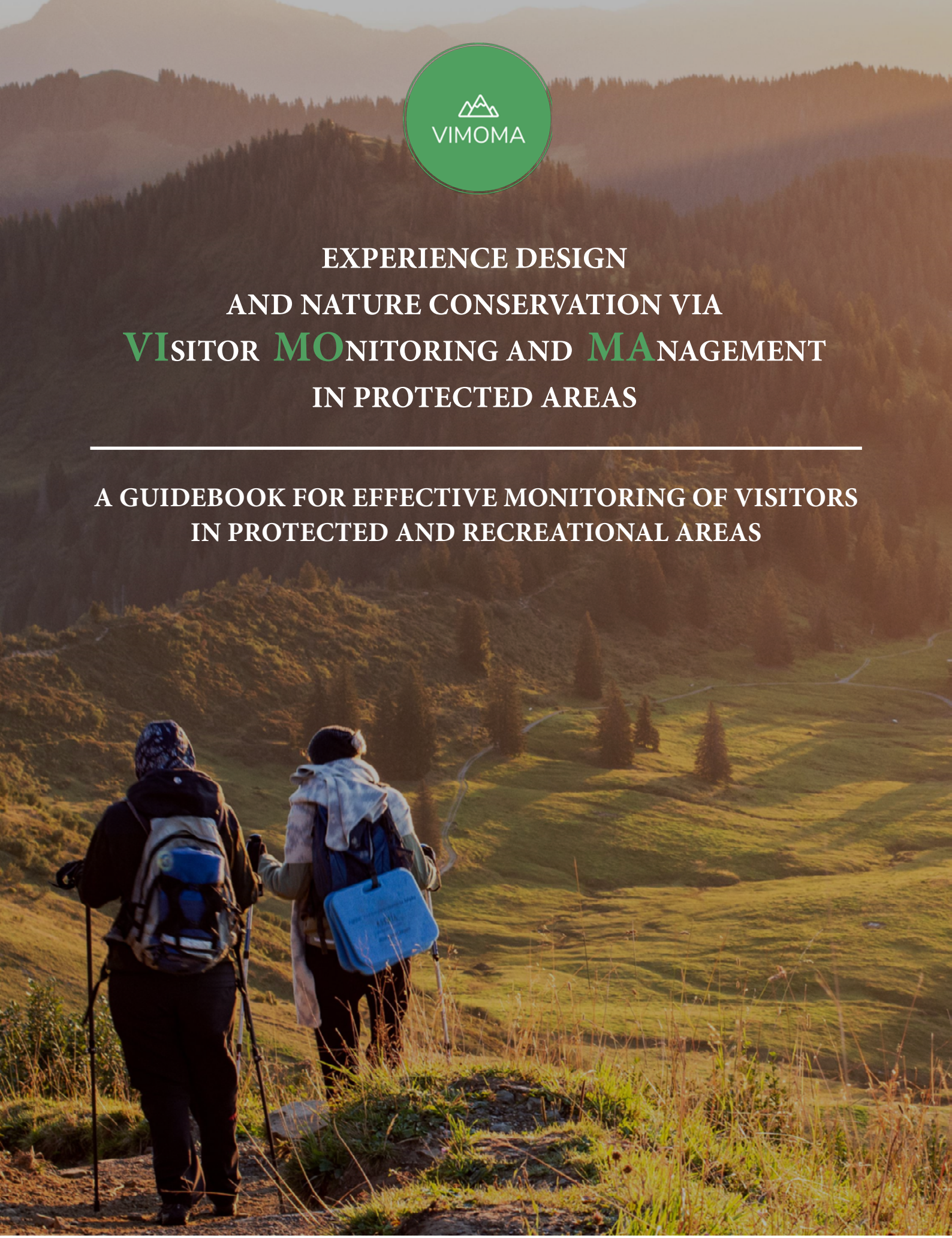
VIMOMA

EXPERIENCE DESIGN AND NATURE CONSERVATION VIA VISITOR MONITORING AND MANAGEMENT IN PROTECTED AREAS

A GUIDEBOOK FOR EFFECTIVE MONITORING OF VISITORS IN PROTECTED AND RECREATIONAL AREAS



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FOREWORD

This guidebook is part of the ***VIMOMA*** project, the purpose of which is sharing experience and knowledge in terms of visitor monitoring. The general aim of the project is also developing the framework of methodology for visitor monitoring and management.

The **VIMOMA** project aims to connect researchers and relevant stakeholders to make protected areas more efficient in nature conservation and visitor management in both Visegrad (V4) and Western Balkans (WB) countries. Especially nowadays, as the number of people visiting protected areas is significantly increasing and most these areas are struggling with the problem of overtourism or other conflicts between the natural environment and human activity.

VIMOMA – Experience design and nature conservation via VIsitor MOnitoring and MAnagement in protected areas is a project funded by Visegrad Fund under the grant agreement No 22210176. The consortium is formed of experts in fields of nature-based tourism from different countries: Poland - Jagiellonian University (Faculty of Geography and Geology, Institute of Geography and Spatial Management); Serbia - University of Novi Sad (Faculty of Sciences, Department of Geography, Tourism and Hotel Management); Slovakia - Matej Bel University (Faculty of Natural Sciences, Department of Biology and Ecology); Czech Republic – Mendel University in Brno (Faculty of Regional Development and International studies) and Hungary – CEEweb for Biodiversity.

The **VIMOMA** project consists of the three main outputs: workshops, a presented guidebook as well as the project website. The project started with five thematic workshops, which themes referred to the main chapters of this guidebook. For each workshop project partners invited two experts in the field of nature conservation and nature-based tourism, who shared their knowledge and trained protected area representatives in terms of different research tools and techniques useful for efficient visitor monitoring and management. Our experts, who conducted the

workshops were: 1st workshop (Poland) – Bernadetta Zawilińska (Economic University in Cracow) and Joanna Hibner (Jagiellonian University); 2nd workshop (Czech Republic) - Ondřej Vítek (Nature Conservation Agency of the Czech Republic) and Luboš Kala (Director of Partnerships at Ředitel Partnerství); 3rd workshop (Serbia) - Đorđije Vasiljević (University of Novi Sad) and Vladimir Marković (University of Novi Sad); 4th workshop (Hungary) - András Sztaniszláv (PersonaR - Corporate Communication Consultancy), Thor Morante Brigneti (CEEweb for Biodiversity), Joseph Oppong Wiafe (intern at CEEweb for Biodiversity); 5th workshop (Slovakia) – Lauri Laanisto (Estonian University of Life Sciences) with Piia Jaksi and Ly Härm-Kask (Ph.D. students from Estonian University of Life Sciences) and Daniela Casimiro (Mediterranean Experience of Ecotourism (MEET) network). Each workshop consisted of a two-day session. The first day included indoor activities, whereas the second day was dedicated to field trips to local protected areas, during which, the participants had the opportunity to learn about local problems and challenges related to visitor movement. We have visited five different protected areas: Pieniny National Park (Poland), Podyjí National Park (Czech Republic), Fruška Gora National Park (Serbia), Duna-Ipoly National Park Directorate (Hungary) and Nízke Tatry National Park (Slovakia). During five workshops we hosted and trained totally 27 protected areas representatives from 18 different protected areas: **Tatra National Park, Pieniny National Park, Babia Góra National Park, Ojców National Park, Magura National Park, Nature Conservation Agency of the Czech Republic, The Moravian Karst House of Nature, Podyjí National Park, Fruška Gora National Park, Sutjeska National Park, Őrségi National Park, Duna-Ipoly National Park, Bükki National Park Directorate, Fertő-Hanság National Park Directorate, Malá Fatra National Park, Nízke Tatry National Park, Cerová vrchovina PLA, National Park Veľká Fatra.**

More information about the **VIMOMA** project is available at our website: https://www.ceeweb.org/vimoma/

As the project partners and authors, we thank our experts for their contributions in creating content for the project's workshops, as well as for their input in writing this guidebook. We also thank the managers of protected areas for their participation in workshops and for sharing their experience.

AUTHORS

Project partners (authors) with protected area managers during the 4th Workshop of VIMOMA project in Hungary.

From left side (standing row): Ádám Varga (project partner & author; CEEweb for Biodiversity, Hungary); Tomasz Lamorski (PA manager; Babia Góra National Park, Poland); Nevena Novović (PA manager; Sutjeska National Park); András Sztaniszláv (expert during 4th workshop); Zdeněk Mačát (PA manager; Podyji National Park); Aleksandar Vidojević (PA manager; Sutjeska National Park); Borbála Szabó-Major (PA manager; Duna-Ipoly National Park Directorate); Eszter Czibik (PA manager; Őrségi National Park Directorate); Magdalena Kuś (PA manager; Magura National Park)

From left side (sitting row): Juraj Švajda (project partner & author; Matej Bel University, Slovakia); Alice Kozumplikova (project partner & author; Mendel University in Brno, Czech Republic); Joseph Oppong Wiafe (author & intern at CEEweb for Biodiversity, Hungary); Djordjije Vasiljević (project partner & author; University of Novi Sad, Serbia); Zuzana Husáriková (PA manager; Nízke Tatry NP); Thor Morante (project partner & author; CEEweb for Biodiversity, Hungary); Joanna Hibner (project partner & author; Jagiellonian University, Poland).

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AUTHORS

Chapter 1.
Visitor surveys - tool for identifying motivations and perceptions of natural and recreational area visitors

Joanna Hibner, Ph.D. is an assistant at the Institute of Geography and Spatial Management, Jagiellonian University. Her main research interests are the monitoring and management of visitors in protected areas, mountain protected areas, and landscape perception.
E-mail: joanna.hibner@uj.edu.pl

Bernadetta Zawilińska, Ph.D. is an assistant professor at the Institute of Spatial Development and Urban Studies, Economic University in Cracow. Her main research interests are related to local and regional development issues with special attention to Carpathian Mountains region as well as issues related to tourism and sustainable development in protected areas.
E-mail: bernadetta.zawilinska@uek.krakow.pl

Chapter 2.
Monitoring visitors methodologies

Ing. Alice Kozumplíková, Ph.D. is an assistant professor at the Department of Social Studies, Mendel University in Brno. Her main research interests are sustainable regional development in terms of environmental and social pillars focusing on spatial disparities.
E-mail: alice.kozumplikova@mendelu.cz

Chapter 3.
Heritage interpretation and experience design for boosting visitors' satisfaction

Đorđije Vasiljević, Ph.D. is an associate professor at the Department of Geography, Tourism and Hotel Management, Faculty of Sciences, University of Novi Sad. His main research interests are nature-based tourism, visitor management and monitoring, and heritage interpretation. Besides teaching, he conducts research in these fields with more than 30 published papers and more than 1000 citations according to Scopus. Đorđije has also participated in numerous projects funded by Horizont2020, Erasmus+, Visegrad Funds, Western Balkans Fund, etc.
E-mail: dj.vasiljevic@dgt.uns.ac.rs

Vladimir Markovic, PhD is a full professor at the University of Novi Sad (Serbia), where he teaches in the area of Tourism and Wildlife management. He has more than one hundred scientific publications and is currently a member of reviewer boards of few scientific journals. Vladimir has held various positions (e.g. project manager of IPA project between Hungary and Serbia) and has participated as a team member or administrator in few EU-funded projects (IPA, SEE, ERASMUS+). His fields of interest are tourism, outdoor activities, sustainable hunting ground management, as well as GIS in wildlife management. He is a member of the Climatology and Hydrology Research Centre at the Faculty of Sciences.
E-mail: vladimir.markovic@dgt.und.ac.rs

Chapter 4.
Communications tools and approaches to promote natural areas and attract visitors

Ádám Varga is a project officer at CEEweb for Biodiversity. Currently working on management and implementation of projects related to protected area management, agroecology, and urban resilience.
E-mail: vargadam91@gmail.com

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AUTHORS

Joseph Oppong Wiafe is a graduate from Wageningen University in Science Tourism, Society and Environment studies, as well as an intern at CEEweb assisting with the implementation of protected area management-related projects.

Thor Morante Brigneti is a senior project management and communications expert at CEEweb for Biodiversity. He is the lead project coordinator of the 'Game On!' project and communications coordinator at CEEweb.
E-mail: tmorante@ceeweb.org

Contributors

Charlotte Maddinson is an intern at CEEweb and a student at the University of Oxford in the Integrated Masters in Biological Sciences programme.

Rosie Ward is an intern at CEEweb and student at the University of Oxford in the BA Politics, Philosophy and Economics (PPE) programme.

Chapter 5.
Visitor impact monitoring in protected areas

Juraj Švajda is an associate professor at the Department of Biology and Ecology, Matej Bel University. His main research interests are protected areas management, mapping and evaluation of ecosystem services and human dimension of natural resources management.
E-mail: juraj.svajda@umb.sk

Lauri Laanisto is a professor of macroecology in the Department of Biodiversity and Nature Tourism in the Estonian University of Life Sciences. He is mainly interested in global scale ecological patterns and the mechanisms behind them.
E-mail: laanisto@ut.ee

Daniela Casimiro is a biologist, PhD student in Marine Sciences at the University of Azores. Erasmus intern at MEET network (2023). Her main research interests are maritime spatial planning, maritime governance, marine protected areas and ecotourism.
E-mail: daniela.fm.casimiro@uac.pt

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ABOUT THE GUIDEBOOK

The presented guidebook was designed as the result of mutual work of the VIMOMA project's partners, experts as well as the protected areas representatives, who participated in the projects' workshop. The general aim of this guidebook is to introduce protected area managers, students as well as other stakeholders, to different tools and methodologies useful for efficient visitor monitoring and management. The guidebook also includes the developed methodological frameworks for visitor monitoring and management, which could be practically used in different protected areas. The guidebook is divided into five main chapters and a conclusion, which are related to the themes of the five thematic workshops. The first chapter*:* **Visitor surveys - Tool for identifying motivations and perceptions of natural and recreational area visitors –** includes information on visitor surveys. The readers will learn how to prepare a survey campaign, create the questionnaire, collect and present the data. The chapter also includes the examples of questionnaires, which could be practically used by managers of protected areas. The second chapter: **Monitoring visitors methodologies –** presents different tools and techniques that can be used for visitor monitoring and counting. The readers will also learn about new technologies which can support the visitor monitoring system. The third chapter: **Heritage interpretation and experience design for boosting visitors' satisfaction** will teach the readers about the importance of heritage interpretation (both natural and cultural). The chapter includes different interpretation tools used for educating visitors. The fourth chapter: **Communications tools and approaches to promote natural areas and attract visitors** - present tools, softwares and applications useful for promoting natural areas and attracting visitors. The readers will learn how to use such tools and also to prepare a promotional strategy for

protected areas. The fifth chapter - **Visitor impact monitoring in protected areas –** includes information about tools and methodologies for the monitoring of recreational impact. The guidebook includes not only theoretical information about the methods or tools, but also practical information and recommendations for an implementation of the presented research. The guidebook also includes practical recommendations on how to implement a particular method.

The presented guidebook is dedicated especially for protected area managers, who deal with local problems related to tourism on a daily basis. Another group, for whom this book is also important, are students as well as the professors, who have courses on nature conservation or nature-based tourism. The guidebook is a useful source of data, methodologies, contacts and expertise for both students or professors. And the last but not least, target group that might find our guidebook interesting, are local NGOs, stakeholders or other entities dealing with nature conservation and nature-based tourism.

1. Visitor surveys - tool for identifying motivations and perceptions of natural and recreational area visitors

1.1. Introduction

Many authors and practitioners, who concern themselves with the visitor monitoring issues in protected and vulnerable areas, indicated the lack of regular research on this subject in Europe (Cessford, Muhar 2003; Kajala et al. 2007; Jodłowski 2020; Zawilińska 2021). The experience from the 1st workshop of the VIMOMA project also confirmed this issue with regard to Visegrad and Western Balkan countries. There is no systematic and comparable research on this subject either between European countries, or within one country. Moreover, there is no long-term and standard methodology on visitor surveying even within one particular protected area. The majority of visitor surveys are only occasionally conducted by researchers or employees of national parks, or protected areas. Furthermore, the surveys mostly concerned selected issues or zones within a protected area. However, it is important to emphasize that several park managers declared that visitor surveys are conducted. Nevertheless, the questionnaires include only basic information about respondents and the applied methodology is used only within a particular park, which means it is not widespread and comparable with studies in other parks.

Visitor surveying plays a crucial role, as a tool, in the general visitor monitoring system. G. Cessford and A. Muhar (2003) included surveying into so-called inferred counts, which provide both quantitative and, sometimes, qualitative information about visitors. Visitor surveying provides data on visitors' motivations, needs, preferences, opinions (perceptions), attitudes, and many other aspects that are important from the perspective of visitor management. Surveys can also provide information about tourists' dispersion in protected areas, which might be later on correlated with other counting methods as complementary information (Muhar et al. 2002; Cessford, Muhar 2003; Konu, Kajala 2012, Hibner 2015).

Visitor surveying provides information, essential for successful visitor management. This information supports effective planning tasks for employees of protected areas by identifying problematic places. It is also useful for identifying potential conflicts not only between nature and visitors, but also between different user groups. Knowledge of visitors' preferences and opinions can also support constructive communication between protected area managers and visitors, which may lead to better understanding of protected area regulations. Moreover, it may lead to include visitors' opinions and preferences in creating tourist products (participatory planning), which are both satisfying for visitors and harmless for the vulnerable environment (Cessford et al. 2002; Cessford, Muhar 2003; Arnberger et al. 2005; Kajala et al. 2007; Konu, Kajala 2012; Hibner 2015).

The motivations, perceptions, and attitudes of visitors are considered as the starting point when undertaking any recreational activities. Research related to tourist motivations has a long and strong tradition (Bieger, Laesser 2002; Sterl et al. 2006; Park, Yoon 2009; Needham et al. 2010; Konu, Kajala 2012; Rid et al. 2014). Motivation is defined as a process, which starts to satisfy and fulfill human needs (Konu, Kajala 2012 based on Wright 2006). Motivation affects all aspects related to the visitor decision making process. It is a tool to understand visitors' needs and behavior and for this reason it plays a crucial role in managing visitors. Knowledge on tourists' motivations may

support communication between PA managers and visitors. Moreover, it is essential to create an efficient marketing strategy for PAs and surrounding areas.

Perception is another important factor, which affects visitors' decision-making process and determines visitors' behavior. It is defined as a set of information, stimuli that reach human brain and then are processed into impressions, ideas or opinions. It must be emphasized that perception cannot be complete without evaluation of a specific object, area or action. Thus, perception affects visitors' opinions and satisfaction from undertaken recreational activity (Krzymowska Kostrowicka 1999).

1.2. Methodology

1.2.1. Survey techniques

There are several survey techniques which can be used when conducting visitors survey in protected areas, e.g. PAPI, CAWI and CAPI. The table below contains a short description and the advantages as well disadvantages of each technique (tab. 1).

