

ASSESSING SUSTAINABILITY IN MOUNTAIN TOURISM OF DEMANOVSKA VALLEY, SLOVAKIA

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Abstract:

Demanovska Valley belongs to the most beautiful and the most valuable territories of Slovakia. It is a source of interest for its high country aesthetic and natural value not only from the scientific and professional point of view, but also from the touristic and recreational point of view. The aim of this paper is to evaluate the natural potential of Demanovska Valley, to analyze the development of tourism over the past 10 years, the current state of the cable cars, ski lifts and slopes, as well as accommodation facilities in the valley. Also to point to the growing interest in Demanovska Valley and the growing share of visitors within the district, country and Slovakia. We use the Intensity Index of Tourism Development to assess the attractiveness of Demanovska Valley, but also to point out how the development of tourism impacts the environment, as the monitored area is located in the Low Tatra National Park.

Keywords: *Resort Jasna Nizke Tatry, environment, protected areas, amenity, the intensity of tourism.*

1. INTRODUCTION

Slovakia offers a very interesting and varied landscape from the tourism point of view. The development of tourism in Slovakia is one of the potential accelerators of economic development and factors in the standard of living.

Its mountains with their spectacular scenery, majestic beauty and unique amenity values are one of the most popular destinations for tourists. The development of tourism in the mountains can be a key factor in the focal concern for overall improvement in people's quality of life through sustainable economic development initiatives and environmental conservation. In socio-economic and environmental terms, tourism in mountain regions is a mixed blessing: it can be a source of problems, but it also offers many opportunities.

The studied area – Demanovska Valley and resort Jasna Nizke Tatry, mainly its northern part, is one of the most important Slovak resorts lying in the Low Tatra National Park. It has been selected on the basis of progressive changes over the past ten years, particularly including a fast development of tourism and associated changes. The uniqueness and significance of Demanovska Valley lies in its two main functions and their mutual interaction. Firstly, it is extremely important for conservation of natural values and secondly, it enables recreation and tourism of international importance in excellent natural conditions suitable for free as well as bound tourism. However, there is a contradiction between nature conservation and economic objectives, between the tolerable load capacity of the area by incoming visitors and tourism

itself, between the preservation of natural beauty providing an excellent tool for the recovery of mental and physical strength and recreation, relaxation and recovery itself often dealt with in the area.

The aim of this contribution is to evaluate the natural potential of Demanovska Valley, to analyze the development of tourism over the past 10 years, the current state of the cable cars, ski lifts and slopes, as well as the accommodation facilities in the valley. We use the Intensity Indexes of Tourism Development to assess the attractiveness of Demanovska Valley, but also to point out how the development of tourism impacts the environment.

2. BACKGROUND

2.1 Materials and methods

Tourism is a set of activities focused on meeting the needs related to travelling and accommodating persons outside their permanent residence, usually for leisure. Its purposes include relaxation, learning, health, recreation and entertainment, cultural and sports activities, or business travel. The priority is especially refueling physical and mental strength and the total regeneration of the body. Therefore many people prefer long-term stays in the natural environment, where the recreational function is provided mainly by natural landscape, which is characterized by minimal pollution of the individual components.

Demanovska Valley has been the object of our research for several years (Tomcikova, Rakytova, Krticka, 2014; Tomcikova, Rakytova, 2015; Rakytova, Tomcikova, Krticka, 2015), where we have focused mainly on changes in secondary landscape. The strategic advantages of Demanovska Valley, which create a favourable potential for the development of recreation and tourism in this place, are primarily natural conditions in terms of diversity of landscape types, flora and fauna.

Its most valuable asset is its relatively little disturbed mountain and foothill landscape. The landscape provides for a remarkably varied set of tourist and recreational activities in that natural environment. Significant changes in the landscape have occurred especially over the past 10 years just through tourism development. The location of the analyzed area in the national park naturally leads to a conflict between the protection of extremely important natural values (alpine landscape, karst) and economic objectives and interests in tourism development, especially represented by private investors.

The intensity of tourism in tourist centres can be determined using a number of indices of intensity. For the purposes of this study, we employ seven indices of tourism, which determine the degree of tourism frequency over the analyzed area.

According to Mariot (2001), the index which uses the most elementary statistical data is called the *tourism function index*, also called Defert index of tourist function (function Defert tourist rate - DF).

$$DF = \frac{B}{R} \times 100$$

B – number of permanent beds in accommodation
R – number of residents

This index reflects the intensity of tourist activities in an analyzed area through the ratio of the two populations (tourists and residents). The tourist function returns values from 0 to infinity. The higher the value, the more active we consider the tourist resort. This quantitative indicator shows the intensity of the quantitative aspect of tourism. It has the advantage that the input data for the calculation is easily available. It is possible to use specific forms of the index, for example intermediate calculations for individual accommodation (huts and cottages) or collective accommodation facilities (hotels, pensions, etc.).

However, its disadvantages include its exclusion of some data points (e.g. private accommodation, beds in huts and cottages, etc.), and the varying real utilization rates of the existing bed capacity (availability of the accommodation) (Zelenka, Paskova, 2002).

From the tourism function index we can derive *the index of the tourist load of the area*. It is the ratio of the capacity of accommodation and the area of the territory (TL).

$$TL = \frac{B}{A} \times 100$$

B – number of permanent beds in accommodation
A – total destination area

Another group of indices consists of indices which express the intensity of tourism in a resort. The most commonly used indices are the *Charvat index*, the *Schneider index* (also called tourist intensity rate) and the *tourist penetration index*.

The Charvat index (CHI) is the number of overnight stays by tourists per 100 residents. The Schneider index (SCHI) expresses the number of tourists per 100 residents. The tourist penetration index (TPI) is represented by the ratio of visitors times the average length of stay divided by the population times 365 (McElroy, 2003).

$$CHI = \frac{OS \times 100}{R}$$

OS - number of overnight stays
R - number of residents

$$SCHI = \frac{T \times 100}{R}$$

T – number of tourists
R – number of residents

$$TPI = \frac{L \times T}{R \times 365}$$

L – the average length of stay of tourists
T – number of tourists
R – number of residents

The rate of occurrence of the tourists in the area reflects *index of tourist density* (tourist density rate - TDR).

$$TDR = \frac{L \times T}{A \times 365}$$

L – the average length of stay of tourists
T – number of tourists
A - total destination area

For the purpose of evaluating a resort, *indices of accommodation density* are often used. They represent the number of accommodation facilities, or their capacity (number of beds, rooms) compared to the resort area, or the number of residents per accommodation or per bed and so on.

