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LANDSCAPE UNITS TYPOLOGY FOR TOURISTIC PURPOSES IN MOUNTAINOUS AREAS (IN THE EXAMPLE OF THE SILESIAN BESKID MOUNTAINS, POLAND)

The article offers a proposition of the delimitation and typology of landscape for the purposes of spatial research in tourism in mountainous areas. A method of spatial units delimitation based on river basins was presented. Identification of units was an initial step for suggesting the author's units typology. The delimitation and typology were tested in the Silesian Beskid. The studied area was divided into three basins (Vistula, Olza, Brennica) and 74 spatial units. Basing on the shape of the river basin, forest cover and distribution of settlements, the typology of spatial units was suggested. Using river basins for spatial unit delimitation is particularly effective in mountain areas. River basins form there cohesive functional units integrating natural and land cover processes and are clearly visible in the landscape. The presented research shows a relation between physiognomic type of the valley and tourist facilities.

Keywords: landscape, tourism, river basin, landscape units, typology of catchments

Жемла-Сесіцка Анна, Андрейчук В'ячеслав, Мига-Піонтек Уршула. ТИПОЛОГІЯ ОДИНИЦЬ ЛАНДШАФТУ ДЛЯ ТУРИСТИЧНИХ ЦІЛЕЙ У ГІРСЬКИХ РАЙОНАХ (НА ПРИКЛАДІ СІЛЕЗЬКИХ БЕСКИДІВ, ПОЛЬЩА)

У статті запропоновано спосіб розмежування та типології просторових ландшафтних одиниць для цілей оптимізації розміщення об'єктів туристичної інфраструктури у гірських районах з високими темпами туристичного освоєння ландшафтного простору. Розмежування просторових одиниць здійснено на основі виділення річкових басейнів різного порядку («басейновий» підхід). Розмежування та типологія були опрацьовані та апробовані на прикладі одного із карпатських регіонів Польщі - Сілезьких Бескидів. В межах досліджуваної території виділено три головні річкові басейни (річок Вісла, Ольза і Бренниця), а у їх межах - 74 просторові одиниці нижчих рангів. При виділенні одиниць нижчого рангу враховувались форма водозбірного басейну, лісистість та особливості заселення території (характер та розміщення населених пунктів). Ці характеристики були покладені в основу типології просторових одиниць. Проведені в Сілезьких Бескидах дослідження показують зв'язок між фізіономічними типами долин (за формою, рослинним покриттям і розташуванням поселень) та розміщенням об'єктів туристичної інфраструктури. У найбільшій мірі розміщення туристичних елементів пов'язане з розподілом населених пунктів, у той же час лісистість, як виявилось, детермінує їх розташування у найменшій мірі. Описаний спосіб розмежування розчленованого гірського обшару на основі структури річкового басейну є доцільним, оскільки у гірських районах власне водозбори річок і потоків визначають розподіл та динаміку процесів, що детермінують його просторову структуру, Басейнова (потокова) структура гірських районів у вирішальній мірі підпорядковує матеріально-енергетичні обіги у їх межах, змушуючи людину пристосовувати свою

господарську (у тому числі туристичну) діяльність до особливостей ландшафтного середовища. Представлена типологія ландшафтних (просторових) одиниць має регіональний характер, але принцип її застосування є універсальним. Тому цей спосіб диференціації території може бути апробований також у інших гірських системах.

Ключові слова: ландшафт, туризм, річковий басейн, одиниці ландшафту, типологія водозборів.

Introduction. Tourism is an increasingly important activity which affects the landscape [15, 39]. Numerous articles on the relationships between tourist activities and landscapes have been published so far [1, 17, 19, 21, 23, 37, 38, 39, 40, 42, 53]. However, very few studies analyse the relationship between tourist elements location and the physiognomic aspects of the landscape [12, 14, 17, 42, 58, 59, 60]. A particular problem and conflict between tourist and landscape is present in Carpathians. As a mountain range with special landscape values, the Carpathians are under strong tourist pressure. All countries in which this mountain range lies struggle with the problem of being properly prepared for tourist exploration. Problems of sustainable tourism development in Carpathians are considered in many research and presented in the papers articles, eg. Romanian [18], Serbian [44] or Polish [30, 45, 55]. This article presents a study concerning wide issue of the relationship of tourism and landscape, which is a part of the larger research on the spatial distribution of the tourist infrastructure. The aim of this article is to propose a delimitation of units and landscape typology in mountainous areas for the purposes of spatial research in tourism. It includes the use of river catchments as spatial units and the author's typology of these units based on landscape physiognomy. The second aim is to verify the relation between the type and the location of tourist facilities. The delimitation method and typology of identified landscape units were tested in the Silesian Beskid mountain range (Western Carpathian). The delimitation and typology of the primary units used in its assessment is an important subject in the research concerning the relationship of tourist infrastructure and the landscape. The issue of the delimitation of spatial units is widely discussed in the literature, both in the theoretical and in the application approach [5, 22, 48]. Spatial units, understood as primary units, are fundamental to research in various fields. The selection of spatial units depends on several factors, including the scale and purpose of the study [5, 12, 24]. Three types of spatial units can be used in tourism and landscape research: administrative boundaries [37], artificial geometric units with uniform outlines [11, 28, 29, 37, 46, 47] and natural environment boundaries. Natural based units are one of the most suitable for tourism studies in the spatial context. It can be delimited on the basis of various criteria. In physical geography, units based on geographical regionalisation are used, for example, macro, meso, microregions (dependent on the scale of the study) (i.e. [27, 52]. These units are understood as relatively closed sectors of nature which constitute a coherent whole due to the processes occurring within them and the interdependencies of the geocomponents of which it is composed [4, 10, 26, 31]. Other natural units based on the geographical criteria are river catchments (basins) [36,48,56]. In landscape architecture, the units are based on criteria of terrain relief and land cover [8, 13]. In this article, the primary spatial unit (used in calculations) is a river basin of the appropriate category (microbasin). In the case of spatial studies in mountain areas, basins form functional units integrating natural processes [25] and processes related to land cover [7].Spatial units based on catchments are commonly used, but mostly in environmental research [2, 7, 32, 41, 48, 57]. In reference to the tourism it is not a typical approach. Usually the river basin is an area

