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The system and spatial distribution of protected areas in Hungary, Slovakia, Romania, Serbia and Croatia

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Abstract

Protected areas play a key role in nature conservation but are also crucial for tourism. There are international recommendations in nature conservation (IUCN), and several international conservation conventions exist. Nevertheless, the protection categories are different in each country, and the proportion of protected areas also varies. Here we compare the nature conservation systems of some countries (Hungary, Slovakia, Romania, Serbia and Croatia) taking into consideration their nature protection laws. The selection of countries is based on an international project dealing with "Karst and National Parks". For the comparison, national data sources and an international database (WDPA) are used. Our results show that the protection categories of the studied countries are largely similar, but there are unique characteristics as well (such as "forest park", "monument of park architecture" in Croatia; "nature conservation area" in Hungary or "protected landscape element" in Slovakia, etc.). On the other hand, the internal proportions of protection categories are more heterogeneous, like, for example, the proportion of national parks within all protected areas which is 57.0 percent in Hungary but 11 percent in Croatia. International protection categories (Natura 2000, Ramsar, UNESCO World Heritage natural sites, UNESCO MAB reserves) are more or less similarly present in the countries studied (except Serbia, where there are no Natura 2000 areas yet). If national categories and Natura 2000 sites are all taken into consideration (and the overlapping areas are counted only once), then Croatia has the highest proportion of protected areas (39.1%), Slovakia is in second place with 37.5 percent, while Romania (23.5%) and Hungary (22.0%) show a similar proportion, and with the lack of Natura 2000, Serbia has 9.1 percent at present. As for the reliability of the WDPA, we found that this varies from country to country, with significant deficiencies for certain countries (e.g. Serbia) and very good reliability for others (e.g. Hungary, Slovakia). However, the availability of WDPA is in many cases better than that of national data, and since it also provides GIS data, it can be considered a useful tool for examining international trends and mapping protected areas.

Keywords: protected area, WDPA, national park, karst, IUCN, nature park, World Heritage, Natura 2000

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Introduction

Protected areas are the most important tools for the preservation of our natural heritage (Rodrigues, A.S.L. and Cazalis, V. 2020). In addition to natural settings, the extent and location of protected areas are strongly influenced by historical, political and economic considerations as well (Frost, W. and Hall, C.M. 2015; Kőszegi, M. *et al*. 2019). Although

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the IUCN (International Union for Conservation of Nature) formulates recommendations for protected area categories, the system of protected areas varies to some extent from country to country. Therefore, if we want to compare the protected areas of different countries, then we have to compare not only the territorial extent, but it is also important to compare the categories themselves. Thus, the number one aim of our article is to make a comparison of protected areas by areal extent and category on a regional scale.

The spatial framework of our study is provided by an international project („Karst & National Parks"), in the framework of which we examine national parks established in karst areas. First of all, we highlight that national parks are often set up in karsts because of their special hydrological, morphological, pedological and biological features (Mari, L. and Telbisz, T. 2018; Telbisz, T. and Mari, L. 2020). In the above mentioned project, we primarily study the relationships among the different actors of the national park, the local population and tourism (Nestorová Dická, J. *et al.* 2020; Telbisz, T. *et al.* 2020). With the help of historical demographic statistics, GIS analyses, interviews and questionnaires, we examine how the population and land use of the area and its surroundings have changed and how the protection of the area and the emergence of tourism have affected the lives and job opportunities of local residents (Telbisz, T. *et al.* 2020, 2021, 2022b).

As a background of these relationships and processes, it is important to acquire knowledge on the system of protected areas in the studied countries and the role of national parks within this. Countries included in the above project are Croatia, Hungary, Romania, Serbia and Slovakia. Accordingly, our regional comparison in this paper also covers these countries, but naturally, this comparison can be extended to other countries in the future. A comparison of these countries is also meaningful in the sense that they have many common features in their history, but they also differ remarkably from each other on certain points. It is, therefore interesting to examine the common and different characteristics of their protected area systems. Other results of the research carried out in the framework of this project are presented in the further articles of this issue (Imecs, Z. *et al.* 2022; Kovačević-Majkić, J. *et al.* 2022; Kőszegi, M. *et al.* 2022; Telbisz,T. *et al.* 2022a). In addition, the presentation of ECOKARST project, which has a similar issue and spatial extent, but the focus is rather on ecosystem services was also included in this special issue (Gorjanc, S. *et al.* 2022).

Data on protected areas bear important information for all stakeholders and are, in principle, publicly available. On the global scale, too, a number of studies have dealt with the questions of how different categories of protected areas increased and what their spatial distribution is. In practice, however, it is observed that reliable country-level data are not always easy to obtain. Fortunately, there is an international database, WDPA (World Database on Protected Areas, https://www.protectedplanet.net/), which is the most widely accepted, regularly updated database on this topic (Hockings, M. 2003; Bingham, H.C. *et al.* 2019; Rodrigues, A.S.L. and Cazalis, V. 2020). It contains not only aggregated data, but also free GIS files, so it is technically suitable for comparing protected areas of different countries. However, its reliability and accuracy need to be tested, so the second objective of our article is methodological: to compare the data downloaded from the WDPA site to data collected from national databases of the studied countries.

