

## Chapter 2

# Transport accessibility as a factor of tourist flow in Croatian national parks and nature parks

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### *Abstract*

The aim of the chapter is to assess transport accessibility and examine its connection to tourist flows in Croatian national parks and nature parks. The research included 16 of the 19 Croatian national parks and nature parks, i.e. those for which it was possible to identify the entrances used by the majority of visitors. The assessment of transport accessibility for these 16 entrances to protected areas was conducted using the following indicators: a) public transport connectivity (bus, ship/catamaran/ferry); b) public transport frequency; c) road transport connectivity; d) temporal distance from cities/towns; and e) temporal distance from larger tourist centres. The scoring of individual indicators for each protected area was determined and the protected areas were ranked accordingly. In order to determine the connection between transport accessibility and tourist flow, a correlation analysis was conducted for each national park and nature park, with the transport accessibility score as the independent variable and the number of visitors as the dependent variable.

*Key words:* transport accessibility, tourist flow, national park, nature park, sustainable development, geography, Croatia

## Introduction

Although they are not considered to be a basis of tourism attraction, transport accessibility, transport connectivity, and transport infrastructure are highly significant preconditions for creating and developing a tourism destination (Prideaux, 2000; Kušen 2002; 2010; Čavlek et al., 2011). The intensity of tourist flow is often proportionate to transport accessibility, quality of transport connectivity, and infrastructure in a tourism destination. However, increasing traffic volume caused by the expansion of tourist travel in popular tourism destinations leads to ecological and financial challenges. Although the concept of sustainable tourism development, which facilitates spending leisure time in a clean and peaceful environment, is currently imposed as an essential approach to tourism destination management, it is becoming practically unachievable for more and more tourism destinations. Along with problems arising from high costs of transport infrastructure construction and maintenance (e.g. motorways, modern airports, quality rail network, cruise ship terminals, car parks), traffic in tourism destinations today frequently has a negative impact on the environment (Müller, 2004).

With the purpose of satisfying motives to spend leisure time in ecologically clean and peaceful surroundings and also learn about natural heritage, protected areas are becoming increasingly popular sights/destinations in the modern tourism and recreation supply. The rise of popularity of protected areas in the tourism demand is concurrent with the increase in conflicts between their transport accessibility and connectivity as preconditions for a higher number of visitors, and sustainable tourism development imperatives that require special attention in managing protected areas. It is noteworthy to emphasise that these areas are not characterised as protected for promotion of their most valuable parts of natural heritage, rather for their protection and preservation for future generations.

National parks and nature parks represent one of the largest and most visited categories of protected areas in Croatia in terms of surface area (Bralić, 2000; Klarić and Gatti, 2006; Opačić et al., 2014), so the conflicts between their transport accessibility as a factor of tourism flow and their sustainable development are most pronounced (Fig. 1).

According to data from the Nature Protection Database of the Ministry of Environment and Energy of the Republic of Croatia (2017), protected areas in Croatia encompass 7,528.03 km<sup>2</sup> (8.54 % of Croatian territory, including territorial seas). National parks (979.63 km<sup>2</sup> in total) and nature parks



Fig. 1 National parks and nature parks in the Republic of Croatia

(4,320.48 km<sup>2</sup> in total) together encompass 5,300.11 km<sup>2</sup>, i.e. 70.41 % of the entire area of all protected areas in Croatia, and in 2018 they were visited by 4,444,063 visitors (Ministry of Environment and Energy of the Republic of Croatia, 2019).

The increasing transport accessibility of national parks and nature parks directly and indirectly impacts their sustainable development. For example, one of the most visible direct negative impacts of increased transport accessibility is the construction of transport infrastructure, which irreversibly changes the natural environment, and for which there are increasing spatial demands (Daigle and Zimmermann, 2004; Opačić et al.,

2005). Simultaneously, ecologically valuable space within the borders of national parks (Monz et al., 2016) and nature parks, and their immediate surroundings is exhausted, which shrinks the habitats of numerous plant and animal species (Ament et al., 2008).

Marković Vukadin (2017) recognised the three most negative consequences of the increase in mass visits to national and nature parks: the increase in solid waste; wastewater; and transport. Within the context of Plitvice Lakes National Park, through which state road D1<sup>1</sup> passes, Marković (2015) also emphasised the problem of visitor safety in the national park due to the increased number of vehicles present on the state road. Increased toxic gas emissions, caused by the combustion of fossil fuels, produces air, water, and land pollution. Additionally, noise pollution and light pollution are also increasing (Müller, 2004; Newsome et al., 2013).

The indirect negative impact of transport on national parks and nature parks that has arisen from the increase in their transport accessibility is reflected in the increase in the number of visitors primarily to the most attractive zones (the zones of the fundamental phenomena, due to which a particular area was characterised as protected). Consequently, there has been an increase in the amount of solid and liquid waste (e.g. sewage), as well as damage to fundamental phenomena (e.g. travertine barriers in Plitvice Lakes and Krka national parks) (Opačić et al., 2005). From the tourism demand aspect, the increased number of visitors during the peak season negatively impacts the general tourist experience, which creates a negative perception of overcrowding in Croatia's protected areas.

Moreover, tourist flow in national and nature parks is characterised by extreme spatial and temporal concentration, which increases negative impacts on the environment (Gosar, 2017). Namely, the highest visitor pressure is directed to the zones of fundamental phenomena, and on a yearly level (during peak season) and weekly level (certain weekdays) (Williams, 2003), which the management boards of individual protected areas try to mitigate by raising the entrance fees in peak season and limiting the daily number of visitors or the number of visitors allowed in the protected area simultaneously (Plummer, 2009). On the other hand, a smaller number of tourists and recreational visitors in some national parks and nature parks

1 In Croatia, roads are categorised as follows (labelled with a letter and a number): motorway = *autocesta* (Ax); state road = *državna cesta* (Dx); county road = *županijska cesta* (Žx); local road = *lokalna cesta* (Lx). For the purpose of this chapter, the Croatian abbreviated labels of individual roads will be used, e.g. state road D1.

may be due to their weaker transport accessibility, as one of the main limiting factors of tourist visits.

For an optimal management of national parks and nature parks it is necessary to implement planning of sustainable transport, which means:

- a) minimising atmospheric pollution;
- b) minimizing noise;
- c) minimizing land use conversion;
- d) minimizing the direct impacts of visitation on the environment;
- e) minimizing the impacts of visitation on the recreational experience;
- f) safeguarding the visual perception of naturalness;
- g) enabling all visitor groups to move freely;
- h) ensuring the protection of the local communities' quality of life; and
- i) ensuring financial sustainability (Orsi, 2015b).