All of the presented techniques can be used to conduct surveys in protected areas, but PAPI and CAPI techniques are more effective if you have to gather more precise information. The CAWI technique

Table 1. Survey techniques types

PAPI	
Description	*paper & pen personal interview*: a traditional and one of the most popular techniques. it is a personal interview between the respondent and the interviewer. in this technique interviewers read the questions and note the answers on a paper form of questionnaire.
Advantages	– can be used onsite in the research area – gives an opportunity to explain any ambiguities and misunderstandings with interviewer – has a higher survey return rate – fewer questions are without answers – does not require internet access
Disadvantages	– is time consuming – requires large number of interviewers involved in the research (expensive) – requires entering data manually (time-consuming and prone to errors)
CAWI	
Description	*computer-assisted web interview*: is a technique of collecting data, in which the respondent is asked to fill in an electronic questionnaire. links to the questionnaires can be sent via email,can be shared on a webpage, or social media channels.
Advantages	– is an inexpensive method of collecting data (lack of interviewers) – enables gathering more data in short time – enables adding graphical materials or maps to the questionnaire – does not require manual data entry (data is gathered automatically)
Disadvantages	– is not used onsite (lack of control over who is filling the questionnaire) – is limited only to those respondents who have access to the link – can only contain simple questions to avoid misunderstandings – has a lower survey return rate
CAPI	
Description	*computer-assisted personal interview* : is a relatively new technique, which has become more and more popular. it is a combination of papi and cawi techniques. it is also a personal interview between the respondent and the interviewer. interviewers read the questions, but the answers are marked on electronic questionnaire (e.g. on a laptop or a a tablet)
Advantages	– if the questionnaire does not require a connection to the internet, it can be used onsite in any place – enables the interviewer to explain any ambiguities and misunderstandings – has a higher survey return rate – has fewer questions without answers – enables adding graphical materials or maps to the questionnaire – does not require data entry (data is gathered automatically)
Disadvantages	– requires a large number of interviewers involved in the research and electronic equipment (expensive) – is time consuming – can cause distrust towards the interviewer – sometimes may require internet connection

Source: based on Frankfort Nachmias, Nachmias 1996; Szreder 2010.

can be used if you want to gather information from potential visitors or from a specific group of visitors (e.g. skiers, bikers or frequent visitors who are related closely to the particular protected area). In this second case, links to the questionnaires can be shared via the social media channels of those groups of users. CAWI questionnaires can be used to gather information about opinions e.g. on new park regulations or new infrastructures. In some cases, the CAWI technique can be also used onsite. If you would like to collect information from tourists, without disturbing their recreational activity, we can share QR codes linking to the questionnaire. However, the questionnaire should be simple. Furthermore, there is a risk of low response rate, even if potential respondents will take the QR code. An example of such a leaflet with a QR code is presented below (photo 1). Apart from the QR code, the leaflet should also contain the title of the research and a short description.

Photo 1. An example of a leaflet shared with visitors who visit Las Wolski Forest. The leaflet contains a QR code linking to a questionnaire

Source: research conducted by dr Agnieszka Nowak-Olejnik from Jagiellonian University.

1.2.2. What to ask about?

This chapter contains several important points which should be included in the survey on visitors in protected areas. The chapter also includes some hints about the type of questions to use with regards to different topics.

A. Motivations and tourists segmentations

As it was mentioned earlier, knowledge about visitors' motivations is essential for more effective management of visitors. With regards to motivation, it is possible to divide visitors into several groups with similar attitudes, needs and often behavior. It is believed that services or products dedicated to a particular group of visitors (responding to their motivations and needs) are more effective and satisfying for tourists. The purpose of segmentation is to divide tourists into homogeneous groups that are both different from other categories and internally consistent (Haley 1968; Moscardo et al. 2001; Cessford, Muhar 2003; Van Marwijk, Taczanowska 2006; Dolnicar, Grün 2008; Konu, Kajala 2012; Hibner et al. 2018). It is useful to use theoretical tourist typologies in order to create a list of motives, or cafeterias of responses in the questionnaire. There is a wide range of theoretical typologies based on motivational factors. The tables below present examples of three of them (tab. 2) as well as the result of a finished list of motives based on them (tab. 3).

In order to gain information about visitors' motivations it is recommended to use matrix questions. It is a series of Likert scale questions. Each motive has the same response option and respondents are asked to assess how important each motive is for them (tab. 4).

It is worth noting that multiple-choice questions are also used in this kind of research and it is a faster option for respondents. However, it is not recommended, because of the risk, that respondents would choose too many motives without really considering the importance of each motive. Using Likert scale is also more preferable for further data processing. The segmentation of visitors based on motivations can be done using K-mean clustering, which is a well-established method and also frequently used as statistical analysis. Other often-used statistical analyses are: Principal Components and Factor analysis.

If there is a necessity to expand information on visitors' motivations, more specific questions can be added to the questionnaire. These questions can be

used especially if you want to gain information about why tourists visit a particular place within a protected area. Below is a possible list of factors which can attract tourists to visit a particular area. The list should be completed with other factors related to local facilities and values (tab. 5).

Table 2. Theoretical tourist typologies

Przecławski (1996)	Recreation Experience Preference (REP) scales Driver Tocher 1970	Winiarski (1991)

– cognitive type
  – contact with nature
  – contact with heritage
  – contact with people
  – integrative type
– active type
– rest & entertainment type
– task oriented type
– contemplative type
– health oriented type
	– autonomy leadership
	– risk taking
	– family togetherness
	– similar people
	– new people
	– learning
	– enjoy nature
	– introspection
	– creativity
	– nostalgia
	– physical fitness
	– physical rest
	– escape personal social pressures
	– escape physical pressure
	– social security
	– escape family
	– teaching
	– leading
		– hedonistic & active type
		– relaxation oriented type
		– health oriented type
		– social oriented type
		– adventure seeker
		– ambitious type
		– cognitive type

Source: based on Przecławski 1996; Winiarski, Zdebski 2008 (based on Winiarski 1991); Konu, Kajala 2012 (based on Driver Tocher 1970).

Table 3. Theoretical typologies vs list of motives

Theoretical typology (Przecławski 1996)	Motives listed in the questionnaire
Cognitive type	– contact with nature – observation of wild animals – sightseeing Tatra NP – learning about geography and nature of Tatra NP
Contemplative type	– admiring views, scenery – solitude – silence
Rest and Entertainment type	– well-being – escape from noise and pollution – relax – recreation – escape from urban lifestyle – recovery from stress
Active type	– improving hiking skills – keeping fit – physical activity
Integrative type	– time with family and friends

REP Dimension (Driver 1977, 1983)	Motives listed in the questionnaire
Enjoy nature	– nature experience – scenery
Autonomy leadership; escape physical pressure; reduce tension	– being on my own
Escape physical pressure	– getting away from noise and pollution
Escape personal-social pressure	– mental well-being
Escape personal-social pressure; physical rest	– relaxation
New people	– meeting new people
Family togetherness; similar people	– being together with own group
Nostalgia	– pleasant old memories
Learning	– getting to know the area – learning about the nature
Achievement/stimulation	– improving my own skills – experiencing excitement
Physical fitness	– keeping fit

Source: based on research conducted by Konu, Kajala (2012) and Hibner et al. (2018).

Table 4. Matrix questions related to motivations

What is your main reason for visiting ……national park? (please assess each motive separately on scale 1-5, where 1 - means "not important at all" and 5 – means "very important")					
Being together with own group (friends/family)	1	2	3	4	5
Being on my own (solitude)	1	2	3	4	5
Meeting new people	1	2	3	4	5
Being close to nature	1	2	3	4	5
Admiring scenery	1	2	3	4	5
Learning more about nature	1	2	3	4	5
Learning about the cultural heritage of the area	1	2	3	4	5
Escaping from everyday life	1	2	3	4	5
Escaping from noise and pollution	1	2	3	4	5
Improving my physical health	1	2	3	4	5
Exercising	1	2	3	4	5
Relaxation	1	2	3	4	5
Pleasant old memories	1	2	3	4	5
Experiencing excitement	1	2	3	4	5
Other (please indicate)……	1	2	3	4	5

Source: based on research conducted by Konu, Kajala (2012), Hibner et al. (2018) as well as experience from the 1st workshop.

Table 5. Matrix questions related to motivations to visit particular place

What is your main reason for visiting this particular place within ……national park? (please assess each motive separately on scale 1-5, where 1 - means "not important at all" and 5 – means "very important")					
This area is unique (e.g. beautiful nature)	1	2	3	4	5
There are interesting tourist attractions nearby (e.g. waterfalls, cable cars etc.)	1	2	3	4	5
This area is close to my place of residence (my family/friends place of residence)	1	2	3	4	5
This area is easily accessible (e.g. parking places, easy trails, cable cars etc.)	1	2	3	4	5
This area is less crowded	1	2	3	4	5
This area is wilder	1	2	3	4	5
This area has good tourist facilities (e.g. resting spot; viewpoints, shelters etc.)	1	2	3	4	5
There are good restaurants nearby	1	2	3	4	5
This area is another place, which I'd like to visit in this NP	1	2	3	4	5
It is a national park	1	2	3	4	5
Other (please indicate)……	1	2	3	4	5

Source: based on research conducted by Konu, Kajala (2012), Hibner et al. (2018) as well as experience from the 1st workshop.

B. Landscape perception

Research on landscape perception became popular in 1970s and parts of it can be practically used in terms of tourism in protected areas e.g.: (1) for devising areas used for tourism (land management plans); (2) for research on visitor spatial behavior; (3) for research on the impact of tourism on the visual aspects of the landscape; (4) as well as for research on visitor crowding perception (Kulczyk 2013). There are around 50 different techniques used for perception research. The most frequently used methods are: surveys, landscape preferences research with the use of photography and mental maps (Pietrzak 2010). Here are some of the frequently used and useful techniques:

***S*BE (Scenic Beauty Estimation)**: a study of respondents' preferences in relation to various landscapes presented in the photographs. This method was established by T.C. Daniel and R.S. Boster (1976). Respondents are asked to rate photos based on 10-point scale (Daniel, Boster 1976; Kulczyk 2013).

Q sort or Multiple sorting: scaling, ranking "landscapes" by the respondent based on a prepared set of photos. Respondents are asked to sort the photographies based on specific key parameter (Fairweather et al. 1998; Kulczyk 2013).

VEP (Visitor-Employed Photography): respondents are asked to take some photos on their own during their trip and then describe their experience (positive or negative impression, etc.; Pietrzak 2010; Kulczyk 2013). However, this method can be used only on a smaller group of respondents, because it requires more engagement from the visitors' perspective.

These three methods can be useful in order to assess visitors' attitudes in relation to e.g. new land management plans, planned or existing infrastructure etc.

C. Crowding perception and other disturbances

Since the 1960s and especially 1970s, scientists and PA managers began to consider not only the negative aspect of overcrowding on the environment but also on other visitors and their level of satisfaction from visits in particular protected areas. According to EUROPARC Federation there are three types of carrying capacity and one of them includes the social aspect. Nowadays, this theory is developed into a theory called Limits of Acceptable Changes (LAC). LAC is based on expected conditions that should be met to avoid negative consequences in both ecological and social aspects (Stankey, McCool 1984; McCool, Lime 2001; Cole 2004; Garrigós et al. 2004; Sterl et al. 2004; Hausser et al. 2006; Zaręba 2010; Somarriba-Chang, Wallentinus 2012).

Overcrowding can be measured using two techniques:

1. **VCP - Visitor Crowding Perception**: is a method established by Heberlein and Vaske (1977) and based on the 9-point Likert scale (fig. 1). Respondents are asked to assess the level of acceptable crowding in selected areas (Heberlein, Vaske 1977; Shelby, Vaske 2007; Nasa, Emphandhu 2010; Schamel 2012).

1	2	3	4	5	6	7	8	9
Not at all Crowded		Slightly Crowded			Moderately Crowded		Extremely Crowded	

Fig. 1. VCP scale
Source: Shelby, Vaske 2007.

The authors of this method as well as other practitioners suggest to assess the level of acceptable crowding using three steps: (1) ask visitors whether they experience crowding during their visit to a particular area, then (2) ask visitors to assess the level of crowding based on scale mentioned above, and as last step (3), ask visitors to estimate the number of other visitors they met. This last step can be replaced or complemented with the results of visitor counting, if such research is also conducted in the area. To make a successful correlation between the number of visitors and the respondents' attitude towards crowding, it is important also to add information about the date and time when the questionnaire was filled.

2. **PAOT (People At One Time)**: this is also a well-established method of visual simulation of crowding (Manning 2002; Sterl et al. 2004; Wyttenbach et al. 2012). Respondents are given a set of photos (photo 2) with an increasing number of visitors and they are asked to indicate which photo (level of crowding) is not acceptable for them. This visual simulation can be used not only to assess the level of crowding, but also to assess acceptable levels of other disturbances like the increasing amount of rubbish, infrastructure, trail erosion or decreasing amount of green areas (e.g. decreasing area of forest). Moreover, it can be used to assess the level of acceptance of other visitor types, in order to gain information about potential conflicts between user groups.

Photo 2. The example of PAOT method
Source: research conducted by J. Švajda, Matej Bel University.

If there is a need to expand information on visitors' attitude towards overcrowding, adding the PAOT method to the questionnaire is preferable. It is also worth adding two additional questions: (1) Would you accept any kind of access restriction to this area, in order to decrease crowding here? (YES/NO) and (2) Would you be able to change your plans and visit another area, if you were informed about overcrowding here? (YES/NO).

Crowding is not the only factor which may disturb tourists' visit. In order to gain information about potential disturbances which may affect visitors' satisfaction, these sets of questions may be asked (tab. 6). It is also recommended to use matrix questions.

Table 6. List of disturbances

Did any of the following factors disturb your current visit in NP? (please assess each factor separately on scale 1-5, where 1 - means "not disturbing at all" and 5 – means "very disturbing")					
Behavior of other visitors	1	2	3	4	5
Trail erosion	1	2	3	4	5
Littering	1	2	3	4	5
Noise	1	2	3	4	5
Fear of wild animals	1	2	3	4	5
Fear of dense vegetation	1	2	3	4	5
Fear of lack of people	1	2	3	4	5
Too much infrastructure (obscured sights)	1	2	3	4	5
Other, please indicate……	1	2	3	4	5

Source: based on Konu, Kajala 2007 and research conducted in cooperation with dr A. Nowak-Olejnik (Jagiellonian University).

D. Opinions (expectation and satisfaction)

General opinions about protected areas as institutions are also an important piece of knowledge, essential in terms of visitor management of . Protected areas vary strongly when it comes to the existing facilities and regulations, thus it is not possible to indicate a common list of alternatives recommended for assessment. However, here is a possible question type (matrix questions), which can be used (tab. 7).

This question can be also complemented by an open question in which the respondent will be able to describe the aspect which made them feel disappointed.

It is worth emphasizing that each protected area has its own local problems and sometimes conflicts between visitors and park managers. Most of these problems are related to park regulations. Thus, visitors' attitudes to park regulation can also be assessed. It is recommended to use Likert scale to shorten and simplify questionnaires. However, if this approach is not practicable, open questions are also recommended.

E. Knowledge of park regulations and safety aspects

Information on visitors' knowledge of park regulations as well as some safety aspects can fulfill two important roles. First of all, if visitors are not aware about some important park regulation, a survey which includes such questions can play an educational role. Interviewers can inform respondents about the park regulations and explain why they are necessary. Through such questions, park managers can also receive information about possible violations of the park regulations. Survey questions about park regulations are very sensitive and there is a major risk that respondents will not be honest in answering them. The most important thing is that respondents should feel comfortable and anonymous especially when such questions are asked. Respondents might break rules because they are not aware of them but also because they do not understand the necessity of them. The results of various studies show that people are less likely to violate the regulations if the rules are properly explained to them (Imoos, Hunziker 2015). There are no common questions which can be used in all protected areas, because the areas differ when it comes to the park rules and safety aspects. However, we recommend using:

True/False questions – respondents are given a set of statements referring to park regulations and are asked to indicate, whether the statements are true or false. For example: (1) Walking outside of

Table 7. Evaluation of services and facilities in protected areas

What is your opinion about the quality and quantity of services and facilities that you used during your visit in …..? (please assess each factor separately; If you do not use the service/facility during this visit, please choose option "did not use" Quality scale: 1 – very poor – 5 – very good; 0 – did not use Quantity scale: 1 – too few – 5 – too many; 0 – no opinion												
	quality scale						quantity scale					
Parking places	1	2	3	4	5	0	1	2	3	4	5	0
Trail network	1	2	3	4	5	0	1	2	3	4	5	0
Signposts	1	2	3	4	5	0	1	2	3	4	5	0
Rubbish bins	1	2	3	4	5	0	1	2	3	4	5	0
Public latrines	1	2	3	4	5	0	1	2	3	4	5	0
Cable cars/chairlifts	1	2	3	4	5	0	1	2	3	4	5	0
Resting spots	1	2	3	4	5	0	1	2	3	4	5	0
Campfire sites	1	2	3	4	5	0	1	2	3	4	5	0
Shelters	1	2	3	4	5	0	1	2	3	4	5	0
Catering facilities	1	2	3	4	5	0	1	2	3	4	5	0
Educational activities in the national park	1	2	3	4	5	0						
Information center	1	2	3	4	5	0						
Accessibility for visitors with disabilities	1	2	3	4	5	0						
General safety	1	2	3	4	5	0						
General cleanliness	1	2	3	4	5	0						
Other (please indicate)…….	1	2	3	4	5	0	1	2	3	4	5	0

Source: based on Kajala et al. 2007 and own research.

the marked trails is not forbidden – True/False; (2) Collecting mushrooms is allowed in this park – True/False

Yes/No questions – (1) Do you know the phone number to the local emergency service? – Yes/No – if yes, please elaborate .....

Yes/No questions + **open questions** – you can ask visitors whether they have ever broken the park regulation and then ask why. However, as it was mentioned, there is a risk that people may not be honest.

F. Ecological awareness

If you would like to gain information about general visitors' attitudes to nature you can use a well-established method called **New Ecological Paradigm scale (NEP)** established by R. Dunlap in the 1970s (Anderson 2012). This method includes 15 statements. Respondents are asked to indicate their agreement or disagreement with each statement based on 5-point Likert scale (tab. 8).

G. Spatial distributions

As it was already mentioned, visitors' surveys can also provide information on tourist dispersion, and in this way complement the results of visitor counting. In order to gain information on the visitors' spatial distributions you can use several techniques:

List of attractions – the easiest option to gain information about the spatial distribution of tourists is to prepare a multiple-choice question with a list of important places, attractions, and trails in a particular protected area and ask visitors to indicate which places they visited during their current trip. It is the easiest and the fastest option, however, it is not the most precise, because this method can present mostly the hot spots instead of the linear distribution.

