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Manifestations of the mountain landscape in toponyms: an example from Poland

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Abstract
The names of objects and places (toponyms) are frequently assigned based on various distinctive elements, including the features of the geographical environment. Since these features also aid in the identification of the types of landscapes, toponyms are widely used in analyses aimed at finding relationships between their spatial distribution and the elements shaping the space.
Researchers have particularly favoured analyses concerning mountain landscapes. However, a detailed review of the literature on this subject indicates that such studies rarely extend beyond the boundaries of these regions. For this reason, it was decided to inspect whether there are more localities and physiographic features with mountains in their names in the mountain landscapes compared to other types of landscapes.
A quantitative and spatial analysis of the distribution of toponyms with mountains in their names was conducted as part of the research. The following measures were determined: (i) an index calculated as the product of the number of localities (physiographic objects) with mountain-related names located in a landscape zone divided by the area of that zone; (ii) the percentage share of the number of localities (physiographic objects) with mountain-related names located in a landscape zone compared to all localities within that area. Additionally, the types of objects assigned to the points representing localities with these mountain-related names were examined. Data were sourced from the State Register of Geographic Names. The research was conducted over the entire area of Poland.
In the case of locality names, both their number and density increase with the average elevation of the terrain. However, the analysis of physiographic object names did not reveal such clear correlations. Nevertheless, in both cases, the highest coefficients were observed for mountain landscapes. Additionally, it was noted that in other areas, names related to mountains were given to objects that in some way stood out from their surroundings and not necessarily be actual mountains.

Keywords
locality, place name, physiographic object, State Register of Geographic Names, landscape belt

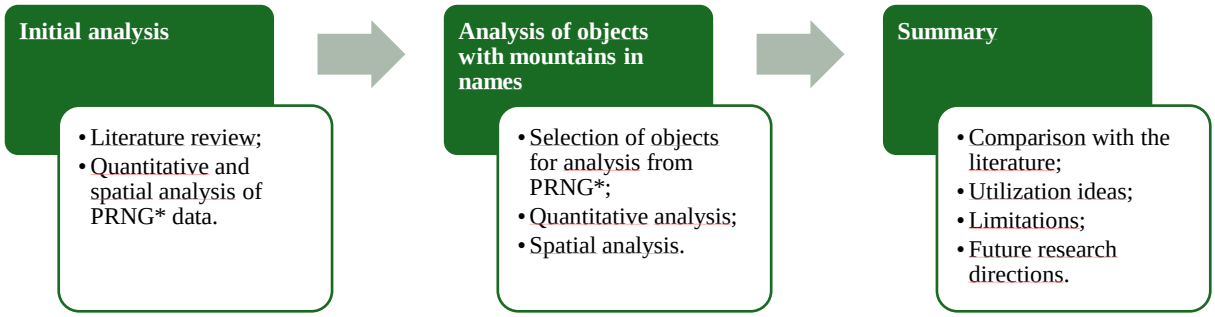
Introduction

Each region has its own identity, and an important part of this is played by its physical content (Entezarinajafabadi & Roig, 2023). For outdoor spaces, this value primarily refers to the terrain's topography, which plays a significant role in shaping the landscape background of such regions (Booth, 1989) and influences the spatial arrangement of its elements (Hreško et al., 2015). In turn, these elements can impact the attachment of individuals and social groups to the space they are a part of (Knez & Eliasson, 2017; Hedblom et al., 2020). This attachment is often expressed by assigning names to these elements, which reflect the geographical character of the space in which they are located (Zeini et al., 2018). For this reason, the literature contains a number of descriptions of landscape studies based on the toponyms (names of places). These studies demonstrate that place names can: (i) be indicators of changes occurring in the landscape over time (Sousa & García-Murillo, 2001; Fagúndez & Izco, 2017) and space (Milić & Vidović, 2018); (ii) help to mark the physical boundaries of natural (Atik & Swaffield, 2017; Wartmann et al., 2018) and cultural (Penko Seidl, 2008; Jażdżewska & Pabijan, 2020) landscapes; (iii) provide a real assistance in the search for lost landscape elements (Sweeney et al., 2007; Calvo-Iglesias et al., 2012; Kharusi & Salman, 2015; Frajer & Fiedor, 2018; Pinna, 2023); (iv) be indicators of potential tourist attractiveness (Olenderek, 2011; Lewandowicz, 2016; Lewandowicz & Witkowska-Dąbrowska, 2016; Saparov et al., 2017; Abdullina et al., 2019).