As good practice examples, we can state “stick measures”, i.e. minimising and limiting car and bus traffic while simultaneously encouraging “carrot measures”, i.e. marketing and visitor education with strengthened bus transport to protected areas and organised shuttle transport within protected areas, as well as bicycle traffic (Eaton and Holding, 1996; Cullinane, 1997; Cullinane and Cullinane, 1999; Daigle, 2008; Collum and Daigle, 2015; Guiver et al., 2015; Orsi, 2015a; Weston et al., 2015). Within the context of promoting desirable modes of transport in protected areas there has been an increased level of discussion regarding the concept of so-called “slow travel”, based on pedestrian traffic, bicycle traffic, and some forms of rail, river and sea traffic, as well as bus traffic, whereby visitors can have deep experiences of the beauty of protected areas (Dickinson and Lumsdon, 2010).

Transport accessibility is viewed through three components (origin – link – destination) and can be defined from two aspects: as the ease by which an individual or group can reach one or several opportunities, and the ease by which a destination can be reached generally. Considering that transport accessibility is a broad and flexible concept, characterised by a high level of complexity, there are several indicators that can be used in measuring it. Transport accessibility measurement indicators can be simple (e.g. number of public transport stops within an area, the length of a given road), but also more complex, including a time component, trans-

port organisation level, etc. (Geurs and Ritsema van Eck, 2001; Halden et al., 2005; Litman, 2007; Halden, 2011).

In order to determine whether there is indeed an impact, and the extent to which transport accessibility is linked to the intensity of tourist flow in Croatian national parks and nature parks, it is first necessary to define measurable indicators of transport accessibility assessment, applicable in national parks and nature parks in Croatia. Afterwards, their scoring should be implemented in each researched national park/nature park and, finally, the total scores for each researched protected area should be compared to the number of visitors.

### Research aims and methodology

The aim of the chapter is to assess transport accessibility in Croatian national parks and nature parks and examine its connection to tourist flow<sup>2</sup> in the stated protected areas. The research is based on the hypothesis that the protected areas with higher transport accessibility have a higher number of tourist visits than those with lower transport accessibility. The research included 16 of the 19 Croatian national parks and nature parks, i.e. those for which it was possible to identify the entrances used by the majority of visitors. The research included the following national parks: Brijuni; Krka; Mljet; Paklenica; Plitvice Lakes; Risnjak; and Northern Velebit. Kornati National Park was excluded due to being an insular area for which it was impossible to determine a single point of entrance used by the majority of visitors. Apart from national parks, the following nature parks were included in the research: Biokovo; Kopački Rit; Lastovo Islands; Lonjsko Polje; Medvednica; Papuk; Telašćica; Učka; and Vransko Lake. Velebit and Žumberak-Samoborsko Gorje nature parks were excluded from the research as it proved impossible to identify which entrance was used by the majority of visitors.

- 2 Throughout the chapter, the term *tourist flow in a protected area* refers to the total number of visitors who stay for one or more nights within a protected area as well as day-trippers (tourists who are staying at tourism destinations nearby, one-day excursionists, as well as the local population living in settlements nearby and visiting the protected area for recreation). Likewise, it's important to point out that for some researched protected areas, mainly national parks that charge entrance fees and nature parks close to coastal and insular tourism destinations (e.g. Biokovo, Velebit, Telašćica, Lastovo Islands), more pronounced "real" tourist motivation during a visit could be observed; whereas other researched protected areas, mainly nature parks that do not charge entrance fees (e.g. Medvednica, Žumberak-Samoborsko Gorje), show a more pronounced recreational motivation among visitors was detected.

The assessment of transport accessibility for the 16 entrances to protected areas researched in this paper was conducted using the following indicators:

- a) public transport connectivity (bus, ship/catamaran/ferry);
- b) public transport frequency;
- c) road transport connectivity;
- d) temporal distance from cities/towns; and
- e) temporal distance from larger tourist centres.

Considering that some tourists arrive at protected areas by public transport, the first indicator for assessing transport accessibility was the public transport connectivity of each protected area. In order to determine its public transport connectivity, the cartographic analysis with Google Maps (Google Maps, 2019) was used to determine the existence of public transport stops for bus transport and ship/catamaran/ferry ports, within a maximum buffer of 800 m (which corresponds to a 10-minute walking distance) from the entrance mostly used by visitors. Even though a 400 m distance (i.e. a 5-minute walking distance) is often considered adequate for using public transport (e.g. Murray and Wu, 2003; Hurni, 2006; 2007; Kimpel, 2007), this distance is usually used in the study of public transport accessibility in cities. Some authors consider that the longer distance, in this case 800 m (i.e. a 10-minute walk), from a public transport stop can also be taken into consideration, e.g. in research by Murray et al. (1998) and Hurni (2006; 2007). In this research it is assumed that the tourists who arrive at the protected area are willing to walk for a maximum of 800 m, or 10 minutes, from a public transport stop to the entrance of a protected area<sup>3</sup>.

Regardless of the existence of a public transport stop within 800 m of the protected area, the frequency of public transport was also an impor-

3 For the purposes of this research, places in an extended sense (settlements, localities) rather than strict geographical locations /coordinates of the gates were taken as the entrances to the protected areas. Considering this, when assessing the connectivity of a protected area by public transport, the distance of the gate itself from the public transport station could be taken into account and the connectivity by public transport could be assessed in two categories (strong and weak connectivity). In the case of Croatian protected areas, the following national and nature parks would have weak connectivity, where the distance of the gate is more than 800 meters (or a 10-minute walk) from the nearest public transport station: Risnjak; Paklenica; and Krka national parks, as well as Telašćica and Vransko Lake nature parks, but the research results and conclusions were not affected. Taking into account the other analysed indicators, the selection of entrances to protected areas, which are described in detail below, could be considered as well-grounded.

tant factor in studying transport accessibility of the protected area. Public transport frequency impacts a range of activities of its users. For this purpose, public transport frequency of the busiest day in the season was taken as an accessibility indicator. For example, public transport frequency impacts passenger waiting time (especially in case of stopovers), as well as how people organise their plan for activities corresponding to departures/arrivals of public transport. A higher frequency of public transport makes it easier for visitors to plan their visit, as well as organise their time.

In addition to public transport, visitors to protected areas also use personal vehicles. For them, road infrastructure is of high importance, especially in terms of road category (motorway, state road, county road, local road), together with the width and quality of the road. Road category (with all its parameters) affects the speed, safety, and quality of the journey, but also the connectivity of the protected area with the rest of the country. The assumption is that a higher road category means better quality, which enables greater safety and speed of travel—meaning better transport accessibility. Therefore, the road transport connectivity indicator was taken as one of the parameters of transport accessibility. It was determined in terms of road category leading to the entrance to the protected area.

