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TOURISM IN FUNCTION OF DEVELOPMENT OF THE REPUBLIC OF SERBIA

Tourism in the Era of Digital Transformation

THEMATIC PROCEEDINGS I

UNIVERSITY OF KRAGUJEVAC
FACULTY OF HOTEL MANAGEMENT AND TOURISM IN VRNJAČKA BANJA

ANALYSIS OF THE OF DIGITAL TECHNOLOGIES APPLICATION IN NATURE PROTECTED AREAS

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Abstract

Nowadays, digital technologies are fundamental in all areas of society, including the protection of natural and cultural heritage. The access to online data, the use of remote sensing technologies and platforms will determine the basis for future trends in nature protection and environmentally friendly tourism.
In this paper, we seek to identify and analyze the application of digital technology in the nature conservation of the Serbian protected areas and different aspects in tourism offer. The Republic of Serbia is characterized by a well preserved nature and high level of biodiversity, which is reflected also in the number of protected areas. We will investigate databases that are available to the public through the digitized online register of natural heritage with presentation of all Serbian data related to nature conservation in terms of tourism offer.

Key Words: *Digital technologies, protected areas*
JEL classification: *Q57*

Introduction

Nowadays, if we follow the development of the history of humankind, the period characterized by the increasing use of digital technology to mediate access and manage information has been described as the Age of Information (Maffey et al. 2015). Like many other societal domains, the environmental sciences have embraced digital technology to manage information and enhance analytical power (Stafford et al. 2010). The establishment of sub-disciplines such as ecological modeling or predictions and bioinformatics or global footprint calculations, as well as

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the embedded use of digital technology within others (e.g., Geographic Information Systems - GIS, climate modification, visualization of ecological networks...), testifies to this. As we have mentioned before, we are in the age of laptops, tablets, smart phones, the internet, social networks, and innumerable miniaturized computing devices which permeate every aspect of daily life (Joppa, 2015), also different computer applications, programs or platforms. Also, anthropocenic phenomena defined by an exceptionally rapid loss of biodiversity caused by human activity and changing climates. Conservation biology is the scientific discipline that addresses the dynamics and problems of perturbed species, communities, and ecosystems (Joppa, 2015). The practice of nature conservation has always been interdisciplinary, and searching new methods such as role of digital tools and technology can play in helping monitoring, modeling, mapping and responding to the challenges of global enormous biodiversity loss, ecosystems changes, and finally global tourism interaction or contribution (Galán-Díaz et al., 2015).

Study on the use of digital technologies in the context of nature conservation in its broadest sense is less developed. The academic studies that have begun to consider the use of digital technology in conservation are a big issue and considered to be key challenges in this area. Researching available literature related to this issue, we found a small number of international articles or publications, while there were no publications by national authors or in the Serbian language. According to these facts we can consider that this paper is the first review on this topic. In this paper, we seek to identify and analyze the application of digital technology in nature conservation, with the emphasis on the actual level on application of modern technology in nature conservation, and also compare it with the neighboring countries or world known nature reserves. To undertake this analysis, it was necessary to extend our search beyond peer-reviewed publications and other scholarly works.

The adoption of new digital technologies by State authorities, Institutes or nature conservation organizations, such as GPS enabled mobile devices, interlinked databases and high-performance computing, has led to state changes in a wide range of dimensions including data gathering, public engagement, increased knowledge and skills, and monitoring. Modern technology does not always contribute to protection directly, but in spite of this, nature conservation organizations adopt new digital technologies because of the belief that these may help them to deliver the plurality of

conservation and organizational objectives more efficiently (Verma et al. 2015).

Study methods and approach

The general method we conducted for three study areas is related to:

- keyword searches with Google Scholar and Web of Science, using search terms related to *nature conservation* and *digital technology*. In addition, we gathered material from available online sources.
- results were assessed (by title, introduction, abstract, images, and where needed, body text) to derive recurrent themes, which were subsequently grouped. On the basis of this, we identified key areas of research
- also, it was important to provide an overview of five dimensions recommended by Arts et al., 2015, related to possibilities and problems, challenge of how to increase benefits associated with digital technology in nature conservation

Our investigation focused on three digital innovations in nature conservation, especially the highest rank of protected areas – National parks and Nature parks, as well as some interesting special nature reserves. The first case study is focused on GIS coverage and application in chosen protected areas with emphasis on the conservation of wildlife (birds, other animals or plants) and the places in which they live in a wide variety of ways. Also, attention will be paid to web platforms.