The profit of tourism in a resort is particularly the accommodation tax from accommodation facilities. The following relation expresses *the index of the degree of tourism development* (DTD), which represents the gains of tourism in the municipality and residents (Cuka, 2011).

$$DTD = \frac{G}{R}$$

G – gains of tourism
R – residents

Our analysis of the statistical data from the Regional Office of the Statistical Office of the Slovak Republic gave us the first and basic overview of the intensity of tourism. Their data usually follows the statistical information for tourist accommodation establishments or for paid accommodation facilities. They focus on the number of visitors, the number of overnight stays, the number of accommodation facilities, their categorization, the number of beds and rooms or sales.

For data processing, we used the mathematical and statistical methods available in Excel. For a defined territory, natural potential, history and current status, we used the available literature, maps and other sources of information.

As defined by Palatkova (2006), a destination is an assortment of various services concentrated in a particular place or area, which are provided in response to its potential for tourism. A destination provides services such as accommodation, meals, sports activities and entertainment. The attractiveness of a destination is therefore its essence and the primary motivational stimulus for its traffic.

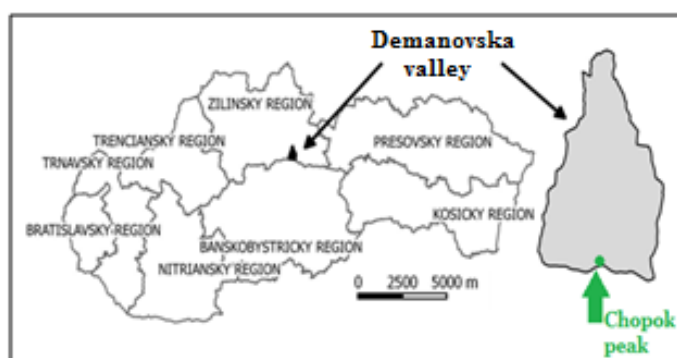
If managed well, tourism is often beneficial for a destination in terms of its environmental, socio-cultural, and economic impact.

In terms of content contribution, we can state that tourism is important for a destination in the field of environmental protection, especially if:

- the revenue from entry fees (to caves, parks) is used to fund nature protection;
- taxes and charges (income tax, health fees, hunting and fishing licenses) are used to help finance the protection of natural resources;
- the number of visitors in protected areas is controlled;
- it contributes to the understanding of the need for environmental protection and the education of local residents as well as tourists.

2.2 Location and demarcation of the study area and its nature bases

Demanovska Valley is situated in the central part of the northern side of the Low Tatras. The highest point of the area is Chopok peak (2,024 m). The valley has a north-south direction and the total area of the valley is 44 square kilometres. The width below the main ridge of the Low Tatras reaches 6.7 km. From there a straight 10-kilometres-long line stretches to the north and opens into Liptovska basin at the height of 705 m a.s.l. near the village of Pavcina Lehota. Here, it reaches its minimum width of 2.4 km.



territorial units for statistics	inclusion of analyzed area
NUTS 1	Slovak Republic
NUTS 2	Central Slovakia
NUTS 3	Zilinsky Region
LAU 1	District of Liptovský Mikulas
LAU 2	Demanovska Valley

Figure 1. Location of Demanovska Valley in Slovakia



Figure 2. View of Demanovska Valley from Mt Ostredok

Until 1964, Demanovska Valley was part of the town of Liptovský Mikuláš – Demanová. The gradual increase in permanent population as well as the overall development in Demanovska Valley was the impulse for the formation of the independent village of Demanovska Valley, which dates back to 1 August 1964. The village consists of five smaller units: Tri studnícky, Jaskyne, Repiska, Lucky, and Jasna. In Jasna, there are ski lifts, cablecars and the slopes of the ski resort Jasna Nízke Tatry, part Jasna – Chopok north. This resort is divided into three smaller centres interconnected by cablecars and ski lifts: Záhradský centre (900–2,004 m a.s.l.), Biela Ľut (1,117–2,004 m a.s.l.) and Otupné centre (1,141–2,004 m a.s.l.). However, accommodation is situated in all areas of the valley (Figure 1, 2, 3, 4).



Figure 3. View of Demanovska Valley from above

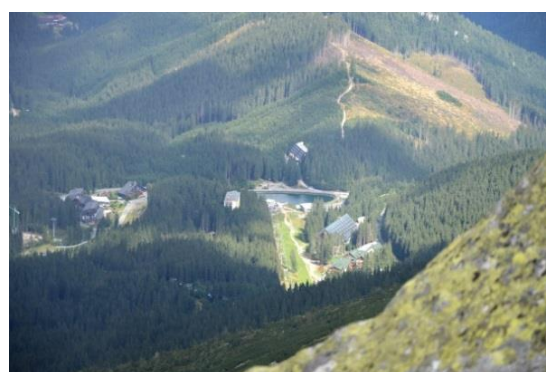


Figure 4. View of Demanovska Valley from Mt Derese

Demanovska Valley is part of the Low Tatras, which are, from the geological point of view, called core mountains. The most important building elements of the valley are its crystalline core, Mesozoic units and Quaternary sediments. We can divide the valley into northern and southern parts from the orographical point of view.

The southern part forms the crystalline complex (granodiorites, less paragneisses) with typical shapes of periglacial processes and strong glacial erosion. The northern part consists of limestone-dolomite series. This part extends from Lucky and Repiská to the mouth of the Demanovka river, where it dives under a paleogene of the Liptov basin. This section is characterized by a relief based on monoclinical structure which is cut by an allochthonous flow of the Demanovka river and its tributaries to monoclinic series of ridges, narrow ridges and isolated rocks, separated by deep valleys. Extreme breakdown of the relief does not give great opportunities for the creation of surface forms (Lacika, 1992). The subsurface karst is represented mainly by the Demanovska cave system, the most extensive and the longest cave

system in Slovakia with a length of more than 40 km. The quaternary sediments include fluvio-glacial deposits, glacial moraines and remnants of river terraces along the Demanovka river. This group includes solifluction streams, walls, scree cones covering the steeper slopes, not only in crystal, but also in limestone-dolomite area of Demanovska Valley. In terms of elevation the southern part of the valley belongs to the high highlands (the altitude exceeds 1501 m) and the northern part to the central highlands (with a height span from 801 to 1500 m).

