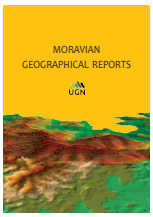


MORAVIAN GEOGRAPHICAL REPORTS

sciendo

The Czech Academy of Sciences, Institute of Geonics

journal homepage: http://www.geonika.cz/mgr.html

doi: https://doi.org/10.2478/mgr-2021-0009

Measuring environmental and landscape-related potential for tourism development in rural areas and assessment of its co-occurrence with tourist movement: The case of Poland

Marcin MAZUR [a]*, Maria BEDNAREK-SZCZEPAŃSKA [a], Jerzy BAŃSKI [a], Damian MAZUREK [a]

Abstract

The assessment of assets regarding their potential for tourism development is a well-recognised aspect of quantitative geographic research. This paper confines such matters to environmental and landscape-related attributes. The methodological objective is to propose a synthetic index for holistic measurement of a complex system of assets at the local level for Poland's rural areas, followed by its empirical verification. The natural and landscape-related potential of a given area is perceived broadly, as the aspects involved are diverse and complementary: the quality of the landscape, the value of the environment, forest cover, relief, accessibility to surface waters and local bioclimate. The cognitive advantage of this research project is attained by confronting this index against a measure of tourist movement, as well as classifying rural areas by means of combining both dimensions. A considerable number of communes in Poland are characterised by relatively high potential, albeit they are not being exploited for tourism development to a correspondingly large degree.

Key words: *local development potential, tourist attractiveness, local assets, synthetic index, rural areas, Poland*

Article history: *Received 18 July 2020, Accepted 31 March 2021, Published 30 June 2021*

1. Introduction

Rural areas possess a variety of tangible and intangible resources shown to be significant for the development of tourism (Bański, 2019). Such items, being employed in this economic sector, are referred to as tourism assets, while the process of their assessment and measurement is known as tourism valuation. The assets in question are (or should be) known to authorities at key spatial tiers – the state, the region or the commune – as well as other institutions and organisations, given their objectives to develop and pursue a more effective tourism policy within the wider context of rural development.

While assessment of assets with respect to their valuable attributes is considered a well-known approach in quantitative research in the geography of tourism, this concept in fact represents one of sub-discipline's more-demanding tasks. One traditional division has been between environmental attributes and those of a non-natural character (Kowalczyk, 2001). Several authors employ the term environmental and landscape-related assets, which more accurately define attributes to be assessed.

The aim of this study is methodological in its attempt to construct a synthetic index of environmental and landscape-related assets for tourism development in Poland's rural areas, which would allow for both quantitative and holistic presentation, ensuring comparability of areas of diverse specificity in this respect.

In the section summing up the spatial differentiation found at present, values for the synthetic index are set against the distribution of actual tourist movement in rural areas of Poland. This provides for a proposed classification of communes from the point of view of the level of use being made of attributes of nature, and the landscape that represents a specific kind of measure of their significance as factors in local development, while also serving to exemplify ways in which the proposed index can be used in practice.

[a] Institute of Geography and Spatial Organization, Polish Academy of Sciences, Warsaw, Poland (*corresponding author: M. Mazur, e-mail: *m.mazur@twarda.pan.pl*)

2. Theoretical background

Natural (environmental) assets are particularly significant in choosing tourist destinations and are considered one of the main factors attracting tourists (Kowalczyk, 2001; Dupeyras and MacCallum, 2013). They represent one of the main purposes for visiting rural areas. Assessment of tourism-related natural characteristics in different spatial units has been the topic of numerous studies conducted in various parts of the world, not the least in Australia (Priskin, 2001), Indonesia (Rahayuningsiha et al., 2016), Nigeria (Obinwanne and Okpoko, 2015), Turkey (Alaeddinoglu and Can, 2011), and Romania (Iatu and Bulai, 2011). Research of this kind most often extends, not only to particular attributes, but also to other elements of tourism space, the aim being to assess aspects such as attractiveness, tourism function and potential. Various methods are employed for this purpose, including simple descriptive ones as well as advanced statistical GIS modelling. Valuation may also draw on the opinions of tourists, experts or inhabitants, in both assessments as such – and the typical approach of assigning rank/weigh to different resources (e.g. Ferrario, 1979; Priskin, 2001; Yan et al., 2017). Research at detailed scales, covering regions or their sections are most common, while there have been very few studies in which a specific method of valorisation of spatial units is applied to the territory of an entire state.

In Polish geography of tourism, nature-related valuation has a long tradition, although today researchers seem to be less attentive to the idea. This article is a continuation of prior achievements in this field. Attempts to assess the natural environment for the purposes of tourism were already undertaken before World War II. The first use of a "quality-class" type of points system was made by S. Leszczycki for assessing recreational attributes of Poland's Podhale region (Leszczycki, 1938). B. Mikułowski (1976) measured attractiveness from a tourism point of view by multiplying the number of attractive objects by defined categories using points total. Considerable input into the development of quantitative means to assess tourism space was made by J. Warszyńska (1974), who applied the so-called "model method" in processing quantitative information on given features of the environment via a defined mathematical function. Traditionally, the main elements of the environment considered in tourism-related valuations have been forest, relief and surface waters.

The valuation of Poland's rural recreational space was also a matter taken up by M. Drzewiecki (1992), who devised a method of assessing communes (in Polish: *gmina*, LAU 2 units) using seven diagnostic features: population density per km^2, proportion of meadows and pastures in arable land, share of forest and waters, proportion of individual (as opposed to collective) agriculture, settlements of defined types, and percentage of the population making a living from non-agricultural sources. After determining threshold values for the listed indicators, this author classified communes in terms of recreation conditions.

Many studies on attractiveness for tourism (*inter alia* in terms of nature and the landscape) have been pursued in Poland, though mainly in relation to the basic units of territorial administration. Exceptions have related to geometrical fields of reference. It needs to be stressed, however, that all were works concerning particular voivodships (provinces, NUTS 2 units) and districts (in Polish: *powiat*, LAU 1 unit at county level) or units within physico-geographical regionalisation. There is then an apparent scarcity of studies seeking to assign value to tourist space at the scale of communes for the entire territory of Poland.

Tourism-valuation research often deploys methods assigning units to quality classes based on certain received points. An obvious flaw in these studies is the typically arbitrary way in which points totals are determined for given features and attributes. Certain authors confer points having compared values for given features in a commune with an average arrived at for their study area as a whole (Parzych, 2010). The most common method nevertheless involves the determination – for the units studied – of values for a synthetic index constructed by weighting different measures (Gołembski [ed.], 2002; Hakuć-Błażowska et al., 2018) but justification for the weighting conferred on particular features is lacking. Weights may also be assigned based on surveys (Bednarek-Szczepańska, 2010).

It is more common to find studies in which measures relating to attributes of nature and the landscape are linked with others in the sphere of tourism management, in order generate a synthetic index of tourism attractiveness (Parzych, 2010; Gryszel and Walesiak, 2014). In turn, by also adding in a measure of tourist movement, an index of the level of development of the tourism function has been devised (Derek, 2007; after Durydiwka, 2012). Only more rarely are features valuable in tourism (be these natural or natural/cultural) treated as potential, the measure of which is then set against another relating to tourism management, so that types of area making differential use of their potential can be identified (Jezierska-Thole, 2007).

The valuations of local assets considering their significance for tourism have usually concerned areas of relatively limited spatial extent, but in fact distinguished by the presence of resources defined as valuable in advance. A plus-point of such studies may thus be the way applied methodology is more or less directed at exposing attributes regarded *a priori* as of greatest importance to the study area. Equally, there is a lack of studies of greater spatial scope, taking in more diversified areas. For many years, that kind of situation was explicable in terms of obstructed or limited access to data. Quantitative conceptualisation of numerous features important from the point of view of tourism required time-consuming measurements made on a detailed scale – hence the typical focus on relatively small areas. Today, however, these difficulties may largely be overcome by using spatial information in the form of digital data, as processed using GIS tools. In connection with this, the work described here took up the challenge of looking holistically at the most important local features of environment- and landscape-related profiles present in the spatially diverse rural part of Poland, as well as conceptualising these synthetically in line with uniform criteria.

