

3 Characteristics of Territories-in-between

Beyond Urban–Rural Classifications: Characterising and Mapping Territories-in-between Across Europe

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Published in *Landscape and Urban Planning* (2014), 130, 50–63. doi:10.1016/j.landurbplan.2014.06.010

KEYWORDS dispersed urban development; the Tyrol, South-Holland; urban rural classification; GIS-mapping

ABSTRACT Much of physical territory of the Europe does not fit classic ‘urban–rural’ typologies but can best be described as ‘territories-in-between’ (TiB). There is considerable agreement that TiB is pervasive and very significant. However, typologies of territory or spatial development continue to employ only degrees of either urban or rural. Similarly, spatial planning and territorial development policies rarely make use of the notion of in-between areas but tend instead to divide the territory into urban and rural zones. Questions have been raised therefore about the lack of understanding of territories-in-between and their negligence in planning policy. This paper contributes to a better understanding of TiB, by proposing a method for their characterisation and mapping. It asks if there can be a common definition of TiB that reflects consistent and distinctive characteristics across the great variety of spatial development contexts in Europe. It proposes spatial and demographic criteria for their definition, mapping and comparison. The comparison with widely used urban–rural classifications shows that the presented classification of TiB has three advantages: (i) it maps the complexity of the spatial structure of urbanised areas on a regional scale, and thereby helps to overcome the prevalent idea that urbanised regions are characterised by a spatial gradient from urban centre(s) to rural periphery; (ii) it emphasises the network structure of territories-in-between and the underlying connectivity of places with different functions and (iii) it raises awareness that in some parts of Europe a settlement pattern has developed that cannot be understood as either urban or rural.

3.1 Introduction

Europe is largely made of 'middle landscapes' or 'hybrid geographies'. 'Urban' areas can be found in rather rural areas. . . while 'rural' areas can be found within urban environments. (MCRIT, 2010: 41).

Much of the territory of Europe is neither distinctly urban nor rural but something 'in the middle' or 'in-between'. These areas cannot be understood as simply places of intensification of urban functions in the rural environment or places of interaction of urban and rural territories. Rather they have specific spatial and programmatic features that do not fit the classic urban–rural dichotomy (Garreau, 1991; Sieverts & Bölling, 2004; Viganò, 2001). This paper aims to unravel the complex relation between urban and rural in the territories-in-between (TiB) of the European Union (EU) and thereby introduce a new territorial classification method. territories-in-between are not a specific European phenomenon, but as Castells (2010), building on Hall and Pain's (2006) work on European polycentric metropolis, puts it, they are a defining characteristic of metropolitan regions across the planet. A metropolitan region is a new form because it includes in the same spatial unit urbanised areas and agricultural land, open space and highly dense residential areas' (Castells, 2010: 2739). What makes territories-in-between in Europe of specific interest is that they also emerged outside of the metropolitan regions.

In this introductory section we first introduce our understanding of territories-in-between. Second, we describe the challenges related to the overlooking of territories-in-between in existing territorial classification models.

3.1.1 Territories-in-between

The many names given to the form of spatial development in territories-in-between reflect its pervasiveness across Europe as well as the particular context in which it is discussed. They include: *Zwischenstadt* (Sieverts, 2001), *Tussenland* (Frijters et al., 2004), *city fringe* (Louis, 1936), *Città diffusa* (Secchi, 1991), territories of a new modernity (Viganò, 2001), *Stadtlandschaft* (Passarge, 1968), shadowland (Hamers in Andexlinger et al., 2005), spread city (Webber, 1998), and *Annähernd Perfekte Peripherie* (Campi, Bucher, & Zardini, 2000). A translation of the non-English terms is not given so as to preserve the meaning embedded in the original language. (We will come back to this in Section 2 where we discuss a variety of concepts). However, while the precise form and meaning of these terms vary, we argue that they share a common conceptual base. They represent a discrete class of territorial development: 'territories-in-between' urban and rural which are more than a simple mixing of the two. The variety in naming is an indication that within this class of territory there is some diversity. At the same time, these terms are an indication of two general issues: (i) the growing attention given in the literature to changing relationships between the urban and the rural and the implications of their interconnections; and (ii) the uncertain relationship between policy and spatial development in territories-in-between in terms of policy influences on the location of housing and economic activities, mobility, social relations and the overall sustainability.

Although this spatial phenomenon has been identified in Europe for at least three-quarters of a century, territories-in-between (in whatever guise) have not generally found their way into mainstream spatial planning discourse and policy until the 2000s, and then only in very limited ways. The geographer Friedrich Leyden (Sieverts & Bölling, 2004) noted as early as 1933 that the areas outside the *Berliner Ringbahn* developed in ways that go beyond how spatial organisation is generally understood. It created a non-traditional urban form requiring fresh analysis. He describes these areas as an intermingling of urban and rural land uses and lifestyles, of city and landscape. Decades later Hamers (in Andexlinger et al., 2005) identified a similar phenomenon in the Netherlands, and called it 'Shadowland'. He understands this as comprising areas forgotten and neglected by planners and policy makers. 'Planners, designers and administrators often lack a sufficient insight into what goes on in areas that cannot be pinned down in conventional categories. They deny the conditions in which such areas emerged, . . . who is active in them' (p. 50). Hamers' conclusion for the Dutch case was confirmed by a survey among 136 experts on spatial planning across Europe undertaken by MCRIT (2010). More than 80 per cent agreed that the European territory is mostly 'middle landscapes'. More than 50 per cent expressed the opinion that planning policies have to be reformed to consider the many implications of this distinctive form of spatial organisation.

3.1.2 The problem of territorial classifications

An important factor affecting the way that government policies may address territories-in-between is the classification of types of territory, which underpins analysis and policy-making. Territories-in-between have been overlooked in the dominant schemes of classification of territory which generally only define land as either urban or rural, or in degrees of urban. Furthermore, the methods used to separate urban from rural tend to be dominated by the use of one criterion – resident population density (OECD, 2010; Scholz, 2009).

Spatial planning policy-making processes based on this kind of classification have produced, not surprisingly, policies for 'urban' and 'rural', indeed often seeking to divide urban from rural and ignoring the real nature of territories-in-between. One consequence of the oversimplification of categorisations of territory has been vagueness in the many terms that are used to explain this form of spatial development. Geographers and planners use notions such as suburbanisation, sprawl, urban-rural relations, fringe and peri-urban to try to capture the real diversity and complexity of such territories. But these terms tend to be ambiguous overgeneralisations with little common definition, while some of them – especially sprawl – have become rather pejorative. For example, Forsyth (2012) gives an overview of the very diverse meanings of 'suburb' and related concepts. Bruegmann (2005) and Galster et al. (2001) set out the plethora of meanings and connotations that are attached to the term sprawl. This ambiguity undermines both spatial planning policy and the empirical research that underpins it. A clearer specification of territories-in-between should provide much needed clarity in meaning and also a means of measurement and comparison.

This paper proposes an alternative classification of territory, which is precise enough to represent the complex (socio-) spatial configuration of territories-in-between and distinguish them from urban and rural areas. This preciseness is achieved by a combination of freely available geo-datasets which allow for a detailed classification and mapping of territories-in-between, going beyond existing typologies. The proposed classification can make a significant contribution to the comparison of the form of territories-in-between, their performance in terms of sustainability, and the evaluation of spatial policies applied within them territories-in-between.

3.2 Methodology and structure of the paper

3.2.1 Research approach

This new classification method is based on analyses of a variety of concepts that are used across Europe to describe dispersed urban development within different cultural and topographic settings. These concepts understand urbanised areas not as gradients from urban and rural but as distinct and highly interconnected regions. Therefore, the presented classification forms a solid base for cross-European comparisons which go beyond the problematic use of administrative boundaries as the classification unit and simple population density studies. The method is especially appropriate for spatial analyses of the networked territory in Europe.

The overarching general concept of territories-in-between is used here as a starting point. The term incorporates all forms of mixed urban and rural that have so far been mentioned. The measurement and analysis of comparative cases using specified parameters provide more specific descriptions of particular types of territories-in-between.

We first review the existing concepts used to describe dispersed urban development across Europe in order to define common spatial characteristics (Section 3). In the next step explained in Section 4, we review existing territorial classification models, in order to understand which criteria and spatial classification units are commonly used, and what are their advantages and limitations. In Section 5 we use two cases, the Tyrol in Austria and South-Holland in the Netherlands, to test which commonly available geographic datasets and thresholds for them can be used to produce a geographical information system (GIS) supported mapping of territories-in-between. The results are verified by fieldwork and the analyses of aerial pictures. Finally, in Section 6 we discuss the outcomes in comparison to other existing classification methods.

3.2.2 Two test cases

The test areas are The Tyrol in Austria and South-Holland in the Netherlands. They represent two extreme cases for European territories, being very different in topography and population density. The Tyrol is a mountainous area in the eastern Alps, with around 750,000 people living in area of 12.5 thousand square kilometres, of which actually only 20% (the valleys) is inhabitable. South-Holland, is the southern wing of the Randstad a metropolitan area in the Dutch delta. Around 3.5 million of people live on an area of 3.5 thousand square kilometres. The assumption is that if the same method to map territories-in-between is successful in these two cases, it should be applicable to a European-wide selection. Ssee FIG. 3.1 for the location, as well as impressions and major characteristics of the two test case study areas).

Our criteria for being successful are: (1) avoidance of illogical outcomes meaning the selection of areas, which are obviously no territories-in-between; (2) showing the relational nature of many territories-in-between, i.e. the strong linkages with infrastructure; (3) use of existing and comparable databases with a minimum need of additional local knowledge to filter out illogical outcomes.

3.3 The characteristics of territories-in-between

Caplan and Nelson pointed out in the context of social problems, ‘what is done about a problem depends on how it is defined’ (1973: 200, quoted in Forsyth, 2012: 271). This is very appropriate for definitions of ‘territory’, if territories are defined as either urban or rural then policy and action will follow in the same pattern. So the reality of spatial development including territories-in-between needs to be defined and mapped, that means they should be geographically located and distinguished from other related spatial conditions that are primarily urban or rural. The definition of territories- in-between requires careful selection of demographic and spatial features that are on the hand, common characteristics for all such areas, but which on the other, can also accommodate variations resulting from historical and cultural differences. Although the discussion that follows reveals varying views about the nature of territories-in-between (and thus the use of different terms) there is sufficient agreement in a wide field of literature, projects and plans dealing with disperse urban development, about key spatial and demographic properties that define them.

