

## Spatial Transformations in Urban Areas During the Past 50 Years

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### 1 ABSTRACT

This research examines the dynamics of spatial transformations in highly urbanized areas and in particular the urban agglomeration of Ghent (Belgium). To this end we go back 50 years in time (1963-2013). The hypothesis is assumed that three major spatial transformations take place during this period: (1) the population increase leads to sub-urbanization or the spreading of functions around the city center until the 1980s and (2) is followed by a period of compaction processes in which remaining open areas are filled within the suburban area. It is mainly about new construction. This condensed nebula - which presents itself as a city edge - (3) finally, together with the city core, transforms both in nature and in use of the existing built-up tissue. This mainly concerns renovation and reuse. The dynamics of these processes can be reconstructed on the basis of building and allotment permits.

Based on this, neighborhoods can be distinguished with low or high dynamics regarding transformations. Finally, it will be investigated where transformations will occur in the future. Socio-economic characteristics of starters on the residential market can be an indication of expected transformations in the future in other neighborhoods. The article introduces the concept of Napoleon plots to carry out statistical and spatial analysis. Dynamics and patterns are mapped.

Keywords: Belgium, urban, transformations, history, mapping

### 2 INTRODUCTION

This article examines the dynamics of spatial transformations in highly urbanized areas and in particular the urban agglomeration of Ghent (Belgium). To this end, we will go back up to 50 years in time (1963-2013). The dynamics of these processes can be reconstructed on the basis of building applications and allotment applications. Based on this, neighborhoods can be distinguished with low or high dynamics regarding transformations. The transformations relate both to the existing built-up tissue and open space that is occupied by new buildings.

Knowing transformations within the existing built-up tissue is important to have an insight into dynamics and the capacity to accommodate present and future housing needs within the existing heritage without going to expansion by cutting open space.

In order to explore the possibilities of the licensing database on the one hand and spatial patterns on the other, the case of the Ghent city region is being investigated. This includes both the urban core and the suburbs and can therefore represent processes and patterns that occur both in the center and in the periphery.

### 3 RESEARCH HYPOTHESIS

The hypothesis is that three major spatial transformations take place in the period 1963-2013: the population increase leads to suburbanization or the spreading of functions around the city center until the 1980s and is followed by a period of compaction processes with remaining open areas be completed within the sub-urban nebula. It is mainly about new construction. This condensed nebula - which presents itself as a city edge - finally, together with the city core, transforms both in nature and in use of the existing built-up tissue. This mainly concerns renovation and reuse.

### 4 TRANSFORMATIONS AND FORMS OF SHARED SPACE

A shared space can be created by various underlying transformation processes down to the level of the building that inter alia act upon the physical tissue and are steered from private ownership (Louw, 2008). Location selection, zoning plans, subsidies, taxes, permits, residual land value, use value, land development, ... are leading in this. In contrast to the Netherlands, the transformation in Flanders still happens mainly through self-realization (private initiative):

#### 4.1 Dividing up buildings

For example, dividing a single-family home into a multi-family dwelling. In order to have an idea of the pace of such a transformation, permit applications for demolition and new construction for the year 2015 were analyzed for the whole of Flanders. In 2015, 57,667 urban applications were approved. In 4,588 files it concerns the demolition of a house or a building with a different function (e.g. bakery, joinery, ...). 45% relates to the demolition of a residential building. A total of 2,315 residential units were demolished. A residential unit can be a house, a villa, an apartment, etc. In the same period (2015), 5,143 residential units were built on these plots. The demolition led to more replacement construction. This means that for every demolition permit 1.1 dwellings will disappear, but will be replaced by 2.5 new housing units. Usually these are flats. Or, 2.2 for each housing unit. If the pace of 2015 continues, approximately 3,000 residential units will be added to the existing built-up area annually. That is about 10% of the annual housing demand in Flanders. Approximately 33,000 building permits for new one-family homes were handed out in 2015. Such compaction means a saving on the cutting of open space and the realization of additional new land developments. In this way, nature and agricultural land can be spared and housing production increased.

For comparison, the annual production of housing through demolition and renewal is much higher in the Netherlands: for the period 2001 until 2005 this amounted to 52,900 new homes each year (Buitelaar et al, 2008: 37). Almost a third of that is realized within existing built-up area.

#### 4.2 Dividing the space

For example, the divide of land into parcels. This transformation was also recently investigated for Flanders. Pisman et al. (2016) showed that over the past 50 years 285,900 approved plots were delivered. This concerns new, changes and cancellations of allotments. 150,000 relate to new housing developments. Throughout this period, the number of plots has declined from 4,800 per year in 1963 to 2,100 in 2013. Especially after the regional zoning plans were drawn up (1976-1980), the number of allotments declined because they were then only delivered in residential destinations. Over the past two decades, the number of land plots has remained stable. The lot size has been decreasing systematically since the 1980s.

