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Geoheritage Resources in Polish Landscape Parks as a Basis for Developing a Network of Geoparks

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Abstract: Despite intensive scientific research on geodiversity and geotourism, the development of a network of geoparks in Poland has been slow. There are only two geoparks here. The reasons include difficulties of an organisational nature. The existing network of spatial forms of nature conservation should be used to streamline the process of establishing geoparks. The areas of the potential geoparks partially overlap with the areas of the landscape parks. The study presents a comprehensive quantitative assessment of abiotic nature sites (abiotic nature reserves, abiotic natural phenomena, documentation sites, geosites) occurring in landscape parks (125 in Poland). Parks with the greatest number of such sites and the highest geoheritage value are indicated (10% of the total number). Within these areas, new geoparks could be established and tourism based on geoheritage resources could be developed. In some cases, landscape parks located within the planned geoparks feature a small number of geoheritage sites, which may indicate the occurrence of deficiencies in the system of spatial forms of abiotic nature conservation in Poland.

Keywords: geoeducation; geosites; geotourism; nature protection; Poland

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1. Introduction

The development of geotourism and geoeducation is now based on geoparks, i.e., tourist functional areas serving the promotion and preservation of geoheritage, while maintaining sustainable economic development [1–5]. Although they themselves are not a new category of nature conservation, they often include areas of national parks, nature parks, etc. UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education, and sustainable development [6–8]. At present, the network consists of 177 geoparks in 44 countries, with the greatest number being in China (41) and Spain (15) [9].

In Poland, the development of the geopark network has been slow despite the existence of geoheritage resources. The lack of legal grounds, and the relatively poor promotion and understanding of the idea of geoparks are an impediment to the establishment of geoparks. The preservation of geoheritage assets in Poland is based on the protection of areas and sites in the form of national parks, nature reserves, and natural phenomena. So far, two areas have gained the status of a UNESCO Geopark—the Łuk Mużakowa (Muskau Arch) Geopark and Geoland Świętokrzyski (Geoland of the Holy Cross Mountains Geopark) [10,11]. Two other areas have national geopark status: Góra Św. Anny (2009) and the Karkonosze National Park with its buffer zone (2010) [12,13]. In some countries, UNESCO Global Geoparks encompass national park areas, e.g., Katla Geopark, Oki Islands Geopark, Dak Nong Geopark. In Poland, despite the fact that national parks, with the highest form of nature conservation, this is not conducive to the establishment of geoparks, due to the restrictions on the development of infrastructure and tourism. However, such development is possible in the buffer zone of national parks.

Many areas in Poland are indicated as potential geoparks [14–19]. To a large extent, they overlap with the landscape parks, an established form of nature conservation in Poland. Landscape parks are "areas whose environmental, historical, cultural, and landscape assets are protected and popularised according to the principles of sustainable development" [20]. Thus, the goals of geoparks and landscape parks are largely convergent. Landscape parks are established in Poland due to the occurrence of various kinds of natural, cultural, and landscape assets within their territory. However, abiotic nature reserves, abiotic natural phenomena, or documentation sites also occur in some of them too [21]. They can provide the basis for selecting geosites which form the basis of geoparks. Geosites, along with the appropriate tourism and education infrastructure, are indispensable to the development of geotourism, i.e., "*a knowledge-based tourism, an interdisciplinary integration of the tourism industry with conservation and interpretation of abiotic nature attributes, besides considering related cultural issues, within the geosites for the general public* [22]".

The potential use of landscape parks, in the context of developing a network of geoparks, was already suggested [23]. However, the authors did not make an attempt to assess the geoheritage resources in these areas. Detailed studies, in this respect, were conducted for a few potential geoparks in south-eastern Poland by Skibiński et al. [21]. The objective of this study was to assess the distribution of sites (assets) of abiotic nature in Poland's landscape parks. On this basis, landscape parks with the greatest quantitative geoheritage potential were indicated, which provides the groundwork for a comprehensive and objective overview of the possibilities of developing a network of geoparks in Poland. The studies conducted in Poland so far have focused on making an inventory of abiotic nature sites in the potential geoparks without considering the broader context (the scale of the entire country).

2. Materials and Methods

The territory of Poland lies within Europe's three major geological units. The Alpine Orogeny belt of Southern Europe occurs in the south and comprises the Carpathians and the Pre-Carpathian Depression. The Palaeozoic Orogeny belt of Western and Central Europe lies in the central and western parts of Poland. Europe's largest geological unit, covering more than a half of the continent's area, i.e., the Precambrian Eastern European Platform, extends across north-eastern Poland [24]. Poland's landforms are closely linked with the country's geological structure. The land relief follows a band pattern, approximating the latitudinal orientation. Southern Poland (the Carpathians, the sub-Carpathian basins, and the belt of old mountains and uplands) features fluvial and denudational relief that formed in the Tertiary era. The relief of central and northern Poland was formed in the Quaternary era. Glacial and glacifluvial relief has developed in the Polish Lowland and lake districts, while aeolian and littoral relief has developed in the coastal belt.

Overall, 125 landscape parks (LP) have been established in Poland so far (data from GDOŚ [General Directorate for Environmental Protection]). In total, they cover about 2.5 million ha, i.e., more than 8% of Poland's area. The biggest—The Dolina Baryczy Landscape Park—covers the largest area (more than 87,000 ha). The percentage of landscape park area in relation to the total area of a province is the smallest in Podlaskie province, and the largest in Śląskie province (Figure 1). Established in 1976, Suwalski Landscape Park in Podlaskie province was one of the first landscape parks in Poland. The largest number of landscape parks (100) was established in the years 1981–1998, while only six were created after the year 2000. The largest number of landscape parks exist in the provinces of Lubelskie (17) and Wielkopolskie (14), while the smallest number exist in the provinces of Podlaskie (3) and Opolskie (3).