Open question – this is another variant of the previous method. Respondents are asked to indicate which places, attractions, or trails they visited. However without a prepared list of such places, the question is left open.

Topographic map – it is a useful tool for asking questions about spatial distribution. Respondents are asked to draw the route of their trip on a prepared map and also to mark the starting and ending points. Additionally, respondents are asked to indicate the time of the beginning and ending of their trip. The results are later analyzed using the ArcGIS software. This tool is useful if you want to receive more precise information on linear distribution (Taczanowska et al. 2016).

GPS loggers – it is a useful tool if you require very precise information on visitors' spatial distribution. In this method, respondents are asked to

Table 8. New Ecological Paradigm scale

Please indicate your attitude towards the environment? (Please assess each statement separately on scale 1-5, where 1 - means "strongly disagree" and 5 – means "strongly agree")					
We are approaching the limit of the number of people the Earth can support.	1	2	3	4	5
Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
When humans interfere with nature it often produces disastrous consequences.	1	2	3	4	5
Human ingenuity will ensure that we do not make the Earth unlivable.	1	2	3	4	5
Humans are seriously abusing the environment.	1	2	3	4	5
The Earth has plenty of natural resources if we just learn how to develop them.	1	2	3	4	5
Plants and animals have as much right as humans to exist.	1	2	3	4	5
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5
Despite our special abilities, humans are still subject to the laws of nature.	1	2	3	4	5
The so-called "ecological crisis" facing humankind has been greatly exaggerated.	1	2	3	4	5
The Earth is like a spaceship with very limited room and resources.	1	2	3	4	5
Humans were meant to rule over the rest of nature.	1	2	3	4	5
The balance of nature is very delicate and easily upset.	1	2	3	4	5
Humans will eventually learn enough about how nature works to be able to control it.	1	2	3	4	5
If things continue on their present course, we will soon experience a major ecological catastrophe.	1	2	3	4	5

Source: M. Anderson (2012) based on R. Dunlop (2000).

take a GPS logger with them on the trip (photo 3). The GPS logger automatically registers the visitors' route, its duration, as well as the duration of resting stops. The results are later analyzed using the ArcGIS software. This method can be used when the starting and ending points of the visitors' trip are the same, or if the respondents have a chance to return the device in a safe place, e.g. an info center. During this research, only a small group of respondents can be interviewed per day, limited to the number of devices which can be bought for the research. To make the research efficient, it is recommended to buy approximately 50-100 loggers. It is also worth remembering that there is a risk that some loggers may not be returned (Taczanowska et al. 2016).

Photo 3. Example of GPS logger

Source: Taczanowska et al. 2016.

Maptionnaire (online questionnaire) – it is a computer software which allows users to collect data using a map-based online questionnaire (Maptionaire, www.maptionnaire.com). Respondents are asked to draw the route of their trip based on an online map (e.g. on computer, laptop or tablet). This solution can be used, if you decide to collect data using the CAWI or the CAPI technique. The results are gathered automatically and later can be analyzed using the ArcGIS software (photo 4).

H. Expenditures

Questions regarding expenditures are very sensitive and hard to measure. It is important to determine what is the main goal of our research: whether it is (1) the basic knowledge on the visitors' expenditures in the area or is (2) the knowledge on the economic impact of tourism in the region. Taking into account the first option, a survey among the visitors that contains several questions regarding expenditures, will be enough. Some examples of questions will be presented in this chapter. However, if your goal is to gain information on the economic impact of tourism in the region, a more complex research is needed. The research requires not only surveys and interviews with tourists, but also surveys and interviews with local residents, entrepreneurs (including managers of

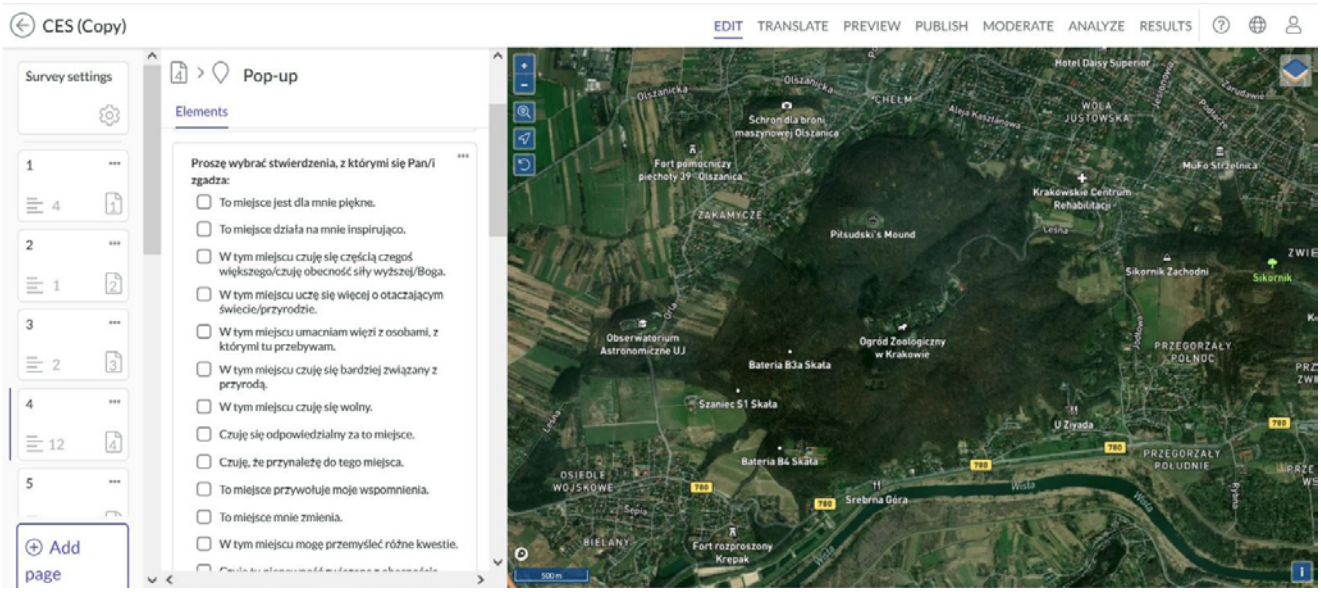

Photo 4. An example of map-based questionnaire using the Maptionnaire software

Source: research conducted by dr Agnieszka Nowak-Olejnik from Jagiellonian University.

tourist facilities) as well as analyses based on the spatial and socio-economic data. More information about this kind of research will be available in the section "Best Practices".

Below is the list of questions to include in the questionnaire about visitors' expenditures (tab. 9).

I. Socio-economic factors and other basic information on respondents and their visits

Questionnaires should also include basic information on respondents, their group and their visit to the area. Such information is most often placed at the beginning of the questionnaire as introductory questions.

Table 9. Questions regarding expenditures

What type of accommodation do you sleep in?	– hotel – pension/vila – private accommodation – rented apartment – holiday resort – shelter – friends/family house – own apartment – other?.....
Which mode of transport did you choose to come here from your place of residence?	– car – tourist bus – bus – train – plane – other?.....
Please estimate the total cost of your current stay in this area (without travel cost)	the given cost applies to: – 1 person (respondent) – whole family (how many?.....including kids?.....) – a group of people with shared budget (how many?)……
What is the total cost of your accommodation?	the given cost applies to: – 1 person (respondent) – whole family (how many?.....including kids?.....) – a group of people with shared budget (how many?)……
What is your arrival cost of coming here and returnning?	the given cost applies to: – 1 person (respondent) – whole family (how many?.....including kids?.....) – a group of people with shared budget (how many?)……
Please estimate your daily expenses in the region (only one day; without accommodation cost)?	expenses / protected area / region catering (restaurants etc.) groceries shopping (other than food) souvenirs fuel (within the area/region) parking local transport (within the area/region) entry tickets to protected area entry tickets (except for the protected area)…… other expenses?..... the given cost applies to: – 1 person (respondent) – whole family (how many?.....including kids?.....) – a group of people with shared budget (how many?)……

Source: Mika et al. 2015.

At the end of the questionnaire there is always a space for a section regarding the basic socio-economic information about respondents.

The section about respondents, their group and their visits should include information like: type of activity; frequency of visits; length of the visit; accommodation; means of transport; group characteristic; importance of the place and the source of information about the area (tab. 10).

Socio-economic information about respondents should include such information like: gender, age, education level; place of residence; professional status and income (tab. 11).

Each questionnaire should also include the title of the research and the invitation part. The invitation specifically includes a request to the respondents to fill the questionnaire, as well as the purpose of the research, and the information about the person responsible for the research.

Table 10. General information about respondents, their group and their visits

What type of recreational activity did you do during your visit in this area?	*The list should include all types of recreational activities related to a particular area. It is recommended to leave multiple choices, because depending on the area, respondents can do several activities (e.g. hiking and bicycling) during one visit*
Which mode of transport did you choose to come here from your place of residence?	– car – tourist bus – bus – train – plane – other?.....
What type of accommodation do you sleep in?	– hotel – pension/vila – private accommodation – rented apartment – holiday resort – shelter – friends/family house – own apartment – other?.....
How long is your current stay in the area?	– 1 day – 2 days – 3-5 days – more than 5 days (how many?.....)
How often have you visited this area?	– it is my first time – first time after many years – less than one a year – once a year – regularly (several times a year) – regularly (several times a month) if you would like to gain more information on which time of the year tourists visit this area, you can ask an additional question: – what seasons of the year do you visit the area most often?
how many people are with you during your current visit?	– i'm alone – ……person, of which under 15 years old…….person
During this visit, your group consists of	– family members – friends – co-workers – school class – student group – club, association members (which?)…… – organized group with travel agency – other?.....
During current stay, visiting this protected area was	– the main reason of coming here – one of other planned destination during current stay – unplanned additional visit

What type of recreational activity did you do during your visit in this area?	*The list should include all types of recreational activities related to a particular area. It is recommended to leave multiple choices, because depending on the area, respondents can do several activities (e.g. hiking and bicycling) during one visit*
Where did you find information about this protected area	– in the visitor center – from my family members/friends/co-workers etc. – from the official web-page – from the official social media channels – from other internet sites/social media channels – from tv/radio/newspapers – from brochures or guidebooks – this place is familiar to me from previous visits – other?.....

Source: based on Kajala et al. 2007; Mika et al. 2015; Taczanowska et al. 2016 and own research.

Table 11. Socio-economic information about respondents

Gender	– female – male
Age	*it is a sensitive question, however we recommend not to use age ranges, because they limit further analysis.* *it is better to ask respondents: in what year were you born?*
Education	– primary education – secondary education – professional education – high school/college education – higher education
Place of residence	– country……. – city/town/village……
Professional status	– student – white collar worker – blue collar worker – freelancer – own business – pensioner – other?.....
Average monthly income per person in my household is	– less than 450 eur – 450-700 eur – 701-1100 eur – more than 1100 eur – prefer not to answer

Source: based on Kajala et al. 2007; Mika et al. 2015; Taczanowska et al. 2016 and own research.

At the beginning of each questionnaire, there should be some space left for the date and time of the survey, the place of the research, the name of the interviewer, and the number of the questionnaire.

1.2.3. Data collection

It is worth emphasizing that in the majority of research carried out in protected areas, the research sample is not calculated. The sample is the result of time and the number of people involved in field work, as well as the budget intended for the survey. However, the size of the sample should be calculated by statisticians based on the estimated number of visitors, the amount of funds intended for the survey, and the maximum error resulting from the sample selection.

The methodology of selecting respondents is also important, however, within open spaces like protected areas it is challenging. The sample should be representative, as well as, it should reliably reflect the studied population. However, in such areas, a fully random selection of respondents is not possible. The time and the spatial distribution of survey should reflect the general spatial and temporal distribution of visitors within the studied area.

In order to determine the correct time and spatial distribution of survey it is recommended to conduct pilot study. This procedure will be also useful to correct errors or misunderstanding in the questionnaire.

1.2.4. Data entry and coding

Data entry as well as coding is a time-consuming process, especially when data is entered from paper questionnaires. Databases in this kind of research are usually sizable, because of the large number of questions and large sample size. Data entry requires a lot of precision during the coding process. Each questionnaire form should have its own, unique number that refers to one row in the database. The majority of questions included in such surveys should be closed (e.g. matrix questions, multiple-choice questions, etc.), which means that each response can be transformed into numerical form. In simple questions with limited alternatives, each alternative should have a unique number, e.g. gender: female – 1, male – 2. In questions with multiple choice – each alternative should be entered as a separate column in the database, with possible answers: yes – 1, and no – 0. In matrix questions, each statement or factor should be entered as a separate column in the database and each alternative should have its own number. Open alternatives, which are often used in questionnaires as "Other", should be entered as text and then recoded after analyzing all possible answers. When the data coding process is ready, it is recommended to double-check the answers in the database in order to correct mistakes, e.g. empty cells. After this process, the database is ready for statistical analysis. Databases can be created in MS Excel– it is an accessible and easy solution, however enables only simple statistical analysis. Databases can be also created in IBM SPSS or Statistica, which can perform more complex analysis.

As it was mentioned, only PAPI techniques require manual data coding. If your survey is done using CAPI or CAWI technique, the data is gathered automatically. However, it is still recommended to double-check the answers in the database.

Open questions are not recommended in research based on a large sample size. This type of questions can be asked only of a smaller group of respondents. The answers should be analyzed with the use of thematic analysis. It is recommended to use MAXQDA software.

1.2.5. Data presentations

The presentation of the research results to the public is also very important, however, it is a mostly forgotten element of the survey. In most cases, the results are presented as scientific articles and are not widely available for the people outside of academia. In some cases, data is presented as a report from the research, and moreover, as internal documents, not available to the public.

It is worth to emphasizing that presenting the results of the research to the public in approachable and understandable form is essential for visitors, local residents, as well as entrepreneurs from the region. The good example of data presentation for the public are presentations of the results of research from USA National Parks (fig. 2).

Fig. 2. Data presentation, an example from USA National Parks
Source: www.nps.gov.

1.3. Best practices

Table 12. Best practices in term – visitors surveys

Destinations	Description	Source
Nature areas from Nordic and Baltic countries	A guidebook on visitor monitoring methodology in Nordic and Baltic countries.	Kajala, L., Almik, A., Dahl, R., Dikšaitė, L, Erkkonen, J., Fredman, P., Jensen, F. Søndergaard, Karoles, K., Sievänen, T., Skov-Petersen, H., Vistad, O. I. and Wallsten, P. 2007. Visitor monitoring in nature areas – a manual based on experiences from the Nordic and Baltic countries
Protected areas from Finland	Research on visitor segmentation based on motivational factors.	Konu, H., Kajala L., 2012, Segmenting Protected Area Visitors Based on Their Motivations, Nature Protection Publications of Metsähallitus. Series A 194, 1-74.
Protected areas	A guidebook on visitor monitoring and data reporting in protected areas.	Hornback, Kenneth E. & Eagles, Paul F. J. 1999. Guidelines for public use measurement and reporting at parks and protected areas. IUCN, Gland, Switzerland and Cambridge, UK. iv + 90 pp. www.iucn.org ISBN: 2–83
Protected areas	A research on recommended methods of visitor monitoring which can be used in protected areas.	Muhar, A., Arnberger, A., Brandenburg, Ch., 2002, Methods for visitor monitoring in recreational and protected areas: an overview. W: A. Arnberger, Ch. Brandenburg, A. Muhar, (red.), Monitoring and Management of Visitor Flows in Recreational and Protected Areas. Conference Proceedings. Vienna: Bodenkultur University
Babia Góra National Park, Poland	A study on the economic impact of tourism with recommended methodology.	Mika M., Pawlusiński R., Zawilińska B., 2015, National Park and the Local Economy. The Economic Relation Model: a Case Study of Babia Góra National Park, IGiGP Jagiellonian University [IN POLISH]
Stołowe Mountains National Park, Poland	Research on Monitoring System of tourist traffic(MSTT) established in 2016. The aim of the MSTT methodology is to quantify visitors flow and evaluate the usefulness of the automated measuring system of visitor flow in a mountain area.	Rogowski M., Monitoring System of tourist traffic (MSTT) for tourists monitoring in mid-mountain national park, SW Poland, 2020, J. Mt. Sci. 17, 2035–2047 https://doi.org/10.1007/s11629-019-5965-y
USA National Parks	Good examples of data presentation.	www.nps.gov

Source: own elaboration.

1.4. Practical implications

It is recommended that surveys among visitors are conducted regularly, however, it is also a time-consuming and sometimes an expensive process. For these reasons, it is recommended to conduct visitors surveys every second or third year. This will allow to maintain the regularity of the research, and at the same time it will not significantly affect other responsibilities of protected area employees.

The size of the sample should be statistically calculated based especially on the annual number of visitors. Moreover, the spatial and temporal distribution of the survey should also reflect the studied population, which is different in each protected area.

When it comes to the technique of the survey, it is recommended to use either PAPI, CAPI, or both techniques together. As it was mentioned, the CAWI technique is not recommended, mostly due to its lower response rate and the fact that we do not know the person who is filling the questionnaire. However, we can carry out mixed techniques, e.g. PAPI and CAWI (as QR code with link to the questionnaire – in case a potential respondent is willing to fill in the questionnaire, but is in a hurry). Although, in such a situation, both techniques should be analyzed separately as complementary methods.

We also suggest approaching potential respondents during their rest, e.g. at the shelters, resting spots, viewpoints etc. There is a risk that respondents who are "on the move" will not be willing to answer the questionnaire.

The results of the survey should be comparable not only within the same protected area, but also between other protected areas. However, each protected area is different and the differences consist in the local or current problems. Hence, we prepared an outline of a questionnaire, which is as universal as possible, and at the same time contains space for questions related to local problems. The outline we suggest is divided into 4 main sections:

1. **The first section** includes questions which are universal and simultaneously the ones which should be asked during each edition of the survey. The first section should include general information about the current visit and previous experience, such as: type of activity, transport and accommodation, as well as the frequency of visits, the length of the current visit and the group characteristics. This section should also include information on spatial distribution and basic information on motivation, opinion and perception.
2. **The second section** includes questions which should be asked only every few editions of the survey, but still universal. Due to that, the questionnaire in each edition will be short, and important issues will still be asked regularly. We prepared four main versions of this part of the questionnaire, which should be used interchangeably every few editions:

OPTION 1 – expanded section related to motivations

This part can be useful if you would like to gain more information about how generally this particular protected area is important during visitor stay in the region and especially, if you would like to gain more information about the reason for visiting a particular area, trail, or attraction within the protected area. For this reason, before the universal motivation questions from section 1, it is suggested to add a question regarding the importance of protected areas during planned visits. After the universal questions on motivation from section 1, questions regarding visiting particular trail, attraction, or object can be added. The alternatives can be adjusted to the local values. In this option, questions regarding crowding and other disturbances factors can be placed after the motivation section (EXAMPLE 1).