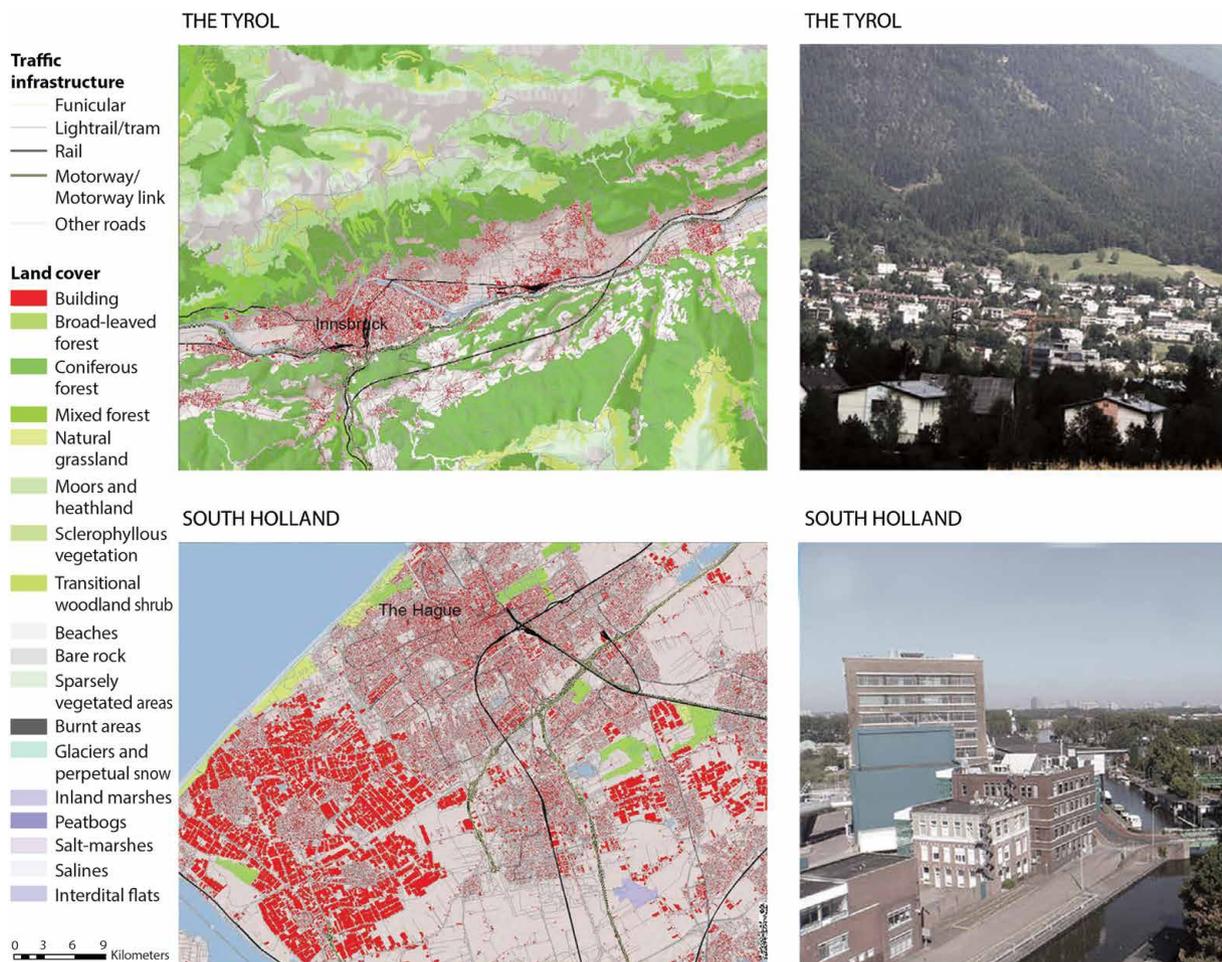


FIG. 3.1 Case study locations, spatial characteristics and visual impressions. Source: Authors' own. Data sources: ESRI 2013; DeLorme; USGS, NPS and EEA Copenhagen 2010.

Table 3.1 presents a summary of the most used terms for territories-in-between in the literature together with an explanation of their meaning and the approach followed by the authors and researchers.

TABLE 3.1 Recent characterisations of territories-in-between across Europe in comparison to sprawl and peri-urban.

Concept	Country authors	Summary of approach and explanation
Annähernd Perfekte Peripherie	Suisse Campi et al. (2000)	Campi et al., describe the territory between Zurich and its airport as one example of an area with a new form of urbanity, characterised by a heterogeneity of fragments of urban and rural land uses. They come to the conclusion that such areas cannot be described as periphery but form an autonomous city, the 'Glattalstadt',
Tussenland	Netherlands Frijters et al. (2004)	The term Tussenland (Dutch for in-between land) arose from research done by the Dutch National Environmental Agency that aimed to identify and raise awareness of territories-in-between for Dutch planning practice. It focuses on the manifoldness of actors interacting in the production of the Tussenland, developed in the shadow of Dutch spatial planning which has given priority to the containment of cities and protection of green spaces over recent decades.
<i>Città diffusa</i>	Italy Indovina (1990) Secchi (1991)	<i>Città diffusa</i> describes the dispersed urban development of parts of the Veneto Region in northern Italy and its distinct urban form and socio-economic condition. The fine-grained character of its urban structure is the basis for its spatial diversity and decentralised but heavily interconnected economy, supporting a variety of lifestyles.
Territori della nuova modernità	Italy Viganò (2001)	In <i>Territories of a New Modernity</i> , a spatial development strategy for the Salento region in the province of Lecce in southern Italy, Paola Viganò and colleagues explain the porosity of the landscape as a driving spatial property for future development. They stress that in the <i>Città diffusa</i> an approach that focuses more on relations than on functions and that understands the landscape as the major infrastructure, offers more possibilities for local and regional development than traditional plans that primarily concentrate on the cities.
Urban fringe	England Gallent, Bianconi, & Andersson (2006)	In a series of articles from 2000 to 2006 Gallent et al. describe the English urban-rural fringes and their planning challenges. They investigate the role (or not) that planning played in 'urban fringe' development in England. They explain the struggles of an urban containment orientated spatial planning with areas where urban and rural uses intermingle. They conclude that, while spatial planning in the UK focused on the containment of cities and the separation of urban and rural land uses, the edges of cities evolved into a mixture of less favoured urban uses, agriculture and other rural land uses.
Zwischenstadt	Germany Sieverts (2001) Sieverts and Bölling (2004)	The term <i>Zwischenstadt</i> (German for in-between city) was introduced by Thomas Sieverts in the late 1990s to describe a new emerging type of city that is in-between on three dimensions: between built and open landscape; between the local rooted and global economy; and between recent young urban development and a yet unknown urban future. He argues that a better understanding of the <i>Zwischenstadt</i> is the base for planners and designers to contribute to its 'qualification'.
TyrolCity	Austria Andexlinger et al. (2005)	<i>TyrolCity</i> is a provocative study of the State of The Tyrol in Austria taking the scenario of the whole federal state being seen as one city (<i>TyrolCity</i>). The study investigates what this paradigm change would mean for planning for an area that has a traditional self-understanding as an 'Alpine rural landscape idyll'. The authors conclude that large parts of the Tyrol are a territories-in-between.
Sprawl	For an overview of definitions see (Bruegmann, 2005)	There are manifold definitions of sprawl, in this article the following is used: sprawl is a land development pattern that spreads residential units over a large area . . . sprawl also encompasses the separation of residential from commercial land uses, the absence of clustered development of town centres, and reliance on the automobile (Dreier, Mollenkopf, & Swanstrom, 2004, p. 59).
Peri-Urban	France Le Jeannic and Vidalenc (1997) EU Piorr et al. (2011)	The term Peri-urban is from French origin, and is used in to identify the wide territory of urban diffusion around urban centres. Only recently, it entered the planning discussion within the EU, primarily through the PLUREL project, which defines peri-urban areas as discontinuous built development, containing settlements of less than 20,000, with an average density of at least 40 persons per km ² . Together with the urban and the rural hinterland they form the rural-urban region

Some approaches remain firmly rooted in the idea of an urban–rural dichotomy, explaining territories-in-between in terms of a gradient of urban to rural or vice versa. They concentrate heavily on characterising territory based on resident population density. Prominent in this category is the notion of urban sprawl. Sprawl is characterised as low-density urban dispersion with segregation of employment and residential development. It is associated with very negative views of urban development including in particular, high car dependency and major traffic infrastructure such as highways and extensive car parking. Galster et al. (2001: 681–682) set out the limitations of this approach. From a European perspective Couch et al. understand ‘sprawl, not as a pattern of urbanisation, as it is more common in the literature, but rather as a process of urban change’ (2007: 4). This is a first step towards understanding territories-in-between as more than just the intensification of urban uses in the rural.

Similarly, the approach coined in terms of urban–rural relations reinforces the urban–rural dichotomy. The notion has been particularly popular in European policy studies to draw attention to urban–rural interrelationships in a context of dominance of urban policy (Dühr, Colomb, & Nadin, 2010; Zonneveld & Stead, 2007). Although the concept is based on a dynamic understanding of urban–rural relations, research is mainly focused on redefining what the two ‘opposites’ ‘urban’ and ‘rural’ mean and thus is not helpful in understanding ‘the in-between’, although it has helped to undermine the separation of urban and rural policy. Concerning spatial characteristics, the focus is very much on flows, the exchange of people and goods, and therefore, the importance of transport and other infrastructure. This is taken forward into the analysis below.

The idea of territories-in-between being a distinctive form of territory was introduced by Jean Gottmann in his 1957 study of the Boston–Washington metropolitan region. He described this as the “BosWash” – Megalopolis – the outcome of poly-nuclear urban growth in urban and suburban areas along a 600-mile axis between the cities. Subsequently, the significance of Gottman’s megalopolis concept to be ‘a blurring of the distinction between urban and rural areas, it gave an impetus to a vast array of studies on both sides of the Atlantic which focused on how to delineate urban and metropolitan areas’ (Zonneveld in Caves, 2005). Gottman was arguing that the BosWash represented a fundamentally different form of socio-spatial organisation. Later, Castells (2010: 2739) was to reinforce this argument in relation to metropolitan regions across the world:

the metropolitan region is not just a spatial form of unprecedented size in terms of concentration of population and activities. It is a new form because it includes in the same spatial unit urbanised areas and agricultural land, open space and highly dense residential areas: there are multiple cities in a discontinuous countryside. It is a multi-centred metropolis that does not correspond to the traditional separation between central cities and their suburbs.

The ‘new form’ of spatial organisation that Castells refers to has been shown to exist beyond the major metropolitan regions of Europe into the Alpine valleys (Andexlinger et al., 2005; Dessemontet, Kaufmann, & Jemelin, 2010) and along the Mediterranean coast line (Viganò, 2001).

Numerous studies have undertaken analysis of this new form of territory from various disciplinary perspectives including geography, environmental and spatial planning, and urbanism (Andexlinger et al., 2005; Barman-Krämer, Brandl, Unruh, Magnago Lampugnani, & Noell, 2007; Campi et al., 2000; Couch, Leontidou, & Gerhard, 2007; Frijters et al., 2004; Gallent et al., 2004; Oswald, Baccini, & Michaeli, 2003; Secchi, 1991; Sieverts & Bölling, 2004; Sieverts, 2001; Viganò, 2001; Woods, 2009). They have broadened their characterisation beyond population density to examine three main spatial qualities:

- the morphology of mixed built and open spaces;
- the connecting and separating role of infrastructure at different scales; and
- the specific mix of functions at the regional scale.

The findings for each variable are presented in the following sections.

3.3.1 The morphology of built and open spaces

In relation to morphology, inherent in all of the studies is an understanding of the ‘urban landscape as a large interlocking system rather than as set of discrete cities surrounded by countryside’ (Bruegmann, 2005: 277). This interlocking system is characterised by an *intermingling of built and unbuilt* where ‘the sharp distinction between city and countryside has dissolved into an ecological and cultural continuum of a built structure between city and landscape’ (Huhlmann & Promski, 2007). Unbuilt or open land becomes according to Viganò (2001) a critical feature for planning and designing in metropolitan regions. Planning approaches such as, landscape urbanism, green infrastructure and eco system services have all in common that they approach the relation between built and unbuilt from the perspective of the open space.

For some authors this distinctive morphology also has a cultural component. In explaining his concept of the *Zwischenstadt*, Sieverts uses examples such as the *Regionalpark Rhein-Main* and the *IBA Emscherpark* (International Bauausstellung Emscherpark). The latter was a ten year long regeneration and redevelopment project in the German Ruhr area which aimed to demonstrate the potential to (re)develop a landscape based on its topography and history in mining and heavy industry leading to a kind of continuum of ‘*Stadt- Kultur-Landschaft*’, city-cultural-landscape. Another example is the *Glatttal*, a term coined by Barman-Krämer et al. (2007). It emphasises the importance of a landscape feature, namely the river valley of the Glatt as a structural element to create a unifying ‘identity’ for the ‘peripheral’ region in the north Zurich.

Both examples, the *Glatttal* as well as *IBA Emscherpark*, show how the specific morphology of a territory-in-between influenced the planning approaches and instruments in a specific area.

3.3.2 The connecting and separating role of infrastructure

The second common character of the literature on territories-in-between is *infrastructure*, and its role in creating a distinctive spatial organisation. Infrastructure includes primarily transport and traffic infrastructure, but also services such as power plants and water treatment facilities. For Viganò infrastructure plays a crucial role for the concept of a porous territory, but infrastructure in her view is not just big traffic infrastructure like highways and railways, which she calls tubes, but also the dense network of secondary roads (and other connections) which she calls the sponge. The structure of a diffuse territory needs to be understood through its infrastructure: ‘where dispersion of settlement has reached serious proportions and caused the formation of an enormous extended city, the extension of the road network and, generally speaking, the network of infrastructure also plays a primary role’ (Viganò, 2001: 27).

There is a common understanding that infrastructure plays different roles at the local and regional scales. At the local scale infrastructure divides the territory, physically separating adjacent land uses. At the regional scale infrastructure has a connecting role – linking places and functions.