Under the climate classification of Slovakia (Lapin et al, 2002), the territory of Demanovska Valley is located in a cold area in three districts: the relatively cool district (C1) with average temperatures in July from 12 up to 16 °C, in the cool mountain district (C2) from 10 to 12 °C and cold mountain district (C3) below 10 °C. A relatively large forest cover area and exposure of the slope have an impact on the temperatures, too. The average annual precipitation total in the period 1951 – 1980 constituted 1327 mm (station Jasna), 1158 mm (station Lukova) and 1139 mm (station Chopok). The greatest long-term average precipitation totals occur in the summer months (June and July). The lowest totals are within the winter period. Towards the higher attitudes, the length of the snowfall period increases. The snow cover is mostly formed at the end of September and by the end of May it is gone. In the area of the main ridge, the period of snowfall lasts, on average, 250 days. Within the general flow of air, the wind conditions of Demanovska Valley are influenced by the orographic increase or decrease of the wind. The average wind speed increases with increasing altitude. The ridge areas are dominated mainly by north-south flow (or sometimes from the southwest and northwest) (Savrnich, 1978).

Demanovska Valley is drained by the river Demanovka (left tributary of the Vah river) and its tributaries Zadna voda and Priečný potok. Demanovka has a length of 18.3 km and flows into the Vah river in the Liptov basin, west from Liptovský Mikuláš. It springs under Krupova hola, takes a left tributary Lukova, which springs under Chopok, and from the right side takes Podrozianka and Krcahovo. Then it takes Priečný potok from the left side on the western edge of Lucky, springing also under Chopok. The Demanovka river flows to the karst region in Lucky (950 m), where it is – depending on the intensity of flow – partly or fully immersed into the underground. Zadná voda springs under Polana and takes on tributaries Hlboka, Vysna and Nizna Sulkovianka, Kobylia, Ploska and, before the entrance into the karst area, it takes Otupianka from the right, flowing from the hills of Dereše. At the height of 839 m a.s.l., part of the water dives underground and flows in the lower parts of the Stefanova cave (Malik et al., 2013). In the underground, it flows into Demanovka. In the karst area (Lucky and Repiska area) the water flows, depending on the intensity of flow, completely or partly into the underground through dives. On the surface, only a dry trough remains, inundated by persistent rainfall or during spring snowmelt (Savrnich, 1978).

Demanovka and its tributaries have participated in the formation of the Demanovska cave system – the system of nine levels (Bella et al., 2014). The entire submersible water in the Cave of Liberty connects to the underground flow of Demanovka, which also flows through the cave Vyvieranie in karstic seepages called Vyvieranie. The seepage of Demanovka (791 m) and its flow rate depends on the number of percolating and plunging water oscillating between 4 l s⁻¹ and 3499 l s⁻¹. The total length of the underground flow of Demanovka – from massive waterline to the seepages – is about 3 km. After coming back to the surface, Demanovka leaves the Low Tatras and enters the Liptov basin at an elevation of 700 m. The average annual flow rates at the mouth of Demanovka in the Liptov basin in the years 1969 to 2009 were 812–1861 l s⁻¹ (Blaškovičová et al., 2011). Almost the whole Demanovska Valley belongs to the highlands of snow-rain drainage regime with high water levels in April–June, the highest flow rates in May and the lowest flow rates in January and February. The areas of the main ridge of Low Tatras have a transient snow drainage regime of high water levels in April–July or August, the highest flow rates in May and June and the lowest flow rates in January and February. The

average annual runoff is 25 to 35 l s⁻¹ km² (Savrnich, 1978). In the valley of Zadna voda, a tarn called Vrbické tarn is situated. It is 4.16 metres deep, has an area of 6873 m² and it is the largest natural lake in the Low Tatras. Smaller lakes are in the glacial kettles of Lukova and under Derese.

Depending on the differences in the rock substrate, terrain relief and climatic conditions in Demanovska Valley, several soil types have been created. On the basis of the crystalline complex, above the forest line, we find the Lithic Leptosols modal, accompanied by the cambisols, podzols and local podzolic soils. The humus horizon of these soils is strongly gravelled and stony. Up to 1400–1500 m there are widespread podzolic soils Cambisols, accompanied by Lithic Leptosols soils. Depending on the relief there are different subtypes of rendzinas on the carbonate base (Saly, Surina, 2002). Depending on the geological structure of the area, various types of soils have been created. On crystalline rocks, sandy-loam soil developed, whereas on limestone and dolomite, clay-loam soil formed. On the alluvial sediments we find aluminium-sandy soils. Overall, mostly clay-loam soils are represented in Demanovska Valley (Savrnich, 1978).

In terms of the phytogeographical division of Slovakia (Futak, 1980), Demanovska Valley belongs to the Western Carpathian flora (*Carpaticum occidentale*), to the circuit of flora of the high (central) Carpathians (*Eucarpaticum*) and its district of Low Tatras. The majority of Demanovska Valley is covered with forests. On the territory there are alpine communities on silicates, subalpine mountain pine communities on acidic substrates, spruce-blueberry forests, fir and spruce-fir forests, spruce-pine forests with occurrences of larch, and in the east there are dropped beech forests in mountainous areas. The vegetation is divided into several stages. Fir-beech zone up to 800–850 m, fir-beech and spruce, which goes up to 1000–1050 m; spruce degree extends up to 1400–1500 m; dwarf pines degree extends to an altitude of 1800 m and is followed by alpine meadows.