Cities play a significant role in tourist travel as departure/arrival and/or transit points. From a transport point of view, cities include transport terminals and ports for short or long journeys, and lines of public transport at the local, regional, national, and international levels. This is why they often play an important role as departure points to protected areas. The assumption was that the vicinity of cities/towns would lead to an increase in the number of visitors to the nearby protected area. Therefore, the time distance by car/ship between the protected area and the closest settlement with the administrative status of city/town was taken as one of the accessibility indicators. In this case, time distance was measured considering that a smaller spatial distance does not necessarily signify a shorter temporal distance and vice versa. This approach is in line with new tendencies in transport accessibility studies (e.g. Kaza, 2015). Temporal distance values in this research were determined using Google Maps (Google Maps, 2019).

In accordance with the previous indicator, it can be assumed that the vicinity of a leading tourist centre will lead to an increased number of visitors to a protected area. A leading tourist centre means a greater possibility of using transport services and, like in the case of the previous indicator, its temporal distance from a protected area was taken as one of the indica-



tors of transport accessibility. In this sense, a leading tourist centre in the coastal area means a local self-government unit (city/municipality) with at least 1,000,000 overnight stays a year or in continental part of Croatia with at least 100,000 overnight stays a year in 2018 (Croatian Bureau of Statistics, 2019).

After determining assessment indicators for transport accessibility of protected areas, each were scored on a point scale (Tab. 1). The scoring of transport accessibility indicators of protected areas in the context of tourist flow is related to similar methodological approaches in geographic research. Fyhri and Hjorthol (2009), for example, assessed the impact of various indicators on mobility of social groups, while Casas et al. (2009) assessed transport-based social exclusion on the availability of living opportunities. Also, D’Haese et al. (2011) used the assessment method to determine the impact of distance and environmental criteria to active travel. The main advantages of this methodological approach are spatial and topic applicability, while the main disadvantage is that there can be subjectivity in creating indicators and scoring.

Tab. 1 Indicators for assessing transport accessibility of protected areas and their scoring

Indicator	Indicator scoring (number of points)
Public transport connectivity of the protected area	0 = no connection 1 = connection
Public transport frequency	1 = 1-2 daily departures 2 = 3-5 daily departures 3 = 6 or more daily departures
Road connectivity of the protected area	1 = local road (L) 2 = county road (Ž) 3 = state road (D) 4 = motorway (A)
Temporal distance from the protected area to nearby city/town	1 = more than 60 minutes 2 = 46-60 minutes 3 = 31-45 minutes 4 = 16-30 minutes 5 = up to 15 minutes
Temporal distance from the protected area to leading tourist centres	1 = more than 60 minutes 2 = 46-60 minutes 3 = 31-45 minutes 4 = 16-30 minutes 5 = up to 15 minutes

The scoring of individual indicators for each protected area was determined with consideration to the total number of points and protected areas were ranked (whereby a higher number of points indicates a higher score of transport accessibility). In order to determine the connection between transport accessibility and tourist flow, a correlation analysis of each protected area's score of transport accessibility and the number of visitors according to data from the Ministry of Environment and Energy of the Republic of Croatia was conducted. Then the Pearson correlation coefficient, with the score of transport accessibility as the independent variable and the number of visitors as the dependent variable, was calculated.

### Transport accessibility assessment for protected areas

The assessment of specific indicators of transport accessibility, as well as the total score of transport accessibility for analysed national parks and nature parks are shown in Tab. 2.

The highest scores of transport accessibility among national parks were achieved by Plitvice Lakes and Krka national parks. The entrances to Plitvice Lakes National Park are located along state road D<sub>1</sub>, which allows for high accessibility, by both public and private transport. State road D<sub>1</sub> is highly significant in terms of the transport connectivity of the Republic of Croatia considering that it connects the border crossing Macelj (on the border with Slovenia) and Split. Regarding the location of the entrance to Plitvice Lakes National Park next to state road D<sub>1</sub>, there is a range of bus lines connecting the continental part of Croatia with the Croatian Littoral that pass by the entrance and serve as connections to Plitvice Lakes National Park (there are at least ten separate daily departures that pass through the Park). Since it is a state road, it has better quality and safety than the county roads that access some of the protected areas of Croatia. In accordance with the research methodology, although Plitvice Lakes National Park is not located in the vicinity of larger urban centres nor leading tourist centres, it was regarded as an individual city/town, i.e. as an individual tourist centre, in and of itself, for the purposes of the research described in this chapter.

Krka National Park also achieved a high score of transport accessibility, identical to Plitvice Lakes National Park. As opposed to other national parks and nature parks, the entrance to Krka National Park is located in the immediate vicinity of motorway A<sub>1</sub>, which connects Zagreb and Ploče, enabling exceptional transport connectivity on the national and regional scale for both public and private transport. Considering that one of

Tab. 2 The assessment of transport accessibility of national parks and nature parks according to indicators

Protected area	Public transport connectivity	Public transport frequency	Road connectivity	Temporal distance from nearby city/town	Temporal distance from leading tourist centre	Total
Plitvice Lakes	1	3	3	5	5	17
Krka	1	3	4	5	4	17
Brijuni	1	3	3	4	5	16
Kopački Rit	1	3	2	5	5	16
Vransko Lake	1	3	3	4	4	15
Medvednica	1	3	2	4	4	14
Paklenica	1	3	3	3	3	13
Telašćica	1	2	3	3	3	12
Risnjak	1	1	3	4	2	11
Lastovo Islands	1	3	3	1	1	9
Lonjsko Polje	1	2	1	4	1	9
Mljet	1	2	3	1	1	8
Northern Velebit	0	0	2	3	1	6
Papuk	0	0	2	3	1	6
Učka	0	0	2	2	2	6
Biokovo	0	0	1	1	1	3

the main entrances to Krka National Park is located in Skradin, transport accessibility within the context of the vicinity to an urban centre is high. There are several bus lines with approximately ten daily departures passing through Skradin. The leading tourist centre as an indicator of transport accessibility of Krka National Park, however, is Šibenik, which is about 20 minutes away by car.

Brijuni National Park has the next highest transport accessibility score. The entrance to Brijuni National Park is the coastal settlement Fažana, which was also taken as a leading tourist centre in the analysis. In its immediate vicinity is state road D21, leading from the border crossing Kaštel (on the border with Slovenia) to Pula, which enables significant transport accessibility. Pula, the nearest urban centre, is the main point of origin of public transport to Fažana, with more than ten daily departures. Fažana is,

however, more than 15 minutes distant from Pula by car, which resulted in a lower score of transport accessibility compared to Plitvice Lakes National Park and Krka National Park.

The main entrance to Paklenica National Park is the coastal settlement Starigrad on state road D8 (a.k.a. the Adriatic Highway) located 1.5 km from the gate of Park. State road D8 runs from the border crossing Rupa (on the border with Slovenia) to the border crossing Karasovići (on the border with Montenegro). The proximity of this road enables easy access by public or private transport, whereby there are about ten bus lines departing daily from Starigrad in the direction of either Rijeka or Zadar. However, the greater distance from urban and leading tourist centres lowers the total score of transport accessibility of Paklenica National Park. Zadar, the closest urban centre and leading tourist centre, is a bit less than 45 minutes from Starigrad by car.