The outcome for territories-in-between is that they are a network of distant but functionally connected areas at the regional scale, and a patchwork of proximate but functionally disconnected areas at the local scale. In other words, adjacent land uses may not have any spatial or functional interconnection, whereas there are closer socio-economic functional relations between areas that are not in the same local area. The result is often a seemingly monofunctional landscape at the local level but a surprising mix of functions at the regional scale.

3.3.3 The specific mix of functions at the regional scale

Gallent et al. (2004: 227) argue that multi-functionality is a key issue in spatial structure: 'working out how the built environment can be sustainable often leads to the conclusion that the way forward is to lessen the impact of the existing built form by enabling it to perform other desirable objectives'. But already a closer look at territories-in-between shows that, despite the dominant view, these areas are not monofunctional sleeping suburbs or simply areas only occupied by transport and logistics uses but exhibit a complex mix of functions. Particularly from a regional perspective the mix of uses often results in a surprisingly high level of functional diversity. For example, as the analysis of two test cases in the following sections will show, territories-in-between are often characterised by a ratio of 0.5 jobs per residents. This is a slightly higher ratio than in the urban areas of South-Holland (0.4) and also higher than the ratio in rural areas in the Tyrol (0.25). This shows also that calling TiB sprawl would be extremely misleading as the latter is characterised as nearly mono-functional residential.

In addition to the three main spatial qualities, the literature also indicates a fourth common concern, the relationship between spatial characteristics of territories-in-between and public policy, particularly spatial planning. In general, there is a view that existing design and planning tools and policies are inadequate to address the conditions and drivers of spatial development in territories-in-between (Andexlinger et al., 2005; Frijters et al., 2004; MCRIT, 2010). For example, authors agree that networks of infrastructure result from both top-down planning and bottom-up pressures, which interact and often conflict in the same area. This interaction may lead to informal responses with a high level of self-organisation, often in loopholes of regulations, which do not reflect the demands of people living and working there. The examination of planning policy for territories-in-between is beyond the scope of this paper, though the argument for the analysis set out here and the intention to provide a more accurate characterisation of territories-in-between is motivated by the need for a better relationship between policy and the reality of spatial development in territories-in-between.

To summarise, numerous studies have demonstrated specific characteristics of territories-in-between, and argued that they constitute a specific variable form of spatial structure that is distinctive from urban and rural classes of territory. The studies draw attention to three interrelated variables or spatial characteristics that distinguish them from urban and rural areas: the intermingling of built and unbuilt or open land; the importance of infrastructure in defining spatial organisation, and the varying mix of functions at local and regional scales. Planning policy has not generally recognised the distinctive character of territories-in-between. The next section explains how much policy has been based on classifications of the territory that characterise territories-in-between only in degrees of urban or rural.

3.4 A critical review of urban and rural classifications

There are four principal forms of characterising and classifying the spatial structure of the territory. Here we critically review these four approaches with references to typologies of territory used in Europe and elsewhere.

3.4.1 Population density-based classifications

The most well-known and globally used typology is the Organisation for Economic Cooperation and Development's (OECD) regional typology.

Regions of OECD member countries have been classified into Predominantly Urban, Intermediate and Predominantly Rural to take into account geographical differences among them. Comparing the socio-economic performance of regions of the same type (whether urban or rural) across countries is useful in detecting similar characteristics and development paths.

(OECD Directorate for Public Governance and Territorial Development 2010: 2)

Like other urban–rural typologies the OECD approach is based on thresholds of population density within a specific spatial entity as the organising factor. The OECD method first classifies local administrative units (LUAs) (mostly municipalities) with a population density below 150 inhabitants per square kilometre as rural. In a second step, these lower level units are aggregated to higher administrative levels (TL3). Classifying the latter as:

- predominantly urban (PU), if the share of the population living in rural local units is below 15%;
- intermediate (IN), if the share of population living in rural local units is between 15% and 50%;
- predominantly rural (PR), if the share of population living in rural local units is higher than 50%.

In a final step the predominantly rural units according to steps 1 and 2 are reclassified to intermediate where they contain an urban centre of more than 200,000 inhabitants. Similarly predominantly intermediate areas are reclassified to predominantly urban areas if they contain an urban centre of more than 500,000 inhabitants. In both cases this only applies if the population of the urban centre is representing at least 25 per cent of the regional population. It is important to mention that the OECD defines urban centres 'by population density and size, not by functional criteria such as commuting' (OECD, 2010: 3).

Newer typologies like the new European Union (EU) typology of 'predominantly rural', 'intermediate' or 'predominantly urban' regions use population data based on a spatial grid (1 km 1 km). This approach was intended to overcome difficulties with using administrative boundaries that led to distorted results.

The first distortion is due to the large variation in the area of local administrative units level. The second distortion is due to the large variation in the surface area of NUTS 3 regions and the practice in some countries to separate a (small) city centre from the surrounding region. (EUROSTAT, 2012)

Eurostat also provides examples for such distortions. 'For example, Aldea de Trujillo in Spain is classified as urban despite having a population of only 439 inhabitants' or 'Badajoz and Cáceres in Spain and Uppsala in Sweden are classified as rural despite all three having a population of 150,000 or more' (EUROSTAT, 2012).

To avoid this distortion Eurostat adjusted the OECD methodology starting from the urban rather than rural, namely every 1 km² grid cell that has more than 300 inhabitants within its boundaries as well as more than 5000 in the boundaries of the eight grid cells from its centre. All other grid cells are considered rural.

To achieve a classification at the regional scale the values of the grid cells are aggregated to the NUTS 3 level, using the same threshold of the share of rural population (50%) for the division between predominantly rural and predominantly intermediate as used by the OECD. The border between predominantly intermediate and predominantly urban was changed to a share of 20% of the population living in rural grid cells. This change is argued by EUROSTAT (2012) 'to ensure that the population share in predominantly urban regions does not differ too much from the original OECD classification applied to NUTS 3 regions'. It is worth noting here that without this adaptation most of Europe would be classified as intermediate.

3.4.2 Land cover based classifications

The *Coordination of Information on the Environment Project* or CORINE uses remote sensing methods to monitor and assess land cover changes in Europe to support policy making. The CORINE land cover classification – maintained by the European Environment Agency – is not an urban–rural classification per se, but was used to define and map urban morphological zones (UMZs) (EEA, 2011). UMZs are defined as built-up areas lying less than 200 m apart. They are primarily made up of four CORINE land cover classes.

- 'Continuous urban fabric' comprises buildings, roads and artificially surfaced area covering almost all ground; non-linear areas of vegetation and bare soil are exceptional.
- 'Discontinuous urban fabric' comprises buildings, roads and artificially surfaced areas with vegetation and bare soil occupying discontinuous but significant surfaces.
- 'Industrial or commercial units' primarily comprise artificial surfaces (concrete, asphalt) devoid of vegetation but also contain buildings and/or vegetated areas.
- 'Green urban areas' are patches of vegetation within the urban fabric including parks and cemeteries with vegetation.

In addition, port areas, airports, and sport and leisure facilities are included within UMZs if they are adjacent to these four land cover classes. Road and rail networks and water courses are considered part of a UMZ if they are located within 300 m. Forest and scrub areas belong to the UMZ if they are completely encircled by one or more of the four core classes.

The CORINE methodology has on the one hand the advantage that it allows for a division between urban and rural at a very precise resolution of 100 m, taking into account geographic and topographic features. On the other hand, it has the disadvantage that the same urban land cover may host very different intensities of urban use. For example a big villa style single family house which hosts four persons could have the same land cover as a housing tower block being home to many more people.

A combination of land cover and population density-based classifications

The EU project on *Peri-urban Land Use Relationships – Strategies and Sustainability Assessment Tools for Urban–Rural Linkages* (PLUREL) defines peri-urban areas as ‘discontinuous built development, containing settlements of less than 20,000, with an average density of at least 40 persons per km² (averaged over 1 km² cells)’ (Piorr, Ravetz, & Tosics, 2011: 10). Together with the urban area (continuous urban areas and cities with over 20,000 population) and the rural hinterland (less than 40 inhabitants per square metre) they form the rural–urban region (Piorr et al., 2011: 25). The PLUREL synthesis report presents this graphically as a gradient from urban core to rural. Nevertheless the report also points out that, ‘in the polycentric version, the peri-urban areas do not only surround the urban, they are also a geographical type and territory unto their own’, and that ‘the reality on the ground is often complex and fast changing’ (Piorr et al., 2011: 25). This is an important starting point for the following discussion on territories-in-between, as it raises other questions about whether territories-in-between emerge outside or around urban centres, or if they emerge without them, or even within them.

This discussion of urban–rural territorial classification methods leads to a number of conclusions for the task of putting territories- in-between on the map so as to inform regional planning. First, an accuracy similar to that used in the UMZs should be achieved. Second, a combination of land use and population density seems more promising than using only one of these variables, as one and the same land use unit may be inhabited by widely varying numbers of people. Third, a classification of territories-in-between should include aspects that recognise functional relations between different areas.

3.4.4 Comparing US and EU classifications

The United States Census Bureau used for its 2010 Urban and Rural Classification a combination of resident density and adjacent non-residential urban land uses. Of specific interest is the territorial classification unit that is used: the census block, which is neither a regular grid nor an administrative jurisdiction, but bounded by streets, roads or creeks. The result is that in cities, infrastructure networks define a census block, but in rural areas with fewer roads, other features, like rivers, may limit blocks. The area and population of census blocks varies greatly. The US Census Bureau (2013) differentiates between urbanised areas (UAs) of 50,000 or more people, and urban clusters (UCs) of at least 2500 and less than 50,000 people while all other areas are considered rural.

It is particular interest to note that only nine and a half percent of the US population lives in UCs (CENSUS, 2010), whereas in Europe, depending on the definition, up to 50% of the population lives in territories-in-between (Piorr et al., 2011). This highlights a major difference between cities in Europe and the US, namely the relatively large proportion of the European population living in small and medium-sized cities and the stability of this pattern over time. Le Galès and Zagrodzki (2010: 11) summarise the factors that distinguish European spatial structure from that in the United States.

Europe is characterized firstly by its very large number of cities and their marked proximity to one another: secondly, by the fact that the major cities of Europe are not huge: large metropolises with a population of over two or three million are rare, and ‘if one compares the total number of urban areas of over 200,000, the average size is of the order of 800,000 in Europe, as against 1.3 million

in the United States and Japan . . . and thirdly, by the relative importance of small and medium-sized cities: Europe distinguishes itself by its relatively large number of urban areas of between 200,000 and one or two million.

They also hint that, at least until recently, suburbs grew in the US, while city centres lost inhabitants, whereas in Europe small and medium sized cities both the centre as well as in the periphery have grown. In the US the urban pattern is related with sprawl, in the sense of low density, car dependent, monofunctional residential development. In Europe, the urban pattern has followed the form of territories-in-between, mixed open and urban land of varying density, intersected by infrastructure including public transport. In Europe urban development has tended to be less monofunctional with mixed uses, especially at the regional scale. The distinction is valid for typical development, although we should beware over-generalisation because some older suburbs in the States also have a more complex configuration as in Europe (Bruegmann, 2005; Fishman, 1990; Mikelbank, 2004).

3.5 Putting different forms of territories-in-between on the map

This section explains how we translated the characteristics of territories-in-between described above, into operational properties (or proxies) used to measure and map, using commonly available data sets in a geographical information system (GIS). The data sets were chosen because their availability allows for relatively uniform application across different countries, and the approach can be repeated and replicability tested rather easily by other researchers. Formerly comparison of territories-in-between has relied on more qualitative verbal description than quantitative analysis. The approach adopted here continues to incorporate a qualitative analysis of the character of the areas but the underlying spatial analysis provides a much more solid base to examine their actual characteristics and make international comparisons.

3.5.1 Mapping territories-in-between in the Tyrol and South-Holland

For the task of mapping characteristics of territory the size of the spatial unit or entity is very important. In previous research (Wandl, 2010, masked for blind review) has shown that a 500 m 500 m grid delivers the most useful results. Thereafter, different analyses and geoprocessing tools of the commercial GIS software ArcGis were used to combine the selected spatial characteristics to map the location of territories-in-between in the two test areas. The result of the GIS mapping was then confronted with observations made in the field and with aerial images obtained from Google Earth in order to evaluate whether the areas selected do have the spatial properties described in the literature.