Figure 1. Landscape park network in Poland. 1—Barlinecki, 2—Bielańsko-Tyniecki, 3—Bolimowski, 4—Brodnicki, 5—Brudzeński, 6—Cedyński, 7—Chełmiński, 8—Chełmski, 9—Chęcińsko-Kielecki,

10—Chojnowski, 11—Ciężkowicko-Rożnowski, 12—Cisowsko-Orłowiński, 13—Ciśniańsko-Wetliński, 14—Czarnorzecko-Strzyżowski, 15—Dłubniański, 16—Dolina Dolnej Odry, 17—Dolina Kamionki, 18—Dolinki Krakowskie, 19—Drawski, 20—Gorzowski, 21—Gostynińsko-Włocławski, 22—Góry Łosiowe, 23—Górznieńsko-Lidzbarski, 24—Gryżyński, 25—Iński, 26—Jaśliski, 27—Jeleniowski, 28—Kaszubski, 29—Kazimierski, 30—Kozienicki, 31—Kozłowiecki, 32—Kozubowski, 33—Krajeński, 34—Krasnobrodzki, 35—Krzczonowski, 36—Krzesiński, 37—Książański, 38—Lednicki, 39—Łagowsko-Sulęciński, 40—Łomżyński, Doliny Narwi, 41—Mazowiecki, 42—Mazurski, 43—Miedzichowski, 44—Nadbużański, 45—Nadgoplański Park Tysiąclecia, 46—Nadmorski, 47—Nadnidziański, 48—Nadwarciański, 49—Nadwieprzański, 50—Nadwiślański, 51—Orlich Gniazd, 52—Beskidu Małego, 53—Beskidu Śląskiego, 54—Chełmy, 55—Cysterskie Kompozycje Krajobrazowe Rud Wielkich, 56—Dolina Baryczy, 57—Dolina Bystrzycy, 58—Dolina Jezierzycy, 59—Dolina Słupi, 60—Doliny Bobru, 61—Doliny Sanu, 62—Gór Słonnych, 63—Gór Sowich, 64—Góra Św. Anny, 65—Góry Opawskie, 66—im. Gen. Dezyderego Chłapowskiego, 67—Lasy Janowskie, 68—Lasy nad Górną Liswartą, 69—Łuk Mużakowa, 70—Mierzeja Wiślana, 71—Międzyrzecza Warty i Widawki, 72—Pasma Brzanki, 73—Pogórza Przemyskiego, 74—Pojezierza Iławskiego, 75—Pojezierze Łęczyńskie, 76—Promno, 77—Puszcza Zielonka, 78—Puszczy Knyszyńskiej im. profesora Witolda Sławińskiego, 79—Puszczy Rominckiej, 80—Puszczy Solskiej, 81—Stawki, 82—Sudetów Wałbrzyskich, 83—Wysoczyzny Elbląskiej, 84—Wzgórz Dylewskich, 85—Wzniesień Łódzkich, 86—Podlaski Przełom Bugu, 87—Poleski, 88—Południoworoztoczański, 89—Popradzki, 90—Powidzki, 91—Przedborski, 92—Przemęcki, 93—Przemkowski, 94—Pszczewski, 95—Rogaliński, 96—Rudawski, 97—Rudniański, 98—Sieradowicki, 99—Sierakowski, 100—Skierbieszowski, 101—Sobiborski, 102—Spalski, 103—Stobrawski, 104—Strzelecki, 105—Suchedniowsko-Oblęgorski, 106—Sulejowski, 107—Suwalski, 108—Szaniecki, 109—Szczebrzeszyński, 110—Szczeciński, Puszcza Bukowa, 111—Ślężański, 112—Śnieżnicki, 113—Tenczyński, 114—Trójmiejski, 115—Tucholski, 116—Ujście Warty, 117—Wdecki, 118—Wdzydzki, 119—Welski, 120—Wiśnicko-Lipnicki, 121—Wrzelowiecki, 122—Zaborski, 123—Załęczański, 124—Żerkowsko-Czeszewski, 125—Żywiecki.

In Poland, the following forms of nature conservation exist for abiotic sites: nature reserves, natural phenomena, and documentation sites [20]. *"A nature reserve is an area under protection because of the occurrence, in a state approximating a natural state, of ecosystems, specific plant or animal species or inanimate nature objects of high scientific, natural, cultural or landscape value. Natural monuments are individual forms of biotic and abiotic nature or groups of such forms having special natural, scientific, cultural, historical or landscape value, as well as having individual characteristics that distinguish them from other forms, such as trees of impressive size, native or foreign species of shrubs, springs, waterfalls, karst springs, rocks, ravines, erratic boulders, and caves. A documentation site is a form of protection of abiotic nature encompassing sites, not easily distinguishable on the surface, but accessible and important for scientific and educational purposes, where geological formations, concentrations of fossils or mineral formations, as well as fragments of active or inactive surface and underground excavation pits or quarries"*.

The concept of a geosite does not exist in the Polish legal system and is only used by researchers [25]. A geosite refers to geological and geomorphological sites that are not only important from the perspective of presenting and preserving Poland's geodiversity, but also significant for science, culture, and history. The Polish Geological Institute collects information on geosites (Central Register of Geosites in Poland) within the Central Geological Database [26]. It should be stressed that this database is not a product of systematic research encompassing the entire territory of Poland. The data have been collected during geological surveys or the preparation of geopark plans. Geosites are only recorded in the above-mentioned register; they are not marked in situ in any way whatsoever, although some of them are protected as natural phenomena.

The information needed to prepare the database and conduct further analyses was collected from the following sources:

- General Directorate for Environmental Protection—landscape parks, nature reserves, natural phenomena (location and boundaries) [27]

- Central Register of Forms of Nature Protection—landscape parks, nature reserves, natural phenomena, and documentation sites (typology) [28]
- Central Register of Geosites in Poland—geosites [26]

The first step was the creation of a database of abiotic nature sites located in Poland's landscape parks. Each site was assigned to the relevant landscape park based on the location data. In addition, geosites were assigned to the appropriate type of site: geological, geomorphological, water, and mining. Their status, accessibility, and assessment of their attractiveness for tourism, teaching, and education were also entered into the database. All the spatial analyses were performed using GIS. Based on the collected data, maps of site density within landscape parks were drawn up.