3. Methodological assumptions and research procedures

The research entailed development of an abstract model (Falkowski, 1994) of rural tourism space in Poland, with the more specific aim to identify and measure valuable environmental and landscape features. In line with this approach, the model is understood as a hypothetical thought construct involving acceptance of a certain configuration of assumptions (at times clearly subjective), as well as simplification of a defined segment or extract of complicated reality. The objective sees the subject of

the research extracted, with the most important features of its internal structure presented, so that the complexity of the phenomenon under consideration is reduced to a degree allowing for overall understanding (see *inter alia* Rawski, 2011).

Following this approach, the modelling forming the key subject of this study proceeded on a series of assumptions working to achieve simplification, along with highlighting key features. Before developing the synthetic index of assets began, it proved possible to identify three key challenges of a methodological nature. The first involved differences in the significance of various environmental and landscape assets for tourism. This may depend on the preferences that tourists themselves display and is associated with different forms of tourism. Each method of assessment is burdened by a certain subjectivity (Kowalczyk, 2001; Priskin, 2001), and the subject literature's various compilations concerning resources underpinning given any areas' (regions' or localities') natural attributes (and weightings assigned to them) cannot be considered to represent the higher, national level. In this connection, an assumption of the work described here was that the set of diagnostic features used in valuation would focus on assets that are:

- Of key importance, i.e. referred to regularly in the literature, no matter which region is being considered;
- Mutually complementary (not doubling or otherwise reproducing the information expressed); and
- Representative of the different elements of the natural environment (relief, aquatic features, climate, etc.).

Given this way of ensuring by definition that the set of diagnostic features was confined to key ones, it was further decided that equal weight should be attached to each of the diagnostic indices brought together to yield the final value. The studies published so far offer no arguments powerful enough to justify conferring particular weighting schemes on assets contributing to a study of Poland as a whole, albeit targeted at the local administrative level (commune).

In fact, researchers have taken different approaches in this regard. The study edited by G. Gołembski (2002) saw different significances assigned to valuable features (with highest rank conferred upon forest areas and those with access to the sea), but in a purely intuitive way, with no concrete justification made available. A similar situation applied to the work by C. Iatu and M. Bulai (2011), concerning parts of Romania. Those authors adopted a very well-developed set of indices, even as the assumptions accompanying them would seem to raise doubts (e.g. with four times as many points potentially being awarded for relief as for the presence of waters – for no obvious reason). In turn, M. Derek (2008) did not assign weightings to measures representing different tourism-related attributes that comprised a synthetic index of the tourist function.

A second challenge concerns the way the research involves Poland as a whole, and hence an area markedly diversified from the point of view of both nature and the landscape. The attendant assumption was that the adopted assortment of diagnostic features should be "universal", to take account of assets relevant to tourist attractiveness in rural areas up and down the country.

Concurrently, no account was to be taken of assets representing very specific attributes that favour certain specialised and advanced forms of tourism (e.g. caving, climbing, angling, sailing, etc.) (cf. Kowalczyk, 2001).

A third challenge then relates to the need for a compromise between the consequences of the work's Poland-wide scope, and its considerable level of spatial detail, as well as limitations imposed by the availability of data. The basic spatial unit considered the commune, i.e. the unit of local administration of which Poland has 2,477. Like the Atlas of Rural Areas in Poland (Bański [ed.], 2016), this research project assumes that the "rural area" is the combined territory coming under the rural commune category, together with those part of urban or urban-rural communes' set in which a town present has fewer than 10,000 inhabitants. In 2017, the area meeting this definition extended to 86.3% of the entire area of Poland. Ultimately, the work detailed here employed secondary statistical data and indexes calculated on the basis of topographical data, aggregated spatially for a set of communes located in parts of rural Poland (in line with the aforementioned assumptions).

The first stage of the work involved selection of a set of diagnostic features in line with study assumptions, and of potential value in further parts of the study. It was accepted that an overall assessment of tourism-related features valuable from the point of view of environment and the landscape at the level of each commune, should attach key significance to six assets. Namely, they are as follows: (1) quality of the landscape; (2) value of the environment; (3) forest cover; (4) relief; (5) accessibility of surface waters; (6) features of the local bioclimate.

In practice, an area's significance from the tourism point of view is rarely seen to be based on a single asset being present, with a set of qualities instead being required, including but not confined to those of a natural character (Martin, 2005). To achieve quantitative conceptualisation and assessment of each feature mentioned, it was proposed to use the following set of diagnostic indices (w_i):

w_1 – the total area within the forms of areal protection known as Landscape Parks and Areas of Protected Landscape, as related to commune area (GUS, 2017);

w_2 – the total area of National Parks and Nature Reserves, as related to commune area (GUS, 2017);

w_3 – the share of the commune's land cover accounted for by forest (GUS, 2017);

w_4 – the average slope inclination of land in the commune (DEM – 100-meter grid-size);

w_5 – an index of accessibility to surface waters;

w_6 – an index of the stimulating effect of climate and health-related features.

The selection of each attribute and its expression using a defined index is linked with the adoption of further model assumptions, with a certain influence obviously being exerted on the result obtained. Considerable emphasis is thus put on full justification of our decisions.

Areas with attractive landscapes epitomise a key valuable feature helping sustain mass tourism (Kowalczyk, 2001). This is particularly the case for tourism in rural areas (including the more specific "rural tourism"), in which landscapes are seen to play their roles (Daugstad, 2008; Jepson and Sharpley 2014). "Picturesque scenery" is renowned as a prevalent element in tourists' imaginings when it comes to rural areas and the countryside (Aznar et al., 2007; Dubois et al., 2017; Frisvoll, 2013). Likewise, landscape is one of the key component parts of the "countryside capital" that tourism is based on (Garrod et al., 2006). Areas featuring landscape values are covered

by dedicated protection forms in Poland. Their share in the area of the commune was adopted as an index of landscape quality.

In the public consciousness, a rural area is likewise associated with nature and the natural environment (Jepson, 2015). Researchers apply the concept of *naturophilia* as they define a trend present in contemporary tourism to attach great significance to valuable natural assets and their protection. An interest in nature also reflects an increasingly higher level of environmental consciousness among tourists (Gossling and Hickler, 2005). Environmental values of rural areas were determined by a measure of the proportion of the commune area made up of National Parks and reserves. The literature most often features a different approach, whereby researchers apply a single measure encompassing all areas enjoying legal protection (e.g. Derek, 2008; Gołembski [ed.], 2002). Certain reservations can be expressed regarding this tactic, however, as the forms taken account of may differ markedly in terms of the subject of protection.

The presence of forests, especially large ones, is of significance in meeting tourism-related and recreational needs (Gossling and Hickler, 2005). Furthermore, it is anticipated that such importance will be greater in the future (Gossling and Hickler, 2005). Forest cover is in fact the index deployed most widely in tourism-related valuations.

In turn, while waters are regarded as one of the most precious attributes from the point of view of tourism (Jones et al., 2005), these attributes can still be omitted in research dealing with large sets of spatial units, because of the sheer difficulty of obtaining relevant statistical data (e.g. Derek, 2008). For similar reasons, researchers' assessments of assets valuable with respect to tourism often neglect the aspect of relief – even where an inquiry deals with mountainous areas (e.g. Gryszel and Walesiak, 2014). Relief is nevertheless regarded as a key environmental aspect determining the attractiveness of a given rural area for tourists (Durydiwka, 2012).