Data and methods

The protection categories of the studied countries were compared taking into account the nature conservation legislation of each country. The following laws and regulations were considered:

– In Croatia: Nature Protection Act (Narodne novine/Official Gazette 80/2013, 15/2018, 14/19, 127/19);

– In Hungary: Act 53 of 1996 on Nature Conservation in Hungary, 03.07.1996;
– In Romania: Government Emergency Ordinance No. 57/2007 on the regime of protected natural areas, conservation of natural habitats, wild flora and fauna (20th June 2007, published in Official Monitor nr. 442 from 29th June 2007);
– In Serbia: Law on Nature Protection ("Official Gazette of RS", no. 36/2009, 88/2010, 91/2010, 14/2016 95/2018), Law on National Parks ("Official Gazette of RS", no. 84/2015, 95/2018);
– In Slovakia: Act on the Protection of Nature and Landscapes (2002).

National data for the countries studied were obtained from several sources. Data about Hungarian protected areas were acquired from the Lechner Knowledge Centre (https://lechnerkozpont.hu/), the official website of Nature Conservation in Hungary (https://termeszetvedelem.hu/) and the Hungarian Central Statistical Office (https://www.ksh.hu/stadat_files/kor/en/kor0015.html). The databases of protected areas in Croatia are from the Ministry of Economy and Sustainable Development (http://www.haop.hr/hr/tematska-podrucja/odrzivo-koristenje-prirodnih-dobara-i-ekoloska-mreza/ekoloska-mreza) and the Ministry of Environmental Protection and Energy (http://haop.dev.perpetuum.hr/hr/tematska-podrucja/zasticena-podrucja/zasticena-podrucja/zasticena-podrucja-u-rh, http://www.bioportal.hr/services). The vector files of the protected areas in Romania are from the LEMN Controlat Information Platform on Forest Protection (https://lemncontrolat.ro/link-uri-si-documente-utile/fisiere-descarcabile/) as they are not available on the website of the Ministry or the State Nature Conservation. The data source for Serbia is the Department for Information System and Cartography Institute for Nature Conservation of Serbia. Data for Slovakia are from the State Nature Protection of the Slovak Republic (http://www.sopsr.sk/web/?cl=114) and the Ministry of Environment of the Slovak Republic (https://www.minzp.sk/spravy/2019/april/100-rokov-statnej-ochrany-prirody-slovensku.html, https://www.minzp.sk/ochrana-prirody/uzemna-ochrana/prehlad-chranenych-uzemi-slovenskej-republiky/).

The WDPA database contains free data from 245 countries. They can be not only viewed online but downloaded in shapefile format by category, country, or other regional bases. The viewer of the database is called Protected Planet, which was created as a result of the collaboration between IUCN and the United Nations Environment Program (UNEP). The regularly updated database has been gradually expanding since 2010 with the help of government organizations and experts. One of the main goals of the international database is to provide a comprehensive image of all terrestrial and marine protected areas on a global platform, along with category classifications, spatial data, and mapping, to make it easy for everyone to understand and inform. It also intends to provide the best possible information to policymakers to raise awareness of the importance of protecting natural areas and their values. On the other hand, it also provides a basis for monitoring international environmental goals, the steps towards which can be easily documented on the basis of this database.

In our study, the GIS data from different sources were converted into a unified projection system, maps were made, and statistical calculations were performed. We have calculated the proportion of protected areas within each country and the proportion of different categories within the protected areas for each country. Furthermore, the relative differences between the areal extent values in the WDPA and in the national databases were calculated as a percentage (the base of the percentage, i.e. 100%, was the value in the national database).

There is often an overlap between different categories of protected areas. Among the national categories, the overlap is generally small, but taking into consideration the international categories as well, such as the European Natura 2000 network, the overlaps are quite significant. In many cases, the international protected area categories are also

mentioned in the laws on nature protection of the studied countries. Thus, we get a false picture of the extent of protected areas if we simply sum up the areas in each category. Therefore, we calculated the sum of the areas of the national categories by simple arithmetic summation (marked as "SUM – with overlaps") first, but also calculated the total area after merging the shapes. The merging and area calculations were performed in three steps: first, only for national categories (marked as "Real Area without Natura 2000"), second, only for Natura 2000 sites (marked as "Real Area of Natura 2000"), and third, for the merged area of both national categories and Natura 2000 territories (marked as "Real Area of All"). The merged area values therefore provide a realistic value of how much proportion of each country is covered by protected areas.

Results

Short historical review

The first serious steps towards nature conservation in the studied countries were taken in the second half of the 19th century. At that time, most of the territory of the studied countries belonged to the Austro-Hungarian Monarchy. The first nature conservation institution in Croatia was the Croatian Nature Society (founded in 1885), and the Laws on Bird protection (1893), Hunting (1893) and Caves (1900) were issued at that time (Sladonja, B. *et al.* 2012). In Hungary, the Forest Act of 1879 was the first law to protect the forests of the high mountains. The scope of this law included the high mountains which now belong to Slovakia and Romania. It was also the period when the designation of areas proposed for protection began, primarily with the help of tourist associations. The first protected area was declared in present-day Serbia in 1874 (Obedska pond), while in the other countries, protected areas appeared between the two world wars. The first national parks of these countries were generally established after the Second World War (Croatia: 1949 – Paklenica and Plitvice Lakes; Hungary: 1973 – Hortobágy; Serbia: 1960 – Fruška Gora; Slovakia: 1949 – Tatra Mountains), except in Romania, where the Retezat Mountains National Park was established in 1935, although in fact the organizational framework was still very rudimentary at that time (Bleahu, M. 2019). The gradual increase in the number of national parks during the communist period was followed by a significant boom in Hungary and Romania in the 1990s. On the other hand, since the turn of the millennium only a few new national parks have been established in the studied countries (except Serbia, where two new national parks were set up in 2021).

