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**ARTICLE**

# Sustainable Tourism Development in the Ždiar Highland Municipality in the Transition Zone of the Tatra Biosphere Reserve (Slovakia)

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## ABSTRACT

The Goral municipality of Ždiar (a Conservation Reserve of Folk Architecture since 1977) is one of the most attractive areas in Slovakia under the growing influence of the developing tourism. Since 1949 it has been part of the protection zone of the Tatra National Park and since 1993 it has been part of the transition zone of the Tatra Biosphere Reserve. In recent years, tourism has taken a major role in the transition zone of this biosphere reserve. In the presented contribution, we therefore evaluate the impact of developing tourism in the cadastral area of the municipality of Ždiar between 1950 and 2022. We rely primarily on available statistical data from various sources and on the analysis of the historical and contemporary landscape structure. During this period, almost 50% of the area has changed land cover. The activities that have significantly changed the landscape include afforestation, deforestation, agrointensification, deurbanisation (naturalisation), urbanisation (anthropisation): tourism development and construction of a water reservoir. Tourism has become the main driver of the economy here and opens up opportunities especially for local inhabitants. However, the lack of completed tourism infrastructure is a drawback. We recommend the establishment of the Coordinating Council of the Tatra Biosphere Reserve and permanent employees at the National Park Administration.

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# 1. Introduction

Countries worldwide, including Slovakia, are focusing on sustainable tourism development in biosphere reserves (BRs) to promote sustainable economic development and environmental protection [1]. BR managers see sustainable tourism as an important part of sustainable development and have even used tourism as a reason to create new BRs around the world.

The BRs have raised environmental awareness to the extent that tourists in these regions perceive environmental issues and their own role in influencing the natural environment [2]. The natural environment of the BRs is considered an important attraction for visitors and residents, which is sensitive to human impacts. For this reason, BRs should work with regional leadership to implement sustainable tourism practices to protect the natural and cultural resources of the destination for future generations [3, 4].

The Man and the Biosphere (MAB) programme of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) aims to link biodiversity conservation to the sustainable use of ecosystem services, including sustainable economic development and the protection of cultural diversity [5]. To achieve this goal, the BR takes a zonation approach: (1) a core area focused on strict protection and conservation of biodiversity, (2) adjacent buffer zones that allow for ecologically appropriate activities such as environmental education and learning, taking into account local knowledge and traditions and limited human intervention, and (3) a transition area with the fewest constraints to sustainable use of ecosystem services and socioculturally sustainable economic and human activities [6–8]. As a consequence, different levels of human-nature interactions can be expected in different zones, leading to different changes in landscape use and transformation.

In BR, over 80% of the demarcated area lies outside the legally protected zones [9]. This poses a significant challenge for BR managers as they have to consider the different functions and management of sustainable development for local communities, conservation, education and research [10]. Due to the variation in land use, human impacts and nature conservation within a delineated BR, biospheres tend to be more dynamic and complex than standard protected areas [11, 12].

Creating appropriate human-nature interactions in the transition zone is considered essential [13]. Transition zones represent the "transition" of BRs from the surrounding area. This outer zone is therefore important for the economic and social development of the region. It is here that clear interventions and activities between people and the environment are emerging with a focus on sustainable development [14]. Many different types of human activities can take place in the transition zone, including the presence of human settlements, agriculture, livestock farming, tourism, industry, and more [15]. In recent years, many transition zones of attractive mountain BRs and human activities have been under strong pressure from tourism development.

Mountain reserves provide recreation and have exceptional cultural and sometimes sacred value. Mountains are home to some of the most remarkable cultural and ethnolinguistic diversity in the world [16]. Such richness, however, is fragile. Mountain regions are particularly vulnerable to global climate change and face the loss of rare and endangered species, altered water balances (including retreating glaciers) and often irreversible changes in land use [17], which are changing socio-economic conditions and ultimately people's livelihoods.

The Tatra BR in the north of Slovakia also belongs to a very attractive and specific mountain area. One municipality in particular – Ždiar in the east of the Tatra Mountains – is highly preferred for its specific features. Because of the unmistakable character of the settlement and the type of folk architecture, the municipality of Ždiar was declared a monument reserve of folk architecture in 1977. The municipality of Ždiar has been one of the rural municipalities with year-round tourism opportunities for several decades [18]. The municipality is unique not only for its beautiful nature, but also for its Goral dialect, folk architecture, traditions and costumes, which are among the most diverse in Slovakia.

The traditional way of using the cadastral area from Ždiar was in the past agricultural and forestry activities. Agriculture in the Tatras has always been associated with cattle and sheep breeding [19]. After the declaration of the Tatra

National Park in 1949 (Act of the National Council of the Slovak Republic No. 138/1948 Coll. on the Tatra National Park), tourism provided the main form of employment, as well as forest management in the BR. The landscape, the life of the people in unfavourable climatic conditions, the authentic folklore of the municipality, the specific dialect, songs and traditional clothing, significantly different from others, have influenced the developing tourism in the municipality so much that it has become the main source of income for a large number of local residents [20]. At the same time, during the period 1950–2022, the landscape cover has changed over an area of 47.30% of the territory of the municipality. The activities that have significantly changed the landscape include afforestation, deforestation, agrointensification, deurbanisation (naturalisation), urbanisation (anthropisation): tourism development and construction of a water reservoir. Continuous monitoring of the impact of activities in the field of tourism is therefore necessary in the cadastral territory of the municipality of Ždiar.

At present, tourism in UNESCO Biosphere Reserves remains under-researched. The ways in which processes enable the transition to sustainable tourism development in BRs are also less explored [21]. Many researchers claim that understanding the local conditions for sustainable tourism development is key to ensuring economic, social and environmental aspects of development that do not threaten the needs of future generations [22, 23]. After the UN declared 2017 as the International Year of Sustainable Tourism for Development [24, 25], it is appropriate to examine the effects of tourism and supporting policies in BRs. Monitoring is a key activity in BRs and other protected areas [26]. It is often used as a basis for evaluating the development of a reserve and the success of the protected area management. However, since tourism in BRs in Slovakia is not continuously and comprehensively monitored, we focused on its development only at the level of the selected cadastral territory in the transition zone of the Tatra BR.

Monitoring activities have many pitfalls even in foreign BRs, as shown by, e.g., project results in the UNESCO Entlebuch Biosphere Reserve [26]. Difficulties arise mainly from frequently used unsystematic data coming from external sources. One of the main challenges in Slovakia is the creation of a link between management activities of the reserve and monitoring results. Slovak BRs need the integration of available data into a simple conceptual model that combines goals and key system factors with sustainability indicators.

# 2. Materials and Methods

## 2.1. Study Area

The study area is the cadastral territory of the municipality of Ždiar. This municipality is located in the transition zone of the Tatra BR in the northern part of Slovakia. The BR originated in the Tatra Mountains, which are the highest mountains of the Long Carpathian Mountains, stretching from Slovakia to Romania via Hungary, Poland and Ukraine.

### 2.1.1. Tatra BR and the Transition Zone

The territory of the transboundary Tatra National Park/Tatra BR includes two national parks on both sides of the political border between Poland and Slovakia. On the Slovak side is the Tatra National Park (TANAP, established in 1949) and on the Polish side is the present Tatra National Park (TPN, established in 1954). This transboundary BR was registered in the World Network of BRs on 15 February 1993 [27]. The main objective of the BR is to protect the alpine character of the highest Carpathian mountain range with a unique set of ecosystems on granite, limestone and dolomite bedrock, with the typical glacial relief of the Western Carpathians, at an altitude of 600–2,655 m. The total area of the BR is 101,819 ha in four districts (Liptovský Mikuláš, Tvrdošín, Poprad, Kežmarok), two regions (Žilina, Prešov). In the Slovak part, core areas occupy 49,663 ha, buffer zones 23,744 ha and transition zones 39,844 ha.

The BR transition zone (**Figure 1**) consists of the agricultural and forest landscape of the entire protection zone of the Tatra National Park with the historically established sub-Tatra municipalities and towns (35% of the area of the Tatra National Park at an altitude of approximately 600–850 m ASL).

### 2.1.2. The Cadastral Territory of the Municipality of Ždiar

The cadastral territory of the Ždiar municipality (**Figure 2**) (coordinates 49°13.300′ N; 20°15,7333′ E) lies in the valley between the Belianske Tatras and the Spišská Magura in the geomorphological unit Podtatranská brázda (Podtatranská furrow) [28].

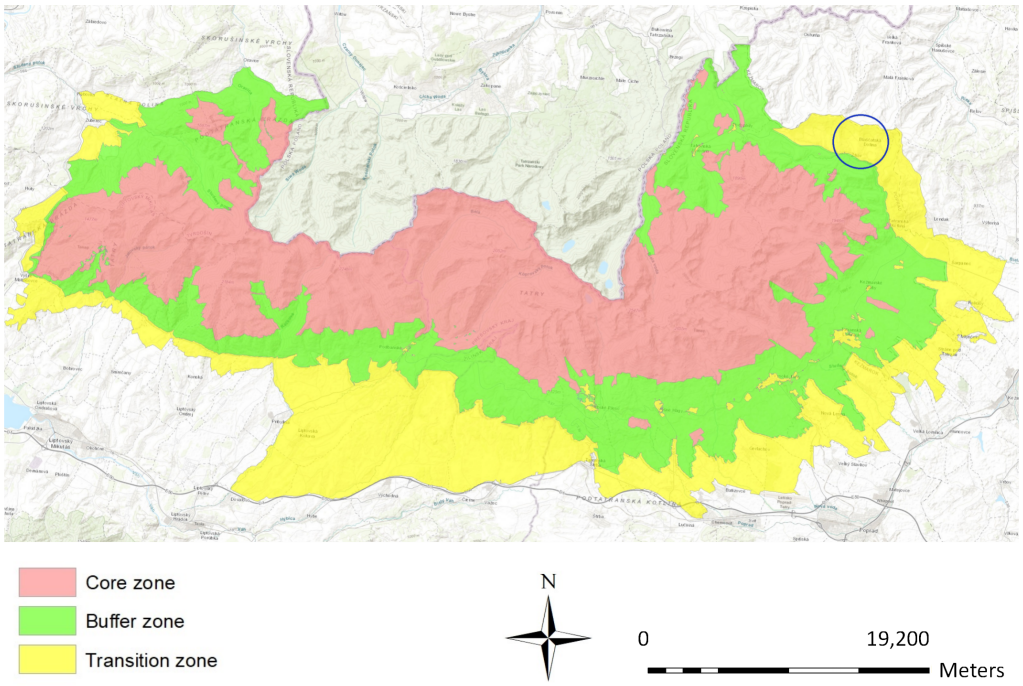


**Figure 1.** Transition Zone of the Tatra BR. Source: TANAP Administration.

Explanations: The Municipality of Ždiar is Located in the Middle of the Blue Circle.