#### 4.3 Redistribution or redevelopment of space

For example demolishing a building and replacing it with a new building with a different function. The possibilities offered by reuse are not easy to estimate for the whole of Flanders (Tritel and UGent, 2012). The method of registration plays a role in this. Nevertheless, the reuse potential of the existing vacancy in Flanders is estimated at around 19,700 residential units. In addition, there are approximately 5,700 stores that can be redeveloped and approx. 3,000 ha of industrial estates (TV SUM and Atelier Romain, 2017).

In the Netherlands, Buitelaar et al. (2008) estimates that 23,000 ha of outdated business parks with empty buildings can yield up to 150,000 new homes. The objectives of the Spatial Planning Memorandum (VROM, 2004) are, just as for the White Paper on the Spatial Policy Plan Flanders (Flemish Government, 2017), relevant for identifying the transformation task: the number of homes to be built each year and the share that has to be built up within the existing built-up tissue must be built.

#### 4.4 Sharing or interweaving space

For example by stacking functions (e.g. houses on top of a supermarket or a school building). Research by Loris and Pisman (2016) provided insight into the possibilities of stacking homes on top of supermarkets. Such a transformation could theoretically accommodate the housing needs for the next ten years, without sacrificing green space.

The above forms of transformations come back under the three waves that are presented as research hypotheses: suburbanization (from the city center) through subdivision, densification (of those suburban areas) by further subdivision, interweaving and redevelopment of buildings, and renovation (within the city centers and the sub-urban area) through reuse, demolition and reconstruction. These spatial processes are tested in the urban region of Ghent (including agglomeration, core city and city center).

## 5 DATA AND METHODOLOGY

### 5.1 Data and data quality

The basic data used for the research are license applications for the period 1963-2013, as collected by the municipalities according to the guidelines of the Flemish Government. Spatial planning is a regional competence in Belgium and most town planning applications are granted by municipalities.

Within the study area of the Ghent urban district, a total of 250,940 urban development applications are analyzed over the past 50 years. Less than 10% of the applications are refused by the municipalities; more than 90% led to a permit for the creation of new lots or the building up of buildings (e.g. housing, businesses, retail etc.). We assume - in view of the long period that is being considered - that these permits are actually being realized. After all, an application takes a long time and is costly for the applicant.

The number of applications varies annually and follows the general Belgian and Flemish economy (decline during the (oil) crises of the 1970s and 1980s, the banking crisis of 2008 and the revival during the 1990s and 2000s). The changing housing market is also reflected in the data: stagnation of new construction versus the increase of renovation of the existing housing stock. New market shares take off proportionally over time (Pisman et al., 2016).

Preliminary analysis of the quality of the data of 2,464,661 licenses for the whole of Flanders, indicated that only 1.5% of these permits could not be assigned to a Napoleon plot (corresponding CAPAKEY coding, see below). This may be considered as an acceptable margin of error for carrying out such historical research over the last 50 years.

The data is the most detailed for an individual cadastral parcel.

Finally, data that reflect the housing dynamics in the short and long term are used: on the one hand property that is for sale (apartments, building plots and houses offered for sale via the internet) and on the other hand the inventory of vacant lots in the urban region (currently or not) for sale. Research by Antea and KUL (2017) shows that the used real estate offer is large enough to carry out meaningful analysis.

### 5.2 Methodology

#### 5.2.1 Spatial exploration of the data by means of heat maps

The exploration of the data is done on the basis of heat-maps for the case of the urban region of Ghent. Heat maps indicate the incidence of a particular phenomenon per grid of 500 m, e.g. to prevent the number of renovation requests for a certain time, e.g. the year 1963, or over a certain period, e.g. 1963-2013. The advantage of this is that the data that is analyzed is easier to understand for the reader and can expose patterns for interpretation (Lukez, 2007).

#### 5.2.2 Entry of the concept of Napoleon plots

Over the past 50 years, many cadastral parcels have been parceled out, divided, merged or renumbered. In order to be able to trace permits over time on a certain cadastral plot, the ground number of the original plot is used. The whole of parcels with the same ground number is called the Napoleon plot. After all, Napoleon has introduced the land register in our regions, hence. For example, the cadastral parcels 100a7 and 100b are assigned to Napoleon plot 100 (fictitious example). Napoleon plots are more stable over time; the statistical processing is therefore easier and more accurate.

The Napoleon plots are then assigned to a fixed grid cell of 500m by 500m. In this way patterns and changes in permits can be animated over time. The generalization of the maps helps to limit the complexity on the one hand, and on the other hand to reflect the essential spatial processes without sacrificing the aesthetics of the maps (Weibel & Dutton, 1999).

#### 5.2.3 Case study city district Ghent

The choice falls on the urban region of Ghent (Figure 1) because of technical and substantive reasons. On the one hand, we only have permit dates for Flanders (and not for the Brussels-Capital Region and Wallonia) and in the case of the Ghent city region also data for both the city of Ghent and its peripheral municipalities (Zelzate, Wachtebeke, Lochristi, Destelbergen, Melle, Merelbeke, De Pinte, Gavere, Nazareth, St-M-Latem, Nevele, Lovendegem and Evergem) is available. This way a coherent urbanized region can be investigated.

