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Identification of the spatial extent of the peri-urban area: The case of three cities in Poland

Jerzy BAŃSKI ^{a*} , Damian MAZUREK ^a

Abstract

The work detailed here seeks to recognise features by which areas that can be deemed peri-urban differ from both city and countryside, to the extent that a separate specific identity for them can be discerned. The recognised features made it possible to identify the extent of the peri-urban area. The wealth of relevant literature is first considered, and this is seen to relate to the spatial side and to definition on the one hand, and to ongoing socio-economic processes on the other. Several Polish cities are then selected as the authors seek to discuss indicators useful in determining the spatial scope of the said peri-urban zones. The work proceeds on the assumption that these represent a real component of an urban-rural continuum characterised by reduced diversity and intensity of social and economic phenomena with steadily-increasing distance from the limits of a city in the direction of “traditional” rural areas.

Keywords: peri-urban area, countryside, town, urban-rural relationships, Poland

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1. Introduction

Those travelling out beyond the limits of a city will note how the surrounding landscape transforms gradually. The density of buildings in built-up areas declines, with buildings also lower and lower in height; while the area under cultivation increases, fewer and fewer people are met with, the natural vegetation becomes denser and the range of landscape that can be viewed grows larger. The intensity of change as regards such features and phenomena proves to be greatest in a city's immediate vicinity, as with further distance covered the differences become less and less visible, before blurring away altogether, as basically speaking we are just in the countryside.

It is clear that the two contrasting categories of settlement – town and countryside – lack a clearly-defined boundary between them, with there instead being a kind of transitional form, known as peri-urban area. Obviously, the aspect both intriguing and troublesome here is that an urban-rural continuum by definition features constant change along it, and hence a lack of boundaries, even as the goal is to somehow delimit what is the peri-urban zone.

The work detailed here seeks to recognise the features allowing for the distinguishing of peri-urban areas – which is to say features allowing a separate identity to be established. This is served by a review of the literature with a significant spatial and historical cross-section, in which the authors recognise the various features of the peri-urban zone. Then, by referring to several large Polish cities as examples, the authors have here been seeking to identify those indicators that can be used to determine the spatial extent of the zone under study. It can be assumed that the identified features will be used in analogous analyses of large urban centers in other

countries of Central and Eastern Europe, where similar development processes are observed after the collapse of the socialist system (e.g. Kocsis, 2015; Slavik et al., 2011; Stanilov & Sykora, 2014).

2. Theoretical background

Usually, the city and the countryside are placed at opposite poles representing complexity on the one hand and simplicity on the other, as well as concentration versus dispersion, modernity versus backwardness, artificiality versus naturalness, and dynamism versus stagnation. It is clear that the two contrasting categories of settlement lack a clearly-defined boundary between them, with there instead being a kind of transitional form (Keil, 2018). As we put more and more distance between ourselves and the core parts of a city, the urban features weaken, even as there is a rise in significance of those that can be seen as rural. Furthermore, under our approach, this waning/growing effect would be as much true of the differences in spatial forms as it would be of the ongoing social and economic processes. Therefore, there can be no precisely-defined boundary beyond which urbanity ends and rurality begins (Kule, 2008). Rather, the peri-urban zone is a “belt of transition” all of its own. Indeed, there is a widespread idea that the city and its peri-urban zone form a single organism – a circumstance that obviously precludes any existence of boundaries between them. An example of this is the concept of a Functional Urban Area (FUA) covering the city and its commuting zone.

Equally, there would seem to be still-greater difficulties at the other end, as we seek to designate some limit to the peri-urban zone beyond which it simply blurs with or into rural areas *per*

^a Institute of Geography and Spatial Organization, Polish Academy of Sciences, Warsaw, Poland (*corresponding author: J. Banski; e-mail: jbanski@twarda.pan.pl)

se. The search for this external boundary may obviously benefit from certain ways of defining rural areas, given the existence and presumed presence of features that can only apply to the countryside. Thus the OECD sees rural areas as units of territory ("rural communities") in which the density of population does not exceed 150 inhabitants/km². The issue of settlement typology (e.g. urban centre, suburban grid cell, rural cluster, etc.) is also explored in the Global Human Settlement Layer project, which produces global spatial information on population density and settlement (<https://ghsl.jrc.ec.europa.eu>).

The subject of the shaping and development of peri-urban zones (and the socio-economic processes ongoing within them) was a popular one in the USA, where, even in the first decades of the 20th century, the population development of cities was such as to cause peri-urban areas to expand (Burgess, 1924; Harris, 1943; Martin, 1956; Pryor, 1968; and others). Census data for the USA showed that the share of all inhabitants residing in the suburbs increased steadily from 19% in 1940 to 38% in 1970, and then 45% by 1990 (Domański, 2005). It is thus possible to state that Americans are more suburbanites than urbanites, and it is thanks to this that the suburban or peri-urban zone has proved to be of such interest to US-based researchers. Equally, their latest work has tended to focus in on the socio-cultural dimensions to the zones in question (Bruegmann, 2005; Clapson, 2003; Garreau, 1991; Fishman, 1987; Silverstone, 1997; Walks, 2013; Airgood-Obrycki, 2019). The process of shrinking suburban zones, and shrinking towns *per se*, is also noted (Audriac et al., 2012; Neil & Schlappa, 2016; Sarzynski & Vicino, 2019).