From the end of the Second World War to the 1990s, the communist regime prevailed in the region (albeit in different forms), which also had an impact on nature conservation, and the top-down approach prevailed in the foundation and operation of protected areas (Kőszegi, M. *et al.* 2019). After the change of political regime, or more precisely after the 2000s, the bottom-up approach gradually began to receive more emphasis (Nastran, M. 2015; Telbisz, T. *et al.* 2020). The first laws on nature protection were issued during the communist period, but these were later replaced by newer laws after the change of regime (see "Data and methods" section; Tardy, J. *et al.* 2018). An interesting fact about the Slovak nature conservation system was that from 1919 to 1981 (then Czechoslovakia) nature conservation and monument protection worked together within the framework of a joint institution. As for the recent decades, it is true for all countries, but perhaps most for Croatia, that the pressure on natural resources has significantly increased, mainly due to the rapid development of tourism, thus the establishment and proper management of protected areas have become particularly important (Sladonja, B. *et al.* 2012; Koderman, M. and Opačić, V.T. 2020). An example which testifies the need for improving protected area management is the recent amendment to Slovakia's law on nature protection (in 2021) that strengthens the ownership and legal personality of national parks.

Comparison of protected area categories

Table 1 shows the protected area categories, which are defined in each country's Nature Conservation Law, with brief descriptions using keywords. The similar national categories were arranged in the same line and IUCN categories were also added (https://www.iucn.org/theme/protected-areas/about/protected-area-categories). There are three categories which are present in each country, and their content is broadly similar, these are the followings: "national park", "natural monument" and "protected landscape". The latter have slightly different names for each country, and in Romania, for example, this is called a "natural park". It is a bit misleading because there are "nature parks" in Croatia and Serbia as well, albeit, with a slightly different content, which means more intense social (tourist) utilization. Moreover, there are "nature parks" even in Hungary, but their legal background is not regulated by the Nature Conservation Act, so this type is not added to the column of Hungary in *Table 1.* The description of the "national parks" is the most uniform throughout the countries, but it is an interesting fact that the concept of biodiversity is literally mentioned only in Hungarian and Croatian laws. The definition of "strict and special reserves" in Croatia, Romania and Serbia is in line with international practice, while in Hungary and Slovakia, this category is missing. There are also specific categories in each country (see *Table 1*). Another special feature of Slovakia is that the protection zones belonging to each protected area (i.e. buffers, which are subject to lighter regulations) are registered separately. Correspondence to IUCN categories is vague in several cases. For example, five of Hungary's ten national parks can be classified as IUCN category II, whereas five as IUCN category V.

Regarding karsts and caves, we note that in the case of Hungary, the caves are given great emphasis, and the law also mentions literally the sinkholes. These karstic phenomena (together with other objects) are among the so-called "ex lege" protected sites, which means that they are automatically protected, i.e. there is no need for a special designation procedure to declare them protected. We can highlight from the Serbian law that the concept of "geodiversity" is mentioned, which is partly due to the fact that Serbian nature protection law is among the most recent, but also to the fact that research on geodiversity plays a significant role in this country. The Serbian Law on Nature Protection also mentions "geoparks". It is interesting because geoparks in most countries were generally created on a completely different basis than other types of protected areas. However, it is noted that most countries have both national and global geoparks (Mari, L. and Telbisz, T. 2019; Telbisz, T. and Mari, L. 2020). A Croatian speciality is a concept of "cave park", of which one exists in the country.

As for the terrain types, one can observe that the protected natural areas of the studied countries are mostly mountainous areas. Karst areas are common among protected areas (for example, in Croatia, all national parks are in karst terrains, in Slovakia, most of the national parks are karstic, while in Hungary, Romania and Serbia, about half of the national parks are in karsts (Mari, L. and Telbisz, T. 2018; Telbisz, T. and Mari, L. 2020). Besides, river deltas, floodplains, (saline) lakes, and lowlands with different features also occur among the protected areas in these countries.

International protected area categories

In addition to national categories, there are also internationally designated protected areas. The most important of these is Natura 2000, which is a network of core breeding and resting sites for rare and threatened species and some rare natural habitat types which are protected in their own right. The aim of the network is to ensure the long-term survival of Europe's most valuable and threatened species and habitats. They have a very significant overlap with the national categories but are much larger in scope in order to provide a closely connecting, ecological habitat for the wildlife. They have several catego-

Table 1. Categories of national protected areas in the countries studied and their correspondence to IUCN categories

Croatia	Hungary	Romania	Serbia	Slovakia	IUCN
Strict reserve – unmodified or slightly modified nature – all economic and other activities are prohibited		*Scientific reserve* – natural area – scientific significance – all economic and other activities are prohibited	*Strict nature reserve* – unaltered and representative natural ecosystem – all economic and other activities are prohibited		Ia
			Special nature reserve – unaltered or slightly altered nature – controlled visits – preservation of the traditional way of life		Ia
National park – large unmodified area – multiple natural values – biodiversity – conservation + scientific, cultural, educational, recreational purpose	*National park* – large unmodified area – multiple natural values – biodiversity – conservation + scientific, cultural, educational, recreational purpose	*National park* – large unmodified area – multiple natural values – conservation + scientific, cultural, educational, recreational purpose	*National park* – diverse natural ecosystems – multiple natural values – conservation + scientific, cultural, educational, spiritual, health, recreational purpose	*National park* – large unmodified area – multiple natural values – nature protection is of higher priority than other activities – visiting rules established	II
Natural monument – indvidual ecological, scientific, aesthetic, educational value – living or non-living	*Natural monument* – individual natural formation	*Monument of nature* – protection and conservation of natural elements – uniqueness, rarity	*Monument of nature* – rather small unaltered or partially altered natural spatial unit	*Nature monument* – point, linear or other smaller ecosystems – caves, natural waterfalls	III
Special reserve – uniqueness, rarity – special scientific importance – actions and activities only for preservation of the area		*Nature reserve* – important habitats and natural species		*Nature reserve* – locality – natural habitats	IV