OPTION 2 expanded information about overcrowding perception and ecological awareness

This part can be useful, if we would like to expand information on crowding perception and general ecological awareness. For this reason, after the general section, questions based on PAOT method can be added. A set of photographs from the specific area with increasing number of visitors are given to respondents as additional material. Questions regarding crowding are already added to the universal section, thus this part is relatively short. Due to that, apart from the PAOT method we can add also questions related to ecological awareness (NEP scale). These issues are thematically related, thus they can be asked during one edition of survey (EXAMPLE 2).

OPTION 3 – information about visitors' opinions, knowledge on park regulation and safety aspects

This part can be useful in order to gain more information on visitors' opinions about park facilities, park regulations etc. This part of questions should be also added just after the universal section. Questions regarding opinions and knowledge on park regulations are also thematically related, thus they can be asked during one edition of the survey. Additional alternatives regarding opinions can be also added based on local facilities and values. As for park regulations, there are no common questions which can be used in all protected areas, because they differ when it comes to the park rules and safety aspects. However, please use the structure of the questions described in chapter 1.2.2. E (EXAMPLE 3).

OPTION 4 – visitors' expenditures

If there is a need to gain more information on visitors' expenditures, such a set of questions can be asked after the universal section. Questions regarding type of accommodation and transport are added in the universal section, thus there is no need to repeat them here (EXAMPLE 4).

3. **The third section** should be dedicated to local and current problems within particular protected areas. If there is such a need, it is recommended to leave space for 2–3 questions in each survey edition, which are dedicated to local problems. There is no common structure for such questions. However, it is recommended to use closed not open type of questions (e.g. based on Likert scale, multiple choice questions, Yes/No questions or questions based on photographs).
4. **The fourth section** should also include universal questions, but those related to general information about the respondents such as: gender, age, education, place of residence and average monthly income. When it comes to questions regarding income, we suggest preparing the alternatives based on local currency and local average salary.

Here is the complete structure of the 4 examples of questionnaires for the paper questionnaire, however it can be easily transformed into a computer version.

EXAMPLE 1 – which include expanded section related to motivations

Part I. General information on current visit

What type of recreational activity did you do during your visit in this area? (You can indicate more than one option)	please list the all types of recreational activities which are related to your protected area (preferably in two columns to gain space for other questions) e.g.: – hiking – bicycling – kayaking – picnicking	 – swimming – skiing – horse riding – others…….
Which mode of transport did you choose to come here from your place of residence?	– car – tourist bus – bus – bicycle	– motorcycle – train – plane – other……
What type of accommodation do you sleep in?	– hotel – pension/vila – private accommodation – rented apartment – holiday resort	– shelter – camping – friend/family house – own apartment – other?.....
How long is your current stay in the area?	– 1 day – 2 days	– 3-5 days – > 5 (how many?)…….....
How often have you visited this area?	– it is my first time – first time after many years – less than one a year what seasons of the year do you visit the area most often? spring summer autumn winter	– once a year – several times a year – several times a month
How many people are with you during your current visit ?	i'm alone …….person, of which under 15 years old…….person	
During this visit, your group consists of	– family members – friends – co-workers – school class – students group	– club, association members – (which?)…….. – group with travel agency – other?.....
Where did you find information about this protected area	– in the visitor center – from my family members/friends etc. – from the official web-page – from the official social media channels – from other internet sites/social media channels	– from tv/radio/newspaper – from brochures or guidebooks – this place is familiar to me from previous visits – other?.....
Which part of the ……national park have you visited or plan to visit during your current stay?	this question can asked using one of the method mentioned in section spatial distribution	
During current stay, visiting this protected area was……	– the main reason of coming here – one of other planned destination during current stay – not planned additional visit	

Part II. Motivation and basic information on opinions, perceptions

What is your main reason for visiting ……national park? (please assess each motive separately on scale 1-5, where 1 - means "not important at all" and 5 – means "very important")					
Being together with own group (friends/family)	1	2	3	4	5
Being on my own (solitude)	1	2	3	4	5
Meeting new people	1	2	3	4	5
Being close to nature	1	2	3	4	5
Admiring scenery	1	2	3	4	5
Learning more about nature	1	2	3	4	5
Learning about the cultural heritage of the area	1	2	3	4	5
Escaping from everyday life	1	2	3	4	5
Escaping from noise and pollution	1	2	3	4	5
Improving my physical health	1	2	3	4	5
Exercising	1	2	3	4	5
Relaxation	1	2	3	4	5
Pleasant old memories	1	2	3	4	5
Experiencing excitement	1	2	3	4	5
Other (please indicate)……	1	2	3	4	5

What is your main reason for visiting this particular place within ……national park? (please assess each motive separately on scale 1-5, where 1 - means "not important at all" and 5 – means "very important")					
This area is unique (e.g. beautiful nature)	1	2	3	4	5
There are interesting tourists attractions nearby (e.g. waterfalls, cable cars etc.)	1	2	3	4	5
This area is close to my place of residence (my family/friends place of residence)	1	2	3	4	5
This area is easily accessible (e.g. parking places, easy trails, cable cars etc.)	1	2	3	4	5
This area is less crowded	1	2	3	4	5
This area is wilder	1	2	3	4	5
This area has good tourists facilities (e.g. resting spot; viewpoints, shelters etc.)	1	2	3	4	5
There are good restaurants nearby	1	2	3	4	5
This area is another place, which I'd like to visit in this NP	1	2	3	4	5
It is a national park	1	2	3	4	5
Other (please indicate)……	1	2	3	4	5

Have you experienced crowding during your current visit in this area?	yes			no					
Can you please assess the level of crowding that you have experienced?	1	2	3	4	5	6	7	8	9
	not at all crowded		slightly crowded		moderately crowded			extremely crowded	
Can you estimate the number of other visitors that you have met?	……								

Did any of the following factors disturb your current visit in the NP? (please assess each factor separately on scale 1-5, where 1 - means "not disturbing at all" and 5 – means "very disturbing")					
Behaviour of other visitors	1	2	3	4	5
Trail erosion	1	2	3	4	5
Littering	1	2	3	4	5
Noise	1	2	3	4	5
Fear of wild animals	1	2	3	4	5
Fear of dense vegetation	1	2	3	4	5
Fear of lack of people	1	2	3	4	5
Too many infrastructure (reduced visibility)	1	2	3	4	5
Other, please indicate……	1	2	3	4	5

Part III – Local problems and opportunities

Place for questions regarding local problems Please add one/two questions regarding local issues

Part IV – General information on respondent

Gender	female	male
Age	in which year were you born?.....	
Education	– primary education – secondary education – professional education	– high school/college education – higher education
Place of residence	country…….	city/town/village…….
Professional status	– student – white collar worker – blue collar worker – freelancer	– own business – pensioner – other?.....
Average monthly income per person in my household is	– less than 450 eur – 450-700 eur – 701-1100 eur	– more than 1100 eur – prefer not to answer

EXAMPLE 2 – which include expanded information about overcrowding perception and ecological awareness

Part I. General information on current visit

What type of recreational activity did you do during your visit in this area? (You can indicate more than one option)	please list the all types of recreational activities which are related to your protected area (preferably in two columns to gain space for other questions) e.g.: – hiking – bicycling – kayaking – picnicking	 – swimming – skiing – horse riding – others…….
Which mode of transport did you choose to come here from your place of residence?	– car – tourist bus – bus – bicycle	– motorcycle – train – plane – other……
What type of accommodation do you sleep in?	– hotel – pension/vila – private accommodation – rented apartment – holiday resort	– shelter – camping – friend/family house – own apartment – other?.....
How long is your current stay in the area?	– 1 day – 2 days	– 3-5 days – > 5 (how many?)…….....
How often have you visited this area?	– it is my first time – first time after many years – less than one a year what seasons of the year do you visit the area most often? spring summer autumn winter	– once a year – several times a year – several times a month
How many people are with you during your current visit ?	i'm alone …….person, of which under 15 years old…….person	
During this visit, your group consists of	– family members – friends – co-workers – school class – students group	– club, association members – (which?)…….. – group with travel agency – other?.....
Where did you find information about this protected area	– in the visitor center – from my family members/friends etc. – from the official web-page – from the official social media channels – from other internet sites/social media channels	– from tv/radio/newspaper – from brochures or guidebooks – this place is familiar to me from previous visits – other?.....
Which part of the ……national park have you visited or plan to visit during your current stay?	this question can asked using one of the method mentioned in section SPATIAL DISTRIBUTION	

Part II. Motivation and opinions regarding perception of crowding and ecological awareness

What is your main reason for visiting ……national park? (please assess each motive separately on scale 1-5, where 1 - means "not important at all" and 5 – means "very important")					
Being together with own group (friends/family)	1	2	3	4	5
Being on my own (solitude)	1	2	3	4	5
Meeting new people	1	2	3	4	5
Being close to nature	1	2	3	4	5
Admiring scenery	1	2	3	4	5
Learning more about nature	1	2	3	4	5
Learning about the cultural heritage of the area	1	2	3	4	5
Escaping from everyday life	1	2	3	4	5
Escaping from noise and pollution	1	2	3	4	5
Improving my physical health	1	2	3	4	5
Exercising	1	2	3	4	5
Relaxation	1	2	3	4	5
Pleasant old memories	1	2	3	4	5
Experiencing excitement	1	2	3	4	5
Other (please indicate)……	1	2	3	4	5

Have you experienced crowding during your current visit in this area?	yes		no						
Can you please assess the level of crowding that you have experienced?	1	2	3	4	5	6	7	8	9
	not at all crowded		slightly crowded		moderately crowded			extremely crowded	
Can you estimate the number of other visitors that you have met?	……								
Which level of crowding on presented photographs is not acceptable for you? Please write the photo number	……								

Did any of the following factors disturb your current visit in NP? (please assess each factor separately on scale 1-5, where 1 - means "not disturbing at all" and 5 – means "very disturbing")					
Behavior of other visitors	1	2	3	4	5
Trail erosion	1	2	3	4	5
Littering	1	2	3	4	5
Noise	1	2	3	4	5
Fear of wild animals	1	2	3	4	5
Fear of dense vegetation	1	2	3	4	5
Fear of lack of people	1	2	3	4	5
Too many infrastructure (reduced visibility)	1	2	3	4	5
Other, please indicate……	1	2	3	4	5

Please indicate your attitude to the environment? (please assess each statement separately on scale 1-5, where 1 - means "strongly disagree" and 5 – means "strongly agree")					
We are approaching the limit of the number of people the Earth can support.	1	2	3	4	5
Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
When humans interfere with nature it often produces disastrous consequences.	1	2	3	4	5
Human ingenuity will insure that we do not make the Earth unlivable.	1	2	3	4	5
Humans are seriously abusing the environment.	1	2	3	4	5
The Earth has plenty of natural resources if we just learn how to develop them.	1	2	3	4	5
Plants and animals have as much right as humans to exist.	1	2	3	4	5
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5
Despite our special abilities, humans are still subject to the laws of nature.	1	2	3	4	5
The so-called "ecological crisis" facing humankind has been greatly exaggerated.	1	2	3	4	5
The Earth is like a spaceship with very limited room and resources.	1	2	3	4	5
Humans were meant to rule over the rest of nature.	1	2	3	4	5
The balance of nature is very delicate and easily upset	1	2	3	4	5
Humans will eventually learn enough about how nature works to be able to control it.	1	2	3	4	5
If things continue on their present course, we will soon experience a major ecological catastrophe.	1	2	3	4	5

Part III – Local problems and opportunities

Place for questions regarding local problems Please add One/two questions regarding local issues

Part IV. General information on respondent

Gender	female	male
Age	in which year were you born?.....	
Education	– primary education – secondary education – professional education	– high school/college education – higher education
Place of residence	– country…….	– city/town/village…….
Professional status	– student – white collar worker – blue collar worker – freelancer	– own business – pensioner – other?.....
Average monthly income per person in my household is	– less than 450 eur – 450-700 eur – 701-1100 eur	– more than 1100 eur – prefer not to answer

EXAMPLE 3 – which include expanded information about visitors opinions, knowledge on park regulation and safety aspects

Part I - General information on current visit

What type of recreational activity did you do during your visit in this area? (You can indicate more than one option)	please list the all types of recreational activities which are related to your protected area (preferably in two columns to gain space for other questions) e.g.: – hiking – bicycling – kayaking – picnicking	 – swimming – skiing – horse riding – others…….
Which mode of transport did you choose to come here from your place of residence?	– car – tourist bus – bus – bicycle	– motorcycle – train – plane – other……
What type of accommodation do you sleep in?	– hotel – pension/vila – private accommodation – rented apartment – holiday resort	– shelter – camping – friend/family house – own apartment – other?.....
How long is your current stay in the area?	– 1 day – 2 days	– 3-5 days – > 5 (how many?)…….....
How often have you visited this area?	– it is my first time – first time after many years – less than one a year what seasons of the year do you visit the area most often? spring summer autumn winter	– once a year – several times a year – several times a month
How many people are with you during your current visit ?	i'm alone …….person, of which under 15 years old…….person	
During this visit, your group consists of	– family members – friends – co-workers – school class – students group	– club, association members – (which?)…….. – group with travel agency – other?.....
Where did you find information about this protected area	– in the visitor center – from my family members/friends etc. – from the official web-page – from the official social media channels – from other internet sites/social media channels	– from tv/radio/newspaper – from brochures or guidebooks – this place is familiar to me from previous visits – other?.....
Which part of the ……national park have you visited or plan to visit during your current stay?	this question can asked using one of the method mentioned in section SPATIAL DISTRIBUTION	

Part II. Motivation, visitors opinion on park facilities and regulations and basic information on opinions, perceptions

What is your main reason for visiting ……national park? (please assess each motive separately on scale 1-5, where 1 - means "not important at all" and 5 – means "very important")					
Being together with own group (friends/family)	1	2	3	4	5
Being on my own (solitude)	1	2	3	4	5
Meeting new people	1	2	3	4	5
Being close to nature	1	2	3	4	5
Admiring scenery	1	2	3	4	5
Learning more about nature	1	2	3	4	5
Learning about the cultural heritage of the area	1	2	3	4	5
Escaping from everyday life	1	2	3	4	5
Escaping from noise and pollution	1	2	3	4	5
Improving my physical health	1	2	3	4	5
Exercising	1	2	3	4	5
Relaxation	1	2	3	4	5
Pleasant old memories	1	2	3	4	5
Experiencing excitement	1	2	3	4	5
Other (please indicate)……	1	2	3	4	5

Have you experienced crowding during your current visit in this area?	yes		no						
Can you please assess the level of crowding that you have experienced?	1	2	3	4	5	6	7	8	9
	not at all crowded		slightly crowded		moderately crowded			extremely crowded	
Can you estimate the number of other visitors that you have met?	……..…….								

What is your opinion about the quality and quantity of services and facilities that you used during your visit in …..? (please assess each factor separately; If you do not use the service/facility during this visit, please choose option "did not use" Quality scale: 1 – very poor – 5 – very good; 0 – did not use; Quantity scale: 1 – too few – 5 – too many; 0 – no opinion												
	quality of the services/facilities						quantity of the services/facilities					
Parking places	1	2	3	4	5	0	1	2	3	4	5	0
Trail network	1	2	3	4	5	0	1	2	3	4	5	0
Signposts	1	2	3	4	5	0	1	2	3	4	5	0
Rubbish bins	1	2	3	4	5	0	1	2	3	4	5	0
Public latrines	1	2	3	4	5	0	1	2	3	4	5	0
Cable cars/chairlifts	1	2	3	4	5	0	1	2	3	4	5	0
Resting spots	1	2	3	4	5	0	1	2	3	4	5	0
Campfire sites	1	2	3	4	5	0	1	2	3	4	5	0
Shelters	1	2	3	4	5	0	1	2	3	4	5	0
Catering facilities	1	2	3	4	5	0	1	2	3	4	5	0
Educational activities in the national park	1	2	3	4	5	0						
Info center	1	2	3	4	5	0						
Accessibility for visitors with disabilities	1	2	3	4	5	0						
General safety	1	2	3	4	5	0						
General cleanliness	1	2	3	4	5	0						
Other (please indicate)…….	1	2	3	4	5	0	1	2	3	4	5	0

Place for questions regarding park regulations Please use the structure of the questions described in chapter 1.2.2 E

Part III. Local problems and opportunities

Place for questions regarding local problems Please add One/two questions regarding local issues

Part IV. General information on respondent

Gender	female	male
Age	in which year were you born?.....	
Education	– primary education – secondary education – professional education	– high school/college education – higher education
Place of residence	– country…….	– city/town/village……
Professional status	– student – white collar worker – blue collar worker – freelancer	– own business – pensioner – other?.....
Average monthly income per person in my household is	– less than 450 eur – 450-700 eur – 701-1100 eur	– more than 1100 eur – prefer not to answer

EXAMPLE 4 – which include expanded information about visitors expenditures

Part I - General information on current visit

What type of recreational activity did you do during your visit in this area? (You can indicate more than one option)	please list the all types of recreational activities which are related to your protected area (preferably in two columns to gain space for other questions) e.g.:	
	– hiking – bicycling – kayaking – picnicking	– swimming – skiing – horse riding – others…….
Which mode of transport did you choose to come here from your place of residence?	– car – tourist bus – bus – bicycle	– motorcycle – train – plane – other……
What type of accommodation do you sleep in?	– hotel – pension/vila – private accommodation – rented apartment – holiday resort	– shelter – camping – friend/family house – own apartment – other?.....
How long is your current stay in the area?	– 1 day – 2 days	– 3-5 days – > 5 (how many?)…….....
How often have you visited this area?	– it is my first time – first time after many years – less than one a year	– once a year – several times a year – several times a month
	what seasons of the year do you visit the area most often?	
	spring summer autumn winter	
How many people are with you during your current visit ?	i'm alone ……person, of which under 15 years old…….person	
During this visit, your group consists of	– family members – friends – co-workers – school class – students group	– club, association members – (which?)…….. – group with travel agency – other?.....
Where did you find information about this protected area	– in the visitor center – from my family members/friends etc. – from the official web-page – from the official social media channels – from other internet sites/social media channels	– from tv/radio/newspaper – from brochures or guidebooks – this place is familiar to me from previous visits – other?.....
Which part of the ……national park have you visited or plan to visit during your current stay?	this question can asked using one of the method mentioned in section SPATIAL DISTRIBUTION	

Part II – Motivation, visitors expenditures and basic information on opinions, perceptions

What is your main reason for visiting .....national park? (please assess each motive separately on scale 1-5, where 1 - means "not important at all" and 5 – means "very important")					
Being together with own group (friends/family)	1	2	3	4	5
Being on my own (solitude)	1	2	3	4	5
Meeting new people	1	2	3	4	5
Being close to nature	1	2	3	4	5
Admiring scenery	1	2	3	4	5
Learning more about nature	1	2	3	4	5
Learning about the cultural heritage of the area	1	2	3	4	5
Escaping from everyday life	1	2	3	4	5
Escaping from noise and pollution	1	2	3	4	5
Improving my physical health	1	2	3	4	5
Exercising	1	2	3	4	5
Relaxation	1	2	3	4	5
Pleasant old memories	1	2	3	4	5
Experiencing excitement	1	2	3	4	5
Other (please indicate).....	1	2	3	4	5

Have you experienced crowding during your current visit in this area?	yes		no						
Can you please assess the level of crowding that you have experienced?	1	2	3	4	5	6	7	8	9
	not at all crowded		slightly crowded		moderately crowded			extremely crowded	
Can you estimate the number of other visitors that you have met?	.....								