of research, not a primary unit of assessment [20, 34, 36]. The typology of the landscape units was particularly developed over the last two decades, mainly due to the development of international legislation on landscape protection and shaping, including the European Landscape Convention [33]. The typology is formed according to various methods and criteria. One of the most popular typologies is British Landscape Character Assessment (LCA) based on natural, cultural and physiognomic criteria (topographic features, flora and fauna, land use, sights, sounds, touch and smell, cultural associations, history and memories [54]. In Spain, there are catalogues used to describe the types of landscape. This typology is based on six criteria: inter alia terrain relief, land cover and land use, landscape structure but also feelings related to the area [43]. In Poland, the typology based on the diversity of land cover and land-use, and the nature of the dominant factors in the landscape was adapted for the purpose of landscape audits [50]. This article proposes a new typology of landscape units based on the shape of the river catchment and of the chosen aspects of land cover (forest, settlement) relevant to location of tourist facilities .Presented in this article hierarchical order of spatial units, regional and typological, is a concept rarely used in spatial studies (e.g. [49]). In the following article, such use is justified due to the physiognomic approach to river valleys, which are determinant for finding similarities between units.

Study area. The study area is located in Poland in the Western Carpathian Mountains (province), Outer Western Carpathians (subprovince), Western Beskid (macroregion), and covers the geographical mesoregion of the Silesian Beskids (Fig. 1) [27]. In accordance with the latest division into mesoregions, the study area also comprises part of the Koniaków Intermontane mesoregion [5, 52]. This is a mountainous area with rolling hills, whose height reaches 1000-1500 m above sea level, with height differences of 300-600 m.

The Silesian Beskid is a mountainous region with an extensive surface water system. The area has numerous watercourses, tributaries of the rivers Vistula, Olza and Soła. Most of the rivers in the Silesian Beskids belong to the Baltic Sea basin. The European watershed between the basins of the Baltic Sea and the Black Sea runs through the southern part of the Silesian Beskid. Also running through the region is the major water divide (category I) between the basins of the Vistula and the Odra rivers. The Olza river basin is part of the Odra river basin, while the tributaries of the Vistula are part of the Vistula basin.

The study area includes the upper Vistula, Brennica and Olza basins (27,300 ha) i.e. the majority of the Silesian Beskid region. The study area also includes numerous minor water divides between the basins of tributaries of the Vistula river (category II) and is divided between the basins of the Olza tributaries (category III). The upper Vistula basin is the largest and most complex part of the region (Fig. 2). It contains numerous tributaries of the Vistula river, with districts of Wisła city and of Ustroń city along their banks, as well as its other tributaries. The Brennica river basin is located in the northern part of the study area. It includes the Brennica and its major tributaries, Leśnica and Hołcyna, and numerous small streams. Istebna is located in the Olza basin, which is located in the southern part of the study area.

Silesian Beskid is a region of high landscape value due to its mountainous character and high forest cover. However, it is also a region suffering from the problem of progressive landscape changes, caused by agriculture, urbanization, forest cutting for production, land abandonment and pressure from tourism [51].