One important lesson from the review above is that for territories-in-between functions like shopping malls or distribution centres often located in these areas, would be considered 'rural' in the traditional territorial typologies, as the resident population is usually around zero or at least very low. This is also true for other parts of territories-in-between that may exhibit important

urban functions but where people work or spend their leisure time, and where there is very small resident population. In other words, if the living population is considered as the only demographic factor, certain areas with function that are typically located in territories-in-between, would be ignored. Therefore, the method explained here includes the working population as an additional demographic factor (as explained below) and together with the resident population adds up to what we call the 'maximum population'. We are aware that this may entail counting the working population twice, once as residents and once as employees in those cases where people live and work in the same unit. Nevertheless, until we have reliable and large-scale dynamic census, this is the easiest and most reliable way to cover the spatial dynamics in Territories-in-between.

In summary, the spatial selection method can be described in the following four steps, which are also illustrated in FIG. 3.2:

- 1 dividing the area of interest into 500 m 500 m grid cells;
- 2 selecting those grid cells with a maximum population density that is characteristic for territories-in-between;
- 3 adding those grid cells with a maximum rural population that spatially overlap with typical infrastructures and services;
- 4 subtracting those grid cells with a territories-in-between corresponding maximum population that are not characterised by the intermingling of built and open landscape pattern.
- 5 The thresholds for the single steps are explained in the following section.

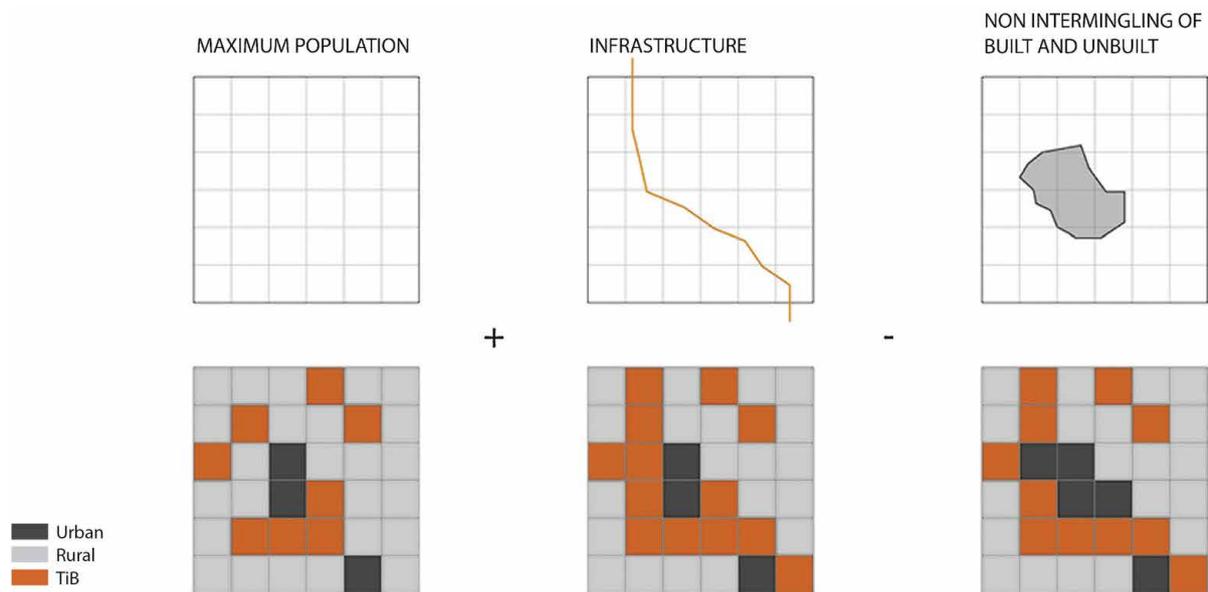


FIG. 3.2 The four steps in mapping territories-in-between. First, the area of interest is divided into a 500 m × 500 m grid. Second, the maximum population density is calculated for every grid cell. Third, rural grid cells that contain infrastructure are added to the territories-in-between grid cells. Fourth, grid cells that have no intermingling of the built and unbuilt environment are subtracted from the territories-in-between.

3.5.2 Defining the thresholds of territories-in-between

Maximum population density

As described above, using only the residential aspect of the population would exclude areas that are considered as territories- in-between. In an ideal case the working population as well as the number of tourists and secondary home 'residents' would be added as spatial selection criteria, but data on these aspects is either not available at all, or not available in sufficient detail. Therefore, the sum of the number of inhabitants and the number of jobs per km² was used as the first selection criteria, and referred to as maximum population density.

For the Tyrol both numbers were available on a 250 m 250 m grid basis and were aggregated into a 500 m 500 m grid. In South- Holland both numbers were available per six digit postal code, which is as small as a block in bigger cities and parts of a street in towns and villages. They were also aggregated to the 500 m 500 m grid. As there was no existing classification method available a deductive and iterative approach using spatial queries, fieldwork and the interpretation of aerial pictures led to the definition of the thresholds. For the delimitation of the territories-in-between to the rural (the lower threshold of maximum population) the Tyrol was used as the primary case as it can be considered as the more rural one; whereas to distinguish the territories-in-between from the dense urban areas (the higher threshold) the case of South-Holland was used as it is the more urbanised one. Both values were then applied to the other case and their validity tested.

Separating territories-in-between from the rural

FIG. 3.3 shows how different maximum population densities relate to urbanisation patterns in the Tyrol. The image shows three typical steps of the urbanisation process in the Tyrol. Starting from a single farm (1) to a farm with additional single family houses originally used by the families who did not inherit the farm in the main (2) and finally a settlement pattern with farm, single family houses and other additional uses (3). In the latter case, multi-story housing or other building forms of a rather urban kind can be found. The in-between may include types 2 and 3 but not type 1. Therefore, the lower limit of territories-in-between to rural was defined with a maximum population density of 150 persons/km², which is equal to a maximum population density of 37.5 persons in a 500 m × 500 m.



FIG. 3.3 Overlay of different urbanisation patterns and the maximum population density in the Tyrol on the left and South-Holland on the right. Background image: Bing Maps aerial imagery, data Sources: TIRIS; Province Zuid-Holland.

Separating territories-in-between from the urban

The case of South-Holland is used to define the upper limit of the maximum population density threshold. South-Holland is for this exercise a specifically interesting case because, there is no land in Holland which is classified as contiguous urban fabric in the sense of the CORINE land cover classification, although it is very densely inhabited. This means that a land cover based distinction between urban and the in-between is not possible. This also means that a certain intermingling of built and open land uses is present over the entire area.

FIG. 3.3 presents different ranges of maximum population density in a part of South-Holland and shows that a maximum of 5000 people/km² or 1250 persons per 500 m 500 m, describes very well the low rise urban edges around the cities, as well as areas with 'big box development' and vast greenhouse areas, which are a specific form of territory in this region.

The resulting spatial selection shows that at this stage most of the areas with the spatial properties of territories-in-between are covered, but that areas with just infrastructure are omitted and parts of the cities are selected that are not characterised by an intermingling of built and unbuilt. Therefore, further adjustments using information about the location of infrastructure as well as land cover have to be added.

Infrastructure and intermingling of built and unbuilt

Regional and global transport infrastructure like motorways, train lines and airports are a characteristic feature of territories- in-between. They produce the typical duality of spatial segregation and what Graham and Marvin (2001) call premium networked spaces, i.e. areas of high global accessibility. Additionally the literature review showed that specific uses like waste and sewage treatment plants or power plants are typically situated in territories-in-between. In the two test areas, two kinds of infrastructure are particularly important. For South-Holland these are the logistics centres, like the Rotterdam seaport, and the glasshouse areas with an underlying infrastructure of gas and CO₂ pipes. In the Tyrol the tourist resorts play a similar role.

The glasshouse areas are captured in the analysis already. This is because the working population was considered in the spatial selection. For the tourist areas in the Tyrol this is true for the villages, but the large areas covered and crisscrossed by winter sport infrastructure like cable cars and snowmaking facilities are left out, though they should be considered when choosing the spatial proxies for the aspect of infrastructure.

TABLE 3.2 Overview of infrastructure and land use data sets used for analysis.

Data Set	Description	Source	Date
<i>CORINE land cover data 2006 for both cases</i>			
1.2.1	Industrial or commercial units	The European Topic Centre on Land Use and Spatial Information.	August 2011
1.2.2	Road and rail networks and associated land	The European Topic Centre on Land Use and Spatial Information.	August 2011
1.2.3	Port areas	The European Topic Centre on Land Use and Spatial Information.	August 2011
1.2.4	Airports	The European Topic Centre on Land Use and Spatial Information.	August 2011
1.3.2	Dump sites	The European Topic Centre on Land Use and Spatial Information.	August 2011

TABLE 3.2 Overview of infrastructure and land use data sets used for analysis.

Data Set	Description	Source	Date
1.4.2	Sport and leisure facilities	The European Topic Centre on Land Use and Spatial Information.	August 2011
<i>South Holland</i>			
National and regional roads	All roads that are categorised 'autosnelweg' of 'regionale weg' and are wider than 4 m	TOP 10 – Kadaster	January 2010
Railways		TOP 10 – Kadaster	January 2010
<i>The Tyrol</i>			
Railways		TIRIS	December 2009
National and main regional roads	All roads that are categorised: A, AS and LST B	TIRIS	December 2009
Skiing Areas		TIRIS	December 2009
1.1.1	Continuous urban fabric	The European Topic Centre on Land Use and Spatial Information.	August 2011

A combination of CORINE land cover data (Seamless Vector 2006) and vector data for motorways, regional roads, railways and (in the case of Tyrol) skiing resorts, provided by the planning agencies of the Tyrol and South-Holland is used to add grid cells to those already selected as territories-in-between. An overview of the datasets used is given in Table 3.2. FIG. 3.4 shows the result of the combination of maximum population and infrastructure on the selection of territories-in-between.

FIG. 3.4 shows how the inclusion of infrastructure extends the parts of the territory identified as in-between, incorporating areas like the harbour in Rotterdam and big infrastructure nodes. This factor also leads to the inclusion of the densest parts of the cities, particularly in the Tyrol. This contradicts the spatial characteristic of intermingling of built and unbuilt. Therefore, grid cells that are primarily covered with continuous urban fabric (>80% impervious land cover) following the CORINE land cover classification, need to be excluded from the selection to give a final result. FIG. 3.5 and FIG. 3.6 show the final result of the spatial selection method explained in this paper.

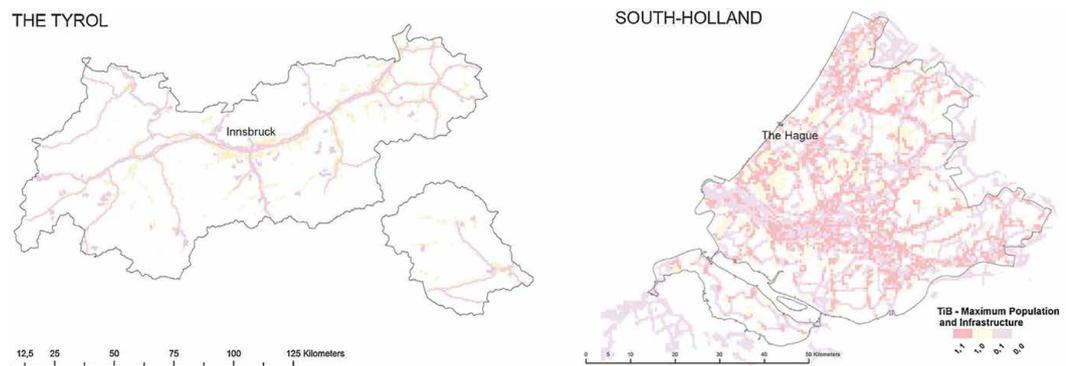


FIG. 3.4 Grid cells considered as territories-in-between in both case study areas because of either the maximum population density and/or the location of infrastructure: red cells (1,1) fulfil both aspects; yellow cells (1,0) are selected only by the aspects of infrastructure; violet cells (0,1) by the maximum population aspect.

