

## The popularity of show caves and their attractiveness: a comparative analysis of Slovakia and Czechia in the period of 1991 – 2023

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**Abstract:** Show caves represent significant geotourism sites that provide significant revenue sources, particularly in developing economies. Simultaneously, their fragile underground ecosystems offer unique opportunities for nature conservation, environmental education, and sustainable tourism practices. Slovak and Czech show caves share a common history regarding accessibility, protection, and management. However, the division of Czechoslovakia in 1993 introduced substantial differences in the administration of these sites. Although national organizations with similar principles manage show caves in both countries, a comparative analysis reveals notable differences in visit rates and attractiveness. This study applies a methodological framework combining comparative analysis and a scoring system based on five physical-geographical and five human-geographical attributes to evaluate the attractiveness of caves. The analysis included correlation methods and Likert scale-based point assessments. The findings indicate that Czechia shows higher absolute visit rates, lower average entrance fees, and better infrastructure. Slovakia, however, achieves higher relative visit rates per 1,000 inhabitants or tourists and offers unique sites such as the Ochtinská Aragonite Cave and Demänová Cave of Liberty. The COVID-19 pandemic significantly impacted visit rates in both countries, with Czech cave tourism recovering more rapidly. Results emphasize the necessity for effective marketing, sustainable management, and infrastructure investments to enhance attractiveness of caves and their economic viability as tourist destinations.

**Keywords:** show caves, popularity of show caves, attractiveness, visit rate, Slovakia, Czechia

### Introduction

Caves as noteworthy geo-localities play a significant role in the tourism industry and have not inconsiderable economic value. According to the research of Zieliński et al. (2022) their operation is not demanding for capital investment nor for labour force, but in the event of successful development this type of tourism can bring marked economic returns. In line with Chiarini et al. (2022) caves rank among the most visited natural attractions in the world, drawing in yearly over 70 million visitors to more than 1200 caves around the globe. These natural systems generate financial income of up to 800 million EUR and create more than 25 000 direct jobs. Cigna (2016) emphasizes that thanks to caves and their surrounding infrastructure, there is revenue for close to 100 million people. Cave tourism is a significant part of the economy in Czechia and in Slovakia as well, where it contributes to the development of local communities and supports employment in areas of high potential for natural and cultural inheritance.

Caves began to be accessible to tourists more than 400 years ago (Cigna and Forti 2013). According to Chiarini et al. (2022), although Slovakia and Czechia assume lower positions on the global rankings of show caves, the volume of caves in relation to the size of the countries ranks them closer to the top of the list. Slovakia, while it rates among the smaller countries

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of Europe, has within its territory more than 8000 examined caves (data from 2024). From this, 18 caves are show caves (Gessert et al. 2018), while the karst areas cover a surface of 2 700 km<sup>2</sup>, which represents roughly 5,5% of the territory of Slovakia. In Czechia, where karst areas account for less than 1% of the total surface area (Hromas and Bilková 1998), there can be found 4 000 caves and chasms, from which there are 14 show caves. Despite the many common characteristics of these central European countries, there are differences in both the operating and management of these show caves. In Slovakia and Czechia the caves are administrated by independent organizations – Slovak Caves Administration (SCA) and the Cave Administration of the Czech Republic (CACR), which also ensure monitoring of the visitors. These organizations regularly publish visitor reports on their official web pages ([www.ssj.sk](http://www.ssj.sk), [www.cave.cz](http://www.cave.cz)) and in specialized publications, such as the periodicals *Aragonit* and *Ročenky Správy českých jeskýň*. Published within these materials are concrete data concerning number of visitors, as well as partial analyses, which are documented in our literature review. The monitoring is mainly focused on aspects of touristic maintainability and cave protection, while the experts, such as Bella (2012) and the annual reports of SCA and CACR, are devoted to assessing the impact of tourism on these fragile natural systems.

In various countries, much research and study has been focused on the relationship between number of visitors to the caves and factors such as microclimate, CO<sub>2</sub> concentration and microbiological life (e.g. Liñán et al. 2009, de Freitas 2010, Lang et al. 2015), as well as the satisfaction of visitors to the touristic attractions (Shoval and Raveh 2003, Bočić et al. 2006, Nowacki 2013). The concept of environmental carrying capacity sustainability, or perhaps the sustainability of the caves has been a long term subject of monitoring in professional literature (Amavis et al. 1974, Aley 1976, Brucker 1976, van Cleave 1976, Forssell 1977, Middaugh 1977, Huppert et al. 1993). Within the framework of the problematic is research for optimization of visitor traffic and efforts to minimize the negative environmental impacts, which could threaten the long term sustainability of the caves as a tourist attraction. The aim is to achieve a balance between access to these natural systems and their protection, in order for them to also be preserved for the next generation.

Caves as a natural phenomenon are characterized by their diversity from the viewpoint of geographical positioning, the character and reasons for their protection, which is reflected in their popularity. This variability often depends on the geologic conditions (Kim et al. 2008, Telbisz and Mari 2020), infrastructure and accessibility (Antić et al. 2022), cultural and historical factors (Barbero-Barrera et al. 2014) or marketing strategies (Cigna and Forti 2013). These factors, influencing the popularity of the caves, play a key role in what the visitors decide. According to Gessert et al. (2018) a whole range of factors exist, which have varied importance for various groups or individual visitors. Amongst the most important factors is the positioning of the cave, accessibility of its entrance, the entrance fee, how rare the cave decorations are, its proximity to other tourist attractions, such as waterparks, ski centers or cultural sites.

Destination management plays an essential role in effectively running a tourist site and ensuring its long term sustainability. According to Ritchie and Crouch (2003), a strategic managing of destinations necessary to raise the competitiveness and attractiveness of a touristic location, while key factors include infrastructure quality, marketing strategies and visitor management. Also important is the destination image, which includes the impressions and thoughts, beliefs and experiences which overlap or connect in parallel with other emotional experiences of tourists, including their feelings (Lai and Li 2016), where various pieces of research are oriented toward evaluating the satisfaction of the visitors with cave marketing or a marketing mix (Paniandi et al. 2018). An interesting situation occurs when comparing various caves of various countries, where they take into consideration factors such as the development level of the tourism industry, political stability of the country, climate conditions, the quality of services on offer, or energy expenses. In this context, the attractiveness of the cave can

markedly differ for tourists as related to the wider factors which subsequently influence the number visits and significance, within the framework of what is on offer for tourists of given countries. Comparing attractivity and number of cave visits in Slovakia and Czechia it is especially relevant, because both countries share many common factors, a similar tourist trade, infrastructure and climatic conditions. Despite this, their destination image is seen differently abroad (Ooi 2004).

The overall number of visits to show caves in countries studied moves between 600 000 and 800 000 visitors. There was a marked drop in visits during the pandemic. According to the data from the Slovak Caves Administration (SCA) and the Cave Administration of the Czech Republic (CACR) from 2024, the number of visitors is gradually returning to an upward trajectory, but Slovakia currently is far from reaching its pre-pandemic levels. This trend indicates the gradual renewal of tourism in the caves, and at the same time the long term impact caused by the pandemic for tourism, especially in the context of visiting natural attractions.

Apart from shocks, such as economic crises, pandemic sickness or environmental catastrophe, which have marked impact on destinations and the number of visitors. The COVID-19 pandemic showed the vulnerability of tourism destinations, when the drop in visitor numbers in 2020 reached historic low levels (Gössling et al. 2020). According to Prideaux et al. (2020) the key measures for easing the impact are a diversity of offer, increasing digitalization and adapting to new preferences of tourists, and also many lessons stemming from the pandemic which may be applicable for resolving climate change or transforming the global economy to carbon neutrality. Unexpected events are quite complex, unforeseeable, and perhaps by definition unmanageable, and therefore according to Aldao et al. (2022) the interested parties in the destination (destination stakeholders) could draw from the knowledge of the brakes and catalyst factors identified during the COVID-19 outbreak, to be better adjusted for the next sanitary crisis and other disruptive occurrences affecting tourism. Regarding the resilience of the travel industry according to Butler (2018), it is key to implement adaptive strategies, such as flexible management, developing sustainable forms of tourism, which in the case of show caves such measures could include for example introducing innovative sightseeing routes, developing virtual tours or investing in infrastructure, which would improve accessibility and safety of the visitor. It is also important to monitor the environmental and social impact of tourism on the destination (Hall et al. 2015). For effective management of visitors, methods must be employed such as regular monitoring, reservation systems, and diversification of the offer based on seasonal trends (Brouder and Eriksson 2013), and these challenges of strategic planning also stimulate areas of the tourist trade, so that they keep adapting and are able to react to the changing contexts with the aim to preserve or even improve performance in areas such as competitive tourism (Hartman 2016).

The aim of the study submitted is to identify and analyze factors influencing visitor numbers and attractiveness of the show caves in both countries. We assess the marketing strategies, infrastructural and environmental measures, which may fundamentally affect an increase in attractiveness of the karst territories of Slovakia and Czechia. Emphasis is placed on identifying the most effective approaches, which support the visitor numbers, but at the same time respect the principles of sustainability and protection of a natural inheritance. Findings lean toward a better understanding of the role of caves in the tourism industry, not only as tourist attractions, but also as bearers of cultural and natural heritage with the potential to support the local economy and raise environmental awareness.

The first section of the study is focused on the evolution of visitor numbers in the years 1991 – 2023, with emphasis on the influence of significant historical milestones, such as entry to the European Union and NATO, the global economic crisis and the COVID-19 pandemic. This comparative analysis may indicate reasons of very changeable dynamics and its understanding may aid in stabilizing or rationally managing visitor numbers in the future. Results

may contribute to sustainable development of the tourism trade, which is key for preserving cultural heritage sites such as caves. The second section of the study presents research in the degree of attractiveness of show caves, where chosen attributes are analyzed affecting the popularity of individual localities. Utilizing such criteria in a study offers a deeper analysis of differences and similarities between Czech and Slovak caves and their potential to influence the popularity of individual caves.

## **Data and methodology**

The research area was the Central European countries of Slovakia and the Czechia, which were created in 1993 by the division of the former Czechoslovak Federal Republic by mutual agreement. These countries are close to each other not only historically and geographically, but also within their systems of state and public administration. Significant similarities are also evident in the management of show caves, which provides a suitable basis for comparative analysis. The geographical and cultural proximity of Slovakia and Czechia makes a comparison of the visitor numbers and attractiveness of caves in both countries justified and beneficial. This analysis can provide useful insights for more effective development of tourism potential in karst areas. Moreover, the comparative approach allows not only the identification of common trends but also specific characteristics that can be used to improve planning and sustainable tourism development.

In the initial phase of the research, we compiled a database of visitor numbers to show caves from both countries. We tracked the evolution of visitation from 1991 to 2023, with data obtained from public data published in the journal *Aragonit* (Nudziková 2001, 2002, 2003a, 2003b, 2009, 2014) and the SCA website, and directly provided by the CACR. Data on visitation to Czech caves as of 2023 have not yet been officially published, but a summary value was available through public media, such as Hradil (2024). Only show caves under the management of state organisations were included in the research. This selection was chosen due to the reliable availability of visitor data, which allows for a consistent comparison across both countries.

The selection of criteria or attributes that influence tourism attractiveness and annual visitor numbers has been supported by studies such as Gearing et al. (1974), Mariot (1983), Gessert et al. (2018), Mitra (2020), Kim et al. (2020) and Antić et al. (2022). In Slovakia, the issue of attractiveness has been addressed by authors such as Rybár (2010), Rybár, Baláž and Štrba (2010), and Štrba and Rybár (2015). Gearing et al. (1974) identified five main categories of attributes influencing the attractiveness of tourist destinations: (1) natural factors, (2) social factors, (3) historical factors, (4) recreational and shopping facilities, and (5) infrastructure, dining and accommodation.