Materials and methods. The method

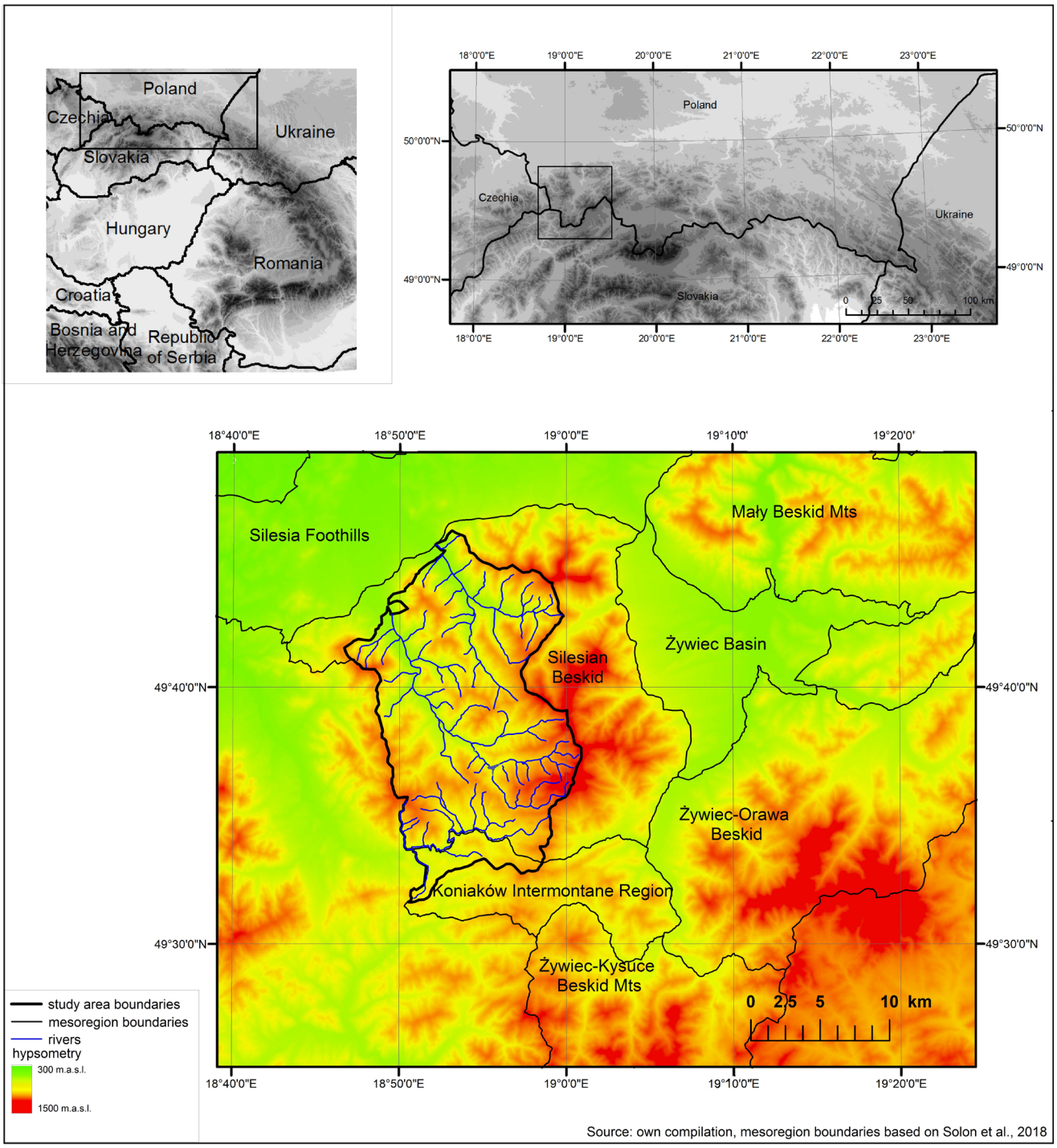
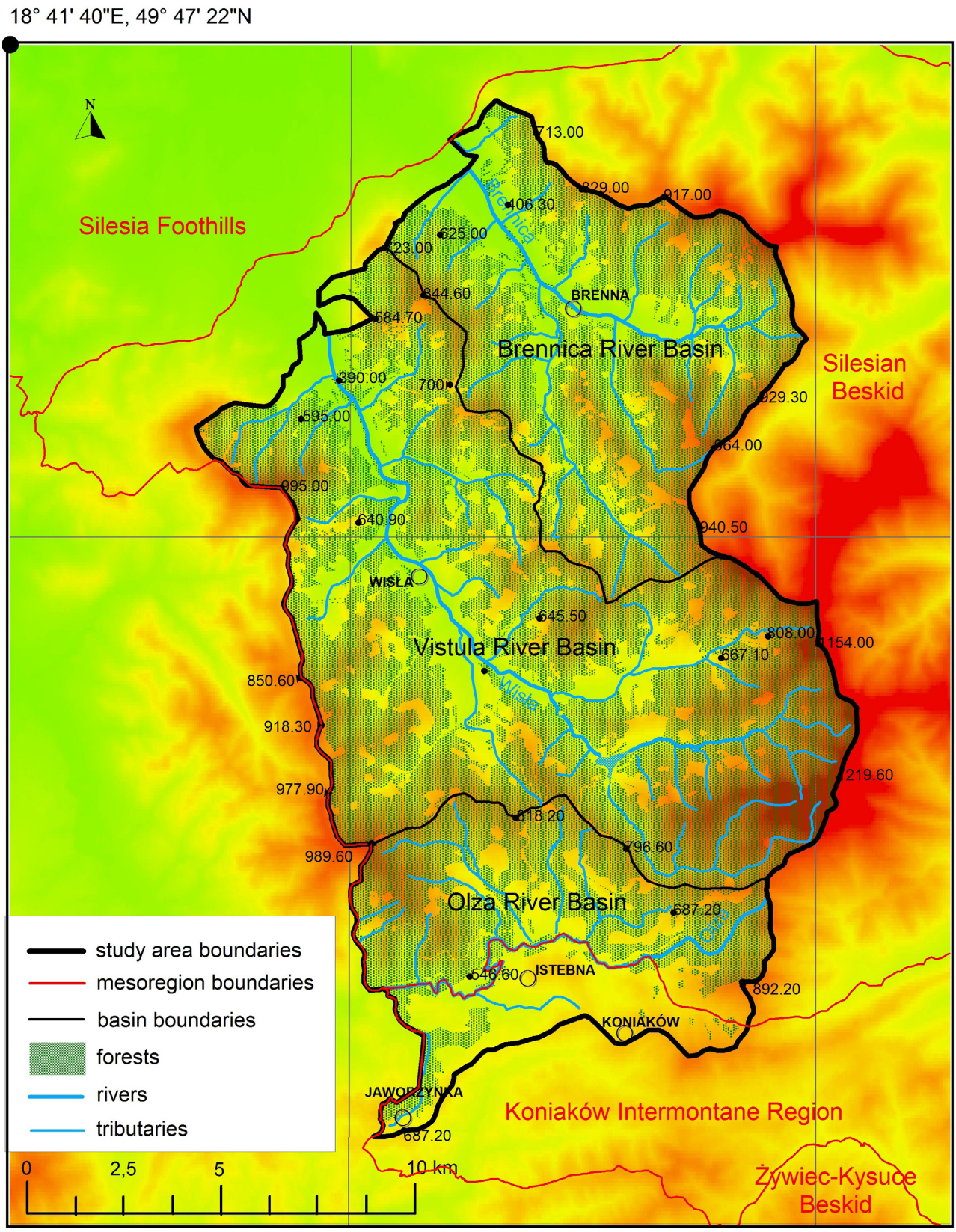


Fig. 1. Location of the study area

includes three stages of work: the first one is the delimitation of landscape units and the second one concerns the typology of delimited units. The third step is the verification of the location of tourist facilities in delimited units.

The boundaries of the study are determined by basins of the Vistula, Brennica and Olza. In the case of the Vistula and Brennica basins, the boundaries coincide with water divides and the resulting microbasins are artificially "enclosed" in locations where this requires the shortest line possible (perpendicular to the river course). In the case of the Olza river basin, the study boundaries follow the state border along the Potok Bystrzański and Olecka rivers, dividing their basins.

Using the river basin as a criterion, it was possible to obtain spatial units delimited based on water divides of various categories, ranging from the European watershed to category III water divides. In order to clearly delimit river basins,



Source: own compilation, mesoregion boundaries based on Solon et al., 2018

Fig. 2. Study area and boundaries

water divides marked on a hydrographic map (Hydrographic maps M-34-86-B, M-34-87-A, M-34-74-D, M-34-75-C 2002 and [61]) were used. Due to the character and scope of the study, a regional scale has been adopted (1:50 000). Figure 3 below presents water divides in the study area.

