on this previous work, as well as on the work of Renes (1981), which is more focussed on the Low Countries. Settlement types and patterns for Europe are also described, but not systematically mapped by Lebeau (1979), Jordan (Jordan-Bychkov and Bychkova Jordan, 2002). *The atlas of rural settlement in England* by Roberts and Wrathmell (2000) is another example.

Uhlig and Lienau (1972) defined three important methodological aspects in the study of settlements: (1) the physiognomic-topographic aspects, dealing with the topographic position (site) of a settlement, its size and shape as represented by the ground-plan, and the outline of the settlement, (2) the functional aspects, referring to factors such as the geographical position, the socio-economic situation, the functions offered and related structures, and the continuity of the settlement, and (3) the genetic aspect, the historical development of the place, characterised by the change of its form, morphology, and functionality. Uhlig and Lienau (1972) see the change of form as a consequence of a functional change. Many settlement typologies are based on physiognomic-topographic properties, which can be inferred directly from (historical) maps (Renes, 1981). Central in these morphological typologies are the size and form or shape of the settlement (Roberts, 1987; 2002).

An updated typology of settlements in Belgium is still lacking and the small scale maps of Dussart and Lefèvre are still used, for example in the most recent version of the National Atlas (Van Hecke *et al.*, 2010), despite its too general scale and

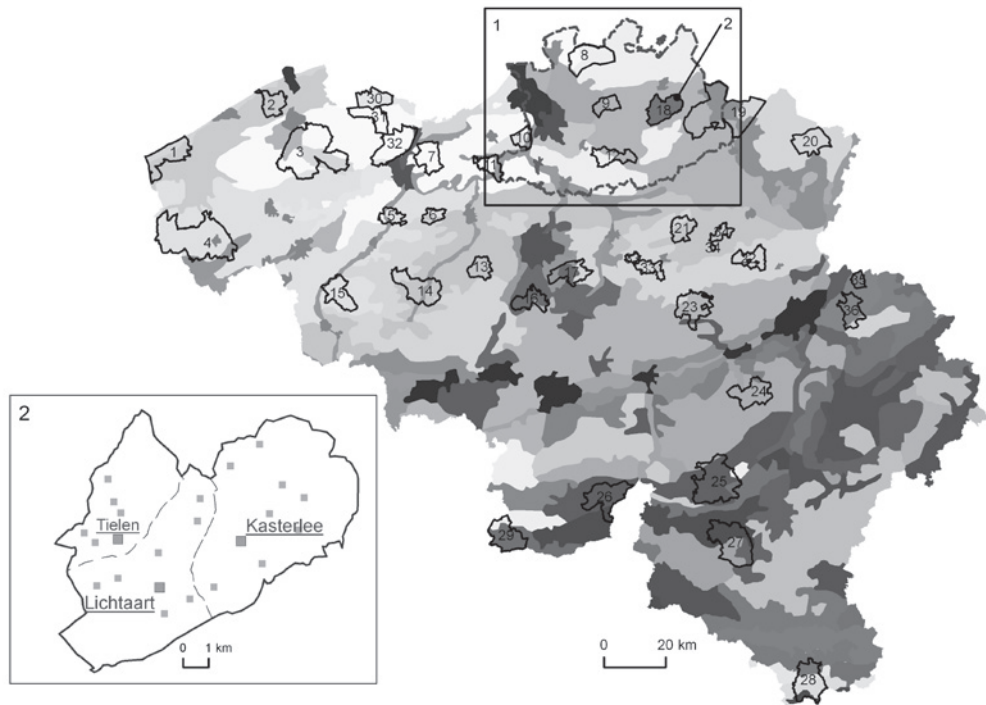


Fig. 1. Location of the 36 case study areas in Belgium belonging to different landscape typologies in different Landscape Character Types (Van Eetvelde and Antrop, 2009). Location of the Province of Antwerp (1) and the case study area “the Central Kempen” (2)

that the classification does not reflect recent research on settlement geography and historical landscape characterisation. Also, the characterisation of the contemporary landscapes of Belgium is based on the current built-up patterns and does not include the genetic and historical features of the settlements (Van Eetvelde and Antrop, 2009). Our aim is to update and complete this landscape typology of Belgium with an improved characterisation of the settlements, using site properties, morphological types, the relationship with the surrounding territory, and the trajectory into the actual urbanised landscape. This paper presents a multistep method for this historical characterisation of the traditional rural

settlements of Belgium. First, the detailed analysis of the settlement and its territory and the place morphology is presented, and secondly, the synthesis of the results for the province of Antwerp is discussed.