A simple assessment concerning the quantity of abiotic nature sites in landscape parks was used in the study. This was achieved with the point-based rating method that consists of assigning an appropriate number of points according to a specific value scale [29–33]. Nine criteria for the assessment of abiotic nature sites in landscape parks were distinguished, namely: (a) density of nature reserves; (b) density of abiotic natural phenomena; (c) density of geosites; (d) number of documentation sites; (e) number of geosites of international rank; (f) number of easily accessible geosites; and attractiveness for (g) tourism; (h) teaching; (i) scientific research (Table 1). It was assumed that the most valuable sites of abiotic nature were placed under protection in the past (abiotic nature reserves, abiotic natural phenomena, documentation sites), or have been selected as geosites. Different weight was attached to the specific criteria depending on their rank; in Poland, nature reserves are the highest form of protection (the most valuable areas and sites), followed by natural phenomena, and documentation sites. The creation of a reserve requires the preparation of an appropriate substantive justification for its creation. It is also necessary to apply the passage of a certain administrative procedure. A similar situation applies to other forms of nature protection. In contrast, the inclusion of a geosites site into the register and the determination of its rank is more subjective. In most cases, the documentation is prepared by one person. There is also no uniform procedure for assigning rank to geosites. Accordingly, geosites have the lowest rank in the assessment.

Table 1. The principles of assessing landscape parks according to the presence of abiotic nature sites.

Criterion	Scoring Rules	Weight
Density of nature reserves (per 100 km^2)	<0.06: 1 pt; 0.06–0.10: 2 pts; 0.11–0.15: 3 pts; 0.16–0.20: 4 pts; >0.20: 5 pts.	5
Density of natural phenomena (per 100 km^2)	<1.0: 1 pt; 1.0–2.0: 2 pts; 2.1–3.0: 3 pts; 3.1–4.0: 4 pts; >4.0: 5 pts.	3
Density of documentation sites (per 100 km^2)	<0.16: 1 pt; 0.16–0.30: 2 pts; 0.31–0.45: 3 pts; 0.46–0.60: 4 pts; >0.60: 5 pts.	2
Density of geosites (per 100 km^2)	<2.6: 1 pt; 2.6–5.0: 2 pts; 5.1–7.5: 3 pts; 7.6–10.0: 4 pts; >10: 5 pts.	1
Geosites of international rank (per 100 km^2)	<0.4: 1 pt; 0.4–0.5: 2 pts; 0.6–0.8: 3 pts; 0.9–1.0: 4 pts; >1.0: 5 pts.	1
Easily accessible geosites (per 100 km^2)	<2: 1 pt; 2.1–4.0: 2 pts; 4.1–7.0: 3 pts 7.1–9.0: 4 pts; >9: 5 pts	1
Value for scientific research [1]	<2.0: 1 pt; 2.1–4.0: 2 pts; 4.1–6.0: 3 pts; 6.1–8.0: 4 pts; >8.0: 5 pts	1
Value for tourism [1]	<2.0: 1 pt; 2.1–4.0: 2 pts; 4.1–6.0: 3 pts; 6.1–8.0: 4 pts; >8.0: 5 pts	1
Value for education [1]	<2.0: 1 pt; 2.1–4.0: 2 pts; 4.1–6.0: 3 pts; 6.1–8.0: 4 pts; >8.0: 5 pts	1

[1]—mean score for geosites based on data from Poland's Central Register of Geosites.

Such an approach is an attempt at a simplified substantive (qualitative) assessment of geoheritage assets of landscape parks. The ranks used are authoritative but are based on the scientific rank of individual areas and objects derived from the principles of their creation. Then, the points for each criterion were added up, and landscape parks were divided into five categories of the geoheritage resources.

3. Results

The total number of abiotic nature sites occurring in landscape parks is 1598, including 1159 geosites, 414 abiotic natural phenomena, 50 documentation sites, and 25 abiotic nature reserves. It should be emphasised that landscape parks cover about 8% of Poland's territory, and about 25% of abiotic nature sites can be found within them. Examples of geoheritage sites are presented in Figure 2.

Figure 2. Examples of geoheritage of landscape parks and planned geoparks in Poland. (**A**)—geosite, sunken lane Korzeniowy Dół (Kazimierz LP, Małopolski Przełom Wisły Geopark), (**B**)—documentary

site, K-Pg boundary, Ścianka Pożaryskich (Kazimierz LP, Małopolski Przełom Wisły Geopark), (**C**)—intepretative panel (Cedyński LP, Kraina Lodowca nad Odrą Geopark), (**D**)—loess outcrop, nature reserve Skarpa Dobrska, (Kazimierz LP, Małopolski Przełom Wisły Geopark), (**E**)—geosite, flysh outcrop, river valley (Czarnorzecko-Strzyżowski LP, Dolina Wisłoka—Polski Teksas Geopark), (**F**)—geosite, Kaliszany quarry (Małopolski Przełom Wisły Geopark) (all photos: W. Zgłobicki).

The following landscape parks have the greatest density of abiotic nature serves: Barlinecki, Chęcińsko-Kielecki, Ciężkowicko-Rożnowski, Jeleniowski, Książański, Góry Opawskie, and Rudniański (Figure 3). In the category of nature conservation subtypes, the most numerous are tectonic and erosional forms (52%) and sites comprising outcrops of rocks, minerals, sediments, and soils (32%). Palaeontological sites (8%), monuments (4%), and natural and semi-natural biocenoses (4%) have the smallest share. The greatest density of abiotic natural phenomena in landscape parks occurs in the provinces of Pomorskie, Zachodniopomorskie, Warmińsko-Mazurskie, Podlaskie, Śląskie and Małopolskie. Erratic boulders account for nearly 50% of the sites in the landscape parks, while rocks account for 30%. Springs and caves have a much smaller share (12% and 7%, respectively). Documentation sites occur in 25 landscape parks. They are the most numerous (16) in Pogórza Przemyskiego Landscape Park, while in other parks the number of these sites is small. In terms of type, rock formations (29) and excavation pits (12) predominate. The highest density of abiotic natural phenomena (>6/100 km^2) occurs in six landscape parks, four of which are located in northern Poland (provinces of Zachodniopomorskie, Pomorskie, Warmińsko-Mazurskie, Podlaskie) and two in the south (provinces of Śląskie and Małopolskie), namely in Trójmiejski LP (nearly 60 sites), Dolinki Krakowskie LP (nearly 50 sites), Suwalski LP, Orlich Gniazd LP, Wysoczyzny Elbląskiej LP, Szczeciński Puszcza Bukowa LP. In four landscape parks, the density of abiotic natural phenomena ranges from 4.5 to 6.0 per 100 km^2. namely in Dłubniański LP, Sudetów Wałbrzyskich LP, Czarnorzecko-Strzyżowski LP, and Chęcińsko-Kielecki LP.