Although there is a lot of attention in the literature devoted to the toponyms related to mountains (Boillat et al., 2013; Derungs & Purves, 2014; Feng & Mark, 2017; Holtkamp et al., 2018; Abdullina et al., 2019), there is a lack of studies that cover entire countries in terms of identifying the connections between the type of landscape and the spatial distribution of toponyms. The authors of the works analyzed during the literature review focused mainly on names of objects located exclusively in mountainous areas and did not analyze whether, and possibly how often, these names appear in other zones. For this reason, this study aims to verify the following research hypothesis: in the mountain landscape area, there are more localities and physiographic objects with mountains in their names than in regions with other landscape types.

Material and Methods

A quantitative and spatial analysis of the distribution of localities and physiographic objects with mountains in their names was conducted as a part of the research. The analyzed toponyms were acquired from the State Register of Geographic Names and were located within the administrative borders of Poland. The scheme of the study is presented in Figure 1.



*) PRNG – pol. Państwowy Rejestr Nazw Geograficznych, eng. State Register of Geographic Names

Fig. 1. Scheme of the study. Source: private work.

Research area

The research was conducted over the entire area of Poland. The country in Central and Eastern Europe with an approximate area of 312 thousand km^2 and quite diverse landscape, in which 6 latitudinally arranged landscape belts can be distinguished (Warowna et al. 2013): 1 – Baltic coast; 2 – Lake districts; 3 – Lowlands; 4 – Uplands; 5 – Basins; 6 – Mountains. Their placement is shown in Figure 2.