The village Crni Lug (1.5 km from the gate of national park) was selected as the main entrance to Risnjak National Park. Although it is located on state road D32 (which runs from the border crossing Prezid, on the border with Slovenia, to Delnice), public transport is not significantly developed. There are only two daily bus line departures on this road. Furthermore, Delnice, the closest urban centre, is located more than 15 minutes away by car; while Crikvenica, the closest leading tourist centre, is a bit less than one hour away from Risnjak National Park by car. It is also noteworthy that there is no direct bus connection from Crikvenica to the Park.

Mljet National Park, as opposed to Brijuni, is located further from the coast. Additionally, the area of the Park does not cover the entire island. Therefore, the main entrance to the national park is a village on the island called Polače. State road D120 passes through the entire island and through the Park. Polače is connected to the rest of the island Mljet with two daily bus line departures and two daily catamaran departures toward Dubrovnik and Lastovo. Mljet National Park is rather far from Dubrovnik, the closest urban and tourist centre—roughly 100 minutes by catamaran or 145 minutes by car.

Northern Velebit National Park is the lowest-ranked national park with regard to transport accessibility. The village Krasno (15 km from the gate of national park) was selected as the entry point to the national park. It is connected by county roads Ž5126 and Ž5140, which have a lower quality and safety level in relation to state roads. Public transport to the park does not exist. Otočac, the closest urban centre, is located at a bit more than 30

minutes away by car, and the leading tourist centre (Crikvenica) is 75 minutes away by car.

Regarding nature parks, the highest score was achieved by Kopački Rit Nature Park. The settlement of Kopačevo was selected as the entrance to the Park. The Park is connected to Osijek, the closest urban and also tourist centre, by county road Ž4056. The Park is roughly 15 minutes from Osijek by car, and is connected by public transport with 7 daily bus departures.

Vransko Lake Nature Park and its entrance Prosika are located in the immediate vicinity of the state road D8 (less than 1 km away) and it is well-connected by public transport, which increases its total score of transport accessibility. Its transport accessibility score is also increased by the relative vicinity of the town Vodice, an urban and leading tourist centre, which is located at about 20 minutes away by car.

The entrance to Medvednica Nature Park is its highest summit (Sljeme), because the highest zone of Medvednica is also the most visited area of this nature park. It is connected by county roads Ž1048 and Ž1049 with the closest urban and tourist centre—Zagreb— and is roughly 20 minutes away by car. It is also connected to Zagreb by eight daily bus departures. At the time of writing, a cable car to the summit Sljeme is being built, which will further increase its public transport accessibility.

Telašćica Nature Park is a unique protected area, because it is located on the island Dugi Otok. The island settlement Sali (1.5 km from the gate of the Park) was selected as the entrance to the nature park. State road D109 runs along the entire island. There are no public buses, but there is public sea transport. Sali is connected to Zadar, as an urban and leading tourist centre, via a 45-minute ferry ride that runs four times daily.

Lastovo Islands Nature Park is far from the mainland, which means that it has lower transport accessibility. The island settlement Ubli, the entrance to the Park, is connected by a larger number of ship departures travelling to Vela Luka, Dubrovnik, and Split, as well as eight bus departures passing along the island on the state road D119. However, the transport accessibility score took a significant hit due to temporal distance from an urban centre (Korčula), which is 75 minutes away by ship, as well as from the leading tourist centre (Split) that is over four hours away by ship.

Lonjsko Polje Nature Park holds the same transport accessibility score as Lastovo Islands Nature Park. The difference is in the road category. Namely, Lonjsko Polje is one of two nature parks, along with Biokovo, that

is connected by a local road (the lowest quality and safety level of road). The entrance to the park is the village Čigoč, which has relatively weak public transport connectivity. The transport accessibility score is improved by the vicinity of an urban centre (Sisak), which is less than 30 minutes away from Čigoč by car, while the leading tourist centre (Zagreb) is slightly less than 90 minutes away by car.

Just as in the case of Medvednica, the summit of the mountain is the entrance to Učka Nature Park. The county road leading to Učka is narrow and winding, so the summit is not connected by public transport. Opatija, which is both the largest urban and leading tourist centre of the immediate area, is located at a less than 45 minutes from the summit of Učka by car.

Papuk Nature Park has an identical transport accessibility score to Učka Nature Park. The entrance to Papuk Nature Park (Jankovac mountain hut, as the most visited site in the park) is not connected by public transport, and personal vehicles access it via county road Ž4253. Moreover, Papuk Nature Park is far from the nearest urban centre (Slatina), as well as from the area's leading tourist centre (Osijek). Jankovac mountain hut is slightly less than 45 minutes from Slatina and 95 minutes from Osijek by car.

Biokovo Nature Park had the lowest score of transport accessibility. The summit Sveti Jure (the highest summit of the mountain and one of the most attractive and most visited park localities for tourists) was selected as the entrance to the park, and it can be reached by a narrow and winding local road. Makarska is the closest urban and tourist centre and is roughly 65 minutes away by car. There are no public transport options available for travelling to Biokovo.

### **The connection between transport accessibility and tourist flow in protected areas**

Although the amount of visitors to Croatian national parks and nature parks is increasing every year, there is an evident and pronounced difference in visits to national parks compared to nature parks. Furthermore, great differences in the number of visitors can be observed if protected areas are compared individually (Tab. 3, Tab. 4)<sup>4</sup>.

4 The tables show the official data from the Ministry of Environment and Energy of the Republic of Croatia related to the estimated number of visitors—not of the total number of entrance tickets sold.

Tab. 3 Number of visitors to Croatian national parks from 2013 to 2018

National Park	Year					
	2013	2014	2015	2016	2017	2018
Plitvice Lakes	1,188,798	1,184,449	1,357,304	1,429,228	1,720,331	1,796,670
Krka	786,635	804,411	951,106	1,071,561	1,284,720	1,354,802
Kornati	94,257	105,000	157,574	220,057	229,061	237,435
Brijuni	151,007	153,086	160,010	181,560	169,299	171,794
Mljet	120,464	100,787	112,156	126,699	140,329	145,751
Paklenica	114,381	122,189	119,686	127,848	140,561	144,624
Northern Velebit	15,777	14,360	16,471	20,299	22,919	30,638
Risnjak	13,725	11,338	12,715	14,346	16,575	16,816
<b>Total</b>	<b>2,485,044</b>	<b>2,495,620</b>	<b>2,887,022</b>	<b>3,191,598</b>	<b>3,723,795</b>	<b>3,898,530</b>

Source: Ministry of Environment and Energy of the Republic of Croatia, Zagreb, 2019

