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Review and Improvements of Existing Delimitations of Rural Areas in Europe

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EXECUTIVE SUMMARY

Over the last twenty years, the European Commission has taken policy initiatives with ever greater emphasis on the territorial perspective. The Common Agricultural Policy (CAP) reform, in particular the rural development policy, foresees measures on territorial characteristics which implies the use of urban/rural definitions for the broad targeting of resources. The focus of the CAP has shifted from the previous dominance of sectoral market measures to a concern for a more integrated and sustainable agricultural and rural development policy. In the 'Future of Rural Society' Report (CEC 1988), the Commission had already identified different types of rural areas: rural areas under pressure of modern life, rural areas in decline and very marginal rural areas. However such a differentiation was not quantified. Accessibility was implicit in this urban-rural gradient.

In 1994, the Organisation for Economic Co-operation and Development (OECD) developed a simple territorial scheme that identifies types of regions based on population density applied at two hierarchical levels. As there is no commonly agreed definition of rural areas at European level, the OECD typology is considered as an easy and acceptable approach for identifying rural areas. However, this typology used is exclusively based on population densities and is highly sensitive to the size of the geographic units and the classification thresholds.

Over the years, attempts have been made to review and improve the OECD approach and also alternative methodologies have been proposed. However, the current methods based merely on population distributions, do not allow for detailed and quantified geographical analysis and do not reflect two main characters differentiating rural from urban areas: the "natural" (non-artificial) surface and the accessibility/remoteness.

The objective of this study was to improve the characterization of rural areas at commune level (Local Administrative Unit – LAU 2) by introducing the criteria of accessibility (peripherality) and 'natural (non-artificial) space in the OECD methodology. The assessment was carried out at LAU2 (and NUTS3) level for 3 Member States (Belgium, France and Poland), testing different thresholds.

Firstly, as indicator of peripherality, the travel time by road network to urban centres has been selected by using the speed limit of each category of roads (based on the EuroRegionalMap dataset) and two impedance factors, a congestion index (Urban Morphological Zones)and a slope index (DEM,100m). In order to discriminate the communes on the basis of the peripherality index, two time breaks have been tested: 30 and 60 minutes. A criterion based on the total population per commune (Eurostat SIRE database, census per commune 2001) has been used to select the urban centres and the thresholds of 50,000 and 100,000 of inhabitants have been tested. The origin/destination cost matrix solver was applied, using centroids of LAU2 as destinations/facilities.

For the final selection of the optimal thresholds, it was opted that extreme situations should be excluded: the threshold of 50,000 inhabitants for an urban centre and the travel time period of 30 minutes appeared to be the most appropriate criteria to evaluate the accessibility to cities. A sensibility analysis was followed out to evaluate the impact of the integration of a 100 m DEM and a congestion effect which showed that the congestion effect impact on the classification is significantly more important than the one related to the slope effect.

The peripherality analysis was done for three countries (BE, FR and PL) considering them as being "isolated" countries. A border-effect analysis was carried out (for Belgium), to assess the impact of the urban centres of the neighbouring countries and it appeared that the accessibility of communes close to borders is indeed influenced by the neighbouring cities.

Secondly, the land cover criterion to assess the 'natural' (non-artificial) surface of a LAU2, was used based on the methodology of Vard et al.(2005) that states that a commune will be classified as "rural" if at least 90 % of its area is covered by forest, agricultural or natural areas (Corine Land Cover 2000).

Finally, the peripherality index and the land cover indicator were integrated in the OECD methodology. The rural typology contains 4 classes as only one threshold of population density (150 inhab./km²) is used and only two characteristics are combined (population density with remoteness/accessibility or population density with land cover) because there are correlations between some categories of the 3 characteristics (population density, land use and remoteness/accessibility).

The original (OECD) rural class (< 150 inhabitants/km²) is divided in 2 sub-classes : *'rural-peripheral'* and *'rural accessible'*, as also as the original (OECD) urban class (>= 150 inhabitants/km²) : *urban with open space* and *urban with closed space*. A commune will be classified as 'rural-peripheral' if located at more than 30 minutes from the nearest urban centre with at least 50,000 inhabitants and 'rural-accessible' if located at less than 30 minutes from an urban centre with at least 50,000 inhabitants. A commune will be categorised as an urban commune with open space if at least 90 % of its area is covered by rural areas i.e. forest, agricultural or natural areas. Otherwise, the commune will be classified as an urban commune with closed space.

Out of the results of the rural classification, the threshold of '90% 'natural (non-artificial) area' appeared to be rather insensitive since very few communes were classified as urban-open. In order to obtain a better differentiation of the urban localities, lower thresholds of 'natural (non-artificial) area' were tested for Belgium (80%, 75% and 70%) and showed to be more appropriate.

A classification at NUTS3 was developed in order to maintain a backwards compatibility with the existing typologies and to compare the results with previous works. The regions were first classified in 3 classes on the basis of the share of population living in rural communes (communes with less than 150 inhab./km²):Rural regions, Intermediate regions and Urban regions. The "rural" regions were then discriminated in 2 classes on the basis of the share of population living in *rural-peripheral* communes (*rural-peripheral regions* and *rural-accessible regions*); the "intermediate" regions were discriminated on the basis of the share of population living in *urban-open space* communes (*intermediate-open space regions* and *intermediate-closed space regions*).

However, the typology at regional level (NUTS3) does not provide an accurate picture of the rurality. Indeed, differences in land cover and accessibility/remoteness have been masked in most places following the regrouping of the communes at regional level. For example, in Belgium and Poland, all rural regions are classified as *rural-peripheral regions* and all intermediate regions are classified as *intermediate-closed space regions*. These results outline the necessity to work at LAU2 level in order to improve the OECD classification.

The methodology developed in order to improve the rurality concept has proven to be flexible and the thresholds of accessibility or land cover implemented in this study can easily be modified to better fit to specific needs of the user or local conditions found in a given Member State. The objective to upscale the methodology - tested for 3 Member States (BE, FR and PL) at LAU2-level- to European level is feasible as simple queries were applied with standard procedures using Pan-European homogeneous datasets.

TABLE OF CONTENTS

1 CONTEXT AND OBJECTIVES OF THE STUDY

1.1 Context of the study

Over the last twenty years, the European Commission has taken policy initiatives with ever greater emphasis on the territorial perspective (the policies with relevance for urban-rural relations are reviewed in detail in ESPON, 2005). The Common Agricultural Policy (CAP) reform and in particular the rural development policy foresees measures on territorial characteristics and therefore use of urban/rural definitions for the broad targeting of resources. The focus of the CAP has shifted from the previous dominance of sectoral market measures to a concern for a more integrated and sustainable agricultural and rural development policy.

In the 'Future of Rural Society' Report (CEC, 1988), the Commission had already identified different types of rural areas: rural areas under pressure of modern life, rural areas in decline and very marginal rural areas. However such a differentiation was not quantified. Accessibility was implicit in this urban-rural gradient.

In 1994, the the Organisation for Economic Co-operation and Development (OECD, 1994) developed a simple territorial scheme that identifies types of regions based on population density. The scheme distinguishes two hierarchical levels: the local community level and the regional level[1].

As there is no commonly agreed definition of rural areas at European level, the OECD typology is considered as an easy and acceptable approach for identifying rural areas. However, the typology used is exclusively based on population densities and is highly sensitive to the size of the geographic units and the classification thresholds. Meanwhile the definition is still in use in the Community strategic guidelines for rural development (CEC, 2006).

1.2 Objectives of the study

The overall purpose of this study is to improve current delimitations of rural areas in Europe as a support to statistical descriptions.

As a matter of fact, it has been recognised for more than a decade, that there is a lack of data on the fine distribution of rural areas within Europe. The current methods based solely on population distributions do not allow for detailed and quantified geographical analysis and do not reflect two main characters differentiating rural from urban areas: the "natural" (non-artificial) space and the accessibility/remoteness.

The specific objective of this study is the introduction of peripherality/remoteness and land cover in the OECD methodology as discriminating factors for distinguishing rural from urban areas.

A peripherality index will first be calculated for 3 Member States and integrated in the OECD approach. In addition to peripherality, an indicator based on Land Cover area will be calculated and combined with the results of the peripherality analysis. Alternative options will

[1] At the first level, communes with population densities lower than 150 inhab. per km² are classified as rural otherwise, they are classified as urban. At the second level, a region with more than 50 % of population living in rural communes is classified most rural; if this share is between 50 and 15 it is classified significantly rural; if lower than 15 % it is most urban. In addition, if a region includes a city of 200,000 inhab. or more it is classified at least significantly rural; if it includes a city of 500,000 inhab. or more it is classified most urban.

also be implemented if they contribute to improve discrimination of rural areas. These analyses will be conducted at LAU2[2] level for 3 Member States: Belgium, France and Poland.

Accuracy analysis will also be conducted and data constraints, strengths and weaknesses of the different alternatives will be highlighted. Recommendations for an approach to be investigated for future research will be formulated in a final stage.

2 REVIEW OF THE STATE OF THE ART

Until now, there is no agreement at EU level on a common concept of what constitutes a rural area, a situation that may lead to increasing difficulties in formulating effective rural development policies (Schwarz, 2005).

The typology developed by the OECD in 1994 presents some limitations. Several attempts have been made in recent years for reviewing the current approach and for proposing improvements (by adding new, more sophisticated data for analysis) or even by introducing alternative methodologies. The main initiatives will be reviewed in this chapter (Table 1). A more detailed review of the alternative typologies has also been made by J. Dusart in the frame of this project (J. Dusart, Potential typologies of rural areas, Deliverable 2.2, EU, December 2006).

Table 1. Main rural typologies

Typology	Variables	Geographic Unit	Output classes	Remarks
OECD approach (OECD 1994)	Population densities	Local community level + regional level	Most urban Significantly rural Most rural	Single criteria Sensitive to size of geographic unit and thresholds
Modified OECD approach with CLC by DG AGRI & JRC (Librecht et al., 2004)	Disaggregated population densities Gravitational attraction index Size of nucleus	LAU2 Level	Fully urban communes Mainly urban communes Semi-urban communes (2 types) Peri-urban rural areas Remote rural	Use of CLC for disaggregating population densities Definition of appropriate thresholds Simplification of remoteness (Euclidian distance)
Modified OECD approach with CLC (Vard et al., 2005)	Land cover classes (forestry, agricultural, natural areas) of PELCOM and CLC	LAU2 Level	Percentage of rural areas per commune	Sensitive to thresholds and accuracy of land cover maps Sensitive to commune sizes
Modified OECD approach with population grid cells (Schwarz, 2005)	Population densities by grid cells using CLC2000	Grid cell and LAU2 Level + regional level	Same as OECD	Test with different thresholds and filter sizes Interest of rural population share and rural area share/NUTS3
EUROSTAT LFS (CEC, 2003)	Population threshold Geographical contiguity	LAU2 Level	Densely-populated areas Intermediate areas Thinly populated areas	Single criteria Focused on urban areas
Modified OECD approach (Copus et al., 2006)	Population densities Peripherality	Local community level + regional level	Depending of the options retained	Backward compatibility with existing OECD But still problems of heterogeneity of NUTS3 regions Data availability for option 3

[2] LAU: Local Administrative Unit; LAU2: Local Administrative Unit – formerly known as NUTS5 - corresponding to communes, municipalities and similar.

Modified OECD approach with CLC by DG AGRI & JRC (Librecht et al., 2004)

One of the limitations of the OECD typology is its dependency on the administrative boundaries. Due to this, abnormal results are generated. Gallego and Peedell (2001) and more recently Gallego (2006) have focused on using disaggregated population data on a grid basis in order to better depict the structure of population within the commune and in relation with its neighbourhood.
DG JRC and DG AGRI have worked in this direction using CORINE Land Cover as a co-variable for mapping the distribution of populations with a higher accuracy. They have also subdivided the three major groups of regions of the OECD typology into subgroups according to size of nucleus, land cover profile and topographic roughness (Librecht et al., 2004).

Modified OECD approach with CLC (Vard et al., 2005)

Using a single criterion (population density) is not flexible enough : the population density criterion does not allow qualifying areas with a relative high population density but with distinct rural features being recognised as rural areas.
DG AGRI (Vard et al., 2005) has tested discriminate analysis on basis of land cover (CORINE Land Cover 1990 and PELCOM databases for areas not covered by CLC1990). Rural areas are defined in this approach as being either forest or agricultural area and natural areas. Different thresholds were applied to denominate a commune as rural. However, presented approach brings some inconsistencies in case of cities like Rome or Valencia.

Modified OECD approach with population grid cells (Schwarz, 2005)

This approach based on population grid cells has been implemented by the GISCO team. They have worked on refinement of the thresholds and the size of a filtering window that reduces effects of highly fragmented patterns of rural and urban pixels.
This modified OECD approach keeps the original concept of OECD while overcoming problems that results from the differing geometry of local administrative units in the Member States (Schwarz, 2005).

Labour Force Survey approach (CEC, 2003)

A different approach is seen in the classification implemented by EUROSTAT. This classification is based on the concept of “degree of urbanisation” developed for the Labour Force Survey (LFS).

The LFS is a quarterly sample survey of households that provide information on the labour market. The EU Regulation on LFS defines “degree of urbanisation” at “local areas”, normally LAU2 level. The three types of area are defined as follows (CEC, 2003):

- Code 1: Densely-populated area. This is a contiguous set of local areas, each of which has a density superior to 500 inhabitants per square kilometer, where the total population for the set is at least 50,000 inhabitants.
- Code 2: Intermediate area. This is a neighbouring set of local areas, not belonging to a densely-populated area, each of which has a density superior to 100 inhabitants per square kilometre, and either with a total population for the set of at least 50,000 inhabitants or adjacent to a densely-populated area.
- Code 3: Thinly-populated area. This is a contiguous set of local areas belonging neither to a densely-populated nor to an intermediate area.

The LFS degree of urbanisation is exclusively defined according to population distribution and is focusing on policies to be implemented in urban areas.

Multiple variable improvements of the preliminary typologies

Most of the above mentioned typologies are essentially based on population densities or land cover discrimination.
Vidal et al. (2001) have proposed to adapt the OECD typology by processing a range of variables collected at NUTS level, that include demography, economic strength, and agricultural employment, farm labour force, land use, farm structure and livestock. The data processing chain includes Principal Components Analysis (PCA) and classification. The results include 13 types of rural areas.

The ESPON study proposes also a harmonized urban/rural typology based on a set of factors including population, economic factors, accessibility, tourism and land use efficiency.

Modified OECD approach (Copus et al., 2006)

One of the rural character indices is the distance to roads or settlements. In the Study Programme on European Spatial Planning (SPESP, 2000), the authors review indicators of accessibility that include various factors such as distance, perceived distance, travel time, travel cost, daily accessibility, peripherality.

The study on mountain areas financed by DG REGIO includes some accessibility indicators for delineating different types of mountain areas (Nordregio, 2004). The accessibility indicator takes into account the size of the destination, considering that the “attraction” of a destination increases with the size and declines with distance or travel time or cost.

In the Study on Employment in Rural Areas (Copus et al., 2006), the authors propose to focus on improving the OECD typology, while maintaining the “backwards compatibility” in three directions:

- Option 1: Integration of the peripherality indicator into the OECD classification by addition of two new classes: accessible and peripheral;
- Option 2: Minor adjustments to the implementation of the population density criterion (introduction of a minimum threshold), together with the integration of the peripherality indicator;
- Option 3: Development of an alternative classification scheme relating to population characteristics (area share of rural and urban communes within the NUTS3 regions), plus integration of the peripherality indicator.

3 INTRODUCTION OF A PERIPHERALITY INDEX

This chapter deals with the implementation of a peripherality index at LAU2 level and its integration in the OECD methodology as discriminating factor.

3.1 Concept

A peripheral region is defined as a region with low accessibility (Schürmann & Talaat, 2000). There are numerous definitions and concepts of accessibility (Spiekermann & Neubauer, 2002) e.g. "accessibility indicators describe the location of an area with respect to opportunities, activities or assets existing in other areas and the area itself, where 'area' may be a region, a city or a corridor" (Wegener et al., 2002).

Examples of accessibility indicators, which can be investigated, are total length of motorways, number of railway stations, travel time or travel cost to economic centres, etc.

In this study, *the travel time* is selected as *indicator of accessibility*

3.2 Geodatabases

The peripherality analysis was conducted for three representative countries: Belgium, France and Poland. For this analysis, the following geodatabases are used.

- Administrative boundaries: a feature dataset of communal boundaries (LAU2 level) from the GISCO database (scale: 1/100,000).

- Transport: a road network feature dataset for each country from the EuroRegionalMap database (scale: 1/250,000) including speed limits for the different road categories. Only speed limits for cars are taken into account.

- Demography: the total population per commune (2001) from Eurostat (SIRE database).

- Land Cover: a feature dataset including Urban Morphological Zones derived from CORINE Land Cover 2000 and the disaggregated map of population density.

- A digital elevation model (SRTM - 100 m) to derive information on slope gradients on roads. [3]

3.3 Methodology

The extension "Network Analyst" of ArcGIS 9.2 is used to implement the process of calculating a peripherality index. This extension allows network-based spatial analysis including routing, origin-destination cost matrix and service area analysis.

In this study, *the travel time is selected as indicator of accessibility.* One of the main advantages of this indicator is the availability of the data at LAU2 level for each European

[3] The original digital elevation model: SRTM - 90 m is publicly available (NASA Shuttle Radar Topographic Mission). The SRTM - 100 m used here is the SRTM - 90 m resampled at 100 m (JRC).

country. This indicator is also more realistic and accurate than indicators like "perceived distance" or "Euclidian distance".

ArcGIS Network Analyst enables users to generate an Origin-Destination (OD) matrix of the cost (travel time for example) from each location to all destinations in a network. This tool can be used in particular to compute the time needed to reach the urban centres of a country (destinations) from each commune (origins).

Datasets	Data Type	Themes	Scale	Coverage	Update
EuroGlobalMap	Vector	-Administrative boundaries -Hydrography -Transport -Settlements -Elevations -Named locations	1/1,000,000	EU 26 (without Bulgaria) EFTA 4 Andorra Croatia Moldova Monaco San Marino The Vatican Ukraine	2006 (vers2/ 2007)
EuroRegionalMap	Vector	-Administrative boundaries -Hydrography -Transport -Settlements -Vegetation -Named locations -Miscellaneous information	1/250,000	EU 26 (without Bulgaria) EFTA 4 Croatia Moldavia	2006 (vers2/ 2007)
TeleAtlas	Vector	Whole road network		EU 27 + other countries	2007
GISCO Database	Vector	-Country Boundaries (world) -Commune Boundaries -Hydrology -Administrative division -Settlements -Transportation network	1/1,000,000 In case of LAU2 boundaries 1/100,000	EU 27 EFTA 4 Adora Monaco San Marino Ukraine	2000
Populations census per commune 2001 (SIRE Database)	Table			EU 25[4] (without Romania and Bulgaria) EFTA 4 Andorra Croatia San Marino Ukraine Vatican	2001

[4]Moreover, a lot of data is missing for the following countries: Cyprus (33 %), Latvia (9 %), Lithuania (100 %), Slovakia (100 %), United Kingdom (68 %).

Disaggregated map of population densities for Europe	Raster	Population in each grid cell	1/100,000	EU 26 (without Cyprus) Croatia Lichtenstein Monaco San Marino	2000 (vers5/ 2005)
CORINE Land Cover 2000	Raster	44 land cover classes	1/100,000 100x100 m	EU 27 Albania Bosnia and Herzegovina Croatia Liechtenstein Macedonia Monaco San Marino	2000 (vers 8/ 2005)
SRTM	Raster	Elevation in each grid cell	100x100 m	EU 27 EFTA 4 Albania Andorra Bosnia and Herzegovina Croatia Macedonia Monaco Montenegro Serbia San Marino	

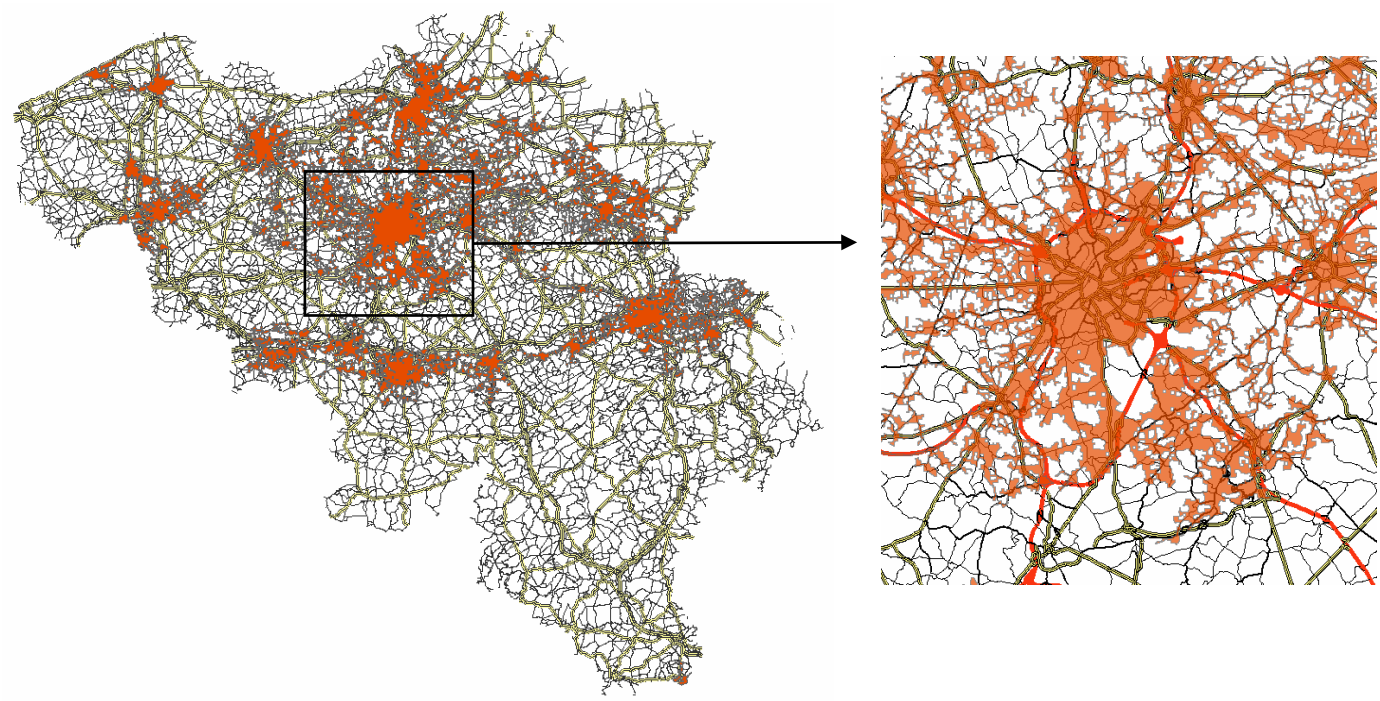
3.3.1 First step

The first step of this process is dedicated to create a Network Dataset (ND) with all necessary information to perform accessibility analysis. This ND is created from the EuroRegionalMap road network completed with attributes such as length and travel speed of each "edge" of road.

The travel speed is defined for each category of road by using the speed limits found in reference tables[5]. Due to the slope and due to the congestion in cities, travel speed impedance is taken into account and expressed by using two indexes described hereunder:

A.) In order to take into account the congestion effect in cities, the travel time is affected by a Congestion Index when the roads overlay with the Urban Morphological Zones (UMZ). The UMZ are defined as "A set of urban areas laying less than 200 m apart". Those urban areas are defined by the CORINE Land Cover classes assumed to contribute to the urban tissue and function. The UMZ dataset was still not available for the year 2000 and has been created for this study by using the EEA[6] methodology.

[5] Available at the web page: http://www.europe.org/speedlimits.html
[6] EEA: European Environment Agency.
Methodology available at the web page: http://dataservice.eea.europa.eu/dataservice/metadetails.asp?id=720



The congestion index values have been taken from works conducted by DG REGIO[7]. The density index has:

- Value 1 for roads outside the UMZ,
- Value 1.5 for motorways inside the UMZ and,
- Value 2 for major roads and urban roads inside the UMZ.

B.) The travel time is also affected by the road slope[8]. The slope index values are the same values used within the DG REGIO study. The slope index has:

- Value 1 for roads with a slope between 0 and 5 %,
- Value 1.2 for roads with a slope between 6 and 10 % and
- Value 1.5 for roads with a slope more or equal to 11 %.

$$Travel\_Time = \frac{Shape\_length * Slope\_index * Congestion\_index}{Speed\_limit * \frac{1000}{60}}$$

Where shape_length is given in meters and speed_limit in km/h

3.3.2 Second step

The second main process is to generate from this network dataset an Origin-Destination (OD) cost matrix by defining origins and destinations:

[7] Information received from H. Poelman (DG REGIO).

[8] The slope index is not taken into consideration when a road is on a bridge or a in tunnel in order to avoid inaccuracies of the DEM, a slope of 0 % is then taken by default for these roads. The slope index is also not taken into account for the slip roads (exit/entrance ramp).