### Study area

The province of Antwerp (Fig. 1) covers the western part of the geographical region known as the Kempenland (Monkhouse, 1949). Today, this region belongs to the highly urbanised part of Flanders region, the northern part of Belgium. It contains a wide variety of settlement types and urban gradients and was therefore chosen to set up and test the methodology. The case study areas for the analysis at the detailed scale are indicated

as well. The one discussed in this paper covers the municipalities of Kasterlee, Tielen and Lichtaart, situated in the traditional landscape region named the “Centrale Kempen” or Central Kempen (Fig. 1). The area is structured by the parallel alluvial valleys of the Aa and the two Nete rivers, separated by elongated interfluvia covered by land dunes (ridges and parabolic blowout dunes) and heath land. The ridge of Lichtaart-Kasterlee (average elevation 40 m) is the most prominent one. Most of the heath land was planted with conifers during the 19th century. Today, it is a highly urbanised landscape, extending from the historical settlements into the woodland on the dunes areas. Only the wet alluvial valleys are free of buildings and carry cropland and meadows.

## Method and materials

In general, the method consists of three steps and has a bottom-up structure. The first step consists in a detailed analysis at the local scale of the territories of a sample of adjacent municipalities, which are representative for a specific type of landscape area as defined in the Belgium landscape characterisation. All settlements in these sample areas are described and their layout is studied. In the second step, the settlement morphology (size, shape, structure) of each place is analysed in detail. In this paper, the results are discussed for the places Kasterlee en Lichtaart, situated in the geographical region of Central Kempen. The third step consists of a cartographic synthesis of the settlement types and their characteristics at a regional scale. Some results are presented for the province of Antwerp to illustrate the method.

In this section, the data sources and their use will briefly be discussed first, followed by the description of steps of the bottom-up method.

### The data sources

Table 1 shows the different types of data sources which were used for the

analysis at both scale levels. The historical maps were used to analyze the landscape and the settlement patterns of the 18th century. They proved to be a very useful data source to define landscape types as they provide, in various ways depending on the quality and properties, information on the landscape character of the different time periods, representing topography, land use, field patterns, settlement patterns, and infrastructure (Vuorela *et al.*, 2002). The oldest map we used is the very detailed historic map of Count de Ferraris at a scale of 1 : 11 200 of 1775, representing the landscape characteristics at the end of the 18th century. A high quality scanned version is available online [http://www.kbr.be/collections/cart\\_plan/ferraris/ferraris\\_nl.html](http://www.kbr.be/collections/cart_plan/ferraris/ferraris_nl.html). The map is of exceptional quality and detail (Fig. 2) and is very significant as it represents the situation just before the beginning of the fast-reaching changes of the 19th century. This map was used — despite some geometrical distortions — as a base to define the initial settlement types. To analyze the transformation of the settlements, two topographical maps of the 20th century were also used. The first one is made by the Military Geographical Institute at a scale 1 : 20 000 and represents the situation before the First World War (1860 — 1881, with revisions until 1948). The second one, at a scale 1 : 10 000, gives the situation from the 1960s onwards, right after the processes of suburbanization had started. A digital and georeferenced version of this topographical map was used in ArcMap 9.3 as a base map for the digitising of the characteristics and join with the geo-database. Finally, cadastral maps of the 19th century made by P.C. Popp at a scale 1 : 5 000 were available and used to verify the morphological details of the places and field patterns. Table 1 shows also several used thematic maps with their properties.