On the other hand, the urban district of Ghent is characterized by growth in the area of households, both in the city of Ghent and in its peripheral municipalities (SVR, 2014) despite the continuing suburbanisation (SVR, 2016). This indicates that there is a dynamic in space. The region is also characterized by a dynamic in the field of property transactions (see below).

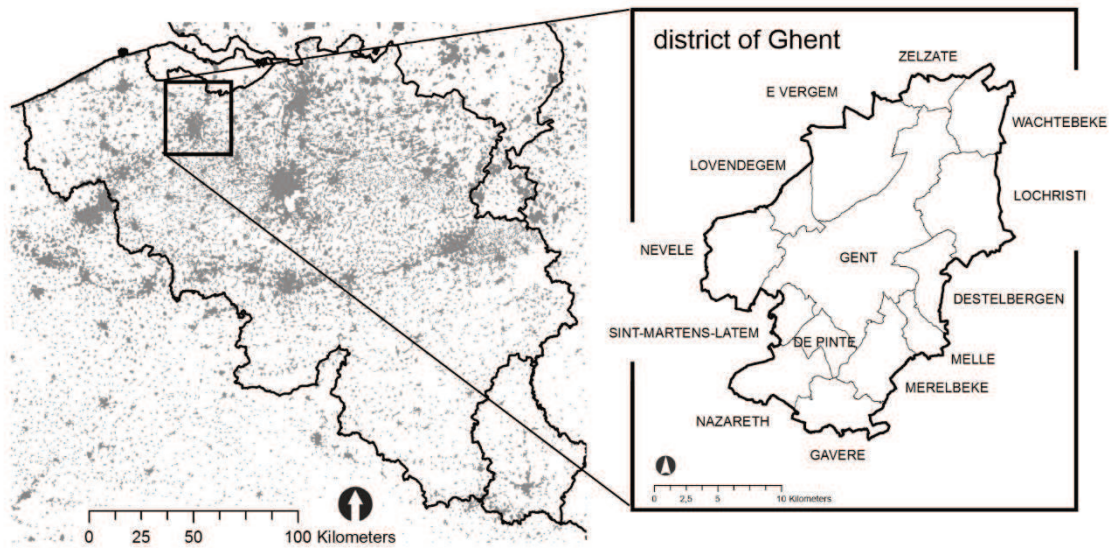


Fig. 1: Situation of the urban district of Ghent in Belgium. The study area includes the municipalities of Ghent, Zelzate, Wachtebeke, Lochristi, Destelbergen, Melle, Merelbeke, De Pinte, Gavere, Nazareth, St-M-Latem, Nevele, Lovendegem and Evergem. Source: left: UMZ, right: own processing.

## 6 SPATIAL EXPLORATION OF THE DATA - CASE URBAN REGION OF GHENT

### 6.1 Global trends in the city and its periphery

Until the beginning of the 1980s, the number of new-build projects in the city of Ghent as in its peripheral municipalities is in line with both trend and size (Figure 2). After a decrease in the number of licenses at the end of the 1970s, there has been a renewed increase in the number of new construction projects, both in the city and in the periphery until the mid-1990s. However, the increase in the city of Ghent is much more limited and stagnates in the period from mid-1990-2013. The growth in the peripheral municipalities, on the other hand, peaks until the mid-1990s, after which a decline also occurs, but still remains above the growth of the city in absolute numbers. The dynamics in the area of new construction are greater in the suburbs than in the city.

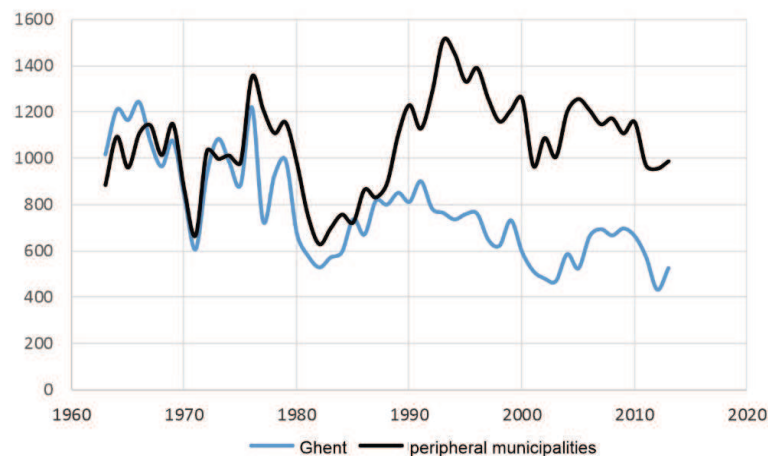


Fig. 2: Trend in new construction (all functions) in the urban region of Ghent in Belgium with a distinction between the city center of Ghent and its peripheral municipalities (Zelzate, Wachtebeke, Lochristi, Destelbergen, Melle, Merelbeke, De Pinte, Gavere, Nazareth, St-M-Latem, Nevele, Lovendegem and Evergem). Source: Licensing register (2015), own processing..