We assessed attractiveness based on five physical-geographic and five human-geographic attributes. These may consciously or unconsciously influence potential cave visitors. To determine the level of attractiveness, we used (1) distance from a city with more than 50,000 inhabitants, (2) distance from Road 1. class, (3) additional tourism amenities of the region, (4) distance of the cave entrance from the parking lot, (5) height difference between the cave entrance and the parking lot, (6) type of trail in the cave (man-made/natural/partial), (7) length of the tour route in the cave, (8) entrance fee to the cave, (9) decoration, and (10) specificity of the tour route.

According to a study by McDonald et al. (2009), the position of a major urban centre strongly influences the popularity of show caves. Caves that are located more than 80 km from larger cities show lower popularity compared to those located near larger urban centres. Examples are the Ochtinská Aragonite Cave and the Špičák caves, which are more distant from major cities, compared to the more popular Punkevní or Belianska caves, which are only about 30 km from major urban agglomerations. Similarly, the distance from major transportation

routes has a significant impact on the number of visitors to tourist destinations, including caves. The accessibility and quality of transport infrastructure directly influence the attractiveness of a destination and the number of visitors (Ouariti and Jebrane 2020). According to Gunn (1979), and Popesku and Pavlović (2013), transportation is a key factor in tourism development, with proximity to major roadways, rail lines, and the availability of public transportation contributing significantly to increased visitation. In addition, Darcy et al. (2010) pointed out that the availability of transport, including quality road links, plays a key role in facilitating visits for a wider range of tourists. Complementary attractions play a key role in enhancing the attractiveness of regions (Swarbrooke and Page 2012), thus supporting overall visitation, including caves. In areas where natural and recreational attractions are combined, tourists are significantly more likely to visit multiple sites during a single trip. This approach leads to a synergistic effect that positively influences tourism in the area (Popesku and Pavlović 2013, Lobo and Santos 2022a). Distance from the parking lot or elevation affects visitor comfort and may discourage a certain portion of potential visitors, such as seniors, persons with disabilities, or parents with young children (Constantin et al. 2021). According to research (Garofano and Govoni 2012, Lobo and Santos 2022b), it seems that the type of walkway in a cave can also significantly affect its attractiveness and visitation. Factors such as trail surface and difficulty, physical accessibility, aesthetic and experiential effects, and safety of the tour are of key importance for tourists. The length of the tour route in a cave is an important factor influencing the attractiveness and visitation of a cave, but the effect can vary depending on visitor preferences, type of visitor, and type of cave. We also find differences among the caves we studied. The most popular Punkevní Cave in Czechia offers several possibilities of sightseeing routes with a total length of over a kilometer. The same is true in Slovakia in the Demänovská Cave of Liberty. However, the Demänovská Ice Cave or the Koněpruská Cave are also popular, which offer shorter sightseeing routes but are distinguished by their specific karst decorations. Another factor influencing the attractiveness and visitation of caves is the price of admission. Economic models of tourism often show that the price must be commensurate with the perceived benefits in order to maximise visitation (Candela et al. 2012, Tribe 2020, Sharpley 2020). For unique caves with rare karst phenomena, demand is less elastic when visitors are willing to pay a higher price, but for less unique caves, demand is more elastic, and a higher price may deter tourists, especially families or school groups. Karst decoration and its aesthetics, uniqueness and its lighting are often the main reasons why visitors prefer a particular cave (Gunn 2004, Hall and Page 2009, Antić et al. 2022). The specificity of the tour route, such as boating, adrenaline elements (e.g. rope bridges, climbing or abseiling), or innovative forms of tours (virtual or interactive tours), can significantly influence the attractiveness of a cave and its visitation which adds to its value relative to traditional tours (Hamilton-Smith 2003, Hall and Page 2009, Lobo and Santos 2022b).

We used a five-point Likert scale with scores ranging from 0 to 4 to assess attractiveness. Table 1 presents the point scale according to which we assigned values determining the level of attractiveness of each cave. The intervals for some attributes were chosen unevenly to highlight details in lower e.g. price categories or lower parking distance from the cave entrance. For higher price entry or greater distance, we used wider intervals to reflect the smaller number of caves in these categories. We set the rating of the region's additional amenities and the specificity of the tour route according to the degree of importance. We assigned (0 points) to a region's complementary tourism amenity rating if the cave is located in a region where basic tourism amenities are absent and the cave is significantly distant from the country's major tourism centers; (1 point) if the cave is more than 100 km from major tourism centers and the region has a very low proportion of overnight stays; (2 points) if the cave is within 80 km of major tourism centers and the region has a low proportion of overnight stays; (3 points) if it is within 60 km of major tourism centres and the region has a higher proportion of overnight stays; (4 points) if it is within 10 km of major tourism centres and the region has a high

proportion of overnight stays. For tour route specificity, we assigned (0 points) if it has none of the mentioned parameters; (1 point) if it has a reservation system or a choice of multiple tour routes or an unlit route or an underground cruise; (2 points) if a combination of the two occurred: reservation system and choice of tour routes, reservation system and cruise, reservation system and unlit route, choice of tour routes and cruise, choice of tour routes and unlit route, cruise and unlit route; (3 points) if a combination of three has occurred: reservation system and selection of sightseeing routes and cruise, reservation system and cruise and unlit route, selection of sightseeing routes and cruise and unlit route, reservation system and selection of sightseeing routes and unlit route, reservation system and selection of sightseeing routes and unlit route; (4 points) if it has all four parameters.

The most attractive cave is considered to be the cave with the highest score, while the cave with the lowest score is considered to be the least attractive. A cave could achieve a maximum score of 40 if it met all the attributes assessed with the highest possible score. This maximum reflects not only the attractiveness to tourists, but also the overall complexity of the experience and infrastructure offered by the cave. In our research, the maximum level of attractiveness achieved a rating of 28 points, with a minimum level of 18 points. Within the range of these scores, we determined the basic levels of attractiveness as follows: very high level of attractiveness for scores between 28 and 26 points, high level of attractiveness for scores between 25 and 23 points, and low level of attractiveness for scores between 22 and 20 points, and the lowest level of attractiveness for scores less than 20 points.

**Tab. 1.** *The scores given in terms of the level of attractiveness of the show caves*

Number of points	Human-geographical attributes			Physical-geographical attributes			
	Distance from a city with 50 000 inhabitants (km)	Distance from 1st class roads (km)	Admission to the cave (Euro)	Distance of the entrance from the parking lot (km)	Height difference between entrance and the parking lot (m)	Trail type	Length of the hiking trail in the cave (km)
0	more than 80	more than 27	more than 25	more than 3.5	more than 240	artificial	0.0 – 0.2
1	61 – 80	21 – 27	18 – 24	2.7 – 3.5	181 – 230	–	0.3 – 0.5
2	41 – 60	14 – 20	12 – 17	1.8 – 2.6	121 – 180	partial	0.6 – 1.0
3	21 – 40	7 – 13	6 – 11	0.9 – 1.7	61 – 120	–	1.1 – 1.6
4	0 – 20	0 – 6	0 – 5	0.0 – 0.8	0 – 60	natural	1.7 – 2.3

## Show caves in Slovakia and Czechia in an overview

### *Show caves in Slovakia*

Since 1970, the Slovak Caves Administration (SCA) has been managing and improving the show caves of Slovakia, which has gone through turbulent periods during its existence. In the period 1981-1990 it underwent a loss of its identity and even in the period 2000-2004 it temporarily lost its name and functioned as part of the State Nature Conservation Centre (Zuskin 2021). The SCA builds and maintains the entrance areas and their technical facilities, provides guiding activities, carries out monitoring, documentation and research of the caves, protection and maintenance of the caves themselves, and educates the public through various programs and varied forms of environmental education.

The area of karst territories in Slovakia is approximately 2 700 km<sup>2</sup>, in which there are more than 8 000 caves. The most important karst areas include the Slovak Karst, the Spiš-Gemer Karst, the Low Tatras, the Belianske Tatras, the Greater Fatra and the Kozie chrbty Mts. There are currently 13 caves in the SCA administration (Table 2).

**Tab. 2.** Basic data on caves in the SCA administration

No.	Cave name	Area	Length (m)	Tourist path (m)	Year of the opening	UNESCO location
1.	Belianska Cave	Belianske Tatras	3 829	1 370	1882	No
2.	Brestovská Cave	Western Tatras	1 890	217	2016	No
3.	Bystrianska Cave	Low Tatras	3 531	580	1968	No
4.	Demänovská Cave of Liberty	Low Tatras	11 117	1 150/2 150	1924	No
5.	Demänovská Ice Cave	Low Tatras	2 445	650	1847	No
6.	Dobšinská Ice Cave	Slovak Paradise	1 491	515	1871	Yes
7.	Domica Cave	Slovak Karst	5 368	780/930	1932	Yes
8.	Driny Cave	Little Carpathians	680	450	1935	No
9.	Gombasecká Cave	Slovak Karst	3 057	285	1955	Yes
10.	Harmanecká Cave	Great Fatra	3 123	1 020	1950	No
11.	Jasovská Cave	Slovak Karst	2 811	720	1846	Yes
12.	Ochtinská Aragonite Cave	Slovak Ore Mountains	585	300	1982	Yes
13.	Važecká Cave	Low Tatras	530	235	1934	No

*Source: SCA (2024)*

Caves differ from each other by the location, type or character of a natural feature of the cave. Belianska Cave is the only one in the High Tatras and is one of the first electrically illuminated caves in Europe (Švecová 2017). Brestovská Cave is the last cave to be opened in 2016 and is exceptional in the way it is opened, as there is no artificial lighting in the cave. Visitors will therefore experience the tour with a helmet and headlamp in small groups (max. 15 people), so this cave does not even have the prerequisites for massive attendance. Bystrianska Cave is typical for its specific rock formations and sinter forms such as curtains, waterfalls and stalactites. Demänovská Cave of Liberty is one of the most visited caves, it has two circular routes in massive passages, halls and domes (short and long), which attract more adventurous visitors (Bella 2011). The Demänovská Ice Cave has been widely visited in the past due to its rich ice decorations. Unfortunately, this decoration is now a thing of the past due to weak winters and warming temperatures. The only show cave that currently has ice decorations is the Dobšinská Ice Cave, which is also one of the largest ice caves in Europe. In addition to floor ice almost 25 m thick, there are richly decorated halls with ice stalagmites, stalactites and waterfalls (SCA 2024). The only show cave in western Slovakia is Driny Cave, a predominantly fissure area with sinter fill (Bizubová et al. 2011). There are 3 show caves in the Slovak Karst. Domica Cave, on the south-western edge of Silická planina, is flowed by the underground watercourse Styx, on which, under favourable natural conditions, 140 m long cruises are offered to tourists. In the Gombasecká Cave, on the same plateau, the very fragile and long sinter straws, which reach up to 3 metres in places, are considered to be a special feature (Jakál et al. 2005). Jasovská Cave is an important roosting site for bats in Slovakia, where up to 19 species usually hibernate. A large part of the halls is richly decorated with sinter decoration. Near Rožňava in the Slovak Ore Mountains, it is possible to visit the unique Ochtinská Aragonite Cave. There are three generations of aragonite in the cave, the most visually attractive being that which forms long needles, spiral and curved helictites that form bush-like formations. Harmanecká Cave is typical of the ceilings, which are covered with white soft sinters containing 40-80% water. It can be found in the central part of Slovakia near the regional seat of Banská Bystrica. The well-accessible Važecká Cave is an important palaeontological site where the remains of the cave bear, which lived here during the Ice Age, have been found (Bella 2011).