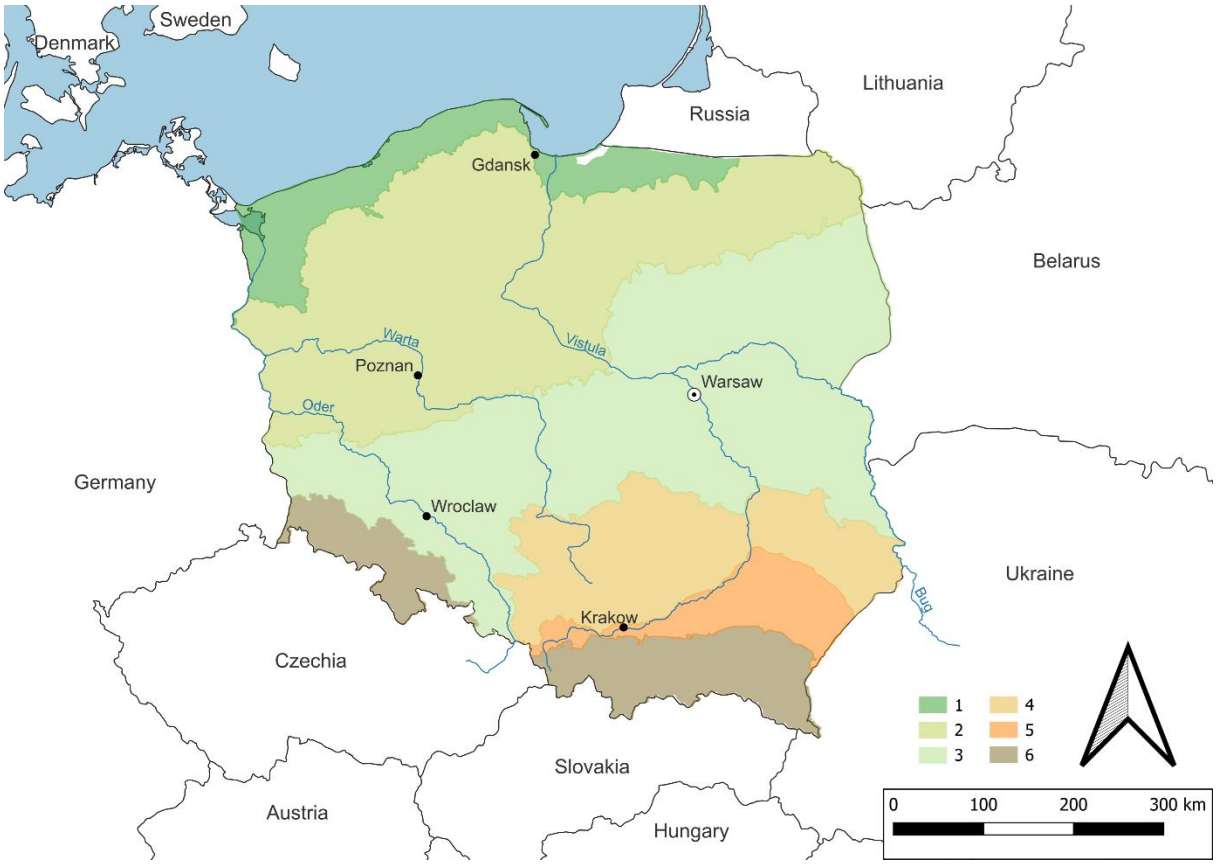


Fig. 2. Landscape belts in Poland: 1 – Baltic coast; 2 – Lake districts; 3 – Lowlands; 4 – Uplands; 5 – Basins; 6 – Mountains. Source: private work based on (Warowna et al., 2013).

Data

Data is sourced from the State Register of Geographic Names (pol. Państwowego Rejestru Nazw Geograficznych; acronym PRNG). This official database is utilized as the basis for systems that use geographical naming. Moreover, it is i.a. basis for the development of topographic maps (Kulka et al., 2023). This database is maintained by the Surveyor General of Poland (Act, 2024). PRNG consists of two parts (Regulation, 2021): (i) the register of geographic names of the Republic of Poland and (ii) the register of geographic names of the world. The register is continuously kept up to date.

For the purpose of this study, only the former part, the one containing names of localities and physiographic objects located entirely or partially within the territory of Poland, was used together with their attributes. From the authors' perspective, the following attributes were significant: *primary name*, *object's category*, *type of the object* and *object representation*. The *primary name* is the name assigned as the base one in PRNG. The *object's representation* refers to the geographic coordinates in the World Geodetic System 1984 (WGS84) and the rectangular coordinates X Y in the PL-1992 coordinate system. The accepted *categories* and *types of the objects* are listed in Table 1.

Tab. 1. Categories and types of objects from the State Register of Geographic Names.

No.	Category	Type
1	locality	city/town; part of a city/town; village; part of a village; settlement of a village; colony; part of a colony; colony of a village; colony of a colony; colony of a settlement; settlement; forest settlement; part of a settlement; settlement of a village; settlement of a colony; settlement of a settlement; housing estate; hamlet; hamlet of a village; hamlet of a colony; hamlet of a settlement; forest settlement of a village; forest lodge; tourist refuge; other object
2	landform	lowland; plain; valley; proglacial valley; ravine; gorge; basin; depression; hollow; edge; cliff; escarpment; upland; part of an upland; plateau; moraine hill; trough; highland; lake district; sinkhole; hump; rolling hills; ridge; foothill; gate; threshold; furrow; natural region; coastal zone; river alluvial plains; hill; dune; mountain; peak; mountain range; ridge; crest; crag; massif; mountains; slope; gully; scree; rock; boulder; mountain pass; glacial cirque; island; peninsula; coast; cape; cave; grotto; other object