Table 1. continued

Croatia	Hungary	Romania	Serbia	Slovakia	IUCN
Nature park – large natural or partially cultivated area with ecological features – activities and actions allowed that do not damage its values			*Nature park* – conserved natural ecosystems – activities harmonized with traditional ways of life		V
Regional park – ecological features with landscape values					V
Forest park – natural or planted forests – rest and recreation					
Monument of park architecture – artificially formed area – group of trees					
	Nature conservation area – smaller, unitary and characteristic territories				
			Protected habitat – one or more types of natural habitats – wildlife populations	*Protected site* – natural habitats – nature cultivated by human activities	IV
				Protected landscape element – landscape element as a biocentre, a biocorridor	
				Protected bird area – bird species, migratory bird species	IV

ries (SPA: special protection area; SCI: sites of community importance; SAC: special areas of conservation), but these are presented in their merged form in the tables and figures of this paper. As Serbia is not yet a member of the EU, there are no Natura 2000 sites here, but Serbia has already started preparing for the designation of these sites (Filipović, D. 2017). Ramsar sites for wetland protection occur in all countries, but in the largest number in Hungary. UNESCO Man and Biosphere Reserves are also present in each country, usually with 2–4 areas, including cross-border areas such as the "East Carpathians Transboundary Biosphere Reserve (Poland / Slovakia / Ukraine)". The UNESCO World Heritage List does not specifically include protected areas, instead, this title can be assessed rather as an award and a responsibility. Nonetheless, the natural sites on the UNESCO World Heritage List are also worth to be mentioned, and they are also registered in the WDPA dataset. Among World Heritage natural sites, two are found in Croatia (with four locations altogether), two-two in Romania and Slovakia, and one in Hungary. These numbers also include those sites, which expand to several countries, such as the "Caves of Aggtelek Karst and Slovak Karst" or the "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe". The maps presenting the protected areas of each country *(Figures 1–5)* show the national categories, which cover more than 1 percent of the country. In addition, Natura 2000 sites are represented as polygons, and the Ramsar and UNESCO World Heritage Sites, which generally have a small areal extent are represented by symbols. Since UNESCO MAB Biosphere reserves almost fully overlap with other categories, they are not shown on the maps to avoid double markings.

Comparison of WDPA and national datasets

Table 2 shows the number and areal extent of protected areas in each country by category. Further on, aggregate values calculated by simple summation and on the basis of merged shapes are also provided as mentioned in the "Data and methods" section. This table also contains the values calculated according to the national databases and the WDPA.

In the case of Croatia, we found significant differences in four of the seven categories examined. In the case of the "nature park", the reason for the difference is that the Dinara Nature Park, established in 2021, is not yet included in the WDPA database. However, if we add the area of Dinara Nature Park (629 km^2) to the area included in the WDPA, we get closer to the national data, but still, the area of this category is about 250 km^2 smaller in the WDPA. As for the "important landscape" category, there are six more units in the national database and an area 100 km^2 larger. The number of national parks is the same, but the area value is 220 km^2 higher in the national database. Within the "special reserve" category, the national database contains four more units and an area 110 km^2 larger. Among the WDPA categories, there is the "horticultural monument", which really existed in Croatia but has already been abolished and merged into another category.

In the case of Romania, the WDPA dataset includes one more object in the "natural park" category than the national dataset, but the size of the area is almost the same. There are numerical and minor areal differences between the WDPA and national datasets for the cases of "nature reserve", "scientific reserve" and "natural reserve".

The largest differences between the two databases are in the case of Serbia. As Serbia does not acknowledge Kosovo as an independent country, the protected areas in Kosovo are included in the national database, while they are missing from the WDPA dataset, thus, in order to make the comparison applicable, these were cut out of the national database. Nevertheless, there are still large differences. The main reason for the discrepancies is that the WDPA contains outdated and inaccurate data on Serbia. Obsolescence is not necessarily old, given that in 2021 several new protected areas were created or others