All of the above-mentioned caves are national natural monuments. In 1995, the caves of the Slovak and Aggtelek Karst were included in the UNESCO World Heritage List. Domica

Cave, Gombasecká Cave, Ochtinská Aragonite Cave, Jasovská Cave and in 2000 Dobšinská Ice Cave were added to these caves. In addition to these caves, other sites in Slovakia have also been included in the UNESCO list, such as Drienovská Cave, Krásnohorská Cave, Hrušovská Cave, Snežná diera Cave, Zvonivá jama Cave, Obrovská Abyss and Diviačia Abyss.

The SCA manages a total of 13 caves, the other 5 belong to the so-called privately show caves, i.e. they are operated by private providers on the basis of a lease agreement (fig. 1). These are the Dead Bats Cave, Stanišovská Cave, Bojnická Castle Cave, Bad Hole Cave and Krásnohorská Cave.

### *Show caves in Czechia*

The care, protection and operation of caves in Czechia is overseen by the Cave Administration of the Czech Republic (CACR). The Czech Cave Administration was established in 2006 as a state contributory organisation, which includes 14 show caves (tab. 3). The Cave Administration of the Czech Republic ensures the operation of show caves and the access to underground spaces. Its main purpose is the protection and care of underground spaces. It also extends its professional activities in the sphere of exploration, research, karst protection and documentation of caves or other underground spaces. Although the karst areas in Czechia do not occupy such a large part, there are many important and interesting karst formations and caves, more than 3000 caves in total. The most developed karst area is the Moravian Karst, which lies north of Brno. There are more than 1 100 caves and karst phenomena. Other karst areas include the Bohemian Karst, Jesenický kras, Krkonoše Karst, Mladečský kras, Javůříčský kras, Hranický kras and others (CACR 2024).

**Tab. 3.** Basic data on show caves in the CACR administration

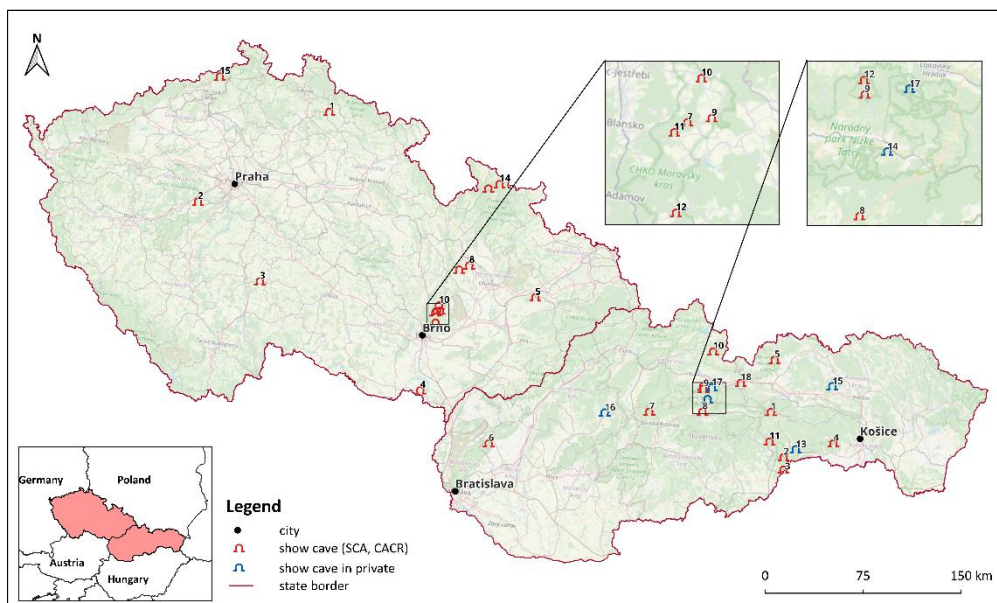
No.	Cave name	Area	Length (m)	Tourist path (m)	Year of the opening	UNESCO location
1.	Bozkov dolomite caves	Giant Mountains	1 060	400	1969	No
2.	Koněprus Caves	Bohemian Karst	2 050	620	1959	No
3.	Chýnov Cave	Bohemian-Moravian Highlands	1 400	260	1865	No
4.	Cave at Turoid	Pavlov Hills	1 650	280	1958	As a part of the site
5.	Zbrašov Aragonite Caves	Hostýn-Vsetín Highlands	1 240	375	1926	No
6.	Javoříč Cave	Bouzov Highlands	4 000	360/790	1938	No
7.	Punkva Caves	Moravian Karst	4 750	1 100/1 250	1914	No
8.	Mladeč Cave	Bouzov Highlands	1 250	400	1911	No
9.	Balcarka Cave	Moravian Karst	1 150	720	1925	No
10.	Sloupsko-Šošůvka caves	Moravian Karst	4 890	890/950/ 1 300/1 760	1890	No
11.	Catherine's Cave	Moravian Karst	950	580	1910	No
12.	Caves Výpustek	Moravian Karst	2 500	600/690	2008	No
13.	Caves on Pomezí	Hornolipovska Highlands	1 320	390	1938	No
14.	Cave on Špicák	Supíkovice Upland	410	220	1885	No

Source: CACR (2024)

The Chýnov Cave was opened to the public in 1868 and is considered the first cave in Czechia. The dominant feature of the cave is the variously-coloured decoration (yellow, ochre, grey-white, brown-red) and the spaces flowing through an active watercourse. Bozkovské dolomite caves are the longest dolomite caves in the republic. The dominant feature of the caves is the largest underground lake with an area of 24x14 m and distinctive sinter decoration (Ší-



rová and Šír 2021). The Zbrasov aragonite caves are characterised by a significant accumulation of CO<sub>2</sub> in their spaces. This has necessitated the construction of equipment that monitors and automatically extracts elevated carbon dioxide concentrations from the viewing route. Aragonite with its various needle-like forms, forms a unique decoration. The temperature is significantly higher than elsewhere (14°C) (Šimečková 2006). The symbol of the most extensive Czech cave system of the Koněprus Caves is the stalagmite Mohyla, which is considered to be the largest stalagmite in Czechia. It reaches a height of 7 m and at the starting point it reaches a diameter of up to 10 m. There is also the world unique so-called Koněprus rosettes, containing milk-coloured opal. These rosettes are more than 1.5 million years old. The caves of Na Pomezí are characterised by narrow, sometimes high passages and domes, where the highest dome reaches a height of 25 m. In the cave there are rich stalactite decorations, sinter straws, cascades, curtains, stalagmites and stalagmites. Characteristic are the large stalactites, which are heart-shaped. North of Jeseník is the Na Špicák cave, the oldest documented Czech cave open to the public and one of the oldest documented caves in Central Europe. Characteristic of this cave are the heart-shaped passages, which were formed by the melting waters of an ancient continental glacier. There are about 4 000 different inscriptions and drawings in the cave, the oldest of which dates back to 1519. The Katherine Cave contains a unique Bamboo Forest, which is made up of rod stalagmites and stalagmites resembling bamboo stalks. These stalactites are 2 to 4 cm in diameter and some reach up to four metres in height. Also worth mentioning is the extensive Main Dome, which is the largest accessible cave space in Czechia (Šírová and Šír 2021).



**Fig. 1.** Show caves in Czechia and Slovakia; Source: CACR (2024), SCA (2024)

Note: Slovakia: 1. Dobšinská ľadová jaskyňa, 2. Gombasecká jaskyňa, 3. Jaskyňa Domica, 4. Jasovská jaskyňa, 5. Belianska jaskyňa, 6. Jaskyňa Driny, 7. Harmanecká jaskyňa, 8. Bystrianska jaskyňa, 9. Demänovská jaskyňa slobody, 10. Brestovská jaskyňa, 11. Ochtinská aragonitová jaskyňa, 12. Demänovská ľasová jaskyňa, 13. Krásnohorská jaskyňa, 14. Jaskyňa mŕtvych netopierov, 15. Jaskyňa Zlá diera, 16. Bojnická hradná jaskyňa, 17. Stanišovská jaskyňa, 18. Važecká jaskyňa; Czechia: 1. Bozkovské dolomitové jeskyně, 2. Koněpruské jeskyně, 3. Chýnovská jeskyně, 4. Jeskyně Na Tuřoldu, 5. Zbrasovské aragonitové jeskyně, 6. Javoříčská jeskyně, 7. Punkevní jeskyně, 8. Mladečská jeskyně, 9. Jeskyně Balcarka, 10. Sloupsko-šošůvské jeskyně, 11. Kateřinská jeskyně, 12. Jeskyně Výпустek, 13. Jeskyně na Pomezí, 14. Jeskyně na Špicáku

Most of the show caves are concentrated in the Moravian Karst. Among the most famous and most visited caves is the Punkevní Cave, through which flows the active watercourse Punkevní. The sightseeing tour includes an underground cruise along this watercourse together with a visit to the bottom of the Macocha Abyss, which ranks among the most massive abysses in Central Europe (Zouharová 2017). Balcarka Cave is one of the caves with the most beautiful cave passages that form an underground labyrinth. The cave also stands out thanks to its colourful and varied stalactite decoration. The Sloupsko-šošůvské Caves are among the most extensive cave open spaces in Czechia. There are several abysses, of which the Nagel's Abyss, up to 92 m deep, stands out in particular. For adventurous visitors, the 1,300 m long adventure trail "In the footsteps of Nagel" is open, which takes tourists to the lower floor of the cave, to the active Sloupský Brook and also to the bottom of the Nagel's Abyss. The tour also includes the Kůlna cave, famous for the remains of Neanderthal man. The Výpustek cave has an unusual past, as its interior was marked by the mining of phosphate clay and was later used by the German and Czechoslovak armies. The dripstone decoration of the cave was destroyed and today it is preserved only in hard-to-reach places inaccessible to the public. Visitors can also see military workplaces with technical equipment of the Czechoslovak army, which were to be used in the event of a nuclear conflict. On the northern outskirts of Mikulov on the Tuřid Hill there is a cave called Na Tuřid. Its dominant feature is the so-called Tuřid decoration, which resembles coral reefs. The lowest part of the cave, the "Lake Hall", is regularly flooded with groundwater. As a result, emerald green pools form here (Šírová and Šír 2021).

## Results

### *Visitation rate*

According to Nudzikova (2020), caves are among the important economic resources for the regions in which they are located. Visitation to caves depends on many factors such as politics or the political situation (domestic as well as national policies of the countries from which visitors come), tax policy, promotion and level of tourism development, pricing policy (tickets and the current exchange rate of a given country compared to another country's currency), but also global events, transport and public transport access, built access roads and parking facilities near the cave, geographic location, available form of complementary programme or other tourist attractions, infrastructure/facilities (e.g. accommodation facilities, restaurants), quality and prices of services in the region; weather and climate.