The first two periods, namely 1963-mid 1980 and the period mid-1980-mid-1990s, have a similar trend in the number of renovations between the city and its periphery. In Ghent, however, more is being renovated



than in the peripheral municipalities (more than twice as much). Since the 1990s, the number of renovations has increased both for the city and for the peripheral municipalities (Figure 3). This increase coincides with the decline of the new building during that period. The renovations then far exceed the number of new construction projects.

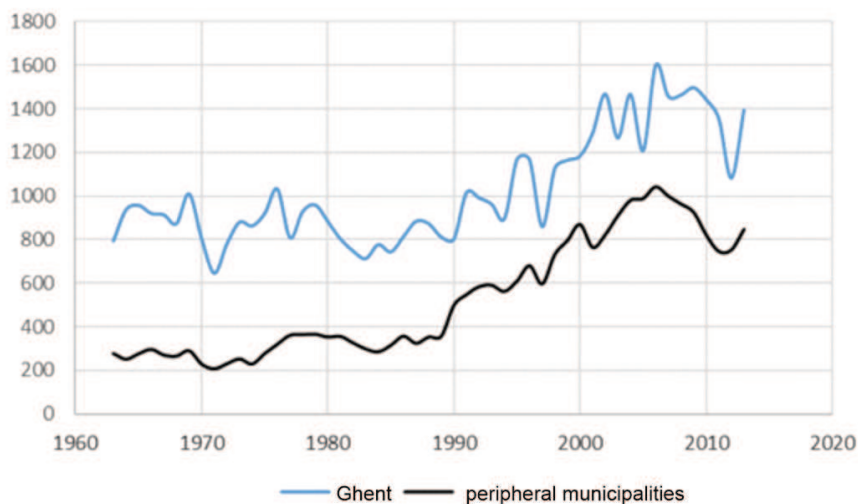


Fig. 3: Trend in renovations (all functions) in the urban region of Ghent in Belgium with a distinction between the center city of Ghent and its peripheral municipalities (Zelzate, Wachtebeke, Lochristi, Destelbergen, Melle, Merelbeke, De Pinte, Gavere, Nazareth, St-M-Latem, Nevele, Lovendegem and Evergem). Source: Licensing register (2015), own processing.

In addition to the quantity question, it is interesting to look at the real demand about the same three periods. This is done on the basis of the heat maps.

## 6.2 Trends in the neighborhoods

We have clearly seen two trends over the past 50 years: on the one hand the swarming of the buildings from the center of Ghent to the peripheral municipalities (suburbanization and densification) and on the other hand a more recent renovation wave in that center of Ghent and to a lesser extent in a first belt around Ghent (e.g. neighborhoods Wondelgem, Sint-Amandsberg, Gentbrugge) (Figure 4). These trends were started during the years 1980 to 1990 (Figure 5). Outside the city of Ghent and the first belt the start of the growth of the port villages (Zelzate and Ertvelde) occurs, and suburban villages such as Sint-Martens-Latem, De Pinte, Lovendegem, Evergem, Lochristi, and the villages in the Scheldt valley (Merelbeke, Schelderode, Melsen, Semmerzake, Gavere, ...). Also nearby villages are beginning to grow: Eke, Nazareth, Landegem. The Scheldt valley as well as the open spatial areas in Wachtebeke and Lochristi are coming under increasing pressure.

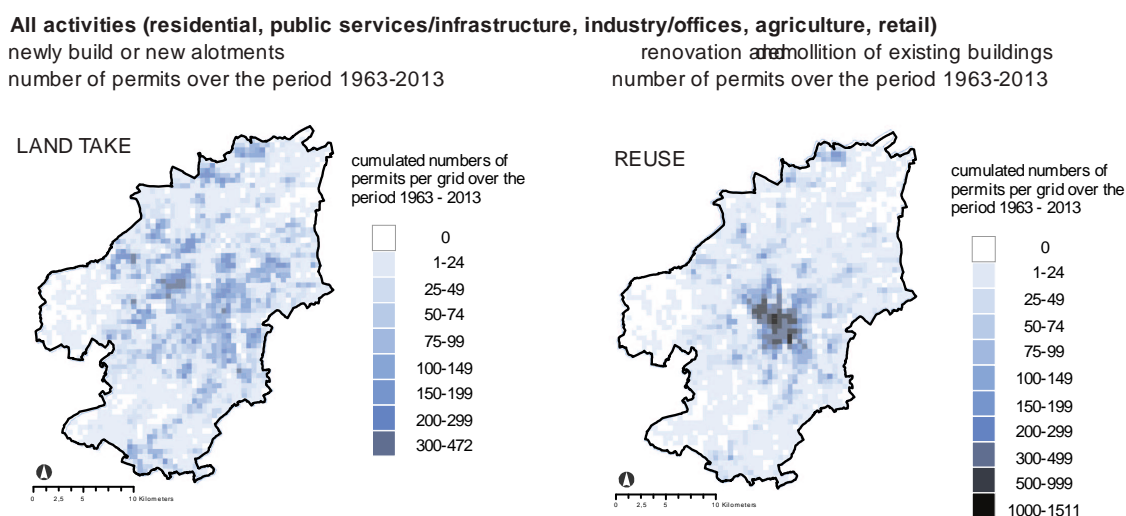


Fig. 4: Heatmap of the spatial pattern of the distribution of the number of building permits for new construction and for renovation over the period 1963-2013 in the urban district of Ghent. Source: own processing of data permits register (2015).