In terms of the zoogeographical subdivisions, the territory of Demanovska Valley belongs to the province of the Carpathian Mountains (*Montium Carpathorum*) – the Low Tatras circuit. Since the vegetation zones of Demanovska Valley are represented from the alpine zone to the foothill zone, it provides favourable conditions for different species. Apart from several species of beetles, butterflies, amphibians and birds; ungulates, for example deer (*Cervus elaphus*), roe deer forest (*Capreolus capreolus*), wild boar (*Sus scrofa*) and predators, for example brown bear (*Ursus arctos*), lynx (*Lynx lynx*) and wolf (*Canis lupus*) live here as well. Mountain marmot (*Marmota marmota*) and Tatra chamois (*Rupicapra rupicapra tatrica*) live in the high altitudes.

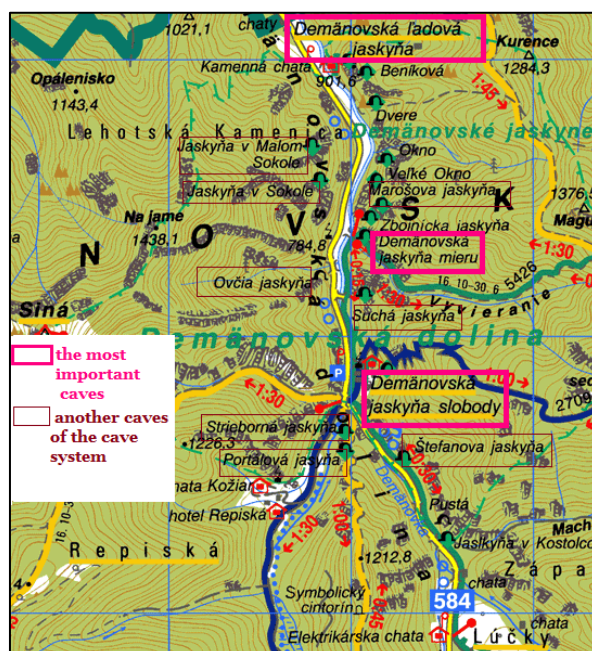
2.3 Tourism in Demanovska Valley

2.3.1 Cave system in Demanovska Valley

The first historical reference of the analyzed area dates from the 13th century. At the time, seekers of gold, silver and other metals began to appear and visit Demanovska Valley. The first written record of Demanovska Valley dates from the 5 December 1299, when the existence and discovery of the Dragon caves (Ice cave today) was first documented. The first human settlements in the valley were probably huts and shepherds' huts built by the coming shepherds and woodcutters. From about the 18th century, objects associated with mining of iron ore, in particular hematite and siderite, were created at the end of the valley. Mining was stopped in the 19th century, but the trails and some of the submerged tunnels remained. In the early 20th century, the valley began to be associated with the development of tourism, mainly due to the discovery and the making available of the caves. This was a major impulse for the development

of tourism in Demanovska Valley at this time. It initiated the construction of tourism facilities, such as transport, roads and buildings for essential services, and access walkways.

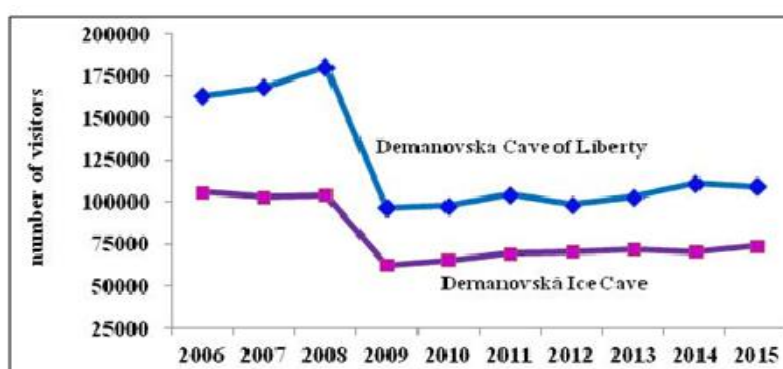
The cave system in Demanovska Valley is the largest cave system in Slovakia. This system comprises a complex of about 30 caves. The main core lies on the right side of the river valley of Demanovka. From a tourist point of view, the most important are: Demanovska Cave of Liberty and Demanovska Ice Cave (Figure 5).



Source: <http://www.nizketatry.sk/mapy/djslobody/djslobody.html> [online] [cit. 2016-11-10]

Figure 5. Cave system in Demanovska Valley

Although caves in Demanovska Valley attract high visitor numbers, these have had a stagnant character since 2009. Nevertheless, the Demanovska Cave of Liberty is the most visited cave in the Slovak Republic (Figure 6).



Source: Slovak Caves Administration, 2016[online] [cit. 2016-11-10] Available at: <http://www.ss.j.sk/sk/navstevnost-jaskyn>

Figure 6. Views of caves in the years 2006 – 2015

2.3.2 Resort Jasna Nizke Tatry

It was crucial for the development of tourism in Demanovska Valley to build the first chairlift from Jasna to Chopok in 1949 and subsequently a new recreational centre of winter sports (Rakytova, Tomcikova, Krticka, 2015).

In 1992, the company SKI Jasna, a.s. was established, the legal predecessor to TMR, by the National Property Fund of the Slovak Republic. In 2003, there was a change of trade name to Jasna Nizke Tatry, a.s. and in 2009, shareholders agreed to rename the company to Tatry Mountain Resorts, a.s. Just the change of owners of the resort led to rapid development. Demands on the quality of the ski resort were grown, and it led to its modernization (<http://www.tmr.sk/about-us/history/>) [cit.2016-11-10].

The obsolete lift was replaced with a new modern cable car. In 2012, the new FUNITEL was put into operation on the north side of Chopok peak and a new cable car on the south side, renewing the link between both sides of Chopok peak after a 15-year hiatus.

Currently, the centre is the largest and the most important tourist centre in Slovakia.