After obtaining the spatial units, a typology of units was carried out. The identification of the types of units was based on the following criteria:

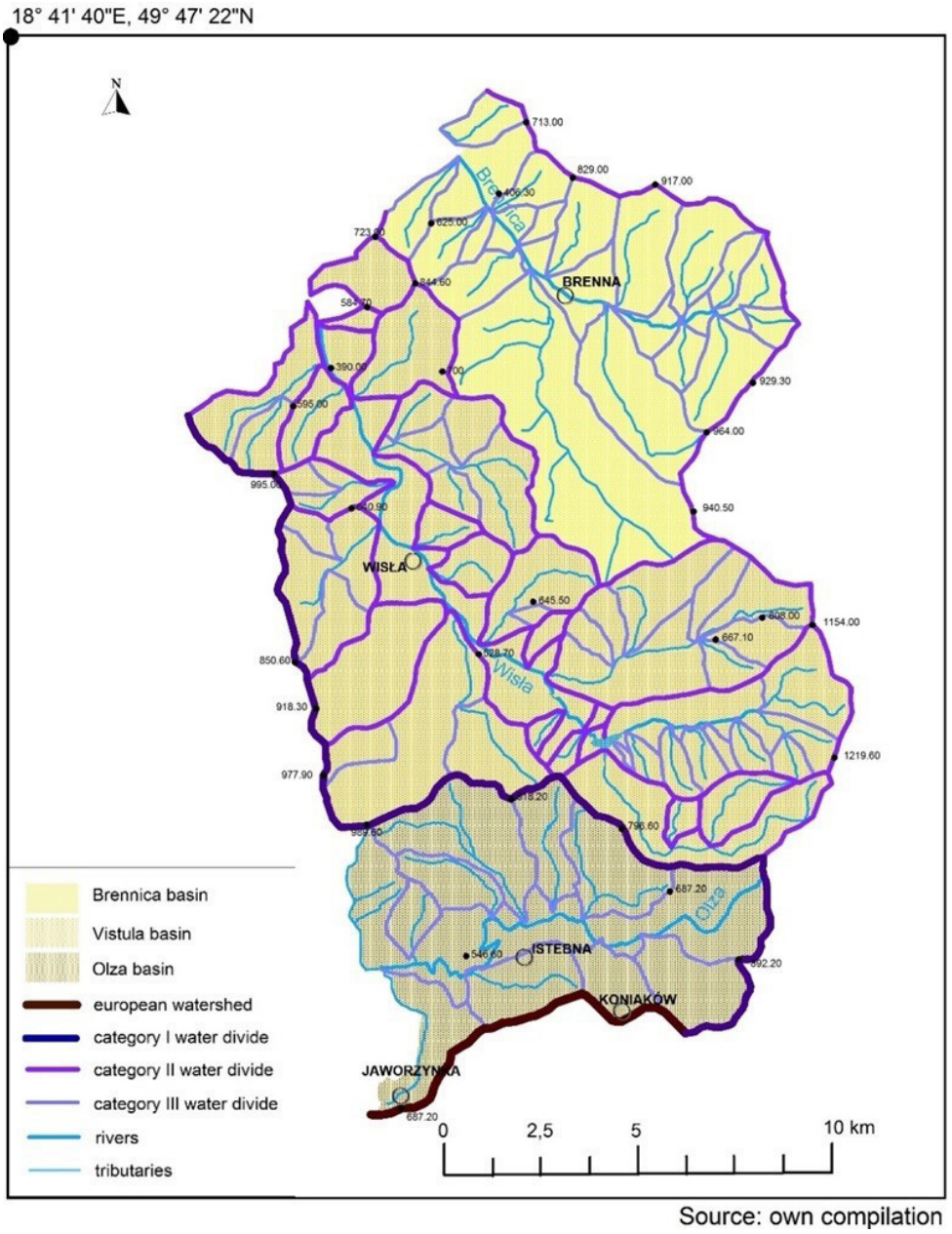


Fig. 3. Water divides and river basins in the Silesian Beskids study area

a) the shape of the valley: the shape understood as the type of valley depending on the type of river:

- main rivers with a wide floor,
- narrow valleys of streams and tributaries,

b) forest cover: understood as the percentage area of forest in relation to the unit area,

- low (0-30%),
- medium (≥30%-70%),
- high (≥70%-100%).

c) distribution of settlements:

- no settlements,
- dispersed or compact development, located along the river,
- dispersed or compact development, located along the water divide,
- dispersed or compact development, independent of the river,

The typology was provided in three steps: first, all units were assigned to the group of the shape of the valley. The visual shape of the valley is the most important criterion deciding of physiognomic aspect of the landscape, as, in mountain areas, catchments (understood here as individual valleys), create clear, visible and