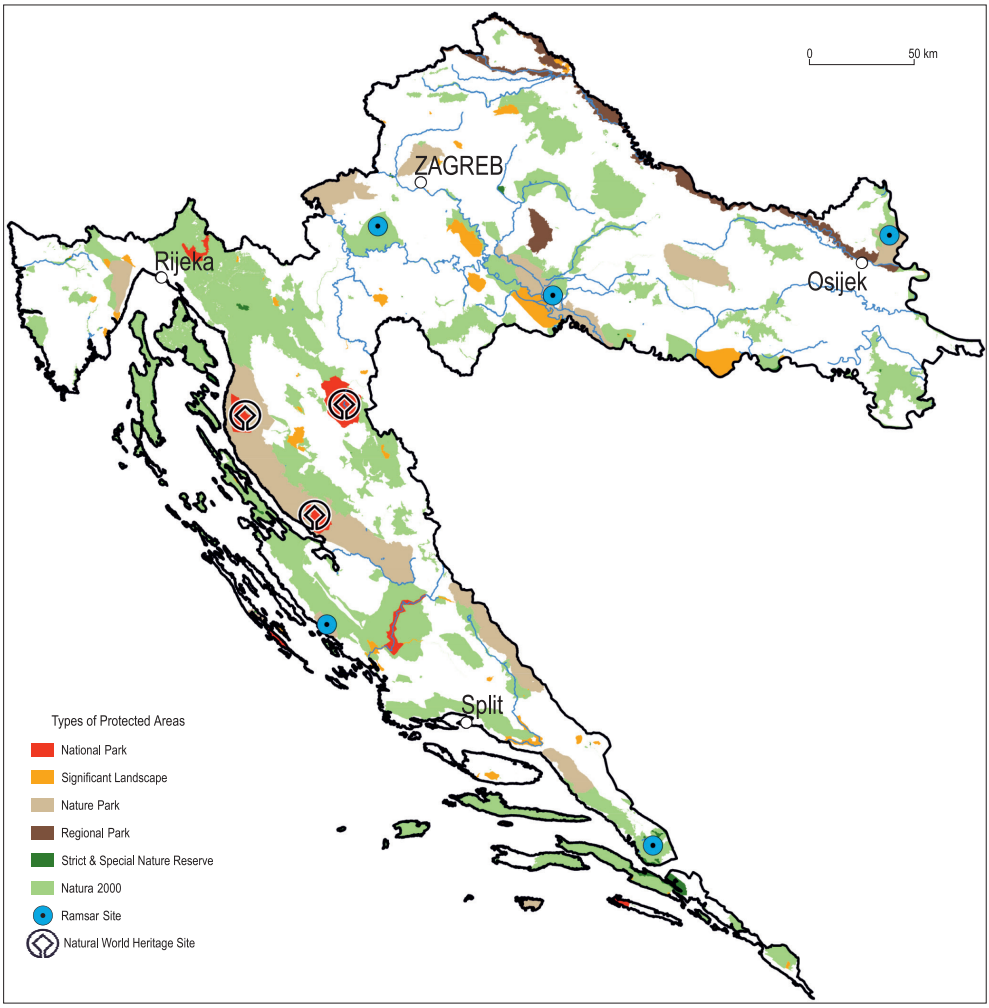

Fig. 1. Protected areas in Croatia

reclassified in Serbia that explains several differences. For example, in the "national park" category, there are six national parks in the national database, while only 4 in the WDPA database. The difference is due to the fact that two new national parks (Stara Planina and Kucaj-Beljanica) were established in 2021 by merging and expanding previously existing protected areas. The largest differences in both number and area are found in the case of "outstanding natural landscape" category.

Regarding the data of Hungary and Slovakia, there are no significant differences between the two databases.

Comparison of proportions

Finally, we got to the point where we can compare the countries based on the proportion of protected areas *(Figure 6).* Based on the above evaluation, we use data from national