The second case study involved information and research on the community-based endeavor aimed at digital promotion of protected areas as tourist important localities. Through the collaboration with tourist organizations, and developed infrastructure for online data gathering, we collected information on actual problems, level of digitalization and relationship conservation-tourism.

The third case study focused on digitalization review of supporting wildlife and habitat diversity, through the different ecological networks such as NATURA2000 or EMERALD.

Review of nature protected areas

Protected areas are areas characterized by significant geological, biological, ecosystem and / or landscape diversity, for which they are

declared as protected areas of general or public interest. The Institute for Nature Protection of Serbia is developing protection studies of certain areas on professional and document basis. Protection studies contain data on the property, protection zones and cadastral municipalities that includes data on natural characteristics and values of the property (geographical and geomorphologic, geological and hydrogeological, climatological characteristics, data on wildlife species, animals and mushrooms, cultural heritage, tourism, socioeconomic, and other aspects), the protection regimes and proposed protection measures, as well as the proposal for the management of a natural good (National Institute for nature conservation, 2018). Based on the applied measures of institutional protection, for more than six decades, the area of protected sites in Serbia currently stands at 662,435 ha, or 7.9% of the territory of Serbia. According to the data (November 2015) by National Institute for nature conservation, there are 461 areas under protection in the Republic of Serbia:

- 5 national parks
- 18 nature parks
- 20 landscapes of outstanding features
- 68 nature reserves
- 3 protected habitats
- 310 nature monuments
- 38 areas of cultural and historical significance that are protected on the basis of the former Law on Environmental Protection and the Law on the Protection of Cultural Monuments.

Besides the protected natural resources, 1760 strictly protected and 868 protected wild species of plants, animals and fungi are also protected by the Law.

An area with the following characteristics is protected as the national park: a large number of diverse natural ecosystems of national significance, the prominent landscape features and cultural heritage, the existence of human populations in communion with nature, an area intended for the preservation of existing natural values and resources, with the overall landscape, geological and biological diversity, also intended for meeting the scientific, educational, spiritual, aesthetic, cultural, tourist, health and recreational needs and other activities in accordance with the principles of environmental protection and sustainable development. It is important to mention 5 National parks:

Đerdap, Fruška gora, Kopaonik, Tara and Šar-planina. Nature Park is an area of well-preserved natural values, with mostly preserved natural ecosystems and picturesque landscapes, designated to ensure the overall geological, biological and landscape diversity, as well as to meet the scientific, educational, spiritual, aesthetic, cultural, tourism and health and recreation needs and other activities in accordance with the traditional way of life and the principles of sustainable development. There are 16 Nature parks, where, among others, the ones worth mentioning are Golija, Stara mountain, Sićevačka gorge.

In addition to the natural resources protected at the national level in Serbia, there are also protected areas which are important according to international regulations (Luković, 2017). Internationally significant natural resources in Serbia are also the basis for the development of international cooperation and the exchange of good practices, in order to improve the protection of nature. Internationally important protected areas are also under the ecological networks. The ecological network includes interconnected or spatially close protected areas and ecologically significant areas which are connected by natural or artificial corridors.

Figure 1: *Map of the identified 61 EMERALD areas*

Source: *Institute for nature conservation of Serbia (http://www.zzps.rs/novo/index.php?jezik=en&strana=zastita_prirode_ekoloske_mreze_emerald 2.03.2018.)*

The ecological network of Serbia contains 101 ecologically significant areas. The most important networks in Serbia, as well as in Europe and

wider are NATURA2000 and EMERALD. "Emerald" is a European ecological network for the conservation of wild flora and fauna and their natural habitats in those non-EU countries.

