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Place matters, but differently: Pro-environmental behaviour across the rural–urban continuum in Poland

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Abstract

Pro-environmental behaviour (PEB) is often treated as a coherent set of practices, although opportunities to act vary across spatial contexts. This study examines how four domains of self-reported PEB vary along a perceived rural–urban continuum in Poland. Data from a nationwide CAWI survey of 1,082 adults were used to construct 0–1 indicators for transport, grocery shopping, non-grocery shopping and waste management. Respondents classified their residential surroundings as rural, suburban, housing-estate or urban. Kruskal–Wallis tests revealed significant differences between landscape types for transport, grocery shopping and waste management, but not non-grocery shopping. Transport-related PEB increased from rural to urban settings, whereas grocery-shopping and waste-management PEB were stronger in less urbanised settings. The findings show that place matters in a domain-specific rather than uniformly directional way. Environmental planning should therefore address practice-specific infrastructural and contextual constraints rather than assume that urban or rural populations are inherently more pro-environmental.

Keywords: pro-environmental behaviour; rural–urban continuum; environmental planning; sustainable consumption; Poland.

Introduction

One of the most pressing challenges facing contemporary societies is to maintain environmental conditions that support human quality of life and remain resilient to further change amid growing anthropogenic pressure associated with population growth and the continuing concentration of people in cities (Steffen et al., 2015). Effectively limiting adverse environmental change requires action consistent with the principles of sustainable development, including legal, technological and economic measures implemented at different spatial scales. Equally important, however, are changes in how society approaches environmental issues and the development of pro-environmental behaviour (PEB) (Liu et al., 2014). Although fostering such behaviour is a long-term process that requires appropriate environmental education, increasing public awareness of issues such as environmental pollution and climate change provides a foundation for sustained environmental stewardship (Pawuł & Sobczyk, 2011; Strumińska-Doktór, 2016). The prevalence and intensity of PEB are shaped by a range of interrelated determinants that the literature organises into different, partly overlapping classifications. These include internal factors related to individual characteristics, values, knowledge and motivations, as well as external factors arising from the social, institutional and spatial contexts in which behaviour occurs (Li et al., 2019; Gifford & Nilsson, 2014). Individual determinants include age, gender, education and previous experience, while social determinants include norms, cultural conditions, social position and the character of the living environment. This study focuses particularly on external spatial determinants, understood as characteristics of the immediate residential environment that may create different opportunities and constraints for specific forms of PEB (Dąbrowski et al., 2022; Sheasby & Smith, 2023; Zou et al., 2024).

The aim of this study is to determine whether, and in what ways, the intensity of different dimensions of pro-environmental behaviour varies along a rural–urban continuum defined by the subjectively perceived character of the residential environment. Four domains of everyday behaviour are analysed: transport, grocery shopping, non-grocery shopping and waste management. Two research questions are addressed: (1) does the intensity of individual PEB dimensions differ between the landscape types that form the rural–urban continuum? and (2) is the direction of these differences consistent across PEB dimensions? The study assumes that PEB varies across domains of everyday life, while also hypothesising that, irrespective of domain, the degree of urbanisation of the place of residence is associated with the intensity of PEB. Theoretically, the study adopts a contextual perspective in which pro-environmental behaviour is shaped not only by individual characteristics but also by the socio-spatial conditions under which it is performed. Particular attention is therefore paid to the immediate residential environment, conceptualised along the rural–urban continuum. The main data source is a nationwide survey of a representative sample of Polish adults, considered sufficiently robust to support conclusions and generalisations. Poland provides a relevant case because, unlike Western societies, where changes in environmental awareness and PEB have a longer history, Central and Eastern European societies began to treat environmental protection as a priority considerably later (Mikuła et al., 2021; Iwińska et al., 2023).

The article is structured as follows. The introduction is followed by the theoretical framework, materials and methods, empirical results, and a discussion and conclusions.