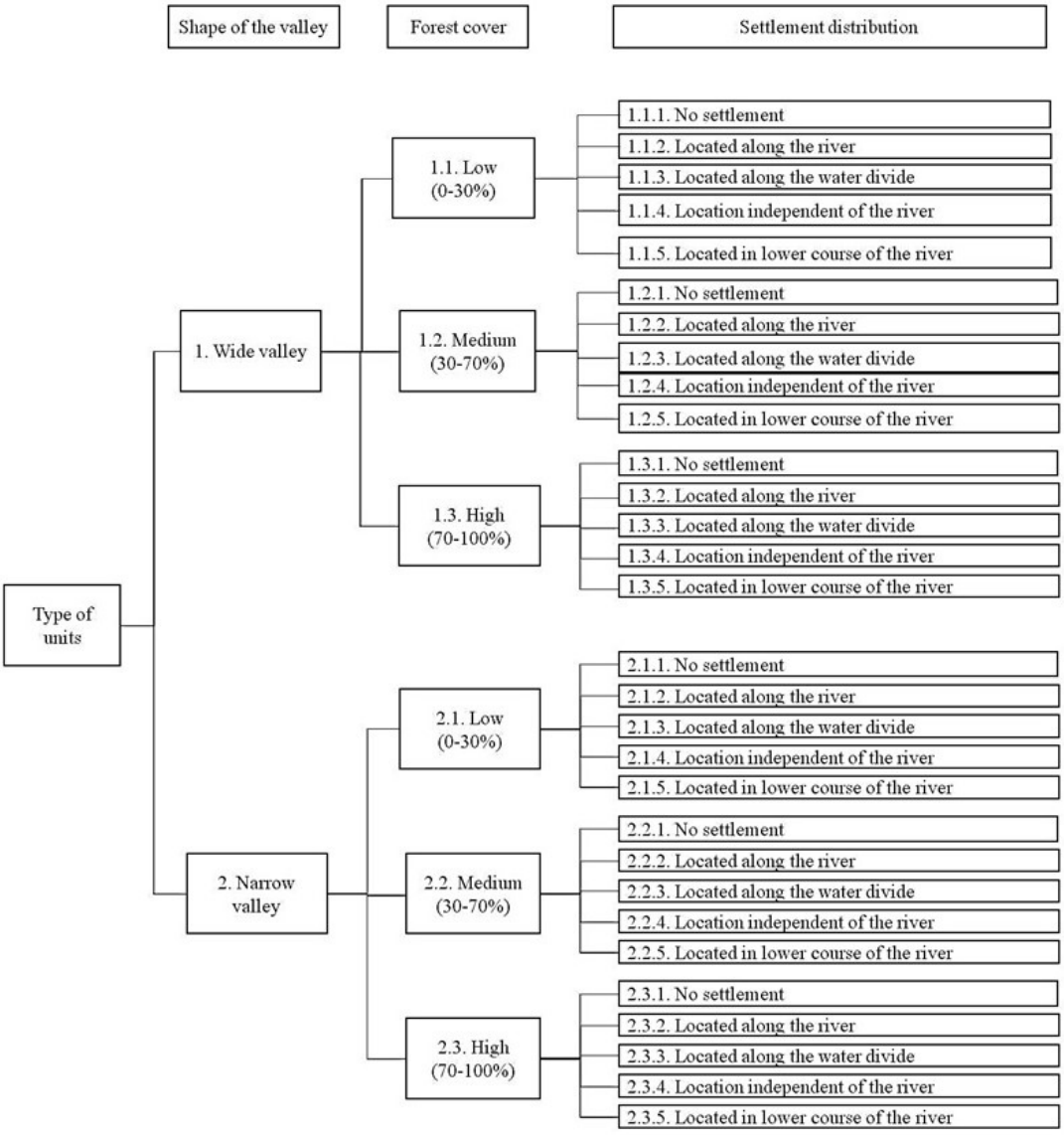


Fig. 4. The algorithm of typology of the units

cohesive units. Next the units were divided depending on the forest cover. The percentage of the forestation decide not only about the visual aspects of the valley, but also about the possibility of the location of new tourist infrastructure. The greater is the forest coverage, the less opportunity there is for developing tourist infrastructure.

In the last step, the units were assigned to one of the types of settlement distribution. The tourist infrastructure (hotels, restaurants) often occur in the built-up areas. The authors assumed that the settlement distribution will be related to the location of the tourist elements. The algorithm of typology is presented in Fig. 4. Thirty types of units were obtained.

The third stage of the studies was an inventory of the tourist facilities (carried out on the basis of field research and tourist maps) based on spatial types of elements (*cubature, area and linear elements*). The *cubature elements* include buildings such as accommodation facilities, restaurants, sports facilities (sport halls, swimming pools, horse riding halls) and ski lift stations. The *area elements* are tourist infrastructures without buildings (for example, downhill runs, summer toboggan runs, off-road areas, training areas, paintball fields, mini-zoos, horse farms, golf courses, amusement parks). The