- Destinations are derived from centroids of urban centres. A criterion based on the total population per commune is used to select the urban centres and the thresholds of 50,000 and 100,000 of inhabitants have been tested.
- Origins are centroids of all other communes of the selected country.

The minimum travel time to reach the nearest main city is selected and the communes are classified in one of the three levels of accessibility:

- Communes located at 0 to 30 minutes from the nearest urban centre,
- Communes located at 30 to 60 minutes from the nearest urban centre,
- Communes located at more than 60 minutes from the nearest urban centre.

3.4 Main results

This section aims to provide an overall view on the results and will explain the differences found between the three case studies.

Maps 1 to 6 and table 2 show the classification of the communes for BE, FR and PL in three degrees of accessibility by means of the methodology described above.

Belgium

Map 1 shows that 100 out of 589 Belgian communes (LAU2) (i.e. 17 %) are classified as remote communes located at more than 30 minutes from the nearest city with at least 50,000 inhabitants (Table 2). This area contains 7.8 % of the Belgian population. Only 21 communes (3.6 %) with 1.1 % of the total population are classified as remote and located at more than 60 minutes from an urban centre.

Interestingly, map 1 shows that all the remote communes at more than 60 minutes are concentrated in the south of Belgium near to the boundaries with France and Luxembourg. It could be assumed that if the urban centres of France and Luxembourg were taken into account, these communes would very likely be classified as less remote (see further 3.5.2 border effects).

Map 2 depicts the results of accessibility using a threshold for an urban centre of 100,000 inhabitants instead of 50,000 inhabitants. Predictably, this approach identifies more remote communes (287 or 48.7 % at 30 minutes and 31 or 5.3 % at 60 minutes from an urban centre). Some remote communes located at more than 60 minutes distance are now located near the west and east boundaries of Belgium.

France

Map 3 shows that 66.3 % of the French communes (containing 32.5 % of the total population) is classified as being remote communes located at more than 30 minutes from the nearest city with at least 50,000 inhabitants; while 18.4 % of the French communes with 7 % of the total population are classified as remote located at more than 60 minutes away from an urban centre.

Raising the threshold for urban centres to 100,000 inhabitants (Map 4), the number of remote LAU2 increases significantly: 29,179 LAU2 (79.8 %) located at 30 minutes and 12,473 LAU2 (34.1 %) located at 60 minutes away from an urban centre.

Since Corsica has only one city with more than 50,000 inhabitants (Ajaccio with 52,851 inhabitants) and no city with at least 100,000 inhabitants, a lot of communes is located at more than 60 minutes from Ajaccio (Map 3). Logically, if the threshold of 100,000 inhabitants is used (Map 4), all Corsican communes are classified as remote at more than 60 minutes from an urban centre.

Poland

Map 5 shows that 1388 out of 2488 LAU2 communes in Poland or 55.8 % are classified as remote communes located at more than 30 minutes from the nearest urban centre (with at least 50,000 inhabitants). These places are inhabited by 32.8 % of the total population. Only 182 communes (7.3 %) with 4.2 % of the Polish population are classified as remote located at more than 60 minutes distance away from an urban centre.

Map 6 depicts the results of the accessibility analysis using the threshold of 100,000 inhabitants. As it prevailed for France and Belgium, this approach produces a lot of new remote communes (1901 or 77.5 % at 30 minutes and 654 or 28.1 % at 60 minutes from an urban centre).

Table 2. Number of remote communes located at more than 30 or 60 minutes from the nearest cities with at least 50,000 or 100,000 inhabitants

	50,000 inhabitants		100,000 inhabitants	
	30 minutes	**60 minutes**	**30 minutes**	**60 minutes**
Belgium	100 (17 %)	21 (3.6 %)	287 (48.7 %)	31 (5.3 %)
France	24,255 (66.3 %)	6719 (18.4 %)	29,179 (79.8 %)	12,473 (34.1 %)
Poland	1388 (55.8 %)	182 (7.3 %)	1927 (77.5 %)	698 (28.1 %)

3.5 Conclusion

In this chapter, the possibility to introduce a peripherality index in the OECD methodology was assessed. The travel time by road network to urban centres has been selected as indicator of peripherality. This indicator has been defined by using the speed limits of each category of road and two impedance factors, a congestion index and a slope index. In order to discriminate the communes on the basis of the peripherality index, two time breaks have been tested: 30 and 60 minutes. A criterion based on the total population per commune has been used to select the urban centres and the thresholds of 50,000 and 100,000 of inhabitants have been tested.

The methodology has been applied for Belgium, France and Poland. By comparing the maps 1 to 6, differences between countries can be outlined.

France and Poland have more than half of their communes located at more than 30 minutes from an urban centre, while only 17 % of the Belgian communes are classified as remote from an urban centre with at least 50,000 inhabitants (Table 2).

For France and Poland, when the threshold is raised to 100,000 inhabitants, the number of remote communes increases to more than 75 % (30 minutes) or 25 % (60 minutes).

Among these 3 selected countries, the average surface area of communes varies enormously in the same way it can be observed between other Member States of Europe. The average surface area of communes is 52 km² for Belgium, 15 km² for France and 125 km² for Poland.

Map 1 to 6 and table 2 show significant differences between accessibility values when modifying the thresholds of inhabitants for an urban centre (50,000 or 100,000 inhabitants) and the travel time criterion (30 or 60 minutes). The optimal thresholds should exclude extreme situations i.e. the occurrence of a high proportion of remote communes (for example, 77.5 % of remote Polish communes and 79.8 % of remote French communes when using the threshold of 100,000 inhabitants and 30 minutes distance) or a very small number of remote communes (for example, 3.6 % and 5.3 % of remote Belgian communes when using the threshold of 60 minutes).

The threshold of 50,000 inhabitants for an urban centre and the travel time period of 30 minutes seems to be the most appropriate criteria to evaluate the accessibility to cities. These thresholds will be used in the next steps of this study when implementing the new typology.

3.5.1 Impact of the slope and the congestion effects on accessibility

A sensibility analysis has been conducted in order to show the impact of the integration of a 100 m DEM and a congestion effect when conducting peripherality analysis.

Table 3 shows the number of remote communes for BE, FR and PL in different situations when taking into account both effects (slope and congestion) and without taking into consideration one of these effects.

Congestion effect impact on the classification is significantly more important than the one related to the slope effect. For Belgium, only 7 communes i.e. 1.2 % of communes have changed from accessible class to remote (at more than 30 minutes from an urban centre with at least 50,000 inhabitants) class when adding the slope effect. By contrast, 32 communes i.e. 5.4 % of communes have changed from accessible status to remote (at more than 30 minutes from an urban centre with at least 50,000 inhabitants) status when adding the congestion effect. Figures for Poland also clearly show a more significant impact of the congestion effect than the slope effect.

Table 3. Number of remote communes located at more than 30 or 60 minutes from the nearest cities with at least 50,000 or 100,000 inhabitants (slope and congestion effects)

	Indexes taken into account	**50,000 inhabitants**		**100,000 inhabitants**	
		30 minutes	**60 minutes**	**30 minutes**	**60 minutes**
Belgium					
	Slope/Congestion	100	21	287	31
	Congestion	93 (-1.2 %[9])	16 (-0.8 %)	273 (-2.4 %)	20 (-1.9 %)
	Slope	68 (-5.4 %)	18 (-0.5 %)	166 (-20.5 %)	18 (-2.2 %)
France					
	Slope/Congestion	24,255	6719	29,179	12,473
	Congestion	23,123 (-3 %)	5100 (-4.4 %)	28,414 (-2.1 %)	10,863 (-4.4 %)

[9] (Number of remote communes when taking into account the congestion effect – Number of remote communes when taking into account both effects) * 100 / (Total number of communes).

	Slope[10]	NA	NA	NA	NA
Poland					
	Slope/Congestion	1388	182	1927	698
	Congestion	1357 (-1.2 %)	149 (-1.3 %)	1901 (-1 %)	654 (-1 %)
	Slope	1167 (-8.9 %)	114 (-2.7 %)	1697 (-9.2 %)	515 (-7.3 %)

3.5.2 Border effects

The peripherality analysis was done for three countries (BE, FR and PL) considering them as being isolated countries. The accessibility of communes close to borders (example of southern Belgium) seems to be influenced by the neighbouring cities. In order to understand this effect, the peripherality analysis has been achieved for Belgium by using a buffer zone of 100 km around the country.

The impact of the urban centres of the neighbouring countries is clear for Belgium as it is illustrated in figures 1 and 2. The first figure shows the nearest urban centres with at least 50,000 inhabitants for each Belgian commune. Interestingly, southern Belgium is only served by foreign urban centres (Charleville-Mezieres and Luxembourg). The northwest of Belgium is also well served by Dutch urban centres (Roosendaal, Breda, Oosterhout, and Eindhoven). The second figure still shows that the south of Belgium is closer e to French urban centres than Belgian urban centres when using the threshold of 100,000 inhabitants.

Maps 7 and 8 show the classification of Belgian communes when taking into account the neighbouring countries. As it is illustrated in table 4, fewer communes are now classified as remote communes located at more than 30 minutes (85 instead of 100 and 242 instead of 287) or 60 minutes (0 instead of 21 and 16 instead of 31) away from the nearest city with at least 50,000 or 100,000 inhabitants.

Table 4. Number of remote communes located at more than 30 or 60 minutes from the nearest cities with at least 50,000 or 100,000 inhabitants (border effects)

	50,000 inhabitants		**100,000 inhabitants**	
	30 minutes	**60 minutes**	**30 minutes**	**60 minutes**
Without a buffer zone	100	21	287	31
With a buffer zone of 100 km around the country	85	0	242	16

[10] Peripherality analysis taking into account only the slope effect has not been processed for France because of the very extensive time requested for the GIS processing.

Figure 1. Accessibility (by roads) of the Belgian communes to the nearest cities with at least 50,000 inhabitants (border effects – buffer zone of 100 km)

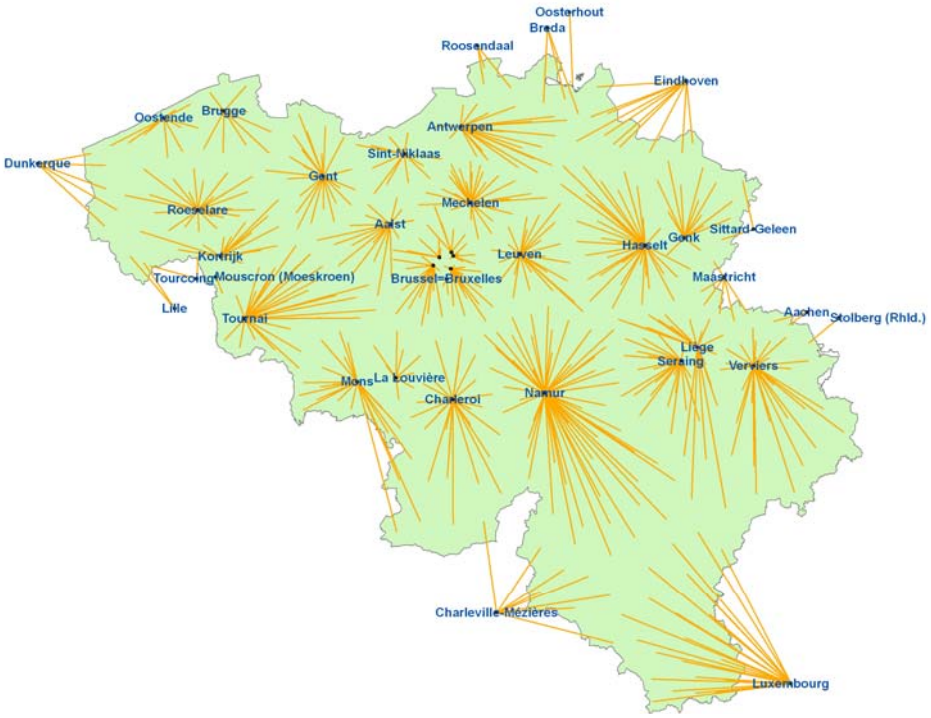
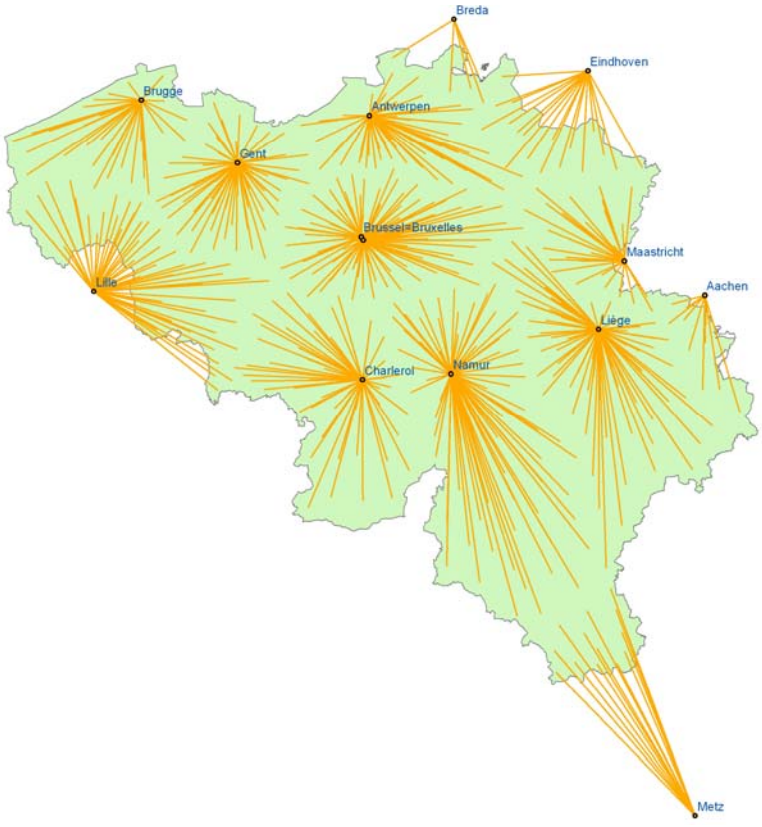


Figure 2. Accessibility (by roads) of the Belgian communes to the nearest cities with at least 100,000 inhabitants (border effects – buffer zone of 100 km)



3.5.3 Comparison with the DG REGIO methodology[11]

The methodology described above has been implemented after having reviewed works already conducted in this field. The approach of DG REGIO has in particular been investigated in the frame of this study.

Figure 3 highlights the main differences identified between the methodology proposed in this report and the one developed by the GIS team of DG REGIO.

The first main difference which can be outlined is the disaggregation level of the study. The objective of this study is to improve the characterization of rural areas at LAU2 level while DG REGIO´s investigation has been conducted at NUTS3 level.

The second difference can be seen in the selection of the network dataset. This study is based on the network dataset EuroRegionalMap (scale: 1/250,000) while DG REGIO has used EuroGlobalMap (scale: 1/1,000,000).

The third significant difference is the GIS solver used to calculate the peripherality index. Regarding this study it was decided to use the Origin/Destination Cost Matrix solver while the methodology of DG REGIO focused on the Service Area solver. In addition to this, different sources of data have been used as input for these GIS solvers.
Indeed, in this study, centroids of LAU2 have been used as destinations/facilities while DG REGIO has focused on using city point locations from the Urban Audit 2007. Moreover, data of population have been taken from the SIRE database (census per commune 2001) while DG REGIO has used population grid data (1x1 km generalised from the 100x100 m population density grid). In both methodologies, two thresholds for the selection of destinations/facilities have been tested (50,000 and 100,000 inhabitants) but the threshold of 50,000 inhabitants has been finally selected in this study while DG REGIO has selected 100,000 inhabitants.

Concerning the time break, two time periods (30 and 60 minutes) have also been investigated in both methodologies but the shortest time period has finally been used in the methodology developed in this report while the longest one has been used by the DG REGIO.

The travel speed (cost attribute in both solvers) has been defined in both methodologies by using the speed limits but also travel speed impedances (due to the congestion effect and the road slope). The criteria used in this study to implement the travel speed impedances have been taken from the one developed by DG REGIO but different sources of DEM necessary for implementing the slope index have been used : DG REGIO has used GISCO DEM (1x1km) while this study used a higher raster resolution (SRTM 100x100m).

Table 5 shows a comparison for Belgium of the outputs of the Service Area solver and the OD Cost Matrix solver following the methodology developed in the current study. Figures are quite similar but the number of remote Belgian communes is always fewer when using the OD Cost Matrix solver.

The outputs of the Service Area solver are polygons. Areas outside the polygons are considered to be at more than 30 minutes or 60 minutes distance from urban centers; while the outputs of the OD Cost Matrix solver are tables/matrices containing the time needed to travel

[11] A map of accessibility produced by the DG REGIO is available in the *Fourth report on economic and social cohesion* (EU, May 2007).

from each origin to each destination/facility. Given outputs produced by the solvers, Service Area solver should be used when working with population grid data and percentage of population living in a specific zone (overlapped or not by the resulting polygons) while OD Cost matrix should be used when working with population data from census per commune and centroids of communes (i.e. points instead of areas).

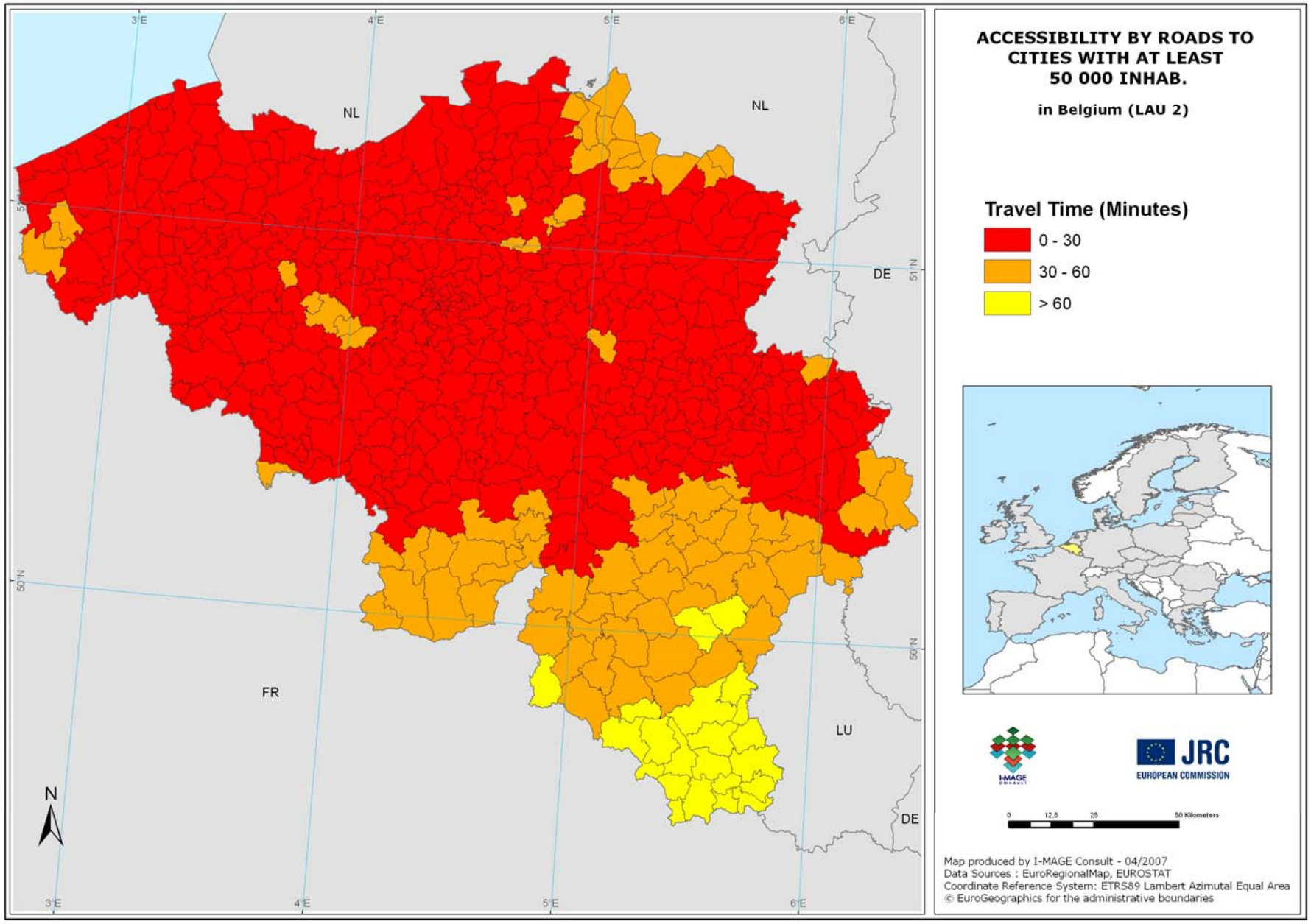
Table 5. Number of remote communes located at more than 30 or 60 minutes from the nearest cities with at least 50,000 or 100,000 inhabitants (OD Cost Matrix solver vs Service Area solver) - Belgium

	50,000 inhabitants		**100,000 inhabitants**	
	30 minutes	**60 minutes**	**30 minutes**	**60 minutes**
OD Cost Matrix solver	100	21	287	31
Service Area solver	109	25	299	37

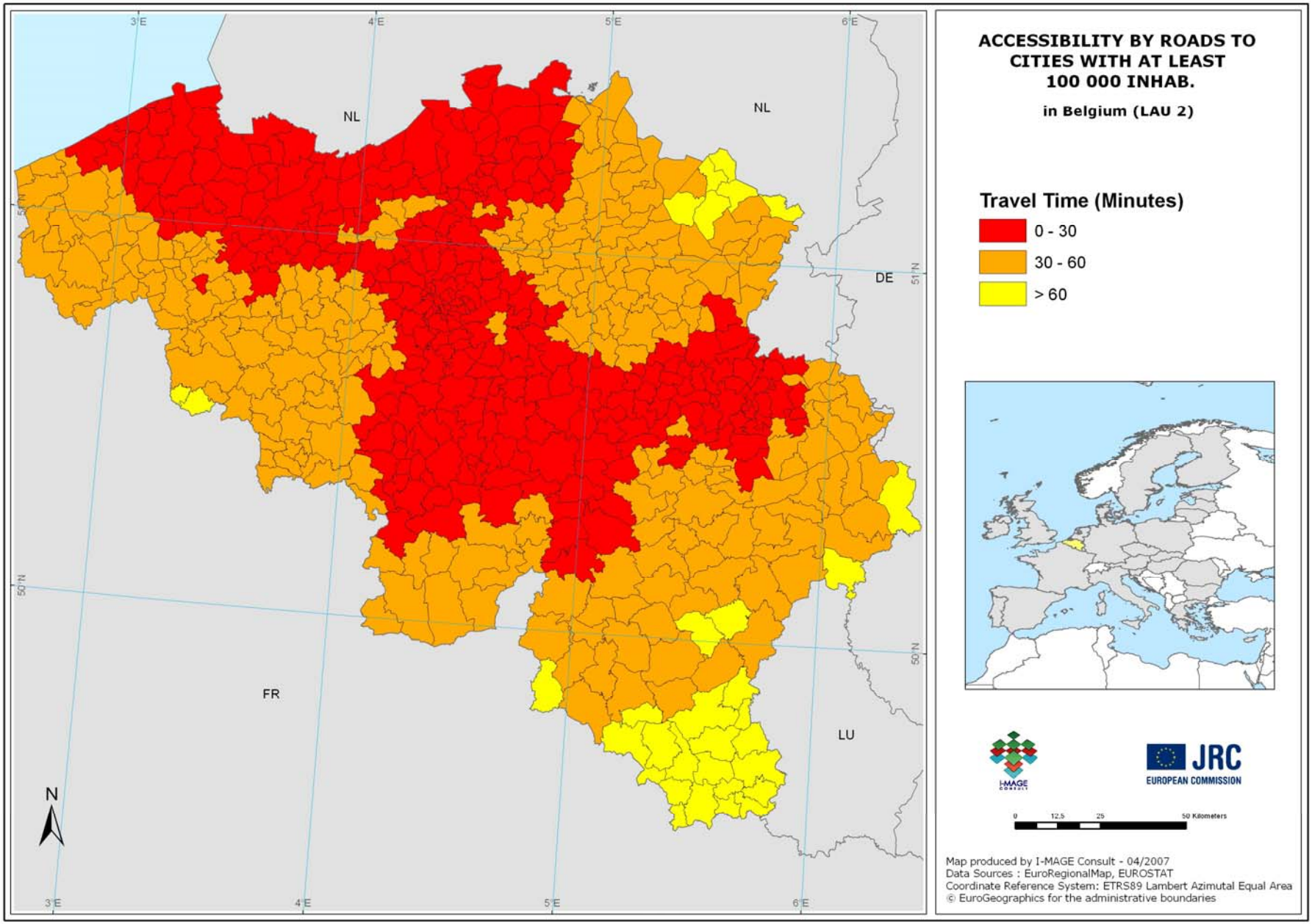
Figure 3. Comparison between the methodology developed in this report and the one developed by the DG REGIO