PEB in the context of the rural–urban continuum: theoretical framework

Growing anthropogenic pressure heightens the need to protect the environment and to guide development in accordance with the principles of sustainable development (Gallopín, 2003; Robèrt et al., 2004). Achieving this objective requires a holistic approach that recognises the interdependence of environmental, economic and social dimensions (Chen, 2001; Hopwood et al., 2005). In this context, environmental education plays an important role (Chodkowska-Miszczuk et al., 2016), alongside the systematic promotion of PEB and active public engagement in environmental protection (Liu et al., 2014).

PEB is a broad category encompassing both everyday habits and more complex consumer, political and social decisions that contribute to the protection of ecosystems and natural resources (Liu et al., 2014). The literature offers a range of definitions which, although they differ somewhat in conceptual scope, share an understanding of PEB as behaviour that seeks to reduce the harmful environmental impacts of human activity. Stern (2000) defines PEB as individual behaviour that contributes to protecting or improving the state of the environment. Kollmuss and Agyeman (2002) describe it as action consciously undertaken to minimise the negative environmental impact of human activity, thereby highlighting the role of psychological, social and structural factors. Steg and Vlek (2009) define PEB as behaviour aimed at reducing the harmful environmental effects of human activity, including both individual actions and support for wider environmental initiatives. Gifford and Nilsson (2014) broaden this perspective to include actions motivated by environmental concern, such as conscious consumer choices, environmental activism, reduced resource use and support for environmental policies. Reflecting these differences in conceptual scope, the literature also employs a range of related terms, including ecological behaviour, environmental action, eco-friendly behaviour, sustainable behaviour and green behaviour (Han et al., 2009; Stern, 2000; Halpenny, 2010; Tian & Liu, 2022).

Operationalising such a broad concept requires a systematic classification that allows its individual dimensions to be examined empirically. Across the main disciplines concerned with PEB—social psychology, environmental psychology, sociology, experimental economics and human geography—behaviours are classified according to a variety of criteria (Blankenberg & Alhusen, 2019). A common approach is to distinguish domains of everyday life, including transport, grocery shopping, non-grocery shopping and waste-related behaviour. This approach is well established in both theoretical and empirical research (Moore & Boldero, 2017; Stern, 2000; Whitmarsh & O'Neill, 2010). In his seminal work, Stern (2000) distinguishes four broad types of environmentally significant behaviour, including private-sphere environmentalism encompassing transport, purchasing and waste management. This classification has provided a point of departure for many subsequent studies. Smith-Sebasto and D'Costa (1995) propose a multidimensional classification comprising civic, legal, financial, educational, physical and persuasive actions. More recent research also distinguishes between public- and private-sphere behaviour (Hunter et al., 2004; Whitmarsh & O'Neill, 2010), with the latter referring to individual practices and everyday consumer choices related to transport, purchasing and waste management. Diekmann and Preisendörfer (2003) and Andersson and von Borgstede (2010) further distinguish between low-cost and high-cost behaviours, a distinction that is particularly relevant when analysing the determinants of different PEB categories. Accordingly, this study focuses on four domains of everyday life: transport, grocery shopping, non-grocery shopping and waste-related behaviour.

Within these domains, transport-related PEB includes choosing environmentally preferable modes of travel, such as public transport, cycling and walking (Moore & Boldero, 2017; Eriksson et al., 2008). Reducing car use is a key component, while travel habits are also associated with social influences, pro-environmental attitudes and physical activity (Bamberg & Möser, 2007; Eriksson et al., 2008). Grocery-shopping PEB includes choosing local, organic and seasonal products and adopting practices that reduce food waste (Jörissen et al., 2015; Whitmarsh & O'Neill, 2010). Such behaviours affect the environment through consumer decisions related to food production, transport and packaging, while green purchasing is an important component of sustainable consumption (Wang et al., 2014; Jörissen et al., 2015). In the case of non-grocery purchases, such as clothing, electronics and household goods, PEB increasingly encompasses conscious consumption, repair rather than replacement, and the purchase of second-hand items (Moore & Boldero, 2017). Behavioural and psychographic segmentation is increasingly used in this area to understand the motivations underlying consumer choices of durable and sustainable products (Wells, 2021). The fourth domain concerns waste-related behaviour, including waste separation, recycling, composting and waste prevention (Concari, 2023; Stern, 2000; Liu & Feng, 2020). Recycling is a core activity within this domain (Whitmarsh & O'Neill, 2010), while recent research places growing emphasis on the circular economy and on reducing waste at source (Ghisellini et al., 2016; Geissdoerfer et al., 2017).