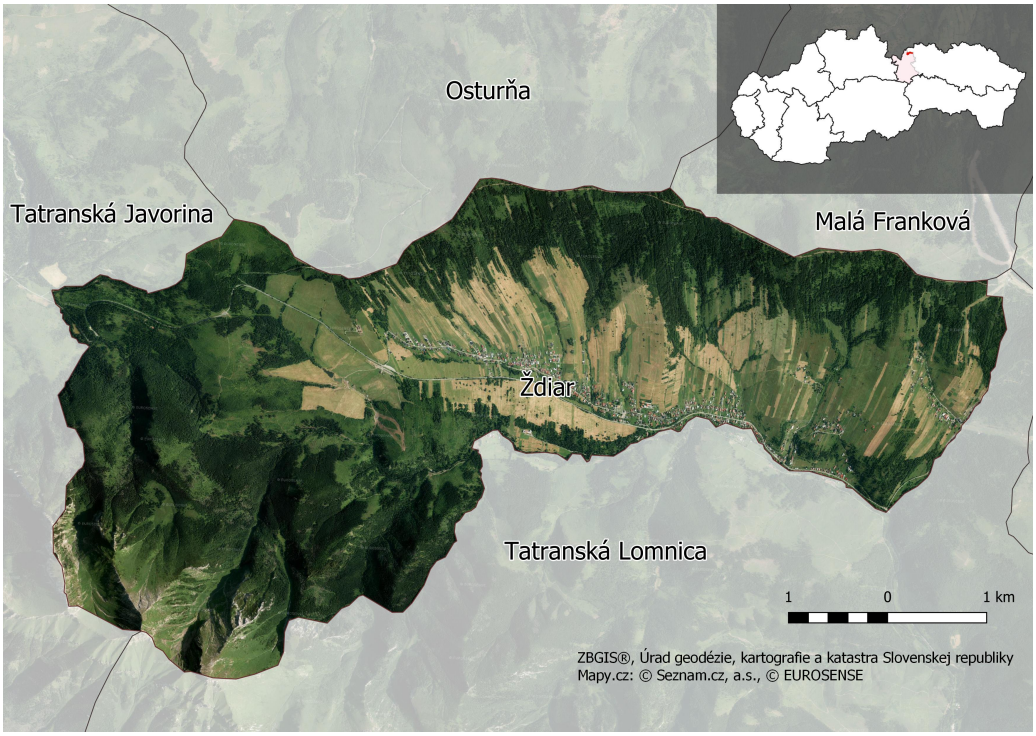


**Figure 2.** The Cadastral Territory of the Municipality of Ždiar. Source: Pucherová et al. [28].

The adjacent territory of Ždiar is included in the protected area of the Tatra National Park, the Goliasova Nature Reserve, the Belianske Tatras Nature Reserve and the UNESCO Tatra BR. The area is part of the national ecological network NECONET. In 1977, the municipality of Ždiar was declared a conservation reserve of folk architecture due to the unmistakable character of its settlement and type of folk architecture.

### 2.1.3. Brief History of the Development of the Cadastral Area

The municipality of Ždiar is documented from 1282 (as Stragar, later as Zdyar in 1773, Morgenrőthe in 1786, Žjár in 1808, Ždiar in 1920 or in Hungarian Zsdjár, Zár, Zdjár), but the first written mention of the municipality is from 1590 [29]. In 1590, Ždiar was a small permanent settlement of the Wallachian population. The territory was divided by 13 families into 13 equal forest parts across the stream, thus creating the boundaries [30]. The cultivated area was quite large; the settlement extended to a length of 6 km. In the second half of the 16th century, shepherds and coal miners from the surrounding municipalities, especially from Lendak, settled in the valley around the stream. They burnt forests and expanded pastures. This activity was called 'shining' the forest, which is why the municipality was called 'Žiar'. During the second wave of colonisation, they split the side valleys and adjacent hills. The inhabitants converted some of the pastures into fields using hoes and later ploughs. Hoeing, however, was typical of high-altitude settlements, and isolated lazas, hermitages, "shawls" and "cholvarks" were created. On the new plots of land in the Bacheda valley and below Antošovský vrch, in the Pavlovská valley, the Blaščatská valley, the Bartušová and Monková valleys, and on the Sladičovský vrch, several settlements were established, which administratively belong to the municipality [31]. In addition to farming the land and forests, some inhabitants of Ždiar were involved in smuggling, poaching and banditry. Also known is the "thieves' road", which after the First World War was named the Freedom Road [30]. Almost 100 years ago, tourism appeared in the territory. The first guests were accommodated in the municipality in 1928 [30]. In the 1970s and 1980s, Ždiar was among the most popular Tatra tourist destinations [32]. Today, the destination offers a variety of private and guesthouse accommodation, excellent catering services and information; the destination is still one of the most visited. While the destination is moving away from traditional foothill farming, built-up areas are expanding.

## 2.2. Methodology

When assessing the socio-economic development of the municipality of Ždiar, we rely on the official values of the Statistical Office of the Slovak Republic, DATAcube 2024 [33], from the Census of Population, Houses and Flats, which took place in 2021 [34] (it is implemented in decades) or from the statistical data of the Municipal Office of Ždiar [35]. As not all data necessary to assess the development of tourism for the period 1950–2022 are available, we assess the demographic development in the cadastral territory of the municipality only in the period 1993–2021 from the available databases of the Statistical Office of the Slovak Republic DATAcube 2024 [33]. Since inflation in 2017–2022 is very uneven, it is not possible to assess it with the available data. The average inflation for this period is 4.07%. Year-on-year changes in price data are presented in **Appendix A Table A1** [34, 35].

We process the socio-demographic characteristics of the cadastral territory for the year 2021 according to the data provided by the Municipal Office of Ždiar [35] and from the Census of Population, Houses and Flats in 2021 [34]. We assess the accommodation possibilities in the cadastral territory for the period 2017–2022, based on the data provided by the Municipal Office of Ždiar [35] and from the Census of Population, Houses and Dwellings 2021 [34]. We assess changes in average accommodation prices and tourism revenues in the cadastral territory for the period 2017–2022, using data from the Statistical Office of the Slovak Republic DATAcube 2024 [33] and the Census of Population, Houses and Apartments in 2021 [34]. We conducted interviews with selected accommodation providers in the village of Ždiar on the issue of guesthouse ownership and preserving the cultural character of the village.

Physical Carrying Capacity (PCC), defined as the maximum number of tourists that can physically fit into or onto a specific area over particular time (a modification of some of the formulae proposed by Cifuentes et al. [36] and Ceballos-Lascuráin [37], is determined by

$$PCC = A * D * Rf \quad (1)$$

where PCC is the physical carrying capacity, A is the size of the tourist area or the area available for recreation, D is tourist density (tourists per hectare) and Rf is the rotation factor [36, 37]. The rotation factor is calculated as the ratio of open hours for recreation and the duration of the visit.

To detect changes in landscape structure in the period 1950–2022, we used the evidence from the Historical Landscape Structure (HLS) and Contemporary Landscape Structure (CLS) mapping, which were based on the methodological procedures according to the work of Ružička et al. [38].

We classified individual landscape elements of the Secondary Landscape Structure (SLS), subsequently grouped into eight land cover classes ((1)built-up areas, (2) sport and leisure areas, (3) agricultural mosaics, (4) grasslands, (5) shrubs, (6) forests and non-forest tree vegetation, (7) bare rocks, (8) water bodies) into one of six basic groups: (1) group of forest elements (including non-forest woody vegetation), (2) group of meadow and pasture elements (grass-herbaceous vegetation), (3) group of field elements (agricultural crops), (4) group of rock and raw soil elements (including subsoil outcrops), (5) group of water elements (standing water bodies and watercourses) and (6) group of technical elements (settlements and built-up areas, including technical elements). For geodata processing we used 2022 orthophotomosaic raster layers with spatial resolution of 0.2 m (Orthophotomosaic © GKÚ Bratislava, NLC) and orthorectified BW historical aerial photographs from 1949–1950 with a resolution of 0.5 m/pixel (Historical aerial photography © Topographic Institute Banská Bystrica)[39, 40]. Imagery from 2022 was subjected to visual photointerpretation with support of DEM and DSM raster data with a spatial resolution of 1 m/pixel (ALS product © ÚGKK SR) to produce a recent land cover map[41]. The historical land cover layer (1950) we obtained by means of backdating procedure on 2022 layer based on visual photointerpretation with historical topographic maps support. This method can eliminate most of the errors resulting from simple overlay. Since the visual photointerpretation method was used, we did not establish the classification accuracy quantitatively. The geodata were processed using Input analytical data of HLS and CLS were processed based on military aerial photographs from 1949 (Topographic Institute Banská Bystrica) and aerial photographs from 2015 (Orthophotomap © Geodis Slovakia, spol. s r.o., Aerial photographs and Digital orthophotomap © Eurosense, spol. s r.o.) in the Geographic Information Systems (GIS) environment in ArcGIS 10.1 software. Both periods were evaluated in terms of quantitative and qualitative representation of landscape features.

Changes in the land use of the Ždiar municipality were evaluated by comparing the selected two time horizons processed within a file geodatabase in ArcGIS 10.1 software. Based on the analysis of these periods, we divided the resulting changes in land use patterns according to Cebecauer et al.[42] into two basic categories: no change or changed[42], and in this category we distinguish two basic types of changes according to whether new landscape features are created in the SLS, such as urbanisation, agriculture intensification, agricultural extensification, afforestation, flooding, or landscape features disappear, such as deurbanisation, deforestation, abandonment, and others.

Taking into account the transition zone of the BR, we have worked out the strengths and weaknesses of tourism in the cadastral area, along with the opportunities and threats of tourism, in terms of the natural potential of the area, tourism development, business and infrastructure of the area. The individual issues are listed in **Appendix A Table A2**. Subsequently, we created decision matrices (**Appendix A Tables A3** and **A4**) for strengths and weaknesses with weighting values. We evaluated the intensity of the interrelationships of the different perspectives with each other using the matrix in **Appendix A Table A5**.