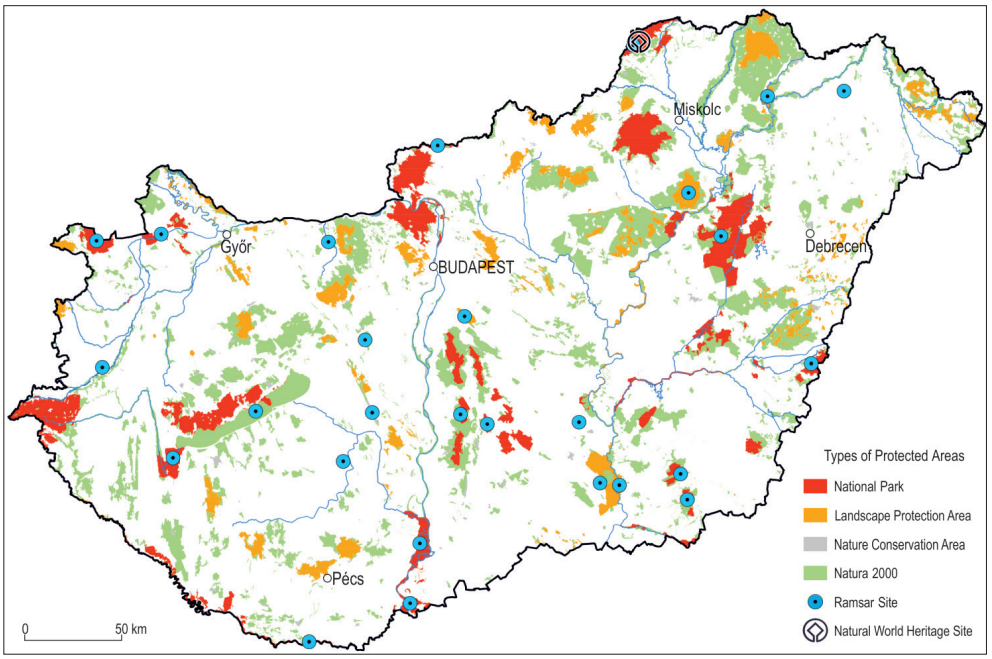

Fig. 2. Protected areas in Hungary

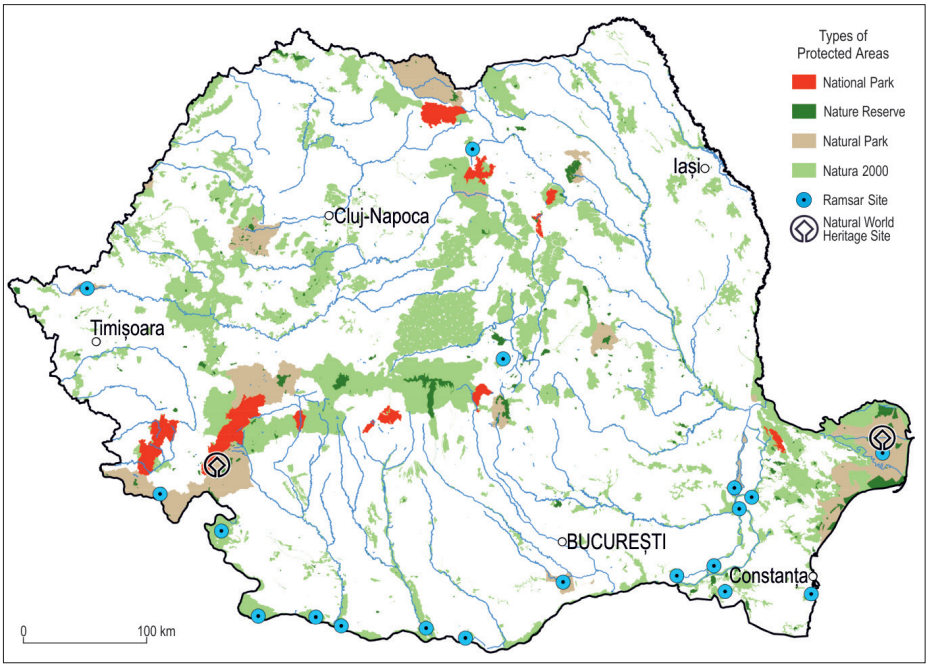

Fig. 3. Protected areas in Romania

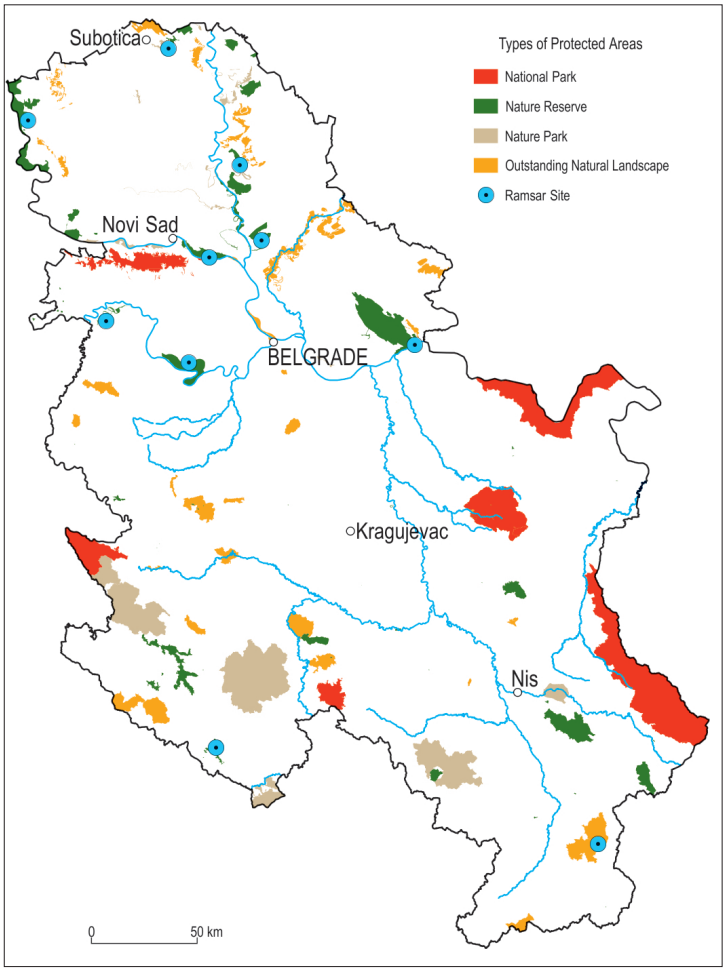

Fig. 4. Protected areas in Serbia

databases to make the comparison. Taking into consideration the percentage of protected areas related to the total area of each country, we can observe significant differences among the countries studied. 23.5 percent of the territory of Slovakia, 14.6 percent of the territory of Croatia, 10.5 percent of the territory of Serbia, 9.1 percent of the territory of Hungary and only 5.4 percent of the territory of Romania are protected by law according to the national categories. However, adding the non-overlapping part of Natura 2000 sites to the nationally protected areas will significantly increase the proportion of protected areas and even change the order of the countries according to this parameter. Calculating in this way, Croatia has the highest proportion of protected areas (39.1%), Slovakia is in second place with 37.5 percent, while Romania (23.5%) and Hungary (22.0%) show a similar proportion. Finally, this aggregate parameter is the lowest in Serbia that is due to the fact that there are no Natura 2000 sites in this country yet. However, according to the estimations, the area of ecological networks will cover about 20 percent of the territory of the Republic of Serbia (Filipović, D. 2017).