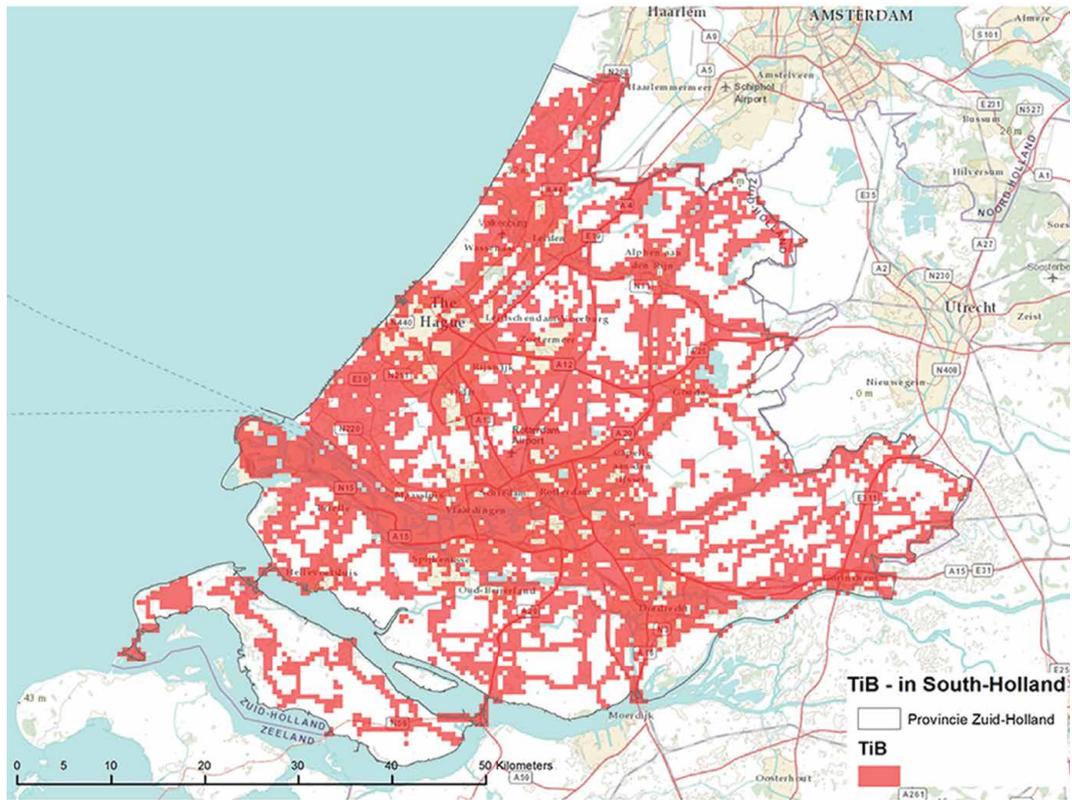


FIG. 3.5 Territories-in-between (red) in South-Holland. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.) Background image: USGS, NPS, ESRI, TANA, AND.

To summarise, the method and the developed thresholds to map the extent of territories-in-between in South-Holland and The Tyrol has followed four steps:

- 1 dividing the area into 500 m 500 m grid cells;
- 2 selecting those grid cells with a population between 38 and 1250 inhabitants per 500 m 500 m;
- 3 adding grid cells, with a rural density of maximum population density that overlap with areas of the CORINE land cover classes industrial or commercial units, port areas, airports, mineral extraction sites, waste sites, port and leisure facilities, and all major roads and railway tracks and associated land;
- 4 subtracting all cells that are classified continuous urban fabric according to the CORINE land cover classification.

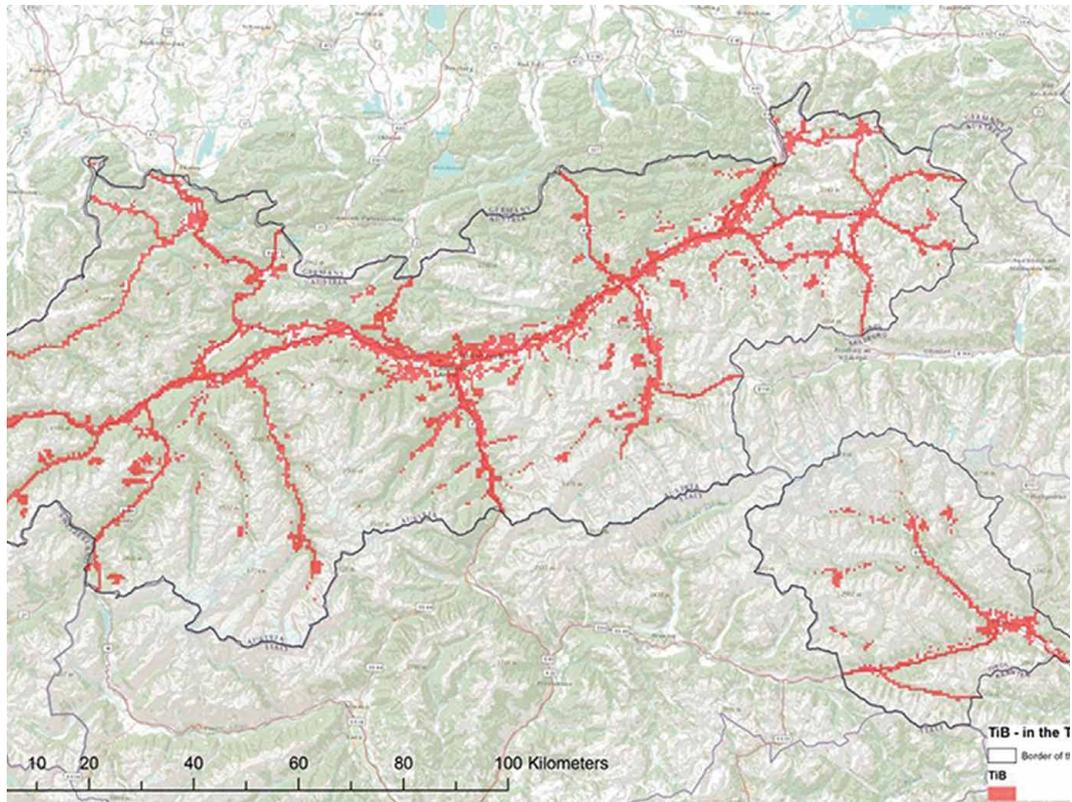


FIG. 3.6 Territories-in-between (red) in the Tyrol. Background image: USGS, NPS, ESRI, TANA, AND. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)

To illustrate the applicability of this method and the general and networked characteristics of territories-in-between more fully, it was applied to two other regions in Europe: west of Lille in France and parts of the Veneto in Italy. A map of the results is shown alongside the findings for the two test cases reported in this paper in Figure 7. To be able to apply the method to other cases across Europe two adaptations had to be made. First, instead of locally acquired data sets for the road infrastructure, open street map data was used. Cross-checking results in the field showed that the open street map data were reliable and makes no difference in the results, at least concerning the national and regional roads that were used. Second, data on the location of workplaces had to be acquired on a case- by-case basis as there are no consistent data sets on the location of workplaces. The results confirm that the method, which was developed in two extreme cases, can be applied to other locations and deliver reliable results.

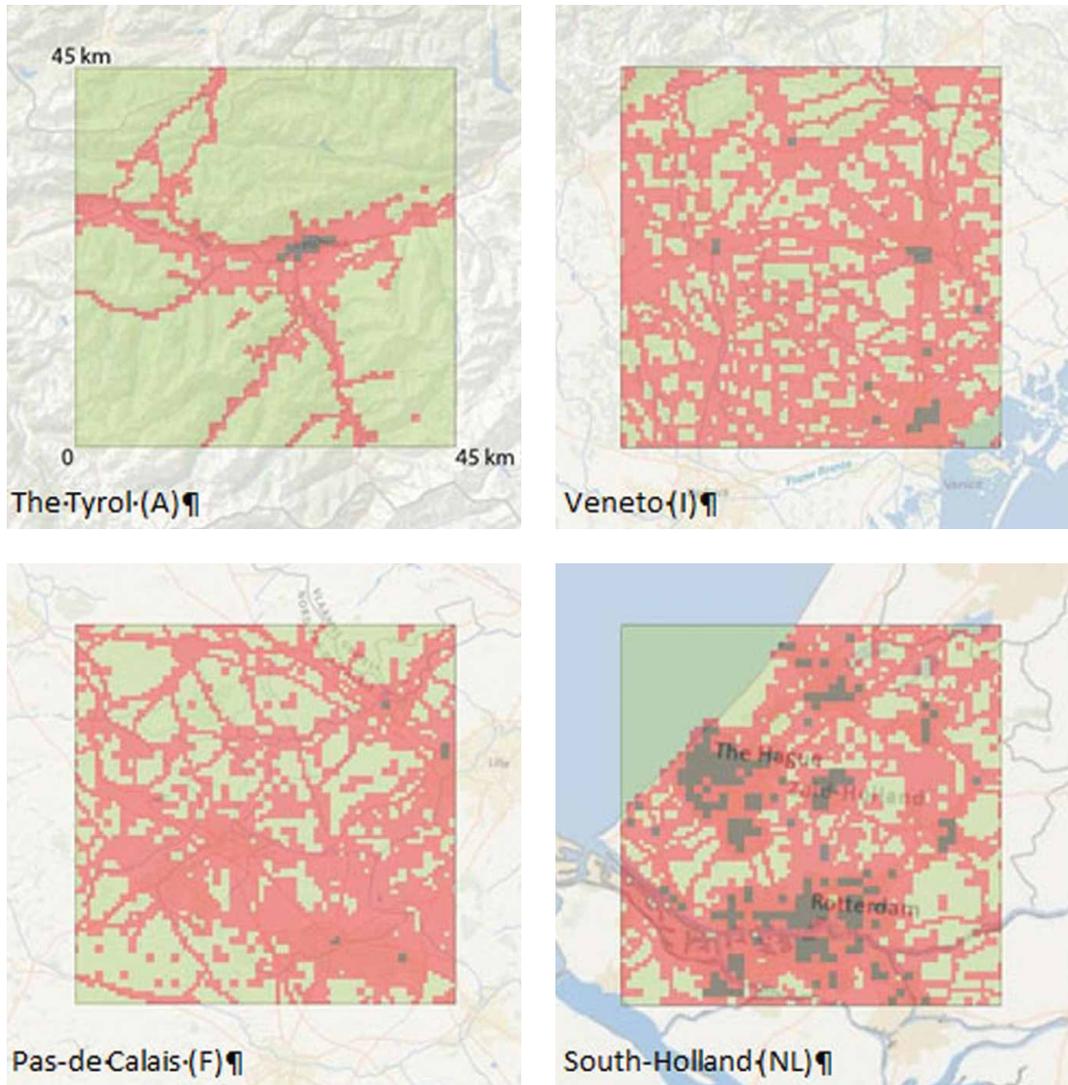


FIG. 3.7 Territories-in-between (in red): four examples in Europe: top left, parts of the Tyrol (Austria); on the bottom left-hand side, the area west of Lille (France), on the top right-hand side, parts of the Veneto (Italy) and finally on the bottom right-hand side, parts of South-Holland (The Netherlands). The green areas are rural areas, and the black areas are urban.

TABLE 3.3 Comparison of characteristics of territories-in-between and their wider regions.

Test areas	Inhabitants total	Inhabitants TiB	Jobs total	Jobs TiB	Area total in km ²	Area TiB in km ²
South-Holland	3,450,488	2,267,898 (65%)	1,433,094	1,102,561 (78%)	32,295	17,567 (54%)
The Tyrol	693,703	591,574 (85%)	292,264	241,404 (82%)	126,185	1366 (1%)

3.6 Discussion

3.6.1 The importance of territories-in-between

Having completed the analysis to define territories-in-between in the two test cases, it is possible to examine and compare the extent of these areas and their significance in their respective regions. The findings in Table 3.3 show that more than two thirds of the population live and/or work in these areas and the ratio of jobs and population is higher than outside of territories-in-between in both cases, mirroring the continuing spatial decentralisation of economic activity over recent decades.

The results broadly support that our understanding of territories-in-between. In South Holland the number of people living outside territories-in-between, both urban and rural, is very significant and equals the number of inhabitants of Rotterdam and The Hague together. Considering the low rise nature of Dutch cities and comparably large areas of open space (like parks and canals) within them, the results confirm that the decision to start the selection with a demographic aspect was appropriate. It ensures that the city centres of The Hague and Delft for example are excluded. This would not have been the case if the land cover category 'discontinuous urban' was chosen as a starting point.