Despite a large amount of research, there has never been genuine development of a universally-accepted definition of the peri-urban (or suburban) area, of the features and indicators that might be used in identifying its limits, or of the ways in which urban and rural areas are to be distinguished definitively (Coombes & Raybould, 2001; Hill, 2003; Champion & Hugo, 2004; Hahs & McDonnell, 2006; Forsyth, 2012). Perhaps Forsyth (2012) may have offered the best solution to the definition problem, given the recommendation that a one-off approach be taken each time to a given area, with descriptive terminology used to characterise type and relevant features.

In the face of such a lack of formal definition, practitioners, academics and scientists have devised a series of different methodologies providing for the identification and further

classification of peri-urban space. For their part, Airgood-Obrycki and Rieger (2019) identify three types of approach to the defining process, which they dub: "census-convenient", "suburbanism" or "typology". While the first views the kind of area under discussion as one present outside the city limits but still located within the wider metropolitan area; the second takes account of the form and way of life of inhabitants (by reference to single-family housing, journeys by car, etc.); and the third seeks to categorise areas of different types, through the supply of extra detailed information regarding form of built-up area, location, demography or history.

According to R. Pryor (1968), the suburban zone is characterised by transformations of land use and socio-demographic characteristics, arising out of urbanisation; with the effect being for forms of land management other than the agricultural to develop, as the given area is penetrated by firms operating in the services, and as an influx of new inhabitants is maintained. For example, the issue of land-use forms and specific rules is one way for E. Gottero et al. (2021) to determine the extent of Milan's peri-urban area. R. Pahl (1965), on the other hand, considers this a "mentally urban but physically rural" area. J. Jauhiainen (2013) offers an insight suggesting that, through to the present day, it is most typical to see the suburbs as an extensive if diffuse area adjacent to a city that has lower density of population; limited amounts of industry, commerce and retail sale activity; and "suburban" inhabitants whose lifestyles are modest. At the same time, a historical and spatial consideration of how such areas develop leads to the establishment of a core typology in which we might find: terraced suburbs, villa suburbs, industrial and working-class suburbs, garden suburbs, extended suburbs, gated communities, squatter and shanty-town suburban areas, suburban sprawl and suburban edge cities. And each type referred to has its own defined set of features.

What is it that distinguishes the peri-urban zone from among other categories of area? It is worth noting that earlier studies (from the first half of the 20th century) identified features of peri-urban (suburban) areas that were mainly quantitative in nature (Tab. 1), allowing for the possibility of determination by reference to different measures (e.g. density of buildings in the built-up area, density of population, social-class structure, and so on). In contrast, in later decades the interest in qualitative features grew, despite the way in which these can be described rather readily, but only measured with some difficulty (as with aspects like multi-dimensionality, physiognomic instability, inter-penetration of different ways of living, etc.).

Author	Features of peri-urban areas
E.W. Burgess (1924)	Dormitory towns, prevalence of single-family construction, large share of middle-class inhabitants
C. D. Harris (1943)	Presence of zones that are multi-functional (residential, residential/industrial, industrial/residential, industrial, mining/industrial),
W. Schärer (1956)	Low-density residential construction, open space
W. L. Martin (1956)	A large share of the population commuting to work in a city each day, a defined density of built-up areas and defined population density
G. A. Wissink (1962)	Dependence on a city from the point of view of services and employment
R. Pryor (1968)	Land-use other than agricultural, penetration of area by potential developers, a steady influx of new inhabitants
J. Beaujeu-Garnier, G. Chabot (1971)	Dormitory towns, with a city as the place in which the population gains its income, presence of city-dependent industrial functions
J. Connell (1974)	Open space, functional linkage with a city (fluctuation migrations), a limited sense of belonging to a local community
S. Leszczycki (1977)	Sources of upkeep other than farming, a dense transport network and urban lifestyle, with physiognomy of settlement also urban
G. Dematteis (1985)	Fuller integration with a city than with other parts of the suburban zone
S. Liszewski (1987)	Interdigitation of urban and rural features and phenomena, processes of concentration (polarisation and agglomeration) and de-concentration (diffusion and deglomeration)
K. Dziwowski (1987)	A differentiated socio-functional system with lead (typical) features lacking
M. Marsh (1990)	A specific family and neighbourly lifestyle
J. Garreau (1991)	An important role for the residential function, single-family construction
S. Mayhew (1997)	Low density of households, open space, a transport system linking up with the city, a community mainly of just one social class
R. Silverstone (1997)	"multi-dimensional" geographical, architectural and social space
R. Bruegmann (2005)	A defined density of population
L. Poniży (2009)	Physiognomic instability, with interdigitation of urban and rural landscapes
J. Jauhiainen (2013)	Heterogeneity of spatial configurations, with marked differentiation of social, economic and spatial features
W. Airgood-Obrycki, S. Rieger (2019)	Given demographic features to be noted from Censuses, and a characteristic form and period of construction

Tab. 1: A historical perspective on selected examples of peri-urban areas features reported in the subject literature

Source: author's own elaboration

Certain of the features authors have chosen to identify can be expressed in relation to simple measures (as with the aforementioned densities of buildings and population, as well as the presence of cities and satellite settlements), even as others involve sets of indicators or are not in any way quantitative. Finally, there are also features not manifested by peri-urban zones specifically, but rather being generalised in nature, and hence also capable of relating to areas of other categories. Thus, for example a prevalence of single-family construction is not a distinguishing feature for peri-urban areas alone, given that built-up areas in villages as well as in certain parts of cities may prove to be of the same nature.