Tab. 4 Number of visitors to Croatian nature parks from 2013 to 2018

Nature park	Year					
	2013	2014	2015	2016	2017	2018
Telaščica	121,746	114,413	113,295	116,378	123,327	124,841
Vransko Lake	10,938	13,449	unknown	24,385	114,598	122,256
Biokovo	44,059	46,378	46,982	54,820	64,130	64,484
Velebit	35,317	32,030	37,202	43,091	49,889	56,319
Žumberak-Sa- moborsko Gorje	2,800	1,652	52,600	44,254	41,674	43,179
Kopački Rit	26,013	26,764	29,836	38,679	37,062	40,135
Lastovo Islands	29,792	21,209	unknown	17,000	24,520	29,567
Medvednica	20,560	26,191	29,873	32,591	34,423	20,081
Učka	2,346	1,687	unknown	30,000	30,000	20,000
Lonjsko Polje	11,850	12,320	12,100	16,500	17,000	17,500
Papuk	6,636	5,741	4,333	5,685	7,470	7,171
<b>Total</b>	<b>312,057</b>	<b>301,834</b>	<b>326,221</b>	<b>423,383</b>	<b>544,093</b>	<b>545,533</b>

Source: Ministry of Environment and Energy of the Republic of Croatia, Zagreb, 2019

The number of visitors to national parks was seven times higher in 2018 than the number of visitors to nature parks. It is worth emphasising here, however, that the official number of visitors is not wholly accurate. Namely, certain nature parks have a significantly higher number of visitors compared to official data. The absence of an entrance fee in nature parks is the main reason for this; entrance fees are only charged for some individual sights or activities within nature parks. Therefore, the actual number

of visitors to nature parks located near large cities with high recreational demand (e.g. Medvednica, Žumberak-Samoborsko Gorje, Učka) is significantly higher than official data. It can be assumed that the aforementioned nature parks have a higher number of visitors than most national parks.

For the most visited parks—Plitvice Lakes and Krka—there were three, i.e. two and a half times more visitors than all visits to the rest of the national parks combined, confirming the significantly higher general tourist attractiveness of national parks than of nature parks.

Plitvice Lakes is the most visited national park in Croatia, because it is the only Croatian protected area included in the UNESCO World Nature Heritage list. In other words, this status provides the Park a greater level of attraction than other Croatian national and nature parks, because it guarantees a certain sensation or “wow-effect” to visitors, i.e. promising to be a memorable tourism experience (Opačić, 2019). Due to the aforementioned, as well to the accommodation capacity in and around the protected area, it should be observed as a tourism destination in and of itself and pillar of tourism development of the wider area (Lika, Kordun).

Among other national parks, Krka National Park stands out in visitor numbers. Its high number of visits is due to the Park’s exceptional level attractiveness to tourists, high transport accessibility due to the nearby town (Skradin) and strong coastal tourist centre (Šibenik), as well as its motorway connection to other leading tourism destinations along the Adriatic coast. Other national parks that stand out in number of visitors (Kornati, Brijuni, Mljet, and Paklenica) are also situated on the Croatian Littoral, which is the leading tourism area of Croatia.

In contrast to the aforementioned parks, Northern Velebit and Risnjak national parks, despite their level of ecological preservation and tourist attractiveness, are significantly less visited. Both of these national parks encompass some of the most well-preserved mountainous areas of Croatia, and they have lower transport accessibility than most of the national parks located on the coast and islands. A significant reason for lower visitor numbers is also the fact that the most attractive sights of the Northern Velebit and Risnjak national parks (certain summits of Velebit, Premužić Trail, Veliki Risnjak Peak, the source of the Kupa River) are inaccessible by car, thus demanding more time and effort in order to visit them.

The most prominent nature parks in terms of visitor numbers are definitively Telašćica and Vransko Lake. The reason for this is their geographical position on the Croatian Littoral, the leading tourism area in the



country, in the immediate vicinity of strong coastal tourism destinations (Zadar, Biograd na Moru, Vodice, Šibenik). An additional reason for high visitor numbers in Telašćica is also the vicinity of Kornati National Park, with which it has a certain landscape unity, so it is also visited by many visitors who visit Kornati. Velebit and Biokovo nature parks encompass large mountains rising steeply above the coast, where strong coastal tourism destinations have developed (e.g. Crikvenica-Vinodol Littoral, Makarska Littoral). An important reason for the high number of visitors to Biokovo Nature Park compared to other nature parks also lies in direct road transport access to the most attractive sights (Sveti Jure and Vošac summits).

The island Lastovo is the central area of Lastovo Islands Nature Park, and it shows far lower visitor numbers due to its weak transport connectivity. An additional reason for low visitor numbers may also be the modest promotion of the Park on the tourism market. It is noteworthy that this is the youngest Croatian nature park, founded in 2006, so a stronger dependence on the status of protected area for tourism development can be expected in the future. Among other nature parks, only Kopački Rit is generally considered to be a must-see tourist sight during a tour of Baranja, a region that has had successful development of rural tourism of late, and of the nearby urban and tourist centre Osijek.

Žumberak-Samoborsko Gorje, Medvednica, Učka, Lonjsko Polje, and Papuk nature parks encompass mountainous or marsh/flood plain areas visited mostly by day-trippers (recreationists) from nearby urban centres (e.g. Zagreb, Rijeka, Sisak, Osijek), rather than tourists, which is the main reason for their low visitor numbers. An equally significant reason is also the fact that in these nature parks, specific locales are not prominent enough in terms of attractiveness to become independent tourist attractions in their own right. Rather, the fundamental phenomena due to which these areas were protected are dispersed throughout a wider area, making it difficult to valorise them in terms of tourism.

When interpreting data on visits to protected areas, especially nature parks, it is necessary to take into account that they show the estimated number of visitors and not the number of entrance tickets sold, which indicates discrepancies in relation to the actual numbers of visitors. As there is no entry fee for nature parks (only for specific locales or attractions therein), it is clear that the number of visitors in this category of protected areas is harder to estimate than in national parks, where entrance fees are charged. Therefore, it is realistic to expect discrepancies between the offi-

cial statistical data of the Ministry of Environment and Energy regarding the number of visitors, and the actual number of visitors.

In order to determine the extent to which transport accessibility for entrances to the 16 Croatian national parks and nature parks is related to the number of visitors, the method of correlation analysis was used, whereby the transport accessibility scores for entrances to protected areas were taken as the independent variable, and the number of visitors as the dependent variable.

On the level of all protected areas included in the analysis, a strong correlation between the transport accessibility score of a protected area and the number of visitors in 2018 ( $N=16$ ;  $r=0.536$ ) was determined, whereby the more transport-accessible Croatian national parks and nature parks were those with higher numbers of visitors, i.e. higher tourist flow (Fig. 2).

A high value of Pearson coefficient is weighted mainly by national parks, recording an even higher correlation among the variables, as opposed to nature parks, where a correlation between transport accessibility and the number of visitors in 2018 was not determined. Therefore, an even stronger correlation between the transport accessibility score and the number of visitors in 2018 ( $N=7$ ;  $r=0.706$ ) is shown for national parks, whereby the more transport-accessible national parks show higher visitor numbers. It is noteworthy that the number of national parks in the correlation analysis is low, so these results can be taken into consideration only as illustrative (Fig. 3).