	Current Study	DG REGIO study
1. LEVEL:	LAU2	NUTS3
2. NETWORK DATASET:	EuroRegionalMap (scale: 1/250,000)	EuroGlobalMap (scale: 1/1,000,000) + GISCO for RO and BG
3. NETWORK ANALYST SOLVER:	OD Cost Matrix	Service Area
3.1 ORIGINS:	▪ Centroids of LAU2 ▪ Population 2001 (SIRE database)	▪ Population grid 1x1 km (generalised from the 100x100 m Population Density Grid)
3.2 DESTINATIONS/FACILITIES:	▪ Centroids of LAU2 ▪ Threshold: 50,000 inhabitants	▪ City point locations from the Urban Audit 2007 and UMZ ▪ Threshold: 100,000 inhabitants
3.3 TIME BREAK:	30 minutes	60 minutes
3.4 COST ATTRIBUTES:	▪ Maximum speed ▪ Slope Index: SRTM 100x100 m ▪ Congestion Index: UMZ (Source: EEA/ Threshold: 50,000 inhabitants)	▪ Maximum speed ▪ Slope Index: DEM 3 Million scale, resolution 1x1 km (GISCO) ▪ Congestion Index: UMZ (Source: EEA/Threshold: 50,000 inhabitants)

Map 1


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 50 000 INHAB.
in Belgium (LAU 2)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
NL
NL
DE
FR
LU
DE
N
3°E
4°E
5°E
6°E
50°N
51°N
JRC
EUROPEAN COMMISSION
0 12.5 25 50 Kilometers
Map produced by I-MAGE Consult - 04/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
© EuroGeographics for the administrative boundaries

Map 2


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 100 000 INHAB.
in Belgium (LAU 2)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
NL
NL
DE
FR
LU
3°E
4°E
5°E
6°E
50°N
51°N
N
JRC
EUROPEAN COMMISSION
0 12.5 25 50 Kilometers
Map produced by I-MAGE Consult - 04/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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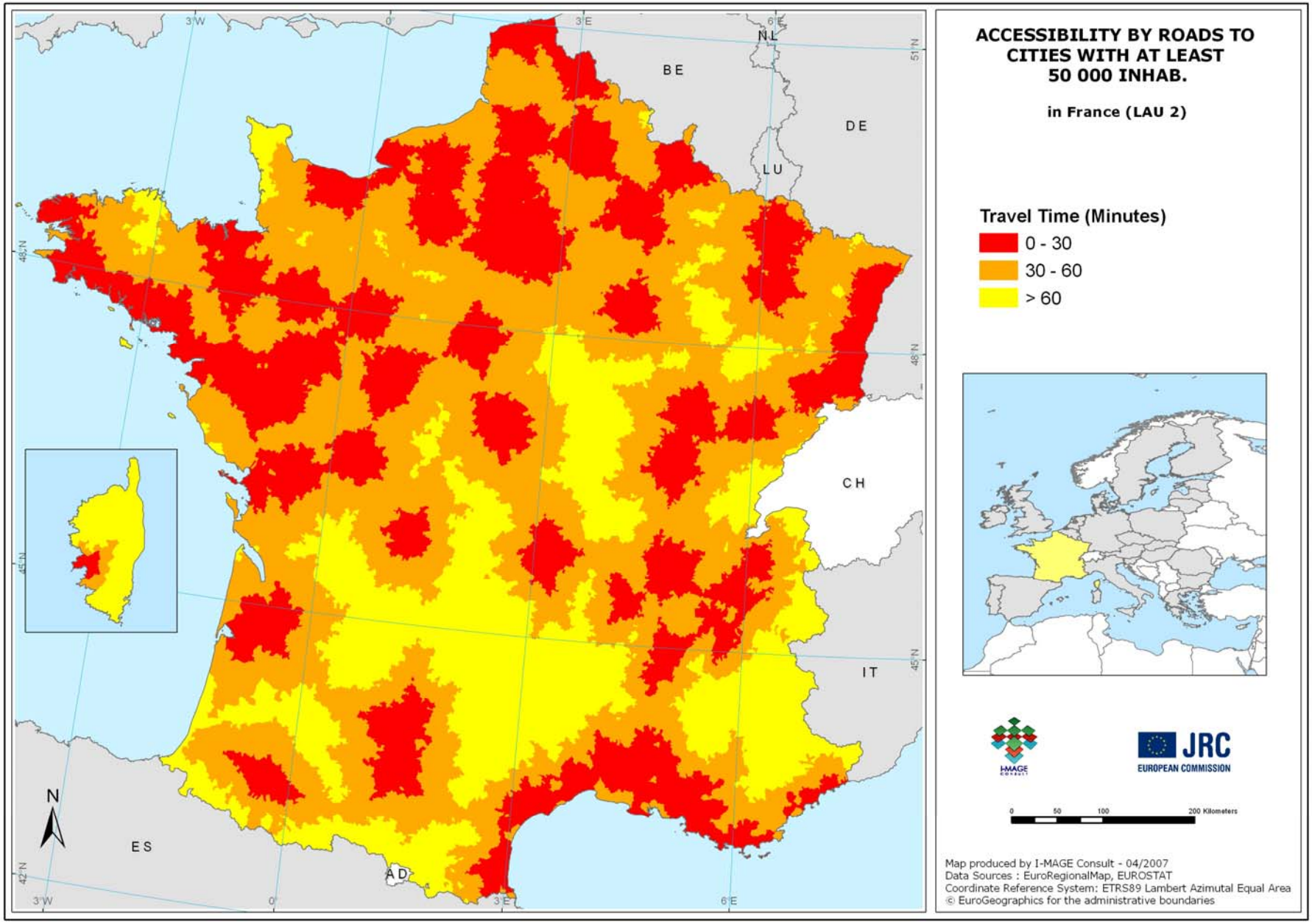
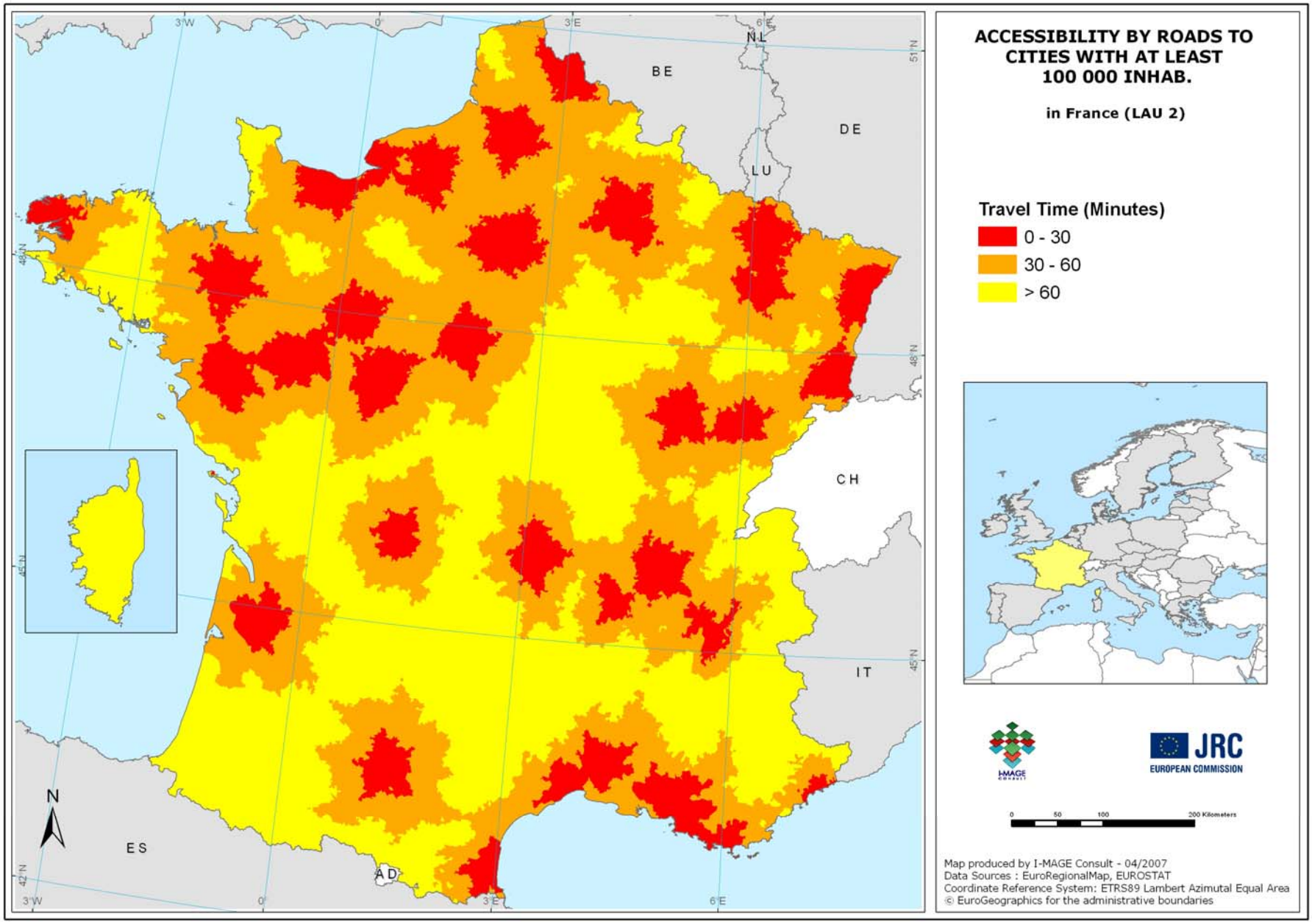
Map 3


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 50 000 INHAB.
in France (LAU 2)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
BE
NL
DE
LU
CH
IT
ES
AD
N
3°W
0°
3°E
6°E
51°N
48°N
45°N
42°N
I-MAGE
JRC
EUROPEAN COMMISSION
0 50 100 200 Kilometers
Map produced by I-MAGE Consult - 04/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
© EuroGeographics for the administrative boundaries

Map 4


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 100 000 INHAB.
in France (LAU 2)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
BE
NL
DE
LU
CH
IT
ES
AD
N
JRC
EUROPEAN COMMISSION
0 50 100 200 Kilometers
Map produced by I-MAGE Consult - 04/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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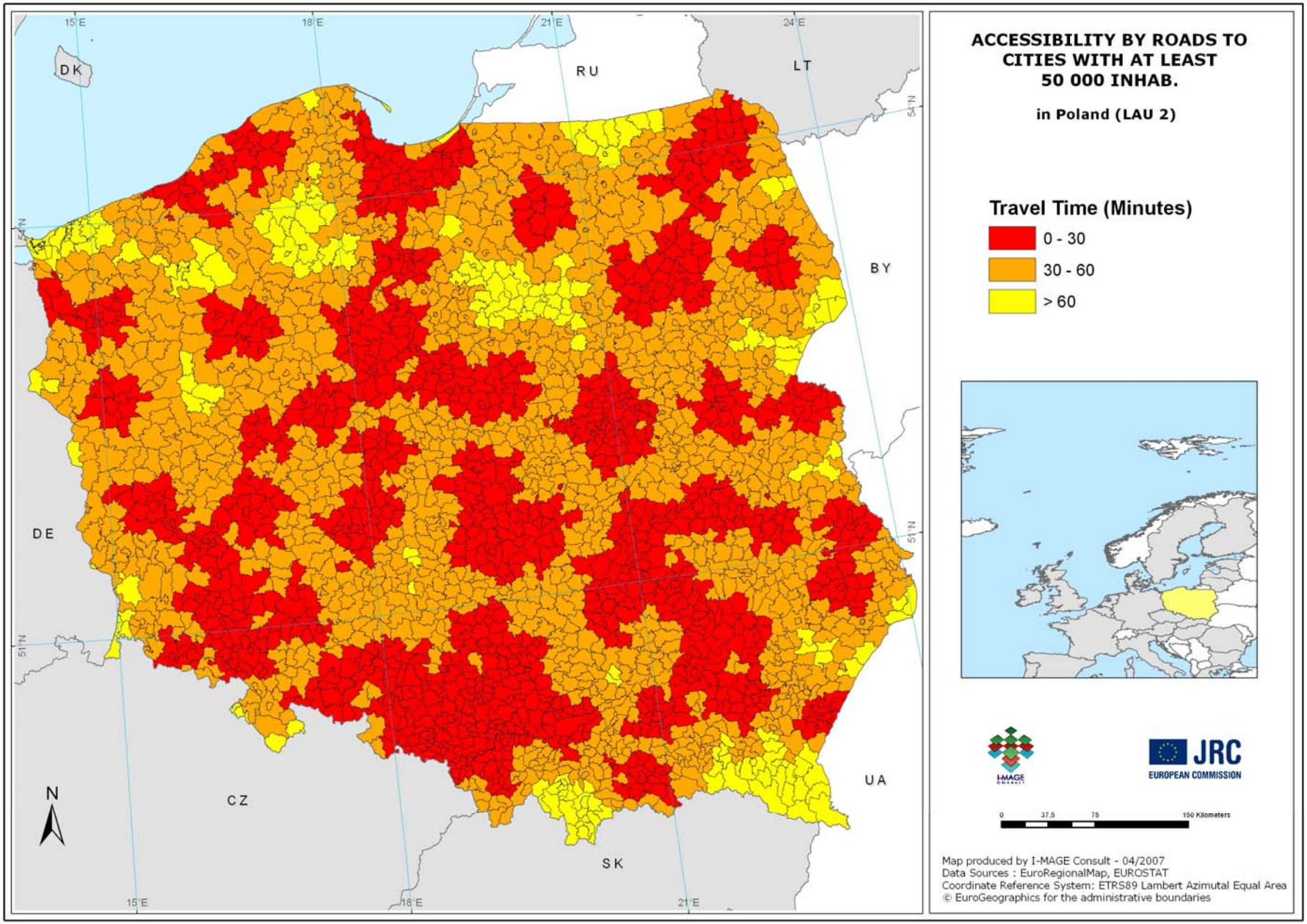
Map 5


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 50 000 INHAB.
in Poland (LAU 2)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
DK
RU
LT
BY
DE
CZ
SK
UA
N
15°E
18°E
21°E
24°E
54°N
51°N
0 37,5 75 150 Kilometers
Map produced by I-MAGE Consult - 04/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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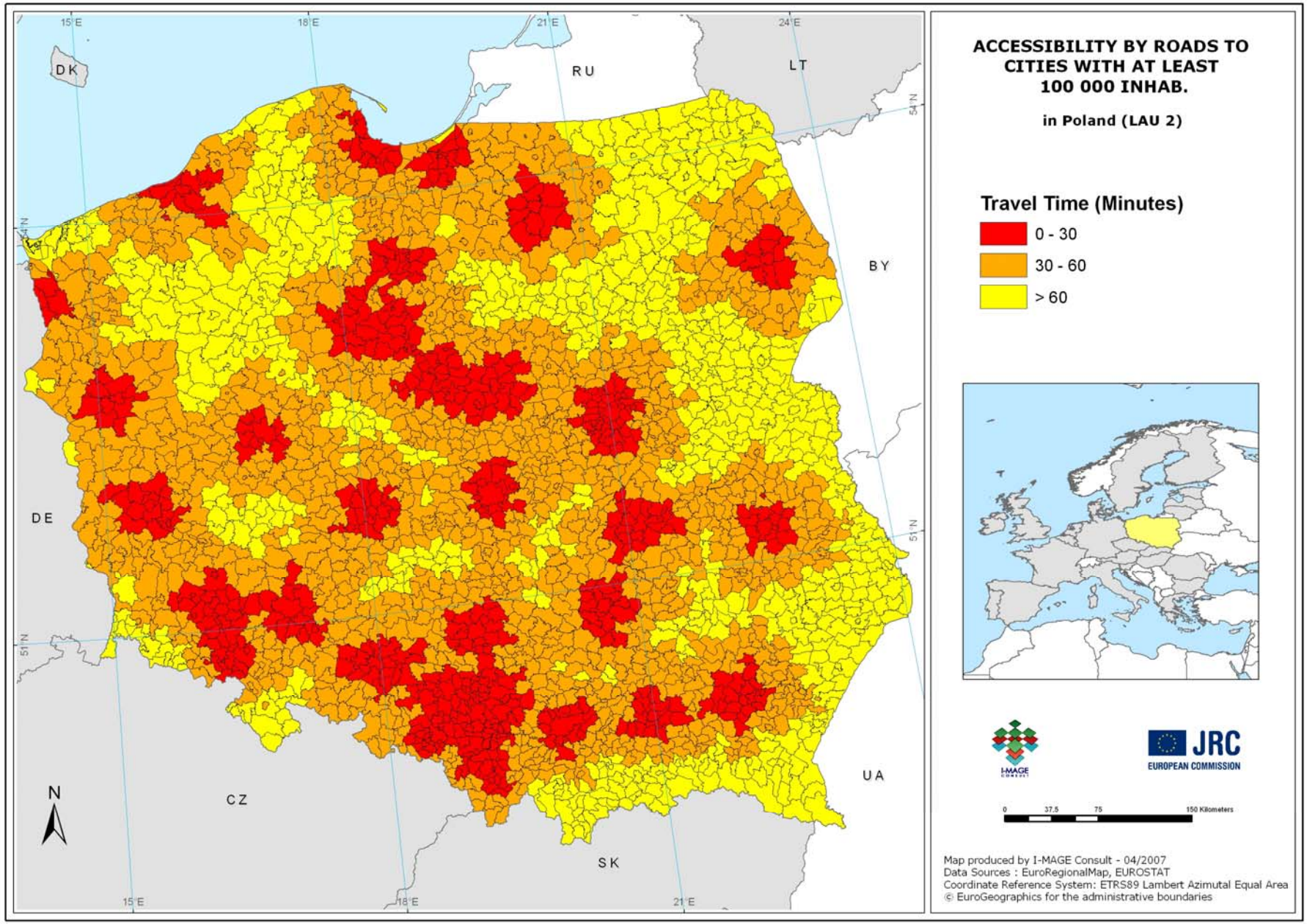
Map 6


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 100 000 INHAB.
in Poland (LAU 2)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
DK
RU
LT
BY
DE
CZ
SK
UA
N
15°E
18°E
21°E
24°E
54°N
51°N
0 37.5 75 150 Kilometers
Map produced by I-MAGE Consult - 04/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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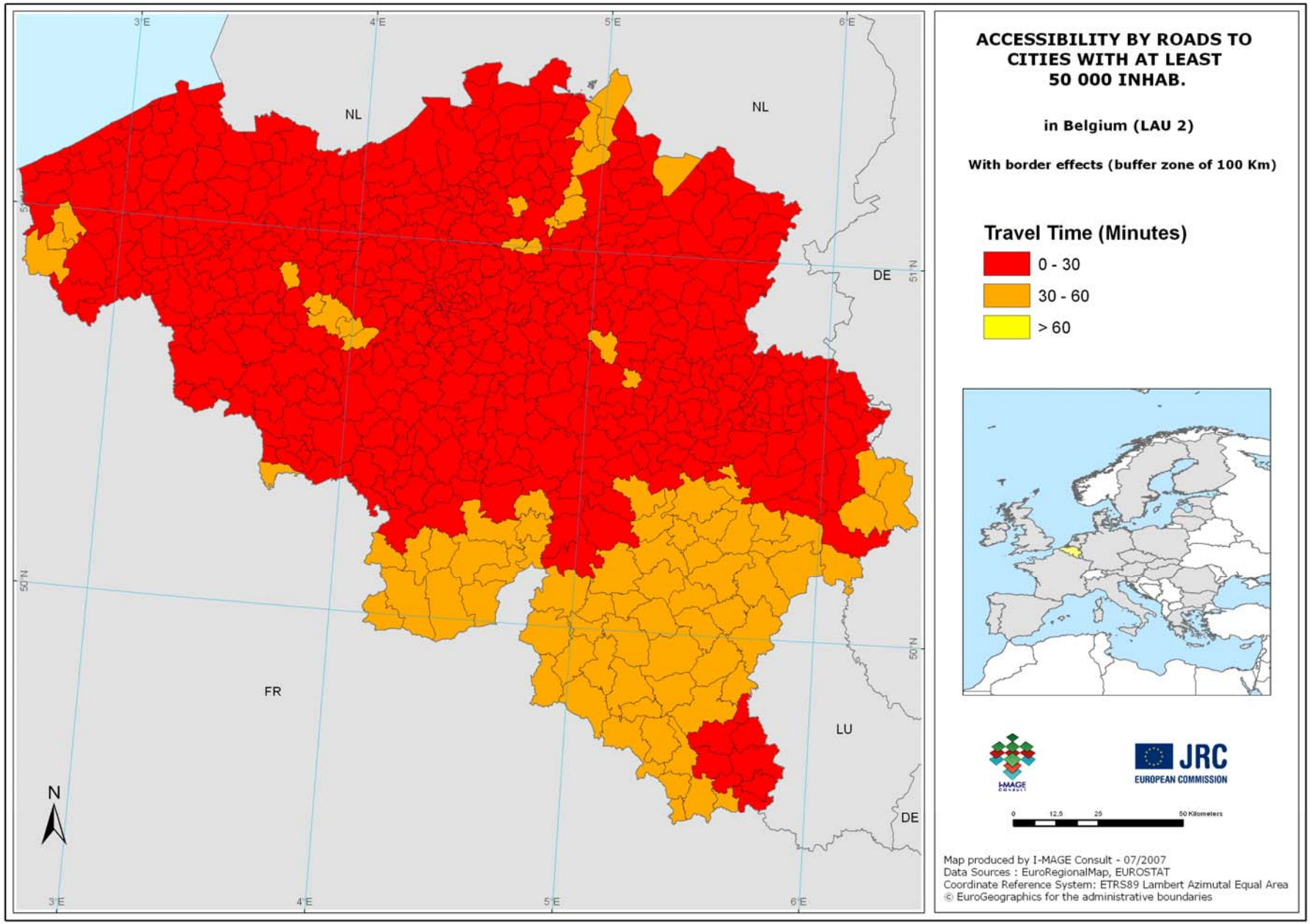
Map 7


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 50 000 INHAB.
in Belgium (LAU 2)
With border effects (buffer zone of 100 Km)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
NL
NL
DE
FR
LU
DE
N
3°E
4°E
5°E
6°E
50°N
51°N
JRC
EUROPEAN COMMISSION
0 12.5 25 50 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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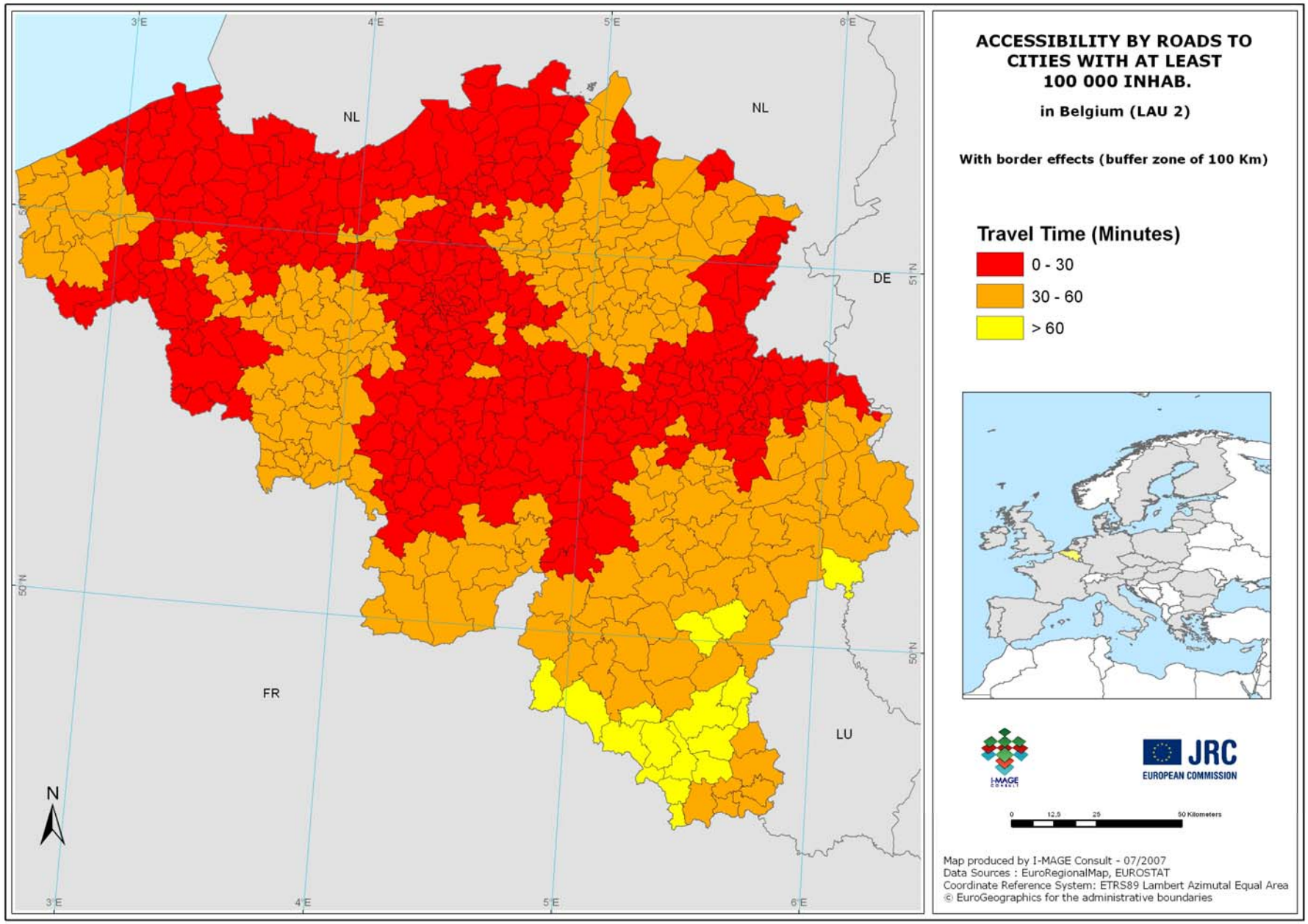
Map 8


ACCESSIBILITY BY ROADS TO CITIES WITH AT LEAST 100 000 INHAB.
in Belgium (LAU 2)
With border effects (buffer zone of 100 Km)
Travel Time (Minutes)
0 - 30
30 - 60
> 60
NL
NL
DE
FR
LU
3°E
4°E
5°E
6°E
50°N
51°N
N
0 12.5 25 50 Kilometers
I-MAGE CONSULT
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EUROPEAN COMMISSION
Map produced by I-MAGE Consult - 07/2007
Data Sources : EuroRegionalMap, EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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4 USE OF THE CORINE LAND COVER

This chapter deals with the use of CORINE Land Cover (CLC2000) in order to assess the rural (versus urban) character of communes. The aim is to calculate an indicator based on land cover area estimates at commune level (LAU2).
The CLC analysis has been achieved for the three representative countries (Belgium, France and Poland) which not only have differences in administrative unit's area but also in land cover and population distribution.