Natura 2000 is the cornerstone of the EU's policy for nature conservation and biodiversity, designed as a broad European network of protected natural areas, and is designed on the basis of the Habitats Directive. "Natura 2000" is the name of a European ecological network that includes protected areas in the territory of EU Member States, established under the 1992 Habitats Directive. The network includes the Special Areas of Conservation (SAC) declared by EU Member States under the Habitats Directive and Special Protection Areas (SPAs), which were designated under the 1979 Birds Directive.

These areas of importance for nature protection have been isolated on the basis of the implementation of EU directives and uniform criteria based on the principles of sustainable development and the application of other international conventions related to the conservation of biodiversity, in particular the Biodiversity Convention (Kostić, 2016). Natura 2000 areas cover an average of 17.5% of the territory of the European Union, and the network comprises 26,106 areas with a total area of 949,910 km2 in (then) 27 Member States.

Application of Geographic information system (GIS) in protected areas - Case study: National park Đerdap

Geographic information system is an information technology that combines geographical locations of natural and artificial structures (mountains, rivers, forests, roads, buildings, bridges...) and other data aimed to generate interactive visual maps and reports (Nevetić, 2004). We can say that GIS is a spatial database which contains the data sets that represent geographic information in terms of a general GIS model data. In this paper we will give general review of GIS application and possibilities for the protected areas (Pavlović, 2008).

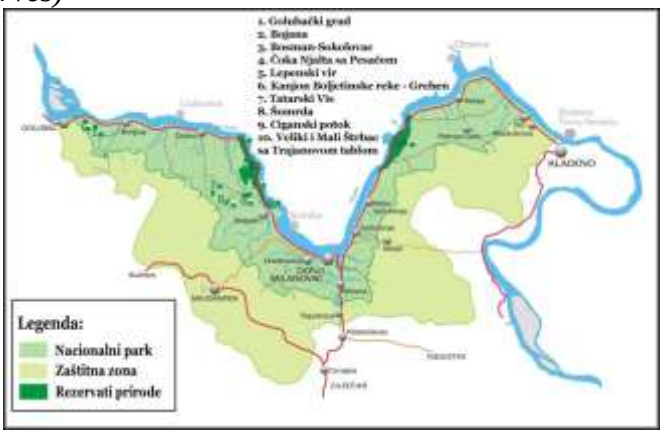
Đerdap National Park is located in the southeastern part Europe, in northeast Serbia at the border with Romania. The total area of the national park is 63,608 hectares, while the protected zone covers 93,968 hectares. National Park covers parts of three Municipalities: Golubac, Majdanpek and Kladovo, where the largest national park in Serbia is situated. Due to its large surface, in order to maintain efficient and durable protection as

well as a sustainable use of natural resources, it is necessary to start building the potential of the National Park Đerdap, and then to implement an integral geographic information system. A unique database will be created to contain forest types, flora, fauna, paleontology, hydrology, geology, nature reserves, special areas, natural values, natural monuments, roads, hiking trails, immovable cultural goods of exceptional importance, etc. National Park "Đerdap" is among the most attractive national parks in the Balkans with its unique natural characteristics and the specificity and biodiversity and protected species of plants and animals. Member of the EUROPARC association is incorporated in the List of International Important Bird Areas - IBA (Important Bird Areas) area, also in the Important Plant Areas List (IPA) and in the list "Selected areas for daily butterflies"- PBA area (Prime Butterfly Areas) under Butterfly Conservation Europe. A part of the Emerald Network of Areas of Special Conservation Interest (ASCI) identified / established under the name of the National Park Đerdap. The National Park Đerdap represents the unity of the natural and cultural heritage of Serbia, because of the specific natural features of this area, there is also an extremely valuable cultural heritage (http://www.npdjerdap.org).

The process of implementation of the geographic information system in the National Park Đerdap is in progress, and the phase of scanning and georeferencing of forest maps is currently underway, as well as their digitization. By completing the system, i.e. the implementation of GIS in the "National Park Đerdap" will primarily be able to provide:

- more efficient and lasting protection of the biodiversity of the park
- more efficient management of the national park
- better protection of natural assets
- interactive access and management (query, update, delete, add, connect...) with databases
- identification and evaluation of natural potentials (park potential)
- statistical analysis of data
- displaying digital maps (displaying maps on the computer screen and printing them)
- management of forest cadastre
- displaying multimedia data (establishing connections between data on the map and photos or films about, for example, certain plant or animal species)
- analysis and modification of existing data
- display and print reports, etc.... (Pavlović, 2008).