A higher level of correlation between the transport accessibility score and the number of visitors in national parks can be explained with the fact that national parks, in the context of the number of visitors (tourist visits), can be identified with tourist sights (some even with tourism destinations). It could be recognised that better quality of their transport accessibility is in line with their higher tourist flow. Namely, national parks are generally more attractive to tourists than nature parks, due to their higher level of protection and preservation of nature. Therefore, considering the significance of transport accessibility, they showcase features similar to other tourist sights/destinations. Furthermore, national parks undoubtedly keep more accurate records of the number of visitors, because all visitors are required to pay an entrance fee during their visit.

Nature parks show lower levels of correlation between their transport accessibility score and the number of visitors ( $N=9$ ;  $r=0.355$ ), leading to the conclusion that the more transport-accessible Croatian nature parks are of-

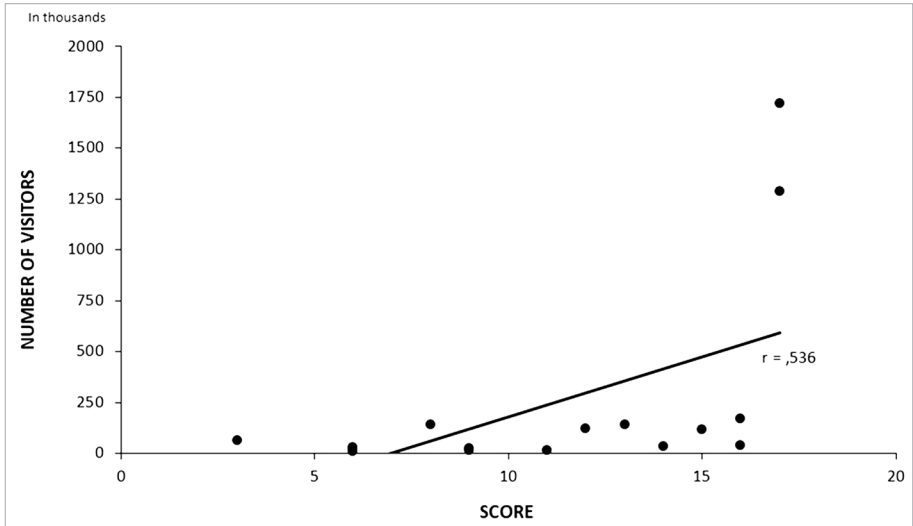


Fig. 2 Scatter plot of the transport accessibility score of the protected area (x) and the number of visitors in 2018 (y) in Croatian national parks and nature parks  
Source: authors, according to data from the Ministry of Environment and Energy of the Republic of Croatia, 2019

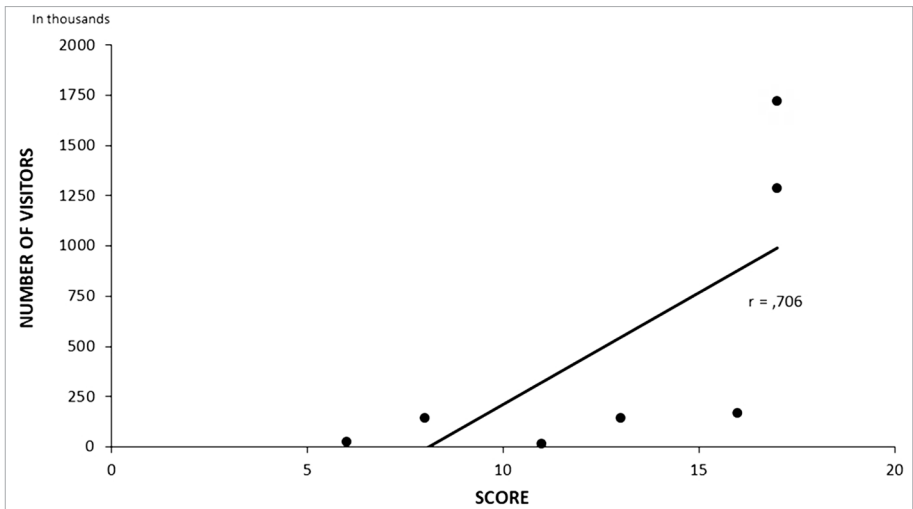


Fig. 3 Scatter plot of the transport accessibility score of the protected area (x) and the number of visitors in 2018 (y) in Croatian national parks  
Source: authors, according to data by the Ministry of Environment and Energy of the Republic of Croatia, 2019

ten not the most visited. As with national parks, it is necessary to emphasise the small number of nature parks in the sample, so the results of the correlation analysis should only be taken into consideration as illustrative (Fig. 4).

A significantly weaker correlation between the transport accessibility score and the number of visitors in nature parks leads to the conclusion that these protected areas, in terms of visitor numbers (tourist visits), are less attractive to tourists. They are also less prominent in marketing campaigns on the tourism market, so the number of visitors to nature parks does not depend on the quality of transport accessibility to the same extent as it does in national parks. The exceptions to this are nature parks with a large number of visitors, located in the vicinity of leading coastal tourism destinations, as well as those featuring highly attractive tourist sights (e.g. escarpments in Telašćica Nature Park and the summits Sveti Jure and Vošac in Biokovo Nature Park that offer views of the Dalmatian islands and Dalmatinska Zagora). In the observed context, these nature parks “behave” like national parks, i.e. like tourist sights/destinations in and of themselves. Moreover, the estimation of the number of visitors to nature parks is less accurate in comparison to national parks, because there is no entrance fee

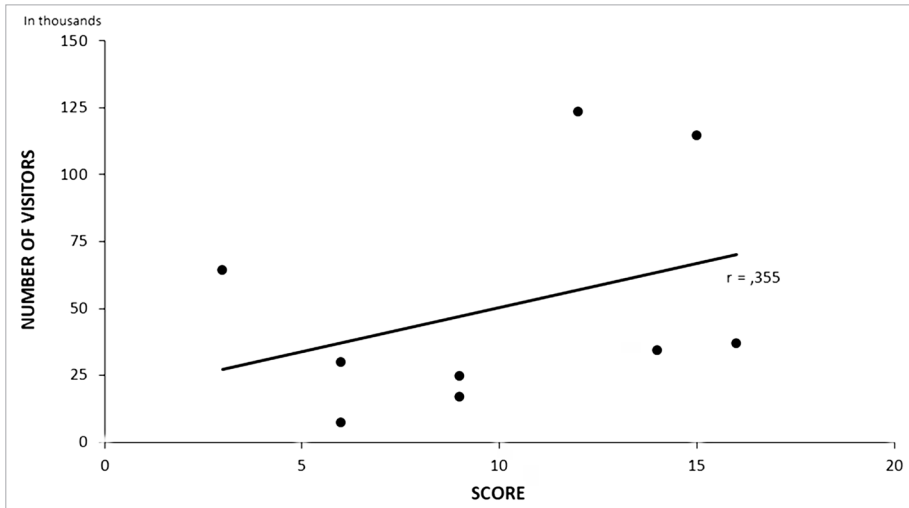


Fig. 4 Scatter plot of the transport accessibility score of the protected area (x) and the number of visitors in 2018 (y) in Croatian nature parks  
Source: authors, according to data by the Ministry of Environment and Energy of the Republic of Croatia, 2019

to the nature park itself, only to specific sights or specific activities/programmes within the protected area; therefore, these findings should be taken into consideration with reserve.