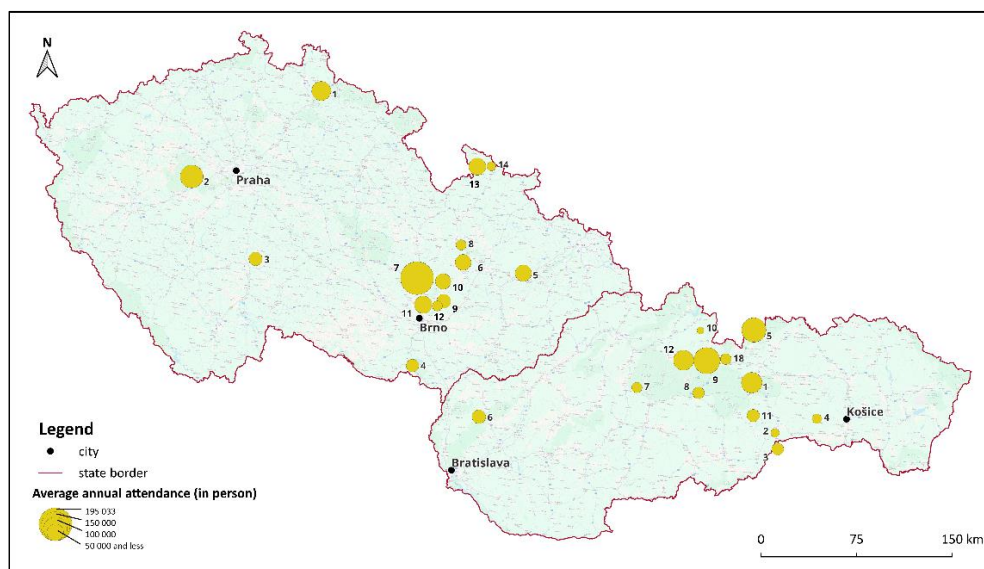
The opening times or the opening period of the caves also have a great influence on the level of visitation. In Slovakia, caves are closed in the winter months and reopen in the spring months, i.e. from February to May. Most of the caves are closed from November, the exception being the ice caves, which close in mid-September. While four caves in Czechia have year-round operation, none in Slovakia do. Other caves are closed in the winter months and open in spring (SCA 2024, CACR 2024). Thus, the length of the operating period of individual caves has a significant influence in the evaluation of the total number of visitors, which in Slovakia is up to 51 operating months per year compared to the Czech 23 months.

In the period 1991 – 2023, a total of 18.5 million visitors visited the show caves in Slovakia, which represents more than 560 thousand visitors per year (tab. 4). The most visited caves in Slovakia are the Belianska and Demänovská Cave of Liberty, which account for up to 2/5 of the popularity of Slovak cave tourism (fig. 2). However, the popularity of Czech caves is greater by more than 5.7 million visitors, which makes an annual average of up to 720 thousand visitors. Similarly to Slovakia, the two most visited caves in Czechia represent 2/5 of the total number of visitors. The most visited caves in both countries are located in important and most visited tourism areas (Kmeco 2016, Jarolímková 2018).

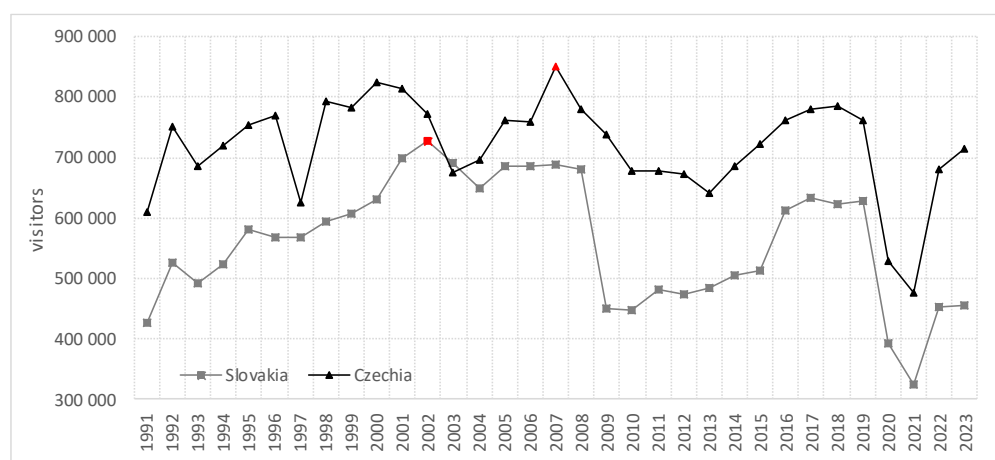
**Tab. 4.** Basic characteristics of cave tourism in Slovakia and Czechia

Country	Population in 2023 (million)	Total number of show caves	Total show caves path-ways (km)	Total cave length (km)	Total visitors in 1991-2023 (in millions)	Average annual visitors 1991-2023 (in thousands)	Total visitors in 2023 (in thousands)
Slovakia	5,4	13	9.9	38,9	18,5	561	456
Czechia	10,9	14	11.5	34,8	23,7	719	714

Source: SCA (2024), CACR (2024)



**Fig. 2.** Average annual number of visitors to show caves in Czechia (1991-2022) and Slovakia (1991-2023); Source: CACR (2024), SCA (2024)



**Fig. 3.** Cave visitation in Slovakia and Czechia, 1991-2023

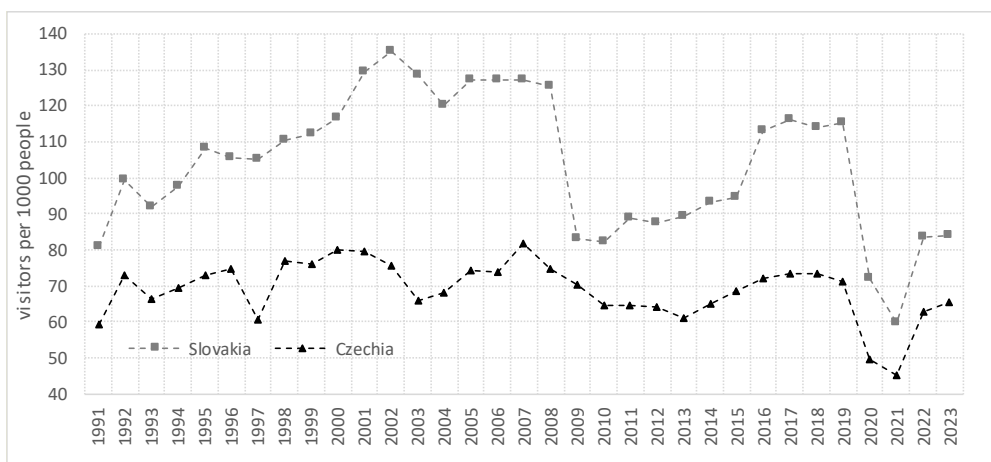
Source: SCA (2024), CACR (2024)

The development of the visitor numbers from the beginning of the observed period follows the increase of the visitor numbers until the beginning of the new millennium, with a short

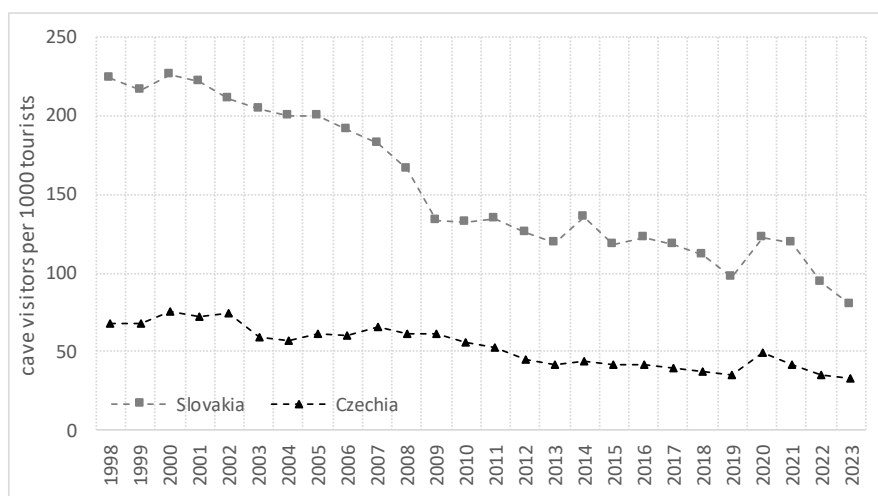
interruption in 1993 (fig. 3), when the decline may have been caused by the division of the Czechoslovak Republic into two separate countries, Slovakia and Czechia. The year 1997 was not favourable for Czechia in terms of cave visitation, when visitation dropped by almost 20% year-on-year due to a severe flood triggered by intense rainfall in the Moravian Karst region (Gáfríková 2022) and the year-long cave closure in this region. Further decline or interruption of continuous growth is observed in the early 21st Century, in Slovakia during 2003-2004 and in Czechia during 2001-2003. Following the 2001 terrorist attacks and the uncertainty associated with other geopolitical events, there was a global decline in tourism, including regional tourism (Bonham et al. 2006, Demiralay and Kilincarslan 2019, Arlou 2022). At the same time, in the early 21st century, countries are registering a slight economic slowdown, and also the lack of prioritization of tourism at the government level has been the cause of a decrease in competitiveness compared to other foreign destinations (Vystoupil et al. 2010, Smrčka et al. 2011). The aforementioned may have influenced the short-term decline in popularity. A further decline in the popularity of cave visitation was caused by the global economic crisis. While in Czechia the decline was gradual and less dramatic, in Slovakia a year-on-year decline of up to 34% was recorded. The crisis brought with it, among other things, high inflation and rising prices, deepening poverty and rising unemployment (Černaj 2022), and at the same time Slovakia adopted euro as a new currency in 2009, which had the effect of increasing the exchange rate differential between other currencies, which in turn had an impact on the decline of foreign tourists (Seben et al. 2020). The peak year for Czechia was 2007, i.e. before the outbreak of the global economic crisis, and for Slovakia was 2002, i.e. before the introduction of various economic reforms prior to joining the EU, when the popularity of caves was at its peak. Further fluctuations in visitation until the outbreak of the pandemic were caused by various reconstruction works or changed natural conditions in the caves.

The popularity of cave tourism in the two countries is very different, with Czech cave tourism far exceeding Slovak cave tourism. The ratio of cave visitation in Slovakia and Czechia between domestic and foreign tourists is probably different, but tends to show a predominance of domestic visitors. However, in the pre-modern period and also in recent years, Czechia has seen an increase in the number of foreign visitors, which is related to the increasing internationalisation of tourism and the improvement of marketing and infrastructure conditions. The situation is similar in Slovakia, where, despite the higher number of domestic visitors, Slovak cave tourism is one of the attractive destinations for tourists from countries such as Poland, Czechia and Hungary (SCA 2024). When comparing the total number of visitors in both countries with the population size of each country, Slovak cave tourism shows a higher number of visitors per capita in the period under review (fig. 4). At the same time, the population development in both countries is stable throughout the monitored development without significant fluctuations. The above development reflects that in both countries the population has not changed significantly during the period under review, which means that the growth or decline of cave tourism is not directly influenced by demographic changes. Rather, this shows that other factors such as improving economic conditions, tourism infrastructure, marketing and tourism trends also play a key role in the growing interest in visiting caves.

A comparison of cave tourism in relation to the overall visitation of the two countries yields different findings. Due to the increasing overall visitation of Slovakia and Czechia (SO SR 2024, CSO 2024), until the outbreak of the global pandemic, there was a significant decline in the share of cave visitation in both countries. This trend suggests that despite the overall tourism boom, interest in cave tourism has been declining. In a more detailed comparison of cave tourism in relation to the total number of tourists per country, Slovakia shows a significantly higher share of cave visits per thousand tourists in the period under review compared to Czechia (Fig. 5). This difference may be influenced on the one hand by the different attractiveness of caves in the two countries, as well as by the marketing and accessibility of cave destinations. On the other hand, however, it is the significantly higher overall visitation and attractiveness of Czechia, where the total number of tourists almost four times exceeds the total visitation of Slovakia.