Figure 2: *Map of the National park "Djerdap" (protected zones and nature reserves)*



Source: *http://www.geografija.rs/zasticena-podrucja/zasticena-podrucja-zasticena-podrucja/nacionalni-parkovi/djerdap/derdap-proglasenje-i-zone-zastite/*

In terms of other digital presentation, national park "Đerdap" has one of better web site presentations available to wider public. This information is comprehensive and systematically scheduled. In the context of tourism, web presentation is divided in several parts: basic info, news, cultural heritage, natural heritage. Each of these sections is divided into detailed information in these issues. Especially, section for guests is covered by maps, walking routes, info tables and many other visual features (*www.npdjerdap.org*.)

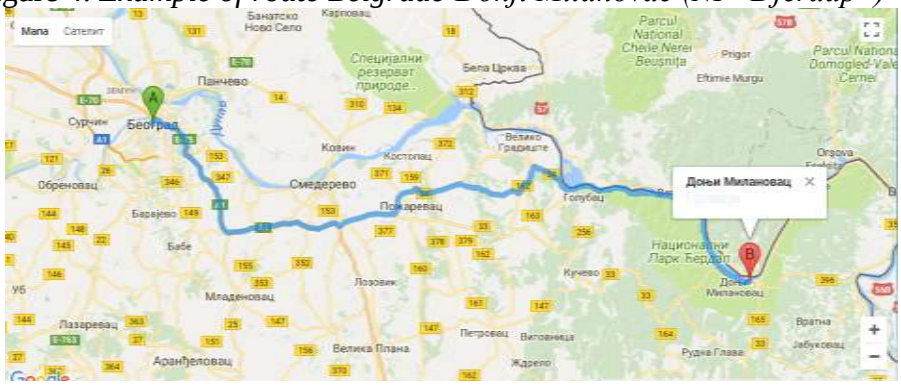
Figure 3: *Web site presentation*

Source: *http://www.npdjerdap.org/novi/?page_id=6013*

The national park's position is georeferenced and covered by map route for tourists. The area of the park is between $44^{o}42`$- $44^{0}24`$of the northern

latitude and 22°33`-21°40`of the eastern latitude. Access to the NP Đerdap is possible from three directions: the Đerdap highway from the direction of Belgrade, the Đerdap highway from the direction of Kladovo and from the direction of Niš, via Zaječar, Bor and Miloševa tower by a regional route. Đerdap National Park has three primary entrances, two are located on Đerdap highway near Golubački grad and Diana Karatas, and one on the regional road Porec bridge – Klokočevac (*www.npdjerdap.org).*