The spatial selection also shows areas that are characterised by an intermingling of built and unbuilt which on the one hand excludes the larger parts of primarily agricultural areas within the Den Haag–Rotterdam metropolitan area in South-Holland; while on the other, includes the rather small green 'left-over spaces' within the alpine valleys in the Tyrol.

However, the most striking part of the mapping exercise is that in both cases the resulting image is one of a network or web of territories-in-between. This reflects their relational nature where, as explained in the literature (inter)connections are more relevant than spatial proximities.

3.6.2 Evaluation of the proposed classification

In this section we compare our approach with the urban–rural classification methods presented in Section 4 and discuss advantages as well as disadvantages. In the OECD classification the central part of the Tyrol, which includes the state capital Innsbruck, is classified as intermediate, while the rest of the state is classified as rural. South-Holland is completely classified as predominantly urban. The only difference in the new EEA urban–rural typology is that the central part of the Tyrol is classified as predominantly urban.

The method proposed in this paper gives a more detailed analysis and mapping, as the results are not aggregated to NUTS 3 level. It therefore describes the complex pattern of urban, rural and in-between areas much more clearly. We argue that this reflects the reality of urbanisation patterns in the test areas far more accurately than other methods. For example, the Inn-valley in the Tyrol can be described as a ribbon city, including parts of densely built-up and populated Innsbruck and other towns, but intermingling with agricultural land and other open spaces. The same is true for the urbanisation pattern of South Holland that exhibits a complex intermingling of built and open land. Both the OECD and the EU classifications do not represent these patterns well, instead they show either sharp transitions from urban to rural, as in the Tyrol, or define the whole area as urban, as in South Holland.

TERRITORIES-IN-BETWEEN



URBAN-MORPHOLOGICAL ZONES

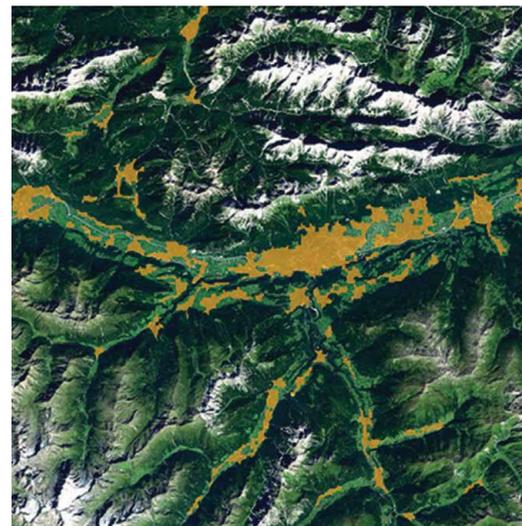
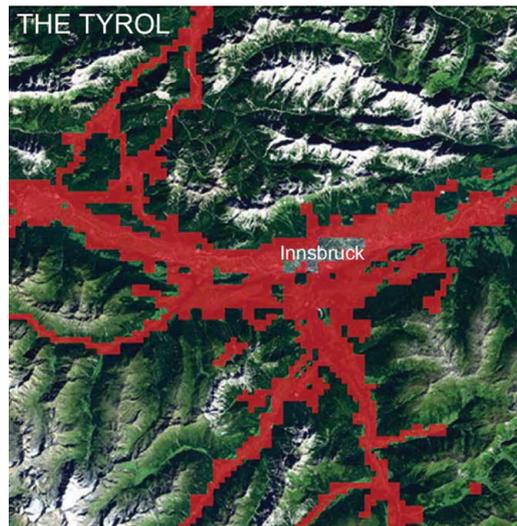
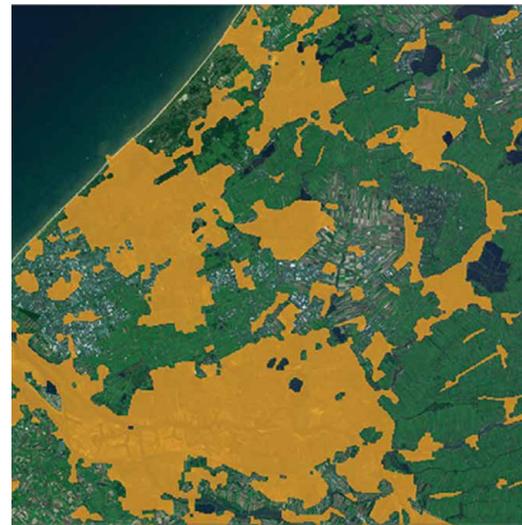


FIG. 3.8 A comparison of the territories-in-between classification (left) and the UMZ classification (right) in a 45 km per 45 km square showing the most densely inhabited areas in both cases.

South-Holland was also used as a case study in the PLUREL project which developed a more sophisticated and detailed method than the OECD one. The comparison of the map in the synthesis report (Pirr et al., 2011: 28) with our classification shows two major differences. First our classification shows a softer edge between urban areas and territories-in-between, while also acknowledging that territories-in-between can be found within cities. The second major difference is that large parts of the harbour of Rotterdam are classified by the PLUREL approach as rural, whereas we classify these areas as territories-in-between.

The first difference may be explained by a diverging understanding of the structure of urbanised areas. Apparently, the understanding of peri-urban as a result of an urban centre to edge gradient was dominant within PLUREL. The second difference could be either a result of using old or limited sets of land use data, or resulting from the fact that the working population is not included in the PLUREL method. Both points indicate that the proposed classification method here has advantages.

The urban morphological zones (UMZs) derived from the CORINE land cover mapping do not share the disadvantage of aggregation to large administrative areas. Therefore, a closer look at difference, between the UMZ and the proposed method presented here is shown in FIG. 3.8. The figure demonstrates that the inclusion of infrastructure offers significant benefits. The presence of infrastructure is clearly a driving force of both urban development patterns and the daily routines of life within territories-in-between. This relational aspect provides a glue-like function for spatial development of metropolitan regions and therefore is crucial to the analysis.

3.7 Conclusions

We started with the aim to develop a new territorial classification method, and in particular to unravel the complex relation between urban and rural in territories-in-between. We have shown that by using a combination of publicly available data on resident and working population, CORINE land cover and infrastructure, we can separate territories-in-between from urban and rural areas with logical outcomes. The maps resulting from the classification method show the relational nature of many territories-in-between, i.e. the strong linkages of urbanisation with infrastructure.

In conclusion we argue that the methods of the dominant territorial classifications have significant disadvantages, particularly in defining areas of great importance for Europe's contemporary spatial development, the territories-in-between. The aggregation to NUTS 3 level may be convenient for administrations but it results in gross overgeneralisation, and does not consider detailed topographic aspects. The higher grade of detail makes the new selection method better suited to map, understand and therefore, to undertake planning and design tasks in territories-in-between. Urban development patterns are increasingly characterised by places that are neither urban nor rural but 'in-between'. Current territorial typologies tend to be limited to shades of urban and rural that do not reflect the reality of urban development and are thus less useful in explaining the nature of spatial development and supporting spatial planning policy and action. A method of defining types of territory is needed that reflects the actual complex morphology of built and unbuilt land, mix of functions, and the connecting and separating effects of infrastructure. The method reported here is a first attempt to meet that objective. The testing of the method suggests that this general approach can be more widely applied and has three advantages in making a typology of the territory: (i) it maps the complexity of the spatial structure of urbanised areas on a regional scale, and thereby helps to overcome the prevalent idea that urbanised regions are characterised by a spatial gradient from urban centre(s) to rural periphery; (ii) it emphasises the network structure of territories-in-between and the underlying connectivity of places with different functions and intensities; and (iii) it raises awareness that in some parts of Europe a settlement pattern has developed that cannot be understood as either urban or rural.

3.8 Atlas of territories-in-between – Part B: Characteristics of TiB

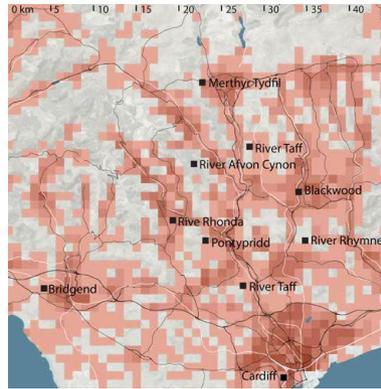
This part of the atlas of territories-in-between contains five thumbnail double-pages:

- 1 A land cover map to understand the landscape and urbanisation pattern in the case study areas.
- 2 The population density to provide a basic understanding of the distribution of the residential population.
- 3 The location and size of companies to provide an understanding of the type of economy and the spatial distribution of the working population.
- 4 Mobility infrastructure to present the different types, mesh sizes and spatial distribution of different kinds of transportation infrastructure.
- 5 The areas classified as territories-in-between, with an overlay of buildings and transport infrastructure.

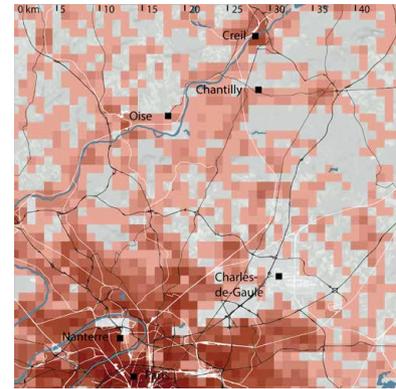
RESIDENTIAL POPULATION DENSITY

Number of Inhabitants (2006)

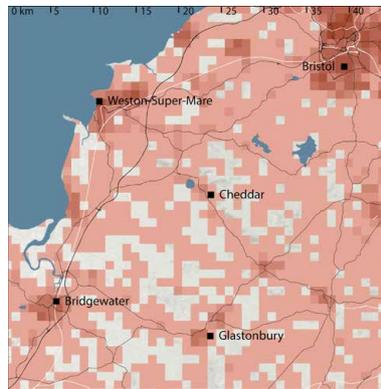
- 1 - 400
- 401 - 1150
- 1150 - 2200
- 2201 - 3500
- 3501 - 5000
- 5001 - 7500
- 7501 - 11000
- 11001 - 17500
- 17501 - 28000
- > 28001



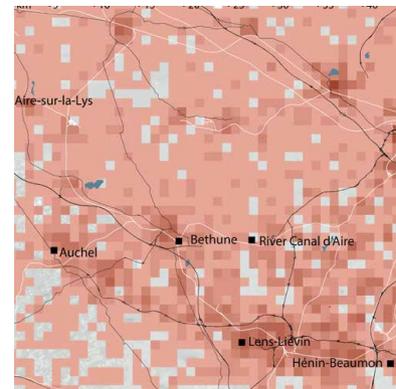
1 South Wales



2 Île-de-France

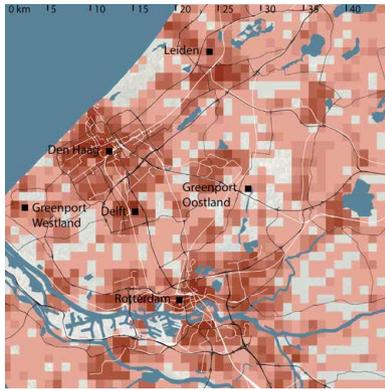


6 North Somerset

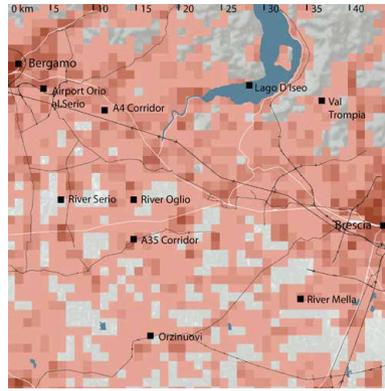


7 Pas-de-Calais

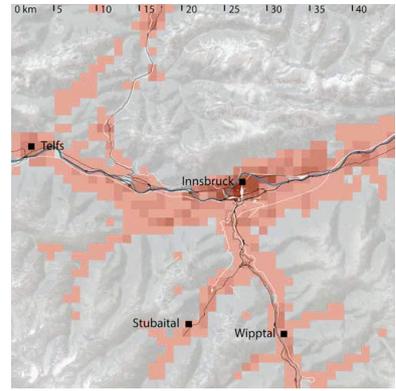
FIG. 3.9 The thumbnails show the population density per square kilometre, which together with the density of the working population was used to map TiB. Data Source: Eurostat GEOSTAT_Grid_POP_2006.