No.	Category	Type
3	hydrography	river; creek; brook; stream; canal; ditch; mouth branch; side branch; old riverbed; lake; part of a lake; pond; artificial water reservoir; sea, bay; lake bay; river bay; canal bay; bay section; strait; section of a strait; swamp, muddy terrain; waterfall; spring; outflow spring; disappearing stream; depth; sandbank; shoal; deep water; other object
4	land cover	forest; part of a forest; wilderness; wilderness – former settlement; glade; meadow; park; field; mountain hall; mountain pasture; peatland; area of sands; other object
5	buildings	bridge; sluice; dam; harbour basin; trench; fortification; embankment; dike; other object
6	transport	road; railway line; crossroad; other object
7	other	historical region; ethnographic region; hillfort; mound; other object

Source: private work based on (Regulation, 2021).

The representation of a geographic object in the PRNG depends on its geometry and is depicted accordingly as a point (for localities or point-like physiographic objects) or a group of points (for linear and surface-like physiographic objects). The name of a linear physiographic object is represented by the start and end points. If a linear feature spans more than one commune (the smallest unit of administrative division in Poland; 2477 as of the year 2024), at least one additional point is introduced in each commune. The name of a surface-like physiographic object is represented by a main point located near the centre of the object. In the case of spanning over more than one commune, additional points are added near the centres of respective fragments of the object within each one.

The register was downloaded on October 25, 2024, from the National Geoportal in the SHP format as two separate files containing localities and physiographic objects, respectively.

Methods

Data sourced from the State Register of Geographic Names in the SHP format was loaded into the QGIS software. Next, localities and physiographic objects with mountain-related names were selected using the ILIKE function, which helps search for texts containing a specified string of characters without case sensitivity. Due to the fact that the Polish language has many complexities, the search was limited exclusively to the words *góra* (noun, singular, meaning: *mountain*) and *góry* (noun, plural, meaning: *mountains*), as well as the sequence *górsk-*, which represented the words *górska*, *górski*, *górskie* (adjectives, meaning: *mountain*, which declines like the base noun– the ending "a" indicates feminine, "I" masculine, and "ie" neuter). The search was performed based on the formulas (1), (2) and (3):

"nazwaGlown" ILIKE '%góra%'; (1)

"nazwaGlown" ILIKE '%góry%'; (2)

"nazwaGlown" ILIKE '%górsk%', (3)

where *nazwaGlown* refers to the atribute *primary name*.

Due to the fact that spatial analyses of the landscape are conducted, it was decided not to reduce the number of selected points representing linear and surface objects to just a single point. This approach allowed for the placement of points representing real objects to reflect their true distribution better.

Based on the analyzed points, the following were determined: (i) an index calculated as the product of the number of localities (physiographic objects) with mountain-related names located within a landscape belt and its corresponding area; (ii) the percentage share of localities (physiographic objects) with mountain-related names within a landscape belt relative to the total number of localities (physiographic objects) within it. Moreover, the type of objects assigned to the points representing localities (physiographic objects) with mountain-related names was inspected.

Results with Discussion

The results were divided into two sections: (i) quantitative and spatial analysis of toponyms and (ii) types of objects with "mountain" names. At the end of each section, a brief discussion of the results was conducted, and the findings were compared with the results from studies described in the literature.

Quantitative and spatial analysis of toponyms

For the study, 1 600 points representing names of the localities (out of 124 401 in the database) were selected, as well as 6 933 points representing physiographic objects (out of 247 479 in the database), of which 45 were starting points of linear objects, 45 were endpoints of linear objects and 400 – additional points of linear and surface-like objects. Their spatial distribution, again the landscape belts, is shown in Figure 3, while their quantitative characteristics are detailed in Tables 2 and 3.