A look at the relevant geographical literature shows how work on peri-urban zones is above all focused on the spatial and morphological aspect(s). This ensures that features taken to characterise the areas in question are most often those of amorphous spatial structure, dispersed nature of buildings, low-value indices for the area utilised, intensive drives to build homes with which infrastructural development is unable to keep pace, ribbon forms of development along roads, increasing fragmentation of the landscape, and so on (Brueckner, 2000; Ewing, 2008; Ghani et al., 2014; Sudra, 2016; Szmytkie, 2020).

3. Research procedure and study area

A review of the literature points to a diverse range of theoretical and methodological approaches to the issue of peri-urban zones. According to A. Forsyth (2012), relevant definitions to be found there constitute a combination of attributes (often forming a complex index of features), as for example linked to physical, functional, social, process-related and analytical aspects. However, bearing in mind the solutions applied to date, it is possible to draw a distinction between two main (i.e. structural and functional) approaches to the definition of peri-urban areas. While the first pays most attention to socio-economic features separating rural and urban areas, the second relates to economic and social linkage with the city.

The most-widespread attempt at defining or identifying peri-urban zones relates to the structural approach. The properties and nature of the zones in question are in this way expressed

by reference to socio-demographic, physiognomic and economic features. Where the socio-demographic sphere is concerned, categories associated with demography, social structure and lifestyle can be identified; while in the physiognomic sphere researchers focus on features of space, the nature of construction, as well as forms and structures that land use assumes. In turn, in the economic sphere it is possible to note references to features of technical and residential infrastructure, the level of employment, land prices and so on (Tab. 2). In the case of the category of functional features a key role is played by those indicative of the diverse relations pertaining between peri-urban zones and the core urban centre; even as there are no such relations between the zones and rural areas *per se*.

This study primarily used quantitative characteristics based on rich and detailed statistical material. Analysis of the specific features of peri-urban areas is based around a case study involving three of Poland's agglomerations differing in terms of functions, size and location. The localities chosen for the purpose were Warsaw, Poznań and Lublin – which are also seen to differ in terms of their socio-economic potential¹. The work made use of statistical materials, as aggregated for two types of area, i.e. 2-kilometre (ring) zones around the cities analysed, as well as three successive zones formed by municipalities (*gminy*, LAU 2, local-level administrative units) that are located around the centres in question (Fig. 1).

4. Results and discussion

Leaving aside the density of construction within the built-up area, it is population density that is the feature used to define peri-urban areas that is referred to, and studied, most often. The figure for this will usually be higher close to cities than in traditional rural areas (i.e. areas located at a greater distance from a large urban centre), while at the same time being lower than in urban centres. With distance, the values assumed by this measure will be progressively lower, even as the phenomenon is not linear in nature, given that the peri-urban zone is characterised by fluctuating values of rather high intensity. Moreover, the values should and do vary in relation to natural barriers, the courses taken by the main transport routes, the sizes of the urban centres, and other conditioning.

Categories of feature	Zone	Features
Structural	Socio-demographic	- Population density - Social structure - Lifestyle (co-occurrence of content and forms of both city and country life)
	Physiognomic	- Presence of satellite settlements and towns - Density of residential construction - Land-use structure - Density of single-family housing construction - Openness of space - Inter-digitation of urban and rural landscapes
	Economic	- Land fragmentation index - Employment structure - Prices of land - Conflicts over land use - Density of technical infrastructure - Residential area - Density of the transport network
Functional	- Multifunctionality - Intensity of commuting or fluctuation-migration - Forms and density assumed by the system of public transport - Cooperation with a main centre	

Tab. 2: Diagnostic features for peri-urban areas
Source: authors' elaboration

¹ Warsaw – capital of the country, 1,861,975 inhabitants, Poznań – capital of Wielkopolska voivodeship (NUTS 2), 541,316 inhabitants, Lublin – capital of Lublin voivodeship (NUTS 2), 331,243 inhabitants, 2023 (source: www.stat.gov.pl, access: July 27 2023)