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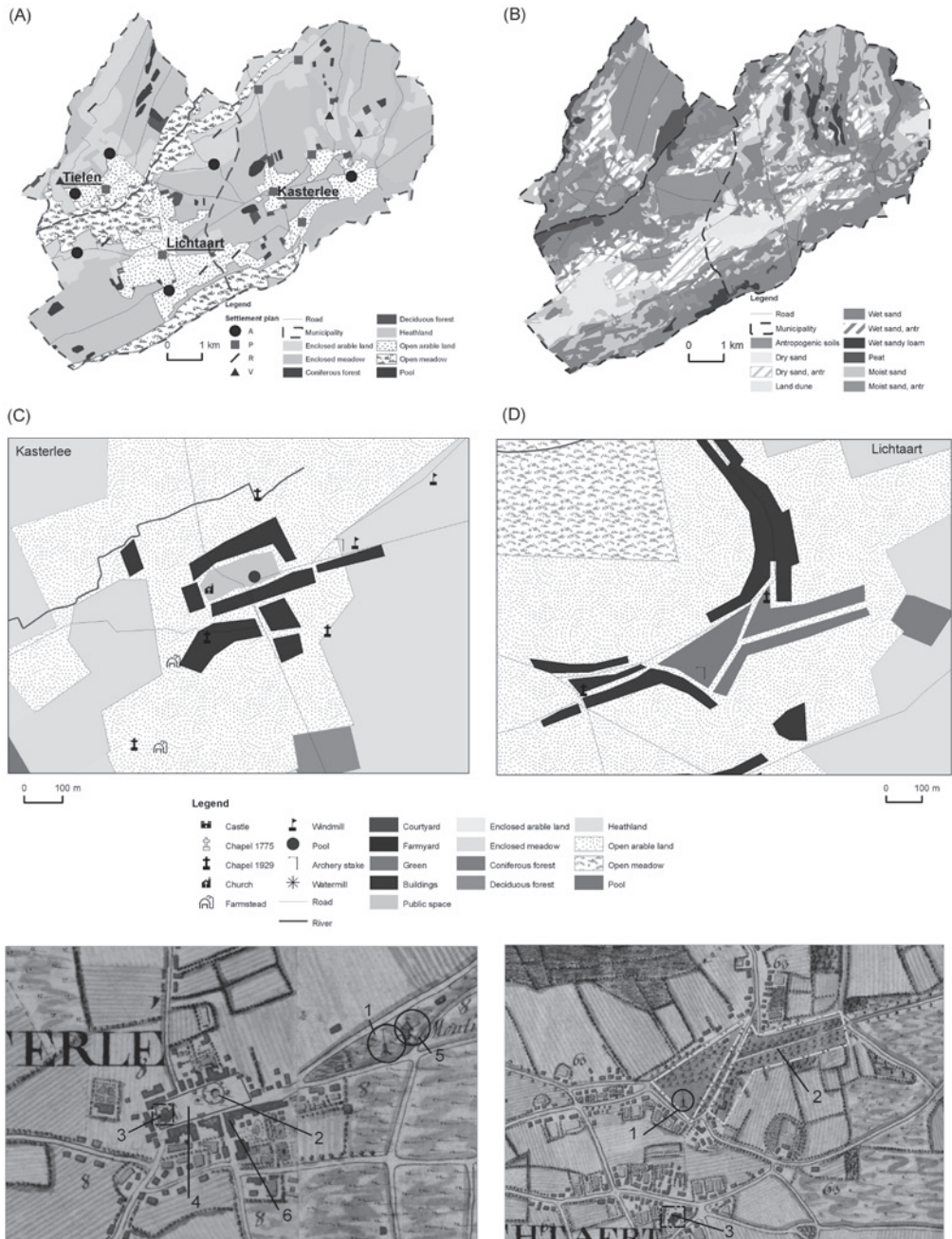


Fig. 2. Top: Analysis of the territory of Central Kempen at the end of the 18th century (A) and the main soil characteristics (B). Centre: Site characteristics of Kasterlee (C) and Lichtaart (D). Bottom: Map of de Ferraris with following settlement components: pillory (1), green (2), common place (3), church (4), pool (5) and windmill (6)



**Table 1. Datasets used to define and set up the historical settlement typology of the province of Antwerp**

Datasets	Date	Original scale/ Resolution
<b>Historical and topographical maps</b>		
Historical maps by de Ferraris	1770–1778	1 : 11 200
Topographical map (Military Geographic Institute)	1860–1881 (1949)	1 : 20 000
Topographical map (National Geographic Institute)	1970–1990	1 : 10 000
Topographical map (National Geographic Institute)	2002–2008	1 : 50 000
<b>Thematic maps</b>		
Cadastral map (P.C. Popp)	1842–1879	1 : 5 000
Settlement typology (Lefèvre, 1964)	1964	1 : 500 000
Soil map	1970	1 : 20 000
Landscape Characterisation of Belgium (Van Eetvelde and Antrop, 2009)	2009	1 km
Digital elevation model (AGIV)	2006	10 m
<b>Aerial photographs</b>		
Google Earth	2007	Variable