Given the breadth of activities encompassed by PEB, the concept must first be clearly defined and then operationalised. In this study, PEB is treated as a continuous rather than categorical variable, allowing different degrees of behavioural performance to be analysed rather than reducing behaviour to a binary outcome (Kaiser, 1998; Kaiser & Wilson, 2000, 2004; Markle, 2013). A fuller explanation of PEB also requires consideration of the variables that shape it. Spatial context is particularly important because the conditions under which behaviour is performed may vary from place to place (Bruderer Enzler, 2015; Klaniecki et al., 2018). Against this background, the study focuses on Poland. As Węcławowicz (2007, 2018) notes, after 1989 Poland underwent a relatively rapid

transition from state socialism to democracy in the political sphere and to capitalism in the economic sphere, while social transformation has proceeded more gradually. Changes in social attitudes and behaviour have therefore unfolded more slowly, although progressively (Vasconcelos et al., 2022; Iwińska et al., 2023). This process also applies to PEB. Comparative research suggests that self-reported PEB is, on average, less widespread in Poland than in many Western and Northern European countries (Silvi & Padilla, 2021; Mikuła et al., 2021).

Explaining the spatial variation in PEB requires consideration of a broad range of determinants. These include environmental knowledge, values, attitudes, perceived responsibility, agency and control, as well as social norms, group influence, social capital, and broader cultural and institutional conditions (Hines et al., 1987; Stern, 2000; Kollmuss & Agyeman, 2002; Bamberg & Möser, 2007; Steg & Vlek, 2009; Klöckner, 2013; Gifford & Nilsson, 2014; Blankenberg & Alhusen, 2019; Dąbrowski et al., 2022). Less extensively explored, but equally relevant, are spatial conditions associated with the local residential environment, including infrastructure availability, local social context, and differences between urban, suburban and rural areas (Huddart-Kennedy et al., 2009; Klaniecki et al., 2018; Sheasby & Smith, 2023; Piao & Managi, 2024). In line with Steg and Vlek (2009) and Gifford and Nilsson (2014), these conditions can influence both the form and intensity of PEB (see also Duron-Ramos et al., 2020; Brenneis et al., 2022; Mateer et al., 2022). Yet the extent to which urban or rural context shapes PEB remains an open question (Huddart-Kennedy et al., 2009), made more complex by suburbanisation. In general, cities—especially larger ones—are characterised by initiatives related to building energy efficiency, public transport and recycling (Barr et al., 2011). Pro-environmental practices may also be facilitated by supportive infrastructure, including dense cycling networks and separate waste-collection systems that improve recycling efficiency and are concentrated primarily in urban areas (Thøgersen & Crompton, 2009; EEA, 2021). In more dispersed rural areas, greater emphasis is placed on natural-resource management, sustainable water management, organic farming (Pretty, 2008) and energy self-sufficiency, for example through rainwater harvesting or renewable energy use (Liu et al., 2018).

Although the literature identifies some differences between settlements classified dichotomously and according to their formal legal status, this approach does not provide a clear answer as to whether living in an urban or rural area affects PEB (Berenguer et al., 2005; Huddart-Kennedy et al., 2009; Dymitrow & Stenseke, 2016; Dąbrowski et al., 2022). Accordingly, rather than relying on the formal legal status of settlement units—an approach that appears too coarse to explain the spatial variation of social phenomena such as PEB—this study considers the actual degree of urbanisation along a rural–urban continuum (Dymitrow & Stenseke, 2016; Dymitrow et al., 2018; Biegańska et al., 2018).