Figure 4: *Example of route Belgrade-Donji Milanovac (NP"Djerdap")*

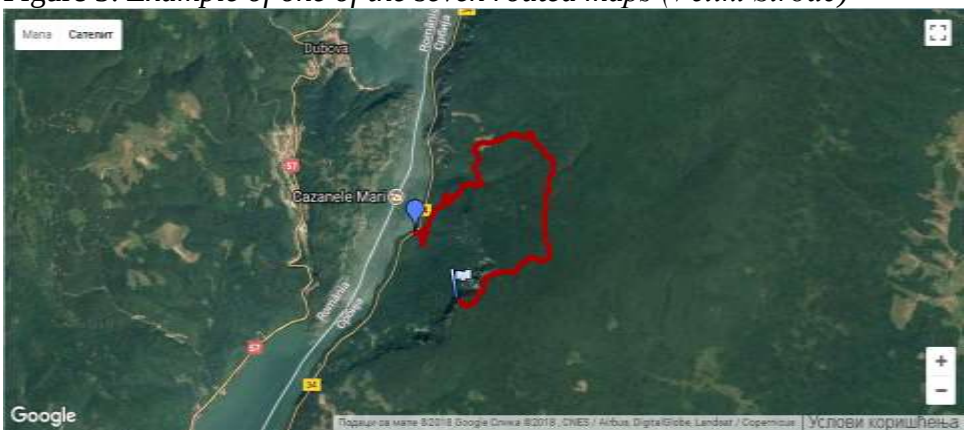


Source: *http://www.npdjerdap.org/novi/?page_id=101, modified by author*

Renovated and marked walking paths of different lengths passing through attractive areas, nature reserves and ending on viewpoints, is the way to get to know NP Đerdap. With the nature conservators of JP National Park Đerdap, the use of pedestrian paths is a real experience, but it is also possible to use a personal GPS device with routed maps. With each marked hiking trail, the slope of the terrain is also prominent (*www.npdjerdap.org).*

Other protected areas in Serbia have also started with digitalization. A table with the level of digitalization of several main protected areas and its connection to the modern technologies is given in Table 1. Results of this research shows that coverage of the main National parks by GIS is almost partly applied, and better visualized then low level of protection. Almost, all protected areas have web presentation, but the information varies from basic to very complete. None of the researched protected areas has any applications that are related to mobile phones. Also, all protected areas offer walking tours through the nature, but only four have georeferenced routes.

Figure 5: *Example of one of the seven routed maps (Veliki Štrbac)*



Source: *http://www.turizam.npdjerdap.org/?page_id=110*

Figure 6: *Example of elevation profile for Veliki Štrbac trail*

Source: *http://www.turizam.npdjerdap.org/?page_id=110*

Table 1: *Review of digital technologies application in chosen protected areas*

Protected area	**Status**	**GIS application**		**WEB site presentation**	**Connection to phone application**	**Georeferenced rout maps**
		Partly	**Full**			
Kopaonik	National park	+	-	+	-	+
NP Fruska Gora	National park	+	-	+	-	-
NP Tara	National park		+	+	-	+
NP Sar planina	National park	-	-	+	-	+
Golija	Nature park	-	-	+	-	-
Stara planina	Nature park	+	-	+	-	+

Zasavica	Special nature reserve	-	-	+	-	-
Carska bara	Special nature reserve	-	-	+	-	-

Source: *created by author*

In order to manage natural resources in a sustainable manner, accurate and timely information is needed to timely address the changes in space. For this reason, it is necessary to create a system that will integrate all the relevant data in order to achieve the given goal (Silc, 2016).

Example of digitalization in world protected areas

Protected areas, special places set aside for conservation and sustainable use have a long history. While many cultures have regarded certain natural areas as sacred for centuries, the first "modern" protected area, Yellowstone National Park in the United States, was established in 1872. Early park rangers relied on paper maps and physical patrols to document the health of parks, tools that many still rely on today. But we now live in a world with more than 177,000 protected areas in more than 150 countries (Davis et al., 2014). Patrolling these large areas to document and crack down on harmful and often illegal activities like logging, mining, and poaching requires time and money – resources lacking in many countries. By enabling the creation of networks of electronic sensors and human participants, new technologies have shaped the ways in which conservation-related organizations monitor wildlife. These networks enable gathering data perceived as necessary to evidence conservation strategies and foster public support. In terms of practice, large amounts of new data can now be gathered and processed more cost-effectively (White, D., 2009).

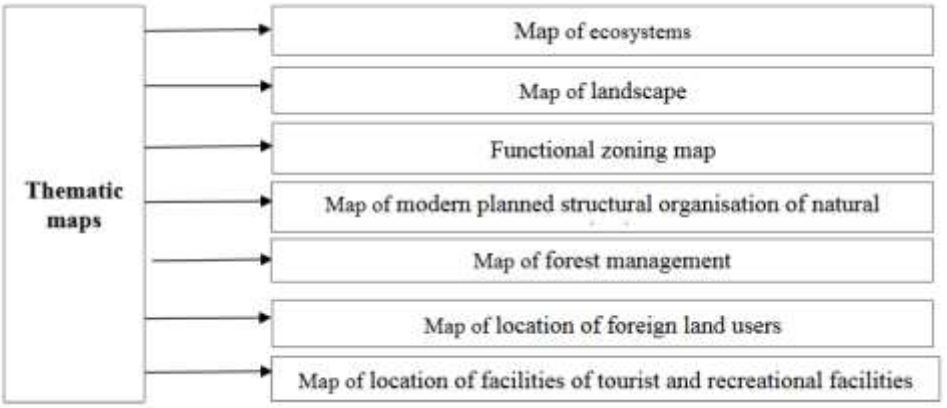
One of the basic technologies which are used in world protected areas is GIS. At present, GIS technologies have become one of the most effective tools in implementation of control and monitoring in various fields, especially in the field of land management. Application of GIS technologies in this field allows to analyze a large amount of thematic maps, as well as to develop new cartographic models. For example, national parks and nature reserves in the territory of Kazakhstan have a great variety of natural-territorial units and their complex spatial