### Step 1: Detailed territorial analysis of sample areas

#### *Selecting the sample areas for local analysis*

In the first step, different sample places were selected for a detailed territorial analysis. A first selection of “initial” rural settlements was based on the hierarchical list of places defined by Van Hecke (1998), which is also commonly used in the context of spatial and urban planning (Taverne and Visser, 2004). Cities and towns of different hierarchical scales are not taken into account in this research, as for example the city of Antwerp.

Secondly, overall 36 different case study areas in Belgium were selected (Fig. 1) to test the methodology and the classification criteria and to build the typology. Their sampling was based on the landscape characterisation of Belgium based on the classification of Van Eetvelde and Antrop (2009) and on the old administrative division of the independent municipalities (situation before 1961), as these fit better the traditional territories than the redesigned actual municipalities (Van Eetvelde and Antrop, 2005). Each of the 36 case studies areas consists of several adjacent municipalities, which have one main centre and several dependent smaller settlements. Using adjacent municipalities

allowed a better understanding of the relationship between place and territory, in particular the evolution of the common land.

For this paper, the local case study number 18 “the Central Kempen”, consisting of two neighbouring municipalities, was chosen to test the methodology.

*Map and photo-interpretation and building of the geo-database*

The characteristics of the settlement and their territory as represented on the historical and topographical maps and on aerial photographs were visually interpreted, starting with the historical map of de Ferraris (end of the 18th century) and moving to the contemporary situation. The method of holistic interpretation of the patterns on maps and photographs, was adapted from the one used by Antrop and Van Eetvelde (2000). First, the results of the interpretation were

generalised on a topographical base map of 1 : 50 000 and described in a notebook. Second, this compiled version was digitized in ArcGIS 9.3 and the descriptions were coded in a linked database (Microsoft Access 2007).

**Step 2: Detailed analysis of the morphology and defining the settlement type**

First the settlement characteristics were described of the “initial” settlement at the end of the 18th century, based on the historical map of de Ferraris. This is mainly based on its morphological structure as represented on the map, and on the occurrence of specific elements which are known to be associated with different settlement types. For each settlement, the following characteristics were included: the morphological properties (the extent and shape of the central square

*Table 2. Settlement characteristics*

	<b>Variables/ attributes</b>	<b>Scale type</b>	<b>Source</b>
Morphological properties	The extent and shape of the central square if any, the layout of different elements	Qualitative (nominal)	Map by de Ferraris, cadastral map
Site properties	Number of churches, chapels, water pool, water pump, wind- or watermill, castle...	Quantitative	Map by de Ferraris, cadastral map, Military topographical map
Functional properties	Agrarian, social and economic	Qualitative (nominal)	Map by de Ferraris, Military topographical map
Historic properties	Age, continuity of habitation, land use change	Qualitative (nominal)	Map by de Ferraris, Military topographical map and Google Earth

Table 3. Overview of morphological settlement types for the province of Antwerp

Code	Name	Description
<b>Settlement plan (main type)</b>		
A	Agglomeration	Cluster of buildings without a distinct common place or a green.
P	Settlement with a distinct common place	Settlements with a distinct common place in the centre of the settlement, functioning as an agrarian green or market place.
R	Row settlement	Settlements with a linear arrangement of buildings along a road.
V	Dispersion, isolated settlement	Large isolated farmsteads and buildings. The minimum distance between two buildings is more than 150 m.
<b>Building layout</b>		
c	Continuous	Buildings form a closed street front.
o	Discontinuous	All buildings stand on a separate lot
x	Not applicable	
<b>Common place (in combination with main type A, R, V)</b>		
p	Common place	Settlement associated with a common space or green outside the built-up part.
z	Without common place	Settlements without any common place.
x	Not applicable	
<b>Complexity (in combination with common place P or p)</b>		
e	Simple	Settlements with one common place; the function is not defined.
m	Multiple	Settlements with more than one common place, which can have different functions
x	Not applicable	



if any, the pattern of different elements), the site properties (topography, slope exposition), functional properties (agrarian, social and economic), and historic properties (age, continuity of habitation, land use change) (Table 2). Furthermore, an analysis of geographical characteristics (hydrology, soil properties, and geomorphologic properties) was added, as well as an analysis of place names as given on the maps and described in literature. All information is integrated in a GIS database using ArcGIS 9.3 and Microsoft Access 2007.