# 3. Results

The importance of tourism in the cadastral territory of the municipality of Ždiar is manifested in its impact on employment, on the use of the landscape and the urban environment, and is reflected in the demands on the areas for carrying out activities and ensuring the stay. It thus enters into more intense relations with the various conditions in the territory (socio-demographic, cultural, economic, ecological, urban, territorial-technical), as well as with the functional components in the territory (housing, infrastructure, transport, etc.).

## 3.1. Demographic Development in the Cadastral Area in the Period 1993–2021

Although the demographic development in Slovakia is generally characterised by declining natural population growth and an ageing population[29], the population in the territory has been slightly increasing since 1994. A significant decline in population occurred in 1993 (**Figure 3**, **Appendix A Table A6**)[35]. In 1993 (1 January), after a referendum, the municipality of Tatranská Javorina became independent from the municipality of Ždiar and the territory lost 197 inhabitants[30]. In the following years, the number of permanent residents increased slightly, rising to almost 1,400 inhabitants by 2021[38].

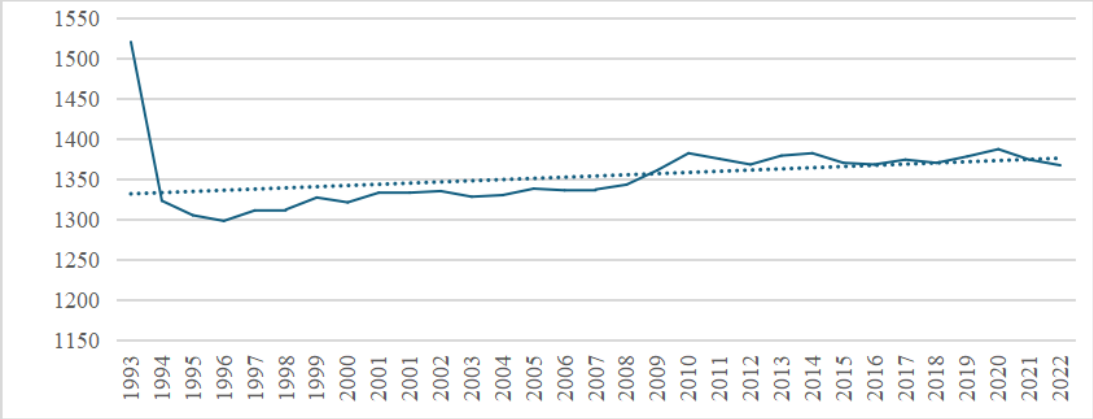


**Figure 3.** Average Number of Permanent Inhabitants of the Cadastral Territory of Ždiar 1993–2022 Data Source: Statistical Office of the Slovak Republic [33].

## 3.2. Socio-Demographic Characteristics of the Cadastral Area in 2021

In 2021, there were 1,374 inhabitants living in the cadastral territory of the municipality of Ždiar on an area of 2,730.75 ha. The population density was 50.32 inhabitants per 1 km$^2$. In terms of the gender structure, the population of the cadastral territory is dominated by women (50.22%) over men (49.78%) (**Appendix A Table A7**)[34, 35]. The birth rate during the year was 10.23‰ (14 births) and the death rate was 12.37‰ (17 deaths). The migration balance was negative (–3 inhabitants), as eight persons immigrated to the municipality and 11 persons moved out of the municipality. In 2021, the municipality recorded a total loss of six inhabitants. The pre-productive age (0–14 years) reached 15.79%, the productive age (15–64 years) 67.18% and the post-productive age (65 years and over) 17.03% (**Appendix A Table A7**)[34, 35]. The average age of the population of Ždiar municipality in 2021 was 40.64 years. The share of economically active population in 2021 was 50.58%. Most of the inhabitants of the cadastral territory work in the field of accommodation and catering services. Among the frequent jobs of residents are in construction; wholesale and retail trade; industrial production; agriculture, forestry and fishing; arts, entertainment and recreation; and education[34, 35].

In terms of religious denomination in the cadastral territory of the municipality, Ždiar is dominated by the Roman Catholic Church (87.92%) and the Evangelical Church of Augsburg Confession (1.16%) (**Appendix A Table A1**)[42, 43]. A relatively large group consists of inhabitants without any religious affiliation (7.13%). In terms of nationality, 97.02% of the inhabitants belong to Slovak nationality, 0.87% to Polish, 0.51 % to Czech and others. In terms of educational structure, the majority of residents have attained secondary education (57.57%), and a relatively large group of residents has completed university education (13.83%). However, there are also many children under the age of 14 living in the territory who have only achieved primary education (15.79%)[34].

## 3.3. Accommodation Options in the Cadastral Area in 2017–2022

Between 2017 and 2022 there was a decrease of three accomodition facilities (**Figure 4**, **Appendix A Table A8**)[34, 35]. Despite this, the number of visitor accommodation rooms increased by 10. The total number of beds has increased by 116.

During this period there were also changes in the number of visitors. The total number of visitors increased by 905 persons (18.33%); however, while the number of domestic visitors increased significantly (by 1019 persons, 13.24%), the number of foreign visitors decreased (by 114 persons, 25.00%) (**Figure 4**, **Appendix A Table A8**)[42, 43]. There were also changes in the number of overnight stays. The total number of overnight visitors in 2022 was 2,252 higher compared to 2017 (by 19.00%). While the number of domestic visitors increased by 2,648 (27.28%), the number of overnight foreign visitors decreased by 396 (18.49%)[39].

In 2021, the municipality of Ždiar offers tourists and visitors a number of accommodation capacities in private houses (21 cottages and apartments, 78 private accommo-

dation options), in 46 guesthouses and two hotels (Magura in Monkova valley and Bachledka Strachan in Bachledova valley). The capacity of these accommodation facilities is approximately 3,500 beds [34, 35].

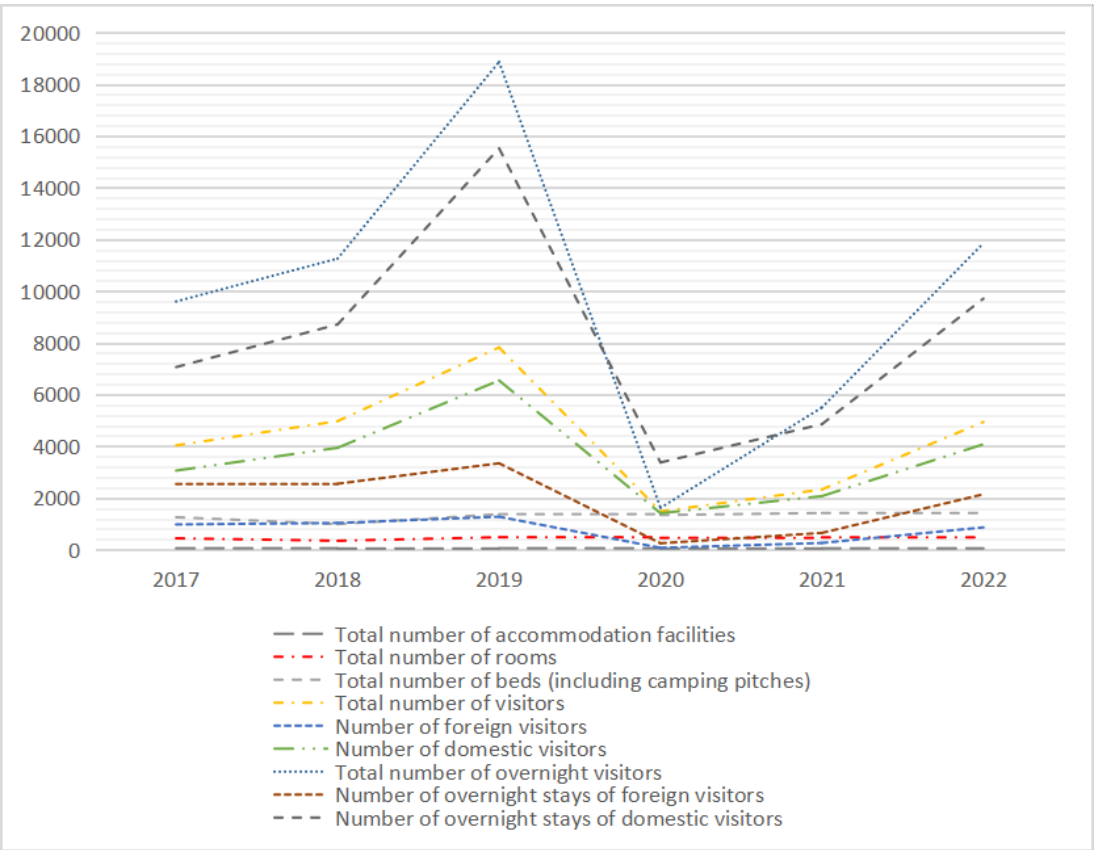


**Figure 4.** Accommodation Options in the Cadastral Area in 2017–2022. Data Source: Municipal Office of Ždiar [35].

Between 2017 and 2022, average accommodation prices and tourism revenues in the cadastral area have also changed. Compared to 2017, total accommodation receipts in 2022 were higher by 510.93 EUR, foreign visitor receipts were higher by 60.25 EUR and domestic visitor receipts were higher by 450.68 EUR. The average price for accommodation in accommodation establishments increased by 38.30 EUR, while the average price for accommodation in accommodation establishments per foreign visitor increased by 33.00 EUR and the average price for accommodation in accommodation establishments per domestic visitor increased by 39.80 EUR (**Appendix A Table A1**) [34, 35].

## 3.4. Physical Carrying Capacity (PCC)

The total area available for tourist activities in the cadastral area of Ždiar is 1,758.88 ha, while the tourist density was 0.34 persons per hectare (domestic and foreign). The value of rotation factor is 1. Therefore, the PCC in 2022 of the municipality of Ždiar was calculated as 598 persons per day. According to statistical data, this number was not exceeded in any month of 2022 (**Table 1**).

## 3.5. Tourism Services in the Cadastral Area in 2021

All accommodation facilities in the cadastral area of Ždiar provide, in addition to parking, various forms of recreation, such as private lifts, climbing walls, playgrounds, minigolf and others. In terms of services, there are several public catering options in the municipality (restaurants, buffets, pizzerias, day bars), several commercial establishments, a grocery store, a petrol station, a post office, a regional health centre, a pharmacy and a sporting goods store. In addition to the favourable conditions for accommodation and catering, the people of Ždiar started to take an active approach to the

development of tourism by beautifying the municipality, by demonstrating highland folk customs and costumes (e.g., highland folk festivals, horse-drawn carriage races, the traditional Ždiar slaughter, the Ždiar slaughter, etc.), by setting up tourist attractions (e.g., the "Ždiar" tourist attraction, the "Ždiar museum, house with a stylish restaurant, House of Light in Ždiar, local public library, family amusement park Strachankovo, bobsled track with a lookout tower in Bachledova dolina, souvenir shops, etc.), offer of sports facilities (e.g., electric bicycle rental, paintball and football field, tennis court), cycling paths, nature trails, ski areas (Skicentrum Strednica – Ždiar, a.s., Bachledka Ski & Sun, Strachan Ski Centrum – Ždiar, Ski Monkova dolina) with ski slopes, ski lifts, cross-country tracks, ski rental together with a ski school [35].