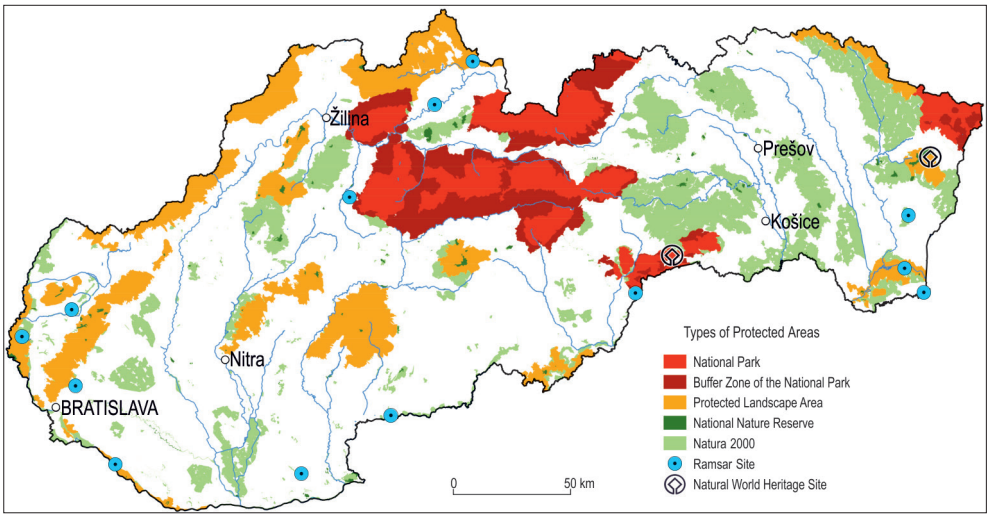

Fig. 5. Protected areas in Slovakia

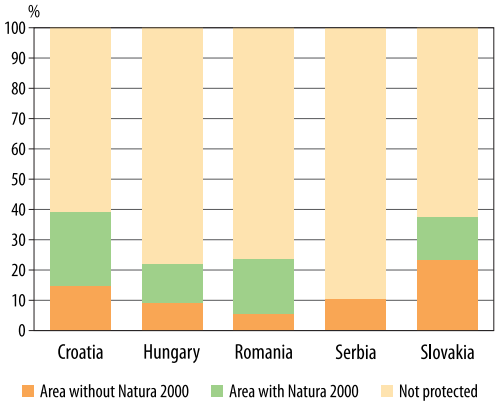

Fig. 6. Percentage of protected areas in relation to the area of each country

It is interesting to observe how different the distribution of the protected area categories is in each country *(Figure 7).* "Nature parks" are in the absolute majority in Croatia and Romania, while in Hungary, "national parks" provide more than half of the protected areas. In contrast, the situation is more balanced in Serbia and Slovakia. In Serbia, the "national park" is also the category with the highest proportion (but not an absolute majority), while in Slovakia this is also the case if the buffer zones are added to the area of the national parks. Croatia has the most diverse category system.

Conclusions

Overall, we can state that the nature conservation systems of the studied countries are fairly similar, partly as a result of analogous historical developments. However, in addition to similarities, there are also differences in their systems, such as the lack of "strict reserves" in Hungary and Slovakia, or the existence of certain specific categories in almost all countries (e.g. "forest park", "monument of park architecture" in Croatia; "nature conservation area" in Hungary, "protected landscape element" in Slovakia, etc.). Despite the similarity of the systems, we can find remarkable differences in the relative proportions of the categories among the countries, with Hungary (57%) and Croatia (11%) being the two extremes in terms of the proportion of national parks. The demand for tourism utilization is increasing in each country, and

Table 2. Protected areas by category and country as calculated from the national dataset and the WDPA

Country	Category	Number	Area, km²	Percentage of protected areas	Percentage of the country	Rel. diff. to WDPA, %	WDPA number	WDPA area, km²
CROATIA	Nature park	12	4,950	56.2	8.7	17.6	11	4,078
	Important landscape	84	1,379	15.7	2.4	7.3	78	1,278
	Regional park	2	1,026	11.6	1.8	0.3	2	1,022
	National park	8	980	11.1	1.7	23.1	8	753
	Special reserve	80	408	4.6	0.7	29.1	76	289
	Forest park	27	29	0.3	0.1	1.1	26	28
	Strict reserve	2	24	0.3	0.0	0.0	2	24
	Monument of park architecture	115	12	0.1	0.0	0.6	113	12
	SUM (with overlaps)	330	8,807	100.0	15.6	14.9	428	7,497
	Real area without Natura 2000	–	8,284	–	14.6	15.9	–	6,966
	Real area of Natura 2000	–	20,621	–	36.4	–	–	–
	Real area of all	–	22,101	–	39.1	–	–	–
HUNGARY	National park	10	4,812	56.7	5.2	0.4	10	4,793
	Landscape protection area	39	3,365	39.6	3.6	0.0	39	3,364
	Nature conservation area	170	313	3.7	0.3	-1.4	174	317
	Natural monument	88	1	0.0	0.0	-5.6	100	1
	SUM (with overlaps)	307	8,492	100.0	9.1	0.2	323	8,476
	Real area without Natura 2000	–	8,492	–	9.1	0.0	–	8,496
	Real area of Natura 2000	–	19,682	–	21.2	–	–	–
	Real area of all	–	20,471	–	22.0	–	–	–
ROMANIA	Natural park	15	7,698	54.8	3.2	0.0	16	7,699
	National park	13	3,174	22.6	1.3	0.0	13	3,174
	Nature reserve	723	2,883	20.5	1.2	4.4	667	2,757
	Scientific reserve	32	167	1.2	0.1	-71.1	45	285
	Natural monument	161	130	0.9	0.1	-5.3	203	137
	SUM (with overlaps)	944	14,052	100.0	5.9	0.0	944	14,051
	Real area without Natura 2000	–	12,876	–	5.4	0.0	–	12,880
	Real area of Natura 2000	–	54,449	–	22.8	–	–	–
	Real area of all	–	56,032	–	23.5	–	–	–