Climate obviously affects choices of tourist destination (Hamilton and Lau, 2005). On the global and continental scales, it is decisive as in the distribution of the main areas of mass tourism of the "3S" type (cf. Becken, 2010). Equally, it may be of importance locally as well (Martin, 2005). At this local scale, a crucial role in tourism is played by bioclimates (Krzymowska-Kostrowicka, 1997; after Derek, 2008; Knezevic, 2008). Bearing in mind the extent of the study area (located entirely within a single climatic zone), it was assumed that features of local climates are matters of overriding significance for the spatial differentiation of climatic impacts on tourist attractiveness, particularly when it comes to stimulatory effects.

While the first four indices are relatively simple constructs, w_5 and w_6 do require some more explicit comments. The w_5 index is a ratio between the conversion index for the area of surface waters (P_{wp}) and the overall area of a given commune (P_g). The category of a conversion index is introduced to take account of the differentiated inputs of the sea, a lake or a river on attractiveness to tourists. There is no doubt that the sea is of greater importance to tourism than a lake, while the latter is in turn more attractive than a river (cf. Gołembski, 2002) – hence the need for such a distinction to be drawn. The w_5 index was calculated according to the formula:

$$w_5 = \frac{P_{wp}}{P_g} = \frac{3\times P_m + 2\times P_j + P_r}{P_g},$$

where P_m is the area of land located up to 5 km from the seashore; P_j is the area occupied by lakes or located within 5 km of a lake shoreline (albeit not meeting the criteria qualifying it for inclusion within the P_m category); P_r is the area occupied by rivers or canals, or located within 5 km of such a feature (albeit not meeting the criteria for inclusion within the P_m or P_j categories).

The source of data on the different categories of surface waters was Corine Land Cover dating from 2012. Its defined (constant) level of spatial resolution provides for comparability of the index values across Poland, due to the standardisation of: a) the criterion of the size of bodies of water and watercourses taken account of, as well as b) the level of detail of the spatial generalisation thereof.

The value of the w_6 index was calculated by reference to: a) bioclimatic data for Poland after the map of T. Kozłowska-Szczęsna (1994) – as the mean rank for the stimulatory effect of the bioclimate as weighted by the area of occurrence within the commune (P_b); as well as b) the locations of health resorts (U). This is expressed by the equation:

$$w_6 = P_b + U = \frac{\sum_{r=0}^{3} r\times P_{b,r}}{P_g} + U,$$

where P_b is the area of the commune by different categories of stimulatory impact, in which:

$$r = \begin{cases} 0 \textit{ rates an area whose stimulatory impact is weak} \\ 1 \textit{ rates an area whose stimulatory impact is mild} \\ 2 \textit{ rates an area whose stimulatory impact is moderate} \\ 3 \textit{ rates an area whose stimulatory impact is strong} \end{cases}$$

and U – is the health resort index, in which:

$$U = \begin{cases} 0 \textit{ rates a commune in which no locality enjoys health} - \textit{resort status} \\ 2 \textit{ rates a commune in which locality enjoys health} - \textit{resort status} \end{cases}$$

In the cases of both of the indices described, certain values were adopted arbitrarily and thus require further discussion. Some are determined by reference to accessible data, e.g. resolution of Corine Land Cover images defining the level of detail for surface waters taken account of in research. Other values adopted arbitrarily were determined by applying the expert method. The subjectivism of this kind of approach needs to be seen as an inseparable aspect of each instance of modelling geographical space (including as regards tourism). In this sense it is no different from the arbitrary (if more or less universally accepted) decision to aggregate data, as well as research results, by reference to Poland's administrative division at the level of the commune, and even therefore the criterion for the study area adopted here which sees sharp boundaries delimiting the rural area.

Here it further needs to be noted that arbitrary decisions taken in regard to two indices described have only a limited influence on the value of the synthetic index. This reflects the way in which they account for only one-third of the weighting attributable to all six variables. Moreover, adoption of: a) determined weightings of different categories of water for the overall calculation; b) determined distances to surface waters delimiting an "area of enhanced tourism attractiveness"; c) a determined rank for different stimulatory levels of the climate, as well as d) a determined influence of health-resort status on the ultimate value assumed by the w_6 index, means that a considerable share of impact on index values noted from one commune to another is exerted, leaving only a relatively limited influence for the actual hierarchy of communes and the overall distribution of areas with high or low index values. For instance, the adoption of a defined

distance from surface waters is of marginal significance as regards hierarchy of spatial units, when we note the local extent of areas considered "attractive" in the context of a nationwide scope of research. Irrespective of the distance adopted, the given areas are located along the shoreline of the same body of surface water or watercourse. Equally, in line with the means of transforming statistical values for the diagnostic indices in the second phase of the valuation, a major role is played by the hierarchy of spatial units, with the importance of differences in values for various diagnostic indices being leveled out to a considerable degree.

The second stage of the valuation was intended to offer a synthetic conceptualisation of the state of six diagnostic features taken account of in each studied commune j, with these being expressed along one axis of valuable environmental and landscape-related assets, due to the use of the synthetic index W_{pk_j}. This objective was achieved through normalisation of the values for different diagnostic indices in commune j (w_{ij}), with these being expressed by reference to a synthetic index (W_{ij}). The expression of the same measure was achieved subsequently in terms of the arithmetic mean of component values ($\overline{W_j}$), as calculated in line with the equation:

$$\overline{W_j} = \frac{\sum_{i=1}^{6} W_{ij}}{6}$$

The aforementioned joint measure from different W_{ij} component values, as well as the W_{pk_j} synthetic index, was the probability of the obtainment at random of a value lower than the empirical one recorded in a given commune. That probability is a left-hand-side value in the cumulative distribution function f_i (w_{ij}), which fits best to the empirical frequency distribution of the given index w_i. In this connection, in the case of commune j:

$$W_{ij} = F_i(w_{ij}) = \sum_{k:w_{ik} \le w_{ij}} f_i(w_{ik})$$

It is most typical for this kind of analysis (i.e. synthetic Perkal or Hellwig measures) to assume *a priori* that the most optimal reference is a theoretical normal distribution $N(m,\sigma)$. However, in the present study, it would be an over-simplification to adopt an assumption of this kind, as most applied diagnostic indices serve to register "rare goods" in analysed tourism space, in connection with which there is natural tendency for it to be characterised by a markedly positive (right-sided) skewing of the frequency distribution.

The same measure as with component values was also expressed by reference to a synthetic index of environmental and landscape-related assets for tourism development of commune j (W_{pk_j}) Its ultimate value is therefore the probability that an arithmetic mean derived from random values for the six components ($\overline{W_j} = \frac{\sum_{i=1}^{6} W_{ij}}{6}$) is lower than the mean derived from component values relating to commune j ($\overline{W_j}$). Once again, this is the left-side value of the cumulative distribution function:

$$Wpk_j = F(\overline{W_j}) = \sum_{k:\overline{W_k} \le \overline{W_j}} f(\overline{W_k})$$

In this case, however, the central limit theorem gives rise to an assumption that the empirical frequency distribution for the index that is the arithmetic mean of uniformly normalised values for independent variables coincides with the normal distribution $N(m,\sigma)$. In connection with this, the cumulative distribution function in the case of the synthetic index W_{pk_j} is:

$$F(\overline{W_j}) = \Phi_{m,\sigma}(\overline{W_j}) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\overline{W_j}} e^{-\frac{1}{2}t^2}\, dt$$

The synthetic index W_{pk_j} was ultimately therefore expressed on a scale of 0–100%, where empirical values cannot be boundary values.