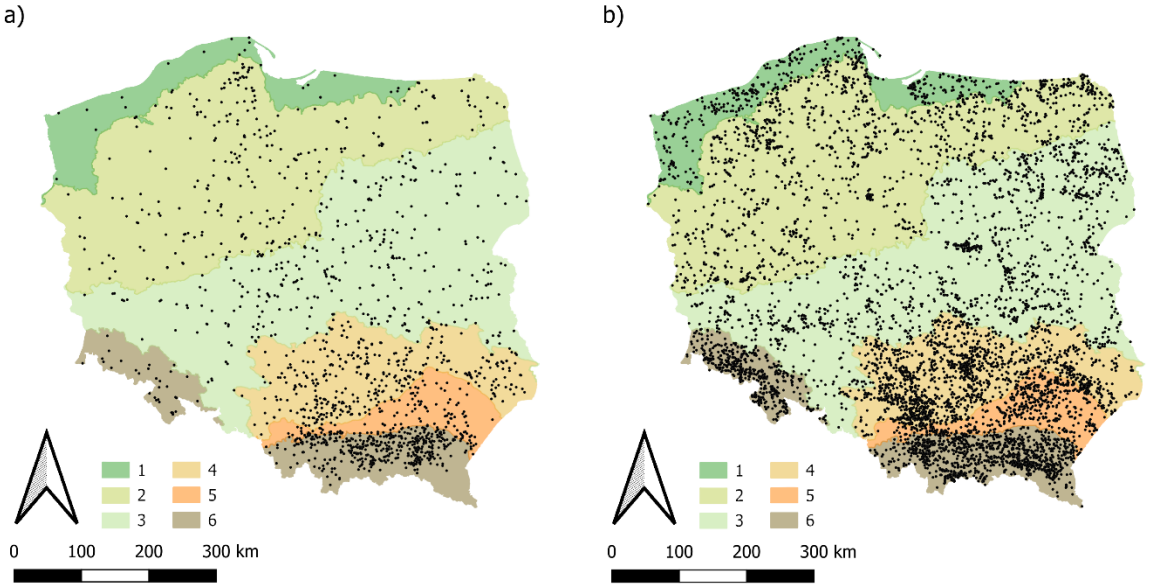


Fig. 3. Objects selected for analysis against the backdrop of landscape belts (1 – Baltic coast; 2 – Lake districts; 3 – Lowlands; 4 – Uplands; 5 – Basins; 6 – Mountains): a) localities' names; b) physiographic objects' names. Source: private work.

Tab. 2. Qualitative characteristics of localities' names.

Landscape belt		Area of the belt	Number of all toponyms in the belt	Number of "mountain" toponyms in the belt	Number of "mountain" toponyms/Area	Share of "mountain" points in all toponyms
No.	Name	[km^2]	[-]	[-]	[- / tys. km^2]	[%]
1	Baltic coast	20 366	4 523	22	1,1	0,5
2	Lake districts	96 822	25 370	265	2,7	1,0
3	Lowlands	110 327	41 599	317	2,9	0,8
4	Uplands	40 147	21 827	378	9,4	1,7
5	Basins	14 993	8 425	130	8,7	1,5
6	Mountains	29 233	22 657	488	16,7	2,2
Sum		311 888*	124 401	1 600	-	-
Average		-	-	-	6,9	1,3

**) The area of the land, including inland waters.*

Source: private work.

Tab. 3. Qualitative characteristics of physiographic objects' names.

Landscape belt		Area of the belt	Number of all toponyms in the belt	Number of "mountain" toponyms in the belt	Number of "mountain" toponyms/Area	Share of "mountain" points in all toponyms
No.	Name	[km^2]	[-]	[-]	[- / tys. km^2]	[%]
1	Baltic coast	20 366	11 946	433	21,3	3,6
2	Lake districts	96 822	42 431	1 327	13,7	3,1
3	Lowlands	110 327	62 161	1 407	12,8	2,3
4	Uplands	40 147	40 604	1 561	38,9	3,8
5	Basins	14 993	21 354	506	33,7	2,4
6	Mountains	29 233	68 983	1 699	58,1	2,5
Sum		311 888*	247 479	6 933	-	-
Average		-	-	-	29,7	2,9

**) The area of the land, including inland waters.*

Source: private work.