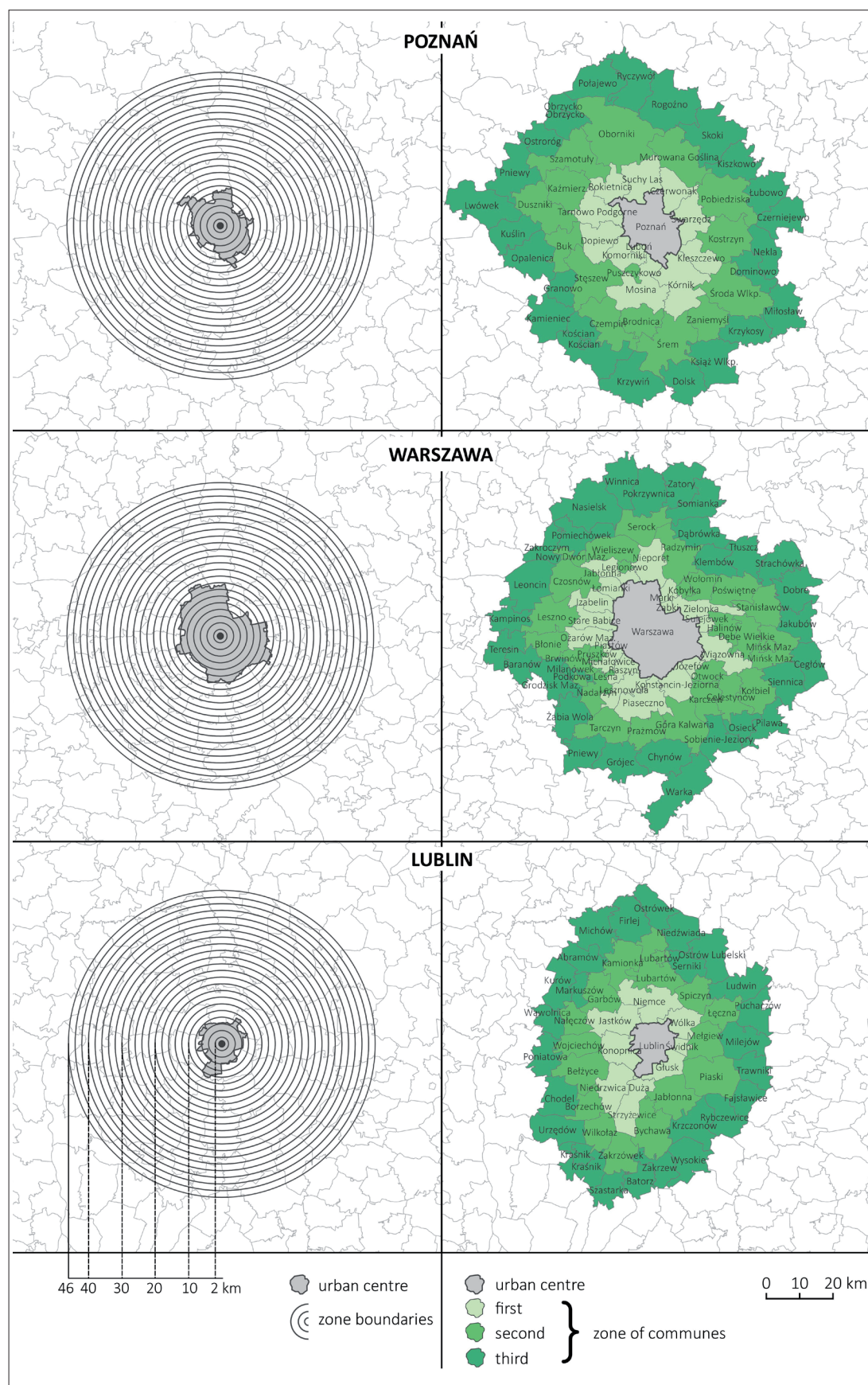


Fig. 1. Two categories of zone located around the urban centres constituting research areas (administrative division 2021)
Source: authors' elaboration

4.1 Socio-demographic features

According to research based around the 2021 National Census of Poland, the population density analysed by reference to successive ring-zones of 2-kilometre width around Warsaw is seen to decline dynamically until the zone some 14–16 km from the city centre is reached (Fig. 2). Beyond that, the further decline in population density only proceeds very slowly, to stabilise at a distance some 28–30 km out from the centre of the Polish capital. In the case of the two others, smaller, cities, i.e. Poznań (with its ca. 547,000 inhabitants as of 2021) and Lublin (with a total of around 332,000), the data for population density display a marked downward trend out to the 8–10 km zone. Beyond that, a stabilisation occurs 14–16 km out from the centres. It should therefore be assumed that this indicator can delimit the suburban zones of individual agglomerations, though it will need to be applied along with other measures allowing for verification of the area identified. It may be tempting to pursue analogous analyses for sets of defined city-size categories (as regards number of inhabitants, therefore), with this probably permitting the indication – for each model category – of the ranges of studied zones of variability for the indicator.

Peri-urban areas are usually characterised by positive balances where permanent migration is concerned, albeit with this feature declining steadily with distance from the urban centre. In areas located further out (in a manner relating to city size), the migration balance increasingly assumes values that are markedly negative. It is known that influxes of people into the suburbs largely involve the wealthy and well-educated. These sometimes also transfer the seats of their firms, in this way helping to expand labour-market resources.

The social structure characterising the inhabitants of peri-urban zones is dependent on a country's level of economic development. While in developed countries the peri-urban areas are settled by social groups of average or high social status; in states only weakly-developed those involved are mostly the poorest (present in areas known as slums or *favelas*).