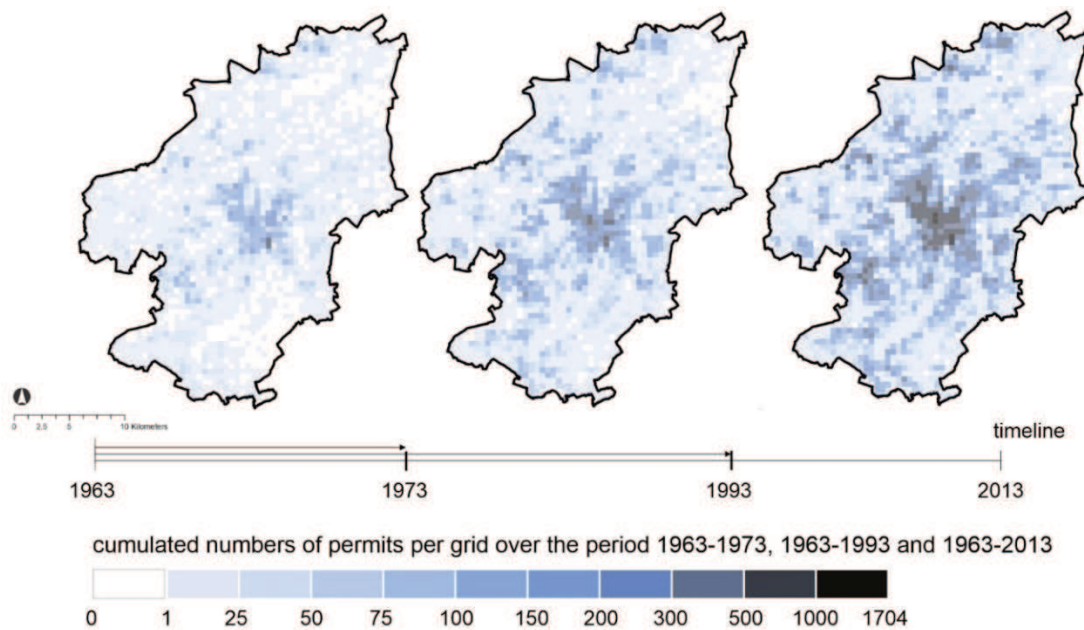


Fig. 5: Timeline of the spatial pattern of the distribution of the number of building permits (new construction and renovation) over the period 1963-2013 in the urban district of Ghent. Source: own elaboration.

### 6.3 Major driving forces behind transformations

Six driving forces are mapped: residential new construction, public services and infrastructure, industry and offices, agriculture, retail and deforestation, and new allotments. Both new construction and renovation and demolition are indicated on the maps (Figure 6).

In absolute numbers, the share of residential permits is the largest compared to the other functions. The number of permits for new construction and renovation is concentrated in the city center and in the villages around it, with the exception of the port villages that are growing due to the expansion of the port of Ghent. The new building is driven by land parcels and deforestation. This is very visible in Sint-Martens-Latem, Eke and Sint-Amandsberg, but has a dynamic all over the city region. This also puts more rural areas under pressure such as the municipality of Evergem. We also see the transformation of the rural area in Lochristi where greenhouse cultivation is being expanded. Finally, a concentration of public functions and infrastructure on the one hand is noticeable, and on the other hand of retail in the center of Ghent. Renovation coincides with this.

## 7 RESULTS AND DISCUSSION

### 7.1 Spatial transformations of the past 50 years

The post-war developments and Golden Sixties, with increasing car use and the Babyboom generation, led to optimism about the growth opportunities for Belgium. A consequence of the idea of progress was that in the later regional plans (i.e. zoning plans were drawn up for the entire territory in terms of housing, industry, recreation, nature, agriculture, etc.), a multitude of residential destinations were provided, based on optimistic population prognoses. The crises of the 1970s and 1980s will show that once again. Nevertheless, this large range of created building plots will reinforce later megatrends in the field of spatial planning. The accompanying economic policy and policy in the field of infrastructure have fueled the urbanization of Flanders (car oriented development).

Three major trends have been observed in the Ghent urban region since 1963: the growth of the urban region and the accompanying suburbanization, the densification of the growth centers and, finally, the renovation and transformation of the existing built-up tissue (Figure 7).