Please estimate total cost of your current stay in this area (without travel cost)	the given cost apply to: – 1 person (respondent) – whole family (how many?.....including kids?.....) – a group of people with shared budget (how many?)……		
What is the total cost of your accommodation?	the given cost apply to: – 1 person (respondent) – whole family (how many?.....including kids?.....) – a group of people with shared budget (how many?)……		
What is your arrival cost of coming here and return?	the given cost apply to: – 1 person (respondent) – whole family (how many?.....including kids?..... –)a group of people with shared budget (how many?)……		
Please estimate your daily expenses in the region (only one day; without accommodation cost)?	expenses	protected area	region
	catering (restaurants etc.)		
	groceries		
	shopping (other than food)		
	souvenirs		
	fuel (within the area/region)		
	parking		
	local transport (within the area/region)		
	entry tickets to protected area		
	entry tickets (except for pa)……		
	other expenses?.....		
	the given cost apply to: 1 person (respondent) whole family (how many?.....including kids?.....) a group of people with shared budget (how many?)……		

Part III. Local problems and opportunities

Place for questions regarding local problems Please add One/two questions regarding local issues

Part IV. General information on respondent

Gender	female	male
Age	in which year were you born?.....	
Education	– primary education – secondary education – professional education	– high school/college education – higher education
Place of residence	– country……	– city/town/village……
Professional status	– student – white collar worker – blue collar worker – freelancer	– own business – pensioner – other?.....
Average monthly income per person in my household is	– less than 450 eur – 450-700 eur – 701-1100 eur	– more than 1100 eur – prefer not to answer

2. Monitoring visitors methodologies

2.1. Introduction

Protected areas are crucial for conserving our natural and cultural heritage and providing visitors with unique experiences. However, conflicts often arise between visitor expectations and the need to protect these delicate ecosystems. To effectively address these conflicts, protected area managers must implement strategies that incorporate visitor monitoring.

Visitor monitoring is a valuable tool for understanding visitor behaviors, preferences, and impacts. By gathering accurate data on visitor numbers, behaviors, and impacts, park managers can develop appropriate management plans. This ensures a balance between visitor satisfaction and the long-term conservation of natural and cultural resources.

Technological tools and methodologies play a significant role in visitor monitoring. These tools enable park managers to collect precise and timely data, facilitating effective decision-making and management strategies. Examples of such tools include: crowdsourcing, social media analysis, mobile applications, camera traps, remote sensing technologies, automated counters, or computer vision approaches.

By utilizing these technology-based tools, we gain valuable insights into visitor behaviors, preferences, and impacts in protected areas (e.g. Hausmann et al. 2018). This understanding helps us make informed decisions and implement targeted management strategies that address conflicts between visitor expectations and nature protection (Cessford, Muhar 2003). The ongoing research and technological advancements hold great potential for improving visitor monitoring practices and promoting sustainable nature-based tourism.

When implementing a visitor monitoring program, it is essential to carefully select appropriate technology-based tools, develop a data management plan, and train staff on their usage. Regular evaluation and adaptation of the program enhance its performance. Moreover, stakeholder engagement and collaboration are vital in designing and implementing visitor monitoring programs.

Visitor monitoring offers numerous benefits, such as assessing visitor behavior and providing use indicators. The data nature makes it possible to analyze visitors' spatial and social behavior (Riungu et al. 2018). However, it also presents challenges, including the need for infrastructure, employment requirements, and human services, which have implications for the economy, society, culture, and the environment (Leung et al. 2018).

Keep in mind: Technology-based tools are crucial for visitor monitoring in protected areas. They offer valuable information to assess visitor behavior and usage patterns. To ensure accurate and reliable data, it is essential to carefully choose, implement, and maintain these tools. By integrating visitor monitoring programs and utilizing technological advancements, protected area managers can effectively handle conflicts between visitor expectations and nature protection. This promotes sustainable conservation and enhances visitor experiences.

2.2. Tools and methodologies for visitor monitoring

Visitor-monitoring techniques encompass a diverse array of methods employed to collect comprehensive data on visitor numbers, behaviors, and impacts within protected areas. These techniques play a vital role in assisting park managers by providing

valuable insights into visitor dynamics, facilitating an evaluation of the effectiveness of management strategies, and enabling informed decision-making. It is essential to note that the successful implementation of these techniques necessitates not only the utilization of appropriate tools but also the complementary aspects of data analysis, interpretation, and efficient management of monitoring systems. By carefully analyzing the gathered data and effectively interpreting the results, managers can gain a deeper understanding of visitor patterns, preferences, and the overall impact on the protected area. This comprehensive understanding enables them to make evidence-based decisions and adapt management approaches as needed to ensure the preservation and sustainable management of these valuable natural and cultural resources.

When developing a visitor counting program, it is important to address the following essential inquiries (fig. 3; Spenceley et al. 2021).

Table 13 below provides a concise overview of the different counting methods, highlighting their key

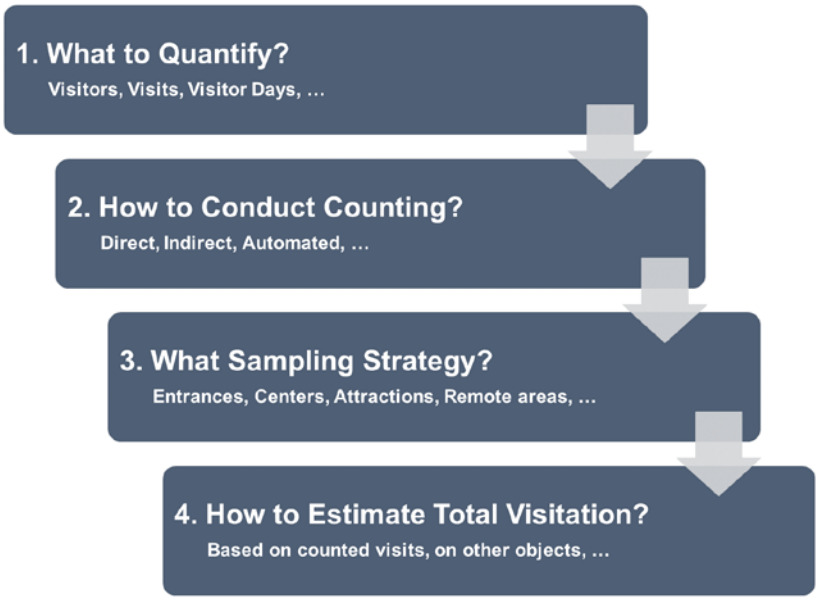

Fig. 3. Inquiries for visitor counting program
Source: Spenceley et al. 2021.

Table 13. Counting methods with their key characteristics

Counting Method	Characteristics
Direct Counts	– flexibility in time and location – minimal equipment and expertise required – labor-intensive and suitable when labor costs are low or for limited counting periods
Indirect Counts	– accurate count information from entrance tickets or permits sold – additional data sources: accommodation records, passenger transportation – accuracy depends on completeness and coverage of data
Self-Registration	– low-cost option (e.g. summit books or accommodation guest books) – visitors may not always complete the registration, affecting accuracy
Automated Counts	– requires high investment for purchasing, mounting, and calibrating counting devices – devices need to be calibrated, installed correctly, and protected from vandalism – advancements allow distinguishing user groups and data transmission through mobile networks – continuous year-round counting after installation – less flexible for multiple counting locations compared to direct methods – suitable for high labor costs, long counting periods, remote or difficult-to-access sites

Source: Muhar, et al., 2002.

characteristics and considerations (Muhar et al. 2002).

In the text below, we present a selection of commonly used tools for effectively monitoring visitors, including some emerging approaches (fig. 4). As noted by Cessford and Muhar (2003), each method for counting visitors has its own strengths and weaknesses.

Keep in mind: The choice of visitor-monitoring techniques depends on the objectives, resources, and characteristics of the protected area. It is often necessary to use a combination of techniques to fully comprehend visitor dynamics and impacts. This comprehensive understanding enables effective management and conflict resolution between visitor expectations and nature protection.

2.2.1. Manual Counting, Field observers

Manual counting, specifically through field observers, involves park staff or volunteers conducting surveys at significant locations within the protected area, such as entrances, trails, or visitor centers. This method relies on direct interaction with visitors, employing questionnaires or interviews to collect a wide range of information, including visitor demographics, motivations, activities, and satisfaction levels. By engaging visitors in conversations, manual surveys offer an opportunity to gather detailed qualitative and quantitative data.

One of the key advantages of manual counting is the depth of insights it provides. Through face-to-face interactions, observers can gather nuanced information about visitor experiences, preferences, and behaviors. This qualitative data can be invaluable in understanding the motivations behind visitor actions and their perception of the protected area.

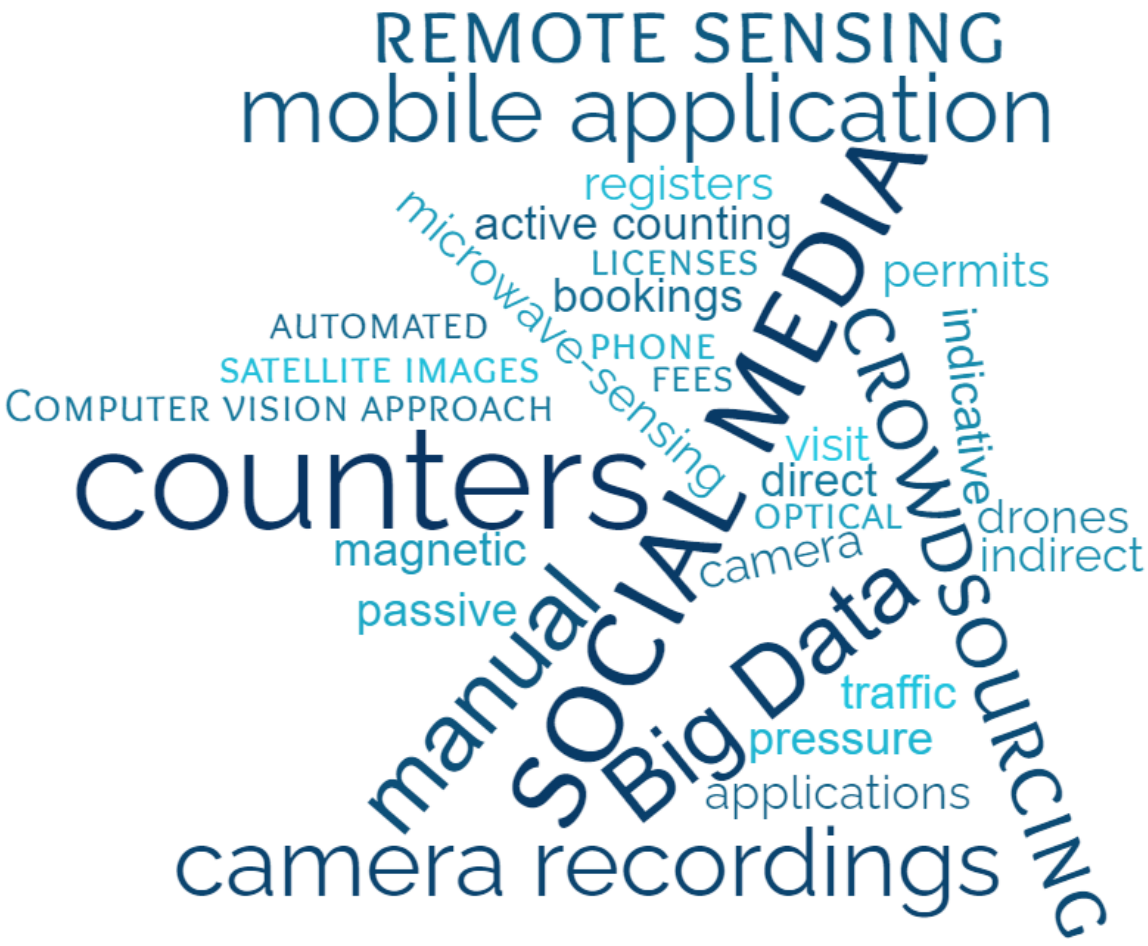

Fig. 4. Tools used for effectively monitoring visitors
Source: own compilation based on Cessford, Muhar 2003.

Additionally, quantitative data collected through manual counting allows for the measurement of visitor numbers, their distribution across different locations, and changes in visitation patterns over time.

Manual counting can be particularly useful for understanding visitor preferences and determining the impact of management strategies. For example, by surveying visitors at different trailheads, park managers can assess the popularity and usage of specific trails, identify areas of high visitor concentration, and make informed decisions about trail maintenance and development. Moreover, manual surveys can shed light on visitor satisfaction levels, helping managers identify areas for improvement and tailor their offerings to meet visitor expectations.

While manual counting provides valuable insights, it does have limitations. It can be time-consuming, especially if conducted over an extended period or at multiple locations within the protected area. The scale of data collection may also be limited by the availability of staff or volunteers to conduct surveys. Furthermore, manual counting may not capture the entire visitor population, as some visitors may decline to participate or may not be present during the survey period.

To optimize the effectiveness of manual counting, it is essential to carefully plan the survey design, including selecting appropriate locations and timing. Strategic placement of observers at high-traffic areas and during peak visitation times can ensure a representative sample and maximize data collection efficiency. Training for staff or volunteers involved in the survey process is crucial to ensure accurate data collection and consistent survey administration.

In summary, manual counting through field observers offers a valuable approach to gather comprehensive data on visitor behavior in protected areas. It enables park managers to gain insights into visitor demographics, motivations, activities, and satisfaction levels. By utilizing this method, managers can make informed decisions, develop tailored management strategies, and enhance the visitor experience. However, careful planning, adequate resources, and proper training are crucial to overcome potential limitations and ensure the reliability and validity of the collected data.

2.2.2. Automated Counters

Automated counters utilize sensors, such as infrared or laser beams, to detect and count visitors as they pass specific locations within the protected area. These counters can be strategically placed at entrances, trails, or other key points. By accurately counting visitors, automated counters enable managers to gain insights into visitation patterns and trends. Advanced automated counters can even distinguish between different types of visitors, such as pedestrians, bicycles, or horse riders.

The application of automated counters for visitor monitoring in protected areas offers numerous benefits. They provide a cost-effective and scalable solution for collecting data on visitor behavior and use patterns. These counters offer a convenient and efficient method for obtaining accurate visitor counts without the need for extensive manual efforts (photo 5 and 6; e.g. Farías-Torbidoni et al. 2022).

One way to utilize automated counters is by analyzing visitor inflow. The data generated by these counters include visitor inflow by entrances, visitor inflow by months, and the distribution of visitor inflow across different trails or recreational areas within the park. This information can help managers understand peak visitation periods, popular entry points, and the utilization of specific areas within the protected area.

Moreover, automated counters can provide valuable insights into visitor behavior and use patterns beyond visitor counts alone. By tracking the movement of visitors within the protected area, managers can generate hotspot maps and distribution models that depict visitor utilization across different areas. This information assists in identifying high-use areas, potential areas of congestion, and areas that may require additional management attention.

In summary, automated counters serve as effective tools for visitor monitoring in protected areas. They offer a cost-effective and scalable approach to collecting data on visitor behavior and use patterns. By leveraging automated counters, managers can obtain accurate visitor counts, analyze visitation trends, and gain insights into the distribution of visitors within the protected area. However, it is important to carefully consider the advantages and limitations of using automated counters for visitor monitoring and to tailor their application based on the specific needs and characteristics of the protected area.

Photo 5. Automated visitor counter in the Urho Kekkonen National Park (Finland)

Photo: A. Kozumplíková.

Photo 6. Automated visitor counter in the Podyjí National Park (Czech Republic)

Photo: O. Vítek.

2.2.3. Remote Sensing

Remote sensing technologies, such as satellite imagery and aerial photography, offer valuable tools for estimating visitor density, assessing movement patterns, and monitoring impacts within protected areas. These methods provide a broader spatial perspective, making them particularly useful for large-scale monitoring. Additionally, remote sensing techniques aid in identifying changes in land cover, habitat disturbances, and encroachment, providing crucial insights for effective management (e.g. Duan et al. 2020). Remote sensing can be applied in visitor monitoring in a number if ways:

1. **Visitor Density Estimation:** Remote sensing can help estimate visitor density by analyzing high-resolution satellite imagery or aerial photography. By examining indicators of visitor presence, such as vehicles or tents, park managers can approximate the density in different areas. This information is invaluable for identifying popular hotspots and understanding spatial patterns of visitation.
2. **Movement Pattern Analysis:** Remote sensing enables the analysis of visitor movement patterns. By tracking changes in vegetation indices or disturbance patterns over time using satellite imagery, frequently visited areas and visitor routes can be identified. Understanding movement patterns helps assess the impacts on sensitive habitats, identify potential areas of conflict, and plan infrastructure or trail improvements accordingly.
3. **Environmental Impact Assessment:** Remote sensing supports the assessment of environmental impacts caused by visitor activities. Satellite imagery can detect changes in land cover, vegetation health, or water quality, providing insights into the ecological consequences of visitation. This information assists in targeted conservation efforts and habitat restoration initiatives.
4. **Monitoring Sensitive or Restricted Areas:** Remote sensing allows non-intrusive monitoring of sensitive or restricted areas, such as wildlife sanctuaries or archaeological sites. Satellite imagery helps identify unauthorized access, detect encroachments,

and monitor compliance with visitation restrictions, without compromising the integrity of these areas.

5. **Evaluating Carrying Capacity:** Remote sensing aids in evaluating and adjusting carrying capacity estimates. By combining satellite imagery, visitor count data, and environmental parameters, managers can assess the impacts of visitation on natural resources. This information helps make informed decisions regarding visitation limits and infrastructure development to ensure sustainable management.
6. **Data Integration and Decision Support Systems:** Remote sensing data can be integrated with other visitor monitoring data, such as automated counters or manual surveys, to create comprehensive visitor management systems. Geographic Information Systems (GIS) and decision support tools utilize remote sensing data to generate maps, models, and simulations. These tools aid in planning and managing visitor activities, evaluating different management scenarios, and making data-driven decisions.