While social structure represents an interesting research topic, it seems that its features cannot define contemporary peri-urban areas, as these are settled by people from different social strata, depending on the type or area and prevalent form of housing construction. According to D. Boorstin (1974), in the era through to the 1960s there was a distinct division present in the peri-urban zones around US cities – in line with standard of living, and in a circumstance whereby the place of residence is linked with the level of income. But the peri-urban zone was mainly a place of settlement for the rich of the WASP (White Anglo-Saxon Protestant) group, though this did not preclude their being enclaves with poorer, less well-educated populations. Later

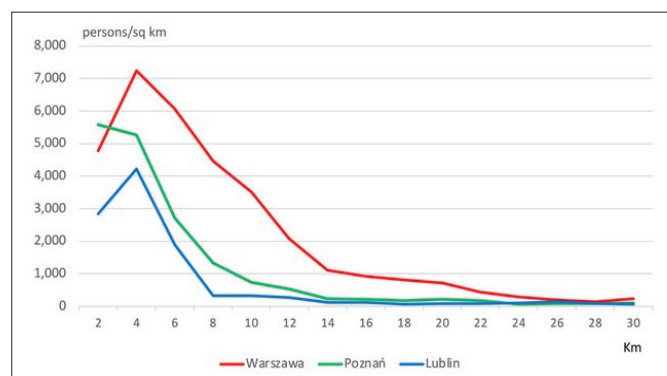


Fig. 2. Changes in density of population in successive rings of 2-kilometre width surrounding the cities as of 2021

Source: author's own elaboration based on data from the National Census 2021, Central Statistical Office (CSO)

years brought a structural assimilation process, of which one result was a flattening-out of the social structure in peri-urban zones – from the point of view of levels of income, education and socio-occupational categories. Similar conclusions were arrived at by Jauhiainen (2013), for whom America's extended suburbs – earlier suburban housing projects mainly targeted at young and prosperous white couples – had their places taken by projects characterised by a more-disparate model involving social and racial segregation.

In Poland, contemporary trends in the development of peri-urban areas result in a change in the social structure in place previously, with an increase in the share of the population that is well-educated and wealthy. An accompanying phenomenon is the polarisation of social classes within the peri-urban zone, which *inter alia* denotes the emergence of closed enclaves inhabited by members of different social classes. These are phenomena mainly observable close to large urban agglomerations.

Lifestyle is a qualitative feature that is not readily measurable. A peri-urban area is characterised by a kind of interweaving of urban and rural models for cultural behaviour (e.g. as regards anonymity and directness, modernity and simplicity, artificiality and naturalness, and so on), as well as specific forms of family and neighbourly life (neighbourly contacts tend to be fleeting and shallow). Individualism is a key aspect of the lifestyle in peri-urban areas, though it is often associated with the opposite kind of behaviour encouraging imitation. It is possible to propose a set of diagnostic features giving expression to ways in which communities in peri-urban areas behave (e.g. form of weekend activity, frequency of departures from home, types and frequencies of use made of transport, etc.). However, the choice of these features and the ways in which results are to be interpreted will inevitably be burdened by subjectivity, even to the point of their being highly subjective. The suburban lifestyle was traditionally linked to daily commutes to work (as a kind of fluctuating migration). This issue is included within the category of functional features.

4.2 Physiognomic features

The sphere of physiognomic features relates to the nature of the space and landscape, the forms that construction takes, and the ways in which land is managed. The measures and indicators used to reveal this include numbers of towns and other settlements of "satellite" status, the density of construction, the degree of openness of the landscape, the level of physiognomic stability, the degree to which construction is in the single-family category, the density of the transport network, the degree to which land fragmentation has taken place, and other features. Particular attention is paid to land-use features (Hersperger et al., 2018; Shaw et al., 2020).

One of the basic physiographic features distinguishing peri-urban areas from other categories relates to the nature of the settlement process that has been ongoing. This is first and foremost manifested in the presence of "satellite" towns or other settlements, though they mainly an issue for large agglomerations. Centres of genuinely satellite status are not considered to arise in the vicinity of smaller urban localities; though the so-called closed (or gated) housing estates do make their presence felt. Elements of these kinds (be they towns or estates) are of point distribution, so by definition do not suit a situation in which the extents of peri-urban zones along a continuum are supposed to be identified. Equally, their presence is characteristic for the peri-urban position along that continuum.

Another key physiognomic feature of peri-urban areas is the form and density assumed by built-up areas. Prevalent among these forms is single-family construction present at lower density (albeit very much correlated with density of population), given that it is this which is responsible for the shaping of the

specific peri-urban landscape. In our case, analysis of the density of construction in built up areas was possible by reference to data in the 2021 Database of Topographic Objects, in relation to consecutive zones 2 kilometres wide arranged concentrically around Warsaw, Poznań and Lublin. The overall conclusion from our analyses is that, around 22–24 km out from the centre of Warsaw (and 14–16 km out from the centres of Poznań and Lublin) a point is reached at which the share of all residential construction that is single-family in status stabilises out at 90–100%. Even then, some fluctuation might occur due to the presence of small urban centres. Also important is the way in which there is a distinct weakening of the tendency for the given index to increase at distances 14–16 km out from Warsaw and 8–10 km out from Poznań and Lublin, this therefore attesting to some kind of “commencement” of the peri-urban zone. The characteristic depiction in Fig. 3 correlates clearly with that in Fig. 2.