organization (Kamelkhan et al., 2016). Proper functional organization and zoning related to protected areas are one of the criteria for evaluation of scientific based planning and design solutions, choosing protection regimes and the scope of recreational and tourism activities. Structure of protected areas in Kazakhstan is as follows:

- 33 reservations;
- reserves;
- national parks;
- natural parks;
- nature monuments;
- botanical gardens and arboretums;
- therapeutic areas and resorts;
- territories of traditional nature (Gohman V., 2014).

More accessible and interesting is the information transmitted visually, and it is more relevant and informative. They create a series of thematic maps using application of GIS technology and materials of processing of satellite

Figure 7: *The structure of the thematic maps*



Source: *Kamelkhan et al., 2016*

The next steps in digitalization beside technologies that are used in nature protection are applying digital technologies in tourism-nature correlation. To address the environmental impacts of tourism in protected areas, park managers need to understand the spatial distribution of tourist use (Yang et a., 2014). Standard monitoring measures (tourist surveys and counting and tracking techniques) are not sufficient to accomplish this task, in particular for off-road travel. The good example of this initiative is one of

famous National parks in northwest Yunnan Province of China where there is an increasing concern about potential impacts of unregulated tourist use. New technology patterns provide information that can help park managers develop strategies that are effective for both tourism management and species conservation (Buntaine et al., 2007). National parks, heritage sites, and other protected areas are increasingly important for nature-based tourism. They are the primary places chosen by most people who want to enjoy nature. There is growing evidence that tourism activities have negative impacts on biological resources (as a result of resource extraction, wildlife disturbance, and habitat degradation) and physical environments (as a result of increased soil compaction, water pollution, and fire frequency).

Modern counting equipment, including cameras, infrared sensors, and pressure pads, can collect tourist distribution information accurately and efficiently. However, they are expensive, and their use is usually limited to the main entrances and road and track heads (Xia and Arrowsmith, 2008; Pettebone, 2009). Newly developed tracking techniques, such as cellular phone triangulation and global positioning systems (GPSs), have become attractive options for tourist studies (D'Antonio et al., 2010).

The most used technologies in world protected areas are:

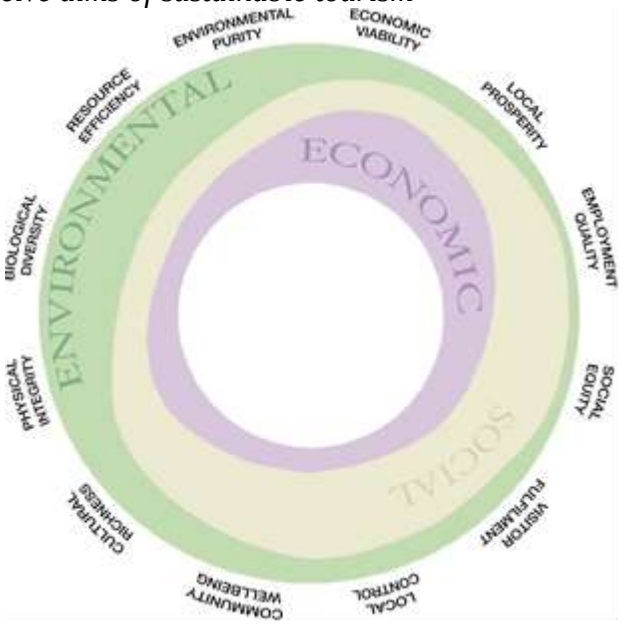
- Carbon calculator
- Community informatics
- Computer simulations
- Destination Management Systems (DMSs)
- Economic impact analysis
- Environmental Management Systems (EMSs)
- Gamification
- Geographic Information Systems (GISs)
- Global Positioning Systems (GPSs)
- Intelligent Transportation Systems (ITSs)
- Location-based services (LBSs)
- Virtual tourism
- Weather and climate change systems