It is important to note that remote sensing should be combined with other visitor monitoring techniques to obtain a holistic understanding of visitor behaviors and impacts. Integrating remote sensing data with on-the-ground observations, manual surveys, or automated counters enhances the accuracy and reliability of visitor monitoring efforts. This comprehensive approach supports the effective management of protected areas and the resolution of conflicts between visitors' expectations and nature protection.

In summary, remote sensing technologies offer effective and scalable methods for monitoring visitors in protected areas. By utilizing remote sensing platforms and sensors, managers can collect valuable data on visitor behavior, use patterns, and environmental impacts. This information aids in evidence-based decision-making, sustainable management practices, and the preservation of the natural and cultural heritage within protected areas.

2.2.4. Camera recordings

Camera recordings, achieved through the use of camera traps equipped with motion sensors, offer a valuable method for monitoring visitors in protected areas. These devices can be strategically placed along trails or in sensitive areas to capture images or videos of both wildlife and visitors. Camera recordings provide visual evidence that can be utilized to monitor visitor interactions, assess their impacts on wildlife and ecosystems, and educate visitors about responsible behavior (e.g. Miller et al. 2017).

Below is a more comprehensive exploration of how camera recordings can be applied to visitor monitoring:

1. **Visitor Monitoring:** Camera traps can be strategically positioned at key locations within the protected area, such as trailheads, camping areas, or wildlife viewing spots, to capture images or videos of visitors. This data helps in understanding visitor numbers, demographics, and patterns of visitation. Furthermore, camera recordings provide insights into visitor activities, such as hiking, picnicking, or wildlife observation, facilitating the evaluation of visitor preferences and behaviors. **Example:** Camera traps placed at a popular trailhead can capture data on the number of visitors, their arrival times, and the duration of their stay. This information aids in understanding peak visitation periods and visitor flow.
2. **Visitor-Wildlife Interactions:** Camera recordings enable the monitoring of visitor-wildlife interactions. They can capture images or videos of visitors observing or approaching wildlife, providing valuable insights into visitor compliance with guidelines and regulations for wildlife viewing. By assessing these interactions, managers can identify potential disturbances or impacts on wildlife behavior and habitats, contributing to wildlife conservation efforts. **Example:** Camera traps placed near wildlife habitats can document visitor behavior, such as maintaining a safe distance from wildlife or avoiding behaviors that may disrupt natural processes.
3. **Visitor Behavior Assessment:** Camera recordings offer an objective method to study visitor behavior in protected areas. By analyzing the footage, managers can observe visitor compliance with regulations, identify instances of inappropriate behavior (e.g., littering or feeding wildlife), or assess the use of designated trails and facilities. Understanding visitor behavior assists in designing targeted educational programs, signage, or management strategies to promote responsible visitation. **Example:** Camera traps placed at popular viewpoints can help assess visitor compliance with designated

trails and the impact of off-trail exploration on sensitive vegetation.

4. **Encroachment and Unauthorized Activities:** Camera traps can assist in detecting and monitoring encroachments or unauthorized activities within protected areas. These devices can be placed strategically along boundaries or in sensitive areas prone to illegal access or resource extraction. The captured images or videos provide evidence of unauthorized activities, aiding park authorities in taking appropriate enforcement actions and ensuring the integrity of protected areas. **Example:** Camera traps placed at the entrance of restricted areas can help monitor and deter unauthorized access, providing evidence in case of violations.
5. **Visitor Education and Awareness:** Camera trap images and videos can be utilized for visitor education and awareness campaigns. Sharing captivating footage of wildlife or visitor interactions through social media, interpretive displays, or visitor centers engages and educates visitors about the importance of responsible behavior and conservation ethics. It serves as a tool to promote positive visitor experiences and a sense of stewardship. **Example:** Sharing camera trap images of rare or charismatic wildlife encounters on the park's social media platforms helps raise awareness about the importance of protecting these species and their habitats.
6. **Research and Management Planning:** Camera recordings contribute to research and management planning efforts. Analyzing long-term trends and patterns in visitor behaviors, visitation rates, or visitor-wildlife interactions provides valuable insights for making informed decisions regarding infrastructure development, trail design, or visitor management strategies. Camera trap data supports the evaluation of management interventions and the impacts of visitor management policies. **Example:** Analyzing camera trap data over multiple years can reveal changes in visitor use patterns, aiding in the development of long-term visitor management plans.

It is crucial to note that camera recordings should be used ethically and in compliance with privacy regulations. Respecting sensitive areas and visitor privacy is essential, and proper protocols should be in place for data handling and storage. Integrating camera trap data with other visitor-monitoring techniques provides a comprehensive understanding of visitor dynamics and impacts, supporting effective management and conflict resolution between visitors' expectations and nature protection in protected areas.

In summary, camera recordings obtained through camera traps offer an effective and scalable method for monitoring visitors in protected areas. provide valuable data on visitor behavior, use patterns, and impacts, aiding in evidence-based decision-making, sustainable management practices, and the preservation of the natural and cultural heritage within protected areas.

2.2.5. Social Media Analysis

Social media analysis is an effective method for monitoring and understanding visitor dynamics in protected areas. By leveraging social media platforms like Instagram, X, and Facebook, park managers can gain valuable insights into visitor experiences, behaviors, preferences, and potential impacts. This real-time and large-scale approach offers numerous applications that can enhance visitor monitoring efforts and inform management strategies (e.g. Wilkins et al. 2021; Barros et al. 2022).

One significant benefit of social media analysis is its ability to provide information about **visitor experiences and feedback**. Through the analysis of geotagged posts, hashtags, and comments, park managers can gain a deeper understanding of visitor satisfaction levels, identify popular attractions or activities, and address any issues raised through feedback or complaints. For instance, by monitoring social media platforms, park managers can quickly identify and respond to visitors' concerns, ensuring a positive experience and fostering visitor satisfaction.

Another practical application of social media analysis is the identification of **visitor hotspots** within protected areas. By analyzing geotagged posts and check-ins, managers can pinpoint popular destinations, trails, viewpoints, or camping areas. This information aids in understanding visitation patterns and can inform management strategies, such as resource allocation, infrastructure development, or visitor flow management. For instance, if social media analysis reveals a significant concentration of visitors in a particular area, managers can allocate additional staff, facilities, or signage to effectively manage and distribute visitor traffic.

Social media analysis also helps in detecting **potential impacts of visitation on natural and cultural resources**. By analyzing user-generated content, park managers can identify instances of inappropriate behavior, such as littering, off-trail hiking, or disturbance of wildlife or sensitive habitats. This information allows for targeted educational campaigns, increased monitoring, or the implementation of visitor management measures to mitigate negative impacts. For example, if social media analysis reveals instances of visitors engaging in prohibited activities, park managers can develop educational programs or signage to promote responsible behavior and conservation practices.

In terms of crisis management and emergency response, social media analysis provides a valuable tool for **monitoring and addressing real-time events**. By tracking social media posts and hashtags related to a protected area, managers can identify and respond to emergencies, natural disasters, or issues affecting visitors' safety. Rapid communication through social media enables timely updates, alerts, and the dissemination of crucial information to visitors, ensuring their well-being and minimizing potential risks.

Additionally, social media analysis can **inform targeted marketing and communication strategies**. By understanding visitor profiles, interests, and preferences, park managers can tailor promotional campaigns, content creation, or visitor engagement initiatives to specific audiences. This enables more effective messaging and outreach, attracting the right visitors and enhancing their overall experience in the protected area.

Furthermore, social media analysis provides valuable data for **studying visitor behavior and understanding their motivations and activities**. By analyzing trends, patterns, and sentiments expressed in social media posts, managers can gain insights into the social and cultural dimensions of visitation. This information aids in the development of visitor profiles, understanding visitor expectations, and designing targeted visitor experiences.

However, it is important to conduct social media analysis ethically and with respect for user privacy. Care should be taken to consider the representativeness and biases of social media data, as not all visitors may actively engage on social platforms. Integrating social media analysis with other visitor-monitoring techniques and data sources provides a more comprehensive understanding of visitor dynamics and impacts, supporting effective management and conflict resolution between visitors' expectations and nature protection in protected areas.

In summary, social media analysis offers valuable insights into visitor behavior, spatial patterns of use, and visitor experiences in protected areas. By leveraging data from social media platforms, park managers can enhance visitor monitoring efforts, inform management strategies, and create more meaningful visitor experiences while ensuring the conservation and protection of natural and cultural resources.

2.2.6. Mobile Applications

Mobile applications offer a promising approach to visitor monitoring in protected areas. These park-specific apps engage visitors directly and provide a range of features to collect data on their activities and experiences (e.g. Muñoz et al. 2019). Let us explore the applications and benefits of using mobile apps for visitor counting and monitoring:

1. **Visitor Tracking and Check-Ins:** Mobile applications can include features that allow visitors to check-in upon arrival at the protected area or specific sites within it. This real-time data on visitor numbers enables managers to understand visitation patterns, peak times, and visitor flows. It also aids in ensuring visitor safety by having information on their location within the protected area. For example, an app can allow hikers to check-in at trailheads, providing park managers with valuable insights into trail usage and visitor distribution.
2. **Activity Logging:** Mobile apps can enable visitors to log their activities and experiences during their visit. They can record information such as hiking, biking, or wildlife sightings. By collecting this activity data, managers gain insights into visitor preferences, popular activities, and the usage of different trails or facilities. This data helps in resource allocation, infrastructure planning, and the development of visitor-centered management strategies. For instance, an app can allow mountain bikers to track their routes, providing information on popular biking trails and areas that may require maintenance or improvement.
3. **Reporting Environmental Observations:** Mobile apps can facilitate visitor participation in citizen science initiatives. Visitors can report environmental

observations or wildlife sightings they encounter during their visit. This crowd-sourced data contributes to scientific research and helps managers monitor and respond to environmental issues in a timely manner. For example, an app can allow birdwatchers to report rare bird species they spot in the protected area, aiding in conservation efforts and species monitoring.

4. **Feedback and Surveys:** Mobile apps can include mechanisms for visitors to provide feedback, opinions, and suggestions. Surveys can be conducted to gather information on visitor satisfaction levels and preferences. This feedback helps evaluate the effectiveness of management efforts, identify areas for improvement, and ensure visitor satisfaction. For instance, an app can allow visitors to rate their experience, leave comments, or provide suggestions for park amenities or services.
5. **Interpretation and Education:** Mobile apps can serve as educational tools, providing information on the natural and cultural resources of the protected area. They can include interactive maps, species identification guides, or multimedia content that enhances visitor understanding and appreciation of the area's significance. Interpretive trails within the app can provide educational information and points of interest along designated routes, enriching the visitor experience and fostering a deeper connection with the protected area.
6. **Emergency Alerts and Safety Information**: Mobile apps can be used to send real-time alerts, updates, and safety information to visitors. This is particularly useful during emergencies, weather events, or temporary closures. Providing vital information on evacuation routes, park regulations, or potential hazards through the app ensures visitor safety and minimizes risks.
7. **Data Management and Analysis:** Mobile apps facilitate the collection, storage, and analysis of visitor data. The data collected through the app can be integrated into visitor management systems, allowing for comprehensive data analysis, visualization, and reporting. This enables managers to make data-driven decisions, evaluate the effectiveness of management strategies, and identify visitor trends and preferences over time.

While mobile applications offer numerous benefits, it is important to consider user experience, accessibility, and data privacy during the design and development process. Not all visitors may have smartphones or be willing to download and use the app, and the data collected may not represent all park users. Integrating mobile app data with other visitor-monitoring techniques and data sources enhances the accuracy and reliability of visitor monitoring efforts.

In summary, mobile applications present a powerful tool for visitor monitoring in protected areas. These apps engage visitors directly, collect valuable data on their activities and experiences, and support management efforts in providing enhanced visitor experiences while ensuring the conservation and protection of natural and cultural resources.

2.2.7. Crowdsourcing

Crowdsourcing is a powerful method for visitor monitoring in protected areas. By leveraging the collective intelligence and participation of visitors, data can be gathered on various aspects of their experiences and behaviors (e.g. Walden et al. 2018). Here is an improved and expanded explanation of how crowdsourcing can be applied and examples of its practical use:

1. **Observation Reporting:** Crowdsourcing allows visitors to report their observations of wildlife, rare species, invasive plants, or environmental disturbances. Online platforms or mobile applications can be designed to facilitate easy submission of these observations. For instance, visitors can report a rare bird sighting, the presence of an invasive species, or instances of illegal activities, contributing valuable data for ecological research and management actions.
2. **Citizen Science:** Crowdsourcing engages visitors as citizen scientists, enabling them to actively participate in scientific research and monitoring projects. Visitors can contribute data on specific research objectives, such as tracking migratory bird populations or monitoring water quality. This involvement increases the spatial and temporal coverage of data collection, providing valuable insights for ecological research and management decision-making. For example, visitors can collect water samples from different locations within a protected area and submit their findings through a mobile app, supporting water quality monitoring efforts.
3. **Trail Conditions and Maintenance**: Crowdsourcing

can be utilized to collect information on trail conditions, infrastructure maintenance needs, or potential safety hazards. Visitors can report issues they encounter during their visit, such as fallen trees, damaged trail sections, or erosion problems. This real-time data allows park managers to prioritize maintenance and repair tasks, ensuring visitor safety and enhancing the visitor experience. For instance, visitors can use a mobile app to report a hazardous trail condition or an unsafe bridge in need of repair.

4. **Feedback and Reviews**: Crowdsourcing enables visitors to provide feedback, reviews, and suggestions regarding their experience in the protected area. Online platforms or mobile applications can incorporate sections for visitors to share their opinions on visitor facilities, interpretive programs, or visitor management strategies. This feedback provides valuable insights into visitor satisfaction levels, identifies areas for improvement, and helps shape future management decisions. For example, visitors can provide feedback on the cleanliness and availability of restroom facilities through an online survey, leading to improvements in maintenance and visitor services.
5. **Interpretation and Storytelling:** Crowdsourcing can involve visitors sharing their stories, photographs, or experiences related to the protected area. Online platforms or social media campaigns can encourage visitors to contribute their personal narratives, creating a sense of community and fostering emotional connections with the protected area. These stories can be used in interpretive programs, promotional materials, or visitor engagement initiatives, enhancing visitor experiences and increasing public awareness. For instance, visitors can share favorite wildlife encounters or memorable hiking experiences through a designated hashtag on social media, inspiring others to explore and appreciate the protected area.
6. **Invasive Species Reporting:** Crowdsourcing can aid in the detection and management of invasive species within protected areas. Visitors can report sightings of invasive plants or animals, helping to identify new infestations or track the spread of existing populations. This information supports invasive species control and eradication efforts, safeguarding the native biodiversity of the protected area. For example, visitors can submit photos and location data of invasive plant species they encounter during their visit, assisting park managers in targeting and mitigating invasive species threats.
7. **Monitoring Compliance and Rule Enforcement:** Crowdsourcing can assist in monitoring visitor compliance with park regulations and rules. Visitors can report instances of rule violations or inappropriate behavior they witness during their visit. This information helps park managers identify areas of concern, deploy enforcement efforts effectively, and enhance visitor safety and resource protection. For example, visitors can report instances of off-trail hiking or illegal camping through a mobile app, allowing park rangers to take appropriate actions and educate visitors about responsible behavior.

Incorporating effective communication, user-friendly platforms, and active engagement strategies are crucial when implementing crowdsourcing initiatives. Clear guidelines, incentives for participation, and recognition of the contributions of citizen scientists foster a sense of ownership and stewardship among visitors. Integrating crowdsourced data with other visitor-monitoring techniques enhances the comprehensive understanding of visitor dynamics, behaviors, and impacts, facilitating effective management and conflict resolution in protected areas.

In summary, crowdsourcing, social media analysis, and mobile applications are distinct methods with their own unique strengths. However, when used together, can provide a more comprehensive understanding of visitor behavior, experiences, and impacts in protected areas.

2.2.8. Computer vision approach

The computer vision approach is a valuable method for visitor monitoring in protected areas. By utilizing machine learning-based computer vision, park managers can collect data on visitor behavior and usage patterns in a cost-effective and scalable manner. Here is an improved and expanded explanation, along with examples of how this method can be applied:

The computer vision approach can be employed to analyze triggered trail camera images as a means of visitor monitoring. For instance, a study conducted in a protected forest area compared the effectiveness

of established visitor monitoring approaches with triggered trail camera images and machine learning-based computer vision. The results demonstrated that a convolutional neural network derived comparable visitor numbers to other visitor counting methods in terms of visitation patterns and visit counts (Staab et al. 2021).

Furthermore, the computer vision approach enables differentiation between visitor types and activities, such as dog-walking or cycling, at relatively low costs. This capability allows managers to gain insights into specific visitor groups and their activities within the protected area. For example, computer vision algorithms can distinguish between different types of recreational activities by analyzing images captured by trail cameras, providing valuable information for resource allocation and visitor management strategies.

However, it is essential to consider the limitations and challenges associated with the computer vision approach for visitor monitoring. Camera-based systems are susceptible to theft, vandalism, malfunctioning, and data security issues. Adequate measures should be taken to address these concerns, such as ensuring secure camera placement, regular maintenance, and appropriate data handling protocols.

In summary, the computer vision approach offers a cost-effective and scalable solution for visitor monitoring in protected areas. By utilizing machine learning algorithms to analyze triggered trail camera images, managers can obtain valuable data on visitor behavior, usage patterns, and even differentiate between visitor types and activities. While careful consideration of limitations and challenges is necessary, the computer vision approach provides an innovative and efficient method to enhance visitor monitoring efforts in protected areas.

2.3. Best practices

The table below (tab. 14) provides a selection of best practices to inspire and guide practitioners in protected areas. These practices have been proven effective in visitor monitoring and can serve as valuable references for implementation.