4.1 Concept

A commune (LAU2) will be classified as "rural" if at least 90 % of its area is covered by forest, agricultural or natural areas (Vard et al.,2005). The CORINE Land Cover classes (44 classes) are aggregated into 6 classes: forest area, agricultural area, natural area, inland water, sea and artificial area. An area is categorised as rural areas if defined as either forest area or agricultural area or natural area.
(see also Annex 2 : Additional analysis: Modification of the threshold used in the land cover approach).

4.2 Geodatabases

To conduct this analysis, three geographic datasets are used:

- Administrative boundaries: a feature dataset of commune boundaries (LAU2 level) from the GISCO database (scale: 1/100,000).

- Land cover: CORINE Land Cover 2000 raster version 8, 100x100m.

- Demography: the total population per commune (2001) from Eurostat (SIRE database).

4.3 Methodology

Processes implemented in this frame are based on the methodology developed by Vard et al. (2005). This methodology has been updated in order to use the upgraded version of CORINE Land Cover database 2000 (CLC 90 previously used).

The following procedure has been applied (Vard et al., 2005):

1. Analysis of CORINE Land Cover information in order to evaluate the percentage of the areas of the different land cover classes at commune level. The 44 classes of the 3-level CORINE nomenclature are aggregated into 6 classes: forest area, agricultural area, natural area, inland water, sea and artificial area. Rural areas are defined as being either forest areas or agricultural areas or natural areas.

2. Classification of each commune as rural or non rural is based on the importance of the different land cover classes. The rule proposed by Vard et al. (2005) and used in this study is to classify a commune as rural if at least 90 % of its area is covered by forest, agricultural or natural areas. When communes contain inland water bodies, 50 % of the area of these water bodies is included in the rural area but the total area of the commune used to calculate the share of rural area is reduced by 50 % of the area of the inland water bodies.

$$Forest\_area + Agriculture\_area + Natural\_area + \frac{Inland\_water\_area}{2} \geq$$

$$90\% * \left(Commune\_area - \frac{Inland\_water\_area}{2} \right)$$

4.4 Main results

Maps 9, 11 and 13 show the percentage of "rural" area per commune (based on CORINE Land Cover analysis), whereas maps 10, 12 and 14 display the population density per communes for BE, FR and PL.

Belgium

Map 9 shows that 98 of 589 communes (16.6 %) are classified as "rural" if the CORINE Land Cover (CLC) approach is used (Table 6). However, map 10 depicts that 148 communes (25.1 %) are considered as "rural" if the OECD criterion (150 inh./ km²) is used.

France

Map 11 and map 12 outline the important number of "rural" communes in France. Map 11 shows that 30,874 of 36,588 communes (84.4 %) are classified as "rural" by using the CLC approach, while map 12 indicates that 31,579 communes (86.3 %)[12] are considered as "rural" by using the OECD approach.

Poland

It can be noticed in map 13 that 2139 of 2488 communes (86 %) are "rural" if the CLC approach is used. In map 14, 1982 communes (79.7 %) have a population density lower than 150 inhabitants per square kilometres.

Table 6. Number of "rural" communes with the Land Cover approach and with the population density method

	CORINE Land Cover approach	**Population density method (OECD)**
Belgium	98 (16.6 %)	148 (25.1 %)
France	30,874 (84.4 %)	31,579 (86.3 %)
Poland	2139 (86 %)	1982 (79.7 %)

4.5 Conclusion

In this chapter, we assessed the use of CORINE Land Cover to define the rural character of communes. The methodology developed in this study is based on the works of Vard et al. (2005) and the use of the upgraded version of CORINE Land Cover database 2000 (CLC 90

[12] The population density is not available for 7 French communes. The percentage is based on a total number of 36,581 communes instead of 36,588.

previously used by Vard et al.). Following this methodology, a commune will be classified as "rural" if at least 90 % of its area is covered by forest, agricultural or natural areas.

It was demonstrated that the land cover criterion is significantly inversely correlated to the population density criterion (OECD typology). It was something already assumed but not yet demonstrated.

Table 6 outlines the differences between the classification of communes in rural/non rural based on land cover approach and the one based on the population density method of OECD. For Belgium and France, more communes are classified as "rural" when using the population density method (OECD) while Poland has more "rural" communes when using the land cover approach.

Differences between countries can also be outlined. France and Poland have more than 80 % of their communes classified as "rural" with the CLC approach. In Belgium, more than 80 % of the communes are classified as "non-rural" or "urban" (CLC approach).

Tables 7, 8 and 9 show the results of both approaches (OECD and CLC) expressed in percentage of area instead of number of communes. These tables also allow comparison of the results of this study with the results obtained by Vard et al. (2005).

Table 7 compares the results obtained with the OECD classification. This comparison is made on the percentage of area of communes classified as "rural" or "non-rural". As expected, Table 7 shows similar results between both studies.

Table 7. Share of area of "rural" communes with the population density approach

	Population density approach	
	Current study	**Vard et al.**
Belgium	40.5 %	40.4 %
France	89.4 %	89.4 %
Poland	90.5 %	90.5 %

Table 8 and 9 depict the results of CLC approach. Table 8 shows the percentage of area of commune classified as "rural, while table 9 shows the percentage of area of CLC classes considered as "rural". These results are broadly similar in both studies except for Belgium in table 8.

Table 8. Share of area of "rural" communes with Land Cover approach

	Land Cover approach	
	Current study	**Vard et al.**
Belgium	30.5 %	59.1 %
France	87.7 %	90.9 %
Poland	94.6 %	92.6 %

Table 9. Share of area of "Land Cover Classes" considered as "rural"

	Land Cover approach	
	Current study	**Vard et al.**
Belgium	79 %	79.6 %
France	94.2 %	95.5 %
Poland	95 %	95.5 %

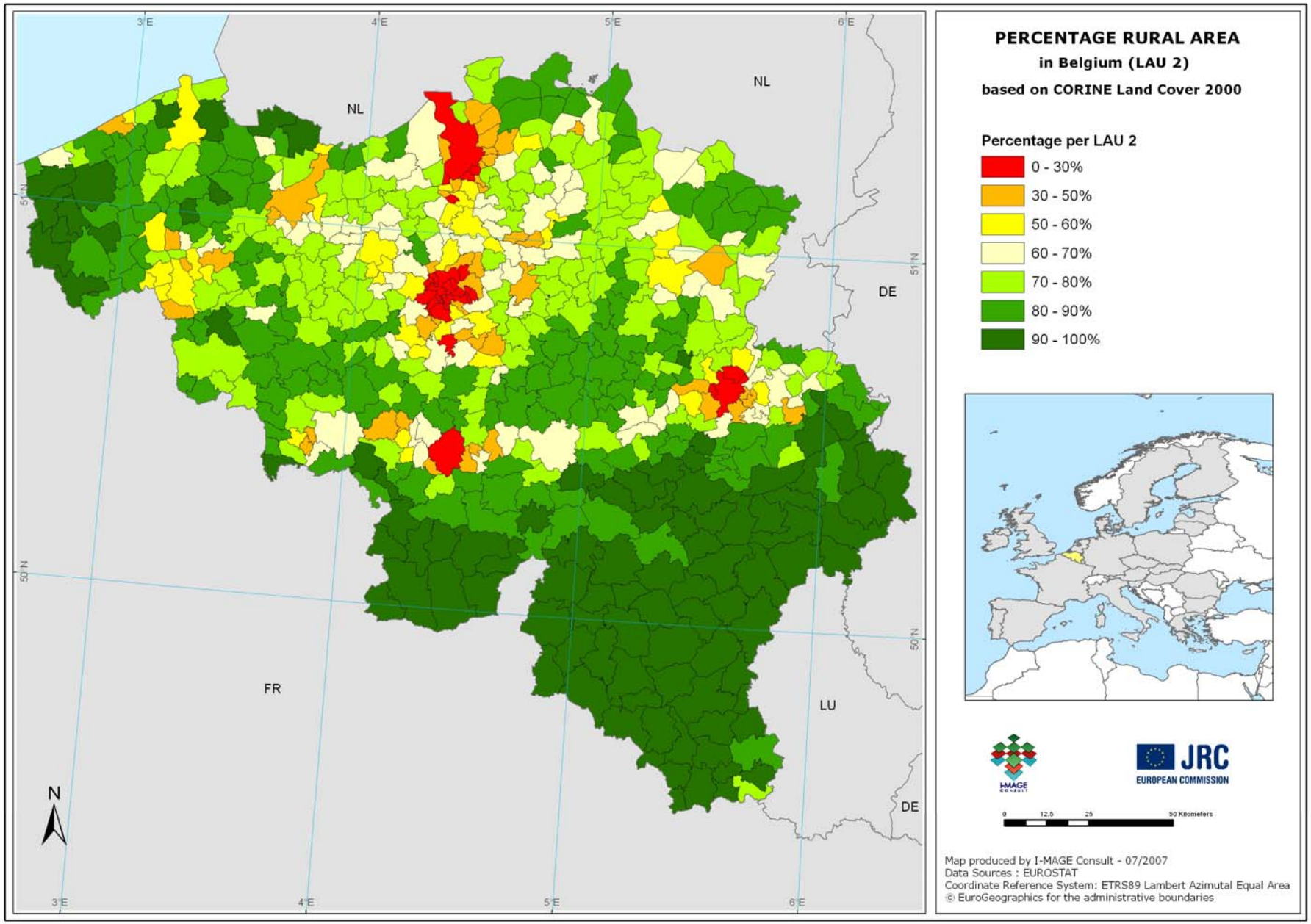
This difference is explained by the threshold used to classify a commune as "rural" or "non-rural" (cfr. section 4.2). In Vard et al., a threshold of 80 % has been used for Belgium instead of 90 % as for the other Member States[13]. If the threshold of 80 % is used, the output is equal to 57.8 % which is close to the results obtained by Vard et al. (59.1 %).

Small differences can also be explained by the different data sources used (CLC 1990 in Vard et al. and CLC 2000 in this study) and serve to outline the evolution of the land cover in the three selected countries.

It is also interesting to compare the percentages obtained in table 8 and 9. The main surprising difference is observed in Belgium: 79 % (Table 9) of the total area in Belgium is covered by "rural" CLC classes, while only 30.5 % (Table 8) of the total area is represented by "rural" communes. This difference can be explained by the spatial dispersion of the categories of land cover. The CLC classes considered as "rural" are indeed far less concentrated in Belgium than in Poland and France.

[13] In the present study, the threshold of 90 % has been used for each country.

Map 9


PERCENTAGE RURAL AREA
in Belgium (LAU 2)
based on CORINE Land Cover 2000
Percentage per LAU 2
0 - 30%
30 - 50%
50 - 60%
60 - 70%
70 - 80%
80 - 90%
90 - 100%
NL
DE
FR
LU
N
3°E
4°E
5°E
6°E
51°N
50°N
JRC
EUROPEAN COMMISSION
0 12.5 25 50 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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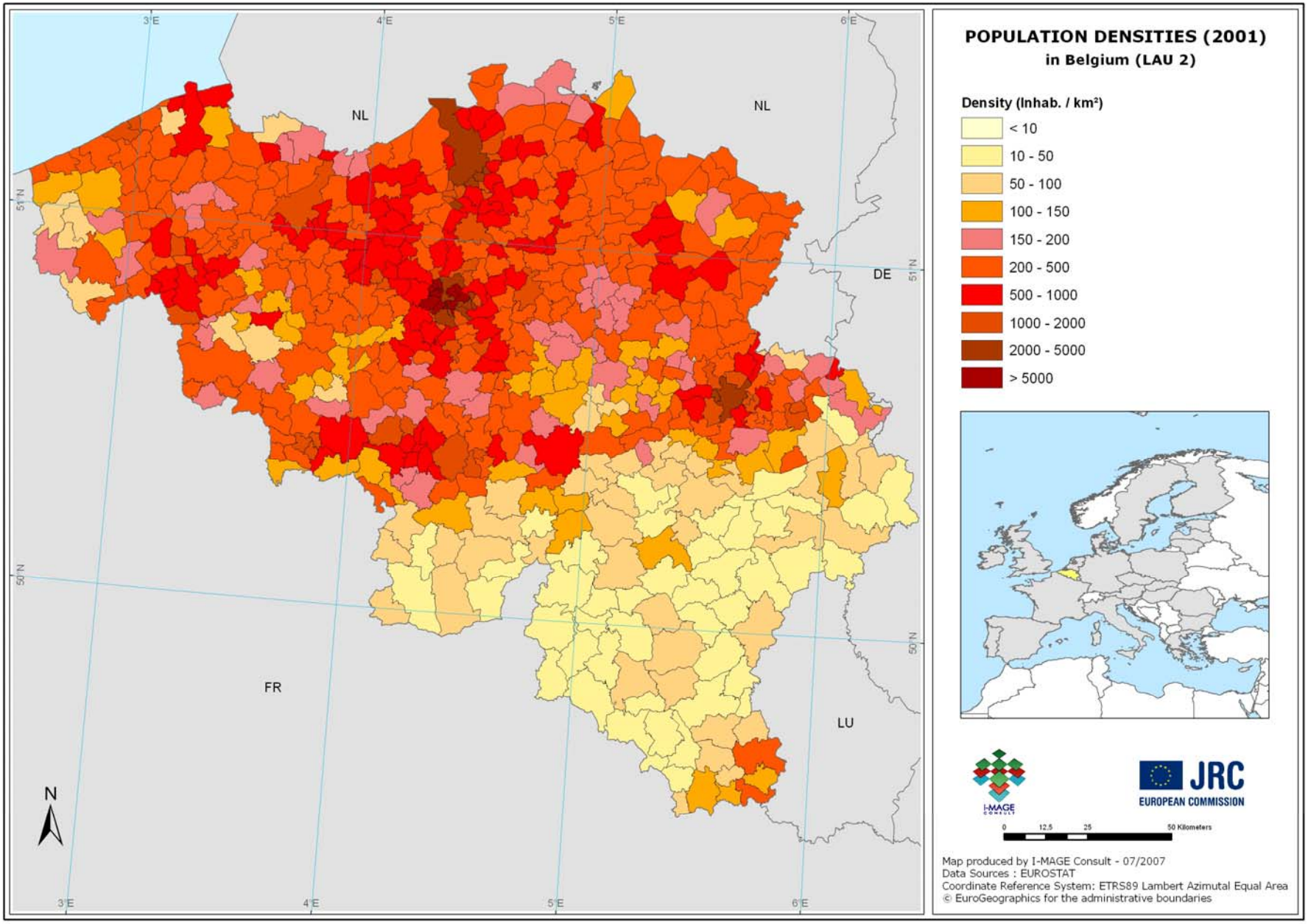
Map 10


POPULATION DENSITIES (2001)
in Belgium (LAU 2)
Density (Inhab. / km²)
< 10
10 - 50
50 - 100
100 - 150
150 - 200
200 - 500
500 - 1000
1000 - 2000
2000 - 5000
> 5000
NL
NL
DE
FR
LU
3°E
4°E
5°E
6°E
51°N
50°N
N
I-MAGE
JRC
EUROPEAN COMMISSION
0 12.5 25 50 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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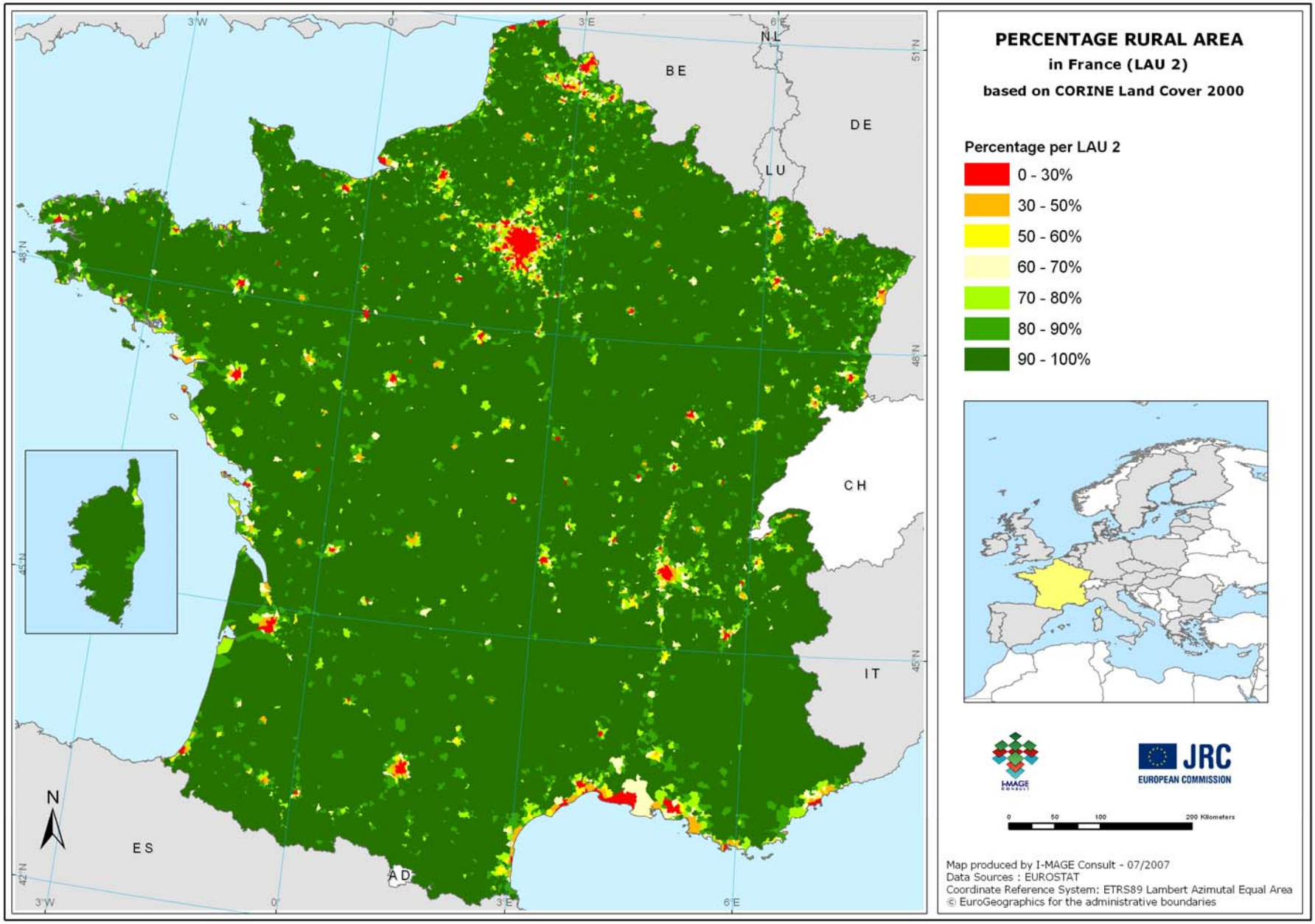
Map 11


PERCENTAGE RURAL AREA
in France (LAU 2)
based on CORINE Land Cover 2000
Percentage per LAU 2
0 - 30%
30 - 50%
50 - 60%
60 - 70%
70 - 80%
80 - 90%
90 - 100%
BE
NL
DE
LU
CH
IT
ES
AD
N
JRC
EUROPEAN COMMISSION
0 50 100 200 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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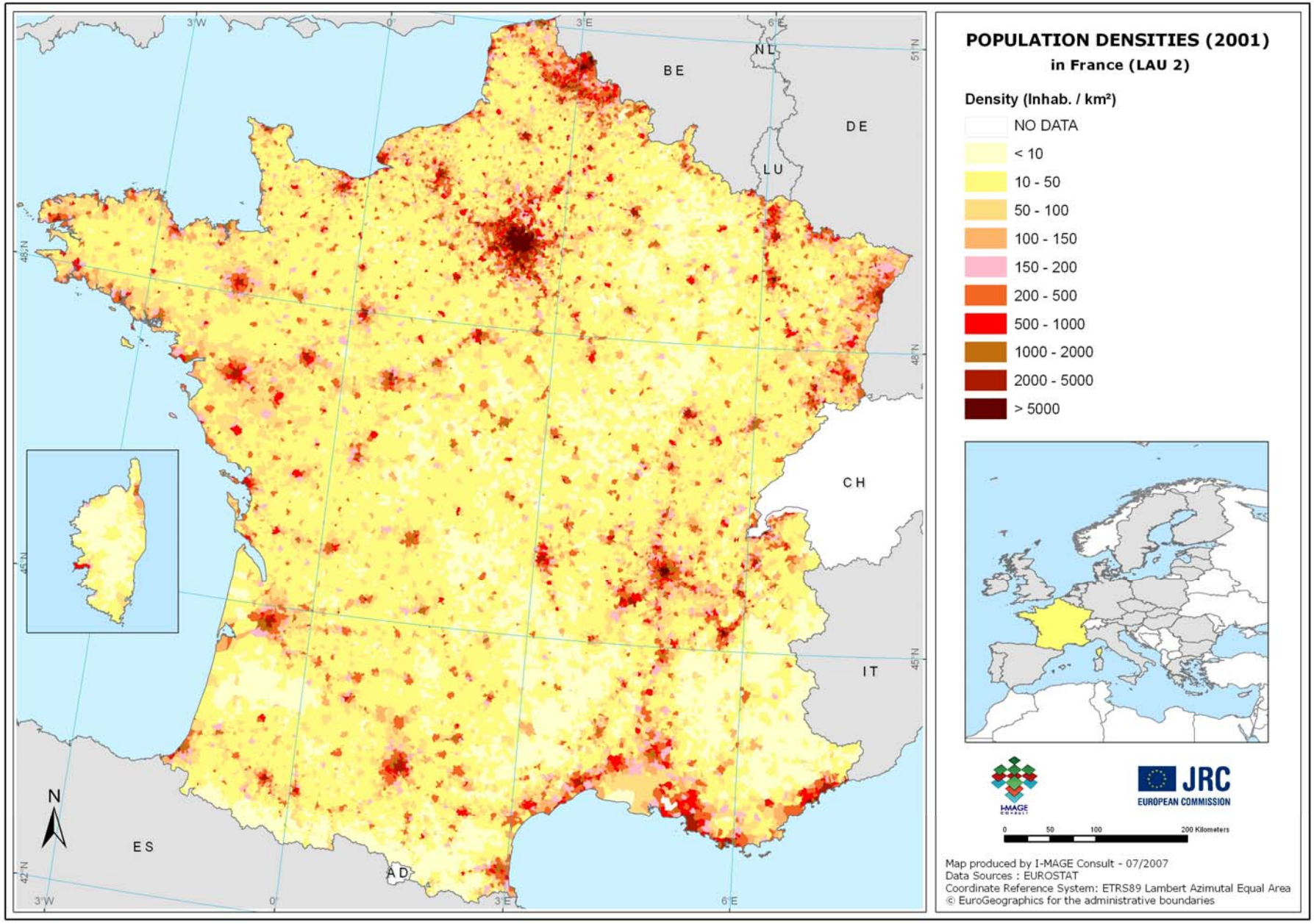
Map 12