Table 1. Cablecars and Ski Lifts in ski resort Jasna Nizke Tatry at present

Cablecars/ Ski Lifts	Length in metres	Elevation in metres	Lower Station m a.s.l.	Upper station m a.s.l.	Capacity	Type
Priehyba – Chopok peak	2130	655	1349	2004	2480	Cabin
Grand – Brhliska	1960	312	1113	1425	2400	Cabin
Jasna – Priehyba	360	124	1225	1349	324	Cabin
Zahradky - Rovna Hola	1720	463	1028	1491	2700	Chairlift
Zahradky – Priehyba	1285	342	1038	1380	2400	Chairlift
Biela Put – Jasna	816	101	1117	1218	1800	Chairlift
Jasna – Lukova	1251	544	1126	1670	1800	Chairlift
Otupne – Lukova	1725	514	1156	1670	1200	Chairlift
Rovna Hola - Kinsky Grun	1720	352	1491	1843	900	Chairlift
Lucky – Vyhliadka	1879	344	943	1287	2460	Chairlift
Zahradky	750	198	1038	1236	900	ski lift
Pekna vyhliadka	908	295	1295	1590	800	ski lift
Jasna – Lukova	684	291	1240	1531	840	ski lift
Otupne – Zrkadlo	613	132	1170	1302	830	ski lift
Brhliska	324	28	1387	1415	400	ski lift
Otupne	405	69	1153	1222	500	ski lift
Children Ski Lift, Biela Put	70	4	1146	1150	150	ski lift
Children Ski Lift, Lucky	120	7	943	947	250	ski lift

Source: cablecars [online] [2016-11-10]. Available at: <http://www.lanovsky.sk/?page=lan>

In Demanovska Valley there are 13 lifts, 3 cablecars and 7 chairlifts (3 are six-seated, 3 four-seated and one two-seater), as illustrated in Table 2. Skiers have the opportunity to take a ride on all types of ski slopes at 28 ski slopes with a total length of 31,670 m (approx. 82 ha), of which 22,935 m (approx. 71 ha) could be artificially snowed by 240 snow points. From the 28 slopes, 51.6 % are easy, 35.7 % medium and 12.7 % difficult slopes (Table 2).

Table 2. Slopes in ski resort Jasna Nizke Tatry at present

slopes	number	Length (m)
TOTAL	28	31 670
BLUE easy	15	16335
RED medium	10	11320
BLACK difficult	3	4015
EVENING SKIING	1	990 m - Chopok north Biela Put
SNOW PARK	1	Chopok north Otupne
FREERIDE	12	12 free ride zones

Source: Jasna [online] [2016-11-10]. Available at: <http://www.nizke.sk/en/mountains/skiing/resort-information/>

Thanks to its all-year cableway operation, the Jasna resort offers a wide spectrum of sports activities even in summer – rides on mountain cars, scooters, or in the bike park, Nordic walking, a bungee trampoline, or lake boat rides. In the past three years, the resort has been focused on the development of cycling under the banner of the modern bike park Rocky Mountain Bike World Jasna. Thanks to its diversity, it offers trails of different difficulties. It makes use of the natural terrain and along with wooden obstacles and terrain adjustment it provides high quality mountain conditions and space for training and developing the skills of professional and less experienced riders, recreational cyclists, and for families with children it offers comfortable riding through the beautiful countryside, enjoying the views.

The highest-situated bicycle route in Central Europe was opened there in 2014. It leads from Jasna through Rovna Hola to Chopok. The trail culminates at an altitude of 2004 metres. [http://www.nizke.sk/en/bike-world-nizke/bike-world-Nizke/\[2016-11-10\]](http://www.nizke.sk/en/bike-world-nizke/bike-world-Nizke/[2016-11-10]).

There is also a family outdoor game prepared with new tasks and attractions of the Dragon Demian at Drakopark Chopok. So the resort has been transformed from a typical winter resort to a resort with year-round operation and use.

2.4 Accommodation facilities in the Demanovska Valley

The development of the centre has helped the development of accommodation facilities, especially hotels, guest houses and apartment houses. They began to form cottage settlements. Around the valley station and the intermediate station, hotel facilities, restaurants, and equipment for sports were built. In parallel, in the middle and lower part of the valley (Repiska, Tri Studničky) the construction of new buildings was started.

In terms of capacity, hotels have the dominant position (Table 3). 73.9 per cent of beds are located in hotels. Apartment houses make up 8.9% and pensions 6.5% of the total capacity of beds in Demanovska Valley. 10.8% goes to other types of accommodation (eg. bungalows, cottages, tourist accommodation).

Table 3. Hotels in Demanovska Valley

Category of hotel	number	hotels in %	beds	beds in %
hotel**	3	17,7	537	14.5
hotel***	8	47.1	1655	44.8
hotel****	6	35.3	1501	40.6

From the current 17 hotels in the resort, six originated in the period of 2005–2015, which makes up 35% of the total.

TMR currently invested in technical equipment for the resort, as well as in accommodation and catering facilities. It owns four 4-star hotels (Tri Studničky, Hotel Grand, hotel Rotunda on the top of Mt Chopok with a panoramic restaurant called Rotunda, Boutique Hotel Posta) and Apartments Chalets Jasna de Luxe ****. TMR also operate ten dining facilities.

In addition to the dining facilities, TMR also offers visitors multiple sport services – individual or group lessons with licensed instructors at the ski school.

In addition, under the brand name Tetry Motion, TMR built a business network of specialized stores with top brands of the ski and snowboard range, ski schools and sports equipment rentals. Tetry Motion branches are located at the valley station of the mountain resorts TMR. The theme park shops offer souvenirs and specialized summer and sporting goods (<http://www.tmr.sk/about-us/resorts/nizke-nizke-tetry/>) [2016-11-10].

3. ANALYSIS

3.1 Assessment of the attractiveness of Demanovska valley for tourism

Based on the statistical data we can conclude that the interest in Demanovska Valley continues to grow. The Figure 7 shows the positive fact that the number of visitors from Slovakia is growing gradually. Recalculating the representation of tourists in Demanovska Valley of statistical territorial units (NUTS 1 and 3) and local territorial units for statistics (LAU1), it is clear that within the district of Liptovský Mikuláš, it has a dominant position and a gradually increasing share in the Slovak Republic, respectively in Žilina Region (Table 4).

Table 4. Share of visitors in Demanovska Valley

share of visitor sof Demanovska Dolina from:	2005	2006	2008	2009	2010	2011	2012	2013	2014
all of visitors of Slovakia	2.8	2.6	2.1	2,0	2.7	2.7	3.1	3.4	3.5
all of visitors of Žilina Region	15.2	14.5	11.1	10,7	14.0	13.4	15.4	16.8	17.5
all of visitors of district Liptovský Mikuláš	34.2	33.6	28.4	28.7	36.4	32.6	35.4	36.8	36.9

Source: Regional Administration of the Statistical Office of the Slovak Republic in Žilina, 2015. Data was not available for the year 2007.