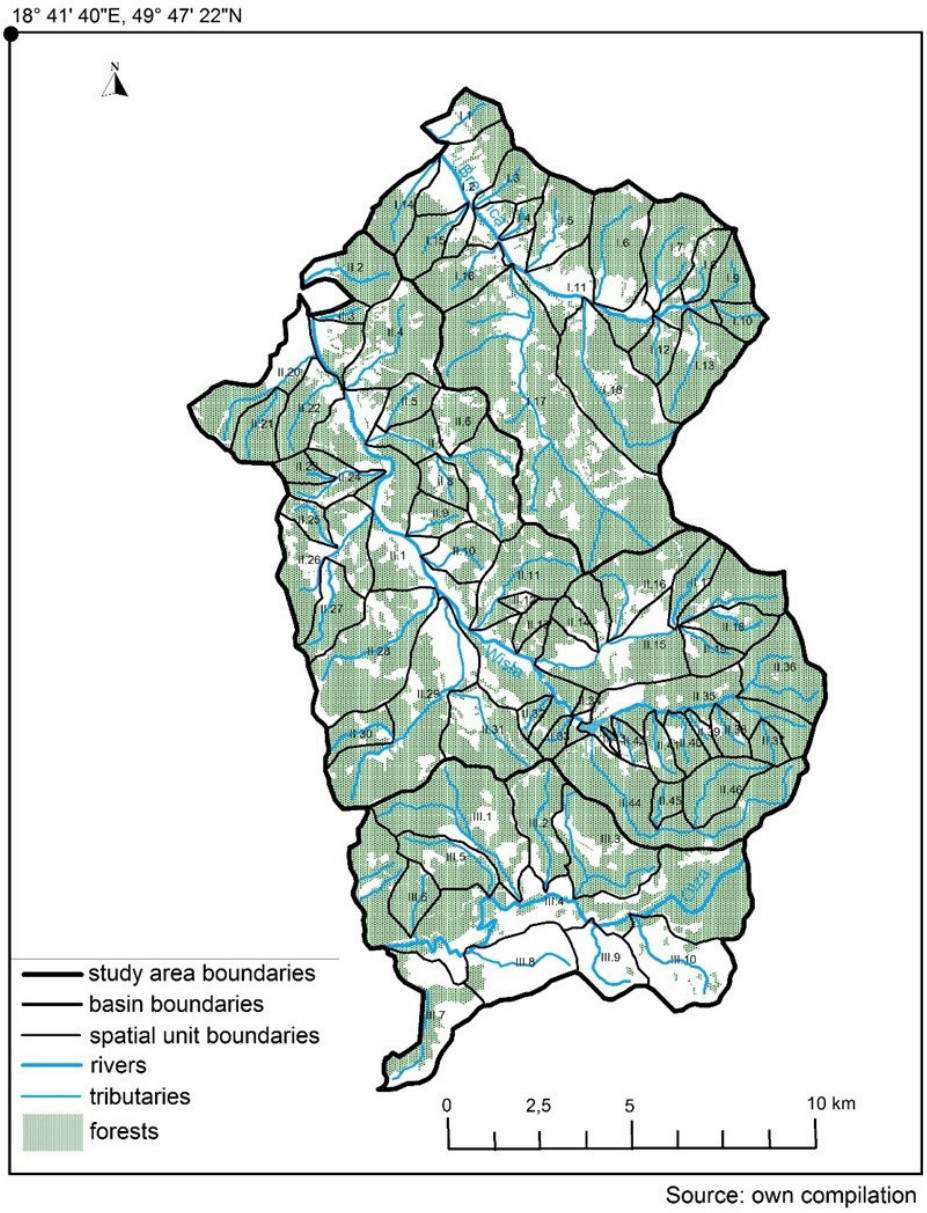


Fig. 5. Spatial units of the Silesian Beskids' studied area

linear elements include tourist trails and ski lifts.

Results. As a result of the cartographic analyses, 74 spatial units were delimited: 18 units in the Brennica basin (I), 46 units in the Vistula basin (II) and 10 units in the Olza basin. The smallest unit is II.43 (13.44 ha), covering a small stream emptying into Lake Czerniańskie. The largest unit is I.17 (2320.53 ha), covering the Leśnica stream and its tributaries. The delimited spatial units are presented in Fig. 5.

Spatial units were assigned to the types of units based on the criteria of the shape of the valley, forest cover and settlement distribution. In the studied area, 12 types were identified (Fig. 6). Every type of unit was examined for the location of tourist facilities. The results are presented in table 1.

The spatial distribution of different types of units is presented in Fig. 7. The most prevalent unit type (in terms of quantity of units) in the study area is type 2.3.2. (15 spatial units), while the least frequent is type 1.2.3. (1 spatial unit). In terms of area, the largest type in the studied area is type 2.2.2 (16%) and types 1.2.2 and 2.3.2 (15%). The smallest types are type 2.2.4 (1%) and 2.2.3 (2%).

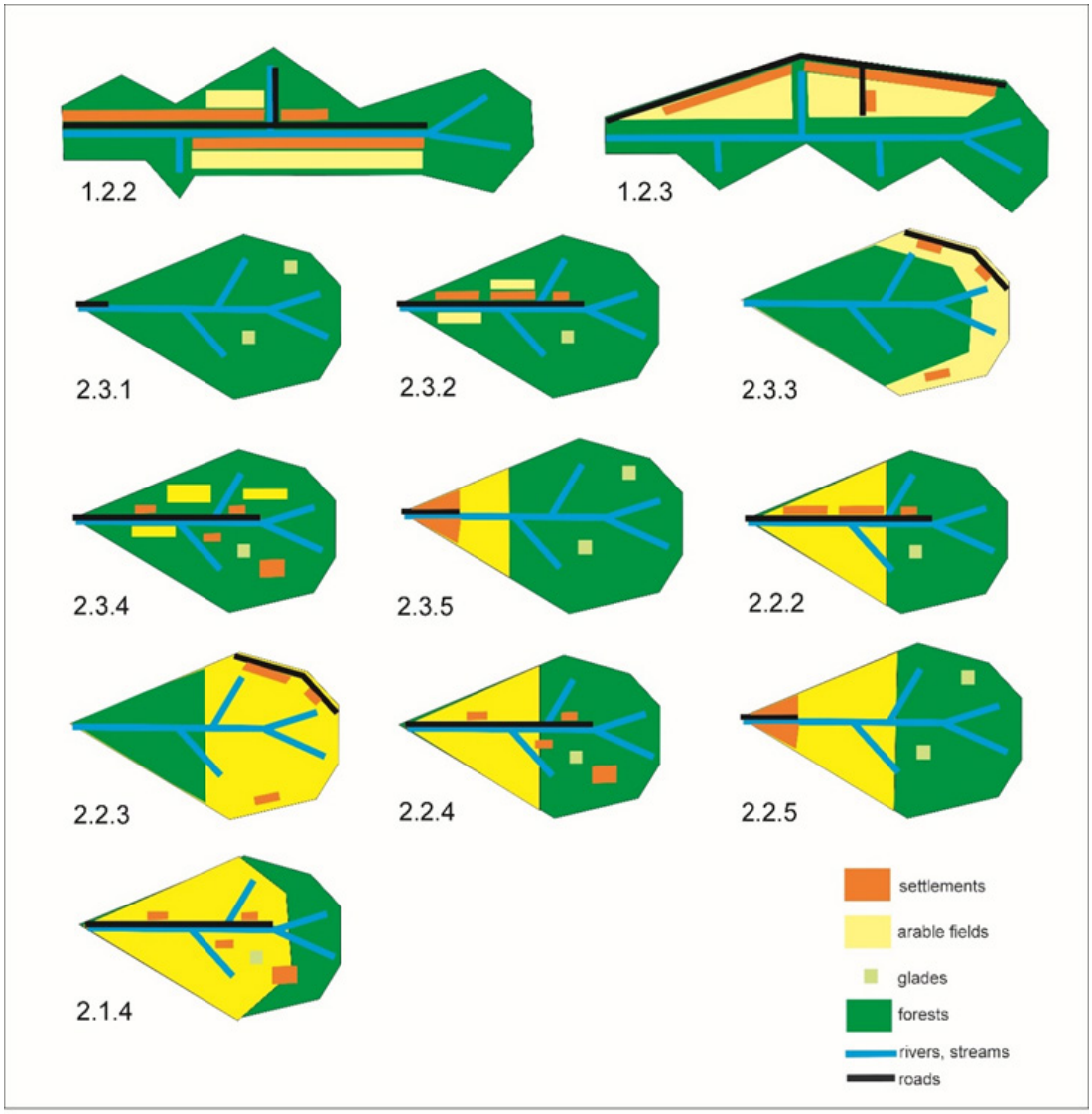
Discussion. A relationship between the shape of the catchment, the size of the watercourse,