**Table 1.** Visitor Numbers in the Cadastral Area of the Municipality of Ždiar in Individual Months (2022).

| Month | Number of Total Visitors | Average Number of Daily Visitors |
|---|---|---|
| January | 2,597 | 84 |
| February | 3,111 | 111 |
| March | 2,443 | 79 |
| April | 800 | 27 |
| May | 1,622 | 52 |
| June | 2 174 | 72 |
| July | 3,131 | 101 |
| August | 4,144 | 134 |
| September | 2,303 | 77 |
| October | 1,830 | 59 |
| November | 1,142 | 38 |
| December | 1,965 | 63 |

## 3.6. Land Cover Changes 1950–2022

The total area of the cadastral territory of the municipality of Ždiar is 2,730.35 ha. Comparing the years 1950 and 2022, we found the most significant decrease in the area of agricultural mosaics from 508.83 to 10.01 hectares (18.63% and 0.37% of the total area, respectively) (**Table 2**, **Figures 5** and **6**). However, the acreage of other landscape features increased. The area of forests increased by 188.48 ha (6.90%), shrub vegetation by 143.99 ha (5.27%), sports and recreational areas by 64.06 ha (2.53%), built-up areas by 61.92 ha (2.27%), grasslands by 41.14 ha (1.51%), and water areas by 1.10 ha (0.05%).

**Table 2.** Area of Land Cover Classes in the Cadastral Territory in 1950 and 2022.

| Land Cover Classes | 1950 | | 2022 | |
|---|---|---|---|---|
| | ha | % | ha | % |
| Built-up areas | 43.47 | 1.59 | 105.39 | 3.86 |
| Areas of sport and leisure | 0.00 | 0.00 | 64.06 | 2.35 |
| Agricultural mosaics | 508.83 | 18.63 | 10.01 | 0.37 |
| Grasslands | 868.93 | 31.82 | 910.07 | 33.33 |
| Shrub vegetation | 249.24 | 9.13 | 393.23 | 14.40 |
| Forests and non-forest tree vegetation | 1002.22 | 36.70 | 1190.70 | 43.60 |
| Bare rocks | 53.29 | 4.11 | 51.39 | 1.88 |
| Water bodies | 4.77 | 0.17 | 5.87 | 0.21 |

A comparison of the HLS (1950) and CLS (2022) of the cadastral territory of the municipality of Ždiar reveals several changes. All changes between the assessed years occurred on an area of 1291.25 ha, which represents changes on 47.30% of the municipality's territory. On the remaining area of 1439.22 ha the land cover has not changed (52.70%). The most significant changes in land cover are in the agricultural mosaic group, with a significant decrease of 366.142 ha, and in the forest elements group, where there was an increase of 506.30 ha (**Table 3**, **Figure 7**).

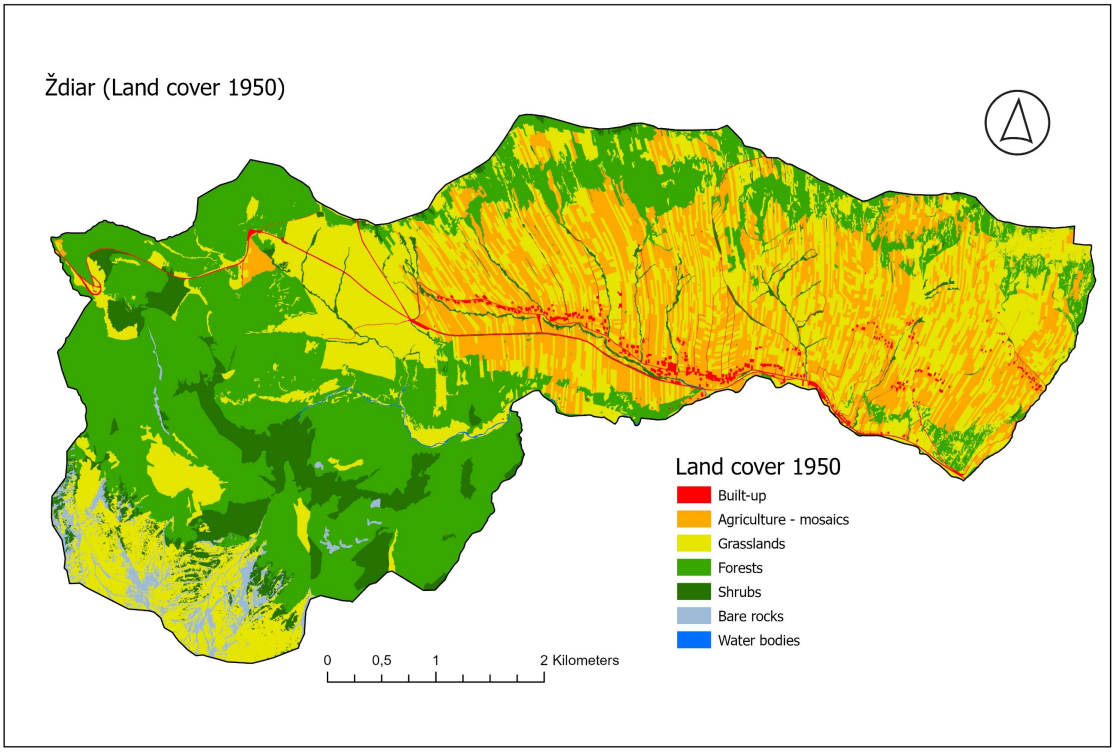


**Figure 5.** Landscape Cover or HLS of the Cadastral Territory in 1950.

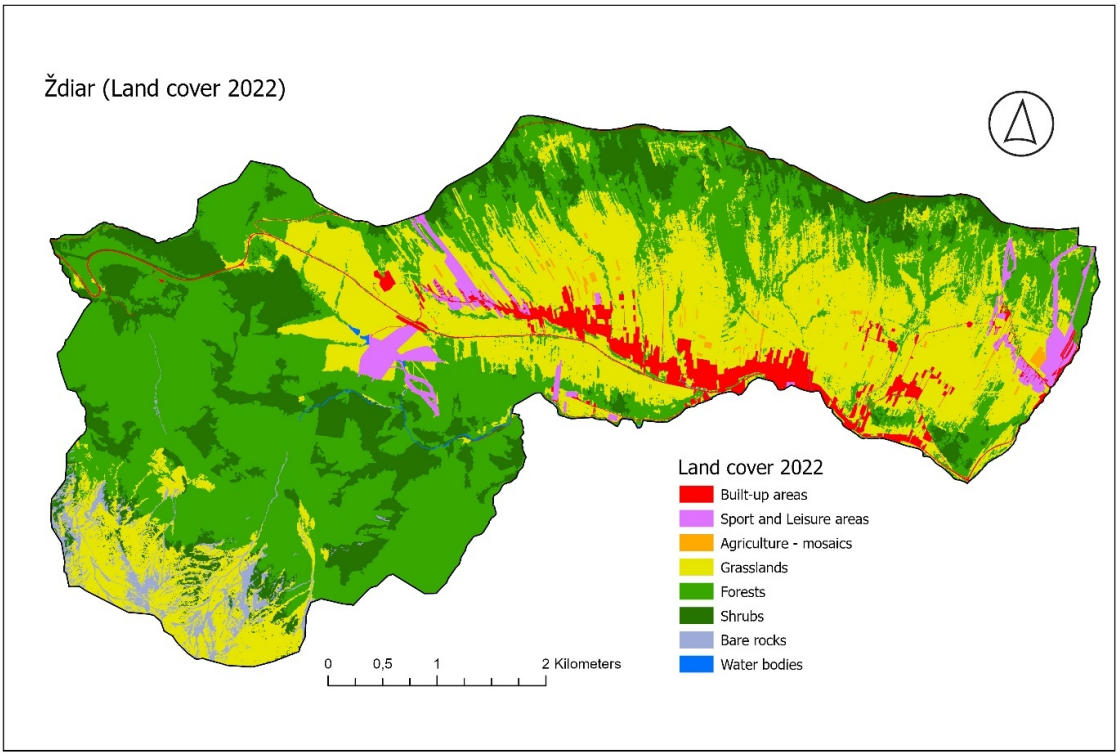


**Figure 6.** Landscape Cover or CLS of the Cadastral Territory in 2022.

**Table 3.** Changes in the Landscape Cover of the Cadastral Territory between 1950 and 2022.

| Types of Land Cover Change | ha | % | % of Changed Areas |
|---|---|---|---|
| Afforestation | 519.57 | 19.02 | 40.23 |
| Agriculture extensification | 330.33 | 12.10 | 25.58 |
| Urbanisation (anthropisation) | 81.14 | 2.97 | 6.28 |
| Urbanisation (anthropisation) – tourism development | 64.44 | 2.36 | 4.99 |
| Deforestation | 20.28 | 0.74 | 1.57 |
| Agriculture intensification | 8.88 | 0.33 | 0.69 |
| Deurbanisation (naturalisation) | 5.13 | 0.19 | 0.40 |
| Urbanisation (anthropisation) – construction of dams | 1.07 | 0.04 | 0.08 |
| *Other changes (not classified)* | *260.69* | *9.55* | *20.18* |
| **All changes** | **1291.53** | **47.30** | |
| **No change** | **1439.22** | **52.70** | |
| **Total** | **2730.75** | **100.00** | **100.00** |