**Fig. 4. Gross cave visitation rate per capita**  
Source: SCA (2024), CACR (2024), SO SR (2024), CSO (2024)



**Fig. 5. Gross cave visitation rate per tourist, 1998-2023**  
Source: SCA (2024), CACR (2024), SO SR (2024), CSO (2024)

#### COVID-19 influence on the visit rate

In the last period, the biggest impact on cave visitation was caused by the COVID-19 pandemic. In 2020, the anti-pandemic measures introduced to limit the spread of the disease caused the biggest historical decline in visitation. Even the gradual relaxation of these measures has failed to restore visitation to pre-pandemic levels. In Slovakia, the first pandemic year (2020) saw a 37.5% loss in attendance, but the biggest drop occurred in the second pandemic year (2021), when attendance dropped by 48% compared to 2019. 2021 also made history as the year with the lowest recorded attendance since the emergence of SCA in 1970, when attendance reached just over 325 000 visitors. The third pandemic year (2022) marked an improvement, but attendance still lagged nearly 28% behind 2019 levels. Even in the first post-pandemic year (2023), the situation did not improve significantly, and in 2024 the loss was

still around 25% of pre-pandemic levels. Thus, the recovery of visitation to Slovak caves in the post-pandemic period is very slow and still does not reach the level of the pre-crisis years. On the Czech side the losses were less dramatic. During the first two years of the pandemic, the visitation to Czech caves decreased by 31% (2020) and 37.5% (2021) compared to the pre-pandemic situation. In the final phase of the pandemic, the decline was more moderate - at 10%. In the post-pandemic period, Czech cave tourism shows a gradual growth and the latest data from 2023 show that the loss is only 6% compared to the pre-pandemic level. Czech cave tourism in the post-pandemic period reached the status of the average annual visitation (Fig. 3, Table 4) of the studied period in the popularity of caves, however, the Slovak traffic lags significantly behind in this evaluation. At the same time, the pandemic period affected the most touristically-frequented caves the most and, on the contrary, smaller losses were registered in less visited caves (see more SCA 2024, CACR 2024).

When comparing cave tourism in Slovakia and Czechia during the pandemic and post-pandemic period, it is clear that Czech cave tourism was less severely affected and has experienced a faster recovery, which is influenced by several factors, including differences in domestic tourism, the structure of visitors and the effectiveness of measures aimed at promoting tourism during the crisis, and last but not least by the geographical location of Czechia compared to Slovakia, which is closer to the war-affected Ukrainian border.

### *Status Attractiveness*

The evaluation of the attractiveness of the show caves was comprised of the sum of points assigned to individual caves managed by state organisations in the Slovak and Czech Republics. The points were awarded on the basis of a rating system we designed, which is detailed in tab. 1. This system includes ten key attributes that, consciously or unconsciously, influence the popularity of cave tourism.

The research of the Slovak caves shows that from the physical-geographical point of view the Demänovská Cave of Liberty and Domica Cave have the highest attractiveness. These caves are particularly attractive in terms of karst decoration, which is very rich. The Domica Cave also attracts visitors with its underground cruise, which has been carried out sporadically in recent years due to the low water table. The same number of points was awarded to the Ochtinská Aragonite Cave, which is highly attractive thanks to its aragonite decoration, and the Demänovská Ice Cave, which is specific for its ice filling. The above-mentioned caves also benefit from the proximity of the car park and the small height difference between the car park and the cave entrance. From a human geographic point of view, the Ochtinská Aragonite Cave scored the lowest precisely because of its disadvantageous location in relation to a larger urban centre, a road of greater importance or additional amenities. In contrast, the highest attractiveness from a human geographic assessment is Harmanecká Cave, which achieved the opposite ratings to Aragonite Cave. In the overall summary, the research highlighted Demänovská Cave of Liberty and Demänovská Ice Cave as the most attractive caves, distinguished by their specific karst decoration, which is the main factor in deciding which cave a tourist will visit. They also lie in a year-round tourist area of the Low Tatras, where a cave is a pleasant diversion for the visitor or a fill-in activity in case of bad weather. The Driny Cave, whose underground spaces are not very extensive with a short sightseeing route, has the lowest attractiveness. A summary on each of the assessed attributes of the show caves is provided in tab. 5.

However, the findings of the level of attractiveness of the Slovak caves do not fully correlate with the popularity of the caves. While the most attractive cave occupies a leading position in popularity, the least attractive Slovak cave is among the very popular caves, as it is the only show cave in western Slovakia and represents a key tourist site of the Little Carpathians.

**Tab. 5.** Evaluation of selected attractiveness attributes for Slovak show caves

No.	Cave name	Attribute										Points		
		1. (km)	2. (km)	3.	4. (km)	5. (m)	6.	7. (km)	8. (EUR)	9.	10.	HG	FG	Total
1.	Demänovská Cave of Liberty	64.6	10.50	4	0.40	73	U	2.15	12.0	2	1	11	13	24
2.	Demänovská Ice Cave	62.2	8.50	4	0.76	116	U	0.65	10.0	4	0	11	13	24
3.	Domica Cave	94.7	10.40	2	0.16	4	U	0.93	10.0	3	2	10	13	23
4.	Belianska Cave	28.2	0.03	4	1.00	144	U	1.37	12.0	2	0	13	10	23
5.	Dobšinská Ice Cave	30.0	0.04	3	0.92	166	U	0.52	12.0	4	0	12	11	23
6.	Bystrianska Cave	40.0	0.03	3	0.27	37	U	0.58	9.0	0	0	13	10	23
7.	Važecká Cave	26.9	1.40	4	0.00	7	U	0.24	8.0	0	0	14	9	23
8.	Jasovská Cave	30.4	10.00	1	0.18	11	U	0.72	10.0	2	0	10	12	22
9.	Brestovská Cave	80.5	15.60	4	0.20	39	Č	0.22	10.0	0	1	10	11	21
10.	Gombasecká Cave	80.9	1.70	2	0.13	26	U	0.53	9.0	2	0	9	12	21
11.	Harmanecká Cave	14.3	0.04	4	1.30	255	U	1.02	10.0	0	0	15	6	21
12.	Ochtinská Aragonite Cave	95.3	22.70	2	0.40	30	U	0.30	10.0	4	0	6	13	19
13.	Driny Cave	22.0	6.60	3	0.96	130	U	0.45	9.0	0	0	12	6	18

Source: own elaboration

The research of the Czech caves shows that from the physical-geographical point of view the Sloupsko-Šošůvské Caves (tab. 6) are the most attractive, as they are known for their large cave spaces with rich stalactite decoration. Their attractiveness is increased by the number of sightseeing routes, the close position of the parking lot and the negligible height difference between the parking lot and the cave entrance. Also from the human-geographical point of view, the Sloupsko-Šošůvské jaskyňa has the highest attractiveness, but also the Výpustek Cave, the Mladečská jaskyňa or the Punkevní jaskyňa, which are close to a larger urban centre. While Výpustek Cave and Punkevní Cave are about 30 km away from Brno, Mladečská Cave is about 25 km away from Olomouc. They also have an online entry reservation system in place. Punkevní Cave also offers an underground cruise. The lowest rating was achieved by Koněpruské jasky, which is considerably far from the higher traffic roads, without possible online booking with a choice of one tour route. The most attractive caves in the summative evaluation are the Sloupsko-Šošůvské Caves, where the advantages of a varied set of sightseeing routes, online booking, proximity to a major town, as well as a rich extensive karst interior came together. On the contrary, the least attractive caves were classified as Na Pomezí and Na Špicák. Both caves are located near the border with Poland, far from major urban centres, with less rich karst decoration and with only one tour route choice.

Similarly to Slovak caves, the level of attractiveness of Czech caves is not directly dependent on their popularity (fig. 5). The most attractive caves are often not at the top of the visitor rankings. For example, the most popular Punkevní Cave received one level lower attractiveness rating, which can be attributed to the higher elevation of the entrance and the relatively high price of admission. This discrepancy suggests that other factors also influence the cave's popularity.

The potential correlation between attractiveness and traffic can be observed in fig. 6. The Slovak caves, namely Demänovská Cave of Liberty and Belianska Cave, have the highest visitor numbers. The top three most visited caves are complemented by Punkevní jaskyňa in Czechia. However, by observing the level of attractiveness, we find that there is only a weak correlation between attractiveness and popularity of a cave. A direct correlation was therefore not confirmed, suggesting that other factors also influence cave visitation. These may include,

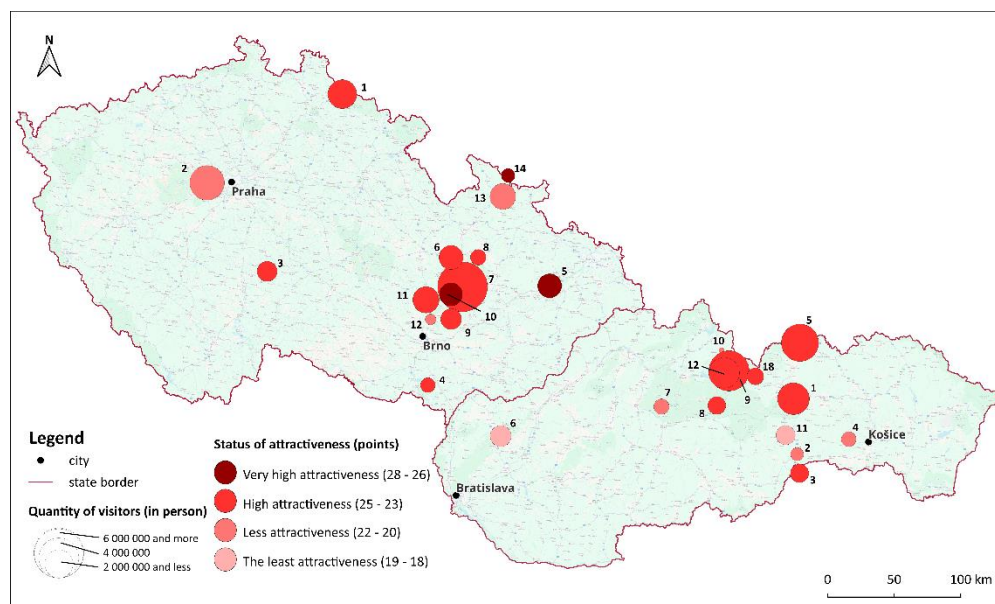


for example, location near major transportation hubs, the intensity of marketing activities, the availability of other tourist attractions in the region, or the socioeconomic background of tourists (Gunn 1979, Swarbrooke and Page 2012, Popescu and Pavlović 2013). The rule that the more attractive a cave is, the higher its visitation is not confirmed in this case, which underlines the complexity of factors that shape tourist behaviour. This inconsistency also opens up scope for further research focusing on specific motivational factors and their impact on visitation.