Notwithstanding a quite complicated procedure, this solution has the advantage of exceptionally clear interpretation of an obtained value for the synthetic index as compared with the indices applied most often in human geography. Also important is the way in which a value for the proposed synthetic index is relative, as it positions particular spatial units in relation to other elements of the given dataset over a defined time interval. The results of applying the described valuation method to another area, to another set of spatial units in the same area, or to another time interval, should therefore involve comparison as regards spatial structure, rather than in relation to concrete values.

A further stage saw the spatial distribution of W_{pk_j} values in communes set against the distribution of tourist movement, as measured in terms of the numbers of Polish tourists staying overnight in 2014 (R_{t_j}). This adopted measure of tourist movement is merely one of the possible ways of conceptualising the phenomenon (and in fact reflects just a small part of the overall spectrum of aspects). However, given the methodological objectives of this paper, this one-dimensional approach to the issue of tourism appears to be appropriate for the purpose, providing an example and illustrating how valuation results can be employed in practice to assess the distribution of tourism. In line with the cognitive goals, other measures of the development of tourism could be subject to analogous verification.

The co-occurrence of two features of rural space set against each other was assessed using a boundary value for the statistical significance p for obtained Pearson linear correlation coefficients: $r_{xy}(W_{pk_j}, R_{t_j})$. Then, through comparison of values for each of the two compiled indices with the arithmetic means (respectively equal to 50% and 3,346 tourists a year), it was possible to designate four categories of rural areas in line with the use made of tourist assets (Fig. 1).

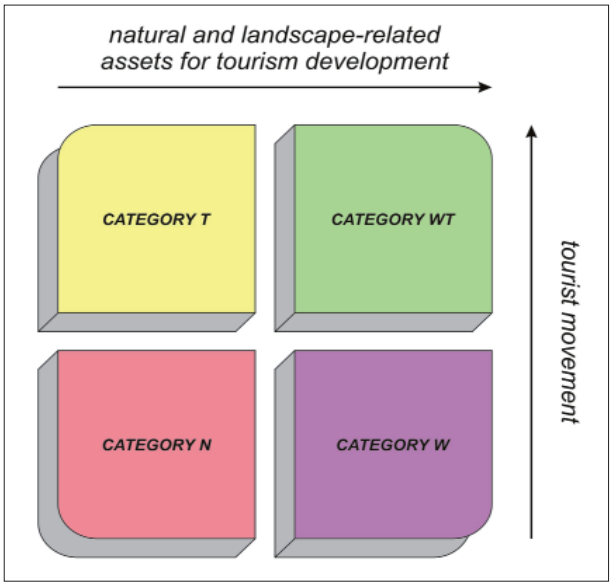


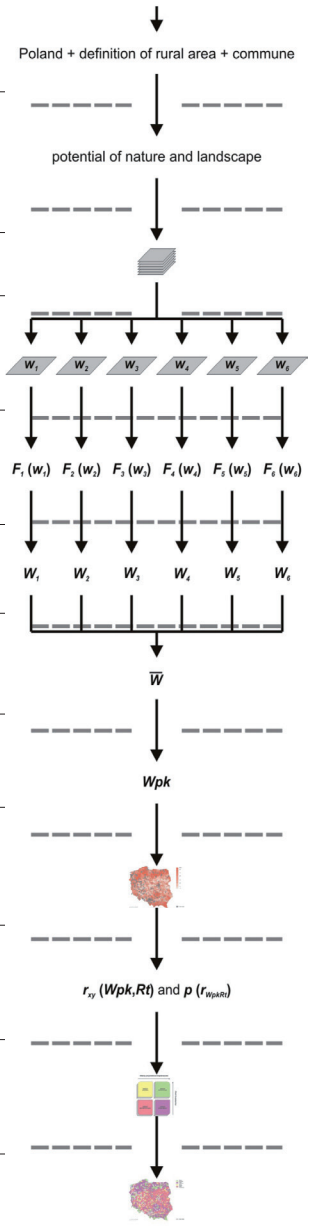
Fig. 1: Categories of rural areas as regards environmental and landscape-related assets for tourism development and tourist movement. Source: authors' elaboration

Areas in the "WT" category have features highly valuable from the point of view of tourism. They see use made of conditioning arising out of nature and the landscape that favours tourism, with the effect that tourist movement is of above-average intensity. In turn, "category T" areas are those in which tourism is developing intensively, even though they do not stand out for their particularly high values for natural and landscape-related features. They may thus be defined as areas of "local tourism success", given that the basis lies in features other than those of environment or the landscape (for example relating to ease of access from a large city and/or a high level of development of relevant infrastructure). That leads to areas in category "W", in which there is no high-intensity tourist movement despite the presence of highly valuable features. Resources here therefore go unused or underused by tourists, because of barriers or obstacles of one kind of another (e.g. infrastructural), unsuitable management of this sector's development locally, or even a conscious decision in development strategies to favour alternative priorities for the commune or higher-order unit of administration. Finally, category "N" relates to non-tourist areas which do not stand out in terms of assets and – in a sense justifiably – have no tourist movement of above-average intensity. Table 1 presents the entire research procedure applied, along with its chronology.

4. Results

The spatial breakdown of values for the synthetic index W_{pk} is in line with the widely-known distribution of areas in Poland most important for tourism (Fig. 2). These are first and foremost mountainous or hilly parts of the south; as well as the Świętokrzyskie Mountains; the Jurassic limestone landscapes in the Kraków-Częstochowa area; Roztocze; the Pomeranian, Mazurskie and Suwalskie

Stage	Task	Method	Result	Scheme and symbolization
Preliminary assumptions of the valuation	Designation of spatial scope	Delimitation of study area	Determined extent of area studied and set of fields of reference	
	Designation of subject scope	Review of subject literature	Valuation name	
Valuation stage I (Analysis of assets)	Identification of key assets		List of diagnostic features	
	Quantification of key assets	Review of sources of data, statistical transformation of data and spatial re-aggregation	Values of diagnostic indices for different fields of reference	
	Matching of theoretical frequency distribution to empirical distributions of different diagnostic indices	Least-squares error method	Theoretical frequency distributions and parameters for different indices	
	Normalisation of diagnostic indices	Left-sided distribution function of theoretical frequency distribution	Six component values for different fields of reference	
Valuation stage II (Synthetic conceptualisation of assets)	Synthesis of analysed assets	Arithmetic mean	Mean component values for different fields of reference	
	Normalisation of synthetic index	Left-sided normal distribution function fitted using least-squares method	Value of synthetic index for different fields of reference	
	Assessment of spatial differentiation characterising assets	Cartographic method of presentation (cartogram)	Map of synthetic index of analysed assets	
Distribution of valuable assets against distribution of tourist movement	Statistical assessment of co-occurrence of tourist movement and analysed assets	Pearson linear correlation and limit values for its statistical significance	Value of linear correlation and its boundary level of significance	
	Identification of main categories of area in terms of tourism-related use made of analysed assets	Two-dimensional classification of spatial units	Subordination of type to different fields of reference	
	Assessment of co-occurrence of tourist movement and analysed assets across space	Cartographic method of presentation (quality background method)	Map of distribution of communes by type	