As can be easily observed, both the localities and physiographic objects with mountains in their names can be found throughout the country. Nevertheless, their spatial distribution is not uniform. In the Baltic coastal, lake districts, and lowlands landscapes, the names of "mountain" localities constitute 0.5-1.0% of all their localities. In these lower parts of the country, about 1-3 such localities can be found per 1000 km^2. As the average terrain elevation rises, both their number and density increase. In the uplands and basins regions, the values are greater. The share of "mountain" names amounts to approximately 1.5% of all localities' names from the State Register of Geographic Names, and their density is approx. 9 per 1000 km^2. The highest coefficients were found for the mountainous area (share – over 2%, density – almost 17 per 1000 km^2).

Unfortunately, analysis of the physiographic objects' names did not indicate similar dependences. Although the density of the mountain-related toponyms is still lower in the Baltic coastal, lake districts, and lowlands landscapes compared to others, the Baltic coastal area is characterized by a higher density than lake districts and lowlands regions. Moreover, the percentage share of objects with mountains in their name among all the objects in the PRNG across different landscape zones ranges from 2.5% to 3.8%, with higher values for the Baltic coast and lake districts areas compared to the mountain regions.

It should be noted that in the case of localities and physiographic objects' names, slightly lower values of the share and density of mountain-related toponyms in the basins belt than in the uplands belt are expected. In the latter, the lowest and, at the same time, the oldest Polish mountains are located – Góry Świętokrzyskie. At the same time, in the basins region there is a lack of terrain elevations, mostly due to the presence of river valleys (mainly the largest Polish river, the Vistula, and its tributaries).

The abovementioned observations confirm the conclusions obtained by Milić & Vidović (2018) in their small-scale studies (approx. 500 toponyms spread over the 80 km^2 area around the Opuzen, Slivno commune, Dubrovnik-Neretva county, Croatia) and by Holtkamp et al. (2018) on the bigger scale (the Rocky Mountains and Southwest regions of the United States of America). Milić & Vidović noticed that within the studied area, toponyms indicate a significant diversity in the terrain, which causes changes in the landscape from plain and coastal to mountainous. On the other hand, Holtkamp et al. found that the boundaries drawn between the analyzed regions using toponyms correspond relatively well to the boundaries defined by the physiographic objects. It should also be noted that in the Rocky Mountains area, mainly the names containing the word "alpine", understood as a "generic term for mountain environments", were amongst those searched.

Type of the objects with "mountain" names

Due to the ambiguous results for physiographic objects, it was decided to examine which types of objects have "mountain" names. The analysis also included localities. The results are presented in Tables 4 and 5.

Tab. 4. Types of the objects in the category of localities.

No.	Object type	Number of objects in the landscape belt						Total
		Baltic coast	Lake districts	Lowlands	Uplands	Basins	Mountains	
1	part of a village	5	73	109	201	97	392	877
2	village	6	81	98	51	12	12	260
3	hamlet of a village	1	17	49	46	7	33	153
4	part of a city/town	1	13	25	41	11	36	127
5	settlement	8	24	4	3	1	1	41
6	colony of a village	0	13	10	11	0	4	38
7	forest settlement	0	16	4	6	0	3	29
8	colony	0	10	6	8	1	0	25
9	forest lodge	0	10	4	0	1	3	18
10	settlement of a village	1	3	0	2	0	2	8
11	part of a colony	0	0	4	3	0	0	7
12	city/town	0	1	3	1	0	2	7
13	forest settlement of a village	0	4	0	3	0	0	7
14	hamlet of a colony	0	0	1	1	0	0	2
15	colony of a colony	0	0	0	1	0	0	1
	Total	22	265	317	378	130	488	1 600

Source: private work.