Geological sites (36%), geomorphological sites (25%), and other sites (25%) form the most numerous categories of geosites. Water geosites (12%) and mining geosites (2%) are the least numerous. The geosites are not distributed evenly. The landscape parks located in the south and north of Poland (close to the Baltic Sea) are characterised by the greatest density of geosites (Figure 4). The biggest density of geosites (>10/100 km^2) occurs in 20 landscape parks. The greatest number of geosites occurs in Orlich Gniazd LP (148 sites) and Kazimierski LP (70 sites). A large density occurs in Południoworoztoczański LP (60 sites), Dolinki Krakowskie LP (53 sites), Czarnorzecko-Strzyżowski LP (51 sites), and Chęcińsko-Kielecki LP (30 sites).

The greatest number of geological sites are located in south-eastern Poland. With regard to the largest density of geosites, three landscape parks of geological character should be mentioned: Sudetów Wałbrzyskich, Kazimierski, and Chęcińsko-Kielecki. The total number of geomorphological sites in landscape parks is 288. Most geosites of this type occur in south-eastern and northern Poland. In total, 23 landscape parks belong to the highest density category (>2/100 km^2). Among them, three parks with considerable density should be mentioned: Kazimierski, Suwalski, and Południoworoztoczański.

Geosites show different degrees of accessibility. Easily accessible sites predominate in a vast majority of landscape parks (94). A total of 949 geosites (82% of the total number) belong to this category. These sites are usually located along or close to tourist trails. Geosites differ in terms of status highlighting their uniqueness. Geosites of international rank are either rare on the global scale or have some unique characteristics. A total of 40 geosites of international rank occur in landscape parks (4% of the total number). Most of these geosites occur in eight landscape parks, including Kazimierski LP (8 sites), Cedyński LP (5 sites), Orlich Gniazd LP (3 sites), and Śnieżnicki LP (2 sites). Geosites with unique resources on the national scale in Poland have been awarded the national rank. 148 of such geosites (13% of the total number) occur in landscape parks.

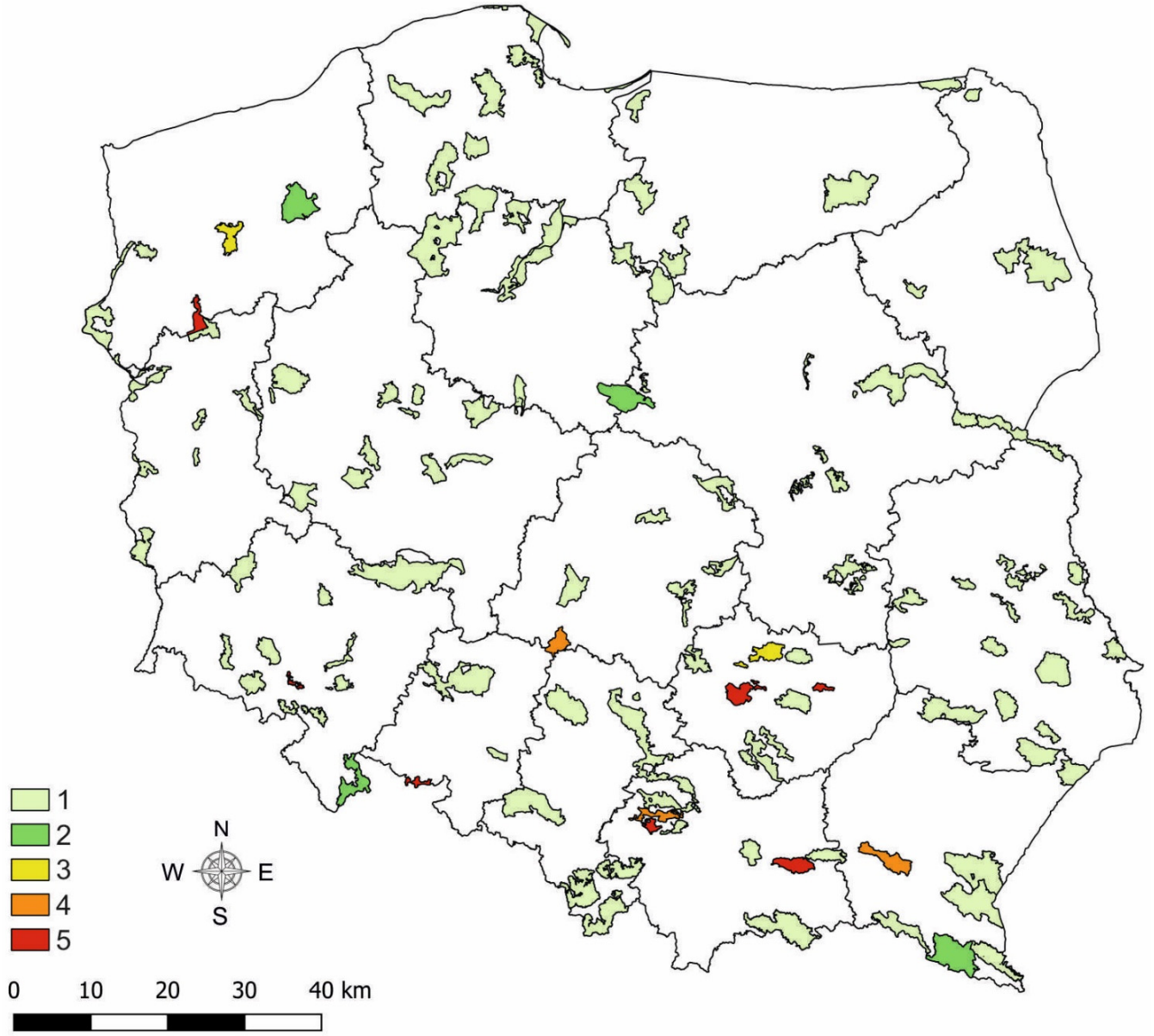

Figure 3. Density of nature reserves within landscape parks (per 100 km^2). 1: <0.06, 2: 0.06–0.10, 3: 0.11–0.15, 4: 0.16–0.20, 5: >0.20.

According to the conducted assessment, a clear majority of landscape parks belong to the class of small and very small abiotic natural resources (Table 2, Figure 5). However, it is important to stress the relativity of this assessment which is used to rank parks according to the occurrence of abiotic nature sites within them. Thus, this is not a qualitative assessment of geoheritage. Hence, the names of categories refer to the position in the ranking rather than the actual value.