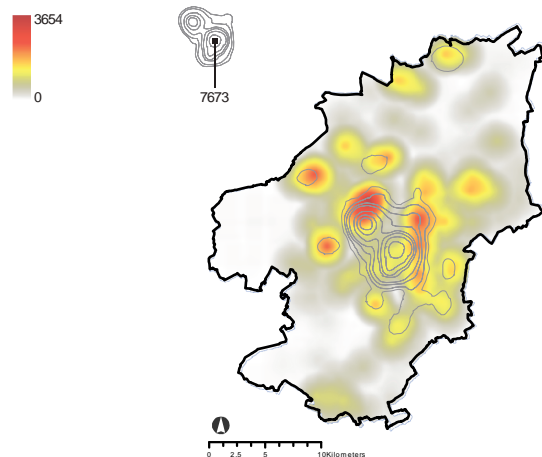
#### (1) Growth and suburbanization

Population growth and household growth are creating an increasing demand for building plots for mainly detached buildings, the dominant architectural style since the 1960s. The share of homeowners continues to increase. Suburbanization and ribbon development outside the village centers are typical for the Flemish

landscape and therefore also for the Ghent peripheral municipalities. The interpretation of the residential areas on the regional plans from the 1980s plays a role in this.

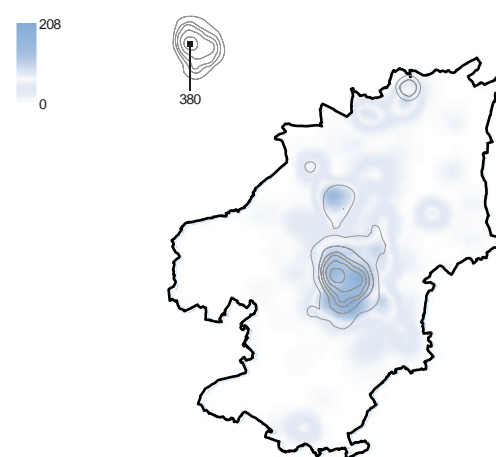
**residential**

number of permits over the period 1963-2013  
newly build    renovation & demolition



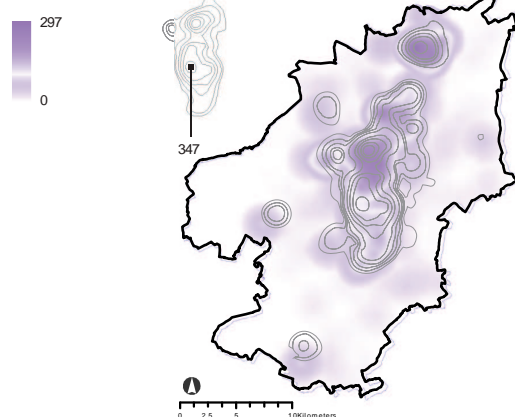
**public services & infrastructure**

number of permits over the period 1963-2013  
newly build    renovation & demolition



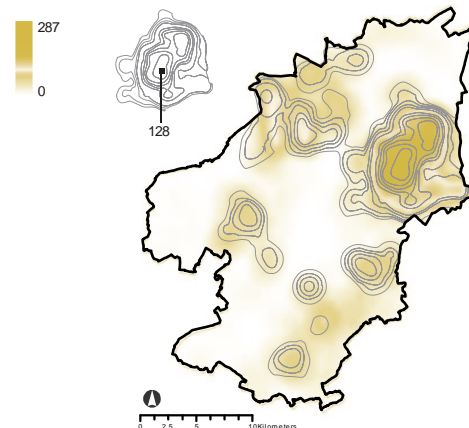
**industry and offices**

number of permits over the period 1963-2013  
newly build    renovation & demolition



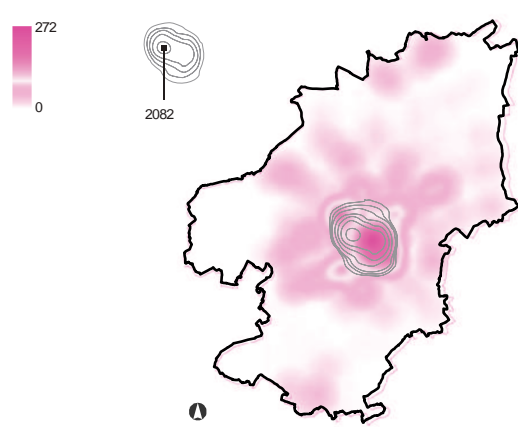
**agriculture**

number of permits over the period 1963-2013  
newly build    renovation & demolition



**retail**

number of permits over the period 1963-2013  
newly build    renovation & demolition



**deforestation and new allotments**

number of permits over the period 1963-2013  
new allotments    deforestation

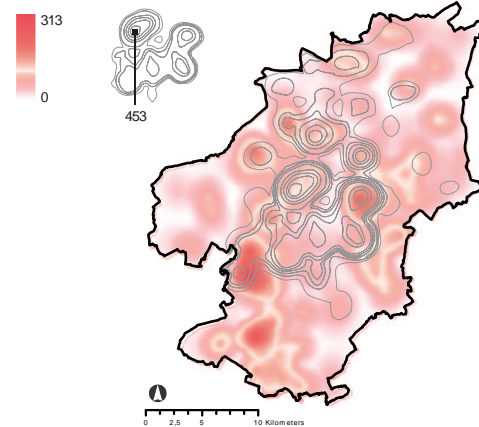


Fig. 6: Timeline of the spatial pattern of the distribution of the number of building permits (new construction and renovation) over the period 1963-2013 in the urban district of Ghent. Source: own elaboration.