We processed an analysis of the tourist attraction of Demanovska Valley as a tourism destination in order to evaluate the level of development for the last 10 years. We used the indices based on different variables like the number of tourists, the number of beds in accommodation at the resort area (municipalities), or the population (formulas see chapter 2).

Analysis of tourist function indexes in 2005–2015 revealed that the development of tourism, as well as tourist activity in Demanovska Valley, is very high. Based on Defert's index (Table 6, Figure 9), it was found that the area of Demanovska Valley was crowded by tourists. The highest value of the index was noted in 2005 and the lowest in 2006. From that time, the value of Defert's index has remained approximately constant. (Figure 7, Figure 8)

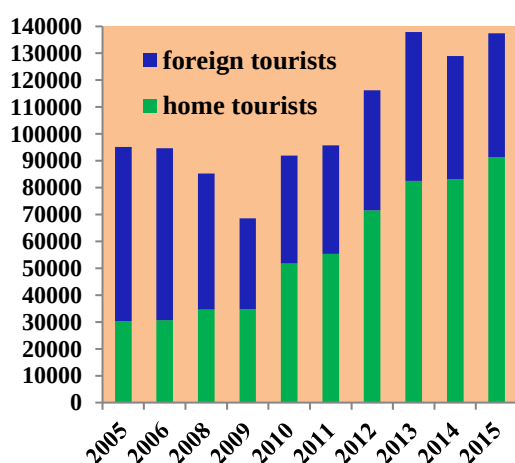


Figure 7. Number of tourists in D. Valley

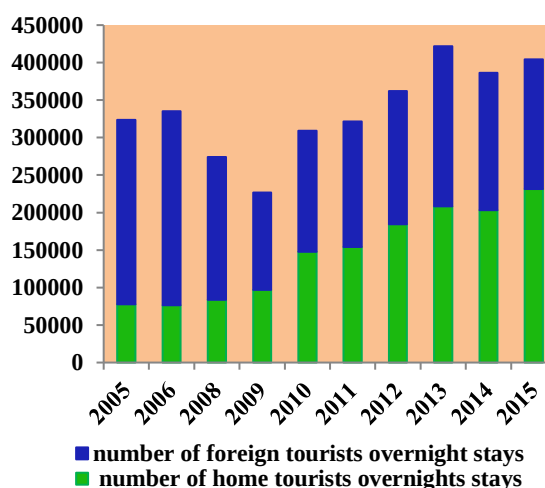


Figure 8. Number of overnight stays in D. Valley

Source: Regional Administration of the Statistical Office of the Slovak Republic in Žilina, 2016. Data was not available for the year 2007.

The index of tourist load has had a fluctuating character. An exception is 2008, when the tourist industry was hit by the global economic crisis (Figure 10).

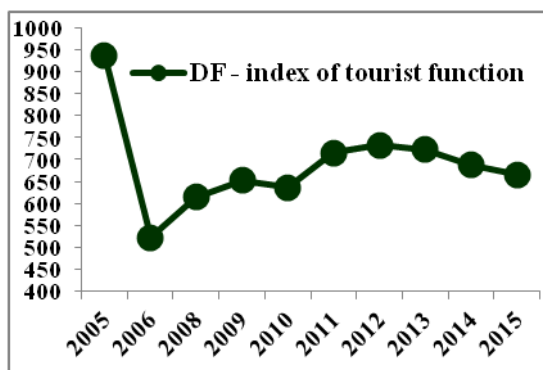


Figure 9. Index of tourist function in D. Valley

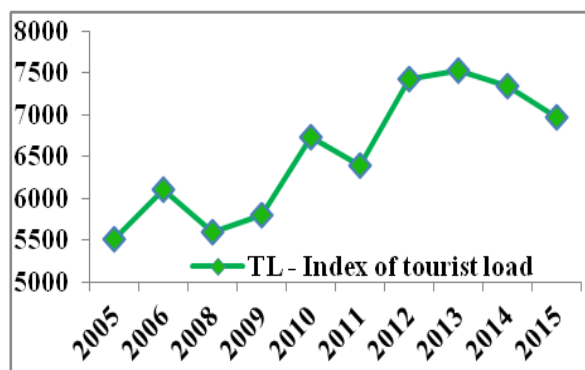


Figure 10. Index of tourist load in D. Valley

Indices reflecting the intensity of tourism in Demanovska Valley also showed high values (Figure 11).

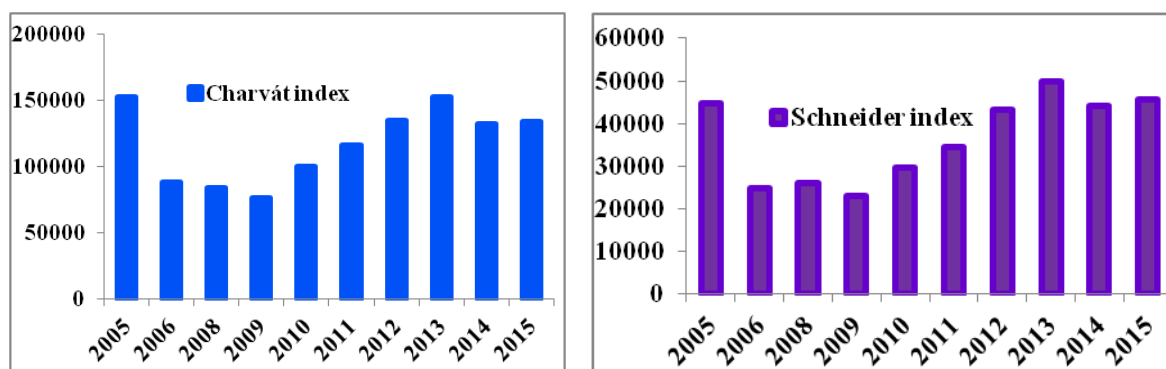


Figure 11. Charvat and Schneider index in Demanovska Valley

By comparison of the intensity index for Demanovska Valley with the data for all of Slovakia and lower administrative units (NUTS 2 and LAV1), it is clear that Demanovska Valley is strongly influenced by tourism. While its values of the Charvat index are in the range of 10000–160000, the rest of the Slovak Republic and Zilina are in the range of only 100–400. The district Liptovsky Mikulas has slightly higher values of the index (1000–1500), nevertheless they remain below the values of the analyzed area. (Table 5)