POPULATION DENSITIES (2001)
in France (LAU 2)
Density (Inhab. / km²)
NO DATA
< 10
10 - 50
50 - 100
100 - 150
150 - 200
200 - 500
500 - 1000
1000 - 2000
2000 - 5000
> 5000
BE
NL
DE
LU
CH
IT
ES
AD
N
JRC
EUROPEAN COMMISSION
0 50 100 200 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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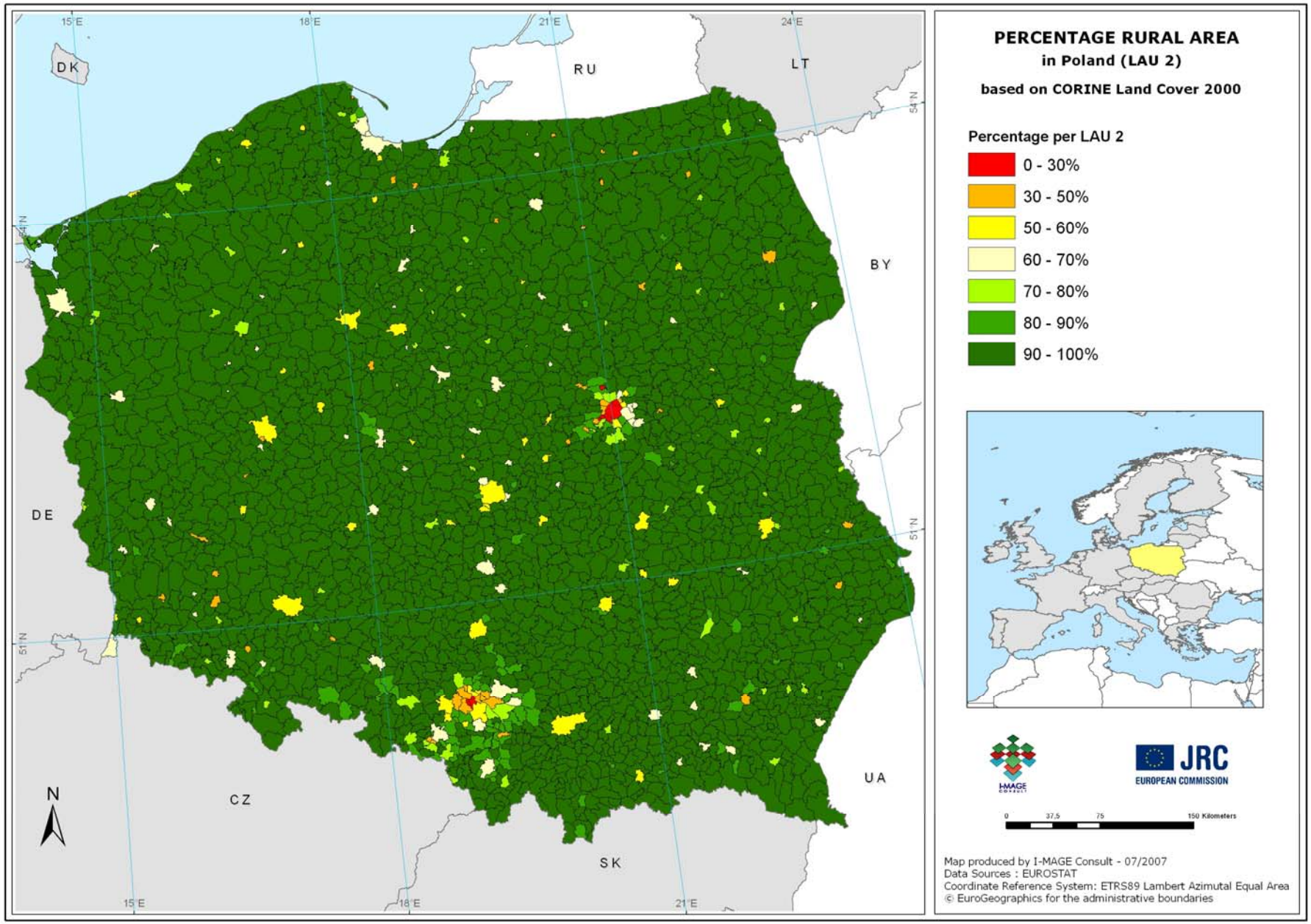
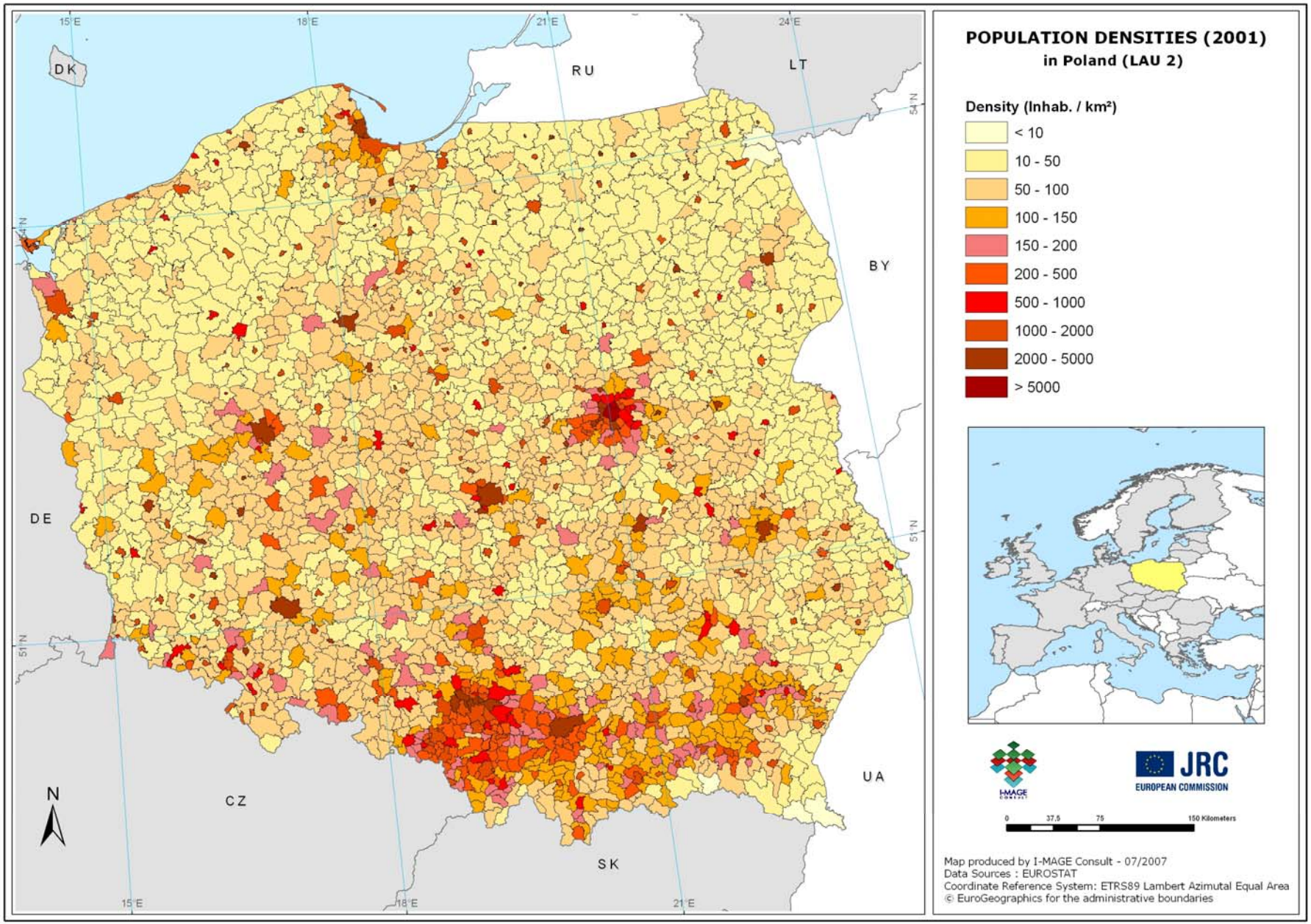
Map 13


PERCENTAGE RURAL AREA
in Poland (LAU 2)
based on CORINE Land Cover 2000
Percentage per LAU 2
0 - 30%
30 - 50%
50 - 60%
60 - 70%
70 - 80%
80 - 90%
90 - 100%
DK
RU
LT
BY
DE
CZ
SK
UA
N
15°E
18°E
21°E
24°E
54°N
51°N
JRC
EUROPEAN COMMISSION
0 37,5 75 150 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
© EuroGeographics for the administrative boundaries

Map 14


POPULATION DENSITIES (2001)
in Poland (LAU 2)
Density (Inhab. / km²)
< 10
10 - 50
50 - 100
100 - 150
150 - 200
200 - 500
500 - 1000
1000 - 2000
2000 - 5000
> 5000
DK
RU
LT
BY
DE
CZ
SK
UA
N
15°E
18°E
21°E
24°E
54°N
51°N
0 37.5 75 150 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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5 RURAL TYPOLOGY *(OECD + CLC + Peripherality)*

The aim of this chapter is to develop a new rural typology by integrating the peripherality index and the land cover indicator in the OECD methodology.
Initially, it was proposed to add socio-economic criteria (unemployment rate, employment rate in the agricultural sector, etc.) in the classification. However, the Steering Committee suggested not to include socio-economic criteria in the classification in order to keep a straight-forward and Pan-European classification.

The first step of this chapter is to improve the OECD typology at LAU2 level. In a second step, a typology at NUTS3 level will also be developed in order to allow comparison with previous works.

5.1 Concept

The criteria of accessibility (peripherality index) and 'natural (non-artificial) space (land cover) are combined and introduced in the OECD methodology (population density).
The threshold of 150 inhab./km² is the same as in the original OECD approach to distinguish between **urban** and **rural**.
The new rural typology classifies a commune as an "***open space***[14]" commune if at least 90 % of its area is covered by forest, agricultural or natural areas. Otherwise, the commune is classified as a "***closed space***" commune.
For the peripherality criterion, the threshold of 30 minutes travel time is used : a commune is considered as "***peripheral***" if it takes more than 30 minutes to travel from the commune to reach the nearest city with at least 50,000 inhabitants and "***accessible***" if it takes less than 30 minutes to access a city with at least 50,000 inhabitants.

5.2 Methodology – LAU2

Table 10 shows the results of the classification at LAU2 level based on the integration of the peripherality index and the land cover indicator in the OECD methodology.

In this classification, two thresholds of population density (150 inhab./km² and 500 inhab./km²) are analysed. The threshold of 150 inhab./km² (for ***sparsely populated*** communes) is the same as in the OECD typology (OECD, 1994), while the threshold of 500 inhab./km² (for ***densely populated*** communes) is taken from the labour force survey (CEC, 2003) and the option 3 of the study on employment in rural areas (Copus et al., 2006).

Only one threshold is set when using the Land Cover criterion. The threshold of 90 % is taken from Vard et al. (2005). (see also Annex 2 : Additional analysis: Modification of the threshold used in the land cover approach).

In the classification below, a commune is classified as an "***open space***" commune if at least 90 % of its area is covered by forest, agricultural or natural areas. Otherwise, the commune is classified as a "***closed space***" commune.

For the peripherality criterion, one additional time threshold is used: 30 minutes (see conclusion chapter 3). A commune is accordingly considered as "***peripheral***" if located at more than 30 minutes from the nearest city with at least 50,000 inhabitants and "***accessible***" if located at less than 30 minutes from a city with at least 50,000 inhabitants.

[14] The terms "Low human intervention" and "High human intervention" are replaced by the terms "Open space" and "Closed space".

The number of classes in table 10 should be reduced in order to simplify the classification and make it meaningful. It can be observed at a first glance that some classes will be less represented considering the criteria associated. This is shown in Table 11 : only one French commune is classified in class 9 and only 3 Polish communes and 3 French communes are classified in class 10. Class 3 and class 4 are also represented with a few numbers of communes in Poland. These classes reflect situations where population density is low and human intervention is high (closed space) or inversely, with high population density and low human intervention (open space). It seems reasonable to assume that these situations will not be frequent or can even be of a contradictory nature.

Table 10. A possible classification of communes based on population density, land cover and peripherality criteria

N°	Criterion 1	Criterion 2	Criterion 3	Sub-Categories	Code
	Population density	*Land Cover analysis*	*Peripherality index*		
1	< 150 inhab./km²	>= 90 %	>= 30 minutes	Sparsely populated - Open space - Peripheral	SOP
2	< 150 inhab./km²	>= 90 %	< 30 minutes	Sparsely populated - Open space - Accessible	SOA
3	< 150 inhab./km²	< 90 %	>= 30 minutes	Sparsely populated - Closed space - Peripheral	SCP
4	< 150 inhab./km²	< 90 %	< 30 minutes	Sparsely populated - Closed space - Accessible	SCA
5	150 – 500 inhab./km²	>= 90 %	>= 30 minutes	Intermediate - Open space - Peripheral	IOP
6	150 – 500 inhab./km²	>= 90 %	< 30 minutes	Intermediate - Open space - Accessible	IOA
7	150 – 500 inhab./km²	< 90 %	>= 30 minutes	Intermediate - Closed space - Peripheral	ICP
8	150 – 500 inhab./km²	< 90 %	< 30 minutes	Intermediate - Closed space - Accessible	ICA
9	> 500 inhab./km²	>= 90 %	>= 30 minutes	Densely populated - Open space - Peripheral	DOP
10	> 500 inhab./km²	>= 90 %	< 30 minutes	Densely populated - Open space - Accessible	DOA
11	> 500 inhab./km²	< 90 %	>= 30 minutes	Densely populated - Closed space - Peripheral	DCP
12	> 500 inhab./km²	< 90 %	< 30 minutes	Densely populated - Closed space - Accessible	DCA

Table 11. Number of communes per class

Classes	1	2	3	4	5	6	7	8	9	10	11	12
Belgium	66	26	7	49	1	5	21	247	-	-	5	162
France	21,924	8194	762	700	217	531	989	1603	1	3	357	1300
Poland	1226	746	3	7	61	103	15	62	-	3	83	179

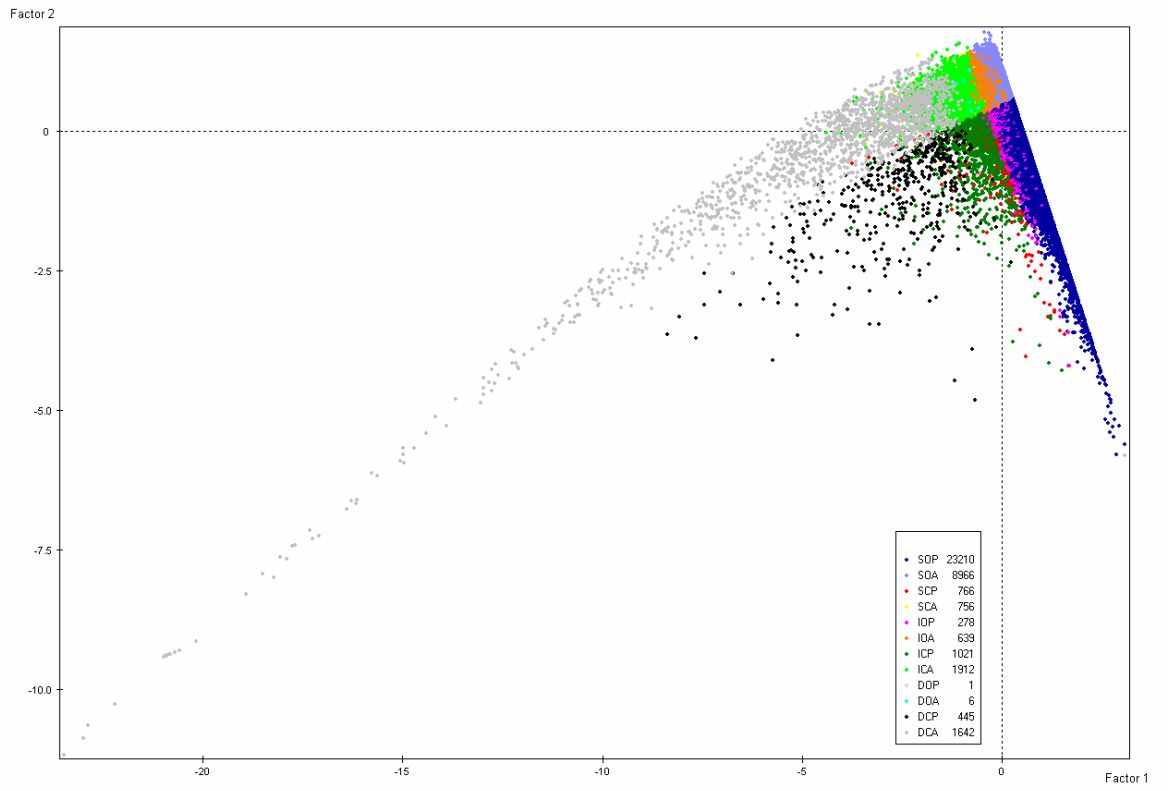
Table 12 hereunder shows the correlation matrix between the 3 criteria. Interestingly, the population density criterion is inversely correlated to the land cover criterion with a significant correlation coefficient of -0.67. This correlation matrix confirms the previous observations and shows that the integration of the peripherality index in the OECD classification is more discriminating than the integration of a land cover criterion which is correlated to the OECD criterion.

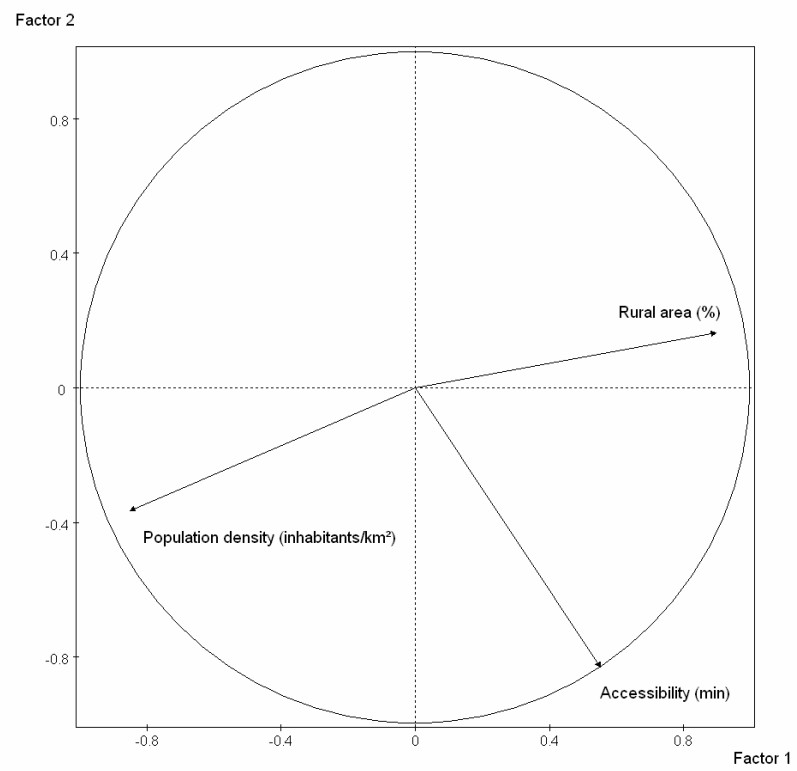
Table 12. Correlation matrix of criteria

	Population density	Land Cover	Peripherality index
Population density	1	-0.67	-0.20
Land Cover		1	0.33
Peripherality index			1

A principal components analysis (PCA) was also applied on the data in order to visualize to which degree the 12 classes are separated. The PCA graphic (Figure 4) confirms the low distinction of the classes 3, 4, 9 and 10.

Figure 4. Principal components analysis (PCA)



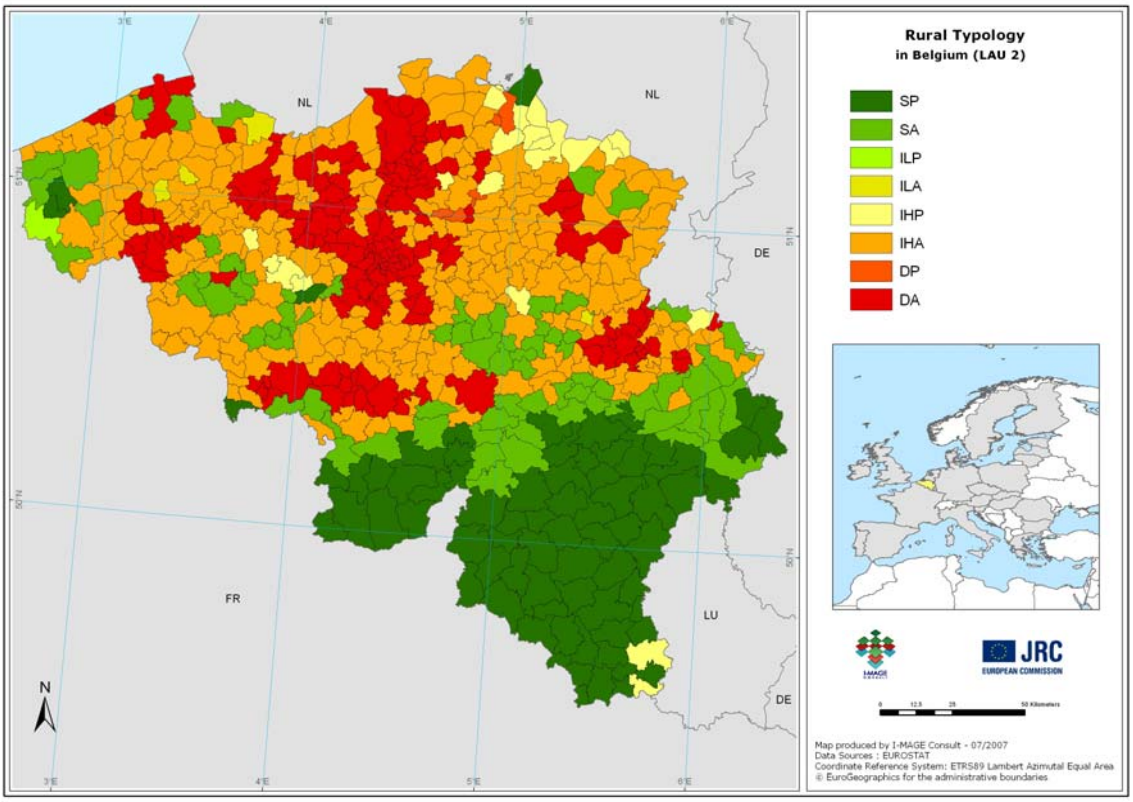


This PCA clearly shows that another classification could be proposed by grouping class 3 with class 1, class 4 with class 2, class 9 with class 11 and class 10 with class 12. In other words, the land cover criterion is not taken into account for the extreme population density values (< 150 inhab./km² and > 500 inhab./km²). This new classification is shown in table 13 and maps 15-17.