This approach is particularly relevant in Poland, where formal legal status often corresponds only weakly to the actual degree of urbanisation (Bański, 2009; Dymitrow, 2013, 2017; Dymitrow et al., 2018; Biegańska, 2019). For example, the largest villages in Poland have populations exceeding 10,000 and are typically suburban settlements with a high degree of urbanisation. Conversely, numerous very small towns have fewer than 1,000 inhabitants. As of 30 June 2025, Opatowiec—the smallest town in Poland—had a population of 306, illustrating what may be described as semi-urbanisation (Konecka-Szydłowska, 2018; Biegańska, 2019; Cudo, 2019). This mismatch supports moving beyond the formal classification of individual settlements and adopting an approach that allows them to be compared along a rural–urban continuum. In the context of PEB, place of residence can be understood both as a space in which particular resources, infrastructure and opportunities for action are available and as a place associated with identity and a sense of belonging (Graham, 2009; Csurgó et al., 2018; Csurgó &

Smith, 2022). As Tuan (1977) emphasises, relationships between space, place and the individual are reflected in human behaviour. For PEB, the conditions of everyday life are especially important because the residential environment and available infrastructure can enable or constrain particular practices (Verplanken & Wood, 2006; Steg & Vlek, 2009; Shove, 2010).

From this perspective, the immediate residential environment can be understood as the socio-spatial context of everyday behaviour. Built form, spatial layout and infrastructure availability can shape opportunities to engage in practices related to mobility, consumption and waste management (Barr et al., 2011; Steg & Vlek, 2009; Gifford & Nilsson, 2014; Klaniecki et al., 2018). The importance of this context may vary by behaviour because different types of residential environment along the rural–urban continuum provide different opportunities and constraints for everyday practices (Huddart-Kennedy et al., 2009; Dąbrowski et al., 2022; Sheasby & Smith, 2023). This perspective therefore treats PEB not only as an outcome of individual attitudes and preferences but also as a set of practices embedded in specific socio-spatial conditions. Understanding these relationships is relevant to spatial planning and to the design of interventions intended to support sustainable behaviour.

This perspective also has broader practical implications. Identifying the links between people and their living environments may contribute to environmental awareness, PEB and the formulation of policies that respond to locally specific challenges (Mayer & Frantz, 2004; Beery & Wolf-Watz, 2014; Gosling & Williams, 2010; Martin & Czellar, 2017). Place identity and PEB are not static; they evolve over time in response to migration, urban change and suburbanisation (Lewicka, 2011; Devine-Wright, 2009; Brown et al., 2003). Changes in the local environment, such as infrastructure development or environmental degradation, may redefine residents' relationships with place and the environment and influence their willingness to engage in PEB (Manzo & Devine-Wright, 2020). The adopted perspective therefore conceptualises place of residence not as a simple administrative category but as a socio-spatial context that can create different opportunities and constraints for particular forms of PEB.

Materials and methods

The theoretical framework and literature review informed the methodological approach. The main data source was a nationwide survey conducted using Computer-Assisted Web Interviewing (CAWI) with a probabilistic sample of 1,082 Polish adults. This design made it possible to estimate the potential sampling error (3% in this case) and to generalise the results to the wider population (cf. Chater et al., 2006; Matoušek & Vondrák, 2008). The sample structure was established with reference to the 2021 National Population and Housing Census, using gender, age and place of residence as key characteristics. The final sample comprised 51.7% women and 48.3% men. In terms of age, 34.9% of respondents were aged 18–39, 42.0% were aged 40–65, and 23.2% were aged over 65. Respondents lived in rural areas (40.4%) and urban areas (59.6%); the latter included 23.7% living in towns and cities with up to 50,000 inhabitants, 17.1% in cities with 50,000–200,000 inhabitants, and 18.8% in cities with more than 200,000 inhabitants.