Tab. 1: Chronology of research procedure
Source: authors' conceptualisation

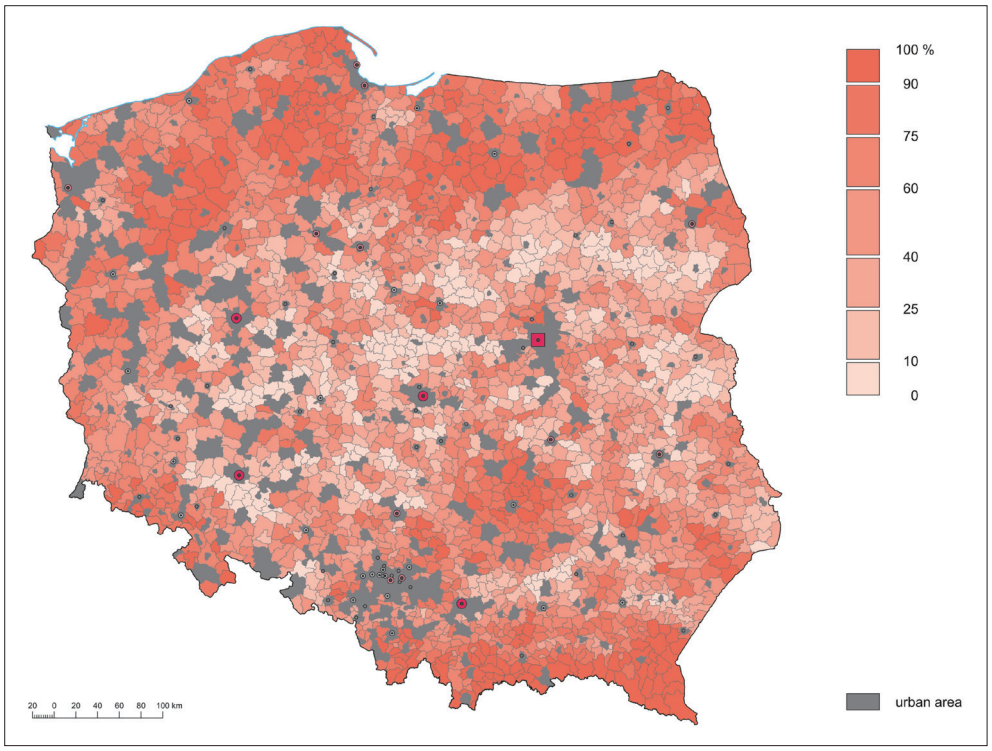


Fig. 2: The synthetic index of environmental and landscape-related assets for tourism development (Wpk)
Source: authors' elaboration

Lakelands; and the Baltic coast. At the absolute top of the ranking, more of the communes involved are located in the Carpathians than anywhere else. A value above 99.5% was achieved by two communes, i.e. Czorsztyn (in the district of Nowy Targ) and Lesko.

The largest area with communes achieving very high scores is in turn the country's Lakeland belt. A result above 95% was achieved by 125 units, or 6% of all communes in the country. Indeed, in Warmińsko-Mazurskie Voivodship, communes in this category account for as many as 27.2% of all of those analysed (as compared with figures of 15.6 and 15.0% in the cases of Małopolskie and Pomorskie Voivodships).

In contrast, lowest values for the index characterise parts of central and eastern Poland, with its relief of limited diversity, a low level of forest cover and a lack of large water bodies. In the rural parts of as many as 4 voivodships (Łódzkie, Mazowieckie, Opolskie and Wielkopolskie), there is not even a single commune with a W_{pk} value above 95%.

The distribution of tourist movement in rural areas, as measured in terms of the number of tourists staying overnight in communes, is correlated with values for the index representing these localities' attributes of nature and the landscape (Fig. 3). The value of the coefficient for the Pearson linear correlation $r_{xy}(W_{pk_j},R_{t_j})$ is of + 0,215, with n = 2,073 observations (units of administration). This achieves statistical significance at a very high level, the boundary level for this result being $p = 3.6 \times 10^{-23}$.

Equally, tourist movement in rural areas of Poland, as registered by Poland's Statistics (GUS), proves to be highly concentrated spatially – which is to say that it focuses on an area far smaller than that actually found to feature very high index values. An above-average number of individuals taking overnight stays in a given year is only characteristic for 19.4% of communes in the study area. Even among communes proving to have very valuable environmental and landscape-related assets (given W_{pk} values above 95%), only 56% are actually found to have such an above-average figure for visits.

At this point it should be stressed that the relatively low value for the linear correlation and high spatial concentration of tourist movement *inter alia* reflects the way in which GUS data on tourist movement completely (or almost completely) fail to take account of numerous agritourist premises scattered across rural areas, as well as other places operating on the small scale but nevertheless making guest rooms available. Thus, the intensity of tourist movement in rural areas assessed solely on the basis of data from GUS is bound to be underestimated. At the same time, there is no up-to-date database encompassing the full set of premises offering overnight accommodation as a small-scale activity that are present in different communes. Indeed, it is even difficult to state how many of these may exist in total

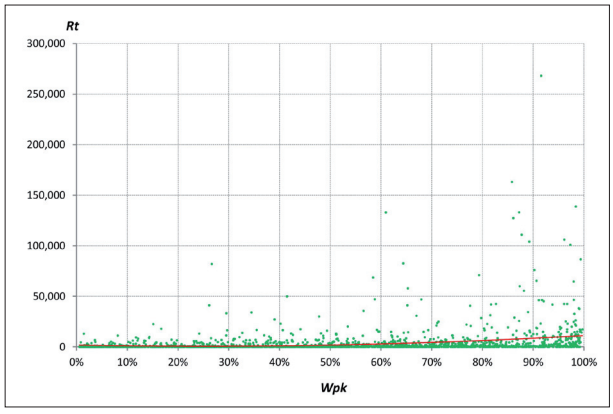


Fig. 3: Correlation between tourist movement (in terms of numbers making overnight stays – R_t) and the synthetic index of environmental and landscape-related assets for tourism development (W_{pk}), by commune in 2017
Source: authors' calculations

across Poland. One must also stress the way in which no notice is taken of tourist movement not needing to resort to overnight accommodation.

There is fundamental cognitive value to this study's spatial breakdown for the four categories of rural area identified by reference to the use (or lack of use) tourism makes of valuable environmental and landscape-related assets that have been identified (Fig. 4). Several key conclusions are to be drawn from it. The "WT" areas (active in tourism and with very valuable environmental and landscape-related assets) represent a relatively small number of communes concentrated in just a few places – the Bieszczady, Tatra, Pieniny and Beskid Żywiecki mountain ranges; the Kłodzko Valley; the Karkonosze Mountains; the coastal communes; the Kaszubskie Lakeland; a contiguous complex of communes in the Warmia and Mazury region; and just a few in the Suwalskie Lakeland and Świętokrzyskie Mountains. Remaining parts of the country generally have only single communes worthy of inclusion in the category in question. In Dolnośląskie Voivodship (Lower Silesia), above-average tourist movement is to be noted in all four such communes, and in Kujawsko-Pomorskie Voivodship the same is true of the two communes with a W_{pk} value exceeding 95%, while movement at this level characterises 31.8 and 16.3% respectively of all communes in these voivodships' rural areas.

On the other hand, as many as five voivodships have a majority of their communes characterised by the highly-valuable attributes that a W_{pk} value over 95% indicates, while still only having below-average tourist movement by Polish standards. In particular, there is only limited optimisation of the distribution of tourist movement in Zachodniopomorskie Voivodship (Western Pomerania), where there is above-average tourist movement in 22.5% of all communes studied, with only 30.0% having W_{pk} values above 95%; as well as in Śląskie Voivodship (Silesia), where the corresponding values are 25.0 and 33.3%. In the first case, considerably more-intensive utilisation in tourism is a positive feature reflecting a coastal location, rather than any greater diversity of resources in the Lakeland belt. In the case of the second of the voivodships mentioned, the communes with the most valuable assets are concentrated in the Beskid mountain ranges, along the southern border of Poland – which is to say areas least accessible from the point of view of transport. The remaining three voivodships in which a majority of communes with very highly valuable assets fail to stand out by having above-average tourist movement are located in eastern parts of Poland. These are Podlaskie and Świętokrzyskie (with 40.0% of communes in each experiencing above-average tourist movement); as well as Podkarpackie Voivodship (47.4%).