Table 1. The characteristic of the types of spatial units

Criteria			Units	% area	Characteristic	Tourist facilities
Shape	Forest cover	Settlement location				
1.Wide valley	2.Medium	1.2.2. Along the river	I.2, I.11, II.1, II.15, II.26	15%	floors of valleys of main rivers in the Silesian Beskids: Vistula River, Biała Wisełka, Malinka and Jawornik (tributaries of the Vistula River) and Brennica; usually a small height differences, arable fields on lower parts of the slopes and forests on the upper parts; forest cover: 39% to 68%.	well or very well developed, cubature elements mostly concentrated along the river, rarely on slopes, area and linear elements located on slopes
		1.2.3. Near tops of the mountains	III.4	7%	wide floor of the Olza river valley with settlements concentrated near the tops of the mountains. Forest (69%) location – on lower parts of the slopes and in the valleys.	well developed, concentrated along the river and on slopes near tops of the mountains
2. Narrow valley	1.Low	2.1.4. Independent of river	III.8 - III.10	4%	small stream valleys with well-developed settlements dispersed or concentrated on slopes and independent of river locations; very low forest cover (2%, 8% and 11%).	poorly developed, dispersed on slopes and near tops of the mountains
	2.Medium	2.2.2. Along the river	I.5, I.17, II.24, II.29	16%	narrow valleys of tributaries of the Brennica and Vistula with settlements concentrated or dispersed along the river, forest cover: 64-69%.	varying level of development – lack of elements (II.24) or numerous elements (cubature) concentrated along the river, area elements located on slopes, linear elements located near tops of the mountains
		2.2.3. Near tops of the mountains	II.43, III.7	2%	valley of the Olecka Stream and a small tributary of the Biała Wisełka with dispersed settlements near the tops of the mountains; forests are located along the stream (45% and 59%).	Individual elements, located near the top of the mountain
		2.2.4. Independent of river	I.1, II.12	1%	small stream valleys with settlements dispersed on slopes, independent of streams; forest cover: 48% and 58%; location of forest independent of streams.	lack of elements
		2.2.5. In the lower reaches of the river	I.4, II.10, II.20	5%	narrow valleys of tributaries of the Brennica and Vistula with settlements located on lower parts of slopes or near mouths of streams; forest located on upper parts of slopes (50% - 64%).	varying level of developments, numerous elements concentrated along the river and slopes in the area of the mouths of river (II.10) or a few elements located near the top of the mountain or lack of tourist facilities (I.4, II.10)

Table 1. The characteristic of the types of spatial units (cont.)

Criteria			Units	% area	Characteristic	Tourist facilities
Shape	Forest cover	Settlement location				
2. Narrow valley	3.High	2.3.1. No settlement	I.10, II.5, II.13, II.21, II.33, II.36, II.37, II.45, II.46, III.6	6%	narrow valleys of tributaries of the Brennica and Vistula with steep slopes and very high forest cover (91%-100%).	infrequent elements, individual tourist trails, only one cubature element near the top of the mountain (II.21)
		2.3.2. Along the river	I.13-I.16, I.18, II.3, II.4, II.7, II.11, II.19, II.28, II. 30, II.31	15%	Narrow valleys of rivers and streams, tributaries of main rivers in the Silesian Beskids (Vistula and Brenica), the settlement mostly concentrated along the river but also dispersed on the slopes, high forest cover (70-92%).	varying level of developments, numerous cubature and area elements located on slopes or numerous cubature elements concentrated along the river, or only tourist trails (I.14, I.16) or lack of tourist facilities (II.7)
		2.3.3. Near tops of the mountains	II.42, III.1-, III.3, III.5,	7%	Narrow valleys of tributaries of the Olza and a tributary of the Biała Wisełka, settlement dispersed on mountain slopes and more concentrated near the tops of the mountains, high forest cover (70-81%).	lack of tourist facilities (II.42) or elements dispersed and few, cubature elements distributed near the top of the mountains, linear elements independent of river
		2.3.4. Independent of river	II.6, II.8, II.17. II.18, II.25, II.32, II.34, II.38-II.41, II.44	8%	narrow valleys of small streams located only in the Vistula river basin, settlement dispersed on the slopes, independent of rivers, high forest cover (74-92%)	very few or no tourist facilities
		2.3.5. In the lower reaches of the river	I.3, I.6, I.7- I.9, I.12, II.2, II.9, II.14, II.16, II.22, II.23, II.27, II.35	14%	narrow valleys of rivers: the Biała Wisełka, tributaries of the Malinka, Jawornik, Brennica, settlements concentrated on the lower parts of the slopes or near mouths of streams, the majority of the area covered with forest (74-93%).	varying level of development, lack of tourist elements (I.6, I.7, I.8) or facilities concentrated with the settlement (I.9, II.22 II.14) or only a few elements (mostly tourist trails).



Source: own compilation based on Zemła-Siesicka 2017, p. 135

Fig. 6. Types of spatial units

the land-use, and the distribution of elements of the tourist facilities can be noticed in different types of the presented units. Tourist facilities are well developed in the wide valleys, in both types of settlement distribution. In the studied area, the number of tourist facilities is not related to the forest cover. In the units with the lowest forest cover (III.8, III.9, III.10), there are only a few cubature, area and linear elements. In areas where the settlement is independent of the river, the tourist facilities are undeveloped, independently the forest cover (types 2.1.4, 2.2.4, 2.3.4). In the case of a settlement located along the river (unit types 1.2.2, 2.2.2, 2.3.2, 2.2.2), the number of tourist facilities is independent of the forest cover but is related to the settlement location - if tourist facilities exist, they are distributed along the river, as are settlements in this type of unit. In the case of settlements located near the tops of the mountains (1.2.3, 2.2.3, 2.3.3), tourist facilities are not related to the settlement. In the type 1.2.3, tourist elements are located along the river and also on the slopes. In types 2.2.3, 2.3.3, facilities are mostly located on the tops of the hills.