The survey questionnaire was developed on the basis of a literature review covering human geography, environmental psychology and sociology. An important point of reference was the Hogan Motives, Values, Preferences Inventory (MVPI), which is used in psychology to assess individual goals, values and motivations (Hogan & Hogan, 1996). The final questionnaire contained four multi-item questions covering four PEB dimensions: (1) transport (Transport Behaviour Indicator – TBI), (2) grocery shopping (Grocery Shopping

Behaviour Indicator – GSBI), (3) non-grocery shopping (Non-Grocery Shopping Behaviour Indicator – NGSBI), and (4) waste segregation (Waste Segregation Behaviour Indicator – WSBI). Each item was measured on a five-point scale to capture variation in PEB and allow the resulting scores to be compared after standardisation. The main questions were supplemented by socio-demographic items used to profile respondents. Respondents were also asked to classify the character of their residential surroundings. The question 'My current place of residence is surrounded by:' offered four response categories: urban landscape, housing-estate landscape, suburban landscape and rural landscape. The structure of the survey questions and the operationalisation of the analysed variables are presented in Table 1.

Table 1. Structure of the main survey questions for the four PEB dimensions (TBI, GSBI, NGSBI and WSBI) and the item identifying the character of the residential environment

Indicator	**Variables**
TBI	How do you usually travel? Please rate each mode on a scale from 1 to 5 (where 1 means never and 5 means most often): • On foot* • By public transport (bus, tram or train)* • By passenger car (petrol, diesel or LPG)** • By electric car* • By conventional or electric bicycle* • By conventional or electric scooter*
GSBI	When choosing food products, how often do you do the following? Please rate each item on a scale from 1 to 5 (where 1 means never and 5 means most often): • Buy local products* • Grow or produce my own food* • Try to avoid wasting food* • Buy organic products* • Buy responsibly sourced products* • Follow a vegan or vegetarian diet*
NGSBI	When choosing non-food products, how often do you do the following? Please rate each item on a scale from 1 to 5 (where 1 means never and 5 means most often): • Use reusable bags* • Choose products in reusable or recycled packaging* • Buy second-hand products* • Limit purchases of new items*
WSBI	When managing waste, how often do you do the following? Please rate each item on a scale from 1 to 5 (where 1 means never and 5 means most often): • Follow recycling principles* • Compost biowaste* • Separate waste at home* • Separate waste when away from home* • When waste cannot be separated while I am away from home, take it home and separate it later*
Residential environment	My current place of residence is surrounded by: • Rural landscape (forests, arable fields, greenery, clean air) • Suburban landscape (quiet streets, low traffic levels, landscaped greenery in private gardens) • Housing-estate landscape (quiet space with limited road traffic, landscaped greenery, and places for rest and children's play) • Urban landscape (dense development, high traffic levels, a park or green areas nearby)

Source: authors' own work. Notes: *stimulant; **destimulant.

Following data collection, the quantitative responses were analysed. Indicators for mobility, grocery shopping, non-grocery shopping and waste management were constructed by comparing each respondent's behavioural profile with a theoretical 'ideal pro-environmental profile'. First, scores on the 1–5 scale were linearly normalised. For mobility, four components were distinguished: active transport (walking/cycling), coded as a binary variable (1 = at least one use, 0 = none), and public transport, electric cars and internal-combustion-engine cars, weighted at 1/3, 2/3 and 1, respectively, to reflect their relative environmental impacts (cf. Transport Scotland; Richardson, 2005). For grocery shopping, non-grocery shopping and waste management, each vector comprised the normalised scores for all items within the relevant domain. Next, for each respondent, the Euclidean distance between the respondent's vector and the point representing 'full pro-environmental performance' was calculated, together with the maximum distance corresponding to an extremely non-environmental profile. Finally, the distance ratio was inverted (1 minus the quotient), producing a standardised measure ranging from 0 to 1, where 1 indicates an ideal match (zero distance) and 0 the maximum distance from the ideal PEB profile. This procedure yielded a 0–1 PEB score for each respondent in each analysed domain.

$$PEB_i = \frac{d_{i,non}}{d_{i,eco} + d_{i,non}}$$

where:

- PEB_i – value of the PEB indicator for respondent i,
- d_i,eco – distance between respondent i's profile and the pro-environmental profile,
- d_i,non – distance between respondent i's profile and the non-pro-environmental profile.