## Conclusion

Transport is one of the significant preconditions and factors of tourist flow in all types of tourist areas. The role of transport in protected areas as a tourist factor is especially pronounced, because transport is simultaneously a prerequisite for a large number of tourist visits, but it is also a limiting factor due to potentially adverse environmental circumstances.

The aim of this chapter was to assess transport accessibility as a factor of tourist flow in Croatian national parks and nature parks. The research observed 16 of the 19 Croatian national parks and nature parks, in which it was possible to determine entrances used by the majority of visitors during their visit. The 16 locations selected in this way underwent scoring assessment using a point scale to determine transport accessibility, according to the following factors:

- a) public transport connectivity (bus, ship/catamaran/ferry);
- b) public transport frequency;
- c) road connectivity;
- d) time distance from city/town; and
- e) time distance from a leading tourist centre.

In order to determine the connection between transport accessibility and tourist flow, a correlation analysis was conducted for each national park and nature park in 2018, with the transport accessibility score as the independent variable and the number of visitors as the dependent variable.

The research showed that the national parks and nature parks with better transport accessibility also have higher visitor numbers. This conclusion rises from the strong correlation between transport accessibility and tourist flow in national parks, whereas in nature parks the correlation between these variables is weaker. The latter can be explained with the fact that national parks are more attractive in a tourism context and are more exposed via marketing campaigns in the tourism supply than nature parks, therefore, they attract a larger number of (foreign) tourists. Those national parks that feature accommodation capacities within their borders, e.g. Plitvice Lakes, Brijuni, Mljet, can be identified as tourism destinations in and of themselves and are frequently presented as such on the tourism mar-

ket. Therefore, within the context of tourism valorisation, the majority of Croatian national parks are recognised as tourist sights belonging to larger tourism destinations (tourism regions).

Most nature parks located in the vicinity of leading Croatian coastal tourism destinations (e.g. Telašćica, Vransko Lake, Biokovo) “behave” in a similar way to national parks on the tourism market, so it could be presumed that tourists prevail in the structure of their visitors. On the other hand, certain nature parks with recreational attractiveness and facilities (e.g. Medvednica, Žumberak-Samoborsko Gorje, Učka), are predominantly visited by day-trippers from urban centres nearby, whereby a significant motive for the visit is recreation.

The chapter represents a contribution to research of the connection between transport and tourism in protected areas, and it should serve as a starting point for future, more comprehensive research studies aimed at enhancing the quality of the implementation of sustainable development principles in the management of protected areas. Thereby, it is especially important to place emphasis on improving the spatial orientation of visitor flows in protected areas, in order to maintain protection of nature as a primary and fundamental goal, while simultaneously developing sustainable tourism and recreation.

## References

- Ament, R., Clevenger, A. P., Yu, O., Hardy, A., 2008: An assessment of road impacts on wildlife populations in U.S. National Parks, *Environmental Management* 42 (3), 480-496, DOI: 10.1007/s00267-008-9112-8.
- Bralić, I., 2000: Turizam i nacionalni parkovi u Hrvatskoj, *Turizam* 48 (4), 373-378.
- Casas, I., Horner, M. W., Weber, J., 2009: A comparison of three methods for identifying transport-based exclusion: a case study of children’s access to urban opportunities in Erie and Niagara Counties, New York, *International Journal of Sustainable Transportation* 3 (4), 227-245, DOI: 10.1080/15568310802158761.
- Collum, K. K., Daigle, J. J., 2015: The shift from automobiles to alternatives and the role of intelligent transport systems, in: *Sustainable Transportation in Natural and Protected Areas* (ed. Orsi, F.), Routledge, London - New York, 57-69.

- Cullinane, S., 1997: Traffic management in Britain's national parks, *Transport Reviews: A Transnational Transdisciplinary Journal* 17 (3), 267-279, DOI: 10.1080/01441649708716985.
- Cullinane, S., Cullinane, K., 1999: Attitudes towards traffic problems and public transport in the Dartmoor and Lake District National parks, *Journal of Transport Geography* 7 (1), 79-87, DOI: 10.1016/S0966-6923(98)00027-1.
- Čavlek, N., Bartoluci, M., Prebežac, D., Kesar, O., 2011: *Turizam – ekonomske osnove i organizacijski sustav*, Školska knjiga, Zagreb.
- Daigle, J. J., 2008: Transportation needs in national parks: a summary and exploration of future trends, *The George Wright Forum* 25 (1), 57-64.
- Daigle, J. J., Zimmermann, C. A., 2004: Alternative transportation and travel information technologies: monitoring parking lot conditions over three summer seasons at Acadia National Park, *Journal of Park and Recreation Administration* 22 (4), 81-102.
- D'Haese, S., De Meester, F., De Bourdeaudhuij, I., Deforche, B., Cardon, G., 2011: Criterion distances and environmental correlates of active commuting to school in children, *International Journal of Behavioral Nutrition and Physical Activity* 8 (88), 1-10, DOI: 10.1186/1479-5868-8-88.
- Dickinson, J., Lumsdon, L., 2010: *Slow Travel and Tourism*, Earthscan, London – New York.
- Eaton, B., Holding, D., 1996: The evaluation of public transport alternatives to the car in British National Parks, *Journal of Transport Geography* 4 (1), 55-65, DOI: 10.1016/0966-6923(95)00037-2.
- Fyhri, A., Hjorthol, R., 2009: Children's independent mobility to school, friends and leisure activities, *Journal of Transport Geography* 17 (5), 377-384, DOI: 10.1016/j.jtrangeo.2008.10.010.
- Geurs, K. T., Ritsema van Eck, J. R., 2001: Accessibility measures: review and applications, *RIVM Report 408505 006*, National Institute of Public Health and the Environment, Bilthoven, [https://www.researchgate.net/publication/46637359\\_Accessibility\\_Measures\\_Review\\_and\\_Applications](https://www.researchgate.net/publication/46637359_Accessibility_Measures_Review_and_Applications) (16. 03. 2019)
- Gosar, A., 2017: Managing sustainable tourism in protected areas, in: *Tourism in protected areas of nature in Serbia and Slovenia* (eds. Filipović, D. et al.), University of Belgrade – Faculty of Geography, Belgrade, 3-11.
- Guiver, J., Davies, N., Weston, R., 2015: Visitor preferences toward scheduled bus use in natural and protected areas, in: *Sustainable Transportation in Natural and Protected Areas*, Routledge (ed. Orsi, F.), London - New York, 45-56.