The relationship of the tourist infrastructure location and the land cover was already a subject of research. The results shows that the development of tourist infrastructure reduces forest and agricultural areas [3, 9]. This is caused by an urbanization pressure related to tourist

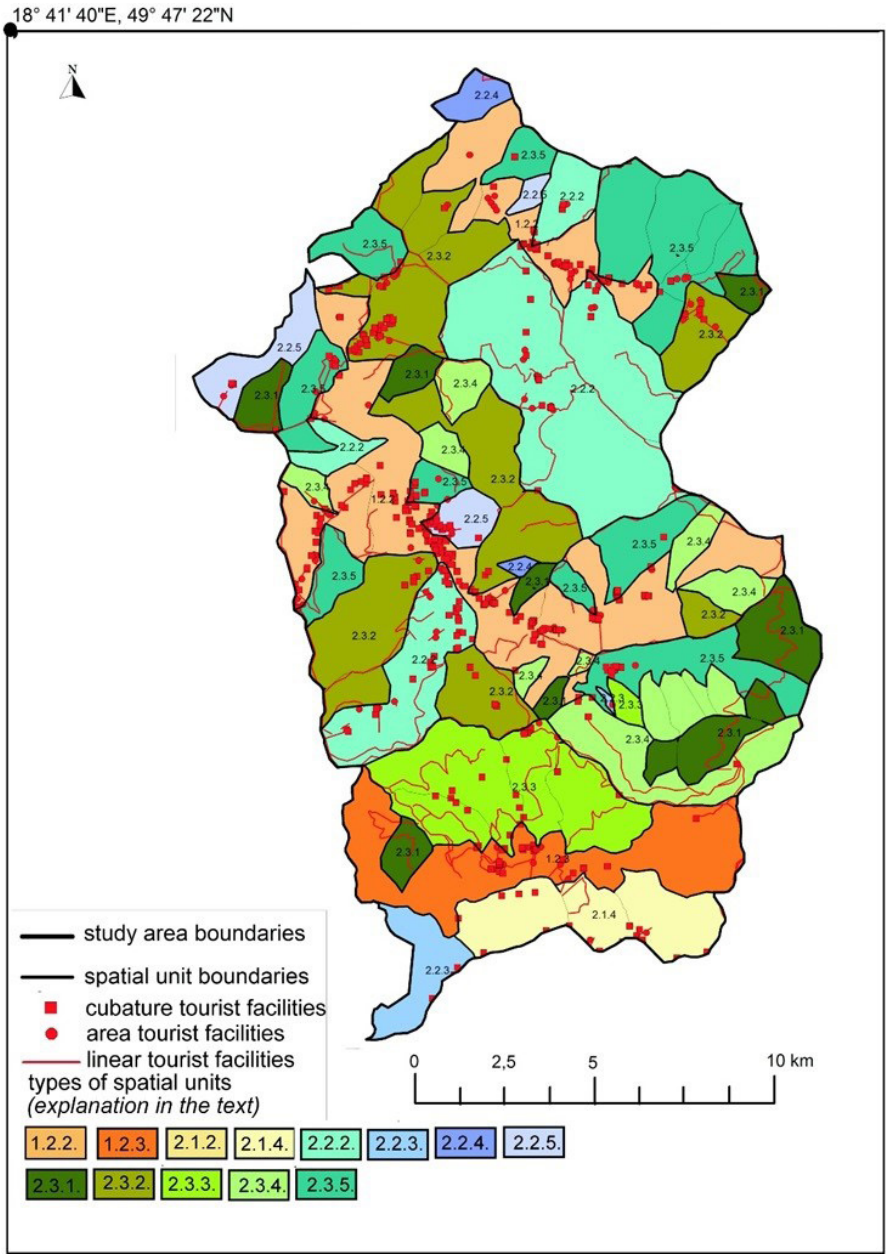


Fig. 7. Spatial distribution of different types of units with reference to tourist facilities.

development. On the other hand the planning of the location of tourist facilities (if proceeded in accordance with the principles of sustainable development) is strongly limited by the forestation. This contradiction shows a particular kind of conflict that arises between the natural environment and tourism development.

The presented delimitation and typology can be used in the analysis of landscape changes caused by the tourism and in the assessment of tourism development for planning purposes. Physiognomic cohesion of spatial units is crucial in determining the impact of existing tourist infrastructure on the landscape. Decisions regarding the location of new facilities (in addition to other conditions, including economic and natural one) should take into consideration the current level of development of the specific area, especially the existing tourist facilities, settlements and forest cover. The similarity of typological units indicates the possibility of determining their homogeneous indications for further tourist development.

The basins units and presented typology seems to be more adequate in mountainous area than in flat areas. In more flattened regions, the function of potential spatial units isn't watershed,

but rather natural or anthropogenic linear elements (rivers, escarpments, borders of various types of land use, etc.). For example, for lakes the studies concerning tourism in the lake areas often takes into consideration a strip of a various width around the lake (as a study concerning the analysis of the density of accommodation facilities and other tourist and recreational facilities was carried out for a 100-m strip around the lakes [16]. Using the river catchment units approach in other than mountainous areas requires additional studies to determine the applicability of this method.

Conclusions. Research pertaining to human influence on the landscape is indispensable during periods of rapid urban expansion and increases in tourism. Any attempt to represent this problem on a geographical scale requires an appropriate approach to establishing the boundaries of the study area and the spatial units used for evaluating the transformation of different areas. The approach presented above is an innovation in delimitation and typology used in spatial tourism studies. The presented delimitation based on the river basin structure is justified because, among other reasons, in mountainous areas, the catchments of larger rivers and streams determine the spatial distribution and dynamics of processes that influence their spatial structure expressed in the diversification of the land form. The basin structure of mountainous areas not only subordinates the material-energy cycles within them, but also forces humans to adapt to them – regardless of how its actions manifest in the mountains.

The presented research in Silesian Beskid shows a relation between the physiognomic types of the valley (in terms of shape, land cover and settlement location) and tourist facilities. However, forest cover is not so related to the number of tourist facilities as was expected. Mostly, the location of tourist elements is related to settlement distribution. Presented typology of landscape units probably isn't the universal one, which could be applied in other parts of Carpathians mountains. It can't fill the research gap of all Carpathians ranges, as all countries and regions has their own historical conditions manifested in the unique settlement system and land cover. To check the universality the same research should also be carried out in other mountainous regions.

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