Table 5. Indices of the intensity of tourism for Slovakia, Zilina Region and District Liptovsky Mikulas

CHARVAT INDEX	2005	2006	2008	2009	2010	2011	2012	2013	2014
Slovakia	206.7	230.8	192.0	191.1	195.2	201.8	212.3	201.3	214.4
Zilina Region	301.8	324.7	364.5	302.5	306.2	323.7	329.3	347.5	311.0
District Liptovsky Mikulas	1269.7	1331.5	1390.3	1097.9	1155.3	1267.6	1338.1	1495.0	1351.5
SCHNEIDER INDEX	2005	2006	2008	2009	2010	2011	2012	2013	2014
Slovakia	63.7	66.5	75.6	62.5	62.5	66.2	69.8	74.8	68.8
Zilina Region	90.2	94.0	110.3	92.4	94.4	104.2	109.7	118.7	106.5
District Liptovsky Mikulas	377.9	383.4	409.7	325.7	345.0	405.2	451.9	516.3	481.5

A similar situation is also observed in the ratio of tourists to residents, where the values for Demanovska Valley are well above values for the other territorial units. Also, the tourist

penetration index has had an increasing value. This means that the number of tourists and their average length of stay in Demanovska Valley has been growing since 2005.

A high level of accommodation development influences the index of accommodation density.

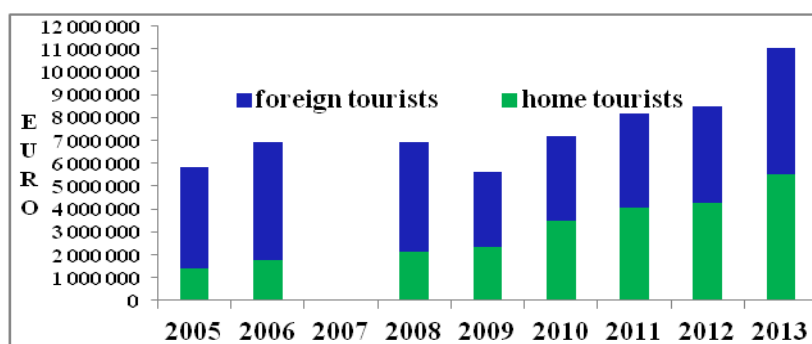
Data on how the village of Demanovska Valley has profited from tourism was available and published only for the period of 2011–2015 (DTD index). The valley received its highest income from municipality taxes for the accommodation of guests in tourist facilities and for parking (Table 6).

Table 6. Indices of tourism in Demanovska Valley

year	indices									
	DF	TL	CHI	SCHI	TPI	TDR	DTD	indices of accommodations density		
	index of tourist function	index of tourist load of area	Charvát index	tourist intensity rate	tourist penetration index	tourist density rate	degree of tourism development	number of beds per the area	number of rooms per the area	number of hotels per the area
2005	937.74	5508.88	152565.57	44857	4.18	18.51	x	55.09	19.73	0.27
2006	521.99	6102.40	87769.63	24789	2.40	19.20	x	61.02	21.82	0.27
2008	613.76	5600.84	83834.25	26076	2.30	15.70	x	56.01	20.67	0.31
2009	652.17	5793.10	75868.23	22915	2.8	12.99	x	57.93	21.42	0.33
2010	635.48	6727.27	99763.55	29658	2.73	17.71	x	67.27	23.55	0.33
2011	715.47	6390.80	115671.94	34449	3.17	18.41	1044.54	63.91	22.9	0.33
2012	732.84	7433.65	135045.90	43364	3.70	20.72	1376.04	74.34	26.31	0.33
2013	722.74	7519.33	152287.36	49800	4.17	24.15	1411.16	75.19	26.12	0.33
2014	687.67	7347.96	132288.36	44160	3.62	22.12	1248.89	73.48	25.71	0.36
2015	665.12	6971.79	134268.77	45677	3.68	23.14	1262.46	69.72	24.28	0.36

x ... data was not available.

The sales of the accommodation facilities are only available until 2013 (Figure 12). Since this time, new data has not been published. However, according to this data, profits have been increasing, which is associated with an increase in the number of visitors.



Source: Regional Administration of the Statistical Office of the Slovak Republic in Zilina, 2015

Figure 12. Sales for accommodation in euro

The increasing interest in Demanovska Valley is also reflected by the growth in the average accommodation price from 18 € to nearly 30 € (Regional Administration of the Statistical Office of the Slovak Republic in Zilina, 2015).

3.2 The development of tourism in Demanovska Valley and its impact on the environment

The territory of Demanovska Valley is significant in terms of natural heritage and conservation. More than 98 % of this valley is located in the Low Tatra National Park, which was founded in 1978, although efforts to protect natural values of this area date back to the twenties of the last century. The bulk of the valley falls into the ecological network of protected areas of the European Union's Natura 2000 bird area. In the central part we find the National Nature Reserve (NNR) Demanovska Valley (8.36 km²). There are also several Small Protected Areas (SPA): National Natural Monument (NPP) Demanovske Caves, which in 2006 was included into the Ramsar List of Wetlands of International Importance, Cave Okno, Stefanova cave and Vrbické glacial tarn.

The territory has a relatively high predisposition to geodynamic phenomena, especially landslides and potential water and gully erosion. These symptoms can be observed mainly in connection with the construction and reconstruction of ski slopes. In locations that are directly influenced by construction activities, significant changes in the structure and species composition within the plant community can be observed. The result is large erosion and transport of unstable soil and stony material, bad regeneration of grasslands, occurrence of ruderal vegetation and species not natural and original for this area. The construction of new ski slopes (Figure 13, 14) and the expansion of existing ones requires extensive deforestation. This is associated with the construction of new ski lifts, trenches for electrical cables, water supply, data infrastructure and other equipment associated with artificial snowing. As a result, the integrity of forests is disturbed and in many places, original soil and vegetation cover is replaced.