The greatest numbers of communes are assigned to categories "W" (with valuable features of nature and the landscape that are going unused) and "N" (for non-tourist areas). The former are mainly in the north and south, and often form a kind of "buffer zone" around markedly tourism-focused areas. It would seem that competition with nearby areas important for tourism (which are distinctly concentrated) impedes development in this sphere in category "W" areas. On the other hand, were account to be taken of tourist movement to premises supplying agritourism services or operating guest rooms, this would probably modify the assignment of communes to the two categories referred to. Furthermore, as has been noted already, there are no data on which to base an unequivocal claim that "WT" communes would gain at the expense of those in category "W" if account were to be taken of these kinds of facilities.

Areas in category "N" form the largest complexes in Mazowieckie, Podlaskie, Kujawsko-Pomorskie, Łódzkie and in Wielkopolskie Voivodships. Their distribution bears a close resemblance to that of areas characterised by a low level of development of the tourism function identified in the research by M. Derek (2008). Interestingly, prevalently non-

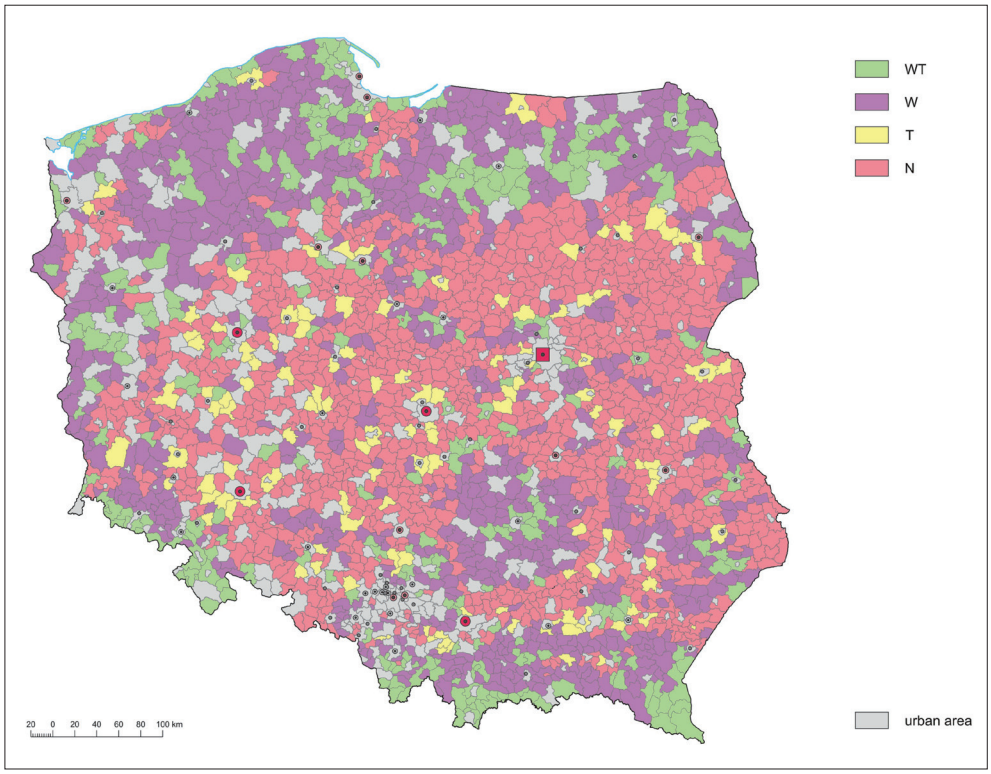


Fig. 4: The distribution of categories of rural area in terms of the utilisation of environmental and landscape-related assets for tourism development. Source: authors' elaboration

tourism areas only occasionally include communes enjoying success – these most often being located in the suburban zones of voivodship capitals and regional centres. These are probably areas playing host to weekend trips taken by individuals or groups, in which many premises providing for overnight stays are located. It can be anticipated that these are also objects rendering services to firms and schools, and catering for various one-off events. The existence of successful communes attests to the way a high level of development of tourism can be achieved in places with environmental and landscape-related assets of only limited value (Bednarek-Szczepańska and Bański, 2014). Equally, this can be presumed to require the establishment of an excellent and often highly-specialised tourist product.

5. Discussion

A discussion of these results can give valuable input to the current state of knowledge within each aspect of concern: cognitive, methodological and application orientations. In the first case, the proposed measure has been dedicated to the recognition of the environmental and landscape-related background for the development of tourism within rural areas. Obviously, this is not the only group of determinants, although researchers agree that in the context of such territories, probably the most important one. Therefore, these conditions are not able to provide an explanation for the variability of all tourist spaces but captured together within a one-dimensional index, seem to be an adequate case study of the analytical (reason-effect) approach. Moreover, if merged with using new spatial data sources and technological tools of analysis for extending the spectrum of diverse features taken into account by means of introducing other dimensions, it can reflect the broadly understood potential for tourism based on natural and landscape assets even more comprehensively than classical research on its quantitative assessment. Various indexes related to the traditional triangle – relief-land use-surface water (e.g. Drzewiecki, 1992) – can be enriched significantly by taking into consideration the value of the environment, local bioclimate and landscape. Each of these aspects is inter-related to the triangles studied previously. Nevertheless, it makes the subject of the interest essentially more extended and delivers some independent informative value. Regardless, as each of three non-standard dimensions can be discussed, transformed, or even undermined as being independent and of crucial importance, they are still valid as indicating a potential field of future methodological development. Another outcome relates to empirical study of the impact of particular dimensions on the actual assessment of environmental and landscape attractiveness by tourists. The equal weights proposed here are just an optimal starting point for further targetted discussion.

It is also worth mentioning that applying new data and technical infrastructure enables not only cognitive extension of a synthetic index, but also the spatial range and resolution of the analysis. This is not only a matter of a simple extension of the area to be studied. Using local units allows researchers to consider deeper insights into the spatial diversity of any rural area within particular regions. As a principle, however, taking into consideration a larger set of local units allows researchers to achieve comparability of the assessment across the regions in relation to studies undertaken independently for each of them. This factor exerts an essential impact on the results if the point of reference relies on the characteristics of a full set of spatial units to be analysed (e.g. Gryszel and Walesiak, 2014). For instance, the peripheries of regions having the highest potential for tourism development are assessed as uncompetitive if such a region is the only one to be studied, while the foothills, central Pomerania or the outskirts of Mazurskie Lakeland have still a great potential on the Polish background (see Fig. 2). Of course, one may emphasise that their position in relation to a close alternative destination matters, but also important advantages and synergies of being adjacent to the best-known tourist destination cannot then be omitted (complementing and specialisation, common regional marketing, etc.).

The cognitive value of these results strictly depends on methodological aspects of the research. Therefore, it is equally important, at least. As the synthetic index was being developed, much attention was paid to the statistical issues – with the ultimate result that a relatively complicated procedure was applied. While this did not influence excessively the overall spatial structure of the results obtained in comparison with studies applying standard methodology, two very important achievements at the stage of elaboration need to be noted.

In the first place, evident benefits arise from the consistent expression of different indices using a measure of the probability of a "worse" result being obtained by the random selection of values for the variables considered, than for empirical values noted in a given commune. This measure is much less abstract in nature than the synthetic indices applied typically in Human Geography, as well as in work on the development of tourism – such as the number of standard deviations, the Euclidean distance or the model lodged in multidimensional space (e.g. Gryszel and Walesiak, 2014). A probability in and of itself confers particular information on the spatial unit being described, even without values in other units needing to be evoked, or descriptive statistics for the whole set of data studied. This supports a perception of result content whose interpretation becomes more intuitive.