Table 2. continued

Country	Category	Number	Area, km²	Percentage of protected areas	Percentage of the country	Rel. diff. to WDPA, %	WDPA number	WDPA area, km²
SERBIA	National Park	6	2,936	35.6	3.8	56.9	4	1,265
	Nature park	19	2,008	24.4	2.6	-47.7	16	2,965
	Outstanding natural landscape	33	1,631	19.8	2.1	64.6	19	577
	Nature reserve	66	1,556	18.9	2.0	6.0	63	1,463
	Monument of nature	106	64	0.8	0.1	4.3	237	61
	Protected habitat	9	35	0.4	0.0	22.6	6	27
	Forest park (former)	10	13	0.2	0.0	100.0	0	0
	Natural areas surrounding cultural sites	8	1	0.0	0.0	-366.8	27	6
	SUM (with overlaps)	257	8,244	100.0	10.6	22.8	374	6,365
	Real area of all	–	8,144	–	10.5	21.9	–	6,361
SLOVAKIA	Protected landscape area	14	5,226	42.8	10.7	-2.3	14	5,348
	National park	9	3,175	26.0	6.5	-1.5	9	3,222
	Buffer of national park	9	2,626	21.5	5.4	1.5	9	2,585
	National nature reserve	202	803	6.6	1.6	-3.6	208	832
	Nature reserve	376	163	1.3	0.3	13.4	372	141
	Protected site	181	117	1.0	0.2	0.5	182	116
	Buffer of nature reserve, monument	–	64	0.5	0.1	1.0	59	63
	Buffer of protected site	–	24	0.2	0.0	-4.8	6	25
	Nature monument	269	15	0.1	0.0	-11.2	265	17
	National nature monument	60	1	0.0	0.0	0.0	60	1
	Protected landscape element	1	0	0.0	0.0	15.7	1	0
	SUM (with overlaps)	1,121	12,215	100.0	24.9	-1.1	1,185	12,351
	Real area without Natura 2000	–	11,512	–	23.5	–	–	–
	Real area of Natura 2000	–	14,664	–	29.9	–	–	–
	Real area of all	–	18,391	–	37.5	–	–	–

Notes: „SUM (with overlap)" is calculated as the arithmetic sum of national protected area categories. „Real Areas" are calculated from the merged data (i.e. no double counting). „All" includes national categories and Natura 2000 areas together. For further explanation, see text.

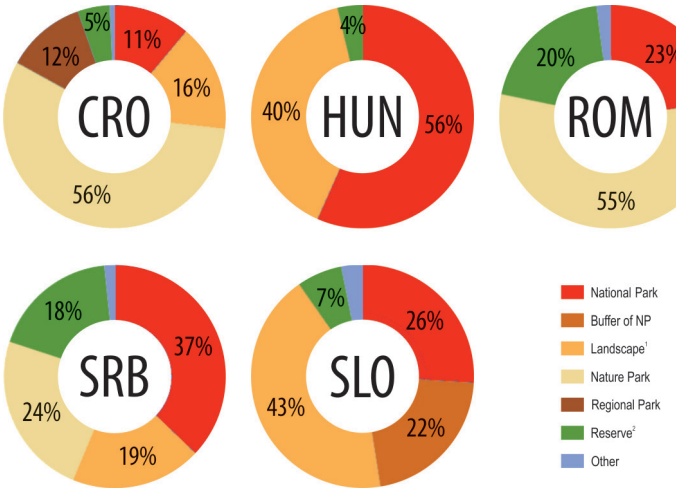

Fig. 7. Percentage distribution of protected area categories within all nationally protected areas. Only categories with a total area of more than 1 percent of each country are presented, the others are shown as "other". Landscape[1] means "Important Landscape" in Croatia, "Landscape Protection Area" in Hungary", "Outstanding Natural Landscape" in Serbia and "Protected Landscape" in Slovakia. Reserve[2] means "Special Reserve" in Croatia, "Nature Conservation Area" in Hungary, "Nature Reserve" in Romania and Serbia and "National Nature Reserve" in Slovakia. CRO = Croatia; HUN = Hungary; ROM = Romania; SRB = Serbia; SLO = Slovakia.

the distribution of protection categories may also affect this issue. For example, the title of "national park" has a stronger marketing value, but the associated restrictions are also stricter than in the case of a "nature park".

International protection categories and titles (Natura 2000, Ramsar, UNESCO World Heritage, UNESCO MAB reserves) are more or less similarly present in the countries studied (except Serbia, where there are as yet no Natura 2000 areas). If we take into account the international categories, we can observe that several areas enjoy multiple, sometimes even five- or six-fold protection. The number of protection categories for a given area may also play an important role in financing the conservation measures of that area. Besides the growing role of tourism, the socio-economic needs of the local population are also increasingly emphasized (Mose, I. 2007), but it is important to emphasize that these aims should be in line with conservation goals.

Among the elements of the geoheritage, caves are literally mentioned in the nature protection laws of most countries, but they have a varying emphasis. As for the concept of "geodiversity", it is literally mentioned only in Serbian law.

As far as the WDPA is concerned, we have found that the accuracy of this database varies from country to country. Where there have been no major changes in recent years and the protected area system is stable, the WDPA contains data of acceptable accuracy, but in certain cases (mainly for Serbia in the present study) we found significant differences. Therefore, we can state that the database is only partially suitable for international comparisons and tracking global changes, and before using it for a detailed analysis, the checking of the country data included in the analysis is necessary. However, as WDPA provides GIS files available free of charge, we highly recommend it as an easily accessible database if one wants to create maps about protected areas.

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