Table 13. Classification scheme in 8 classes

N°	Criterion 1	Criterion 2	Criterion 3	Sub-Categories	Code
	Population density	*Land Cover analysis*	*Peripherality index*		
1	< 150 inhab./km²	NA	>= 30 minutes	Sparsely populated - Peripheral	SP
2	< 150 inhab./km²	NA	< 30 minutes	Sparsely populated - Accessible	SA
3	150 – 500 inhab./km²	>= 90 %	>= 30 minutes	Intermediate - Open space(Low human intervention)- Peripheral	IOP (ILP)
4	150 – 500 inhab./km²	>= 90 %	< 30 minutes	Intermediate - Open space - Accessible	IOA (ILA)
5	150 – 500 inhab./km²	< 90 %	>= 30 minutes	Intermediate - Closed space(High human intervention) - Peripheral	ICP (IHP)
6	150 – 500 inhab./km²	< 90 %	< 30 minutes	Intermediate - Closed space - Accessible	ICA (IHA)
7	> 500 inhab./km²	NA	>= 30 minutes	Densely populated - Peripheral	DP
8	> 500 inhab./km²	NA	< 30 minutes	Densely populated - Accessible	DA

Map 15


Rural Typology
in Belgium (LAU 2)
SP
SA
ILP
ILA
IHP
IHA
DP
DA
NL
DE
FR
LU
N
JRC
EUROPEAN COMMISSION
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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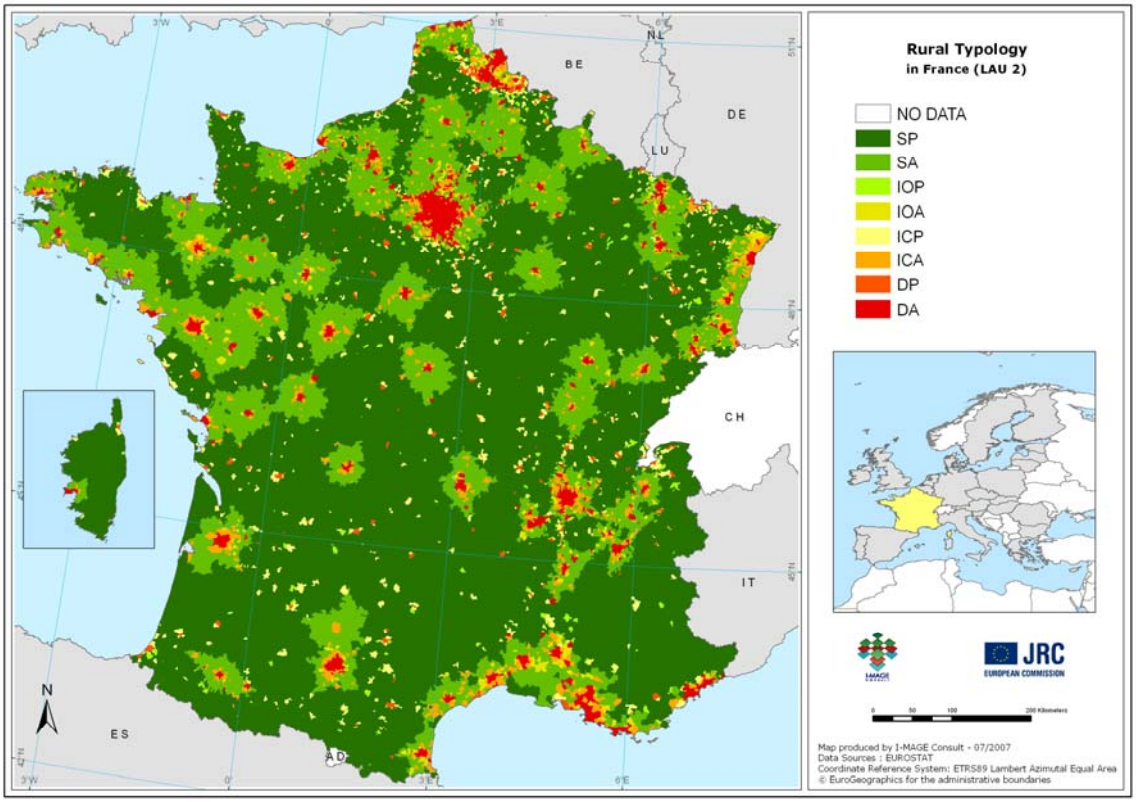
Map 16


Rural Typology
in France (LAU 2)
NO DATA
SP
SA
IOP
IOA
ICP
ICA
DP
DA
BE
NL
DE
LU
CH
IT
ES
AD
N
JRC
EUROPEAN COMMISSION
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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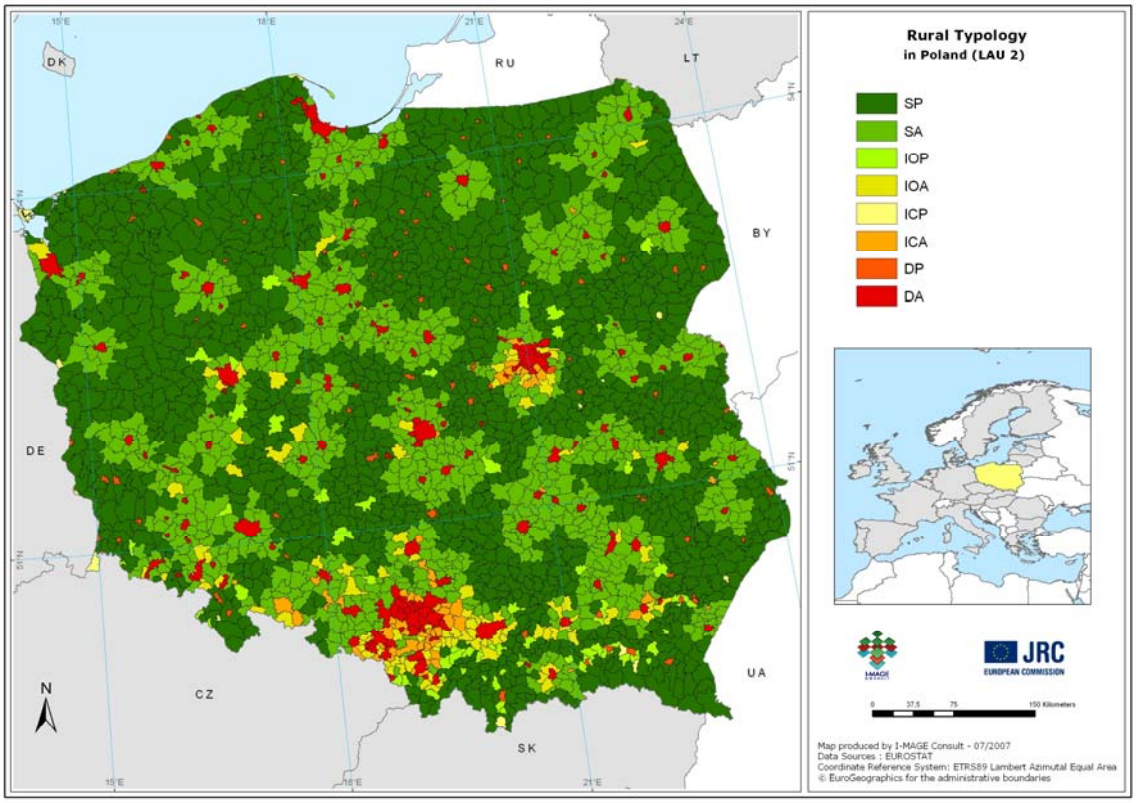
Map 17



The number of communes per "new" class is listed in table 14. This table shows that the 1982 Polish rural communes in the OECD typology are split into 38 % of accessible communes and 62 % of peripheral communes. In Belgium, 50.7 % of the 148 rural communes are classified as accessible, while 49.3 % are classified as remote being located at more than 30 minutes from a city with at least 50,000 inhabitants.

Table 14. Number of communes per class

Classes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Belgium	73	75	1	5	21	247	5	162
France	22,686	8894	217	531	989	1603	358	1303
Poland	1229	753	61	103	15	62	83	182

This classification in 8 classes is simpler and seems to fit more to the reality but the number of classes is still quite big. During the interim meeting, the steering committee suggested to reduce it to 4 classes by maintaining only one threshold of population density (150 inhab./km²) and combining only two characteristics (population density with land cover or population density with remoteness/accessibility) as there are correlations between some categories of the 3 characteristics (population density, land cover and remoteness/accessibility). Indeed, in municipalities with low population densities, the probability to find high share of "rural" areas is high and in the opposite the probability to find municipalities with high population density near urban centre is high.

5.3 Results – LAU2

The 4 proposed classes are: *rural-peripheral*, *rural-accessible*, *urban-open space* and *urban-closed space*. The typology based on these 4 classes is described in table 15. Maps 18 to 20 display the rural typology applied for the three countries (BE, FR and PL).

Table 15. Rural typology at LAU2 level

N°	Criterion 1	Criterion 2	Criterion 3	Sub-Categories	Code
	Population density	*Land Cover analysis*	*Peripherality index*		
1	< 150 inhab./km²	NA	>= 30 minutes	Rural - peripheral	RP
2	< 150 inhab./km²	NA	< 30 minutes	Rural - accessible	RA
3	>= 150 inhab./km²	>= 90 %	NA	Urban – open space	UO
4	>= 150 inhab./km²	< 90 %	NA	Urban – closed space	UC

As already demonstrated in chapter 3 (see point 3.5.2), the accessibility of communes close to borders are influenced by the neighbouring cities. The classification of rural communes close to the boundaries of a country could then be modified if the neighbouring urban centres are taken into account.

5.4 Methodology – NUTS3

A classification at NUTS3 has also been developed in order to maintain a backwards compatibility with the existing typologies and to compare the results with previous works. The regions are first classified in 3 classes on the basis of the share of population living in rural communes (communes with less than 150 inhab./km²):

- Rural regions: more than 50 % of the population is living in a rural commune.
- Intermediate regions: between 15 and 50 % of the population is living in a rural commune.
- Urban regions: less than 15 % of the population is living in a rural commune.

The "rural" regions are then discriminated in 2 classes on the basis of the share of population living in *rural-peripheral* communes (*rural-peripheral regions* and *rural-accessible regions*) and the "intermediate" regions are discriminated on the basis of the share of population living in *urban-open space* communes (*intermediate-open space regions* and *intermediate-closed space regions*)

This classification is described in table 16 and displayed in maps 21 to 23.

Table 16. Rural typology at NUTS3 level

N°	Criterion 1	Criterion 2	Criterion 3	Sub-Categories	Code
	% of population living in rural communes	**% of population living in rural-peripheral communes (class RP)**	**% of population living in urban-open space communes (class UO)**		
1	>= 50 %	> 50 %	NA	Rural - peripheral regions	RPR
2	>= 50 %	<= 50 %	NA	Rural - accessible regions	RAR
3	>= 15 % and < 50 %	NA	> 50 %	Intermediate – open space regions	IOR
4	>= 15 % and < 50 %	NA	<= 50 %	Intermediate – closed space regions	ICR
5	< 15 %	NA	NA	Urban regions	UR

5.5 Results – NUTS3

The 5 proposed classes are: *rural-peripheral regions, rural-accessible regions, intermediate-open space regions, intermediate-closed space regions, urban regions.* The typology based on these 5 classes is described in table 16. Maps 21 to 23 display the rural typology applied for the three countries (BE, FR and PL)

Maps 18 to 20 and table 17 show that all LAU2 classes are represented in the three selected countries. The *urban-open space* class is nevertheless always less represented. The *rural-peripheral* class is the most represented in France and Poland, while in Belgium, most of the communes are classified as *urban-closed space*.

Table 18 depicts the number of regions per each class of the rural typology at NUTS3 level. Surprisingly, no Belgian, French or Polish region is classified as an *intermediate-open space region (IOR)*. This is probably due to the low number and the distribution of the *urban-open space* communes (UO) in the three countries (as seen in Table 17). The *rural-accessible region* class is also very low represented even not represented in Belgium and Poland.

Table 17. Number of communes per class

Classes	RP	RA	UO	UC
Belgium	73	75	6	435
France[15]	22,686	8894	752	4249
Poland	1229	753	167	339

Table 18. Number of regions per class

Classes	RPR	RAR	IOR	ICR	UR
Belgium	6	0	0	10	27
France	25	11	0	49	11
Poland	24	0	0	13	8

5.6 Conclusion

In this chapter, we assessed to improve the characterization of rural areas at commune level by introducing the criteria of accessibility (peripherality) and 'natural (non-artificial) space in the OECD methodology.

The resulting rural typology contains 4 classes which are the outcome of the analysis using one threshold of population density (150 inhab./km²) to distinguish firstly at the level of urban-rural areas. At the second level, two characteristics are combined (population density with land cover (threshold of 90% 'natural(non-artificial) space) or population density with remoteness/accessibility (threshold 30 min. traveltime) resulting in the classes : rural-peripheral', 'rural-accessible', 'urban-open-space' and 'urban-closed space'.

The new rural typology classifies a commune as an **urban** "***open space***[16]**"** commune if the commune has 150 or more inhabitants./km² and at least 90 % of its area is covered by forest, agricultural or natural areas. If the commune has 150 or more inhabitants./km² but less than

[15] Seven French communes are not classified because the population density of these communes is not available.

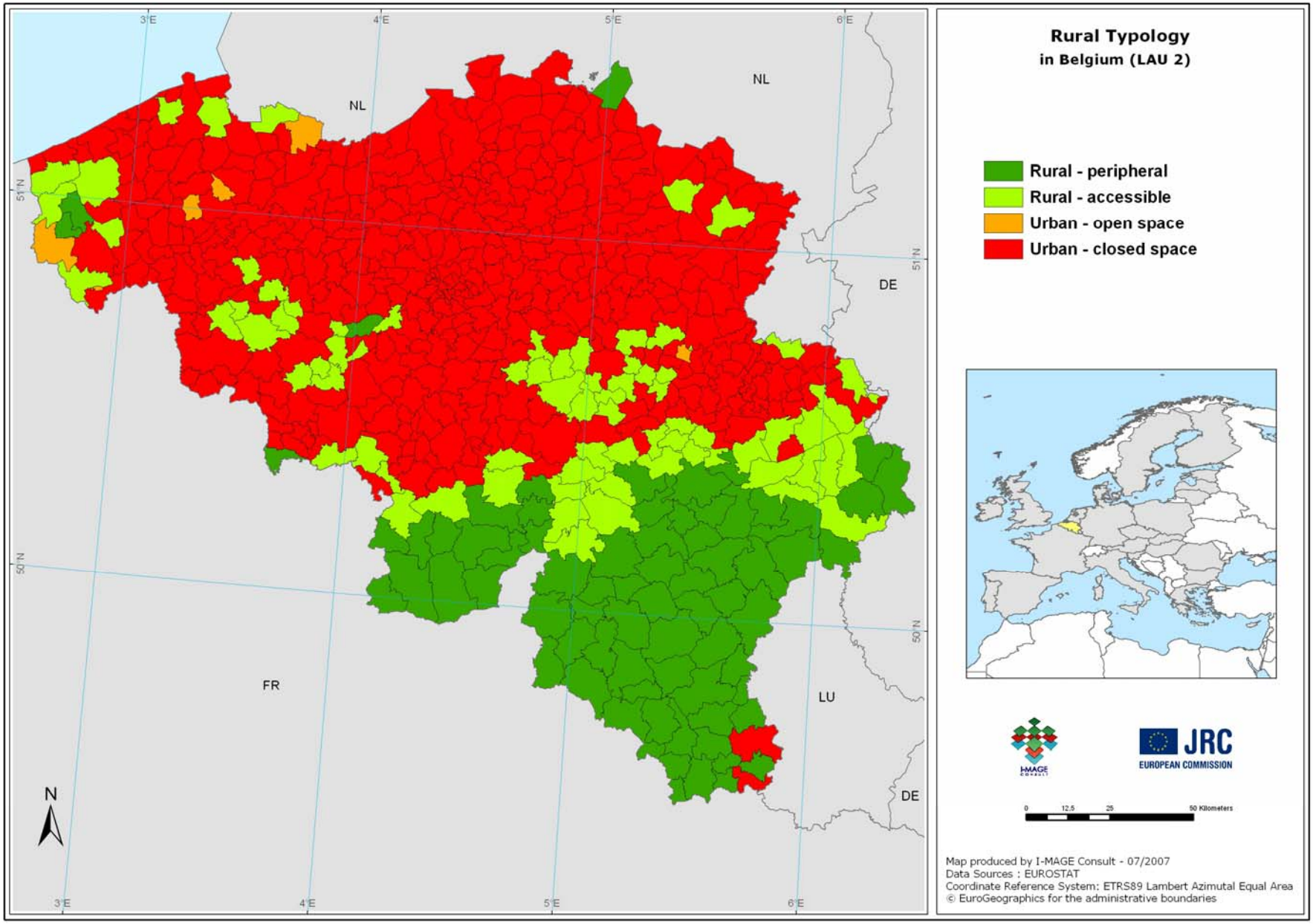
[16] The terms "Low human intervention" and "High human intervention" are replaced by the terms "Open space" and "Closed space".

90 % of ‘natural (non-artificial) area’, the commune is classified as an **urban** “***closed space***” commune.
A commune is categorised as **rural peripheral** if the commune has less than 150 inhabitants./km² and if the traveltime from the commune to the nearest city with at least 50,000 inhabitants is more than 30 minutes. A commune is classified as **rural accessible** if the commune has less than 150 inhabitants./km² and if located at less than 30 minutes from a city with at least 50,000 inhabitants.

The urban-open space class which is mainly defined by the chosen threshold of 90% ‘natural (non-artificial) area’, appears to be less represented.

Applying the rural typology to use at regional level (NUTS3) does not provide an accurate picture of the rurality. Indeed, differences in land cover and accessibility/remoteness have been masked in most places following the regrouping of the communes at regional level.

Map 18


Rural Typology
in Belgium (LAU 2)
Rural - peripheral
Rural - accessible
Urban - open space
Urban - closed space
NL
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3°E
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6°E
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0 12,5 25 50 Kilometers
JRC
EUROPEAN COMMISSION
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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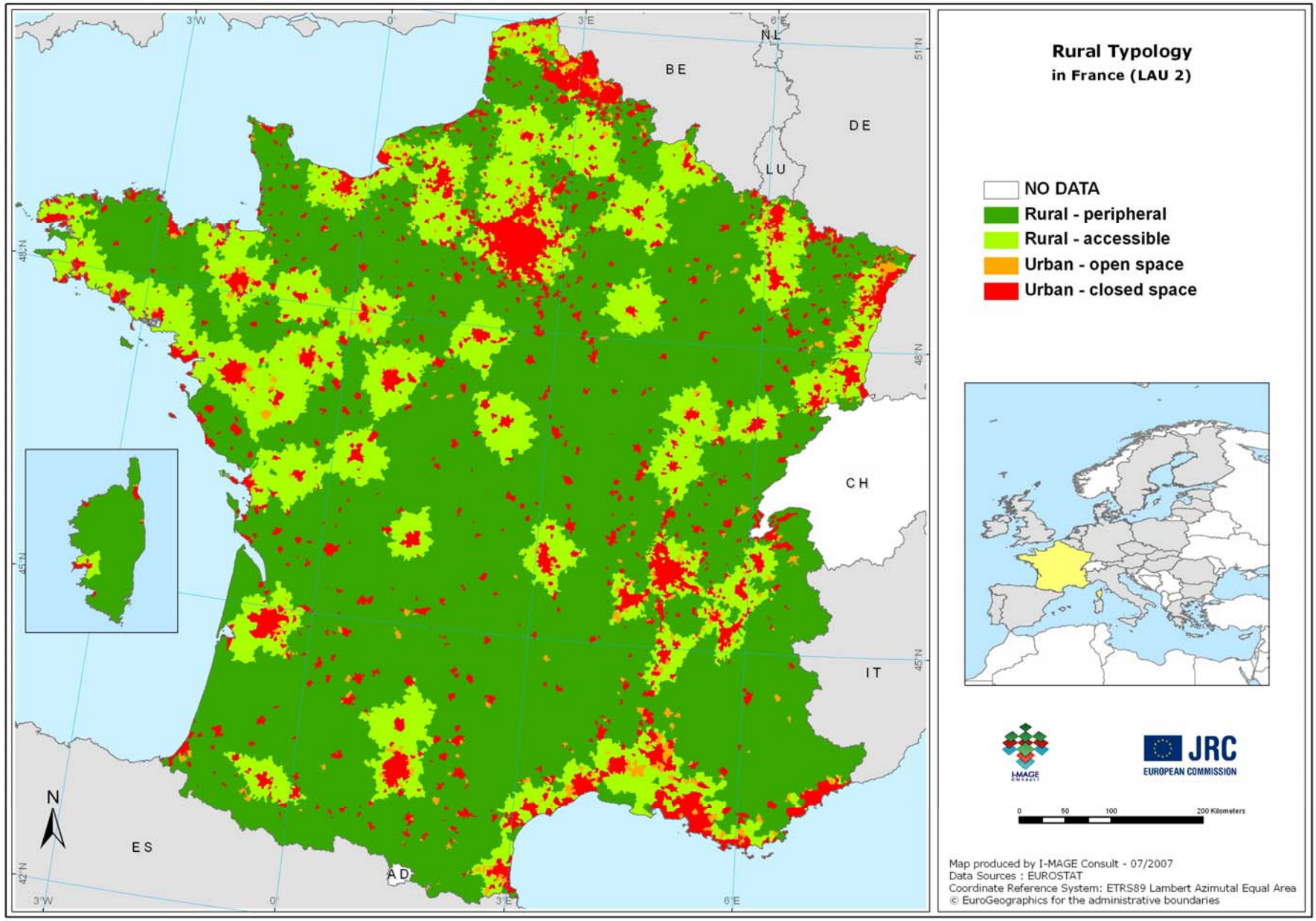
Map 19


Rural Typology
in France (LAU 2)
NO DATA
Rural - peripheral
Rural - accessible
Urban - open space
Urban - closed space
BE
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6°E
51°N
48°N
45°N
42°N
I-MAGE CONSULT
JRC
EUROPEAN COMMISSION
0 50 100 200 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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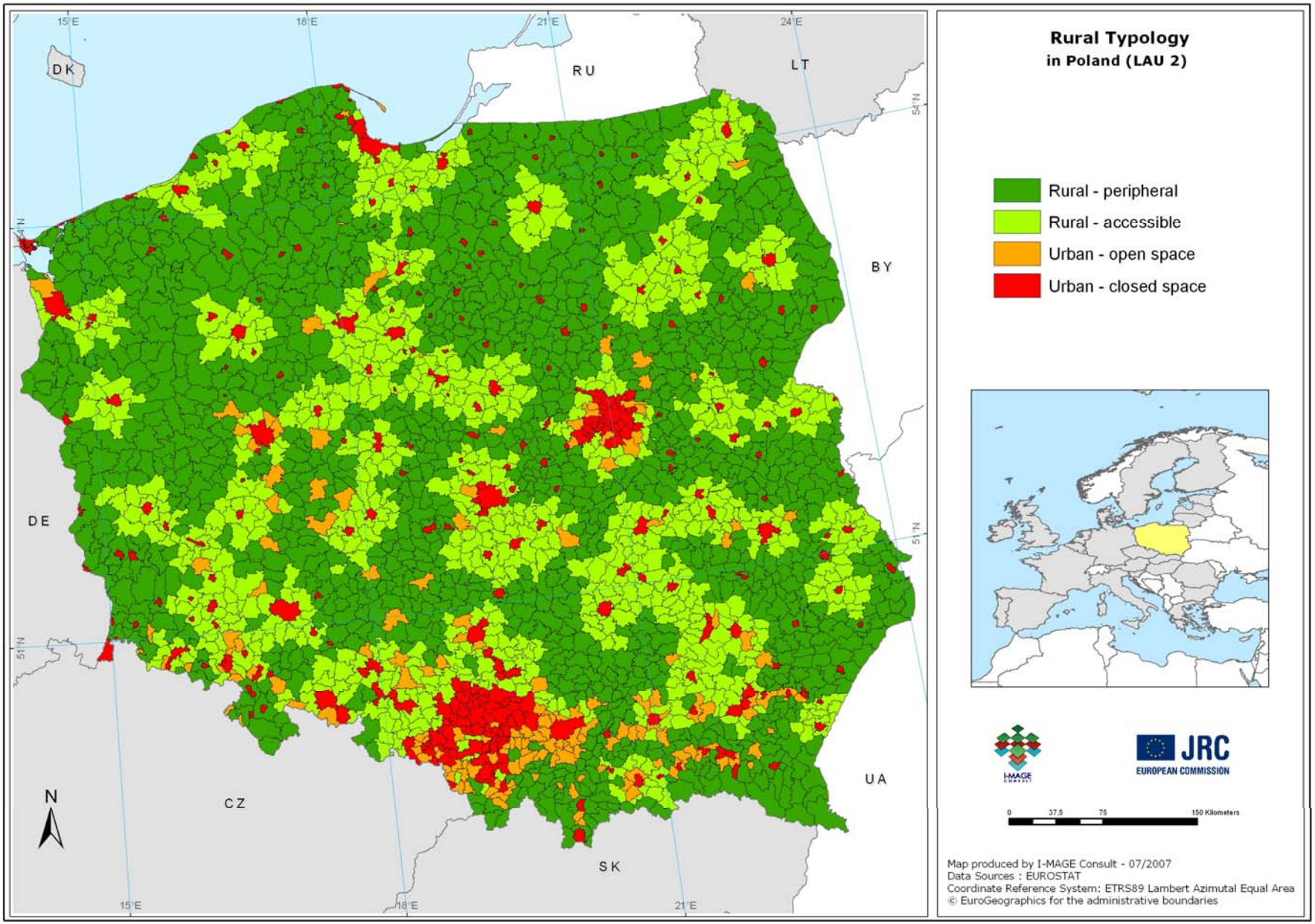
Map 20