Tab. 5. Types of the objects in the category of physiographic objects.

No.	Object type	Number of objects in the landscape belt						Total
		Baltic coast	Lake districts	Lowlands	Uplands	Basins	Mountains	
1	hill	333	1 022	990	781	303	205	3 634
2	mountain, peak	0	6	6	434	7	1 078	1 531
3	hills	40	171	195	69	75	9	559
4	part of a forest	1	13	47	49	17	35	162
5	natural region	0	7	25	77	0	44	153
6	field	1	1	6	34	38	49	129

No.	Object type	Number of objects in the landscape belt						Total
		Baltic coast	Lake districts	Lowlands	Uplands	Basins	Mountains	
7	fields	1	4	15	21	8	71	120
8	forest	4	6	24	19	20	11	84
9	creek	0	0	0	0	0	79	79
10	road	12	8	10	17	0	14	61
11	river	10	17	0	0	20	0	47
12	hillfort	2	17	18	1	0	1	39
13	mountain range	0	0	0	3	0	34	37
14	brook	16	15	0	0	0	0	31
15	other object	0	3	3	10	3	8	27
16	mountains	0	0	0	3	0	20	23
17	dune	2	0	18	2	1	0	23
18	meadow	0	0	11	1	4	4	20
19	dunes	1	0	19	0	0	0	20
20	wilderness	2	6	4	2	1	2	17
21	slope	0	0	0	8	1	7	16
22	meadow	0	1	4	1	3	2	11
23	cave, grotto	0	0	0	10	0	0	10
24	canal	6	3	0	0	0	0	9
25	mound	0	3	4	0	0	0	7
26	escarpment	0	3	1	3	0	0	7
27	gorge	0	1	0	4	0	2	7
28	lake	0	5	1	0	0	0	6
29	glade	0	0	1	0	0	5	6
30	crossroad	0	2	1	1	0	2	6
31	pond	0	0	1	1	4	0	6
32	valley	0	2	0	1	0	2	5
33	forests	0	3	2	0	0	0	5
34	massif	0	0	0	0	0	4	4
35	park	0	0	0	1	0	3	4
36	rock	0	0	0	2	0	1	3
37	gorges	0	0	0	2	0	1	3
38	island	0	3	0	0	0	0	3
39	embankment	0	1	1	0	0	0	2
40	hollow	0	0	0	0	0	2	2
41	area of sands	0	0	0	1	1	0	2
42	swamp, muddy terrain	1	0	0	0	0	0	1
43	depth	0	0	0	0	0	1	1
44	gorge/ravine	0	0	0	0	0	1	1
45	edge	0	1	0	0	0	0	1
46	rolling hills	0	0	0	1	0	0	1
47	ravine	0	0	0	1	0	0	1
48	peninsula	0	1	0	0	0	0	1
49	mountain pass	0	0	0	0	0	1	1
50	rocks	0	0	0	0	0	1	1
51	artificial water reservoir	0	0	0	1	0	0	1
52	sluice	0	1	0	0	0	0	1
53	cliff	0	1	0	0	0	0	1
54	coast	1	0	0	0	0	0	1
	Total	433	1 327	1 407	1 561	506	1 699	6 933

Source: private work.

In the case of localities (Table 4), the mountains most often appear in the names of parts of villages and cities/towns, as well as in the names of villages and their hamlets. Assigning "mountain" names to parts of settlements is most likely associated with their higher elevation relative to the surrounding areas. Similarly, entire settlements most often derived their names from the convex landforms located within their boundaries.