A very important feature of peri-urban areas is the intensive drive to construct and build, which relates in particular to single-family housing construction (Hirt, 2007). Thus, work by M. Wesołowska (2005) in the Lublin region showed that the activity in question concentrated in rural areas located within a radius of around 30 km from the city. Distinct zones of enhanced construction activity could also be noted around three other urban centres of sub-regional rank (i.e. Zamość, Chełm and Biała Podlaska) – albeit in these cases within radii of 15–20 km from the respective centres (Wesołowska, 2005). Vibrant expansion of housing is changing the shape of rural settlements, figuratively; and literally – in terms of the spatial configuration existing now as opposed to up to now. New settlements of modern-type houses can be thought to degrade the often-traditional rural landscape. On the other hand, the development of the residential function denotes an improvement in the quality of life in the countryside, thanks to the remodeling and modernisation of both technical and community infrastructure, improved transport access and better quality of services. The consequence of the pressure to build in peri-urban areas is increased demand for land and an associated increase in land prices. A relevant analysis conducted in 2009 around Kraków, Poznań and Warsaw pointed unequivocally to a link with distance from city limits (in the sense that prices of land were lower and lower with increasing distance from a city) (Bański, 2009).

Housing construction is concentrated close to the main transport routes. Along them, there is a belt of enhanced economic activity, given that construction is not the only thing that develops, as trade, services and manufacturing all grow too. This process carries with it a series of undesirable consequences, as a transport system not adjusted to the new situation hinders inhabitants of peri-urban areas when it comes to the access to the city which was the original reason for their presence. This is above all the

case where daily travel to work and access education is involved. It is shown that the inhabitants of peri-urban municipalities may spend more than 10% of their active time each day in morning and evening traffic congestion. This leads us to one of the core (re-emerging) arguments put forward by advocates of residence in more-central areas of cities.

A further feature of peri-urban areas is some kind of inter-digitation (interweaving) of urban and rural landscapes. In the view of A. Richling and J. Solon (1996), the peri-urban landscape is subject to more-dynamic structural and functional change than are either urban or rural landscapes. By reference to components of vegetation, the aforesaid authors propose distinguishing between three types of peri-urban landscape. The first type takes in land linked closely with the city in a functional sense – this denotes an area that has a very far-reaching mosaic of the different components under study. The second type means areas that have already been changed greatly, to the point where typologically and spatially disordered plant communities have taken shape. The third group in turn includes areas only linked in a loose way with the city, in which vegetation components are relatively extensive and stable at the same time.

Overall, the proposal makes rather clear reference to the traditional way in which areas of landscape were summed up as devastated, cultural, natural or *primaeval*. The peri-urban area is dominated by cultural landscapes (left with only a fragile capacity for self-regulation and much influenced by human economic activity), albeit also with some devastated landscapes (highly urbanised and thus lacking in natural components). The delimitation of areas of this kind is complicated given the need for detailed cartographic processing based on both field studies and GIS-based analysis. However, where appropriate research instruments are available, it proves possible to analyse vegetation present, and then attempt to determine the extent of the peri-urban zone.

A feature of that zone is far-reaching diversification of land-use structure – again as expressed in a mosaic-like arrangement of land of extensive or intensive use. This sees farmland or forest located in the immediate vicinity of land under intensive use in production, housing or commerce (Sovová & Krylová, 2019). The share of land that is built-up is already relatively high, though (in line with the size of the urban locality under consideration) the figure for this rather rapidly becomes lower as we move into successive zones further and further away from the city proper. In the case of Warsaw, the share of land that is built on is seen to stabilise (at a level of several per cent) some 26–28 km from the centre of the capital. Where Poznań and Lublin are concerned, such zones are encountered respectively 18–20 or 14–16 km out from the cities (Fig. 4).

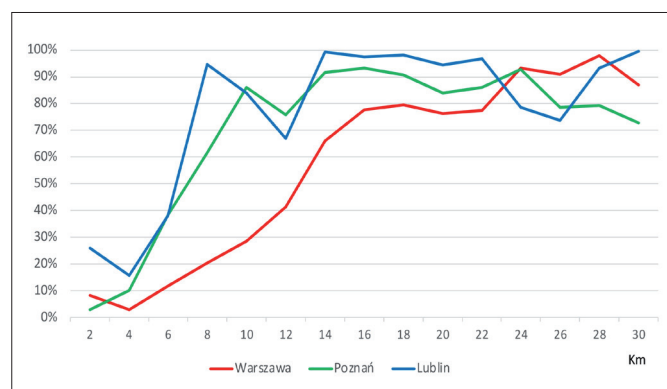


Fig. 3. Percentage share of all residential construction accounted for by single-family housing, as of 2021

Source: author's own elaboration, based on the Database of Topographic Objects, Geoportal (www.geoportal.gov.pl)