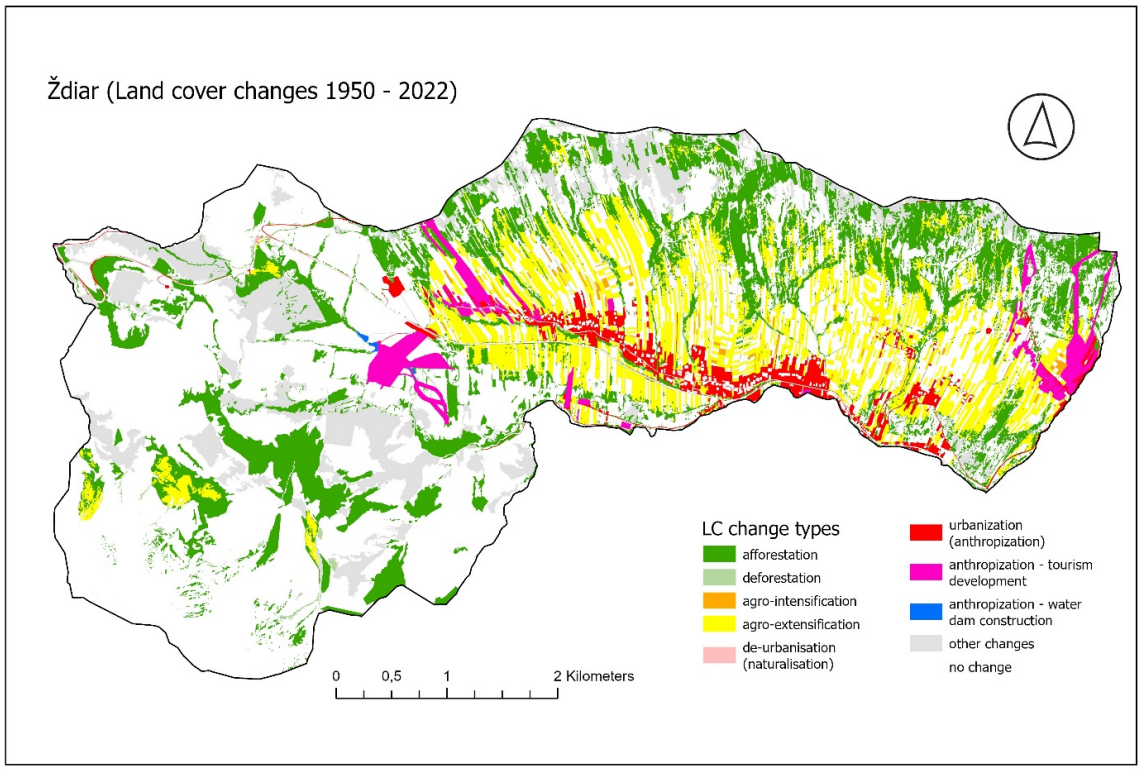


**Figure 7.** Types of Land Cover Changes in the Cadastral Territory between 1950 and 2022.

## 3.7. SWOT Analysis of Tourism Impacts in the Cadastral Area

According to the order of individual factors after numerical processing of the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, we concluded that the strength of tourism in the area is the natural potential for tourism development (**Figure 8**), while the most significant weakness is the insufficiently developed tourism infrastructure. However, tourism in the cadastral area in the transition zone of the BR is the main economic driver, which opens up opportunities especially for the local population. However, the main threat to further sustainable tourism is the municipality's problems in the area of tourism development, both in terms of finances and ownership.

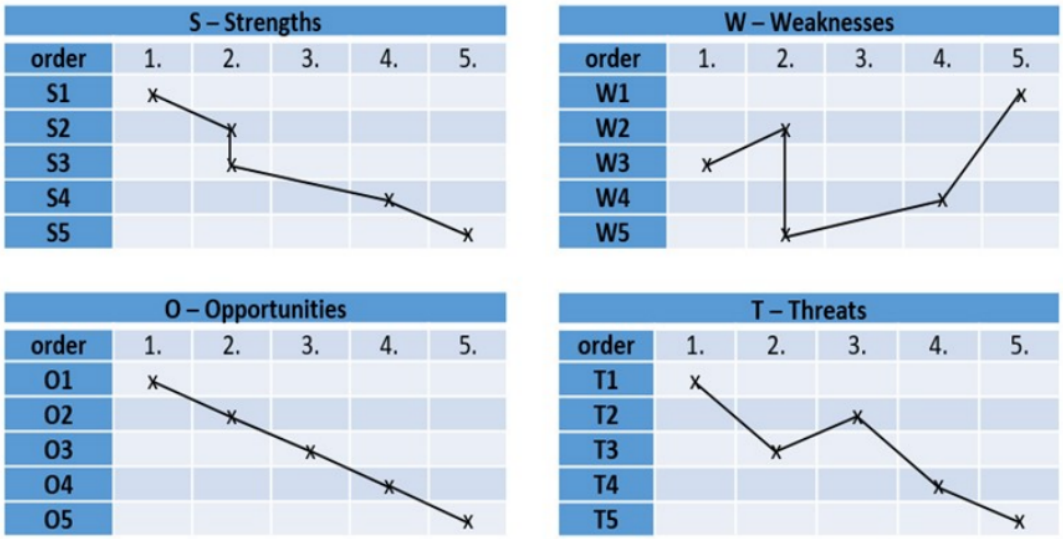


**Figure 8.** SWOT Analysis of Tourism Impacts in the Cadastral Territory.

Explanations: S1 – natural potential for tourism development; S2 – attractions and attractions of tourism; S3 – tourism equipment and services; S4 – manpower; S5 – the built overall infrastructure of the municipality; W1 – dominance of tourism as one sector and its uncoordinated development; W2 – insufficient equipment of tourism services; W3 – insufficiently completed tourism infrastructure; W4 – The outflow of skilled labor and young people; W5 – Infrastructure of the municipality that has been completed with insufficient capacity; O1 – tourism as the main economic driving force; O2 – improvement and completion of tourism infrastructure; O3 – business development and new job opportunities and places; O4 – completion of the overall infrastructure of the municipality; O5 – Support for the creation of suitable conditions for the development of services in the tourism industry (financial and legislative); T1 – problems of the municipality in the development of tourism (financial and ownership conditions); T2 – pressure on the environment and native land; T3 – deteriorating condition of the infrastructure of the municipality; T4 – Deterioration of the business environment; T5 – Endangerment of cultural heritage.

# 4. Discussion

In the present paper, we evaluate the impact of tourism in the cadastral territory of the municipality of Ždiar for the years 1950–2022. During this period, the area was included in different types of protected areas. Since 1949, it has been influenced by the establishment of Tatra National Park, and since 1993 by the declaration of the Tatra BR. Although we tried to obtain data for the entire period, we found that such a comprehensive assessment is not possible, as many statistics are only available for shorter periods of time.

When selecting the territory, we decided for the cadastral territory of the municipality of Ždiar. The reason was that the municipality of Ždiar is one of the most historically preserved municipalities in Slovakia and thus carries a historical picture of the life of the Gorals and the use of the land in the Tatra region. In addition, the municipality is situated in the Tatra Mountains, the highest mountain range in the Carpathians. Due to unfavourable climatic conditions, life and landscape transformation are very specific. They are mainly associated with peasants, shepherds, charcoal burners and woodcutters, who created the foundations of the municipality and were the first to start transforming the territory with their activities [30]. The municipality of Ždiar has a specific folk architecture, which was influenced by the Goral culture. Since 1977, the different parts of the municipality have been gradually declared a conservation area (PRĽA) [30, 32]. Currently, there are 183 national cultural monuments in the municipality [35]. These are mainly wooden log houses, which are characterised by carved mouldings with symbols of a stylised moulder or a beardless red-haired man, light blue painted moss and clay paired fillings between the logs in the living area and red window frames complemented by a simple white ornament. In addition to these incentives for tourism development, the municipality is very conveniently located close to the border crossing with Poland, which has helped it to become very dynamic and modern (Source: Monumental Preservation of Folk Architecture in Ždiar – Urbanistic and Historical Research 2017).

In the years 1950–2022, the development of tourism in the cadastral territory of the municipality of Ždiar enters into an increasingly intense relationship with the socio-demographic, cultural, economic, ecological, urban and territorial-technical conditions of the territory and at the same time affects the functional components in the territory, such as housing, infrastructure, transport.

Although the demographic development in Slovakia is generally characterised by a declining natural population

growth and an ageing population [33, 35], the population in the territory has been slightly increasing since 1994. According to the information from the Municipality of Ždiar, this is related to the construction development of the municipality, related to the increase in the number of visitors to the municipality and the construction of residential areas.

Limiting and regulating the number of visitors and not exceeding this number should be helpful in managing important events. The carrying capacity of the municipality of Ždiar was determined as the maximum capacity of visitors at one point in time. The total area of the destination is 1758.88 ha. The maximum number of visitors that the municipality of Ždiar can physically handle is therefore approximately 598 people per day. Although this number was not exceeded in the area in 2022, the development of tourism in the area also has negative consequences.

The development of tourism in the area goes hand in hand with the abandonment of traditional methods of management and forestry. This is a global trend, which is highlighted, for example, by MacDonald and colleagues [44], but also within Slovakia by Masný and Zausková [18]. However, there is no uniform methodology for evaluating such changes. In particular, the availability of data at the local level appears to be problematic. We have chosen data collection and modeling using GIS and remote sensing tools as a suitable methodology; this methodology also provides valuable information about landscape changes due to tourism according to [45]. The methodology has also been used in foreign mountainous countries, e.g., in the Jeseníky Mountains in the Czech Republic [46], in the Annapurna Protected Area in Nepal [47], in the province of Henan in China [48], or in the Trabzon in Turkey [49]. The methodology is also used in Slovakia, for example in the Low Tatras [49–52].

In the cadastral territory of the municipality of Ždiar, we recorded a more extensive decrease in agricultural mosaics and an increase in the areas of shrub forests, sports and recreational areas, built-up areas, grasslands, arable land and water areas. All changes between the assessed years occurred on 47.30% of the area of the municipality. These changes were related to afforestation, agro-expansion, urbanisation and tourism development.

Several works from abroad point to the issue of abandoning traditional management in the area and the development of tourism, as well as the need to maintain sustainable tourism development. For example, Boori et al. report that in the studied area in the Jeseníky Mountains in the Czech Republic, an area of 11.13% was deforested between 1991 and 2001 due to recreation and tourism [46], and there was a decrease in agricultural and pasture areas; the contribution assesses this impact of tourism development as negative. Using the example of Luanchuan County in China, Xie et al. point to the rapid development of tourism, which has increased seven times [48], resulting in intensive changes in the structure of mountain landscape use and a strong impact on terrestrial ecosystems. Atasoy analyses temporal and spatial changes in the use of a mountain tourism resort in the Trabzon province of Turkey [49], where the region has undergone heavy construction over the past 35 years and a very significant increase in the number of buildings of up to 91% has been identified. Uncontrolled tourism development is again criticised as negative.