**Tab. 6.** Evaluation of selected attractiveness attributes for Czech show caves

No.	Cave name	Attribute										Points		
		1. (km)	2. (km)	3.	4. (km)	5. (m)	6.	7. (km)	8. (EUR)	9.	10.	HG	FG	Total
1.	Sloupsko-Šošůvka caves	38.60	14.40	4	0.20	13	U	1.76	8.5	2	2	14	14	28
2.	Zbrašov Aragonite Caves	41.10	2.10	3	0.46	27	U	0.37	8.0	4	1	13	13	26
3.	Cave at Tuřold	49.40	1.50	4	0.45	19	P	0.28	7.2	0	0	13	13	26
4.	Bozkov dolomite caves	38.40	14.80	3	0.73	50	U	0.40	8.0	4	1	12	13	25
5.	Catherine's Cave	31.50	16.10	4	0.19	7	U	0.58	5.9	2	1	13	12	25
6.	Punkva Caves	32.70	21.30	4	1.90	129	U	1.25	8.5	3	3	14	10	24
7.	Chýnov Cave	66.30	2.00	2	0.10	0	P	0.26	7.2	0	1	11	13	24
8.	Caves Výpustek	22.60	18.70	4	0.12	0	U	0.69	7.2	0	2	14	10	24
9.	Javůvč Cave	33.30	17.90	3	0.86	68	U	0.79	8.9	2	2	13	10	23
10.	Balcarka Cave	33.50	20.00	4	0.12	22	U	0.72	6.3	0	1	13	10	23
11.	Mladeč Cave	23.90	10.80	4	0.34	16	U	0.40	6.8	0	1	14	9	23
12.	Koněprus Caves	31.40	28.40	3	0.41	13	U	0.62	8.9	2	0	9	12	21
13.	Caves on Pomezí	86.20	0.00	3	0.00	0	U	0.39	8.0	0	1	11	9	20
14.	Cave on Špicák	84.80	1.90	3	0.00	0	U	0.22	6.8	0	1	11	9	20

Source: own elaboration



**Fig. 6.** Level of attractiveness of show caves in Czechia and Slovakia

Source: own elaboration, SCA (2024), CACR (2024)



## Discussion

Promotional activities or even inappropriate management (e.g. the effects of tourist trails on the cave environment, the quality of guiding services, accessibility or other attractions in the nearby region) can be recognised by the annual number of visitors to Slovak caves. Tourist visitation to caves and the level of their attractiveness is influenced by a number of factors such as the nature of the cave, the location of the cave, distance or services as additional leisure options in adjacent tourist regions (Gessert et al. 2018). The most attractive caves in Slovakia and Czechia are located in regions where cave tourism is not the main tourist attraction. Most tourists visit these regions for winter and summer tourism or just to enjoy the natural environment and culture of the area. Hu and Ritchie (1993) also state that tourist destinations are a bundle of tourism facilities and services that, like any other consumer product or service, contain multidimensional attributes that influence the attractiveness of a region to a particular individual. According to Nudzik (2020), a visit to a cave is only a supplementary or substitute program influenced by the current weather conditions. The financial revenues from tourism represent a significant contribution to the economies of both countries. Cave tourism also plays a significant role. The potential to promote show caves as a more important aspect of the economies has not yet been exhausted. Some of the destinations show a low level of support for tourism.

Tourism plays an important role in the global economy and cultural exchange, but its vulnerability to crisis situations was strongly demonstrated during the COVID-19 pandemic. Meanwhile, the return to pre-pandemic levels is very slow and uncertain. Globally, tourism was one of the most affected sectors (tourism industry) during the COVID-19 pandemic (Bakar, Rosbi 2020, Shkare et al. 2021, Vărzaru et al. 2021), where it was the restrictions and lockdowns that caused a dramatic decline in visits to tourist attractions, including caves. However, natural and rural destinations experienced less of a decline than urban areas and cultural sites, which was due to tourists' preference for safe and isolated environments during the pandemic (De Luca et al. 2020, Polukhina et al. 2021, Gierczak-Korzeniowska et al. 2021). At the same time, research by Barton (2020) led to the finding that in caves the virus would adsorb to limestone surfaces, further reducing the likelihood that these surfaces could serve as a source of virus transmission, and furthermore, the high humidity of the caves and the chemistry of the limestone surfaces inactivate adsorbed coronavirus particles, suggesting that limestone/rock surfaces or concrete pavements do not pose any specific hazard for contact transmission, but only non-porous surfaces such as plastics, metals or glass are more tolerant to coronavirus viability and tourism operators should focus on disinfecting infrastructure made of these materials. It appears that with more effective implementation of measures and better awareness of potential visitors, the recovery of cave tourism could have been accelerated and the decline in visitation mitigated. It should be added, however, that these investigations were only carried out after the pandemic outbreak, when questions about potential risks were raised. However, this knowledge can be very useful for possible future scenarios of a similar virus spread, thus improving preparations and mitigating negative impacts on tourism and visitor safety. As a result of the various anti-pandemic measures introduced to limit the spread of the virus, there has been a significant decrease in the number of visitors to Slovak and Czech caves. Even after their relaxation, visitor numbers have not been able to quickly return to pre-pandemic levels. The COVID-19 pandemic affected the most sought touristic caves the most, while less visited caves experienced relatively lower losses (SCA 2024, CACR 2024), indicating different dynamics of the impact of the pandemic on different categories of caves. Cave operations were interrupted during the most stringent measures, but even after their release in the summer months, visitation remained below the levels of previous years. Holub (2022) points out that tourism facilities located indoors, such as caves, tend to recover more slowly than outdoor tourist

attractions during periods of relaxed measures. Reduced visitation was influenced by the priority of health protection, where the possibility of observing a social distance played a significant role in tourists' decision-making.

A comparative analysis of Slovak and Czech show caves highlights key factors influencing their attractiveness and resilience as tourist destinations. Effective destination management is a cornerstone for increasing the competitiveness and sustainability of show caves, which could benefit from targeted marketing strategies and infrastructure improvements such as online booking systems and better visitor facilities, especially on the Slovak side. As highlighted by Ritchie and Crouch (2003), strategic management practices, including improved accessibility and a diversified offer, can significantly increase the attractiveness of a destination. The relatively higher visitation to Czech cave tourism reflects its robust infrastructure and promotional activities. Pandemics or economic crises underline the vulnerability of tourism-dependent destinations to external shocks. While both countries have experienced a decline in visitor arrivals, Czechia's more rapid recovery highlights the importance of adaptive measures such as promoting domestic tourism and maintaining flexible operating models (Gössling et al. 2020). Slovakia's slower recovery suggests the need for more resilience planning, including strategies into domestic tourism promotion, flexible operating models, and investment in marketing and digitalisation. Building resilience in show cave tourism involves both short-term adaptation measures and long-term sustainability planning. Strategies such as diversifying the visitor experience through virtual tours or alternative activities can mitigate the impact of crises and attract a wider audience, and these resilience-focused approaches, according to Butler (2018), can help destinations recover more effectively. The findings underscore the critical role of comprehensive management practices in mitigating risks and enhancing the attractiveness of geotourism destinations. By addressing infrastructure gaps, leveraging digital innovations, and fostering collaboration between stakeholders, cave tourism can not only recover from past failures, but also become a model for sustainable tourism development.

Many studies have also looked at the factors influencing the attractiveness of tourism facilities, but fewer studies have been devoted to measuring the level or degree of attractiveness. Gessert et al. (2018) looked at measuring the attractiveness of caves in Slovakia by determining an attractiveness index through multivariate statistical methods, and the findings are similar, with the most popular caves also representing the highest level of attractiveness, with the exception of Harmanecká Cave, which is among the less attractive caves in our assessment. The reason for the divergence is the difference in the sets of attributes used leading to the detection of the attractiveness level. In Poland, Zieliński et al. (2022) measured the level of attractiveness through more detailed environmental, cultural and touristic attributes, where the results lead to consistent findings that the level of attractiveness is not correlated to the level of popularity of the caves. Smocza Jama, which did not receive the highest level of attractiveness, is recognised as the most popular cave in terms of visitor numbers, but its high popularity is not due to its excellent speleological qualities, but to its very good and easy accessibility in a popular location near Kraków.

The highest ratings were achieved by caves located in important and sought-after tourism regions. These regions are naturally unique and have efficient services and facilities for potential customers. Cave tourism is not a primary tourist attraction, with the exception of Punkevní Cave in the Moravian Karst. Most tourists visit the mountains for skiing, hiking or just to enjoy the natural environment and culture of the area and therefore, also according to Hu and Ritchie (1993) and Lew (1987), tourist destinations are a package of tourism facilities and services, which like any other consumer product or service consist of multidimensional attributes that affect the attractiveness of a region, to a particular region individually. All of the top ranked caves occupy very convenient locations to tourist centres and major road routes. The less attractive show cave sites are located away from major roads and areas that do not offer more

varied tourist attractions. Based on these facts, Hochmuth (1997) argues that there is no relationship between cave attractiveness and visitation in Slovakia. Visitation should be supported by other tourist attractions, good transport accessibility and sufficient visitors; the cave is only a secondary destination or an alternative destination in bad weather.

The selected set of attributes has its limits, often subject to scientific criticism. The selection of attributes was focused on the conditions of the countries under study, but many tourism experts debate the set of considerations for a proper assessment of tourist attractiveness for different locations of the world. Some measure of the relative importance of these criteria must be established in determining tourist attractiveness. Studies (Quinn 2009, Ouariti and Jebrane 2020, Khairi and Darmawan 2021, Aronsson 2022) show that the uniqueness of the local people's way of life, historical attractions, museums and cultural attractions, communication, festivals/events also have an impact on attractiveness, but these criteria do not have a major impact as the rich scholarly discussion shows.

## Conclusions

Research on comparative analysis of show caves in Slovakia and Czechia has shown that these geotourist sites play an important role in the development of regional tourism and contribute to the protection of natural heritage. Despite many common characteristics, such as the historical and cultural heritage or the cave management system, the analysis showed several differences in the visitor numbers and attractiveness of these sites. Czech cave tourism, characterised by a higher absolute number of visitors and better accessibility to more sites, shows greater economic potential with more attractive caves in terms of geographical location, infrastructure, operations, additional services or effective marketing strategies. Nevertheless, Slovakia is characterised by high relative per 1 000 inhabitants visitation, and unique sites such as the Ochtinská Aragonite Cave or the Demänovská Cave of Liberty.

In recent years, cave tourism has shown a steady and positive trend of growth in visitor numbers, indicating a growing interest in this type of natural and cultural heritage. However, the well-developing cave tourism has been hampered by the COVID-19 pandemic, which has revealed the vulnerability of the sector and highlighted the need for rapid adaptation. While Czech caves have seen a relatively rapid recovery with a drop in visitation of only 6% compared to pre-pandemic levels, in Slovakia the gap remains as high as 25%. During the pandemic period, the most popular caves in both countries experienced the greatest losses in visitation.

The findings highlight the need for effective marketing and promotion, sustainable management and investment in infrastructure to increase the attractiveness and economic sustainability of caves as tourist destinations. Diversification and innovation of sightseeing routes or involvement of local communities targeted to support regional development are key factors to improve the attractiveness and sustainable development of show caves, and their implementation could contribute to a more competitive cave tourism in Central Europe. The results of the study can serve as a basis for the design of policies and strategies aimed at promoting the sustainable development of cave tourism in both countries.

## References

- ALDAO, C., BLASCO, D., POCH ESPALLARGAS, M. 2022: Lessons from COVID-19 for the future: destination crisis management, tourist behaviour and tourism industry trends. *Journal of tourism futures*. In print. DOI: <https://doi.org/10.1108/JTF-02-2022-0059>
- ALEY, T. 1976: Caves, cows and carrying capacity. *National Cave Management Proceedings*, 70-71.
- AMAVIS, R., SMEETS, J., BRANCA, G., BREUER, E., CIGNA, A. A. 1974: Development et application du concept de la capacité radiologique en radioprotection. *Proceedings Symp. Aix-en-Provence*, 583-592.