Rural Typology
in Poland (LAU 2)
Rural - peripheral
Rural - accessible
Urban - open space
Urban - closed space
DK
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24°E
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51°N
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JRC
EUROPEAN COMMISSION
0 37.5 75 150 Kilometers
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Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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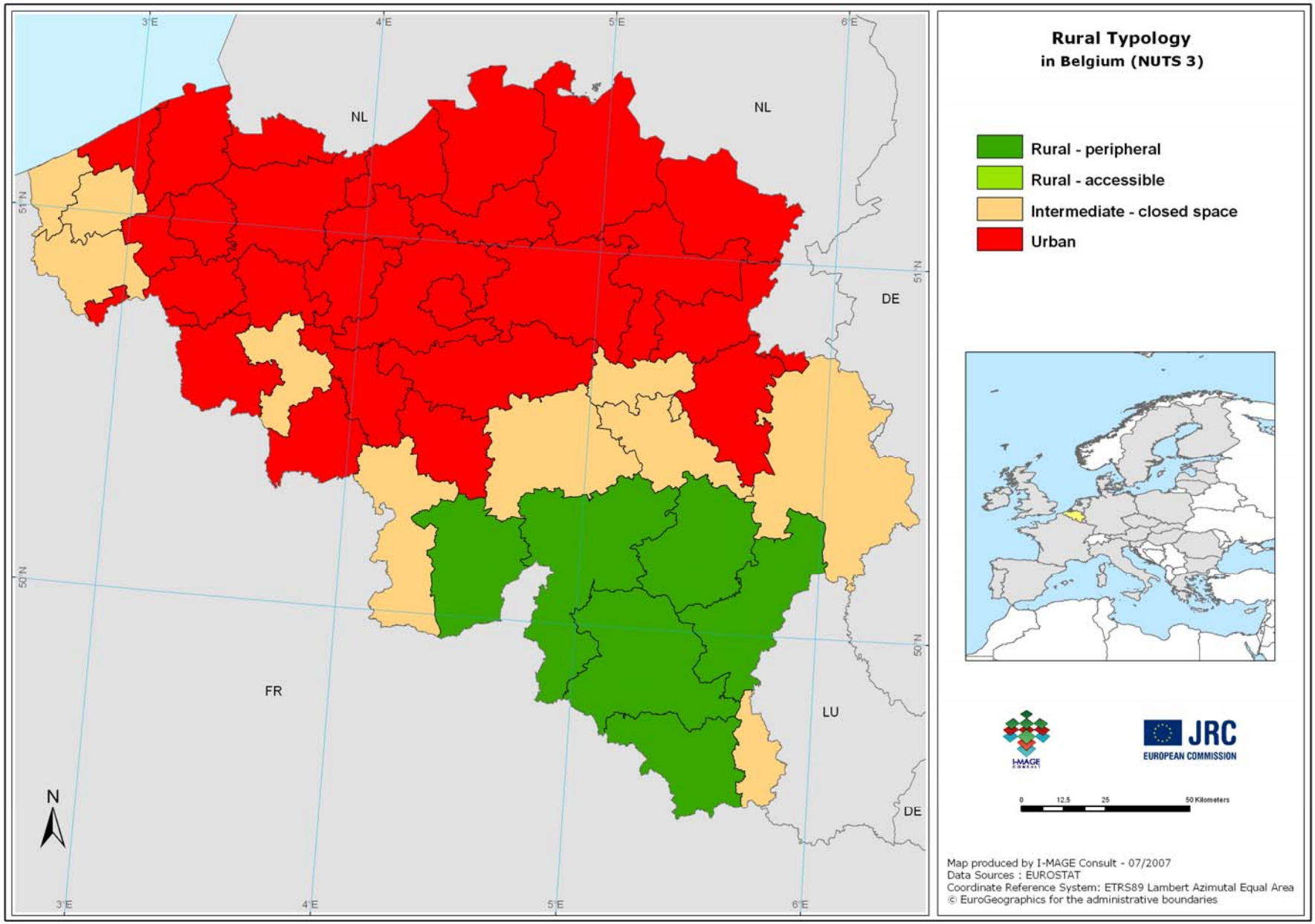
Map 21


Rural Typology
in Belgium (NUTS 3)
Rural - peripheral
Rural - accessible
Intermediate - closed space
Urban
NL
NL
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3°E
4°E
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EUROPEAN COMMISSION
0 12.5 25 50 Kilometers
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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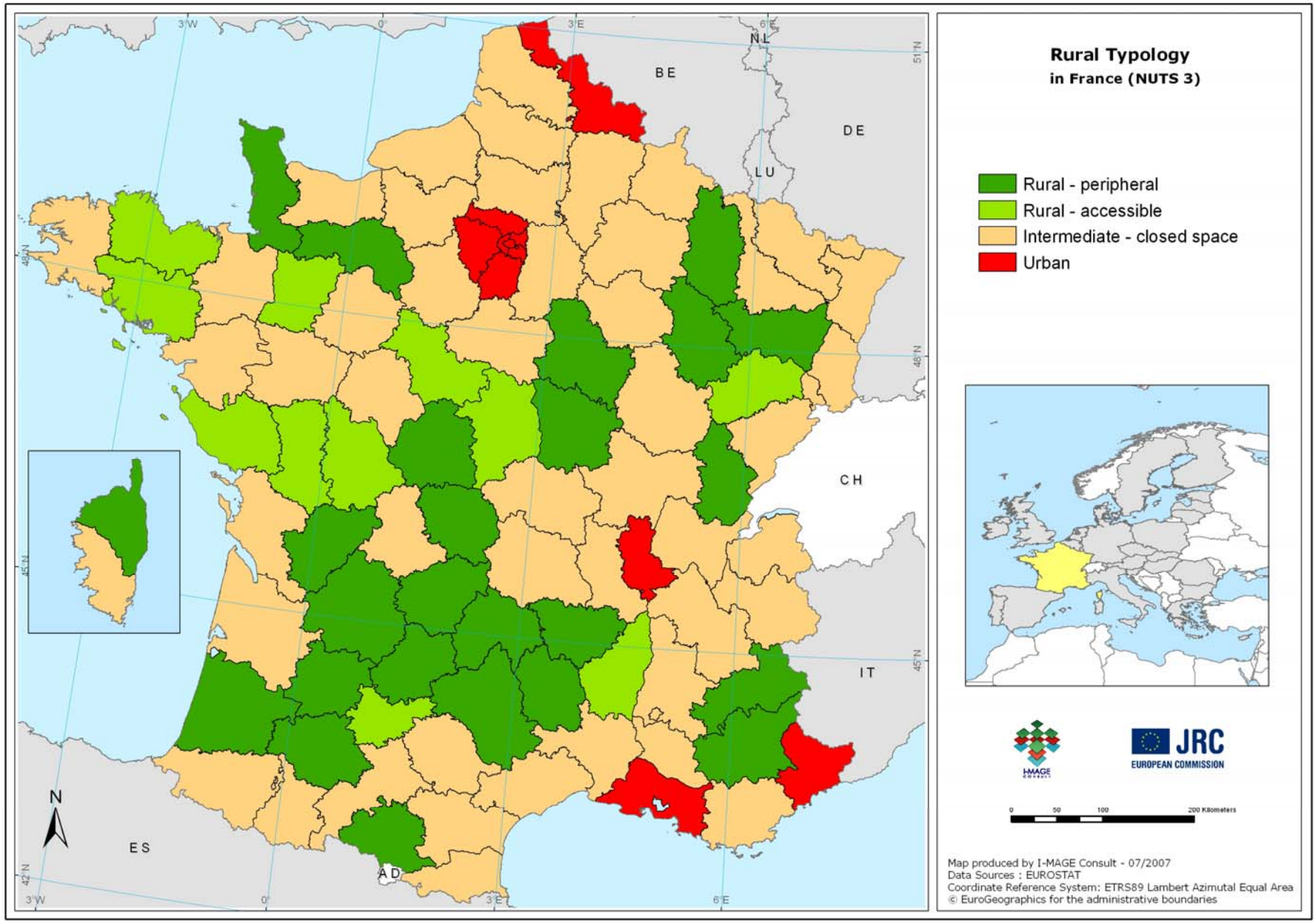
Map 22


Rural Typology
in France (NUTS 3)
Rural - peripheral
Rural - accessible
Intermediate - closed space
Urban
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EUROPEAN COMMISSION
0 50 100 200 Kilometers
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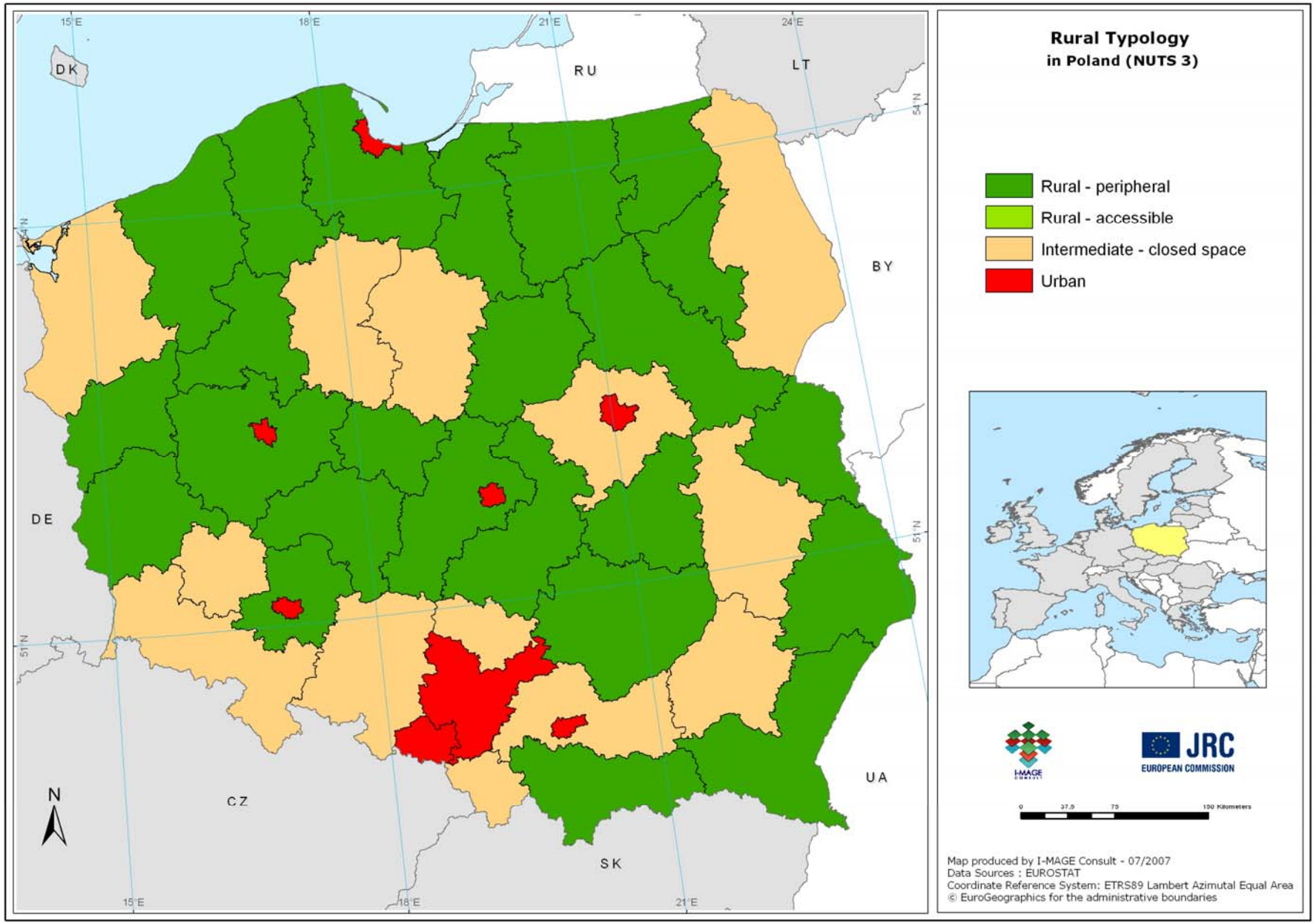
Map 23


Rural Typology
in Poland (NUTS 3)
Rural - peripheral
Rural - accessible
Intermediate - closed space
Urban
DK
RU
LT
BY
DE
CZ
SK
UA
N
15°E
18°E
21°E
24°E
54°N
51°N
JRC
EUROPEAN COMMISSION
Map produced by I-MAGE Consult - 07/2007
Data Sources : EUROSTAT
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
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6 CONCLUSION

In the context of the Common Agricultural Policy (CAP) reform and in particular for the rural development policy, the definition of rural/urban areas is a requisite for the broad targeting of resources. However, currently, there is no commonly agreed definition of the rural areas at European level: the European Commission still uses the typology which was developed in 1994 by the Organisation for Economic Co-operation and Development (OECD, 1994) and which represents a simple territorial scheme that classifies a region as rural based only on its population density.

The overall objective of this study was to propose a methodology to improve current delimitations of rural areas in Europe at commune level (Local Administrative Unit 2) by developing a 'simple' classification namely a categorisation which is straightforward and applicable both at Member State level and at European level. Simple queries were applied with standard procedures using Pan-European homogeneous datasets which allow for upscaling of assessment at European level.

The specific objective of this study was the introduction of the criteria of accessibility/remoteness and natural (non-artificial) space in the OECD methodology to obtain a finer delimitation of rural areas.

The first part of this report focused on the application of a peripherality index in terms of 'travel time to urban centres' and the integration of this accessibility indicator in the OECD classification. This index was combined with two impedance factors: a congestion[17] effect and a slope effect. The impact of the congestion effect on the accessibility is significantly more important than the one of the slope effect. In addition, the benefit that can be gained from using the slope factor should be evaluated against the cost for using it as the GIS (slope)processing is particularly time consuming.
Different thresholds of accessibility have been tested as to assess the particularities (spatial and demographic) of the three selected countries: BE, FR and PL which are very different in term of population density and distribution. The optimal thresholds obtained appeared to be "30 minutes of travel time to reach an urban centre with at least 50,000 inhabitants".
A border-effect analysis revealed that the accessibility of communes close to the (national) border is influenced by the urban centres of the neighbouring countries.
The results demonstrate that the peripherality index is an important discriminating criterion for rurality.

In a second part, the possibility to use the Corine Land Cover to identify the rural character of communes was investigated. The approach is based on the method developed by Vard et al. (2005) and the use of the CLC 2000 database. In essence, a commune will be classified as "rural" if at least 90 % of its area is covered by forest, agricultural or natural areas. It was demonstrated that the land cover criterion is significantly inversely correlated to the population density criterion (OECD typology). This was something already assumed but not yet demonstrated.

The third step of this study was to combine the CORINE Land Cover approach with the peripherality analysis in order to improve the OECD classification at LAU2 level. Following the methodology developed in the frame of this study, a typology in 4 classes was proposed.

[17] In order to take into account the congestion effect in cities.

This rural typology improves the basic OECD typology by discriminating the original rural class (< 150 inhabitants/km²) in 2 sub-classes, ***rural peripheral*** and ***rural accessible***, as well as the urban class (>= 150 inhabitants/km²) in ***urban with open space*** *a*nd ***urban with closed space***.
A commune will be classified as 'rural-peripheral' if the commune has less than 150 inhabitants./km² and if located at more than 30 minutes from the nearest urban centre with at least 50,000 inhabitants. A commune is categorised as 'rural-accessible' if the commune has less than 150 inhabitants./km² and located at less than 30 minutes from an urban centre with at least 50,000 inhabitants.
A commune will be categorised as an urban-open space commune if the commune has 150 or more inhabitants./km² and if at least 90 % of its area is covered by rural areas i.e. forest, agricultural or natural areas. A commune will be defined as urban-closed space if the commune has 150 or more inhabitants./km² and if less than 90 % of its area is covered by rural areas i.e. forest, agricultural or natural areas.

For the three Member States, it was perceived that the urban-open space class was hardly represented. As this class is mainly defined by the 'original' threshold of 90% 'natural (non-artificial) area', more significant results might be established with a lower threshold.[18]

A typology at regional level (NUTS3) was investigated in order to allow comparison with previous works. However, this typology did not provide an accurate picture of the rurality. Discriminations on land cover and accessibility/remoteness were masked in most places following the regrouping of the communes at regional level. These results outline the necessity to work at LAU2 level in order to improve the OECD classification.

In the context of the upscaling of the methodology to European level, particular attention was devoted to implement simple queries, with standard procedures using homogeneous data - all datasets collected and processed are accordingly Pan-European. Given the limited time of the project and the considerable time needed for data standardisation and (GIS)processing at LAU2 (in particular data related to slope), it was agreed to do the assessment for three countries: France, Belgium and Poland which present each of them interesting particularities regarding population density and distribution. Therefore, the up scaling of the methodology at European level is assumed to be possible (common data sets exist and have been identified) but will require additional efforts.

The methodology developed in this report in order to improve the rurality concept has proven to be flexible and the thresholds of accessibility or land cover implemented in this study can easily be modified to better fit to specific needs of the user or local conditions found in given countries. Moreover, some improvements can be made on the proposed methodology:

- Topography was taken into account in the peripherality analysis by using a digital elevation model (SRTM - 100 m). These data do not always produce accurate road slopes information and the GIS processes related to the treatment of these data are highly time consuming. Local road slope information (measured in the field and only in mountain areas) could be collected and used in order to reduce the GIS time processing and upgrade the accuracy.

[18] see Annex 2 : Additional analysis: Modification of the threshold used in the land cover approach

- The selection of urban centres could be based not only on a population density criterion but also on the activities or opportunities offered (economic activities, universities, tourist attractions, etc.).

- Additional data such as socio-economic criteria (unemployment rate, employment rate in the agricultural sector, etc.) could be integrated in this methodology. These data should first be collected at European level in order to keep a European typology. However, a lot of work still remains to collect homogenous socio-economic data in the European Member States. These data are often highly sensitive and not linked to local administrative units.

ANNEX 1 :ADDITIONAL ANALYSIS : MODIFICATION OF THE THRESHOLD USED IN THE LAND COVER APPROACH

In the typology developed in the frame of the "Review and improvements of existing delimitations of rural areas in Europe" study, a commune is classified as an "open space" commune if at least 90 % of its area is covered by forest, agricultural or natural areas.

Maps 18 to 20 and table 17 have shown that all LAU2 rural typology classes are represented in the three selected countries. However, the urban-open space class which is mainly defined by the initially chosen threshold of 90% 'natural (non-artificial) area', is very little represented. Therefore, as to obtain a better discrimination of the urban localities, three additional thresholds have been tested: 80 %, 75 % and 70 % for Belgium.

Table 1 shows the number of Belgian communes per class for each of these thresholds and table 2 shows the number of Belgian regions per class for each threshold.
The corresponding maps for table 1 (LAU2) show that the threshold of '90% natural (non artificial) area' is insensitive for the rural typology 'urban-open space' compared with the lower thresholds.
For the maps of table 2 (regions), the same threshold of 90% is not sensitive for the classification 'intermediate open space' in comparison with the lower thresholds.

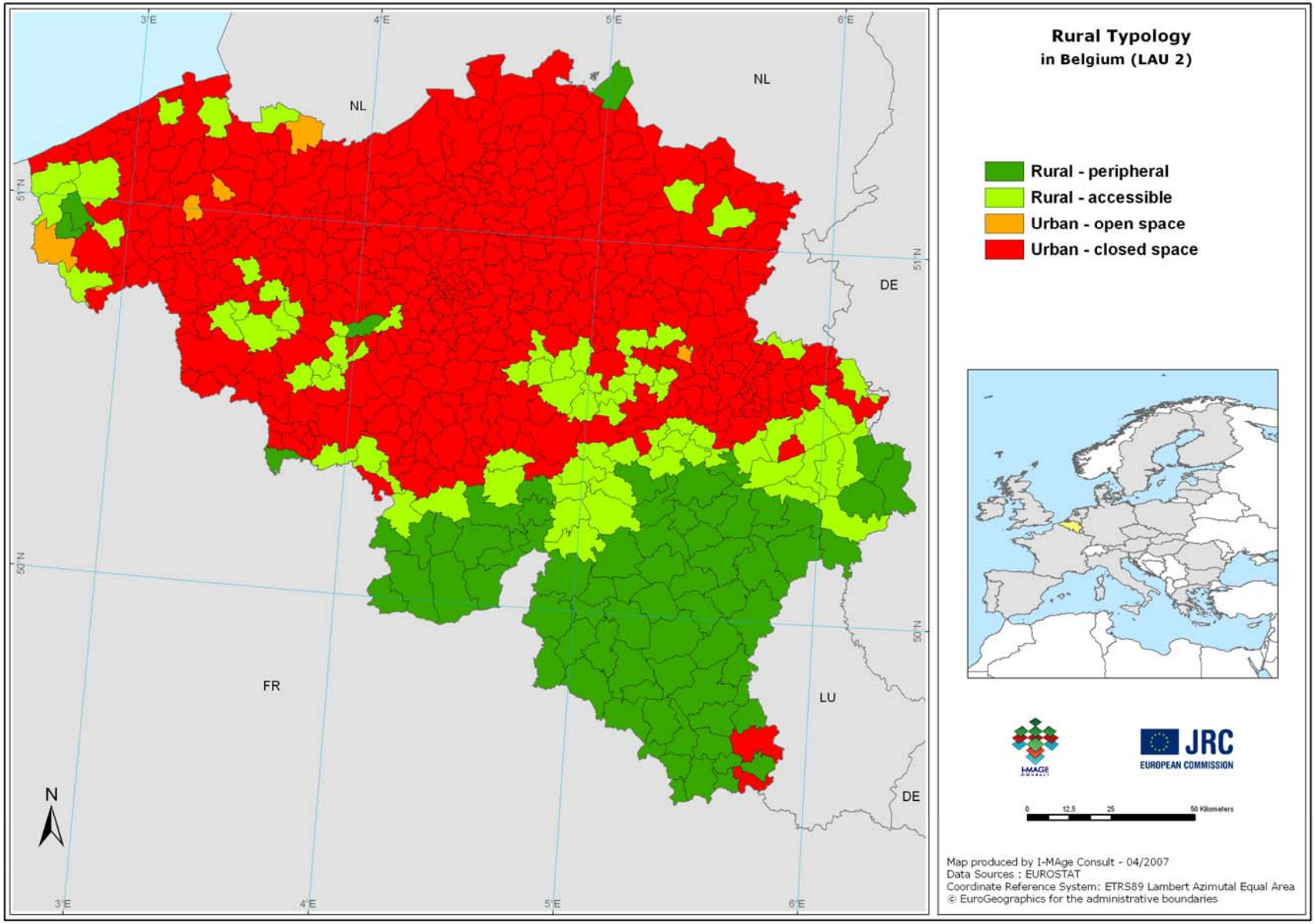
Table 1. Number of communes per class

Classes	RP	RA	UO	UC
Belgium 90%	73	75	**6**	**435**
Belgium 80%	73	75	**103**	**338**
Belgium 75%	73	75	**176**	**265**
Belgium 70%	73	75	**241**	**200**

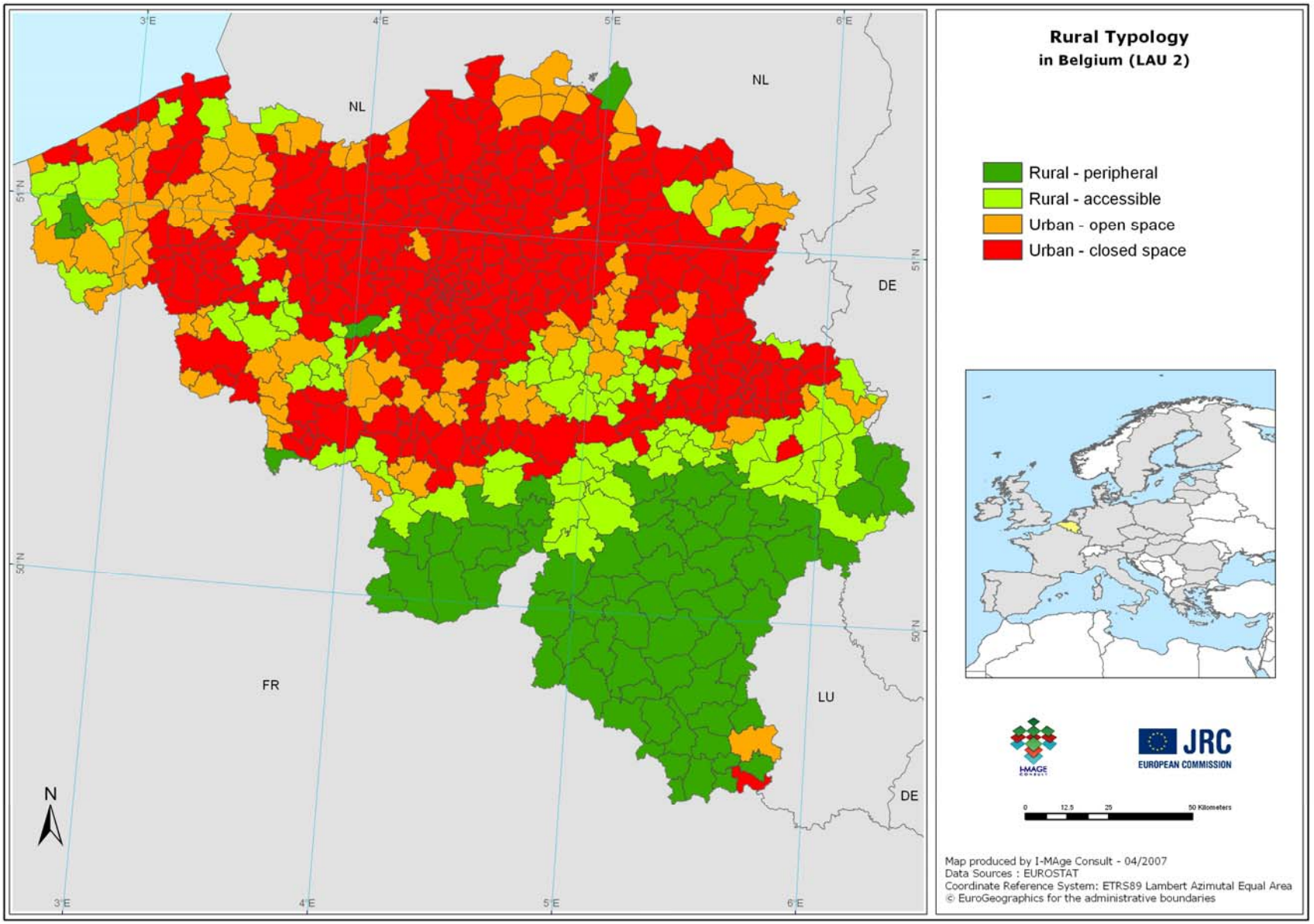
Table 2. Number of regions per class

Classes	RPR	RAR	IOR	ICR	UR
Belgium 90%	6	0	**0**	**10**	27
Belgium 80%	6	0	**3**	**7**	27
Belgium 75%	6	0	**4**	**6**	27
Belgium 70%	6	0	**6**	**4**	27