In addition to the four domain-specific PEB indicators, a key variable was the character of respondents' places of residence in terms of their actual degree of urbanisation (landscape type). Landscape type was based on respondents' subjective classifications, which were assumed to reflect the actual degree of urbanisation of the residential environment at the local scale. Each respondent selected one of four categories: rural landscape (forests, arable fields, greenery, clean air), suburban landscape (quiet streets, low traffic levels, landscaped greenery in private gardens), housing-estate landscape (quiet space with limited road traffic, landscaped greenery and places for rest and children's play), or urban landscape (dense development, high traffic levels, a park or green areas nearby). Together, these categories formed a rural–urban continuum (cf. Gohar, 2017; Rodrigue, 2024; Rural Ontario Institute), ranging from the least to the most urbanised type.

The four PEB indicators and the landscape types were then subjected to statistical analysis to test the research hypotheses, using cross-tabulations (matrix tables) and statistical tests.

Results

Pro-environmental behaviour was analysed across four domains of everyday life: transport (TBI), grocery shopping (GSBI), non-grocery shopping (NGSBI) and waste management (WSBI). For each domain, indicator values were calculated using the procedures described in the Methods section and transformed to a common 0–1 scale, where higher values indicate closer alignment with the adopted ideal pro-environmental profile. This approach treats PEB as a continuous characteristic without imposing arbitrary categories or classification thresholds.

The analysis first compared the mean values of the four indicators for the sample as a whole. The highest mean was observed for waste-management behaviour (WSBI = 0.66), followed by grocery shopping (GSBI = 0.56) and non-grocery shopping (NGSBI = 0.54). Transport behaviour had the lowest mean value (TBI = 0.44). The results therefore indicate clear differences in the intensity of PEB across domains of everyday life. Waste-management behaviour showed the closest alignment with the pro-environmental profile, while transport behaviour showed the weakest alignment.

The analysis was then extended to the spatial context of respondents' places of residence. In accordance with the research design, the four landscape types were ordered along the rural–urban continuum: rural, suburban, housing-estate and urban. The mean values of the four indicators across these landscape types show that the direction of change is not consistent across all PEB domains (see Table 2).

Table 2. Mean values of the PEB indicators (TBI, GSBI, NGSBI and WSBI) by respondents' landscape type (n = 1,082).

	TBI	**GSBI**	**NGSBI**	**WSBI**
Rural landscape	0.385	0.596	0.552	0.723
Suburban landscape	0.422	0.572	0.547	0.670
Housing-estate landscape	0.475	0.539	0.534	0.616
Urban landscape	0.510	0.537	0.540	0.625
Valid observations (n)	1082	1082	1082	1082
Kruskal–Wallis H	57.386	39.112	1.1806	69.773
p-value	$p < 0.001$	$p < 0.001$	$p = 0.7576$	$p < 0.001$
df	3	3	3	3
Mean indicator value	0.44	0.56	0.54	0.66

Source: authors' own elaboration based on survey data (n = 1,082).

The clearest pattern was observed for TBI. Mean values increased systematically along the rural–urban continuum, from 0.385 in the rural landscape to 0.422 in the suburban landscape, 0.475 in the housing-estate landscape and 0.510 in the urban landscape. The difference between the two ends of the continuum was therefore 0.1251 scale points. This ordering indicates a clear monotonic increase in TBI from rural to urban settings, with each successive landscape type recording a higher mean than the previous one. The Kruskal–Wallis test confirmed statistically significant differences in TBI between the four landscape types ($H = 57.386$; $df = 3$; $p < 0.001$) (see Table 2). Thus, the distribution of transport indicator values differed across landscape types, while the pattern of means shows that TBI increased systematically with urbanisation.