- ANTIĆ, A., VUJIČIĆ, M. D., DRAGOVIĆ, N., CIMBALJEVIĆ, M., STANKOV, U., TOMIĆ, N. 2022: Show cave visitors: An analytical scale for visitor motivation and travel constraints. *Geoheritage*, 14(2), 53. DOI: <https://doi.org/10.1007/s12371-022-00686-9>.
- ANTIĆ, A., TOMIĆ, N., MARKOVIĆ, S. B. 2022: Applying the show cave assessment model (SCAM) on cave tourism destinations in Serbia. *International Journal of Geoheritage and Parks*, 10(4), 616-634. DOI: <https://doi.org/10.1016/j.ijgeop.2022.10.001>.
- ARLOU, S. 2022: Impact Of Geopolitical Instability On The Development Of Tourism In The World, Including In Australia. *Journal of Pharmaceutical Negative Results*, 13(9), 3432-3438. DOI: <https://doi.org/10.47750/pnr.2022.13.S09.426>.
- ARONSSON, L. 2022: Living Environment and Attractiveness. In Svalastog, A. L., Müller, D. K., Jenkins I. eds. *Tourism as a Resource-based Industry: Based on the Work of Sondre Svalastog*, 118-125. DOI: <https://doi.org/10.1079/9781800621480.0010>
- BAKAR, N. A., ROSBI, S. 2020: Effect of Coronavirus disease (COVID-19) to tourism industry. *International Journal of Advanced Engineering Research and Science*, 7(4), 189-193. DOI: <https://dx.doi.org/10.22161/ijaers.74.23>.
- BARBERO-BARRERA, M. M., GIL-CRESPO, I. J., MALDONADO-RAMOS, L. (2014). Historical development and environment adaptation of the traditional cave-dwellings in Tajuña's valley, Madrid, Spain. *Building and Environment*, 82, 536-545. DOI: <https://doi.org/10.1016/j.buildenv.2014.09.023>.
- BARTON, H. A. 2020: Safe and effective disinfection of show cave infrastructure in a time of COVID-19. *International Journal of Speleology*, 49(2), 137-147. DOI: <https://doi.org/10.5038/1827-806X.49.2.2332>.
- BELLA, P. 2011: *Prírodné Krásy Slovenska-Jaskyne*. Trnava (Dajama).
- BELLA, P. 2012: Zraniteľnosť, ekostabilizujúce faktory a narušenie jaskynného prostredia. *Geografický časopis*, 64(3), 201-218.
- BELLA, P., HAVIAROVÁ, D., KOVÁČ, E., LALKOVIČ, M., SABOL, M., SOJÁK, M., STRUHÁR, V., VIŠŇOVSKÁ, Z., ZELINKA, J. 2014: *Speleologia Slovaca 4: Jaskyne Demänovskej doliny*. Bratislava (Štátne ochrana prírody SR – Správa slovenských jaskýň).
- BIZUBOVÁ, M., TURANOVÁ, L., RUŽEK, I. 2011: *Spríevodca k exkurzii Malé Karpaty*. Bratislava (Univerzita Komenského, Prírodovedecká fakulta).
- BOČIĆ, N., LUKIĆ, A., OPAČIĆ, V. T. 2006: Management models and development of show caves as tourist destinations in Croatia. *Acta Carsologica*, 35, 2, 13-21. DOI: <https://doi.org/10.3986/ac.v35i2-3.224>.
- BONHAM, C., EDMONDS, C., MAK, J. 2006: The impact of 9/11 and other terrible global events on tourism in the United States and Hawaii. *Journal of Travel Research*, 45(1), 99-110. DOI: <https://doi.org/10.1177/0047287506288812>.
- BROUDER, P., ERIKSSON, R. H. (2013). Tourism evolution: On the synergies of tourism studies and evolutionary economic geography. *Annals of tourism research*, 43, 370-389. DOI: <https://doi.org/10.1016/j.annals.2013.07.001>.
- BRUCKER, R. 1976: *Comments on carrying capacity*. National Cave Management Proceedings.
- BUTLER, R. 2018: Sustainable tourism in sensitive environments: a wolf in sheep's clothing?. *Sustainability*, 10(6), 1789. DOI: <https://doi.org/10.3390/su10061789>.
- CACR 2024: *Ročenka 1991-2022 Správy jeskyní České republiky*. Průhonice (Cave Administration of the Czech Republic). Retrieved from: <https://www.caves.cz/rocenky>.
- CANDELA, G., FIGINI, P. 2012: The Economics of Tourism Destinations. In: *The Economics of Tourism Destinations. Springer Texts in Business and Economics*. Berlin, Heidelberg (Springer). DOI: [https://doi.org/10.1007/978-3-642-20874-4\\_4](https://doi.org/10.1007/978-3-642-20874-4_4).

- CIGNA A. A. 2016: Tourism and show caves. *Zeitschrift für Geomorphologie*, 60(2), 217-233. DOI: [https://doi.org/10.1127/zfg\\_suppl/2016/00305](https://doi.org/10.1127/zfg_suppl/2016/00305).
- CIGNA A. A., FORTI P. 2013: Caves: The most important geotouristic feature in the world. *Tourism and Karst Areas*, 6(1), 9-26.
- CONSTANTIN, S., MIREA, I. C., PETCULESCU, A., et al. 2021: Monitoring human impact in show caves. A study of four Romanian caves. *Sustainability*, 13(4), 1619. DOI: <https://doi.org/10.3390/su13041619>.
- CSO 2024: *Population 1991-2023. Public Database*. Prague (Czech statistical office).
- ČERNAJ, T. 2022: *10 najdôležitejších ekonomických kríz v histórii ľudstva a kríza v roku 2020*. Retrieved from: <https://www.euroekonom.sk/ekonomika/hospodarska-kriza/10-naj-dolezitejsich-ekonomickych-kriz-v-novodobej-historii-ludstva/>.
- DARCY, S., CAMERON, B., PEGG, S. 2010: Accessible tourism and sustainability: A discussion and case study. *Journal of Sustainable Tourism*, 18(4), 515-537. DOI: <https://doi.org/10.1080/09669581003690668>.
- DE FREITAS, CH. R. 2010: The role and importance of cave microclimate in the sustainable use and management of show caves. *Acta Carsologica*, 39(3), 477-489. DOI: <https://doi.org/10.3986/ac.v39i3.77>.
- DE LUCA, C., TONDELLI, S., ÅBERG, H. E. 2020: The Covid-19 pandemic effects in rural areas. Turning challenges into opportunities for rural regeneration. *TEMA*, 119-132. DOI: <https://dx.doi.org/10.6092/1970-9870/6844>
- DEMIRALAY, S., KILINCARSLAN, E. 2019: The impact of geopolitical risks on travel and leisure stocks. *Tourism Management*, 75, 460-476. DOI: <https://doi.org/10.1016/j.tourman.2019.06.013>.
- FORSSELL, S. 1977: The concept of carrying capacity and how it relates to caves. In *Proceedings of the National Cave Management Symposium-Montana*.
- GÁFRIKOVÁ, E. 2022: *Povodeň 1997 den po dni: Bylo 23. července a zveřejnili děsivou bilanci*. Retrieved from: [https://www.denik.cz/z\\_domova/povodne-1997-2002-vyroci-den-po-dni-zaplavy-23-cervenec.html](https://www.denik.cz/z_domova/povodne-1997-2002-vyroci-den-po-dni-zaplavy-23-cervenec.html).
- GAROFANO, M., GOVONI, D. 2012: Underground geotourism: a historic and economic overview of show caves and show mines in Italy. *Geoheritage*, 4(1), 79-92. DOI: <https://doi.org/10.1007/s12371-012-0055-3>.
- GEARING, CH. E., SWART, W. W. & VAR, T. 1974: Establishing a Measure of Touristic Attractiveness. *Journal of Travel Research*, 22, 1-8. DOI: <https://doi.org/10.1177/004728757401200401>.
- GESSERT, A., NESTOROVÁ DICKÁ, J., SNINČÁK, I. 2018: The dynamics of tourist excursion ratios in Slovakia show caves from 2000 to 2014. *Geografisk Tidsskrift-Danish Journal of Geography*, 118(2), 173-183. DOI: <https://doi.org/10.1080/00167223.2018.1503552>.
- GIERCZAK-KORZENIOWSKA, B., SZPARA, K., STOPA, M. 2021: Regional tourism during the COVID-19 pandemic: Losses, missed opportunities and new developments for the tourism industry. *Turyzm/Tourism*, 31(2), 65-86. DOI: <https://doi.org/10.18778/0867-5856.31.2.04>.
- GÖSSLING, S., SCOTT, D., & HALL, C. M. 2020: Pandemics, tourism and global change: a rapid assessment of COVID-19. *Journal of sustainable tourism*, 29(1), 1-20. DOI: <https://doi.org/10.1080/09669582.2020.1758708>.
- GUNN, C. A. 1979: *Tourism planning*. Crane (Russak).
- GUNN, J. 2004: *Encyclopedia of caves and karst science*. New York (Routledge).

- HALL, C. M., PAGE, S. J. 2009: Progress in tourism management: From the geography of tourism to geographies of tourism—A review. *Tourism management*, 30(1), 3-16. DOI: <https://doi.org/10.1016/j.tourman.2008.05.014>.
- HALL, C. M., GÖSSLING, S., SCOTT, D. 2015: Tourism and sustainability: Towards a green(er) tourism economy? In Hall, C. M., Gössling, S., Scott, D. eds. *The Routledge handbook of tourism and sustainability*. London (Routledge).
- HAMILTON-SMITH, E. 2003: Karst and the biodiversity context. *Australasian Cave & Karst Management Assoc. J.*, 51, 18-20.
- HARTMAN, S. (2016). Towards adaptive tourism areas? A complexity perspective to examine the conditions for adaptive capacity. *Journal of Sustainable Tourism*, 24(2), 299-314. DOI: <https://doi.org/10.1080/09669582.2015.1062017>.
- HOCHMUTH, Z. 1997: Krasový fenomén a jeho vplyv na formovanie infraštruktúry turistického ruchu. *Urbánne a krajinné štúdie*, 2, 116-128.
- HOLUB, M. 2022: *Losses and profits in tourism during the Covid19 pandemic in Slovakia. Diploma thesis*. Košice (Pavol Jozef Šafárik University, Faculty of Science).
- HRADIL, M. 2024: *Jeskyním v Česku letos přibýlo návštěvníků. Léto jim ale nepřeje*. Retrieved from: <https://www.novinky.cz/clanek/cestovani-jeskynim-v-cesku-letos-pribylo-navstevniku-leto-jim-ale-nepreje-40484497>
- HROMAS, J., BÍLKOVÁ, D. 1998: *Jeskyně a krasová území České republiky: Přehledná mapa 1 : 500 000*. 1. Praha (Kartografie Praha).
- HUPPERT, G., BURRI, E., FORTI, P., CIGNA, A. A. 1993: Effect of Tourism Development on Caves and Karst. *Karst Terrains, Environmental Changes and Human Impact*. Catena Supplement 25, 251-268.
- HU, Y., RITCHIE, BRENT, J. R. 1993: Measuring Destination Attractiveness: A Contextual Approach. *Journal of Travel Research*, 32(2), 25-34. DOI: <https://doi.org/10.1177/004728759303200204>.
- HVIZDÁK, L., MOLOKÁČ, M., DREVKO, S., KRŠÁK, B., HLAVÁČOVÁ, L., SUKKE, A. 2014: Utilization possibilities of attractions of Slovak Karst to create Geopark. In Štrba L. ed. *Conference Proceedings Geotour & Irse*, 72-80.
- CHIARINI, V., DUCKECK, J., DE WAELE, J. 2022: A global perspective on sustainable show cave tourism. *Geoheritage*, 14(3), 82. DOI: <https://doi.org/10.1007/s12371-022-00717-5>.
- JAKÁL, J., BELLA, P., GAÁL, L., HLAVÁČ, J., KOVÁČ, L., LALKOVIČ, M., SOJÁK, M., ZELINKA, J. 2005: Jaskyne svetového prírodného dedičstva UNESCO. Liptovský Mikuláš (Správa slovenských jaskýň), 159 p.
- JAROLÍMKOVÁ, L. 2018: *Cestovní ruch České republiky*. Gerald Perry Marin. Retrieved from: <https://kth.vse.cz/wp-content/uploads/page/319/Cestovn%C3%AD-ruch-%C4%8Cesk%C3%A9-republiky.pdf>
- KHAIRI, M., DARMAWAN, D. 2021: The relationship between destination attractiveness, location, tourism facilities, and revisit intentions. *Journal of Marketing and Business Research (MARK)*, 1(1), 39-50. DOI: <https://doi.org/10.56348/mark.v1i1.32>.
- KIM, G., DUFFY, L. N., MOORE, D. 2020: Tourist attractiveness: measuring residents' perception of tourists. *Journal of Sustainable Tourism*, 28(6), 898-916. DOI: <https://doi.org/10.1080/09669582.2019.1708919>.
- KIM, S. S., KIM, M., PARK, J., GUO, Y. 2008: Cave tourism: Tourists' characteristics, motivations to visit, and the segmentation of their behavior. *Asia Pacific Journal of Tourism Research*, 13(3), 299-318. DOI: <https://doi.org/10.1080/10941660802280448>.