Table 14. Best practices – visitor monitoring

Destination	Country	Description	Information source:
The Krkonoše Mountains National Park	Czech Republic	The administration of Krkonoše Mountains National Park employs automatic counting devices to monitor visitor intensity in the park's peak and the most vulnerable areas. These devices provide daily and up-to-date data on the movement of people in the area, allowing for effective monitoring of visitor activity.	Paper: Spatio-temporal distribution of tourism in the Krkonoše Mts and its environmental impacts
Czech Regions, Towns, Cyclopaths	Czech Republic	The website shares and presents visitor numbers for cycling and walking trails in one centralized platform.	mereninavstevnosti.cz
Bavarian Forest National Park	Germany	The study focuses on evaluating the use of GNSS-based Volunteered Geographic Information (VGI) for assessing the spatial distribution of visitors within protected areas. Publicly available digital data, including VGI collected through Global Navigation Satellite Systems, has gained attention as a valuable resource for understanding visitor movement patterns.	Evaluation of GNSS-based Volunteered Geographic Information for assessing visitor spatial distribution within protected areas: A case study of the Bavarian Forest National Park, Germany
Ebro Delta Natura 2000 site	Portugal	Researchers conducted an analysis of visitor monitoring and public use in protected areas, utilizing volunteered geographic information (VGI) as a valuable source of big data.	Visitor monitoring in protected areas: an approach to Natura 2000 sites using Volunteered Geographic Information (VGI)
Montsant Natural Park	Spain	The case study describes a comprehensive method for monitoring visitors based on the optimized use of automatic counters called the Optimal Visitor Monitoring System (OVMS).	Optimizing the use of automatic counters to monitor visits to protected natural areas

Source: own elaboration.

2.4. Practical implications

To ensure successful visitor monitoring in protected areas, it is crucial to not only implement effective tools and methods but also to prioritize data analysis, interpretation, and overall system management. These components are essential for maximizing the value and insights derived from visitor data

2.4.1. Data Analysis and Interpretation

Data analysis and interpretation play a vital role in technology-based visitor monitoring in protected areas. By utilizing statistical techniques, data visualization, and spatial analysis, managers can derive valuable insights from the collected data, leading to informed management decisions and improved visitor experiences. Let us explore the process of data analysis and interpretation, as well as practical examples of their application in protected areas:

1. **Statistical analysis** allows managers to identify patterns, trends, and relationships within visitor data. Techniques such as descriptive statistics, regression analysis, and hypothesis testing can be applied to explore visitor behavior, preferences, and impacts. For example, statistical analysis can reveal the correlation between visitor numbers and environmental conditions, helping managers understand the factors influencing visitation patterns.
2. **Data visualization techniques**, such as charts, graphs, and maps, facilitate the communication of complex visitor data in a more accessible and meaningful way. Visual representations can help identify spatial patterns of visitor use, hotspots, or seasonal variations. For instance, a heatmap showing visitor density across a protected area can assist managers in identifying areas of high use and informing infrastructure development or visitor management strategies.
3. **Spatial analysis techniques**, such as Geographic Information Systems (GIS), allow managers to examine visitor data in relation to the physical landscape and environmental features. GIS can help identify visitor flows, identify sensitive areas prone to impacts, or analyze the accessibility of different parts of the protected area. For example, spatial analysis can reveal visitor preferences for specific trails or attractions, aiding in trail management and infrastructure planning.
4. Data analysis and interpretation have **practical implications for practitioners** in protected areas. By understanding visitor behavior, managers can optimize resource allocation, design effective visitor management strategies, and enhance the visitor experience. For instance, data analysis might indicate a high concentration of visitors in a particular area, leading to the implementation of measures such as trail diversification, visitor capacity limits, or educational programs to disperse visitor pressure.
5. Data analysis and interpretation support **adaptive management**, allowing managers to evaluate the effectiveness of their strategies and make informed adjustments. Regular reviews of visitor data help identifying emerging trends, assess the impact of management interventions, and guide future decision-making. For example, if data analysis reveals an increase in visitor impacts on a sensitive habitat, managers can modify visitor management practices or implement additional conservation measures to mitigate these impacts.
6. Data analysis and interpretation can **facilitate stakeholder engagement** by providing evidence-based information for discussions and decision-making processes. When stakeholders are presented with clear and visually compelling data, it fosters collaboration, shared understanding, and collective problem-solving. For example, by presenting data on visitor preferences and impacts, managers can engage with local communities, tourism operators, and other stakeholders to collectively develop sustainable tourism strategies that balance visitor experiences with nature conservation goals.

In summary, data analysis and interpretation are integral to technology-based visitor monitoring in protected areas. Statistical techniques, data visualization, and spatial analysis enable managers to extract meaningful insights from visitor data, inform management decisions, and improve the visitor experience. By utilizing these approaches, practitioners can ensure effective resource allocation, develop sustainable management strategies, and foster collaboration with stakeholders, ultimately contributing to the long-term conservation and enjoyment of protected areas.

2.4.2. Management of Monitoring Systems

Visitor monitoring is a vital component of protected area management, involving the systematic collection

and analysis of data over time. It allows practitioners to gather information on both the natural environment and visitors, enabling effective decision-making and fostering visitors' connection with the protected area values. Here is an improved and expanded explanation of visitor monitoring, including examples of its application and considerations for integrating technology-based monitoring systems within existing management frameworks:

1. **Three Levels of Monitoring**: Visitor monitoring should occur at three levels: site, park, and corporate. Site-level monitoring focuses on specific locations within the protected area, such as visitor centers or popular attractions, to gather data on visitor activities, use patterns, and satisfaction. Park-level monitoring covers the entire protected area, aiming to understand broader visitation trends, impacts, and resource use. Corporate-level monitoring considers the overall management and strategic planning of multiple protected areas, assessing the effectiveness of visitor management policies and strategies across different sites.
2. **Assessing Visitor Behavior:** Visitor monitoring provides insights into visitor behavior and helps develop visitor use indicators. For example, data collected through visitor surveys, trail counters, or mobile applications can reveal visitor preferences, activity patterns, and seasonal variations. This information enables managers to understand visitor needs, design appropriate facilities, and allocate resources effectively.
3. **Spatial and Social Behavior Analysis:** Visitor monitoring data can be analyzed to understand visitors' spatial and social behavior within the protected area. Geographic Information Systems (GIS) and data visualization techniques can help identify popular visitor routes, hotspots, and areas of potential conflict. By analyzing visitor movement patterns, managers can develop strategies for visitor flow management, infrastructure development, and environmental protection.
4. **Challenges and Considerations:** Implementing an effective visitor monitoring program comes with challenges. Considerations include determining the specific aspects of visitor use to measure, selecting meaningful indicators that provide early warnings of potential issues, and striking a balance between visitor satisfaction and safety. Integration of technology-based tools, such as mobile applications or trail cameras, can enhance data collection efficiency and accuracy.
5. **Integration with Management Frameworks:** Technology-based monitoring systems can be seamlessly integrated into existing management frameworks. They provide real-time data that informs management decisions and helps evaluate the effectiveness of visitor management strategies. For instance, data collected through mobile applications can guide infrastructure development plans or assist in implementing visitor education programs. Integration ensures that monitoring efforts align with the overall goals and objectives of protected area management.
6. **Data Management and Quality Control:** Effective data management is crucial for technology-based monitoring systems. This includes establishing protocols for data collection, storage, and analysis, ensuring data integrity, and protecting visitor privacy. Quality control measures, such as regular data checks, validation procedures, and data verification, should be implemented to maintain data accuracy and reliability.
7. **Standardization of Monitoring Protocols:** Standardizing monitoring protocols ensures consistency and comparability of data across different protected areas. This allows for meaningful benchmarking and sharing of best practices. Standardized protocols should address data collection methods, indicators, sampling techniques, and reporting formats. Collaborative efforts among protected area networks and organizations can facilitate the development and implementation of standardized monitoring protocols.

In summary, visitor monitoring is crucial for protected area management, providing insights into visitor behavior, impacts, and visitor satisfaction. Integrating technology-based monitoring systems enhances data collection and analysis. Considerations for successful integration include data management, quality control, standardization of monitoring protocols, and aligning monitoring efforts with management frameworks. By effectively managing technology-based monitoring systems, practitioners can make informed decisions, improve visitor experiences, and promote the long-term conservation of protected areas.

2.5. Final remarks

Visitor monitoring is an important tool for protected area managers, as it can provide valuable information about visitor behavior and use patterns. There are several **technology-based tools** that can be used for visitor monitoring, including crowdsourcing, social media analysis, mobile applications, camera traps, remote sensing technologies, automated counters, and the computer vision approach.

When implementing a **visitor monitoring program**, it is important to carefully select the appropriate technology-based tools that are appropriate for your specific needs and goals. Managers should also develop a data management plan that includes protocols for data collection, storage, analysis, and interpretation. Staff should be properly trained on how to use the chosen technology-based tools and how to follow the **data management plan**.

Regular evaluation and adaptation are essential components of visitor monitoring programs in protected areas. Managers should regularly review the data collected through the monitoring program, assess its effectiveness in achieving its goals, and make changes as necessary to improve its performance.

Stakeholder engagement and collaboration are also essential components of the design and implementation of visitor monitoring programs. Managers should work with local communities, tourism operators, and other stakeholders to ensure that the monitoring program is tailored to the specific needs and context of the protected area.

In summary, technology-based tools can provide valuable information for assessing visitor behavior and providing visitors' use indicators in protected areas. However, it is important for protected area managers to carefully select, implement, and maintain these tools to ensure that they provide accurate and reliable data.

To effectively implement visitor monitoring tools in protected areas, it is important to follow these fundamental steps (fig. 5):

Fig. 5 Steps for implementing visitors monitoring tools
Source: own compilation.

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3. Heritage interpretation and experience design for boosting visitors' satisfaction

3.1. Introduction

National parks hold a special place in the hearts of both nature enthusiasts and casual visitors seeking respite from the rush of daily life. These protected areas offer a sanctuary for diverse ecosystems, captivating landscapes, and a diverse and meaningful blend of culture and history. As guardians of these natural treasures, park authorities face the ongoing challenge of balancing conservation efforts with providing meaningful experiences for visitors who venture into these environments.

In recent times, there has been a growing recognition that the mere presence of untouched wilderness is not sufficient to engage and satisfy contemporary visitors (photo 7). The evolution of tourism trends and visitor expectations has necessitated a shift in approach towards heritage interpretation and experience design within national parks. These practices aim to create immersive encounters that captivate the senses, foster a deeper understanding of the park's (both natural and cultural) heritage, and leave a lasting impression on visitors.

Photo 7. Guided tour in National Park Nízke Tatry (Slovakia)
Photo: J. Hibner.

This chapter delves into the significance of incorporating effective interpretation strategies and thoughtful experience design within the context of national park management. It explores the multifaceted dimensions of heritage interpretation, emphasizing its role in bridging the gap between the natural and the cultural aspects of national parks and other natural destinations. Furthermore, this chapter examines how thoughtful planning and execution can elevate a visitor's experience and satisfaction.

Ultimately, this chapter provides practical insights and actionable recommendations for park authorities, conservation organizations, and heritage interpreters. It aims to inspire and equip these stakeholders with the ideas, tools and knowledge necessary to design transformative experiences that leave visitors with a profound connection to the parks' heritage and a renewed commitment to preserving these environments. By doing so, we can ensure that future generations continue to cherish, protect, and celebrate the wonders that national parks have to offer.

3.2. Theoretical background

3.2.1. Brief history of Heritage Interpretation

The act of interpretation is a form of cultural transmission. It has existed in all communities and all parts of the earth for as long as there have been people. It is a normal part of life to remember stories, learn which plants are edible, and pass on skills learned from previous generations. Traditions of telling tales have evolved into the visual and performing arts, literature, and writing. This narrative practice includes the use of historical interpretation to shed light on the world.

The flourishing of the tourism industry coincided with the birth of modern interpretation. Educational guidance was a standard feature of 19th century sightseeing trips in Europe and the Middle East. The "Grand Tour" of Renaissance Europe was quite similar to the trips given by scholars today. Different museums are the best places to see how interpretation has changed over time: in the past, museums used to only offer the bare facts about their collections, but now they often also present the fascinating tales and even games behind the objects on display.

It was in the late 19th century that natural heritage resources became the focus of heritage interpretation. A useful management tool for both natural and cultural assets, the phrase "environmental interpretation" was first applied to a wide range of settings (national parks, heritage parks, etc.).

However, there were three people who might be characterized as "fathers" of modern heritage interpretation: Enos Mills, John Muire and Freeman Tilden (photo 8).

Enos Mills (1870-1922) worked as a mountain guide, author, lecturer and considered one of the founders of the interpreting profession - Started one of the first interpreter training programs in the country. He began as a "nature guide" in 1889, leading hikes on Long's Peak, in what later became Rocky Mountain National Park, where he guided over 250 groups and encouraged their connection to the resources he loved so much. He published 15 nature books in 35 years as a guide and interpreter.

John Muir (1838-1914) was the first person who used the term "interpretation of nature" while he used his communications about the natural world to encourage people to protect and preserve the subjects of his stories. He was also instrumental in establishing Yosemite as a national park and founded the famous Sierra Club in 1892.

Photo 8. "Fathers" of modern heritage interpretation: Enos Mills (1), John Muire (2) and Freeman Tilden (3)

Freeman Tilden (1883-1980) remains an enduring figure in the realm of interpretation, his influence continuing to resonate strongly in the present day. While he may not have been a naturalist or an interpreter by profession, his prowess as a writer and reporter set him apart. The National Park Service recognized his exceptional abilities and enlisted him to embark on tours of various parks, allowing him to keenly observe and then eloquently document the nuances of the interpretive services offered. Among his notable contributions, "Interpreting Our Heritage" (1957) stands as a timeless masterpiece, possessing an impact on the field of interpretation that has yet to be paralleled by contemporary works. Today, he is fondly regarded as the "Father" of heritage interpretation, an esteemed title that aptly acknowledges his pivotal role in shaping and advancing this critical domain. The Freeman Tilden Award is the highest award given to an individual performer by the National Park Service.

His quote: *Through interpretation, understanding; through understanding, appreciation; through appreciation, protection* is still used for any kind of promotion of nature interpretation and promotion. Hereby, Tilden succinctly captures the transformative power of interpretation. Through interpretation, people gain understanding, leading to appreciation for the natural world. This newfound appreciation, in turn, motivates individuals to protect and preserve our natural heritage, fostering a harmonious relationship between humans and the environment and ensuring a sustainable future for generations to come.

3.2.2. Why should we interpret natural heritage?

During the General Assembly of the International Union for the Conservation of Nature and Natural Resources (IUCN) in New Delhi, back in 1968, Baba Dioum expressed a profound insight: *In the end, we will conserve only what we love; we will love only what we understand and we will understand only what we are taught.* These wise words highlight the interconnectedness of conservation, understanding, and education. To protect and preserve our natural heritage, we must first cultivate a deep love and appreciation for it, which can only come from understanding its value and significance. This understanding, in turn, is achieved through education and interpretation, as we learn about the delicate balance of ecosystems, the wonders of biodiversity, and the urgency of safeguarding our planet for future generations.

Interpreting natural heritage serves several important purposes. First and foremost, it plays a **vital role in the conservation and preservation of our natural ecosystems**, species, and landscapes. By raising awareness about the value and significance of these resources, interpretation encourages individuals and communities to support conservation efforts and to take action to protect the environment.

Moreover, interpretation is an **effective means of educating and raising awareness** among the public about the complexities and interconnectedness of the natural world. Through interpretation, people can learn about the roles of different species, the importance of biodiversity, and the ecological processes that sustain life on Earth (photo 9). This knowledge fosters a deeper appreciation and understanding of the natural world, allowing people to connect with and enjoy nature more profoundly.

Interpretation also facilitates a **bridge between scientific research and the general population**. By disseminating scientific information and research findings, interpretation empowers individuals to better comprehend ecological concepts and stay informed about the latest discoveries in the field of environmental science. This scientific understanding can further inspire people to adopt sustainable practices and make eco-conscious decisions in their daily lives.

Furthermore, interpreting natural heritage **can have positive economic impacts**, particularly in areas with significant natural attractions. By promoting nature-based tourism, interpretation draws visitors who are interested in exploring and experiencing the beauty and wonders of the natural world. This influx of tourists can contribute to local economies, providing financial incentives for communities to prioritize environmental conservation.

Beyond economic benefits, effective interpretation also serves as a **powerful tool for environmental advocacy**. When people become informed and passionate about nature, they are more likely to become advocates for environmental policies and conservation initiatives. Through their actions and advocacy, these individuals can contribute to broader efforts to address environmental challenges and protect the planet.

Why is heritage interpretation important for NPs? Following the previous part, it is evident that heritage interpretation is of paramount importance for national parks:

Photo 9. Visitors of Podyjí National Park (Czech Republic) reading the interpretive panel
Photo: Đ. Vasiljević.

- fills the void between the park's rich natural and cultural heritage and visitors, helping them understand and appreciate its significance.
- enhances the visitor experience by providing context and depth to the park visit, creating meaningful and educational journeys.
- fosters a sense of stewardship and responsibility among visitors, encouraging them to support conservation efforts and the preservation of the park's resources.
- contributes to conservation initiatives and sustainability practices by educating visitors about the fragility of ecosystems, biodiversity, and environmental threats.
- boost the local economy and community development through increased tourism revenue, job opportunities, and economic activities in surrounding areas.
- helps to build a sense of national identity and pride by connecting visitors with the symbolic importance of national parks as representatives of a country's history and heritage.

3.3. Methods

The **principles** of natural heritage interpretation provide a framework for effective communication and engagement with visitors. While different authors provided various range of principles, from Tilden (1957) to Beck, Cable (2011), here we propose some commonly recognized principles:

1. **Know and Understand Your Audience**: Effective interpretation starts with understanding the characteristics, interests, and needs of your audience. Tailor your messages and methods to suit different demographics, cultural backgrounds, and knowledge levels. Use language and concepts that resonate with your audience and create meaningful connections.
2. **Communicate Clear and Relevant Messages**: Ensure that your messages are concise, clear, and easily understood. Use storytelling techniques, anecdotes, and visuals to make information engaging and relatable. Emphasize the relevance and significance of the natural heritage being interpreted

to capture visitors' attention and foster a sense of personal connection.

3. **Foster Emotional Connections**: Create experiences that evoke emotional responses and foster a sense of wonder, awe, and appreciation. Use personal stories, sensory stimuli, and interactive elements to engage visitors on an emotional level. Emotional connections often lead to a deeper understanding and commitment to conservation.
4. **Provide Context and Significance**: Place the natural heritage within a broader context, including its ecological, historical, and cultural dimensions. Explain the significance, uniqueness, and value of the site or phenomenon being interpreted. Highlight the interconnections between different elements and emphasize the role of individuals in shaping and protecting the natural world.
5. **Encourage Visitor Participation**: Encourage active participation and engagement through hands-on activities, interactive displays, guided walks, or dialogue with interpreters. Allow visitors to explore and discover on their own while providing opportunities for guided learning and interpretation. This helps visitors develop a sense of ownership and connection to the experience.
6. **Use a Variety of Interpretive Techniques**: Employ a range of interpretive techniques and media to cater to different learning styles and preferences. These may include signage, exhibits, audiovisual presentations, guided tours, tactile displays, digital platforms, and experiential activities. Use a combination of visual, auditory, and kinesthetic elements to enhance the visitor experience. **More on this is in the "Interpretive tools for natural heritage interpretation" chapter**.
7. **Maintain Accuracy and Credibility**: Ensure that the information provided is accurate, up-to-date, and based on sound scientific knowledge. Interpretation should be grounded in reliable research and sources. Clearly differentiate between facts, interpretations, and personal opinions to maintain credibility and build trust with visitors.