GSBI showed the opposite pattern. The highest mean value occurred in the rural landscape (0.596), followed by the suburban (0.572), housing-estate (0.539) and urban (0.537) landscapes. Thus, unlike TBI, GSBI decreased monotonically from rural to urban settings, although the difference between the housing-estate and urban categories was small. The difference between the rural and urban means was 0.059. The Kruskal–Wallis test nevertheless indicated statistically significant differences in GSBI between landscape types ($H = 39.112$; $df = 3$; $p < 0.001$) (see Table 2).

NGSBI displayed the smallest differences between landscape types. Mean values were 0.552 in the rural landscape, 0.547 in the suburban landscape, 0.534 in the housing-estate landscape and 0.540 in the urban

landscape. Descriptively, NGSBI declined slightly from rural through suburban to housing-estate settings, before increasing marginally in the urban landscape. This pattern does not constitute a clear gradient along the rural–urban continuum. Moreover, the Kruskal–Wallis test found no statistically significant differences in NGSBI between landscape types ($H = 1.181$; $df = 3$; $p = 0.758$) (see Table 2). There is therefore no statistical basis for concluding that non-grocery-shopping behaviour differs across the four landscape types.

WSBI exhibited a different pattern of spatial variation. The highest mean value was recorded in the rural landscape (0.723), followed by the suburban landscape (0.670) and the housing-estate landscape (0.616). The mean in the urban landscape was slightly higher than in the housing-estate category, at 0.625. WSBI therefore did not follow a fully monotonic gradient across the continuum. The difference between the highest mean, in the rural landscape, and the lowest, in the housing-estate landscape, was approximately 0.108 scale points. The Kruskal–Wallis test nevertheless showed statistically significant differences in WSBI between landscape types ($H = 69.773$; $df = 3$; $p < 0.001$) (see Table 2).

Taken together, the four PEB dimensions show that variation by landscape type does not follow a single, universal direction. Statistically significant differences were identified in three of the four domains—transport, grocery shopping and waste management—whereas non-grocery-shopping behaviour did not vary significantly between landscape types.

The directions of change also differed across indicators. TBI increased systematically from rural to urban landscapes, whereas GSBI followed the opposite pattern and declined along the same continuum. WSBI also tended to be higher in less urbanised settings, although its pattern was not fully monotonic. NGSBI, by contrast, remained relatively stable across the continuum.

The findings therefore reveal a domain-specific pattern of spatial variation in PEB, supporting the separate analysis of different areas of everyday behaviour.

Discussion and conclusions

Differences between the four domains of everyday behaviour show that PEB should not be treated as a homogeneous set of practices. Individual forms of PEB differ in their costs, required effort, and the opportunities and constraints that shape their performance, as recognised in the literature on the multidimensional nature of environmental behaviour (Stern, 2000; Diekmann & Preisendörfer, 2003; Steg & Vlek, 2009; Whitmarsh & O'Neill, 2010; Moore & Boldero, 2017). In this study, such variation was also evident across subjectively identified residential landscape types. Statistically significant differences between landscape types were found for TBI, GSBI and WSBI, but not for NGSBI. The direction of these differences also varied: TBI was highest in the urban landscape, whereas GSBI and WSBI were highest in the rural landscape.

These findings support a contextual understanding of PEB, in which the relevance of place of residence depends on the practice under consideration and on the opportunities and constraints affecting its performance. This interpretation is consistent with Huddart-Kennedy et al. (2009), who found only small rural–urban differences in overall PEB while identifying variation in specific practices and in the opportunities to perform them. Similarly, Sheasby and Smith (2023) found no unequivocal difference in overall PEB between urban and rural populations.

The clearest spatial pattern concerned transport, with TBI increasing from rural to urban landscapes. This finding can be interpreted in light of research showing that built form, public transport accessibility, the spatial

distribution of functions, and walking and cycling infrastructure influence travel-mode choice (Cervero & Kockelman, 1997; Boulange et al., 2017; Ding et al., 2017; Eldeeb et al., 2021; Yu et al., 2023). Higher TBI values in urban landscapes may therefore reflect more favourable conditions for lower-emission mobility rather than a generally higher level of PEB among urban residents.