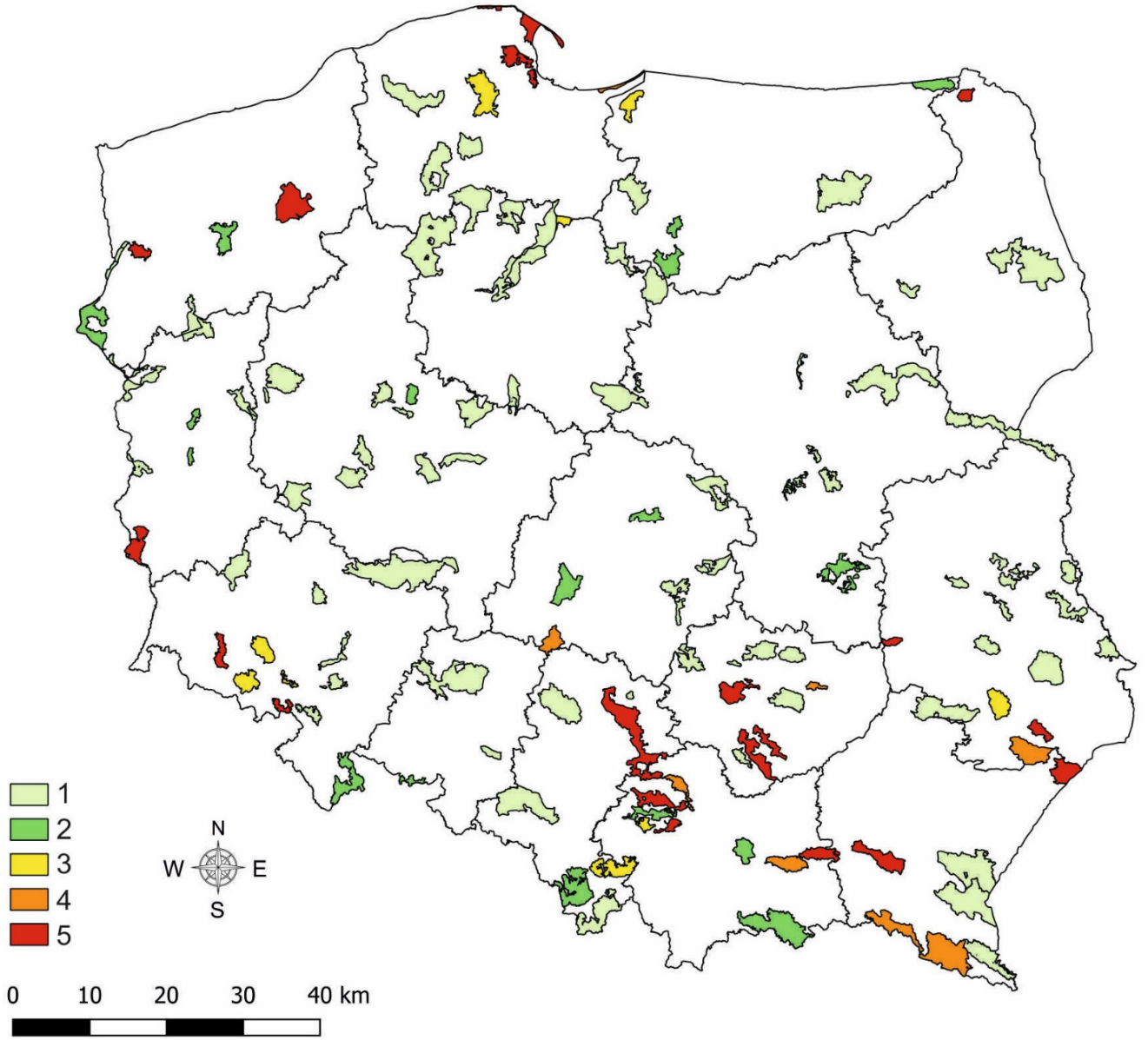

Figure 4. Density of geosites within landscape parks (per 100 km^2). 1: <2.6, 2: 2.6–5.0, 3: 5.1–7.5, 4; 7.6–10.0, 5: >10.

When it comes to the position in the ranking, a decisive role was played by the presence of nature conservation forms, such as abiotic nature sites or abiotic natural phenomena, in the landscape parks. The correlation coefficients between the final assessment and the specific criteria were as follows: 0.73, 0.60, and 0.52.

Table 2. The scoring rules and number of landscape parks in the specific categories.

Total Points	Geoheritage Resources	Number of Landscape Parks
<25.8	very small: I	78
25.8–35.6	small: II	20
35.7–45.4	moderate: III	17
45.5–55.2	large: IV	9
>55.3	very large: V	3