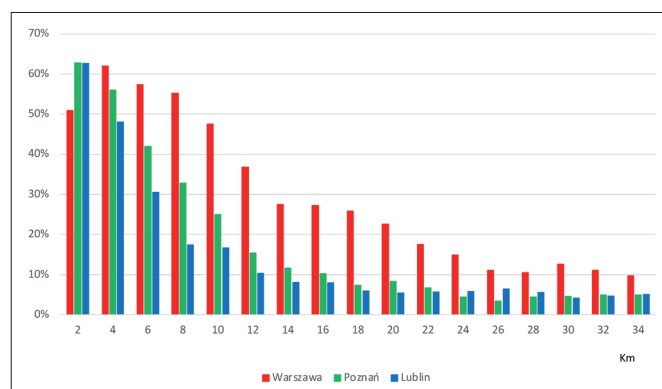


Fig. 4. The proportions of successive zones around the cities studied that were accounted for by built-up areas as of 2021

Source: author's own elaboration, based on the Database of Topographic Objects, Geoportal (www.geoportal.gov.pl)

4.3 Economic and functional features

In general, the peri-urban zone is characterised by the presence of a rather large number of businesses. This fact seems to be confirmed by the way in which municipalities in the immediate vicinities of large agglomerations do manifest positive balances for commutes to work (even as in municipalities further out the balance is definitely negative). This phenomenon characterises all three examined suburban zones. Especially in the case of Warsaw, the differences between the first zone of communes and the other two zones are very large (Tab. 3). It is the result of the intensive settlement process in the communes adjacent to Warsaw, whose new inhabitants are professionally connected with the city.

The diverse suitability of land for a variety of different forms of use ensures that the peri-urban zone is a place of potential conflict over land-use (Alonso et al., 2017; Sarzynski et al., 2014). A typical circumstance of that kind arises where the same space could serve various economic functions, but demand for these valuable features exceeds the actual supply (Bański, 1998). The worst conflicts of land-use tend to break out when the agricultural function clashes with the residential, and this reflects the presence of two irreconcilable interests. While a growing city has a large (indeed expanding) market for food products that can actually stimulate development of intensive commercial variants of farming, urbanisation and urban sprawl are proceeding apace, increasing more and more the demand for new land to be taken out of agriculture in order that it can be built on. However, this is a battle farming is ultimately slated to lose in each case. Over time, the significance of agriculture in the zones must decline, and must retreat in more-peripheral directions. The situation will not be improved by the growing trend of urban farming.

The fact that (relatively) high proportions of peri-urban zones have become built up at the same time denotes a fragmentation of land into far more separate parcels than before – a circumstance confirmed by analysis of their density in consecutive zones further and further out from the centres of Warsaw, Poznań and Lublin. This results first and foremost from the intensive degree to which housing construction has been engaged in, as well as functional diversity and the high level of demand for land that is exerted (Fig. 5).

Zone of municipalities / City	Warsaw	Poznań	Lublin
Zone 1	238,502	64,115	21,158
Zone 2	– 34,231	– 13,102	– 9,566
Zone 3	– 20,674	– 15,827	– 2,440

Tab. 3: Balances for commutes to work characterising the municipalities surrounding the urban centres under study, 2011

Source: author's own elaboration based on data from the National Census 2011, CSO

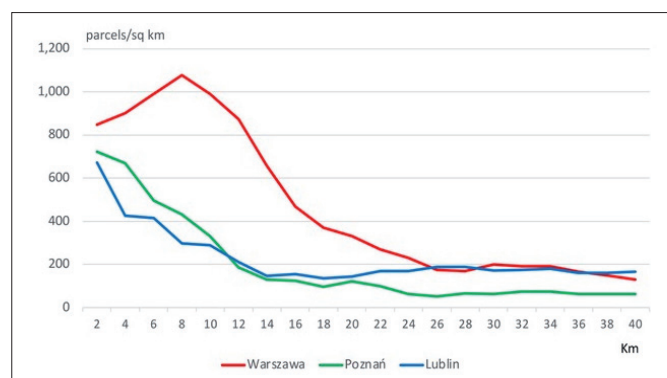


Fig. 5: Numbers of parcels of land per km² in consecutive zones around the cities studied as of 2016

Source: author's own elaboration, based on Geoportal data: Land-Parcel Identification System (www.geoportal.gov.pl)

A peri-urban zone displays far-reaching functional differentiation and strong economic relationships with its city. Multi-functionality is a feature rendering peri-urban zones distinct from rural areas as such (given the leading role in the latter of large-area functions notably farming and forestry). The core functions of areas close to cities in turn include housing, services relating to both production and consumption, agriculture, and recreation. In turn, in cities proper, the above services plus the residential function are joined by social and administrative functions, as well as commerce. Moreover, it is possible to generalise by saying that functions present in cities are intensive by nature and have a point or linear distribution, even as those in the peri-urban zone are present both intensively and extensively, with distributions of the point, linear or areal kinds.