A four letter code was used to identify the characteristics for each settlement and linked to a specific settlement type. This code refers to four main variables describing the main characteristics of the place (Table 3). Also, four main morphological groups of the settlement types were recognised with the first letter: row or linear settlements (R), settlements with common spaces (P), agglomerated or nucleated settlements (A), and dispersed isolated settlements (V). Settlements with commonly used spaces (P) are very common and varied in Belgium and they locally referred to different names such as *bist*, *dries* or *plaats*. These are indicative for the evolution of the place (Knaepen and Antrop, 2000). Therefore, this group is further subdivided according to the number of spaces and their functions (letter 4). The other two variables contain information about the degree of continuity of the buildings (letter 2) and the occurrence of common spaces (letter 3).

### **Step 3: Analysis of the spatial distribution of the settlement properties at a regional scale**

As all descriptive attributes are coded as separate entries in the database they can, besides defining settlement types, also be used to analyse relations and the spatial distribution of features in thematic maps, both at the local as well as regional scale.

## **Results and discussion**

### **Detailed analysis of the settlement morphology of the case study**

Initially, the settlements of Kasterlee and Lichtaart are “islets” of agricultural land surrounded by heath lands on dry sandy soils with dunes and wet alluvial valleys. Figure 2 (A) shows their appearance at the end of the 18th century and Figure 2 (B) gives the soil conditions. The settlements are surrounded by a fringe of arable land and, further away, common grazing land (heath land and meadows). Intensive agriculture and fertilizing during late medieval times transformed the original podzolic soils on the dry sandy land into antropogenic soils (antrosols), locally known as “plaggen” soils.

The historical map of 1775 allows a detailed analysis of the settlement plan and structures for Lichtaart and Kasterlee, as illustrated in Figure 2 (C and D), showing the interpretation map and the historical map. Kasterlee (Fig. 2 C) has a large rectangular square (4) with the church and graveyard (3) located at the west end of the square and partially bordered by buildings forming a street (6). Small elements are represented as well, such as the water pump on the square (2), a windmill at the extension of the common space to the east (5), and an archery stake for training the local militia (1) located on the highest part of the dune. Most probably, the square of Kasterlee once was an agrarian green, but as in other cases, the place was “promoted” to a centre of commerce (Knaepen and Antrop, 2000). Today, it is a market place.

Lichtaart (Fig. 2 D) is characterized by multiple centres. The one in the south is situated on the top of a land dune ridge and has the church and graveyard (3). The other one is situated along the northern edge of the dune ridge and two large common spaces planted with trees stretch out to the eastern side (2). These are probably greens but only

partially surrounded by houses. An archery stake for training the militia is shown on the green.

Consequently, both places are assigned to different settlement type categories (Fig. 2). Kasterlee is described by the code Pcx and Lichtaart Poxm (Fig. 3 and Table 3). Kasterlee is a compact, geometrical and closed (c) settlement with a common area (P) with a juridical and/or market function at the end of the 18th century. The 'e' in the letter code refers to one single common area in the centre of Kasterlee.

Lichtaart is more complicated. It has two centres, one around the church and one situated around multiple village greens area. The first centre around the church has a compact and closed (c) structure. The second has two spaces (m) forming a common area (P) surrounded by discontinuous buildings (o). Both spaces still have the function of an agrarian green.