Curiously, there are 7 cities in Poland with mountains in their names. Only 2 of them are indeed located in the mountain landscape belt. The rest are situated in belts: lowlands (3), basins (1) and lake districts (1). Amongst them are Jelenia Góra (landscape belt – Mountains), which took its name from the hill on which Bolesław Chrobry (the first king of Poland) saw a deer (pol. jeleń, eng. deer) during hunting, and Zielona Góra (landscape belt – Lowlands) from the hill covered with lush vegetation.

As for physiographic objects (Table 5), the "mountain" names in all the landscapes except the mountainous ones are most often assigned to the objects such as *hill*. Exclusively in the latter landscape, the dominant types of objects with mountain-related names are *mountain*, *peak*. Thus, toponyms distinguish objects significantly higher than the surrounding terrain but not necessarily a mountain in its dictionary sense[1].

[1] Mountain – a convex landform with a relative height greater than 300 m (Jackson & Bates, 1997) and an absolute height greater than 500 m above sea level (Whittow, 1984).

The abovementioned is consistent with the conclusions of the research conducted by Saparov et al. (2017), which found that the features of the geographical environment are the main factor in naming the physiogeographical objects. However, at the same time, it was noticed that people tend to assign the names of these objects in a recognizable way – for instance, they pay more attention to trees and water in the semi-desert and desert zones and thus use them more frequently during naming within those areas. The authors of this study claim that in a monotonous landscape environment, atypical phenomena serve as a kind of guide. Therefore, when delimiting areas based on the toponyms, it is necessary to take into account the landscape conditions in which these names function. Similar observations in Indonesia were made by Feng & Mark (2017), who stated that the Indonesian toponyms signifying mountain and hill are used interchangeably regardless of the size (area range) of the described landform. In the scope of the same study, they noted that such division is much stricter in Malaysia. Notably, they also found that in some cases, the spatial distance of a physiographic object from the human settlements may impact the term utilized.

Conclusions

The described study focused on the manifestations of mountain landscapes in the names of localities and geographic objects. It was a preliminary attempt to determine the relationship between toponyms and the type of landscape in which the localities and physiogeographic objects they describe are located. Conducted quantitative and spatial analysis confirmed the presented research hypothesis. The highest percentage of localities and physiographic objects with mountain-related names amongst all landscape types was found in the mountain landscape belt, which includes the Carpathians and the Sudetes in Poland. Moreover, the density of the "mountain" toponyms is also the highest. However, at this stage of the research, we believe that although it is generally assumed that the names of objects and localities in the surrounding world are assigned based on various distinctive features, in the case of mountain landscapes, mountain-related toponyms cannot be treated as their definitive indicators. While the obtained results indicate that, to some extent, the number of "mountain" toponyms in a designated area may point to its characteristic, the deviations between landscape belts are too small to be considered an indicator of the landscape areas' delimitation.

Furthermore, it should be noted that the described analyses have certain limitations that have to be addressed while further research is being considered. Firstly, the analyses considered a very limited set of toponyms. Only the names containing "mountains" were selected from the State Register of Geographic Names. Nevertheless, there are other words in the Polish language, for instance, slope, massif, peak, ridge, range, crag, etc., which, although not frequently used in toponyms, should also be considered. Secondly, the spatial distribution of the toponyms was correlated with the 6 landscape belts of large areas. In the next step, one should examine how the results would vary if they were applied to smaller areas.

Despite moderate scepticism regarding the utility of the conducted analyses in the landscape-oriented studies, it should be emphasized that the strengths of the described research lie in the data source (the State Register of Geographic Names maintained and continuously updated by the Surveyor General of Poland) and the inclusion of an area covering an entire large country (Poland).

To sum up, it should be stated that although the carried out studies indicated the quantitative correlation between the density of the "mountain" names of localities, physiographic objects and the landscape type (there is no such relation between the shares of "mountain" toponyms in the names of all PRNG objects), the issue of the utility of toponyms in the landscape-oriented studies remains debatable. A detailed analysis of the toponyms' distribution in relation to the land cover maps would most likely reveal discrepancies.

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