- KMECO, Ľ. 2016: Regionalizácia a stratégia cestovného ruchu na Slovensku. *Acta Universitatis Carolinae Iuridica*, 62(3), 157-168. DOI: <https://doi.org/10.14712/23366478.2016.44>.
- LAI, K., LI, X. 2016: Tourism destination image: Conceptual problems and definitional solutions. *Journal of Travel Research*, 55(8), 1065-1080. <https://doi.org/10.1177/0047287515619693>.
- LANG, M., FAIMON, J. EK, C. 2015: The relationship between carbon dioxide concentration and visitor numbers in the homothermic zone of the Balcarka Cave (Moravian Karst) during a period of limited ventilation. *International Journal of Speleology*, 44(2), 167-176. DOI: <https://doi.org/10.5038/1827-806X.44.2.6>.
- LEW, A. A. 1987: A Framework of Tourist Attractions Research. *Annals of Tourism Research*, 14(4), 553-75.
- LIÑÁN, C., VADILLO, I., CARRASCO, F. 2009: Carbon dioxide concentration in air within the Nerja Cave (Malaga, Andalusia, Spain). *International Journal of Speleology*, 37(2), 99-106. DOI: <http://dx.doi.org/10.5038/1827-806X.37.2.2>.
- LOBO, H. A. S., SANTOS, G. E. D. O. 2022a: Patterns of tourist use in Brazilian show caves: what do visitors think about it? *Turismo e Sociedade*, 15(1), 77-102.
- LOBO, H. A. S., SANTOS, G. E. D. O. 2022b: Visitation patterns in Brazilian tourist caves: what do the visitors themselves think? *Turismo e Sociedade*, 15(1), 77-101. Retrieved from: <https://revistas.ufpr.br/turismo/article/view/82722/49202>
- MARIOT, P. 1983: *Geografia cestovného ruchu*. Bratislava (VEDA).
- MCDONALD, R. I., FORMAN, R. T., KAREIVA, P., NEUGARTEN, R., SALZER, D., FISHER, J. 2009: Urban effects, distance, and protected areas in an urbanizing world. *Landscape and Urban Planning*, 93(1), 63-75. DOI: <https://doi.org/10.1016/j.landurbplan.2009.06.002>.
- MIDDAUGH, G. 1977: *Practical experiences with carrying capacity*. National Cave Management Proceedings.
- MITRA, S. K. 2020: A different perspective to measure tourism attractiveness. *Current Issues in Tourism*, 23(14), 1718-1722. DOI: <https://doi.org/10.1080/13683500.2019.1656711>.
- NOWACKI, M. 2013: *The Determinants of Satisfaction of Tourist Attractions' Visitors*. Poznań (Active).
- NUDZIKOVÁ, Ľ. 2001: Návštevnosť sprístupnených jaskýň v roku 2000. *Aragonit*, 6, 35.
- NUDZIKOVÁ, Ľ. 2002: Návštevnosť sprístupnených jaskýň v roku 2001. *Aragonit*, 7, 39.
- NUDZIKOVÁ, Ľ. 2003a: Návštevnosť sprístupnených jaskýň v roku 2002. *Aragonit*, 8, 44.
- NUDZIKOVÁ, Ľ. 2003b: Návštevnosť sprístupnených jaskýň v roku 2003. *Aragonit*, 9, 51.
- NUDZIKOVÁ, Ľ., 2009: Prevádzka sprístupnených jaskýň v rokoch 1999 – 2008. *Aragonit*, 14(2), 132-134.
- NUDZIKOVÁ, Ľ. 2014: Vývoj návštevnosti sprístupnených jaskýň na Slovensku od roku 2009. *Aragonit*, 19, 35-38.
- NUDZIKOVÁ, Ľ. 2020: Návštevnosť sprístupnených jaskýň v rokoch 1970 – 2020. *Aragonit*, 25(2), 103-105.
- OOI, C. S., KRISTENSEN, T. P., PEDERSEN, Z. L. 2004: Re-imag (in) ing place: From Czechoslovakia to the Czech Republic and Slovakia. *Tourism*, 52(2), 151-163.
- OUARITI, O. Z., JEbrane, E. M. 2020: The impact of transport infrastructure on tourism destination attractiveness: A case study of Marrakesh City, Morocco. *African Journal of Hospitality, Tourism and Leisure*, 9(2), 1-18.

- PANIANDI, T. A., ALBATTAT, A. R., BIJAMI, M., ALEXANDER, A., BALEKRISNAN, V. 2018: Marketing mix and destination image, case study: Batu Caves as a religious destination. *Almatourism-Journal of Tourism, Culture and Territorial Development*, 9(17), 165-186. DOI: <https://doi.org/10.6092/issn.2036-5195/7246>.
- POLUKHINA, A., SHERESHEVA, M., EFREMOVA, M., SURANOVA, O., AGALAKOVA, O., ANTONOV-OVSEENKO, A. 2021: The concept of sustainable rural tourism development in the face of COVID-19 crisis: Evidence from Russia. *Journal of Risk and Financial Management*, 14(1), 38. DOI: <https://doi.org/10.3390/jrfm14010038>.
- POPESKU, J., PAVLOVIĆ, D. 2013: Competitiveness of Serbia as a tourist destination: Analysis of selected key indicators. *Marketing*, 44(3), 199-210.
- QUINN, B. 2009: Festivals, events and tourism. In Jamal, T., Robinson, M. eds. *The SAGE Handbook of Tourism Studies*. London (Sage), 483-503.
- PRIDEAUX, B., THOMPSON, M., PABEL, A. 2020: Lessons from COVID-19 can prepare global tourism for the economic transformation needed to combat climate change. *Tourism Geographies*, 22(3), 667-678. <https://doi.org/10.1080/14616688.2020.1762117>.
- RITCHIE, J. B., CROUCH, G. I. 2003: *The competitive destination: A sustainable tourism perspective*. Wallingford (CABI).
- RYBÁR, P. 2010: Assessment of attractiveness (value) of geotouristic objects. *Acta Geoturistica*, 1(2), 13-21.
- RYBÁR, P., BALÁŽ, B., ŠTRBA, L. 2010: *Geoturizmus-Identifikácia objektov geoturizmu*. Košice (ES/AMS F BERG TU).
- SEBEN, Z., KORCSMAROS, E., MACHOVA, R., FEHER, L. 2020: Slovak Experience After 10 Years from the Introduction of the Euro as Globalization Factor. In *SHS Web of Conferences*, 74, 6027.
- 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>.
- SHOVAL, N. AND RAVEH, A. 2003: Categorization of tourist attractions and the modelling of tourist cities: based on the co-plot method of multivariate analysis. *Tourism Management*, 25(5), 741-750. DOI: <https://doi.org/10.1016/j.tourman.2003.09.005>.
- SCA 2024: *Caves attendance*. Liptovský Mikuláš (Slovak Caves Administration). Retrieved from: <http://www.ssj.sk/sk/navstevnost-jaskyn>.
- SMRČKA, L., ARLTOVÁ, M., SCHÖNFELD, J. 2011: Ekonomická krize a vývoj cestovního ruchu v České republice. *Acta Oeconomica Pragensia*, 5, 17-33.
- SO SR 2024: *Population 1991-2023. Database DATACube*. Bratislava (Statistical Office of the Slovak Republic).
- SWARBROOKE, J., PAGE, S. J. 2012: *Development and management of visitor attractions*. London (Routledge).
- ŠIMEČKOVÁ, B. 2006: Zbrašovské aragonitové jeskyně. In Šimečková, B. (ed.) *Ročenka správy jeskyní České republiky – Zpřístupněné jeskyně 2006*. Průhonice (Správa jeskyní České republiky), 29-30.
- ŠÍROVÁ, M. K., ŠÍR, J. 2021: *Podzemí České republiky*. Olomouc (Rubico).
- ŠKARE, M., SORIANO, D. R., PORADA-ROCHOŇ, M. 2021: Impact of COVID-19 on the travel and tourism industry. *Technological forecasting and social change*, 163, 120469. DOI: <https://doi.org/10.1016/j.techfore.2020.120469>.
- ŠTRBA, L., RYBÁR, P. 2015: Revision of the "Assessment of attractiveness (value) of geotouristic objects". *Acta Geoturistica*, 6(1), 30-40.



- ŠVECOVÁ, A. 2017: *To naj o slovenských jaskyniach*. Retrieved from: <https://nasavoda.sk/magazin/tury-a-vylety/to-naj-o-slovenskych-jaskyniach/>.
- TELBISZ, T., MARI, L. 2020: The significance of karst areas in European national parks and geoparks. *Open Geosciences*, 12(1), 117-132. DOI: <https://doi.org/10.1515/geo-2020-0008>.
- TRIBE, J. 2020: *The economics of recreation, leisure and tourism*. London (Routledge).
- VAN CLEAVE, P. 1976: Some thoughts on the carrying capacities of developed caves. *National Cave Management Proceedings*, 73-74.
- VÄRZARU, A. A., BOCEAN, C. G., CAZACU, M. 2021: Rethinking tourism industry in pandemic COVID-19 period. *Sustainability*, 13(12), 6956. DOI: <https://doi.org/10.3390/su13126956>.
- VYSTOUPIL, J., KUNC, J., ŠAUER, M., TONEV, P. 2010: Vývoj cestovního ruchu v ČR a jeho prostorové organizace v letech 1990-2009. *Urbanismus a územní rozvoj*, 8(5), 93-108.
- ZIELIŃSKI, A., MAREK, A., ZWOLIŃSKI, Z. 2022. Geotourism potential of show caves in Poland. *Quaestiones Geographicae*, 41(3), 169-181. DOI: <https://doi.org/10.2478/quageo-2022-0032>.
- ZOUHAROVÁ, I. 2017: *Moravský kras ukrývá nielen úchvatné jaskyne a priepasť Macocha*. Retrieved from: <https://www.invia.sk/blog/moravsky-kras-ukryva-nielen-uchvatne-jaskyne-a-priepasť-macocha/>.
- ZUSKIN, J. 2021: *Koncepcia riadenia a rozvoja Správy slovenských jaskýň*. Banská Bystrica: (Štátna ochrana prírody SR).

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