GSBI followed the opposite pattern, decreasing systematically from rural to urban landscapes. This finding should not be interpreted as evidence that rural residents are generally more pro-environmental; rather, it points to differences in the conditions under which food-related practices are performed. In Poland, residents of rural areas and small towns more often prefer local food, whereas preferences for organic food may be stronger in larger cities (Dudziak & Kocira, 2022). Food-waste practices also vary spatially, with some studies reporting lower levels of food waste in rural than in urban communities (Peronti et al., 2024). The observed GSBI gradient may therefore reflect the coexistence of different food-related practices that are enabled or constrained in different ways by local spatial conditions.

Higher WSBI values in rural landscapes may likewise reflect conditions that facilitate practices requiring adequate space or facilities, particularly composting (Kunszabó et al., 2022). By contrast, the absence of significant variation in NGSBI suggests that the immediate residential environment may be less influential for this group of behaviours. Purchasing second-hand goods, reusing products and limiting consumption may depend more strongly on individual and economic factors and on access to different consumption channels (Ertz et al., 2017; Hur, 2020; Zhang & Hale, 2022).

The results therefore do not support the conclusion that residence in any one landscape type is consistently associated with higher PEB. This is in line with previous research, which has not identified a single universal direction of rural–urban differences in pro-environmental behaviour (Berenguer et al., 2005; Huddart-Kennedy et al., 2009; Dąbrowski et al., 2022; Sheasby & Smith, 2023). The rural–urban continuum is thus useful not for ranking places from less to more pro-environmental, but for capturing differences in the conditions under which particular practices are performed. This perspective is consistent with literature highlighting the limitations of a simple urban–rural dichotomy and the need to account for intermediate forms and the complexity of rural–urban relations (Dymitrow & Stenseke, 2016; Biegańska et al., 2018; Dymitrow et al., 2018). Recent research likewise shows that rural–urban regions are internally diverse contexts in which everyday experiences and locally specific issues can differ substantially from broader regional patterns, with implications for planning and land management (Fienitz et al., 2026).

Landscape type is only one determinant of PEB. Previous research also highlights the importance of values and attitudes, social norms, perceived behavioural control, habits, and socio-demographic and economic factors (Stern, 2000; Bamberg & Möser, 2007; Klöckner, 2013; Gifford & Nilsson, 2014; Li et al., 2019). Differences between landscape types should therefore be interpreted within this broader set of determinants rather than attributed to place of residence alone. From a practical perspective, this supports tailoring interventions to the barriers associated with specific practices—for example, the availability of alternatives to car travel, the conditions for sustainable food consumption, and opportunities for waste separation and composting (Boulange et al., 2017; Dudziak & Kocira, 2022; Geiger et al., 2019; Kunszabó et al., 2022).

The findings should be interpreted in light of the cross-sectional and self-reported nature of the data, which precludes causal inference. Although the subjective identification of landscape type is consistent with the adopted research perspective, it does not reveal which specific characteristics of the residential environment

account for the observed differences. Future research should therefore combine perceived residential context with objective spatial characteristics and incorporate social, economic and individual determinants of PEB. This would allow the influence of place of residence to be assessed relative to other determinants of pro-environmental behaviour.

Overall, the rural–urban continuum is a useful but, on its own, insufficient analytical framework for examining spatial variation in PEB. Its relevance depends on the behaviour being analysed and on the conditions under which that behaviour is performed; a fuller explanation of the observed differences also requires attention to social, economic and individual determinants. For environmental planning, this means considering not only broad rural–urban differences but also the locally specific conditions that shape residents' everyday practices. Such an approach is consistent with planning that is sensitive both to wider structural conditions and to local circumstances and residents' perspectives across rural–urban regions (Fienitz et al., 2026).

Clinical trial number: not applicable.

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