In the second place, an advantage of this measure is that the empirical frequency distribution which is quite close to a constant across the whole range of variability (limited on both sides). This ensures that values departing markedly from the mean do not impose a burden of differentiation from remaining values to the extent that they do with the most popular synthetic measures. The latter's universal application of standardisation and rejection or correction of values deviating from the mean beyond two standard deviations only partially evens out this unfavourable effect. In this connection, the result obtained using the method proposed here is much more useful as a component part of further analyses. An example may be furnished by this study's attempt to employ results from the valuation relating to environment and the landscape to assess how optimised the distribution of tourist movement as compared with types of valuable features is, and how adjusted in line with the assets that do exist. This attempt may also be assessed positively in terms of its effects. Two approaches to such an activity are possible. Where the priority is an overall assessment of the scale of the co-occurrence of these phenomena, the frequency distributions for the two measures should be transformed to show significant similarity to the normal distribution. In this study, no such transformation was performed, as this would have distorted empirically observed differentiation of index values in the entire assortment of communes in Poland's rural areas – being of major significance in the case of the adopted measure of tourist movement in particular. A second

approach gaining application here was the one in which the priority is to reflect the spatial structuring of the co-occurrence between two studied phenomena, with account taken of the spatial concentration of an index serving as the dependent or response variable (i.e. in this case, tourist movement).

The third key area of discussion involves applications. Two issues need to be emphasised in this regard: the analytical approach to the study, which focuses on the sphere of conditions for tourism development, and the problem of the intersection of continuous tourist space by artificial sharp boundaries of administrative units. It has been validated that the analytical approach to tourist space, with strictly distinguished spheres of conditions (assets) for tourism development and spheres of their effects (infrastructure, management, revenues etc.), gives a new perspective and applications opportunities. Therefore, in opposition to the research perceiving the entire tourist space as one complex system of relationships, impacts and feedbacks (e.g. Derek, 2007), its results can be compared with a measure of a given area's actual performance regarding tourist function development. The proposed approach can be applicable whenever one needs a tool for an identification of tourism relative underdevelopment within particular areas or searching for good practices within the areas of its relative overdevelopment. As such, it is not to be assessed as better or worse, but undoubtedly delivers cognitive added value, giving a new perspective.

Achieving valuation of attributes of nature and the landscape within the framework of a spatial model that features sharp boundaries between spatial units, especially where these are based around the administrative division of Poland, is problematic. A basic condition for that to be the case is naturally a spatial aggregation of numerous statistical data. An advantage of the solution from this research is the possibility of obtained results being referred directly to the administrative units responsible for shaping local development, including the development of tourism in rural areas. The effect is to raise the applied value of the study. On the other hand, it is clear that this benefit was gained at the expense of an "unnatural" way of aggregating data describing some of the assets that were studied, this leading to a certain distortion of tourism space in rural areas within the framework of the developed model.

Nevertheless, consciousness of the spatial aggregation of environmental and landscape-related assets is still a superficial insight into the problem of the model of tourist space. It is worthwhile to emphasise that it also denotes neglecting the movement between different localities and units of administration. Therefore, the tourist attractiveness of a given commune has a certain impact on the value that can be assigned to neighbouring units of administration at that local level. To take that into account, a further stage of the research would entail a transformation of the spatial portrayal obtained, using a solution that would correspond with the low-pass convolution (smoothing) filters used in the analysis of raster images. Among the latter, there are linear filters (using different kinds of distance function, such as the moving or rolling mean, weighted mean, reciprocal, power function, exponential function, Gaussian function, etc.), as well as non-linear ones (usually based on parameters for the statistical description of the vicinity) (Hsu, 1975; Glassner, 1995). In the case of cartographic depictions, an analogous effect is obtained by using smoothing interpolation (Mościbroda, 1999), especially methods of smoothing cartograms like the areal-raster method of moving means (Mościbroda, 1999), re-aggregation methods (Kolberg, 1970), or the so-called "pycnophylactic" methods (Tobler, 1979). This issue, however, signals a separate methodological concern extending beyond the sphere of interest of the present study. This is *inter alia* true when it comes to assessing the degree to which attributes raise the attractiveness of an area for different kinds of tourism, as well as the mathematical description of distance decay in this area (a function detailing the decline in the significance of different attributes in line with distance), and the method that is used to smooth the cartographic depiction.

6. Conclusions

The developed index of environmental and landscape-related assets for tourism development (W_{pk}) provides a characterisation and synthetic assessment of the features of this kind present in Poland's rural areas and related to an important significance in tourism. As it comprises six very diverse, but at the same time complementary diagnostic characteristics, the index is rendered relatively objective. Three of the assets (relating to relief, surface waters and forest areas) represent fundamental components of the natural environment, while two others assess environmental and landscape value by reference to the presence of different categories of protected area, and one relates to health aspects (including air quality).

The assessment has made it clear that many of Poland's communes are characterised by relatively high values. In many cases, however, these assets are not taken advantage of in tourism development. Dormant potential relating to environment and the landscape may of course be mobilised in such areas, as efforts are made to increase attractiveness to tourists. These could include marketing and promotion measures, efforts to revitalise villages or to develop dedicated tourist (or "para-tourist") infrastructure, new developments specifically designed to bring people in, and so on. These are subjects for an in-depth discussion beyond the scope of this paper.

It should be emphasised that the synthetic index of environmental and landscape-related assets for tourism development reported here, is proposed as just one of many possible measures by which tourism's actual state of development can be assessed. This approach has allowed the identification of four categories of rural area in relation to which it would be possible to propose different strategic actions ranging from action being unjustified in non-tourism areas, through to intensified steps in some areas that do support tourism, where assets of nature and the landscape are highly valuable, but tourism has not yet been activated to a great extent. It would be equally possible to analyse correlations between the index proposed here and other measures, such as valuable features that are not related to nature, or to measures related to the management of tourism. Undoubtedly, there could be different important conclusions drawn regarding the development of tourism in rural areas. Equally, there should be defined categories of 'area' or 'locality' established in the process.

References:

ALAEDDINOGLU, F., CAN, A. S. (2011): Identification and classification of nature-based tourism resources: Western Lake Van basin, Turkey, Procedia – Social and Behavioural Sciences, 19: 198–207.

AZNAR, O., MARSAT, J. B., RAMBONILAZA, T. (2007): Tourism and landscapes within multifunctional rural areas: the French case. In: Mander, Ü., Wiggering, H., Helming, K. [eds.]: Multifunctional Land Use. (pp. 293–303). Berlin, Springer.

BAŃSKI, J. (2019): Waloryzacja zasobów lokalnych i ich zróżnicowanie przestrzenne w regionach Polski Wschodniej. Prace Geograficzne, 269, Warszawa, IGiPZ PAN.

BAŃSKI, J. [ed.] (2016): Atlas Obszarów Wiejskich. Warszawa, IGiPZ PAN.

BECKEN, S. (2010): The importance of climate and weather for tourism. Literature review. Lincoln, Canterbury, Lincoln University.

BEDNAREK-SZCZEPAŃSKA, M., BAŃSKI, J. (2014): Lokalizacyjne uwarunkowania oferty gospodarstw agroturystycznych w Polsce. Przegląd Geograficzny, 86(2): 243–260.

BEDNAREK-SZCZEPAŃSKA M. (2010): Rola podmiotów lokalnych w rozwoju turystyki wiejskiej na wybranych obszarach Lubelszczyzny. Studia Obszarów Wiejskich, 23. Warszawa, Wydawnictwo „Bernardinum".

DAUGSTAD, K. (2008): Negotiating landscape in rural tourism. Annals of Tourism Research, 35(2): 402–426.

DEREK, M. (2007): Gmina turystyczna – ujęcie metodologiczno-metodyczne. In: Kurek, W., Pawlusiński, R. [eds.]: Studia nad turystyką. Prace ekonomiczne i społeczne (pp. 27–32). Kraków, Uniwersytet Jagielloński, Instytut Geografii i Gospodarki Przestrzennej.