The need to maintain sustainable tourism development is also pointed out by several works from Slovakia. For example, Rakytová et al. claim that the intensive development of tourism infrastructure in the Low Tatras in the Demänovská Valley has resulted in a sharp increase in destroyed and built-up areas with hotels, guesthouses, cottage settlements, parking lots and areas related to the construction of cable cars and ski lifts [53]. As a result of the construction of infrastructure related to tourism, coniferous forests (−98%) and alpine meadows (−39%) have almost disappeared from the territory. According to Krtička et al., the built-up areas related to transport, settlement and recreation in the Demänovská Valley have increased from 0.5% in 1949 to 1.5% in 2013 [50]. The authors call for measures to achieve sustainable tourism in the area.

However, in domestic and foreign literature, we note a lack of comparative analyses from other BRs, which limits the ability to contextualise the findings in broader discussions about sustainable tourism.

In an effort to evaluate the strengths and weaknesses of tourism in the cadastral territory of the municipality of Ždiar, as well as opportunities and threats, and to determine whether the development of tourism is moving towards sustainable implementation, as recommended by, e.g., the UN [54], we have identified several problems in the study of the literature. The municipality perceives unfair behaviour on the part of residents in relation to tax obligations [20]. From the

municipality's point of view, they do not report the real attendance at their accommodation facilities in order to avoid overnight tax charges. These negative factors also affect the municipality's budget and the healthy development of tourism in the transition zone of the BR. Several respondents from the municipality of Ždiar argue (e.g., Burgerová; Doyle; Michaláková; Pitoňák; Zoričáková – owners of accomodations, pers. comm.) that one of the other problems is that currently only the indigenous inhabitants who would be interested in preserving the cultural character are not the owners of the properties and operators of the accommodation facilities. Destination managers, local government officials, business people, and inhabitants of the municipality of Ždiar admit that an easier way to comply with the standards is to pay a fine to the building and conservation authority.

At the same time, it should be noted that the sustainability of tourism in this area is questionable in the future. Nowadays, the sustainability of tourism is of great importance, especially in the winter period. But thanks to climate change, winters are getting warmer and drier. If this area wants to maintain tourism as a key industry, it may have to look for a different focus, such as summer tourism, perhaps some eco-forms in tourism.

The uniqueness of Ždiar lies not only in its attractive natural environment, quality of sports centres and various attractions, but also in its distinctive traditional culture. Kurpašová perceives the lack of cooperation between local institutions and tourism entities as a weakness [20]. Our collective of authors appeals for the functioning of the Coordination Council of the Tatra BR and the establishment of permanent positions in the management of the BR, which would direct the development of tourism in this cadastral area, but also in the entire transition zone, towards sustainability. We also call for continuous data collection in all spheres of tourism.

## 5. Conclusions

The municipality of Ždiar is one of the most attractive tourist areas in Slovakia. Between 1949 and 2022, the cadastral territory of the municipality of Ždiar experienced an increasingly intensive development of tourism. The life of the inhabitants of Ždiar is adapting to tourism and the local population is abandoning traditional agriculture and forestry in this area. The decline in the agricultural mosaic and the increase in the areas of shrub forests, sports and recreational areas, built-up areas, grasslands, arable land and water areas took place on 47.30% of the cadastral territory of the municipality. These changes were related to afforestation, agroexpansion, urbanisation and the development of tourism. Despite significant restrictions during the COVID pandemic, total accommodation revenues in the Ždiar municipality were 214% higher in 2022 compared to 2017. Tourism is the main driver of the economy in this cadastral area, opening up opportunities for local residents. The physical carrying capacity of 598 visitors per day of the area is not excessive. However, the weakest point is the lack of completed tourism infrastructure.

Since the transition zones of the BR are particularly key in the interaction of the BR with the surrounding area, we consider it necessary to focus on monitoring the sustainability of tourism development in the transition zone. We recommend the creation of a Coordination Council of the Tatra BR, as well as the establishment of permanent positions in the TANAP Administration to ensure the regulation of human activities in the BR in an effort to achieve sustainable use of the Tatras and sustainable development of tourism.

## Author Contributions

Conceptualisation, V.P.; methodology, V.P., Z.P., R.M.; formal analysis, V.P., Z.P., R.M., K.V., G.B., J.H.; resources, V.P., Z.P., R.M.; data curation, V.P., Z.P., R.M., K.V., G.B., J.H., A.S.; writing—original draft, V.P., Z.P., R.M., K.V., G.B., J.H.; writing—review & editing, V.P., Z.P., R.M., K.V., G.B., J.H. All authors have read and agreed to the published version of the manuscript.

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## Institutional Review Board Statement

Not applicable.

## Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

## Data Availability Statement

No new data were created.

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## Conflict of Interest

All the authors also declare that there is no conflict of interest in relation to the research, authorship, and publication of this study. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

# Appendix A

**Table A1.** Average Accommodation Prices and Revenue from Tourism in the Cadastral Territory in 2017–2022 (Sources: Municipal Office of Ždiar, Census of inhabitants, houses and apartments 2021) [34, 35].

| Average Prices and Revenues | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Average Value |
|---|---|---|---|---|---|---|---|
| Inflation | 1.3% | 2.5% | 2.7% | 1.9% | 3.2% | 12.8% | 4.07% |
| Total revenue for accommodation (in EUR) | 238.59 | 287.97 | 413.73 | 108.48 | 154.24 | 749.52 | |
| Revenue of foreign visitors (in EUR) | 66.72 | 64.96 | 67.66 | Jun-37 | 34.84 | 126.97 | |
| Revenues of domestic visitors (in EUR) | 171.87 | 223.01 | 346.07 | 102.11 | 119.40 | 622.55 | |
| Average price for accommodation in accommodation facilities (Euro) | 24.90 | 25.60 | 21.90 | 30.00 | 28.00 | 63.20 | |
| Year-on-year changes for price data | | 2.81% | −14.45% | 36.99% | −6.67% | 125.71% | 28.88% |
| Average price for accommodation in accommodation facilities per foreign visitor (Euro) | 26.30 | 25.50 | 20.30 | 25.90 | 53.80 | 59.30 | |
| Year-on-year changes for price data | | −3.04% | −20.39% | 27.59% | 107.72% | 10.22% | 24.42% |
| Average price for accommodation in accommodation facilities per domestic visitor (Euro) | 24.30 | 25.60 | 22.30 | 30.30 | 24.60 | 64.10 | |
| Year-on-year changes for price data | | 5.35% | −12.89% | 35.87% | −18.81% | 160.57% | 34.02% |
| Total revenue for accomodition (Euro) | 238.59 | 287.97 | 413.73 | 108.48 | 154.24 | 749.52 | 214.15% |
| Year-on-year changes for price data | | 20.70% | 43.67% | −73.78% | 42.18% | 385.94% | 83.74% |

**Table A2.** Selected Issues Evaluated in SWOT Analysis for the Evaluation of Tourism in the Cadastral Area of the Municipality of Ždiar.

| | Strengths | | Weaknesses | | Opportunities | | Threats |
|---|---|---|---|---|---|---|---|
| **S1** | *Natural potential for tourism development* | **W1** | *Dominance of tourism as one sector and its uncoordinated development* | **O1** | *Tourism as the main economic driving force* | **T1** | *Problems of the municipality in the development of tourism (financial and ownership conditions)* |

**Table A2.** *Cont.*

| Strengths | | Weaknesses | | Opportunities | | Threats | |
|---|---|---|---|---|---|---|---|
| **S2** | *Attractions and attractions of tourism* | **W2** | *Insufficient equipment of tourism services* | **O2** | *Improvement and completion of tourism infrastructure* | **T2** | *Pressure on the environment and native land* |
| **S3** | *Tourism equipment and services* | **W3** | *Insufficiently completed tourism infrastructure* | **O3** | *Business development and new job opportunities and places* | **T3** | *Deteriorating condition of the infrastructure of the village* |
| **S4** | *Manpower* | **W4** | *The outflow of skilled labor and young people* | **O4** | *Completion of the overall infrastructure of the village* | **T4** | *Deterioration of the business environment* |
| **S5** | *The built overall infrastructure of the village* | **W5** | *Infrastructure of the village that has been completed with insufficient capacity* | **O5** | *Support for the creation of suitable conditions for the development of services in the tourism industry (financial and legislative)* | **T5** | *Endangerment of cultural heritage* |

**Table A3.** Numerical Processing of the Strengths of the Resulting SWOT Analysis for Tourism in the Cadastral Territory of the Municipality of Ždiar.

| S-Strengths | Natural Potential for Tourism Development | Attractions and Attractions of Tourism | Tourism Equipment and Services | Manpower | Overall Infrastructure | Sum | Scale |
|---|---|---|---|---|---|---|---|
| Natural potential for tourism development | | 0,5 | 1 | 0,5 | 0,5 | 2,5 | 25 |
| Attractions and attractions of tourism | 0,5 | | 0,5 | 0,5 | 0,5 | 2 | 20 |
| Tourism equipment and services | 0,5 | 0,5 | | 0,5 | 0,5 | 2 | 20 |
| Manpower | 0 | 0 | 1 | | 1 | 2 | 20 |
| Overall infrastructure | 0 | 0,5 | 0,5 | 0,5 | | 1,5 | 15 |
| Sum | | | | | | 10 | 100 |

**Table A4.** Numerical Processing of the Weakness of the Resulting SWOT Analysis for Tourism in the Cadastral Territory of the Municipality of Ždiar.

| Weakness | Dominance of Tourism as One Sector and Its Uncoordinated Development | Insufficient Equipment of Tourism Services | Insufficiently Completed Tourism Infrastructure | The Outflow of Skilled Labor and Young People | Infrastructure of the village That Has Been Completed with Insufficient Capacity | Sum | Scale |
|---|---|---|---|---|---|---|---|
| Dominance of tourism as one sector and its uncoordinated development | | 0,5 | 0 | 0,5 | 0,5 | 1,5 | 15 |
| Insufficient equipment of tourism services | 0,5 | | 0,5 | 0,5 | 0,5 | 2 | 20 |
| Insufficiently completed tourism infrastructure | 0,5 | 0 | | 0 | 0,5 | 1 | 10 |
| The outflow of skilled labor and young people | 1 | 0,5 | 1 | | 1 | 3,5 | 35 |
| Infrastructure of the village that has been completed with insufficient capacity | 1 | 0,5 | 0,5 | 0 | | 2 | 20 |
| Sum | | | | | | 10 | 100 |