- Halden, D., 2011: The use and abuse of accessibility measures in UK passenger transport planning, *Research in Transportation Business and Management* 2, 12-19, DOI: 10.1016/j.rtbm.2011.05.001.
- Halden, D., Jones, P., Wixley, S., 2005: *Measuring accessibility as experiences by different socially disadvantaged groups*, Working Paper 3: Accessibility Analysis Literature Review, Transport Studies Group, University of Westminster, London, [https://pdfs.semanticscholar.org/bf91/f2ab89d40532290e73c5381acdd47c9238e2.pdf?\\_ga=2.123485452.625183411.1565549820-713115584.1565549820](https://pdfs.semanticscholar.org/bf91/f2ab89d40532290e73c5381acdd47c9238e2.pdf?_ga=2.123485452.625183411.1565549820-713115584.1565549820) (16. 03. 2019.)
- Hurni, A., 2006: Transport and social disadvantage in Western Sydney: a partnership research project, *University of Western Sydney and Western Sydney Community Forum*, Sydney, <https://researchdirect.westernsydney.edu.au/islandora/object/uws%3A23088/datastream/PDF/view> (16. 03. 2019.)
- Hurni, A., 2007: Marginalised groups in Western Sydney: The experience of sole parents and unemployed young people, in: *No Way To Go – Transport and Social Disadvantage in Australian Communities* (eds. Currie, G. et al.), Monash University ePress, Clayton, 10.1-10.11, DOI: 10.2104/nwtg0710.
- Kaza, N., 2015: Time dependent accessibility, *Journal of Urban Management* 4 (1), 24-39, DOI: 10.1016/j.jum.2015.06.001.
- Kimpel, T., Dueker, K., El-Geneidy, A., 2007: Using GIS to measure the effect of overlapping service areas on passenger boardings at bus stops, *Urban and Regional Information Systems Association Journal* 19 (1), 5-11.
- Klarić, Z., Gatti, P., 2006: Ekoturizam, in: *Hrvatski turizam: plavo, bijelo, zeleno* (eds. Čorak, S., Mikačić, V.), Institut za turizam, Zagreb, 149-165.
- Kušen, E., 2002: *Turistička atrakcijska osnova*, Institut za turizam, Zagreb.
- Kušen, E., 2010: A system of tourism attractions, *Tourism* 58 (4), 409-424.
- Litman, T., 2007: *Evaluating accessibility for transportation planning: measuring people's ability to reach desired goods and activities*, Victoria Transport Policy Institute, <http://www.vtpi.org/access.pdf> (16. 03. 2019.)
- Marković, I., 2015: *Problemi i mogućnosti održivoga upravljanja zaštićenim prirodnim područjima: primjer Nacionalnog parka Plitvička jezera*, PhD Thesis, University of Zagreb, Faculty of Science, Department of Geography, Zagreb.
- Marković Vukadin, I., 2017: Sustainability issues in management of tourism in protected areas: case study of Plitvice Lakes National Park, in: *Evolution of Destination Planning and Strategy: the Rise of Tourism in*



- Croatia (eds. Dwyer, L. et al.), Palgrave Macmillan, Cham, 201-219, DOI: 10.1007/978-3-319-42246-6\_10.
- Monz, C., D'Antonio, A., Lawson, S., Barber, J., Newman, P., 2016: The ecological implications of visitor transportation in parks and protected areas: examples from research in US National Parks, *Journal of Transport Geography* 51, 27-35, DOI: 10.1016/j.jtrangeo.2015.11.003.
- Murray, A. T., Davis, R., Stimson, R. J., Ferreira, L., 1998: Public transportation access, *Transportation research part D: Transport and Environment* 3 (5), 319-328, DOI: 10.1016/S1361-9209(98)00010-8.
- Murray, A. T., Wu, X., 2003: Accessibility tradeoffs in public transit planning, *Journal of Geographical Systems* 5 (1), 93-107, DOI: 10.1007/s101090300105.
- Müller, H., 2004: *Turizam i ekologija: povezanost i područja djelovanja*, Masmedia, Zagreb.
- Newsome, D., Moore, S. A., Dowling, R. K., 2013: *Natural Area Tourism: Ecology, Impacts and Management*, Channel View Publications, Bristol – Buffalo – Toronto.
- Opačić, V. T. 2019: Tourism valorisation of cultural heritage, in: *Cultural Urban Heritage: Development, Learning and Landscape Strategies* (eds. Obad Šćitaroci, M. et al.), The Urban Book Series, Springer Nature, Cham, 181-196, DOI: 10.1007/978-3-030-10612-6\_15.
- Opačić, V. T., Curić, D., Jandras, M., Kutle, K., Marijan, N., Mirt, I., Perković, D., Vodanović, I., 2014: Zaštićena područja kao rekreacijske zone grada – primjer Parka prirode Medvednica, *Hrvatski geografski glasnik* 76 (1), 61-87, DOI: 10.21861/HGG.2014.76.01.04.
- Opačić, V. T., Lukić, A., Fuerst-Bjeliš, B., 2005: Sustainable development of recreation and tourism in the protected areas of Croatia: issues and indicators, *Problemi na geografijata* 3-4, 209-223.
- Orsi, F., 2015a: Sustainability potentials of various transport modes in natural settings, in: *Sustainable Transportation in Natural and Protected Areas* (ed. Orsi, F.), Routledge, London - New York, 28-41.
- Orsi, F., 2015b: Sustainability requisites of transportation in natural and protected areas, in: *Sustainable Transportation in Natural and Protected Areas* (ed. Orsi, F.), Routledge, London - New York, 11-27.
- Plummer, R., 2009: *Outdoor recreation: an introduction*, Routledge, London – New York.
- Prideaux, B., 2000: The role of the transport system in destination development, *Tourism Management* 21 (1), 53-63, DOI: 10.1016/S0261-5177(99)00079-5.

Weston, R., Davies, N., Guiver, J., 2015: Cycle tourism development in parks: the experience of the Peak District National Park (UK), in: *Sustainable Transportation in Natural and Protected Areas* (ed. Orsi, F.), Routledge, London - New York, 140-149.

Williams, S., 2003: *Tourism and recreation*, Prentice Hall, Harlow.

### Sources

Croatian Bureau of Statistics, 2019: *Tourism, 2018*, Statistical Reports 1639, Zagreb.

Google Maps, 2019: Map data ©2019.

Ministry of Environment and Energy of the Republic of Croatia, 2017: *Nature Protection Database*, Croatian Agency for the Environment and Nature, Zagreb.

Ministry of Environment and Energy of the Republic of Croatia, 2019: *Internal Data*, Zagreb.