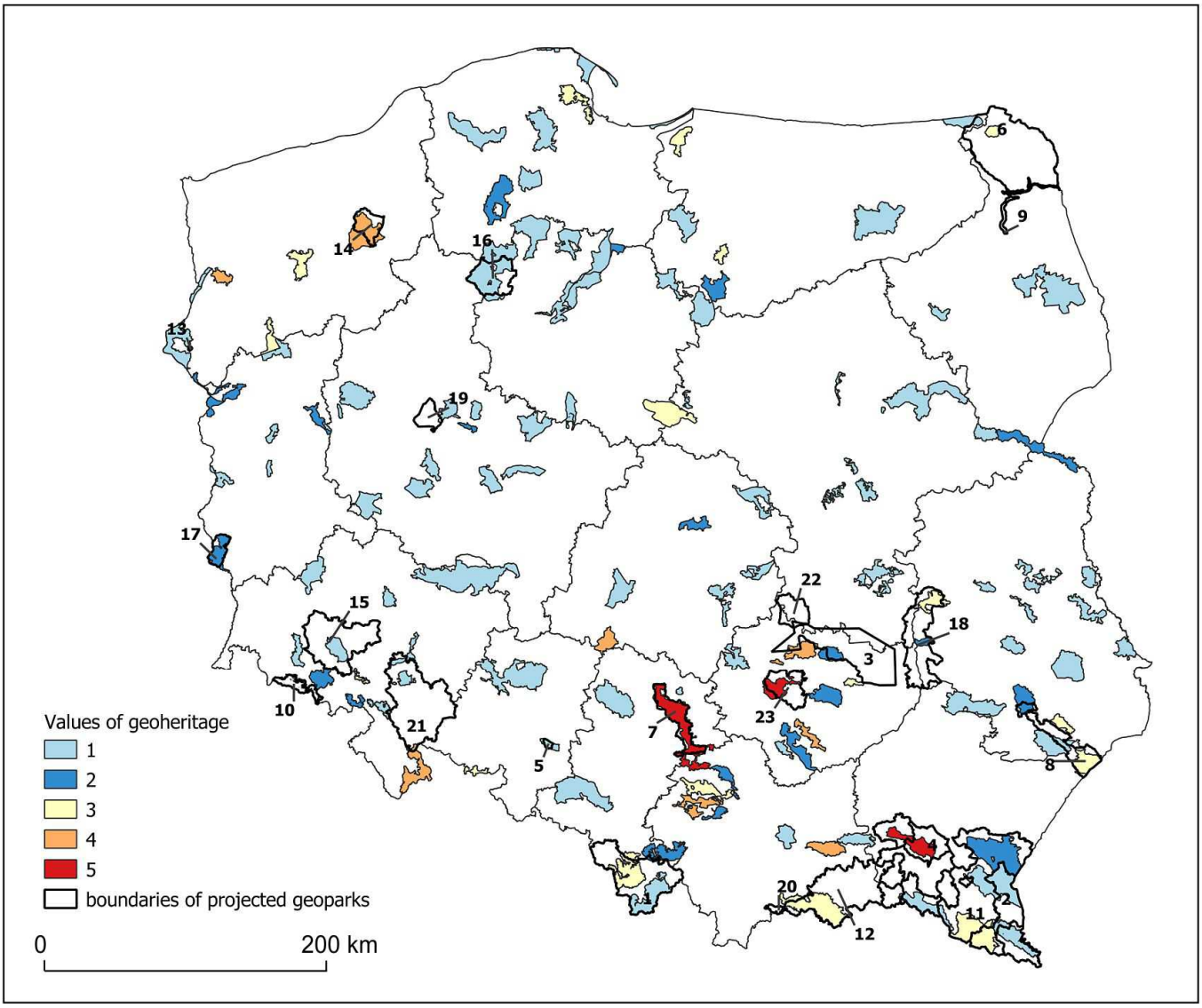

Figure 5. The results of landscape park assessment against the network of the planned geoparks. Category of resources (1) very small, (2) small, (3) moderate, (4) large, (5) very large. Planned and existing geoparks. 1—Beskid Śląsko-Morawsko-Żywiecki, 2—Bieszczady Wysokie, 3—Dolina Kamiennej, 4—Dolina Wisłoka—Polski Teksas, 5—Góra Świętej Anny (national geopark), 6—Jaćwingów, 7—Jurajski, 8—Kamienny Las na Roztoczu, 9—Kanał Augustowski, 10—Karkonosze (national geopark), 11—Karpaty Fliszowe, 12—Karpaty Fliszowe i ich wody mineralne, 13—Kraina Lodowca nad Odrą, 14—Kraina Polodowcowa Drawy i Dębnicy, 15—Kraina Wygasłych Wulkanów, 16—Krajna—Polodowcowa Kraina Ozów, 17—Łuk Mużakowa (UNESCO Global Geopark), 18—Małopolski Przełom Wisły, 19—Morasko, 20—Pieniński, 21—Przedgórze Sudeckie, 22—Przysucha, 23—Świętokrzyski (UNESCO Global Geopark).

4. Discussion

The conservation of the unique abiotic nature through education is an important goal behind the establishment of geoparks which facilitate the popularisation of geological heritage, combined with sustainable socio-economic development policies. The creation of a geopark requires the use and expansion of the existing tourism infrastructure, as well as development of specific geotourist products (information and education centres, geotourist trails, educational materials) [20,21]. Such efforts also require making an inventory of abiotic natural resources.

At present, about 25 areas in Poland are indicated as potential geoparks, but the level of progress on their establishment varies. A detailed inventory has been carried out, and plans have been drafted for some of them, e.g., Małopolski Przełom Wisły Geopark and Kamienny Las na Roztoczu Geopark [17,34]. In the case of other sites, there are only academic publications indicating the possibility of establishing a geopark. In total, 19 potential geoparks are within the boundaries of landscape parks (Table 3). The results of the assessment indicate that the following three landscape parks can be included in the category with the largest (very large) abiotic natural resources: Czarnorzecko-Strzyżowski, Chęcińsko-Kielecki, and Orlich Gniazd. Two geoparks are planned within Czarnorzecko-Strzyżowski Landscape Park, namely "Dolina Wisłoka—Polski Teksas" Geopark (encompassing parts of Magurski National Park) and "Karpaty Fliszowe" Geopark (encompassing parts of the following landscape parks: Ciśniańsko-Wetliński, Jaśliski, Gór Słonnych, and Pogórza Przemyskiego). Part of Chęcińsko-Kielecki LP is within the Geoland of the Holy Cross Mountains UNESCO Global Geopark [11]. "Jurajski" Geopark is planned in the area of Ojcowski National Park and the Complex of Jurassic Landscape Parks, consisting of six landscape parks including Orlich Gniazd LP [23,35].

Table 3. Planned geoparks versus landscape parks (based on Alexandrowicz, Miśkiewicz (2016) [23], modified according to the assessment results).