**Table A5.** Evaluation of the Intensity of Mutual Relations of Individual Views with Each Other.

| | | **Internal Factors** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **S – Strengths** | | | | | | **W – Weaknesses** | | | | | |
| | | **S1** | **S2** | **S3** | **S4** | **S5** | **Total Rating O/T and S** | **W1** | **W2** | **W3** | **W4** | **W5** | **Total Rating O/T and W** | **Final Assessment** |
| **Key external factors** | **O1** | 5 | 5 | 3 | 4 | 3 | **20** | 5 | −4 | −5 | −3 | −5 | −12 | 8 |
| | **O2** | 3 | 3 | 4 | 4 | 4 | 18 | 4 | 5 | 5 | 2 | 5 | 21 | 39 |
| | **O3** | 2 | 3 | 5 | 5 | 3 | 18 | 5 | 5 | 4 | 5 | 4 | **23** | **41** |
| | **O4** | 2 | 3 | 3 | 3 | 5 | 16 | 5 | 3 | 4 | 2 | 5 | 19 | 35 |
| | **O5** | 3 | 2 | 3 | 3 | 4 | 15 | 4 | 5 | 4 | 3 | 5 | 21 | 36 |
| | **T1** | −3 | −5 | −5 | −3 | −5 | **−21** | −5 | −3 | −3 | 0 | −5 | −16 | **−37** |
| | **T2** | −3 | −4 | −2 | 0 | −5 | −14 | −5 | 0 | −3 | 0 | −4 | −12 | −26 |
| | **T3** | 0 | −3 | −3 | −2 | −3 | −11 | −4 | −5 | −4 | −2 | −4 | **−19** | −30 |
| | **T4** | 0 | −1 | −2 | −5 | −1 | −9 | −2 | −2 | 0 | −3 | −2 | −9 | −18 |
| | **T5** | 0 | −3 | 0 | 0 | 0 | −3 | −3 | −1 | −1 | −3 | −3 | −11 | −14 |
| Total rating S or W | | **9** | 0 | 6 | **9** | 5 | 29 | **4** | 3 | 1 | 1 | −4 | 5 | **34** |
| Evaluation weights S and W | | 25 | 20 | 20 | 20 | 15 | | 15 | 20 | 10 | 35 | 20 | | |

**Table A6.** The Proportion of the Number of Women and Men in the Cadastral Territory in the Years 1993–2022 (Source: Municipal Office of Ždiar)[35].

| **Year** | **1993** | **%** | **1994** | **%** | **1995** | **%** | **1996** | **%** | **1997** | **%** | **1998** | **%** | **1999** | **%** | **2000** | **%** | **2001** | **%** | **2002** | **%** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Women | 774 | 50.92 | 663 | 50.11 | 662 | 50.73 | 658 | 50.69 | 661 | 50.42 | 665 | 50.69 | 673 | 50.72 | 665 | 50.34 | 669 | 50.19 | 671 | 50.26 |
| Men | 746 | 49.08 | 660 | 49.89 | 643 | 49.27 | 640 | 49.31 | 650 | 49.58 | 647 | 49.31 | 654 | 49.28 | 656 | 49.66 | 664 | 49.81 | 664 | 49.74 |
| Together | 1520 | | 1323 | | 1305 | | 1298 | | 1311 | | 1312 | | 1327 | | 1321 | | 1333 | | 1335 | |
| **Year** | **2003** | **%** | **2004** | **%** | **2005** | **%** | **2006** | **%** | **2007** | **%** | **2008** | **%** | **2009** | **%** | **2010** | **%** | **2011** | **%** | **2012** | **%** |
| Women | 668 | 50.30 | 668 | 50.23 | 669 | 50.00 | 671 | 50.22 | 665 | 49.74 | 670 | 49.89 | 677 | 49.74 | 695 | 50.29 | 690 | 50.18 | 689 | 49.71 |
| Men | 660 | 49.70 | 662 | 49.77 | 669 | 50.00 | 665 | 49.78 | 672 | 50.26 | 673 | 50.11 | 684 | 50.26 | 687 | 49.71 | 685 | 49.82 | 679 | 50.29 |
| Together | 1328 | | 1330 | | 1338 | | 1336 | | 1337 | | 1343 | | 1361 | | 1382 | | 1375 | | 1386 | |
| **Year** | **2013** | **%** | **2014** | **%** | **2015** | **%** | **2016** | **%** | **2017** | **%** | **2018** | **%** | **2019** | **%** | **2020** | **%** | **2021** | **%** | **2022** | **%** |
| Women | 701 | 50.83 | 702 | 50.80 | 702 | 51.24 | 694 | 50.73 | 693 | 50.44 | 688 | 50.22 | 692 | 50.22 | 698 | 50.32 | 687 | 50.22 | 687 | 50.22 |
| Men | 678 | 49.17 | 680 | 49.20 | 668 | 48.76 | 674 | 49.27 | 688 | 49.56 | 682 | 49.78 | 686 | 49.78 | 689 | 49.68 | 681 | 49.78 | 681 | 49.78 |
| Together | 1379 | | 1382 | | 1370 | | 1368 | | 1374 | | 1370 | | 1378 | | 1387 | | 1368 | | 1368 | |

**Table A7.** Sociodemographic Overview of the Cadastral Territory of Ždiar (Source: Municipal Office of Ždiar, Census of Population, Houses and Dwellings 2021)[34, 35].

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gender | | | | | | | |
| Men | | | | Woman | | | |
| Inhabitants | % | | | Inhabitants | % | | |
| 684 | 49.78 | | | 690 | 50.22 | | |
| Age | | | | | | | |
| Pre-productive age (0–14 years) | | Productive age (15–64 years) | | Post-productive age (65 and over) | | | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % | | |
| 217 | 15.79 | 923 | 67.18 | 234 | 17.03 | | |
| Religion | | | | | | | |
| Roman Catholic Church | | No religious affiliation | | Evangelical Church of the Augsburg Confession | | | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % | | |
| 1.208 | 87.92 | 98 | Jul-13 | 16 | Jan-16 | | |
| Greek Catholic Church | | Other religion | | Undetermined | | | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % | | |
| 11 | 0.8 | 19 | Jan-38 | 21 | Jan-53 | | |
| Ethnic composition | | | | | | | |
| Slovak | | Polish | | Czech | | | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % | | |
| 1.333 | 97.02 | 12 | 0.87 | 7 | 0.51 | | |

**Table A7.** *Cont.*

| | | | | | |
|---|---|---|---|---|---|
| Moravian | | Austrian | | English | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % |
| 2 | 0.15 | 1 | 0.07 | 1 | 0.07 |
| Ruthenian | | Other | | Undetermined | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % |
| 1 | 0.07 | 3 | 0.22 | 13 | 0.95 |
| Educational level | | | | | |
| Education without matriculation | | Complete secondary education (with matriculation) | | Without completed education (0–14 years) | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % |
| 332 | 24.16 | 294 | 21.40 | 217 | 15.79 |
| Tertiary education (with diplomas or academic degrees) | | Basic education (primary) | | Secondary vocational esucation (apprenticeship) | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % |
| 190 | 13.83 | 154 | Nov-21 | 95 | Jun-91 |
| Higher professional education | | Higher education with certificates (15 years and over) | | Undetermined | |
| Inhabitants | % | Inhabitants | % | Inhabitants | % |
| 64 | Apr-66 | 6 | 0.44 | 22 | Jan-60 |

**Table A8.** Offer of Different Types of Accommodation in the Cadastral Territory and Their Use by Visitors in 2017–2022 (Sources: Municipal Office of Ždiar, Census of inhabitants, houses and apartments 2021) [34, 35].

| Accommodation and Attendance | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Total number of accommodation facilities | 53 | 42 | 54 | 43 | 50 | 50 |
| Total number of rooms | 439 | 343 | 481 | 455 | 476 | 449 |
| Total number of beds (including camping places) | 1.255 | 987 | 1.373 | 1.339 | 1.416 | 1.371 |
| Total number of visitors | 4.032 | 4.970 | 7.819 | 1.479 | 2.328 | 4.937 |
| Number of foreign visitors | 975 | 1.031 | 1.274 | 71 | 258 | 861 |
| Number of domestic visitors | 3.057 | 3.939 | 6.545 | 1.408 | 2.070 | 4.076 |
| The total number of overnight stays of visitors | 9.599 | 11.259 | 18.862 | 1.617 | 5.500 | 11.851 |
| Number of overnight stays by foreign visitors | 2.538 | 2.549 | 3.340 | 246 | 647 | 2.142 |
| Number of overnight stays of domestic visitors | 7.061 | 8.710 | 15.522 | 3.371 | 4.853 | 9.709 |

# References


[1] Wilkinson, T., Coles, T., 2024. Do tourists want a transition to sustainability? Visitor attitudes towards destination trajectories during COVID-19. Tourism Geographies. 26(2), 274–291. DOI: https://doi.org/10.1080/14616688.2023.2249423

[2] Hoppstadius, F., 2019. Tourists' reflections on sustainability in a biosphere reserve landscape. International Journal of Tourism Research. 21(4), 560–573. DOI: https://doi.org/10.1002/jtr.2282

[3] Wilkinson, T., Coles, T., Petersen, C., 2023. Mindful continuation? Stakeholder preferences for future tourism development during the COVID-19 crisis. Tourism Geographies. 25(8), 1893–1911. DOI: https://doi.org/10.1080/14616688.2022.2158216

[4] WNBR, 2020. World Network of BRs, 30 October 2020. UNESCO. Available from: http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/world-network-wnbr/ (cited 18 January 2025).

[5] Bridgewater, P., 2016. The Man and Biosphere programme of UNESCO: rambunctious child of the sixties, but was the promise fulfilled? Current Opinion in Environmental Sustainability. 19, 1–6. DOI: https://doi.org/10.1016/j.cosust.2015.08.009

[6] Price, M.F., Park, J.J., Bouamrane, M., 2010. Reporting progress on internationally designated sites: the periodic review of biosphere reserves. Environmental Science & Policy. 13(6), 549–557. DOI: https://doi.org/10.1016/j.envsci.2010.06.005

[7] UNESCO, 2021. Technical Guidelines for Biosphere Reserves, a new tool of the MAB Programme. UNESCO. Available from: https://en.unesco.org/news/technical-guidelines-biosphere-reserves-new-tool-mab-programme (cited 19 January 2025).