(2) Compaction in city and outskirts

The tissue of already spread villages and buildings is gradually being further densified. We see this process in the city center, the suburbs as well as in the peripheral municipalities.

(3) Transformation of the existing built-up tissue

Some change from expansion with new construction to renovation in the city center continues. In view of the supply of owner-occupied homes, owner-occupied apartments and building plots in the peripheral municipalities, the renovation and transformation of buildings may also be started here.

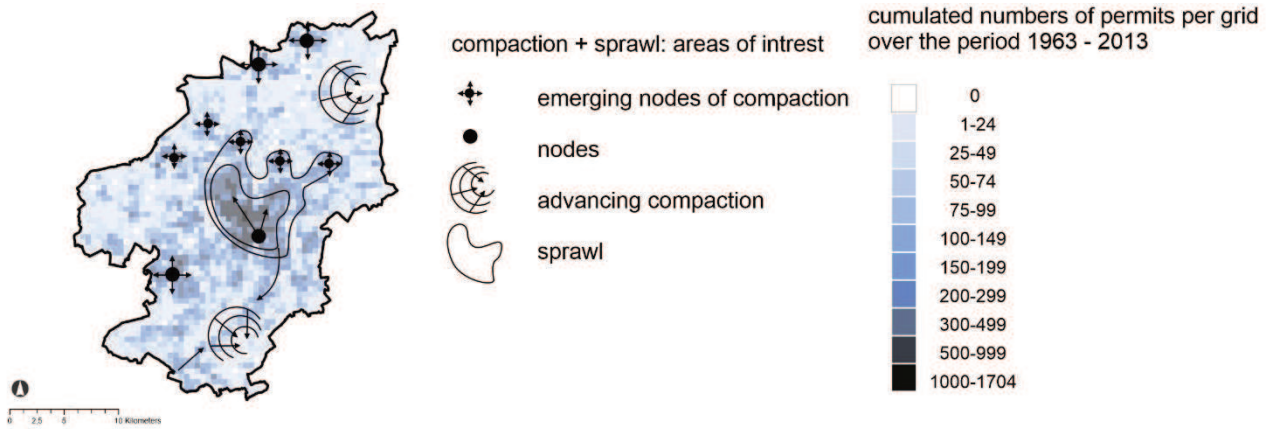


Fig. 7: Spatial trends of the number of building permits (new construction and renovation) over the period 1963-2013 in the urban district of Ghent. Source: own elaboration.

7.2 Where in the future?

7.2.1 Changes in the short term: what will happen in the next five years?

The bulk of what is for sale for houses, apartments and building plots (8,800) is located in the city of Ghent: approx. 5,800 buildings compared to the rest of the urban region (approx. 3,000 properties) (Figure 8a). The sold properties may be assumed that a part will be renovated, demolished and replaced, given up or given a different function. In the short term - given the aforementioned trends in demolition and separation, reuse etc. - the greatest dynamism can be expected in the city center of Ghent.