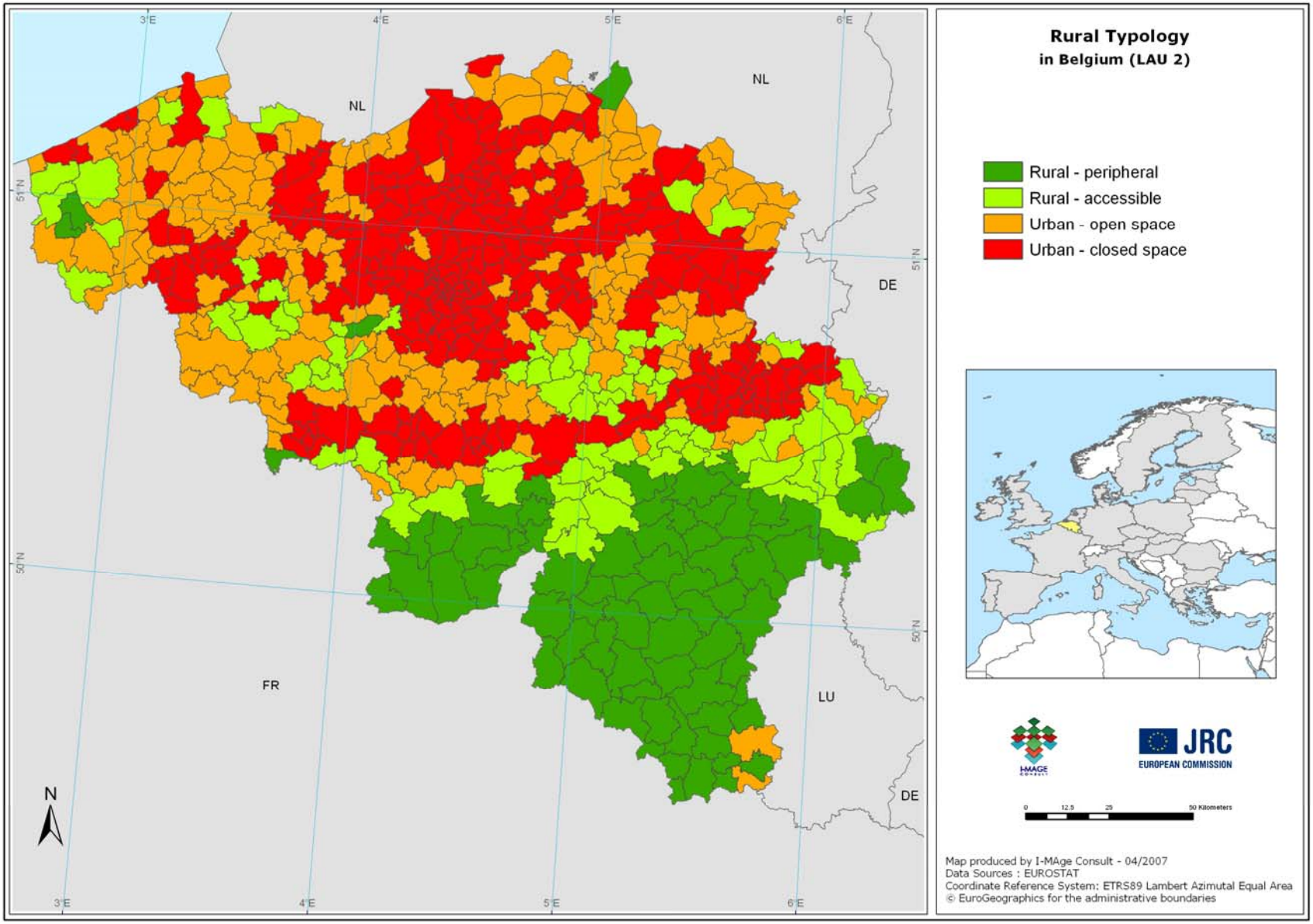
Map 24: Land Cover threshold of 90 %



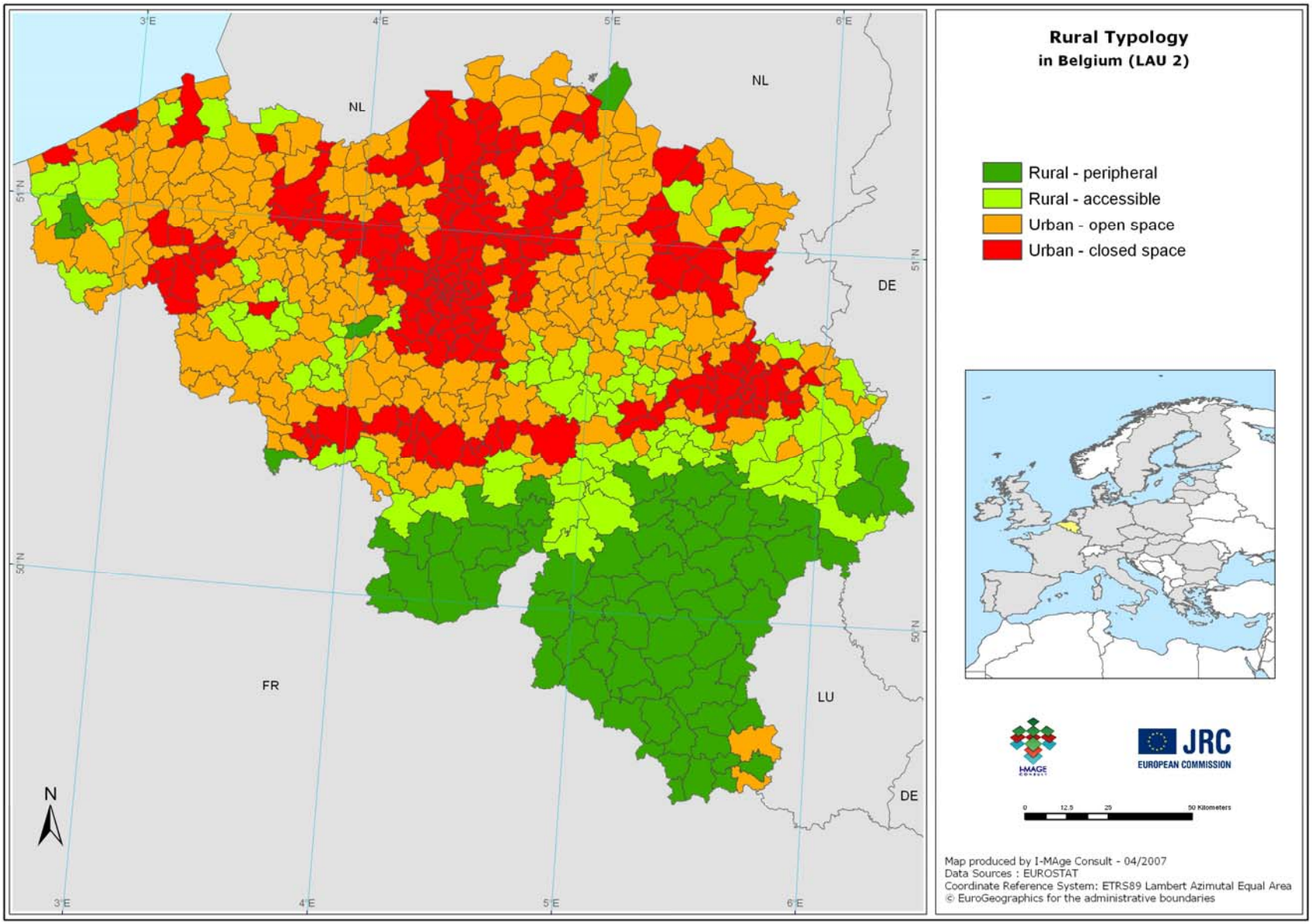
Map 25: Land Cover threshold of 80 %



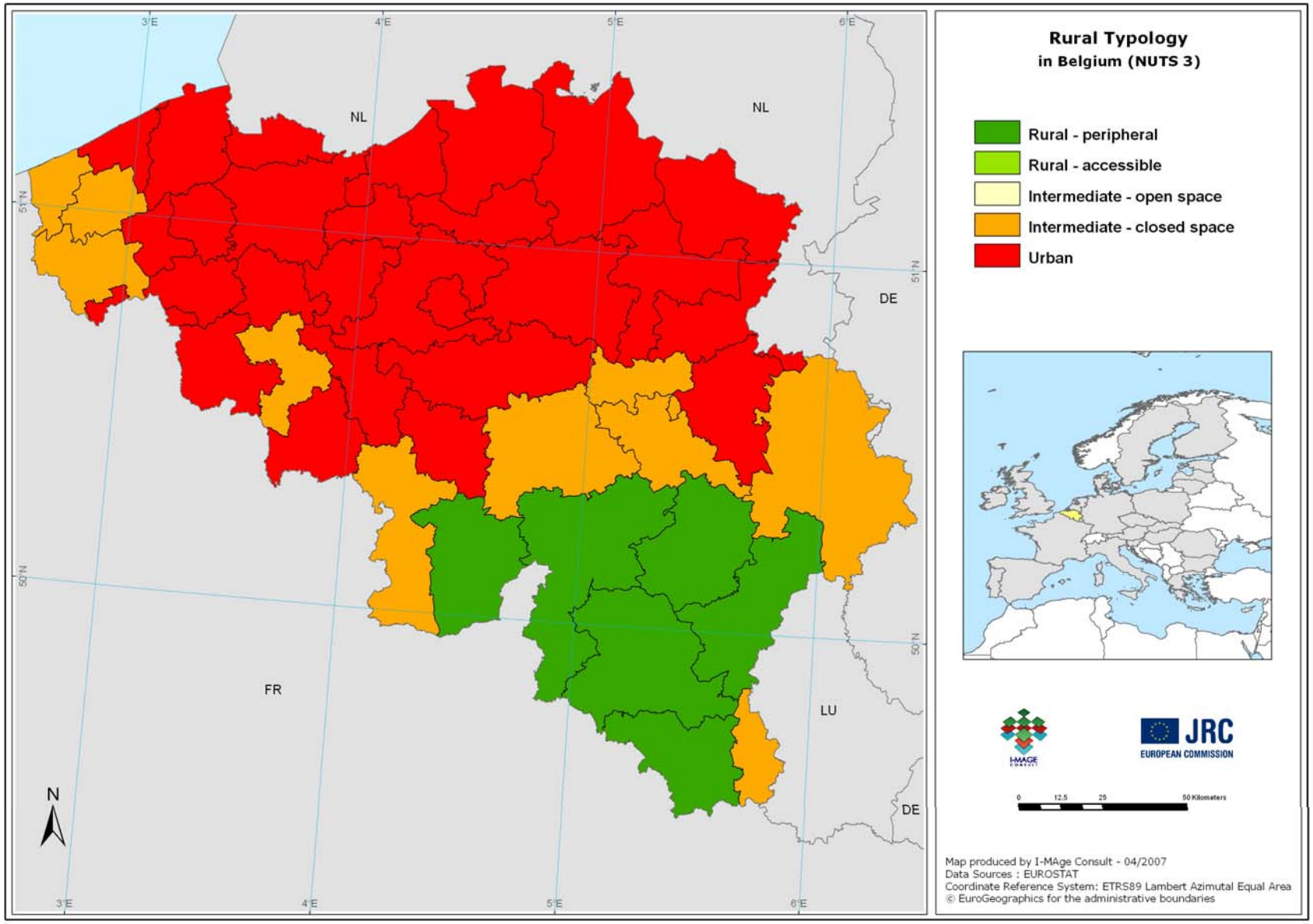
Map 26: Land Cover threshold of 75 %



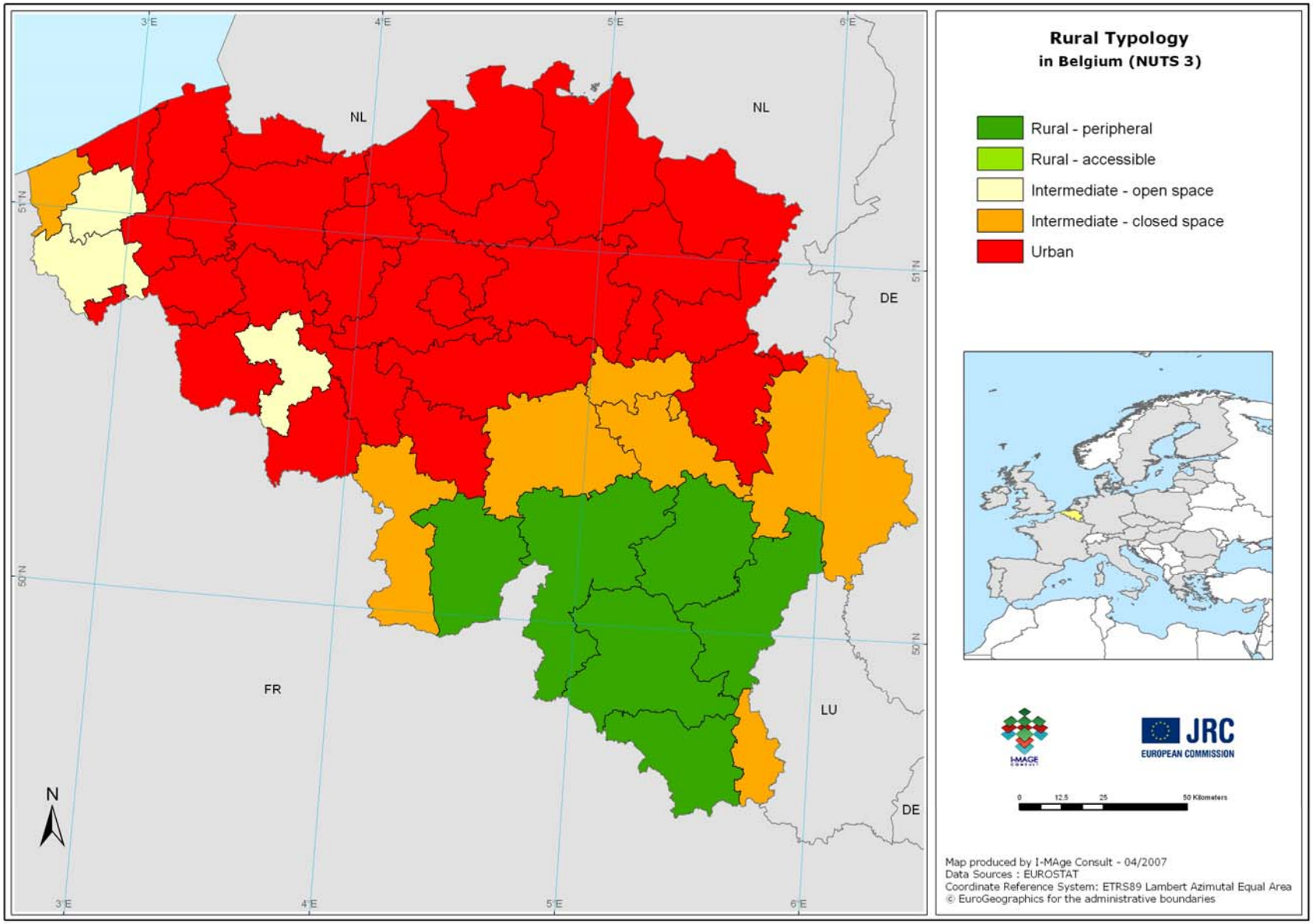
Map 27: Land Cover threshold of 70 %



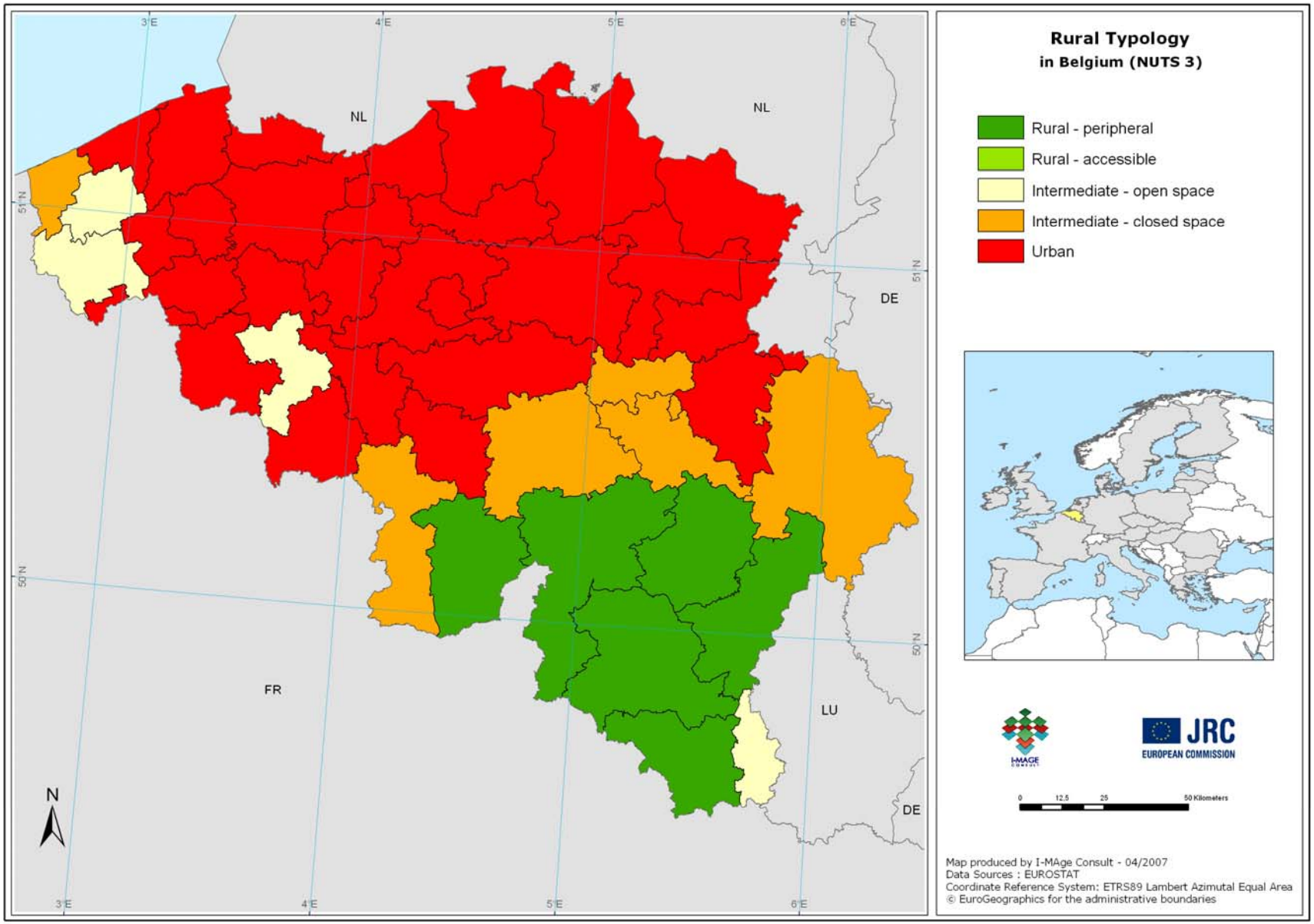
Map 28: Land Cover threshold of 90 %



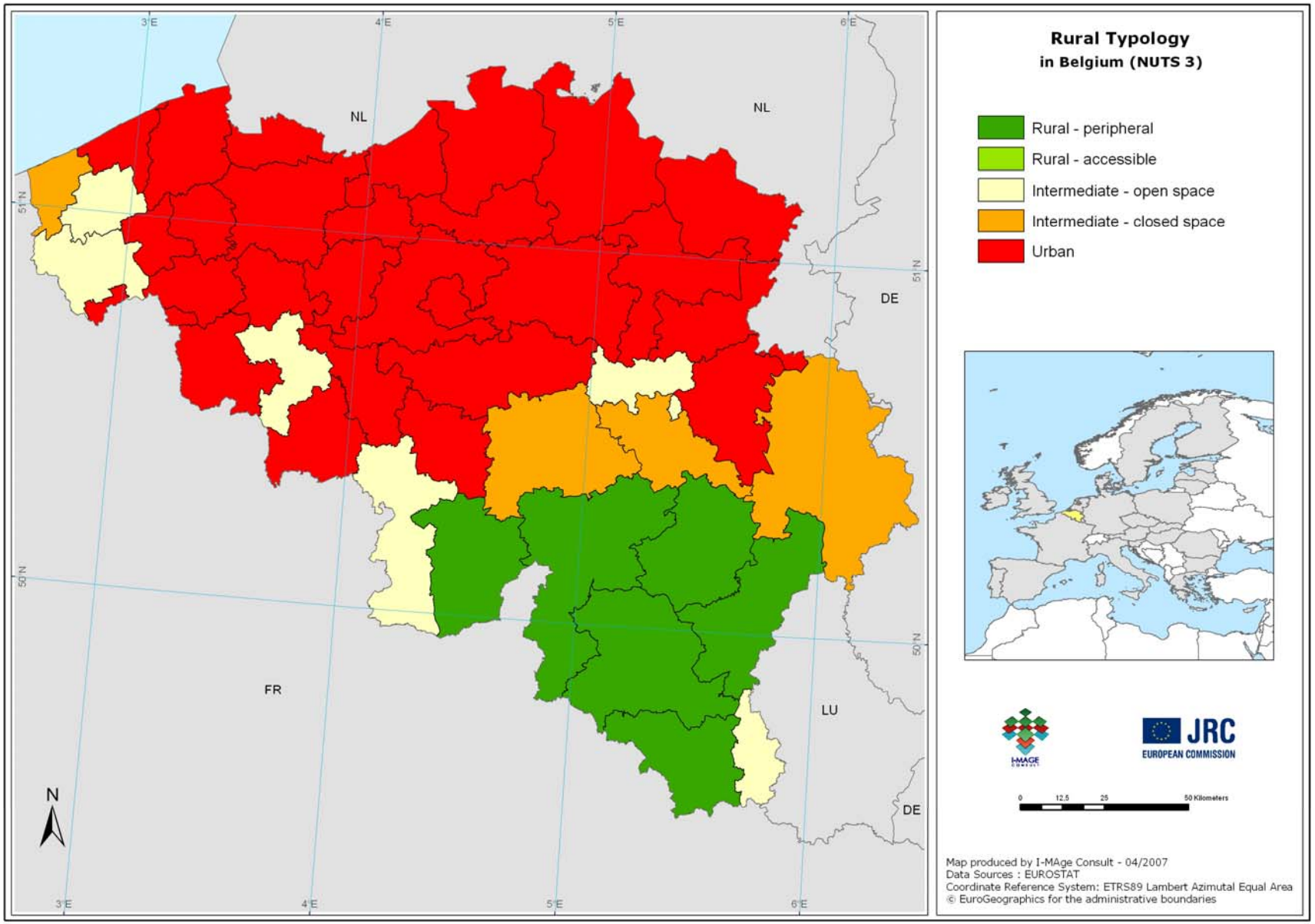
Map 29: Land Cover threshold of 80 %



Map 30: Land Cover threshold of 75 %



Map 31: Land Cover threshold of 70 %



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ANNEX 3: LIST OF MAPS

European Commission

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Abstract
This report aims to improve current delimitations of rural areas in Europe as a support to statistical descriptions by introducing the criteria of peripherality/remoteness and 'natural(non-artificial) area' in the Organisation for Economic Co-operation and Development (OECD) typology. In 1994, the OECD developed an easy concept to identify rural and urban areas based on the population density of a geographical unit. This scheme proved to be highly sensitive to the size of the geographical area and the classification of the thresholds. Over the years, endeavours have been made to review and improve the OECD approach and also alternative methodologies have been proposed. The current methods based solely on population distributions, do not allow for detailed and quantified geographical analysis and do not reflect two main characters differentiating rural from urban areas: the "natural" (non-artificial) surface and the accessibility/remoteness.

In this study, a new rural typology has been developed by integrating the peripherality index and the land cover indicator in the OECD methodology. The analyses were carried out at Local Administrative Unit (LAU) 2 and NUTS3 level for 3 Member States (Belgium, France and Poland). The resulting rural typology classes for LAU2 are 'rural-peripheral', 'rural-accessible', 'urban-open-space' and 'urban-closed space'. The typology at regional level (NUTS3) does not provide an accurate picture of the rurality. The methodology applied is flexible and the thresholds of accessibility or land cover implemented can easily be modified to fit-for-purpose. Simple queries were applied with standard procedures using Pan-European homogeneous datasets so as to allow to upscale for assessment at European level.

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