A further key feature of a peri-urban area is the way it links up strongly with its city in both functional and economic terms. This is evidenced by shuttle migrations related to commuting. The intensity of the migratory movement reflects the degree of linkage present between peri-urban zones and the city – in the sense that, the greater that linkage, the stronger the socio-economic links. It is for this reason that the extent of the phenomenon of daily migration can serve to determine the external boundaries of the peri-urban zone. A feature of an area of the latter type (reflecting the intensive daily migrations) is the specific nature of the system of transport, though this is something that is mainly true of large urban centres. It is possible to simplify (greatly) by saying that the extent of suburban bus routes can denote the limits of intensive daily migrations – given the profitability calculations urban transport enterprises are readily able to carry out. In the case of the urban localities under study here, the density of bus lines shows a marked correlation with other diagnostic indicators already analysed above.

The degree of concentration of the transport network is a further feature influenced by the functional and economic linkage pertaining between peri-urban areas and cities (Fig. 6). In the cases of the three such cities analysed, the km-per-km² densities of local-authority and county roads decline steadily in consecutive zones as more and more distance from city centres is covered. The values bottom out at a distance 24–26 km out from the centre of Warsaw, while the corresponding figures for Poznań and Lublin are 12–14 and 10–12 km respectively.

5. Conclusions

In general, the subject literature is inclined to distinguish two main categories of feature that characterise the peri-urban areas, i.e. the structural and the functional. That said, the first set are further taken as encompassing socio-demographic, physiognomic and economic features. And in each of these groups mentioned

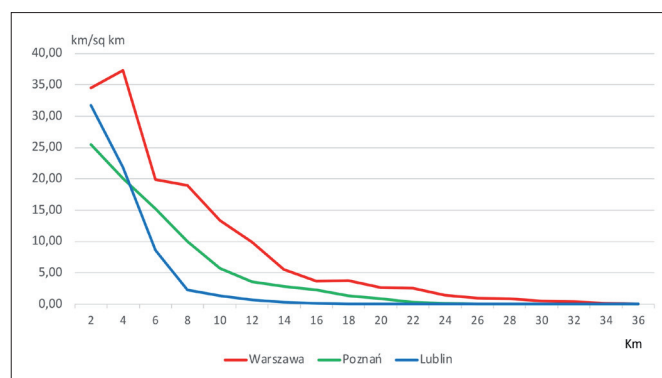


Fig. 6: Densities of bus lines operated by City Transport Boards in the zones surrounding the 3 cities studied, in 2021 (in km-per-km²)

Source: author's own elaboration, based on data from OpenStreetMap (www.openstreetmap.org)

it is possible to identify diagnostic features to a greater or lesser degree permitting determinations of the spatial extent of peri-urban areas.

The presence of these areas is revealed most fully by reference to such features as the inter-penetration/interweaving of the content and forms characteristic of urban and rural life (styles), the presence or absence of towns and settlements of other sizes enjoying “satellite” status, the occurrence of intensive migration processes of a fluctuating nature, the degree to which an area features single-family construction, and other functional changes of a dynamic nature. Other features studied are also in a position to reveal the separate nature of the peri-urban zones, but not to an extent allowing for their spatial identification.

It is as a consequence of the wide variety of definitions of the peri-urban zone that so many different methods of delimiting it have arisen. When it comes to the functional criterion, the designation of the peri-urban zone makes reference to the range and intensity of commutes to work and the economic functions the given area serves. In contrast, the structural criterion is typically analysed by reference to a set of diagnostic features (encompassing land-use structure; the densities of road networks, buildings in the built-up area, and population; and so on). Threshold values are adopted for all of these.

The degree of development of a peri-urban zone depends on the size of a given city, as well as the socio-economic functions it serves. In the case of the three Polish cities researched here (Warsaw, Poznań and Lublin), analyses conducted allow it to be indicated that the spatial extent of Warsaw's peri-urban zone goes out as far as some 24–26 km from the city centre. The respective zones for Poznań and Lublin in turn involve distances out to 18–20 and 12–14 km respectively. This is then a phenomenon markedly dependent on the population potential of the centres concerned.

In developed countries, the urbanisation process in rural areas now extends far beyond the peri-urban zone as such, being associated with the process by which metropolitan areas take shape. Involved here is the development of transport and communication systems (both traditional and electronic, or depending on other modern means), as well as the greater accessibility of the core urban centres, and the reduced time needed to commute in to them. It is thanks to this that population is able to migrate from node areas into the countryside or else into smaller urban centres (by means of the phenomenon of de-urbanisation). This is generally a process impacting favourably upon rural areas, given that it reduces urban-rural disparities. In the face of the accelerated development of countries in general and Poland in particular, it is possible to anticipate a major upcoming expansion of the peri-urban zones around the largest cities. However, there may be a number of unfavourable aspects to this abrupt development, such as a lack of spatial order, difficulties with transport and communications (above all excessive commuting times where work and school are concerned), degradation of the landscape, and a worsening pollution problem. In this connection, it is to be expected that spatial policy seeking to maintain or restore order will face even greater challenges than have been observed to date. Some efforts are already underway and are aimed at balancing the urban-rural or core-periphery relationship. This is primarily about metropolitan areas, which are becoming separate territories with autonomous planning and strategic development.

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