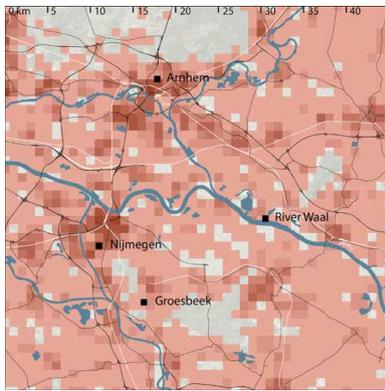
3 South-Holland



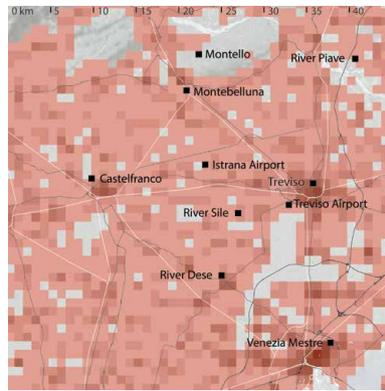
4 Bergamo-Brescia



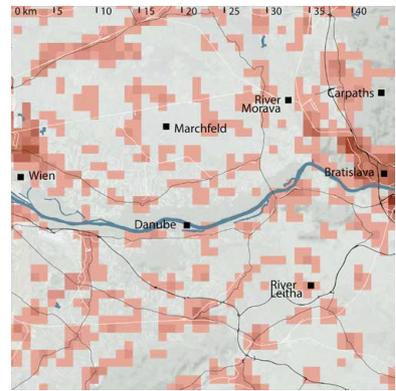
5 The Tyrol



8 Gelderland



9 Veneto

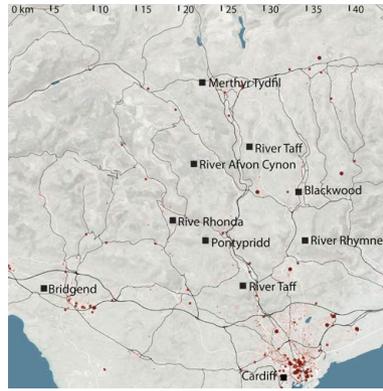


10 Vienna-Bratislava

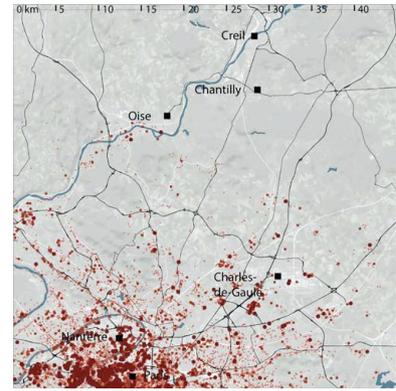
COMPANIES

Location and Size of Companies

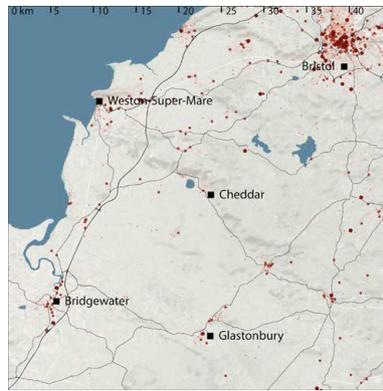
- Small
- Medium
- Large
- Very Large



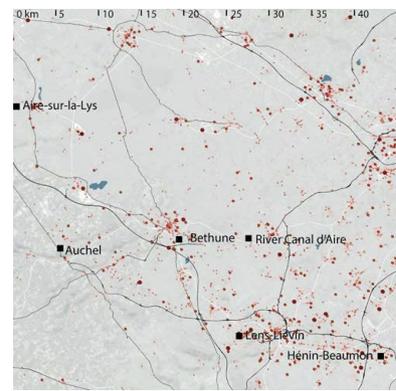
1 South Wales



2 Île-de-France

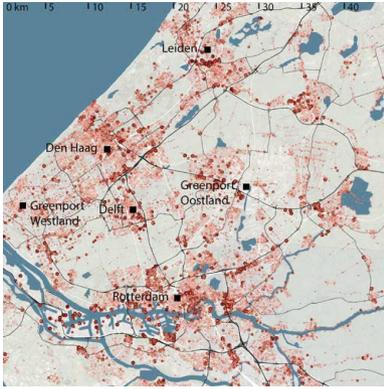


6 North Somerset

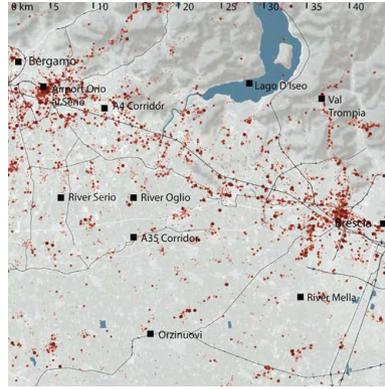


7 Pas-de-Calais

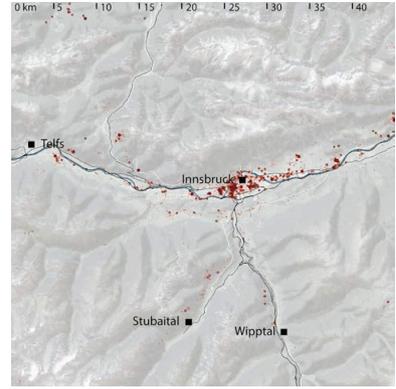
FIG. 3.10 The thumbnails show the distribution and the size of the companies, which were used to estimate the working population together with the density of the residential population to map the TiB. Data source: Bureau van Dijk, Amadeus Database 2014.



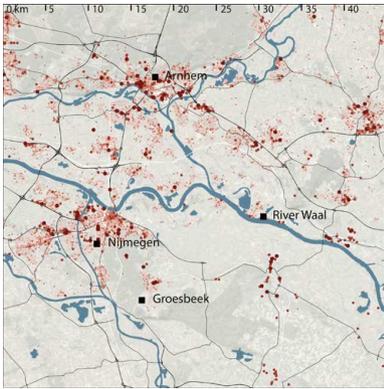
3 South-Holland



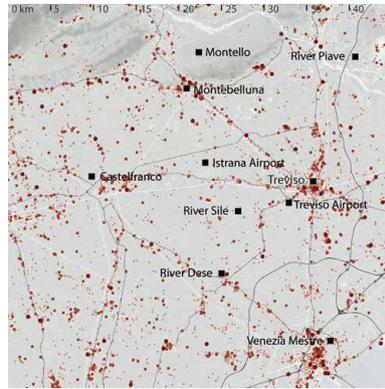
4 Bergamo-Brescia



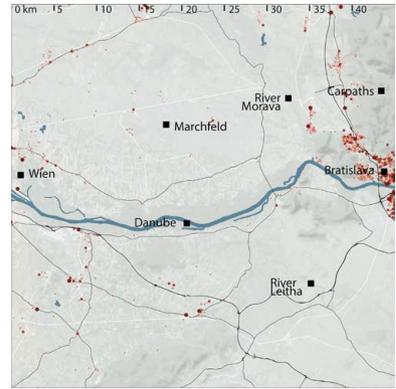
5 The Tyrol



8 Gelderland



9 Veneto

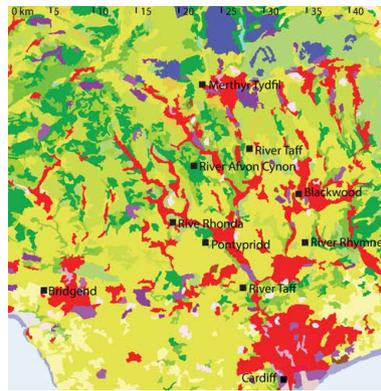


10 Vienna-Bratislava

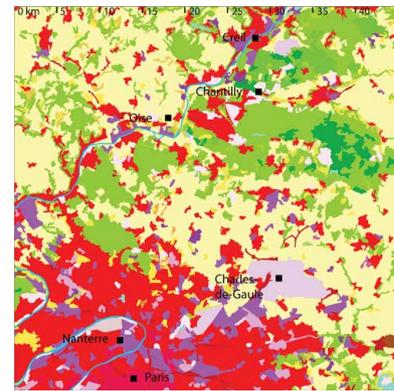
LAND COVER

Corine Land Cover

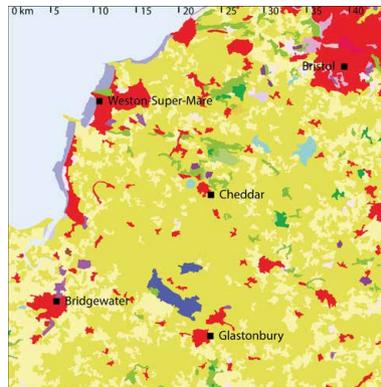
- 111: Continuous urban fabric
- 112: Discontinuous urban fabric
- 121: Industrial or commercial units
- 122: Road and rail networks and associated land
- 123: Port areas
- 124: Airports
- 131: Mineral extraction sites
- 132: Dump sites
- 133: Construction sites
- 141: Green urban areas
- 142: Sport and leisure facilities
- 211: Non-irrigated arable land
- 212: Permanently irrigated land
- 213: Rice fields
- 221: Vineyards
- 222: Fruit trees and berry plantations
- 223: Olive groves
- 231: Pastures
- 241: Annual crops associated with permanent crops
- 242: Complex cultivation patterns
- 243: Land principally occupied by agriculture, with significant areas of natural vegetation
- 244: Agro-forestry areas
- 311: Broad-leaved forest
- 312: Coniferous forest
- 313: Mixed forest
- 321: Natural grasslands
- 322: Moors and heathland
- 323: Sclerophyllous vegetation
- 324: Transitional woodland-shrub
- 331: Beaches, dunes, sands
- 332: Bare rocks
- 333: Sparsely vegetated areas
- 334: Burnt areas
- 335: Glaciers and perpetual snow
- 411: Inland marshes
- 412: Peat bogs
- 421: Salt marshes
- 422: Salines
- 423: Intertidal flats
- 511: Water courses
- 512: Water bodies
- 521: Coastal lagoons
- 522: Estuaries
- 523: Sea and ocean



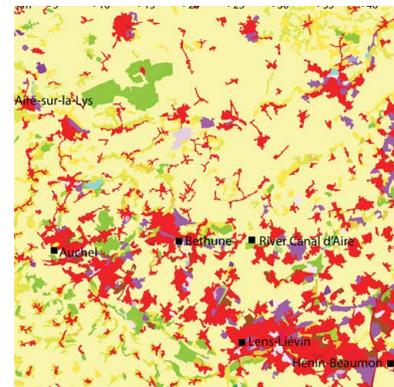
1 South Wales



2 Île-de-France



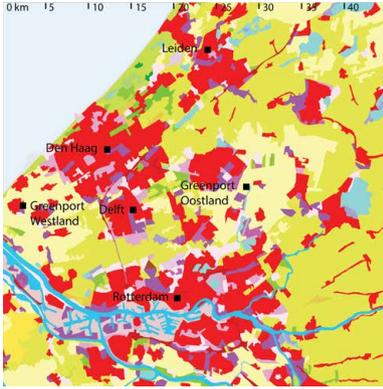
6 North Somerset



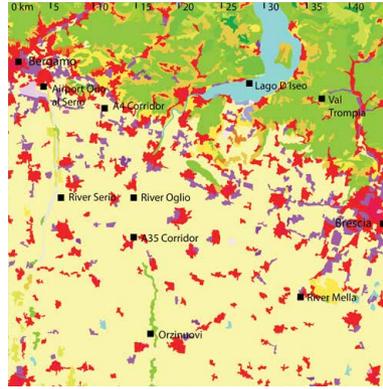
7 Pas-de-Calais



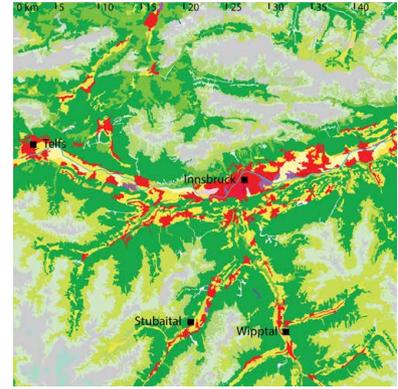
FIG. 3.11 The thumbnails show the spatial distribution of the Coordination of Information on the Environment (CORINE) Land Cover Classes; Classes 1.1.1-Continuous urban fabric, 1.2.1-Industrial or commercial units, 1.2.2-Road and rail networks and associated land, 1.2.3-Port areas, 1.2.4-Airports, 1.3.2-Dumpsites and 1.4.2-Sport and leisure facilities were used as spatial proxies for the infrastructures and other facilities, which characterise TiB. Source: CORINE land cover 2012; EEA: <https://www.eea.europa.eu/legal/copyright>