### Results for the province of Antwerp: the spatial distribution of settlement properties

Figure 3 illustrates some of the results of the spatial analysis and thematic synthesis for the province of Antwerp. In total, 186 settlements were analyzed and classified according to the four main groups as defined previously. The distribution is as follows: nucleated settlements (57), settlements dominated by one or several common spaces (46), linear settlements (75) and irregularly scattered settlements (8). Clearly, a wide diversity of settlement forms occur and no specific settlement type dominates in the province of Antwerp. As a comparison: the classifications of Dussart (1957) and Lefèvre (1964) give only one type and distribution pattern for the whole of the Kempenland: i.e. "Villages and hamlets with extensions along the road". The thematic mapping of key properties also shows that their spatial patterns are rather equally distributed throughout the province.

For example within the municipality of the main village, a hierarchy of smaller settlements can be noticed. The main settlement contains the church and multiple village greens and is surrounded by smaller hamlets of various types as linear settlements, clusters or small green villages.

### Conclusion

The stepwise method allows making a multi-scale typology of the settlements at the end of the 18th century, based on their morphology and spatial structure. The detailed analysis of the settlements in sample areas made it possible to gradually build a typology in an open geo-database. All descriptive attributes characterising the settlement types can be mapped thematically in order to analyse their spatial patterns at a regional scale. The next phase of this research will apply the synthetic typology based on all sample areas to assign a typological category to all villages of Belgium.

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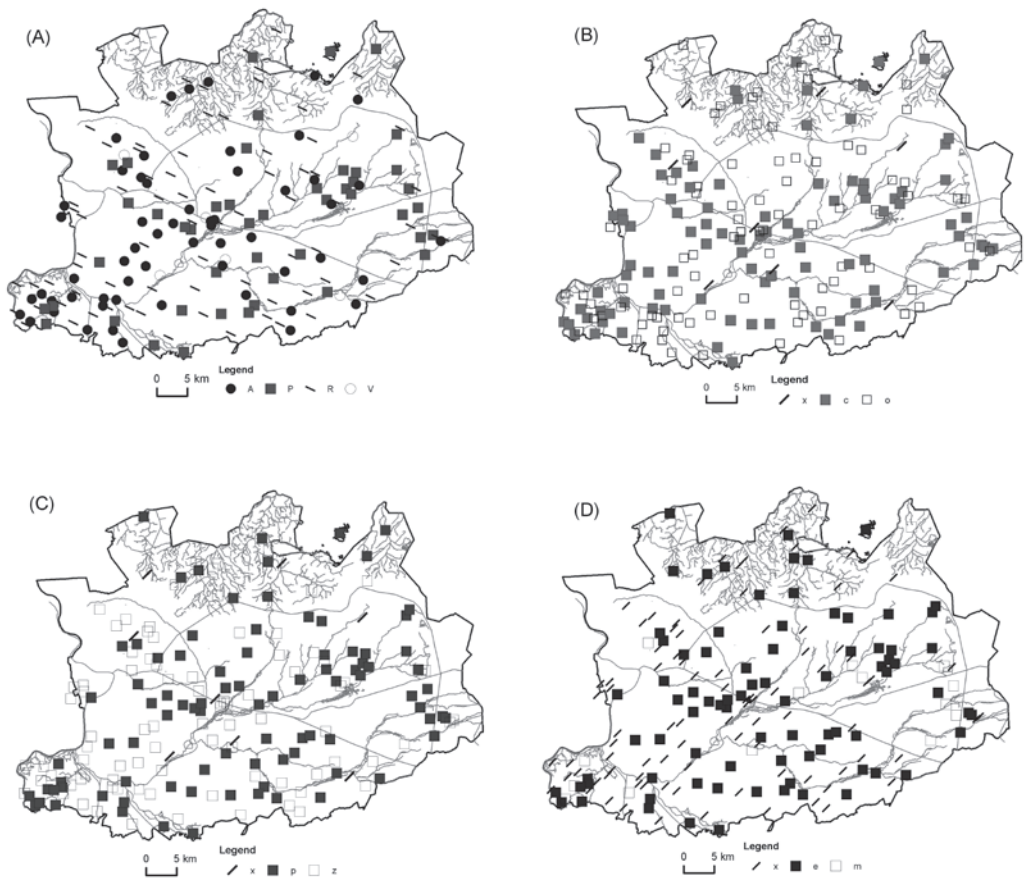


Fig. 3. Overview of the settlement types for the province of Antwerp. The main settlement plan (A), the continuity of buildings (B), the existence of a common space (C) and the degree of complexity of the common spaces (D)

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