Figure 13. Construction of the new cablecar to Priehyba



Figure 14. Construction of the new cablecar to Chopok – FUNITEL

Also some parts of alpine meadows, especially close to the peak of Mt Chopok, have long suffered from human activities (Figure 15, 16). Problems have arisen from a great increase of tourists following hut, cableway and road construction during the past decade. The peak, which was previously difficult to reach, is today engulfed by hikers in the summer and skiers during the winter season, causing problems with trail degradation, mechanical damage to vegetation and soil erosion.

Tourists often deviate from the paths, thereby causing trampling of the original vegetation cover. Hike trails without plant cover are vulnerable to water and rill erosion. Bike World Jasna is one of the new activities in the research area, involving 5 downhill trails. Many parts of the trails use natural terrain along with wooden obstacles and terrain adjustment, some parts use forest roads and ski slopes.



Figure 15. The peak of Mt Chopok, Kamenna chata

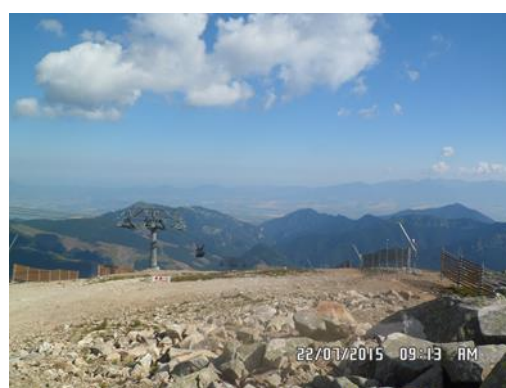


Figure 16. View from the top of Chopok cottage

Regeneration of such sites is problematic in many aspects. The construction of new accommodation and service facilities and new roads is also problematic. Despite the fact that end of the valley is already filled with a variety of accommodation, catering facilities and facilities serving the entertainment of visitors, construction of new recreational facilities is constantly being proposed.

Interestingly, it is no longer only the dominant investor – TMR, but also local associations of land owners who invest in real estate projects. Investments in the modernization of accommodation and catering facilities, ski infrastructure and premium services have led to an increase in the number of tourists. In addition, the resort annually organizes several spectacular events that abruptly burden the environment.

The visual image of the landscape is changing with the development of tourism. Infrastructure is being integrated into the structure of natural elements and architecturally changes the nature of the landscape. Typical anthropogenic linear structures of the territory are ski lifts and gondolas, which along with grassy slopes determine the characteristic appearance of the landscape. The excessive construction of recreational facilities, hotels, guest houses, apartment houses, and cottage settlements has also had a negative impact. Fragmentation of the forest has made the forest more susceptible to strong winds which have produced large clearings on the slopes of the valley (Figure 17, 18).



Figure 17. Zahradky centre



Figure 18. Otupne centre, cablecar Grand Jet

A frequently overlooked problem is noise pollution of ski resorts and their surroundings. The most significant impact on the fauna of the northern side of Chopok during the operation of the ski resort is the disturbance caused by the noise produced by skiers, hikers, snow cannons and grooming machines maintaining the ski slopes. Snow cannons often also operate during the night when their noise level reaches 60–115 dB. In recent years, the organization of various

activities and events on the ski slopes associated with loud music has contributed to the noise pollution. The facility Happy End providing evening entertainment of skiers is located directly in the resort centre.

Development is also related to transportation accessibility and traffic growth. A major problem is especially the fact that the only access road to the ski resort is the road II / 584 that goes through a deep narrow valley, where the exhaust gases remain longer. Parking is addressed by a system of multiple parking lots (Figure 19). Before entering the Valley, there is a parking lot for 650 cars and a ski bus (Figure 20) can be used to reach the resort (connection ten times a day during the winter season). Right in the village there are five other parking lots with a total capacity of 800 parking places.



Figure 19. Parking places in Demanovska Valley



Figure 20. Skibus from L. Mikulas to Jasna

4. CONCLUSIONS

Almost all of the most important winter tourism resorts in Slovakia are located in national parks and protected landscape areas. The model area – Demanovska Valley is located in the Low Tatra mountains, which are part of the NAPANT national park.

This resort has developed rapidly over the past 10 years. Today the resort Jasna Nizke Tatry has become the most important resort in Slovakia. As the largest ski arena with great conditions for winter sports in Slovakia, it offers endless opportunities for entertainment and active relaxation.

In 2014, the resort of Jasna, Low Tatras received five prestigious quality awards “Internationaler skiareatest”. In November 2014, the resort won the World Snow Awards in the category of fastest growing centre, “the best up and coming resort”. In November 2015, it was given the prestigious World Ski Award in the category “the best Slovak ski resort in 2015”. This award has included the centre in a group of the 24 best ski resorts in the world.

(<http://www.Nizke.sk/hory/lyzovacka/denne-aktuality/>) [2016-11-10].

However, uncontrolled tourism development causes a waste of natural resources. This brings a lot of pressure on the territory and leads to negative consequences such as soil erosion, rising pollution, unnecessary loss of natural resources, the disappearance of forests, etc. In the analyzed area, we consider the most serious environmental problems related to tourism development to be the erosion of soil cover, fragmentation of the landscape, changes in the visual image of the landscape, a growing number of visitors, new construction of tourist infrastructure, noise (related to the activity of visitors in the resort), traffic flow and new activities which are implemented (Bike World, skialpinism).

Finally, a few remarks:

- As shown by the overall assessment of natural conditions as well as material and technical equipment of the analyzed area, we can conclude that the attractiveness

of the resort will grow. This is evidenced by the fact that in 2016 the resort hosted the World Cup races in Alpine skiing for women.

- The private investor has had considerable impact on the centre, often at the expense of the environment (construction of new ski lifts, ski resorts, hotels).
- The indices evaluating the attractiveness of the area clearly show that the analyzed area will retain its dominant position on the market in the winter season and – by building the supporting infrastructure for summer activities – will become a first-class centre of tourism in Slovakia.

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