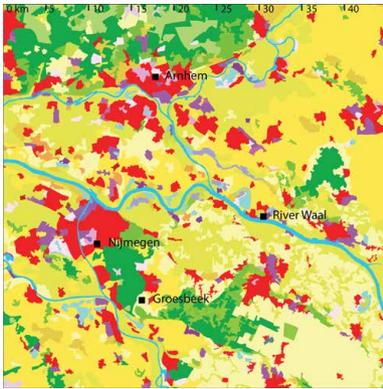
3 South-Holland



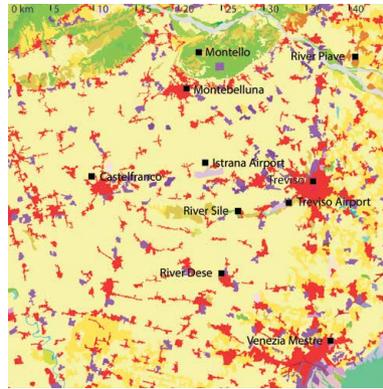
4 Bergamo-Brescia



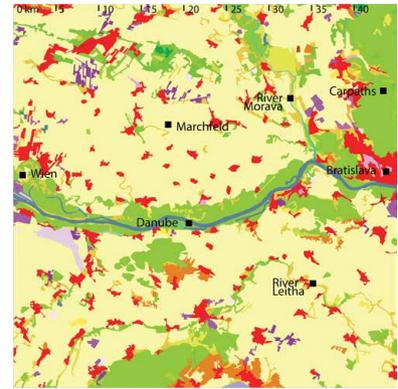
5 The Tyrol



8 Gelderland



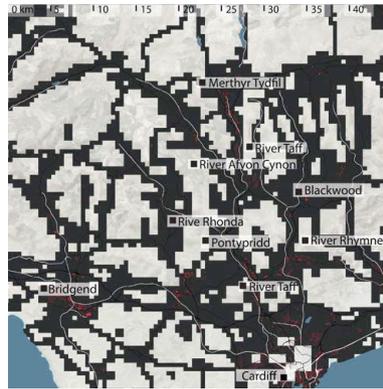
9 Veneto



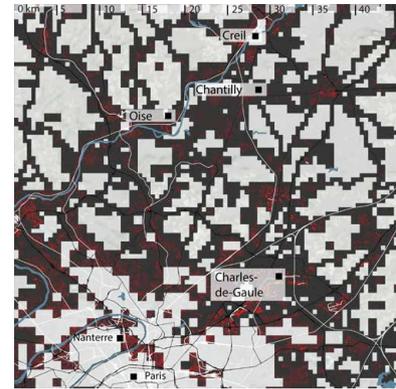
10 Vienna-Bratislava

TERRITORIES-IN-BETWEEN

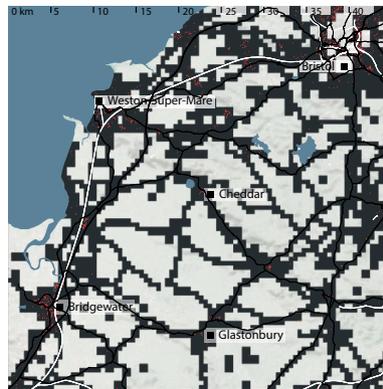
- Territories-in-between
- Buildings
- Roads infrastructure
- Rail infrastructure



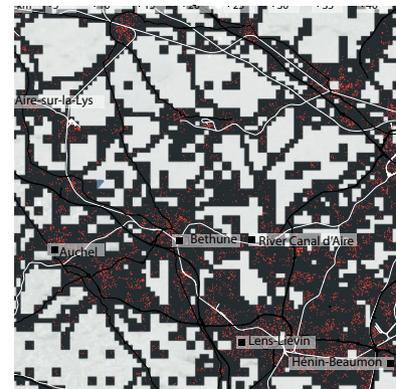
1 South Wales



2 Île-de-France

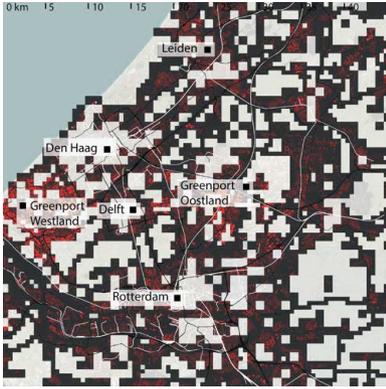


6 North Somerset

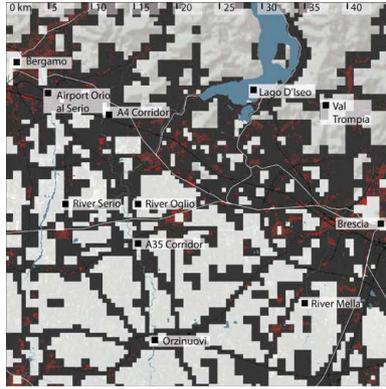


7 Pas-de-Calais

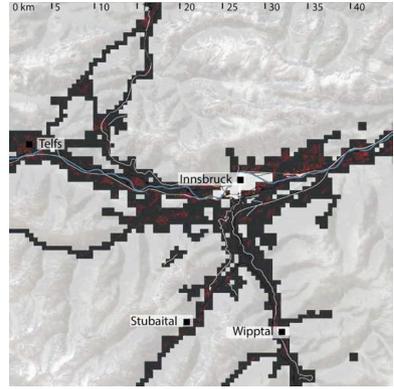
FIG. 3.12 The resulting thumbnail maps of territories-in-between for all ten cases. Overlaid with buildings and transport infrastructure. For large maps and more detailed description see Atlas part G. Data source overlay: copyrighted OpenStreetMap contributors <https://www.openstreetmap.org>.



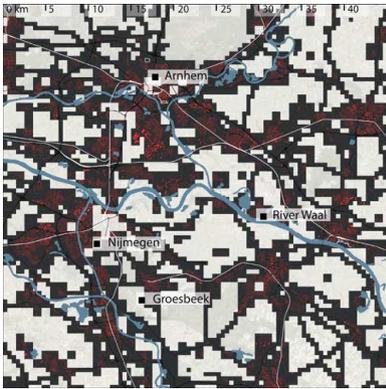
3 South-Holland



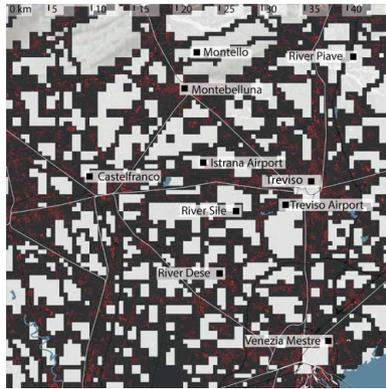
4 Bergamo-Brescia



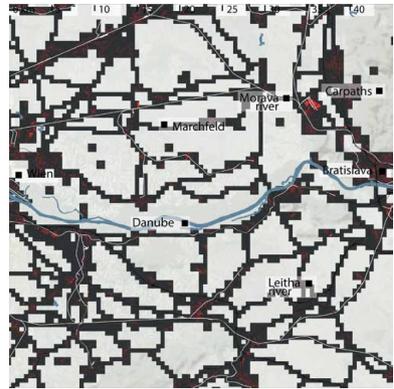
5 The Tyrol



8 Gelderland



9 Veneto



10 Vienna-Bratislava

TERRITORIES-IN-BETWEEN

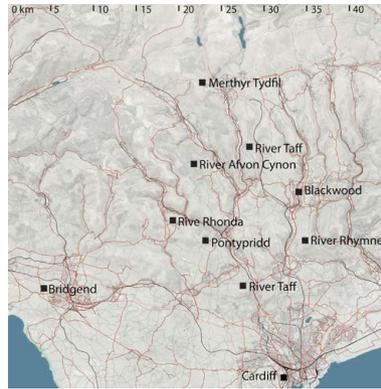
Transport Infrastructure

Rail Infrastructure

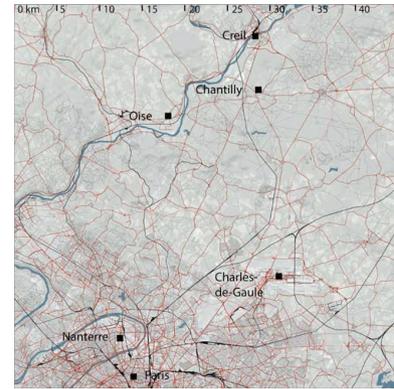
- Rail
- Tram
- Light rail
- - - Subway
- Funicular

Road Infrastructure

- Main roads
- Regional roads
- Local roads



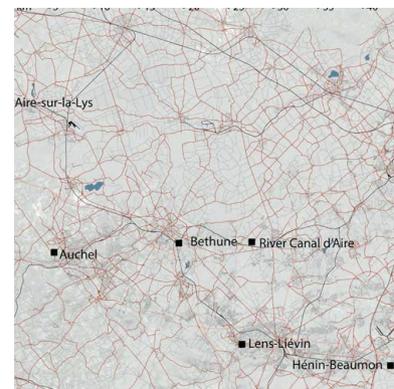
1 South Wales



2 Île-de-France

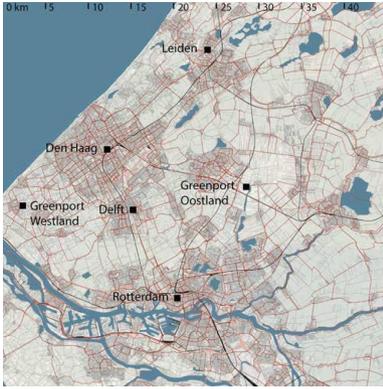


6 North Somerset



7 Pas-de-Calais

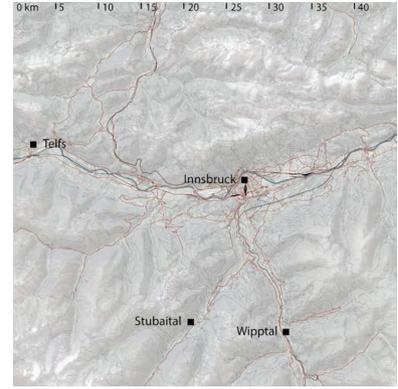
FIG. 3.13 The thumbnails show transport infrastructure networks. Rail, tram and light-rail, and main roads were used to map the territories-in-between. Data source: copyrighted OpenStreetMap contributors <https://www.openstreetmap.org>.



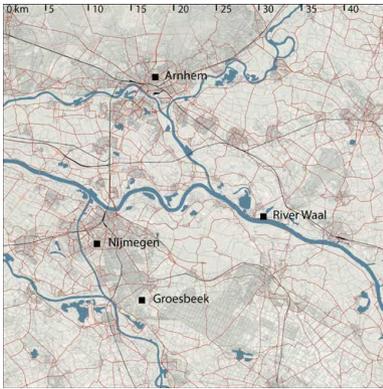
3 South-Holland



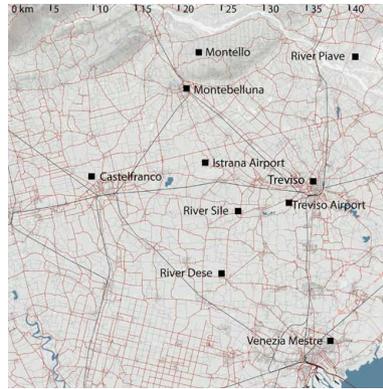
4 Bergamo-Brescia



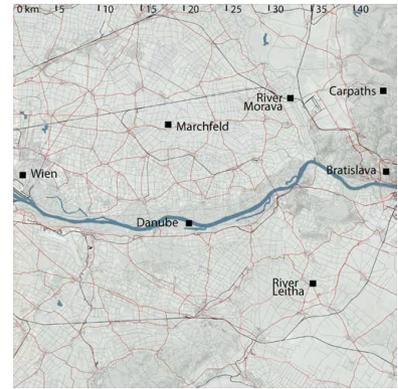
5 The Tyrol



8 Gelderland



9 Veneto



10 Vienna-Bratislava