Name of the Planned Geopark	Large-Area Protection, Results of LP Assessment (Category Number, from Table 2, in Brackets)	References
Jurajski	Complex of Jurassic Landscape Parks with buffer zones, Ojcowski NP with buffer zone	Alexandrowicz, Alexandrowicz 2000 [35]
Chęcińsko-Kielecki	Chęcińsko-Kielecki LP (V)	Urban, Wróblewski 2004 [36]
Ślęży	Ślężański LP with buffer zone (I)	Alexandrowicz, Alexandrowicz 2004 [37]
Śnieżnika Kłodzkiego	Śnieżnicki LP with buffer zone (IV)	Alexandrowicz, Alexandrowicz 2004 [37]
Niecki Śródsudeckiej/Sudetów Środkowych	PK Sudetów Wałbrzyskich (II), Książański LP with buffer zone (III), LP Gór Sowich (I)	Kosiór 2004 [38]
Karpaty fliszowe	Ciśniańsko-Wetliński LP (III), Jaśliski LP (I), Czarnorzecko-Strzyżowski LP (V), Gór Słonnych LP (I), Pogórza Przemyskiego LP (II)	Gonera 2004 [14]
Jaćwingów	Wigierski NP with buffer zone, Suwalski LP with buffer zone (III), parts of Puszczy Rominckiej LP (I)	Graniczny et al. 2008 [39]
Polodowcowa Kraina Drawy i Dębnicy	Drawski LP (IV)	Kamieńska, Giemza 2014 [40]
Kraina Wygasłych Wulkanów	LP Chełmy with buffer zone (I)	Pijet-Migoń, Migoń 2009 [41]
Kraina Polodowcowa nad Odrą	Cedyński LP (I)	Dobracki, Dobracki 2011 [42]
Karpaty fliszowe i ich wody mineralne	Parts of Popradzki LP (III)	Miśkiewicz et al. 2011 [43]
Beskid Śląsko-Morawsko-Żywiecki	Parts of Beskidu Śląskiego LP (III), Żywiecki LP (I)	Golonka et al. 2013 [44]
Małopolski Przełom Wisły	Parts of Kazimierski LP (III), Wrzelowiecki LP (II)	Harasimiuk et al. 2011 [34]
Bieszczady Wysokie	Buffer zone of Bieszczadzki NP—Ciśniańsko-Wetliński LP (III), Doliny Sanu LP (I)	Haczewski 2011 [16]
Kamienny Las na Roztoczu	Parts of Roztoczański NP with buffer zone, Szczebrzeszyński LP (I), Krasnobrodzki LP (III), Puszczy Solskiej LP (I), Południoworoztoczański LP (III)	Krąpiec et al. 2012 [17]
Krajna Polodowcowa Kraina Ozów	Krajeński LP (I)	Kozłowska-Adamczak, Krupa 2013 [45]
Dolina Wisłoka—Polski Teksas	Parts of Magurski NP, Jaśliski LP (I), Czarnorzecko-Strzyżowski LP (V)	Wasiluk 2013 [18]

Chęcińsko-Kielecki park was established by the local government as a form of nature conservation in 1996. Initially, the park was to be called "Chęcińsko-Kielecki Geological

Park" because the geological assets were the main subject of protection. However, that proposal did not meet the approval of the local government, which argued that the appropriate legal basis was missing. Chęciński-Kielecki Landscape Park features 10 abiotic nature reserves, 8 abiotic natural phenomena, and 30 geosites [36]. In terms of the number of conservation forms, it is a unique area in Poland. Nature reserves comprise primarily outcrops of Palaeozoic rocks, with interesting minerals and fossils. Some of these reserves are Góra Zelejowa, Miedzianka, Rzepka, Jaskina Raj, Chelosiowa Jama, and Biesak-Białogon.

Czarnorzecko-Strzyżowski LP, established in 1993, lies in the Carpathians and encompasses the hills of Strzyżowskie and Dynowskie Foothills. The park features outcrops of sandstone that the erosion has turned into outliers. About a dozen of them have the status of a natural phenomenon. The landscape park encompasses two abiotic nature reserves featuring rocky outliers (the reserves are called Herby and Prządki im. prof. Henryka Świdzińskiego). The planned "Jurajski" Geopark will be located in the Kraków-Częstochowa Upland, within the provinces of Małopolskie and Śląskie and will encompass Ojcowski National Park and the Complex of Jurassic Landscape Parks. The landscape parks within the Complex include Dolinki Krakowskie LP, Tenczyński LP, Rudniański LP, Bielańsko-Tyniecki LP, Dłubniański LP, Orlich Gniazd LP. The latter is characterised by considerable diversity of geological forms such as karst rocks and other karst forms e.g., caves or rock shelters with traces of prehistoric cultures. The park comprises three abiotic nature reserves (Góra Zborów, Ruskie Góry, Zielona Góra), 40 natural phenomena, and 148 geosites.

Nine landscape parks were included in the category with large abiotic natural resources. Two of them—Drawski LP and Śnieżnicki LP—overlap with the areas of the potential geoparks listed by Alexandrowicz, Miśkiewicz (2016) [23]. Within Drawski LP, there are fourteen abiotic natural phenomena and one abiotic nature reserve. The planned Geopark "Polodowcowa Kraina Drawy i Dębnicy" covers a large part of Drawski Landscape Park in Zachodniopomorskie Province [40]. Śnieżnik Kłodzki Geopark is planned within Śnieżnicki LP featuring two exceptionally valuable abiotic nature reserves: Jaskinia Niedźwiedzia and Wodospad Wilczki.

The other nine landscape parks with valuable abiotic natural resources are not located within areas of the proposed geoparks. These landscape parks are located in different parts of Poland: in the north (Szczeciński Puszcza Bukowa LP), in central Poland (Szaniecki LP, Załęczański LP, Suchedniowsko-Oblęgorski LP), and in the south (Tenczyński LP, Rudniański PK, Śnieżnicki LP, Ciężkowicko-Rożnowski LP). The assessment carried out within this study thus indicates the existence of areas that have large geoheritage resources but have not been considered as potential geoparks so far.

Some geoparks are planned in landscape parks that received a low score in the assessment. For example, the planned Niecki Śródsudeckiej/Sudetów Środkowych Geopark is to be located within three landscape parks: Sudetów Wałbrzyskich LP, Książański LP with its buffer zone, and Gór Sowich LP. One of the parks with moderate abiotic natural resources is Książański Landscape Park that features an abiotic nature reserve, abiotic natural phenomena, and geosites, but these resources do not represent a high value for education, research, and teaching. Sudetów Wałbrzyskich Landscape Park was assigned to a lower category as it lacks nature reserves even though it features a large number of geosites and abiotic natural phenomena. Gór Sowich Landscape Park, featuring only natural phenomena, was assigned to the lowest category. It should be emphasised that the area is highly valuable in geological terms as, for example, gneisses—very old rocks from the Archean Eon occur on the surface here. Ślężański Landscape Park received a low score since it lacks abiotic natural phenomena and nature reserves, and only a few geosites occur. However, it is quite unique in geological terms (ancient extinct volcano). Despite the small number of abiotic natural sites, "Ślęży" Geopark is planned within the landscape park and its buffer zone. "Krajna—Polodowcowa Kraina Ozów" Geopark is to be located in Krajeński Landscape Park whose abiotic natural resources were assessed as small, considering the absence of abiotic nature reserves and natural phenomena, and just

a few geosites. A similar discrepancy between the assessment results and geopark plans also occurs in the case of Kraina Wygasłych Wulkanów Geopark, Kraina Polodowcowa nad Odrą Geopark, and Beskid Śląsko-Morawsko-Żywiecki Geopark. Some landscape parks situated within the planned geoparks were assessed as having moderate resources: Suwalski LP (Jaćwingów Geopark), Popradzki LP (Karpaty Fliszowe Geopark), Kazimierski LP (Małopolski Przełom Wisły Geopark), Wetliński LP (W Bieszczadach Wysokich Geopark), Południoworoztoczański LP, Krasnobrodzki LP (Kamienny Las na Roztoczu Geopark).