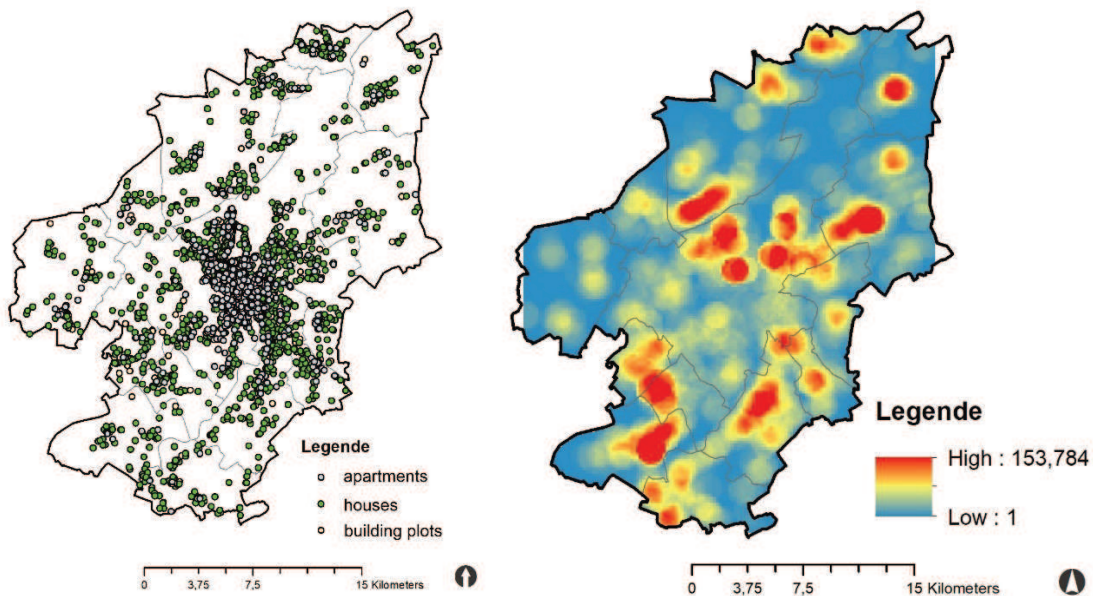


Fig. 8: (a) Real estate offer (for sale) in the urban district of Ghent. Source: own processing of real estate data (2014) and (b) heatmap of supply of vacant plots (whether or not for sale). Source: own processing of register vacant lots (2015).



### 7.2.2 Changes in the long term

In the longer term, it is more difficult to estimate where spatial dynamics will occur. The range of building possibilities on vacant plots shows just the opposite pattern of the supply on the existing buying market: approximately 29,000 of the approximately 109,400 plots in the urban region are located in Ghent, the remaining 80,400 in the peripheral municipalities (Figure 8b). The reserve in the periphery far exceeds the offered property. For example, the availability of new parcels can attract new residents. The potential for this is very great. Only later will they build and possibly renovate again later. Knowing migration patterns at the level of the urban region can play a role in this. Further research into links between these processes is recommended to fully understand the dynamics. The dynamics in the longer term could be greatest in the peripheral municipalities of the urban region if the wide range of services will be effectively addressed for housing or other functions.

Municipalities can counter transformations or give a boost through, among other things, the drafting of (re)zoning plans or through collective transformation by e.g. to encourage renovation. Via the latter, a scale leap can also be made: from building to street, or neighborhood. This can be useful e.g. to build energy-efficient neighborhoods. Steering on the supply of building plots seems necessary if one wants to maintain a dynamic in the existing built-up tissue that is situated mainly in the city of Ghent.

## 8 CONCLUSION

For the first time, data from three databases, i.e. the permit register, the register of vacant plots and real estate ads for sale on the internet, have been used to visualize the spatial transformations of the past 50 years in the Ghent urban region.

These transformations can be reduced to three processes: suburbanization (1963-1983), compaction (1984-1993) and renovation (> 1994). A repetition of this cycle can occur because in the short term property is mainly offered in Ghent and to a lesser extent in the peripheral municipalities, and in the longer term especially the wide range of building plots in those suburbs will lead to a new wave of land development if policy does not steer spatially.

The characteristics of the neighborhood can be a predictor of future transformations. Further research into the relationship between the size of the age group of starters in a neighborhood and the application for a renovation or new building permit can highlight this process.

## 9 REFERENCES

- ANTEA AND KUL, Analyse datakwaliteit en (geografische) verwerking van immodata, in opdracht van het Vlaams Planbureau voor Omgeving, Brussels, 2017.
- BUITELAAR E., SEGEREN A. AND KRONBERGER P., Stedelijke transformatie en grondeigendom, NAi Uitgevers, Rotterdam, 2008.
- LORIS I. EN PISMAN A. (2016), Super(woon)markten, in Ruimte en Maatschappij, jg 8 (2): 34-54.
- LOUW E., Land assembly for urban transformation – the case of 's Hertogenbosch in The Netherlands, Land use policy 25:69-80, 2008.
- LUKEZ, P., Suburban transformations, Princeton Architectural Press, L.N. Packard (ed), 2007.
- PISMAN A., LORIS I., VERMEIREN K., HAHN, K., DE MULDER S., VANACKER S., De verkaveling in cijfers, in Verkavelingsverhalen, De Bruyn (ed), Public Space, Mechelen, 2016.
- RUIJTE VLAANDEREN, database building permits dd. February 2017, Brussels, 2017.
- SVR, Population and household projections. Retrieved from [www.vlaanderen.be/svr](http://www.vlaanderen.be/svr), Brussels, 2014.
- SVR, Municipal profile sketches. Retrieved from [www.vlaanderen.be/svr](http://www.vlaanderen.be/svr), Brussels, 2016.
- TRITEL EN UGENT, Slim ruimtegebruik door hergebruik en omkeerbaar ruimtegebruik, in opdracht van Ruimte Vlaanderen, Brussels, 2012.
- TV SUM-ATELIER ROMAIN, Kwantificeren van hergebruiksmogelijkheden van leegstaande en onderbenutte panden in Vlaanderen, in opdracht van Ruimte Vlaanderen, Brussels, 2017.
- VLAAMSE OVERHEID, Witboek Beleidsplan Ruimte Vlaanderen (Whitebook spatial policy plan Flanders). Brussel, 2017.
- VROM, Nota Ruimte. Ruimte voor ontwikkeling. Den Haag: Ministerie van VROM, 2004.
- WEIBEL, R., & DUTTON, G.. Generalising spatial data and dealing with multiple representations. Geographical information systems, 1, 125-155, 1999.