[8] Guevara, S., Laborde, J., 2008. The Landscape Approach: Designing New Reserves for Protection of Biological and Cultural Diversity in Latin America. Environmental Ethics. 30, 251–262. DOI: https://doi.org/10.5840/enviroethics200830331

[9] Ishwaran, N., Persic, A., Tri, N.H., 2008. Concept and practice: the case of UNESCO UNESCO biosphere reserves. International Journal of Environment and Sustainable Development. 7(2), 118–131. DOI:

https://doi.org/10.1504/ijesd.2008.018358
[10] Bioret, F., 2001. Biosphere reserve manager or coordinator? Parks. 11(1), 26–29.
[11] Nguyen, N.C., Bosch, O.J., Maani, K.E., 2009. The importance of systems thinking and Practice for creating BRs as "learning laboratories for sustainable development". Proceedings of the 53rd Annual Meeting of ISSS-2009; 12–17 July 2009; Brisbane, Australia. 1(1).
[12] Palliwoda, J., Büermann, A., Fischer, J., et al., 2021. Zoning of UNESCO biosphere reserves: A Comprehensive Set of Geodata for Europe. Frontiers in Ecology and Evolution. 9, 736358. DOI: https://doi.org/10.3389/fevo.2021.736358
[13] Leguia-Cruz, M., Cerda, C., Ortiz-Cubillos, N., et al., 2024. Enhancing participatory governance in biosphere reserves through co-creation of transdisciplinary and intergenerational knowledge. Frontiers in Environmental Science. 12, 1266440. DOI: https://doi.org/10.3389/fenvs.2024.1266440
[14] Ma, Z., Li, B., Li, W., et al., 2009. Conflicts between biodiversity conservation and development in a biosphere reserve. Journal of Applied Ecology. 46(3), 527–535. DOI: https://doi.org/10.1111/j.1365-2664.2008.01528.x
[15] Kratzer, A., 2018. Biosphere reserves as model regions for the transition to sustainability? Insights into the peripheral mountain area Grosses Walsertal (Austria). Applied Geography. 90, 321–330. DOI: https://doi.org/10.1016/j.apgeog.2017.04.003
[16] Romeo, R., Grita, F., Parisi, F., et al., 2020. Vulnerability of mountain peoples to food insecurity: updated data and analysis of causes. FAO and UNCCD: Rome, Italy.
[17] Guerquin, F., 2020. Land degradation neutrality for water security and combating drought. UNCCD and FAO: Bonn, Germany. pp. 20.
[18] Masný, M., Zaušková, Ľ., 2014. The abandonment of agricultural land: A case study of strelníky (The pol'ana biosphere reserve - Slovakia). Carpathian Journal of Earth and Environmental Sciences. 9(3), 17–24. Available from: https://www.researchgate.net/publication/275948567_The_abandonment_of_agricultural_land_A_case_study_of_strelniky_The_pol'ana_biosphere_reserve_-_Slovakia
[19] SNP SR (State Nature Protection of the Slovak Republic), 2025. SNP SR. Available from: https://www.sopsr.sk/web/?cl=1601 (cited 19 January 2025).
[20] Kurpašová, L., 2018. The impact of tourism on traditional culture in Ždiar. Kontexty. 2, 101–110. Available from: https://kmkt.sk/kontexty/posobenie-cestovneho-ruchu-na-tradicnu-kulturu-v-zdiari/
[21] Hoppstadius, F., Dahlström, M., 2015. Processes of Sustainable Development: Ecotourism in Biosphere Reserves. Journal of Environmental and Tourism Analyses. 3(1), 5–25.
[22] Dainienė, R., Dagilienė, L., 2015. A TBL approach based theoretical framework for measuring social innovations. Procedia-Social and Behavioral Sciences. 213, 275–280. DOI: https://doi.org/10.1016/j.sbspro.2015.11.537
[23] Ho, L.C.J., Taylor, M.E., 2007. An empirical analysis of triple bottom-line reporting and its determinants: evidence from the United States and Japan. Journal of International Financial Management & Accounting. 18(2), 123–150. DOI: https://doi.org/10.1111/j.1467-646X.2007.01010.x
[24] Boluk, K.A., Cavaliere, C.T., Higgins-Desbiolles, F., 2019. A critical framework for interrogating the United Nations Sustainable Development Goals 2030 Agenda in tourism. Journal of Sustainable Tourism. 27(7), 847–864. DOI: https://doi.org/10.1080/09669582.2019.1619748
[25] Sharpley, R., 2020. Tourism, sustainable development and the theoretical divide: 20 years on. Journal of Sustainable Tourism. 28(11), 1932–1946. DOI: https://doi.org/10.1080/09669582.2020.1779732
[26] Knaus, F., 2014. Lessons learnt from a monitoring endeavour in the UNESCO Biosphere Reserve Entlebuch. eco.mont: Journal on Protected Mountain Areas Research. 5(1), 55–58. DOI: https://doi.org/10.1553/eco.mont-5-1s55
[27] MAB UNESCO, 2025. UNESCO. Available from: https://www.unesco.org/en/mab/tatra (cited 7 January 2025).
[28] Pucherová, Z., Mišovičová, R., Bugár, G., et al., 2019. Interpretation of landscape changes in Ždiar municipality with a focus on tourism. Proceedings of the 14th International Conference CURRENT PROBLEMS OF TOURISM; 27–28 February 2019; College of Polytechnics, Jihlava, the Czech Republic. pp. 283–291. Available from: https://kcr.vspj.cz/cs/uvod/archiv/konference/aktualni-problemy-cestovniho-ruchu-2019
[29] Municipality of Ždiar, 2015. Programme of Economic Development and Social Development of the Municipality of Ždiar for the years 2015-2022 (Programme of Development of the Municipality of Ždiar) - update of the Plan of Economic and Social Development of the Municipality of Ždiar for the years 2007-2015. Available from: http://staryweb.zdiar.sk/images/stories/_schvalene_dokumenty/PHSR%202015-2022.pdf
[30] Kollárová, Z., 2013. Heritage of the Gorals, Ždiar. Municipal Office of Ždiar: Ždiar, Slovakia. pp. 175.
[31] Olejník, J., 1978. People under the Tatras. Osveta: Martin, Slovakia. pp. 295.
[32] Beňušková, Z., 2005. Traditional culture of the regions of Slovakia. SAV: Bratislava, Slovakia. pp. 241.
[33] Statistical Office of the Slovak Republic DATAcube, 2024. DATAcube. Available from: https://datacube.statistics.sk/#!/lang/en (cited 22 November 2024).
[34] Census of Population, Houses and Flats, 2021. Ždiar.

Available from: https://www.scitanie.sk/ (cited 5 November 2024).
[35] Municipal Office of Ždiar, 2025. Ždiar. Available from: http://www.zdiar.sk (cited 20 November 2024).
[36] Cifuentes, M., Mesquita, C.A., Méndez, J., et al., 1999. Capacidad de Carga Turística de las Áreas de Uso Público del Monumento Nacional Guayabo, Costa Rica. WWF Centro America: San José, Costa Rica.
[37] Ceballos-Lascuráin, H., 1996. Tourism, Ecotourism and Protected Areas: the state of nature-based tourism around the world and guidelines for its development. World Conservation Union (IUCN): Gland, Switzerland. p. 315.
[38] Ružička, M., 1978. Landscape structure and functions of ecostabilization elements in the landscape. Quaestiones Geobiologicae. 18, 5–77.
[39] Orthophotomosaic 2022, GKÚ Bratislava, NLC, Slovakia
[40] Historical aerial photography 1949-1950, Topographic Institute Banská Bystrica, Slovakia
[41] Digital elevation models (DEM, DSM), ALS product, ÚGKK SR, Slovakia
[42] Cebecauer, T., Huld, T., Šúri, M., 2007. Using high-resolution digital elevation model for improved PV yield estimates. Proceedings of the 22nd European Photovoltaic Solar Energy Conference; 3–7 September 2007; Milano, Italy. pp. 3553–3557.
[43] Pinto, A.T., Gonçalves, J.A., Beja, P., et al., 2019. From archived historical aerial imagery to informative orthophotos: A framework for retrieving the past in long-term socioecological research. Remote Sensing. 11(11), 1388. DOI: https://doi.org/10.3390/rs11111388
[44] MacDonald, D., Crabtree, J.R., Wiesinger, G., et al., 2000. Agricultural abandonment in mountain areas of Europe: Environmental consequences and policy response. Journal of Environmental Management. 59(1), 47–69. DOI: https://doi.org/10.1006/jema.1999.0335
[45] Dubovyk, O., 2017. The role of Remote Sensing in land degradation assessments: opportunities and challenges. European Journal of Remote Sensing. 50(1), 601–613. DOI: https://doi.org/10.1080/22797254.2017.1378926
[46] Boori, M.S., Voženílek, V., Choudhary, K., 2015. Land use/cover disturbance due to tourism in Jeseníky Mountain, Czech Republic: A remote sensing and GIS based approach. The Egyptian Journal of Remote Sensing and Space Science. 18(1), 17–26. DOI: https://doi.org/10.1016/j.ejrs.2014.12.002
[47] Chaplin, J., Brabyn, L., 2013. Using remote sensing and GIS to investigate the impacts of tourism on forest cover in the Annapurna Conservation Area, Nepal. Applied Geography. 43, 159–168. DOI: https://doi.org/10.1016/j.apgeog.2013.06.007
[48] Xie, Y., Zhu, Q., Gao, G., et al., 2021. Study on changes in tourism land and influence factors in mountain areas: A case study of Luanchuan country, China. Global Journal of Ecology. 6(1), 034–045. DOI: https://doi.org/10.17352/gje.000042
[49] Atasoy, M., 2010. Monitoring land use changes in tourism centers with GIS: Uzungöl case study. Scientific Research and Essays. 5(8), 790–798.
[50] Krtička, L., Tomčíková, I., Rakytová, I., 2018. Development versus conservation: evaluation of landscape structure changes in Demänovská Valley, Slovakia. Journal of Mountain Science. 15, 1153–1170. DOI: https://doi.org/10.1007/s11629-018-4870-0
[51] Čerňanský, J., Kožuch, M., 2001. Monitoring the changes of the Low Tatras National Park using digital photogrammetry. Geodetic and Cartographic Review. 47(8-9), 242–249.
[52] Čerňanský, J., Stanková, H., 2004. Object-oriented classification of land cover in Chopok-Jasná area. Cartographic Letters. 12, 104–113.
[53] Rakytová, I., Tomčíková, I., Krtička, L., 2015. Changing the landscape structure in an area burdened by tourism using the example of the Demänovská valley – Jasná recreation center. Acta Geographica Universitatis Comenianae. 59(1), 83–96.
[54] UN, 2015. Transforming our world: the 2030 Agenda for Sustainable Development. United Nations. Available from: https://sdgs.un.org/2030agenda (cited 15 November 2024).