The assessment carried out in this study had a primarily quantitative character. Only the assessment of the geosites' value for research, teaching, and tourism was a qualitative assessment based on data available in the Central Register of Geosites in Poland [26]. Additionally, the assessment had a qualitative aspect related to the ranking of the criteria. Given the scope of the survey, i.e., the entire territory of Poland, this was the only possible form of assessment, but it provides extensive information on the abiotic natural resources in landscape parks. It indicates which areas, given the current state of knowledge, have a chance of becoming UNESCO geoparks, and which ones can aspire to become national or local geoparks. Quite considerable discrepancies occurred between the results of the assessment, and the geopark plans (Table 3, Figure 5). The quantitative approach used in this study is based on the density of nature conservation forms. It was also assumed that the largest abiotic natural resources had already been placed under protection in the form of nature reserves and natural phenomena. The planned geoparks, on the other hand, are mostly based on geosites that do not always represent the highest geoheritage value. The discrepancies may also result from the fact that the system of spatial forms of abiotic nature conservation in Poland is insufficient. This may concern abiotic natural phenomena and documentation sites in particular. The concepts of geoparks and geotourism, requiring a detailed inventory of geoheritage resources, can support the process of developing the legal protection of the most valuable sites and areas. Further investigation is definitely needed in this respect. Indeed, a geopark can be established and not be necessarily based on a large number of sites; in some cases, the high geoheritage value of individual sites may be more significant (e.g., Góra Św. Anny Geopark). On the other hand, an important aspect for any geopark is geodiversity [46,47]. It is difficult to imagine the establishment of a geopark when there are fewer than 20 geosites. Furthermore, it should be noted that the boundaries of geoparks do not coincide with the boundaries of landscape parks, which has a bearing on the methodology of the study, i.e., identifying the density of sites. Thus, a planned geopark may cover the part of a landscape park that has a greater concentration of geoheritage resources.

Alongside the importance for education and tourism, the establishment of a geopark, particularly a UNESCO global geopark, contributes to the building of an area's tourist brand and to its economic development [48], and enables expanding the tourist offer, especially in view of the dynamic development of geotourism around the world [22,49,50]. Geoparks can also have a direct impact on local development and increased quality of life through the creation of new jobs and income growth [2,3,5,40]. In this respect, the tourist potential of landscape parks is particularly significant given the fact that they usually have valuable historical, landscape, and natural assets alongside abiotic nature sites (e.g., Kazimierski LP, Orlich Gniazd LP and many other parks). These assets can be an important part of a comprehensive tourist offer [51].

It should be stressed once again that the term 'geopark' does not exist in the Polish legal system. A similar situation occurs, for example, in Slovakia [52]. Hence relying on the existing landscape park infrastructure and brand could be helpful in the first stage of efforts on the successive establishment of geoparks in Poland. What is more, the organisational knowledge and competence of services responsible for the functioning of landscape parks would also be useful in the creation of geoparks. Landscape parks have ready-made educational materials that, after being supplemented with information on geoheritage, could be used as geotourism educational products (geoeducation). Similar measures could be taken with respect to the existing educational paths that could become geotourist paths.

Landscape parks are often areas where local tourism organisations operate, and these organisations could initiate bottom-up efforts needed to establish a geopark.

Geoeducation is an increasingly popular trend, similar in essence to geotourism. It is more oriented toward educational elements, especially aimed at children and young people [25,31,53]. At the same time, the rather low conservation regime in the landscape parks does not limit the development of geotourism activities (for example, collecting specimens). Such restrictions, however, may exist in nature reserves, natural monuments, and documentary sites.

The involvement of the local community in the preservation of the geoheritage assets and the development of tourist facilities is crucial [32,41,54,55]. In contrast, the geopark projects presented in the manuscript are mostly the initiative of scientists and are based almost exclusively on the scientific merits of geoheritage. The exception to this is the Land of Extinct Volcanoes Geopark (Kaczawskie Foothills).

The creation of a geopark could be an opportunity for the development of an economically less prosperous rural area. It should be noted, however, that in some cases geopark projects include areas with fairly intense tourist traffic (for example Geopark Małopolski Przełom Wisły, Geopark Kamienny Las na Roztoczu). So, local authorities do not always see the need for them. In addition, Poland is a country where cognitive tourism, especially for geoheritage values, is just beginning to develop. So, the number of geotourists is not very large. Therefore, investment in the development of this form of tourism may be seen as risky. It seems that the lack of awareness of the prospects for local development offered by a geopark is one of the main reasons why the process of establishing geoparks is so slow.

Further research on the possibility of establishing new geoparks in the territory of landscape parks should, in our opinion, focus on: (a) learning the opinions of residents and local authorities on the establishment of such institutions, (b) inventorying the current state of development of the most valuable sites, (c) delineating areas where the establishment of geoparks could significantly improve the social and economic situation of rural areas.

5. Conclusions

The performed assessment confirmed the existence of large geoheritage resources in some of the landscape parks chosen as potential geoparks. Parks that had not been previously considered as potential geoparks, despite the occurrence of a large number of abiotic nature sites, were indicated. In the case of some of the planned geoparks, our assessment did not confirm the existence of large geoheritage resources in the landscape parks located within them. However, the comprehensive assessment made it possible to prepare a ranking of Polish landscape parks, according to their abiotic natural resources. The obtained results allow for the conduction of a more rational policy with regard to developing the geopark network in Poland. Owing to the method used, primarily a quantitative rather than qualitative character of the assessing geoheritage resources, some landscape parks featuring interesting geological sites did not receive a high score. This situation may result from the insufficient development of the legal system protecting abiotic natural areas and sites. Continuing studies on establishing new geoparks can thus lead to increasing the number of spatial forms of nature conservation in Poland.

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