In order to organize sustainable tourism in nature protected areas, it is necessary to respect twelve aims of sustainability. The key elements are Resource Efficiency and IT, Environmental purity and physical integrity, Biological diversity, Virtual Substitute Travel Experiences, Social equity

and community wellbeing, Local control, Cultural richness, Economic viability and local prosperity, Employment quality and capacity building. In this paper our attention is paid to natural resources, and in that context Biological diversity issues related to mentioned technologies are based on three segments (*Beckendorff J. P. et al., 2014)*:

- Citizen scientists: handheld devices can allow tourists to monitor animal and bird species and other environmental phenomenon on their digital devices as they travel.
- Tourist scientist: combining tourism, research, conservation and computers to identify and track flora and fauna (e.g. Earthwatch, Cyber trackers).
- Voluntourists: make meaningful contributions to communities and wildlife in destinations.

Figure 8: *Twelve aims of sustainable tourism*



Source: *Beckendorff J. P. et al., 2014.*

Monitoring has a quite long tradition in protected areas concentrating mainly on observing and managing the natural environment. But increasing visitor numbers and public accountability lead to implement more and more visitor monitoring systems. With ICT-solutions (one of very used technologies) on the rise, the disadvantages of hand-made counting can be solved and the management of visitor flows can be

organized more effectively (Guide to sustainable tourism in protected areas, 2013).

According to (Arts, K. et al., 2015.) digital technology is changing the nature conservation in increasingly profound ways. We describe this impact and its significance through the concept of 'digital conservation', which was found to comprise five pivotal dimensions: data on nature, data on people, data integration and analysis, communication and experience, and participatory governance. Examining digital innovation in nature conservation and addressing how its development, implementation and diffusion may be steered, it warns against hypes, techno-fix thinking, good news narratives and unverified assumptions. Along the way, digital technology may best be reconceptualised by conservationists from something that is either good or bad, to a dual-faced force in need of guidance.

Conclusion

Nature conservation is changing under the influence of digital technology. We have used the concept of digitalization in nature conservation to describe this alteration and to consider its significance. On the basis of websites, scientific and grey literatures and other sources, we analyzed the emerging field and distinguished several areas of application:

- GIS modeling and application in Serbian protected areas
- GIS modeling and application in World protected areas
- Sensor and monitoring data technologies on biological diversity in national protected areas
- Sensor and monitoring data technologies on biological diversity in international protected areas
- Monitoring technologies in Serbian and world's protected areas

Also, we confirmed that five stages of applying digital or IT depend on data on nature, data on people, data integration and analysis, communication, and participatory governance.

In order to manage natural resources in a sustainable manner, accurate and timely information is needed to timely address the changes in space. For this reason, it is necessary to create a system that will integrate all the relevant data in order to achieve the given goal. It is important to mention that the process of implementing a geographic information system in our national protected areas will contribute, the first of all, more efficient and

long lasting protection of the biodiversity, more efficient management of the national parks, better protection of natural assets, interactive access and management (query, update, delete, add, connect...) with databases-identification and evaluation of natural potentials (park potential), statistical analysis of data, displaying digital maps (displaying maps on the computer screen and printing them), management of forest cadastre, displaying multimedia data (establishing connections between data on the map and photos or films about, for example, certain plant or animal species), analysis and modification of existing data, display and print reports, etc. And finally, related to tourism, fully updated modern technologies point to IT applications in all sectors of the industry including airlines, travel intermediaries, accommodation, foodservice, destinations, attractions, events and entertainment, but are the most important and should be mostly used in the nature protection sector.

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