DEREK, M. (2008): Funkcja turystyczna jako czynnik rozwoju lokalnego w Polsce. Warszawa, Uniwersytet Warszawski.

DRZEWIECKI, M. (1992): Wiejska przestrzeń rekreacyjna. Warszawa, Instytut Turystyki.

DUBOIS, C., CAWLEY, M., SCHMITZ, S. (2017): The tourist on the farm: A muddled image. Tourism Management, 59: 298–311.

DUPEYRAS, A., MACCALLUM, N. (2013): Indicators for Measuring Competitiveness in Tourism: A Guidance Document. OECD Tourism Papers, 2, OECD Publishing.

DURYDIWKA, M. (2012): Czynniki rozwoju i zróżnicowanie funkcji turystycznej na obszarach wiejskich w Polsce. Warszawa , WGiSR.

FALKOWSKI, A. (1994): Model, badanie, eksperyment, analiza danych. Kraków, Wydawnictwo Uniwersytetu Jagiellońskiego.

FERRARIO, F. F. (1979): The evaluation of tourist resources: an applied methodology. Journal of Travel Research, 17(3): 18–22.

FRISVOLL, S. (2013): Conceptualising Authentication of Ruralness. Annals of Tourism Research, 43: 272–296.

GARROD, B., WORNELL, Y., YOUELL, Y. (2006): Reconceptualising rural resources as countryside capital: the case of rural tourism. Journal of Rural Studies, 22: 117–128.

GLASSNER, A. S. (1995): Principles of Digital Image Synthesis. San Francisco, Morgan Kaufmann Publishers.

GOŁEMBSKI, G. [ed.] (2002): Metody stymulowania rozwoju turystyki w ujęciu przestrzennym. Poznań, Akademia Ekonomiczna.

GOSSLING, S., HICKLER, T. (2005): Tourism and forest ecosystems. In: Gossling, M., Hall, M. [eds.]: Tourism in global environmental change (pp. 95–106). London, New York, Routledge.

GRYSZEL, P., WALESIAK, M. (2014): Zastosowanie uogólnionej miary odległości GDM w ocenie atrakcyjności turystycznej powiatów Dolnego Śląska. Folia Turistica, 31: 127–147.

HAKUĆ-BŁAŻOWSKA, A., PACEK, N., KUPREN, K., FURGAŁA-SELEZNIOW, G. (2018): Porównanie atrakcyjności turystycznej gmin wiejskich i miejsko-wiejskich powiatu elbląskiego. Studia Obszarów Wiejskich, 50: 81–99.

HAMILTON, J., LAU, M. (2005): The role of climate information in tourist destination choice decision making. In: Gossling M., Hall M. [eds.]: Tourism in global environmental change (pp. 229–250). London, New York, Routledge.

HSU, M. L. (1975): Filtering process in surface generalization and isopleth mapping. In: Display and analysis of spatial data (pp. 115–129). Hoboken, New Jersey, Wiley and Sons.

IATU, C., BULAI, M. (2011): New approach in evaluating tourism attractiveness in the region of Moldavia (Romania). Journal of Energy and Environment, 52(2): 165–174.

JEPSON, D. (2015): The Lure of the Countryside: The Spiritual Dimension of Rural Spaces of Leisure. In: Gammon, S. et.al. [eds.]: Landscapes of Leisure (pp. 202–219). London, Palgrave Macmillan.

JEPSON, D., SHARPLEY, R. (2014): More than sense of place? Exploring the emotional dimension of rural tourism experiences, Journal of Sustainable Tourism, 23(8–9): 1157–1178.

JEZIERSKA-THOLE, A. (2007): Waloryzacja środowiska przyrodniczego a zagospodarowanie turystyczne obszarów wiejskich Pomorza Nadwiślańskiego. In: Grykień S., Hasiński W., Tomczak P. [eds.]: Uwarunkowania przyrodnicze a rozwój obszarów wiejskich, (pp. 97–112). Wrocław, Uniwersytet Wrocławski, Uniwersytet Przyrodniczy we Wrocławiu.

JONES, B., SCOTT, D., GOSSLING, S. (2005): Lakes and streams. In: Gossling, M., Hall, M. [eds.]: Tourism in global environmental change (pp. 76–94). London, New York, Routledge.

KNEZEVIC, R. (2008): Contents and assessment of basic tourism resources. Tourism and Hospitality Management, 14(1): 79–94.

KOLBERG, D. W. (1970): Population aggregations as a continuous surface: an example of computer mapping. Cartographic Journal, 7(2): 95–100.

KOWALCZYK, A. (2001): Geografia turyzmu.Warszawa, PWN.

KOZŁOWSKA-SZCZĘSNA, T. (1994): Typy bioklimatu. In: Atlas Zasobów, Walorów i Zagrożeń Środowiska Geograficznego Polski. Warszawa, IGiPZ PAN.

KRZYMOWSKA-KOSTROWICKA, A. (1997): Geoekologia turystyki i wypoczynku. Warszawa, Wydawnictwo Naukowe PWN.

LESZCZYCKI, S. (1938): Region Podhala. Podstawy geograficzno-gospodarcze planu regionalnego. Prace Instytutu Geograficznego Uniw. Jagiellońskiego, 20.

MARTIN, B. G. (2005): Weather, climate and tourism – a geographical perspective. Annals of Tourism Research, 22(3): 571–591.

MIKUŁOWSKI, B. (1976): Wstępna ocena walorów krajoznawczych. Czasopismo Geograficzne, 47(3): 235–253.

MOŚCIBRODA, J. (1999): Mapy statystyczne jako nośniki informacji ilościowej. Lublin, Wydawnictwo UMCS.

OBINWANNE, C., OKPOKO, P. U. (2015): Comparative Assessment of Coastal Tourism Potentials Of Selected Areas in Rivers State, Nigeria. International Journal of Scientific and Technology Research, 12(4): 262–269.

PARZYCH, K. (2010): Uwarunkowania i ocena potencjału turystycznego województwa podlaskiego. In: Meyer B. [ed.]: Potencjał turystyczny. Zagadnienia przestrzenne. Zeszyty Naukowe Uniwersytetu Szczecińskiego, 590, Ekonomiczne Problemy Usług, 52: 173–182.

PRISKIN, J. (2001): Assessment of natural resources for nature-based tourism: the case of the Central Coast Region of Western Australia. Tourism Management, 22(6): 637–648.

RAHAYUNINGSIHA, T., HARINIMUNTASIBB, E. K. S., BUDI PRASETYO, L. (2016): Nature Based Tourism Resources Assessment Using Geographic Information System (GIS): Case Study in Bogor. Procedia Environmental Sciences, 33: 365–375.

RAWSKI, W. [ed.] (2011): Encyklopedia popularna, Wydawnictwo Naukowe PWN, Warszawa.

TOBLER, W. R. (1979): Smooth pycnophylactic interpolation for geographic regions. Journal of American Statistical Association, 74(367): 519–536.

WARSZYŃSKA, J. (1974), Ocena zasobów środowiska naturalnego dla potrzeb turystyki (na przykładzie woj. krakowskiego), Zeszyty Naukowe UJ, Prace Geograficzne, 36.

YAN, L., GAOB, B. W., ZHANG, M. (2017): A mathematical model for tourism potential assessment. Tourism Management, 63: 355–365.

Please cite this article as:

MAZUR, M., BEDNAREK-SZCZEPAŃSKA, M., BAŃSKI, J., MAZUREK, D. (2021): Measuring environmental and landscape-related potential for tourism development in rural areas and assessment of its co-occurrence with tourist movement: The case of Poland. Moravian Geographical Reports, 29(2): 101–112. doi: https://doi.org/10.2478/mgr-2021-0009