These principles guide interpreters in creating meaningful and impactful experiences that educate, inspire, and connect visitors to the natural world, ultimately fostering a sense of stewardship and appreciation for our natural heritage.

3.3.1. Interpretive tools for natural heritage interpretation

Natural heritage interpretation employs various methods to engage visitors and communicate information effectively. Interpretive tools for natural heritage interpretation play a vital role in engaging and educating visitors about the significance of the environment. These tools enhance the overall visitor experience, facilitate learning, and create lasting impressions. From the point of view of the interpreting person, heritage interpretation can be personal and non-personal. Unlike personal interpretation, which involves engaging with a guide or interpreter, non-personal interpretation focuses on offering visitors the freedom to explore at their own pace by using different devices, printed materials, and infrastructure.

Personal interpretation

Guided interpretation of natural heritage is a valuable approach that involves trained guides or interpreters facilitating meaningful experiences and understanding of the natural world for visitors (photo 10). These knowledgeable individuals play a crucial role in connecting people to the environment, fostering appreciation, and promoting conservation.

Guided interpretation goes beyond simply providing information or facts about natural heritage sites. Skilled interpreters aim to create engaging and interactive experiences that stimulate curiosity, evoke emotions, and encourage active participation. They utilize various techniques, such as storytelling, guided walks, demonstrations, and hands-on activities, to enhance visitors' understanding and connection with the natural environment.

One of the primary objectives of guided interpretation is to provide visitors with a deeper appreciation of the natural heritage they are experiencing. Guides often share fascinating insights, intriguing stories, and interesting anecdotes related to the ecological, cultural, and historical aspects of the site. By highlighting the significance and value of the natural world, interpreters help visitors develop a sense of awe and reverence for the environment.

Guided interpretation also plays a crucial role in raising awareness about environmental issues and promoting sustainable practices. Guides can educate visitors about the importance of conservation, biodiversity, and ecological balance. They may discuss the

Photo 10. Guided tour to National Park Fruška Gora (Serbia)
Photo: Đ. Vasiljević.

impacts of human activities on natural ecosystems and provide insights on how individuals can contribute to environmental preservation through responsible behavior and lifestyle choices.

Furthermore, guided interpretation fosters a deeper connection between visitors and the natural heritage site. Guides have the ability to point out hidden wonders, unique features, and intricate details that might otherwise go unnoticed. By drawing attention to these aspects, interpreters help visitors develop a personal attachment to the environment, creating lasting memories and a sense of stewardship.

Guides also act as facilitators, encouraging visitors to engage their senses and explore their surroundings actively. They may encourage visitors to touch, smell, listen, or observe specific elements of the natural heritage, enabling a multi-sensory experience that enhances the overall interpretation. This hands-on approach fosters a deeper understanding and connection, as visitors become active participants in the learning process.

In addition, guided interpretation can provide a platform for cultural exchange and appreciation. Interpreters often incorporate the cultural significance of the natural heritage site, sharing stories, folklore, and indigenous knowledge associated with the land. This helps visitors understand the interconnections between culture, history, and the natural environment, promoting cross-cultural understanding and respect.

The most common kinds of personal interpretation in national parks and other natural areas are:

Guided Tours and Interpretive Programs: Trained guides or interpreters lead guided tours and interpretive programs that offer personalized experiences and in-depth knowledge. These programs may include nature walks, wildlife spotting, or themed workshops that provide a deeper understanding of the natural heritage and its conservation.

Storytelling and Performances: Storytelling techniques, including dramatic performances, reenactments, or oral traditions, can be employed to engage visitors and create a connection with the natural heritage. These methods tap into the power of narratives to convey information, evoke emotions, and make the experience memorable.

Non-personal interpretation

Non-personal interpretation serves a specific purpose: to provide information and educate visitors without the need for personal interaction.

One notable advantage of non-personal interpretation is its cost-effectiveness. Compared to hiring guides or interpreters, implementing non-personal interpretation methods is often more budget-friendly. This aspect makes it an attractive option for organizations or institutions with limited resources but a desire to provide valuable information and educational experiences to their visitors.

Another benefit of non-personal interpretation is the flexibility it offers to visitors. It allows them to choose the specific topics that interest them and explore them in their preferred order. Additionally, visitors have the freedom to decide when they engage with the interpretive content, selecting the time that suits them best. This personalized approach empowers visitors to tailor their interpretive experiences according to their individual preferences and schedules.

Furthermore, non-personal interpretation can be implemented in various ways, languages, and formats (photo 11). Organizations can utilize a range of mediums such as audio guides, interactive displays, multimedia presentations, or written materials. This versatility ensures that visitors from diverse backgrounds and language preferences can access the interpretive content in a manner that suits them best.

Some of the most common media/tools used for heritage interpretation in national parks and natural areas are:

- **Educational Materials and Brochures:** Printed materials, such as brochures, guidebooks, and pamphlets, provide visitors with additional information and resources to further their understanding of the natural heritage. These materials can be taken home as a reminder of the visit and serve as educational tools beyond the site itself.
- **Interpretive panels**: Well-designed signs and information panels strategically placed throughout the site provide valuable information about the natural features, historical context, and conservation efforts (photo 11). These visuals often include maps, illustrations, and concise text to convey key messages effectively. These panels can be posted along the trail and thus create **Interpretive Trails and Walkways**. Guided trails or walkways with interpretive panels along the route offer visitors

Photo 11. Cultural heritage interpretation at the Pieniny National Park (Poland)

Photo: Đ. Vasiljević.

a structured and immersive experience. These trails may highlight points of interest, ecological processes, or cultural significance, allowing visitors to explore and learn at their own pace.

8. **Visitor Centers and Interpretive Hubs**: Visitor centers serve as hubs for information, interpretation, and engagement. They often include exhibits, audio-visual presentations, interactive displays, and knowledgeable staff who can provide guidance and answer questions. Within visitor centers, there might be **interactive exhibits and displays** that allow visitors to actively engage with the natural heritage. They may include touch screens, interactive models, or hands-on activities that encourage exploration and experiential learning. Also, within these facilities, visitors can use **audio guides** that provide pre-recorded audio commentary that visitors can listen to while exploring the natural heritage site. These guides offer detailed explanations, storytelling, and interesting facts, enhancing the visitor's understanding and connection with the environment. **Multi-media presentations**, such as videos, slideshows, or virtual reality experiences, can captivate visitors and provide a comprehensive visual representation of the natural heritage site. These tools offer a dynamic and immersive way to showcase the site's unique features and educate visitors.
9. **Mobile Applications**: With the rise of technology, mobile applications have become popular interpretive tools. These apps can provide interactive maps, audio guides, augmented reality experiences, and additional information, allowing visitors to personalize their exploration and access interpretive content on their mobile devices.
10. **Virtual Reality (VR), Augmented Reality (AR), and 360 tours** can be valuable tools for enhancing heritage interpretation in national parks in various ways. More about this technology is in the "Use of ICT in Heritage Interpretation – Creation of 360 Tours" chapter.

The choice of methods depends on the specific site, the target audience, available resources, and the desired outcomes of the interpretation. A combination of these methods can be used to create a comprehensive and immersive experience for visitors, ensuring that they have a deeper understanding and appreciation of the natural heritage being interpreted. By utilizing a combination of these interpretive tools, natural heritage sites can offer diverse and engaging experiences to visitors. These tools facilitate learning, inspire a sense of wonder, and encourage a deeper appreciation and stewardship of the natural environment.

3.3.2. Positive and negative sides of interpretative media

Here we will provide some benefits of personal and non-personal interpretive media which can assist to the choice of most suitable ones (tab. 15):

Tab. 15. Positive and negative sides of personal and non-personal interpretation by different parameters

Parameter	Interpretive media	
	personal	non-personal
Cost	high costs, extra employees, training, etc.	usually cheaper
Adaptability	guides can adapt to different groups, languages, ages, etc.	adaptation usually means creating new or updating or reprinting materials
Availability	guide can only be in one place at a time	visitors choose when and where to receive message
Order of information	linear interpretation - the guide generally controls the order of information presented to visitors.	non-linear nature of communication
Control, misunderstandings, clarification	the guide has more control over the message the visitor will take away	visitors may not receive the primary message intended for them.
Freedom	reduced visitors' sense of freedom and exploration	gives them the freedom to choose what interests visitors

Source: according to Carter (1997) and Ham (1992), modified.

Unlike personal interpretation, where a guide can engage in a dialogue and adapt the message to the specific needs of the visitor, non-personal interpretation relies on pre-prepared content. This non-linear format can sometimes make it difficult to convey a clear and cohesive message to every visitor.

In non-personal interpretation, visitors have the freedom to choose the information they access and the order in which they consume it. While this allows for individualized experiences, it also means that visitors may not receive the primary message or the intended emphasis that the organization or institution wants to convey. This element of choice introduces the possibility of visitors missing out on crucial aspects of the interpretive content.

Moreover, due to the lack of direct interaction, there is no way to know for certain which messages have been received and understood by the visitors. Unlike personal interpretation, where immediate feedback can be obtained through conversations and observations, non-personal interpretation lacks real-time assessment of visitor comprehension. This absence of feedback makes it challenging for organizations to gauge the effectiveness of their interpretive efforts and make necessary adjustments to improve the visitor experience.

While non-personal interpretation can be a cost-effective and flexible option, these potential downsides emphasize the importance of carefully designing and evaluating the interpretive content. Organizations should strive to create materials that are engaging, concise, and capable of conveying the primary messages effectively, even in a non-linear and self-guided setting. Additionally, implementing methods to gather visitor feedback and conduct assessments can help address the issue of uncertainty regarding message reception and comprehension.

To be more concrete, here are some advantages and disadvantages of the most common and used interpretive media (tab. 16):

Tab. 16. Advantages and disadvantages of most common interpretive media

Media	Advantages	Disadvantages
Graphic panels, boards	– do not require constant supervision – can satisfy a wide range of audience – low maintenance needs – simple to use – can combine text and images – can help visitors with orientation	– they are becoming ubiquitous, and people may start ignoring them – can have a negative impact on the landscape if they do not blend into the environment – can be subject to vandalism
Guided tours	– highly effective form of interpretation – flexible – can present a complex narrative	– reach a small number of visitors (only those who are on a guided tour) – require good marketing and administration
Publications/printed material	– can be used on-site and off-site – can contain more details than panels – can help with orientation	– must be efficiently distributed – regular reprinting may be necessary – can be discarded as waste
Audio tours	– can be in multiple languages – can use narration to tell a story – have potential for creative characterization	– isolate visitors from each other – relatively expensive – require important operational considerations such as renting headphones
Modern technology and interpretation	– encourages interaction – modern appearance – creative combination of images, text, and sound	– expensive for programming, installation, and maintenance. – technology can become outdated quickly – some visitors may find it complicated to use (e.g., older individuals)
Visitor centers	– introduce complex narratives – can be the main attraction – reach large audiences – can contain a wide range of previously presented media	– very expensive to build and operate – high-level professional management is required

Source: according to Veverka (1994) and Ham (1992), modified.

3.4. Recommendations for implementation

We offer three viable steps to enhance heritage interpretation in your protected area, with a focus on optimizing the guide service and leveraging ICT for a more immersive experience. Both methods are easy to implement and promise to significantly enrich visitors' experiences but first, it is necessary to conduct thorough interpretative planning before taking any steps.

3.4.1. Interpretative planning and implementation

Structuring and conducting interpretive planning and implementation in national parks involve a systematic approach to developing and delivering interpretive programs and experiences. Here are the steps that constitute the process:

1. **Assess Park Resources and Visitor Needs**: Begin by conducting a thorough assessment of the national park's natural, and cultural resources and heritage, visitor socio-demographical characteristics (See chapter 1. Visitor surveys - Tool for identifying motivations and perceptions of natural and recreational area visitors), and their interests and needs. Identify the park's unique features, ecological processes, historical significance, and potential interpretive themes.
2. **Set Goals and Objectives**: Based on the assessment, establish clear goals and objectives for the interpretive planning and implementation process. These goals should align with the park's management objectives, conservation priorities, and visitor experience goals. For example, the objectives could include fostering a sense of stewardship, increasing visitor understanding of biodiversity, or promoting cultural heritage awareness.
3. **Identify Target Audience**: Determine the primary target audience for the interpretive programs and experiences. Consider factors such as age, cultural background, educational level, and visitor preferences. Tailor the interpretive content, methods, and delivery approaches to meet the needs and interests of the target audience.
4. **Develop Interpretive Themes and Messages**: Identify key interpretive themes that will be the focus of the interpretive programs. These themes should align with the park's resources and objectives. Craft clear and concise interpretive messages that convey the significance, values, and stories associated with the themes. Ensure that the messages are easily understandable and engaging for the target audience.
5. **Design Interpretive Programs and Experiences**: Based on the themes and messages, design a range of interpretive programs and experiences that cater to different visitor preferences and learning styles. Consider a variety of methods such as guided tours, exhibits, interactive displays, workshops, or multimedia presentations. Each program should have a clear structure, a logical flow of information, and interactive elements to engage visitors.
6. **Develop Interpretive Materials and Media**: Create interpretive materials and media that support the programs and experiences (photo 12). This can include brochures, interpretive signage, audio guides, videos, or digital platforms. Ensure that the materials are visually appealing, informative, and aligned with the interpretive messages. **For more info please check the part "Methods" of this chapter**.
7. **Train Interpretive Staff**: Provide training and professional development opportunities for interpretive staff (photo 13), including park rangers, guides, and volunteers. Train them in effective communication techniques, interpretive methods, visitor engagement strategies, and relevant knowledge about the park's resources. Encourage ongoing learning and evaluation to enhance interpretive skills.
8. **Implement and Evaluate**: Implement the interpretive programs and experiences, making adjustments as needed. Monitor visitor participation, gather feedback, and evaluate the effectiveness of the interpretive activities. Use visitor surveys, observation, and feedback mechanisms to assess visitor satisfaction, learning outcomes, and the achievement of interpretive objectives.
9. **Collaborate and Partner**: Foster collaboration and partnerships with other stakeholders, such as local communities, academic institutions, NGOs, or cultural organizations. Engage them in interpretive planning and implementation processes to enrich the content, diversify perspectives, and foster community ownership and support.
10. **Continuously Improve and Adapt**: Regularly review and assess the interpretive programs and experiences to identify areas for improvement. Stay updated on emerging trends in interpretation,

Photo 12. Combination of different interpretive tools in Duna-Ipoly National Park (Hungary): panel in natural environment (left) and gamification at the visitor center (right)

Photo: Đ. Vasiljević.

Photo 13. Training on heritage interpretation for national park staff in Novi Sad (Serbia) for participants from Poland, Czech Republic, Slovakia, Hungary, Bosnia and Herzegovina and Serbia

Photo: T. Morante.

visitor preferences, and scientific research. Adapt the programs and experiences to incorporate new knowledge, technologies, and visitor expectations.

By following a structured interpretive planning and implementation process, national parks can create meaningful and impactful interpretive programs and experiences that engage visitors, foster connections to the park's resources, and promote conservation and stewardship.

3.4.2. How to structure and conduct interpretive guided tours?

Structuring and conducting interpretive guided tours in national parks require careful planning, knowledge of the park's resources, and effective communication skills.

Here are some steps to help you structure and conduct interpretive guided tours:

- **Research and Familiarize Yourself with the Park**: Gain a thorough understanding of the national park's natural and cultural resources, history, ecological processes, and significant features. Study maps, guidebooks, scientific literature, and park management plans to gather information. Familiarize yourself with any regulations, safety considerations, or sensitive areas within the park.
- **Identify Tour Themes and Objectives**: Determine the main themes or messages you want to convey during the tour. Consider the park's unique attributes, such as wildlife, geology, vegetation, cultural heritage, or conservation efforts. Set clear objectives for the tour, such as inspiring appreciation for biodiversity, raising awareness about conservation challenges, or highlighting the park's historical significance.
- **Plan the Route and Stops**: Design a route that showcases the park's key features and aligns with your tour themes. Identify specific stops or points of interest along the route where you will provide interpretation. Consider the time required for each stop, ensuring a balance between information sharing and allowing time for visitors to observe and experience the environment.
- **Develop a Narrative and Interpretive Content**: Craft a compelling narrative that connects the different stops and themes of the tour. Develop interpretive content that is engaging, accurate, and relevant to your audience. Incorporate stories, anecdotes, and interesting facts to capture visitors' attention and foster a sense of connection to the park.
- **Use Effective Communication Techniques**: Employ effective communication techniques to engage and interact with your tour group. Maintain a clear and audible voice, speak at an appropriate pace, and use enthusiasm to convey your passion for the subject matter. Encourage questions and discussions, and actively listen to visitor perspectives and experiences.
- **Utilize Visual Aids and Props**: Enhance the interpretive experience by utilizing visual aids and props. These can include photographs, diagrams, maps, or specimens to illustrate key points. Tactile props, such as animal skulls, feathers, or plant samples, can provide a hands-on learning experience for visitors.
- **Incorporate Interactive Elements**: Incorporate interactive elements throughout the tour to encourage visitor participation. This can include short activities, games, or demonstrations that allow visitors to engage their senses or test their knowledge. Interactive elements create a more immersive and memorable experience.
- **Practice Flexibility and Adaptability**: Remain flexible and adapt your tour to meet the needs and interests of your audience. Assess the group's prior knowledge and adjust your level of detail accordingly. Be responsive to changing weather conditions, wildlife sightings, or unexpected opportunities that may arise during the tour.
- **Ensure Safety and Environmental Considerations**: Prioritize visitor safety and adhere to park regulations at all times. Inform visitors about potential hazards and safety measures. Emphasize the "Leave No Trace" principles and responsible behavior to minimize environmental impact. Respect wildlife and cultural sites, and encourage visitors to do the same.
- **Evaluate and Seek Feedback**: After conducting the tour, evaluate its effectiveness and seek feedback from visitors. Assess whether the tour objectives were met, and identify areas for improvement. Feedback from visitors can provide valuable insights and help refine your interpretation techniques for future tours.

Remember, the goal of interpretive guided tours is to engage visitors, foster connections to the park, and provide a deeper understanding and appreciation of its natural and cultural heritage. By carefully planning and conducting tours, you can create enriching experiences that leave a lasting impact on your visitors.

3.4.3. Use of ICT in heritage interpretation – creation of 360 TOURS

Information and Communication Technology (ICT) has revolutionized the way we experience and understand the world around us, including national parks and their rich heritage. One of the innovative ways ICT is being utilized in heritage interpretation is through the creation of 360 tours. These tours provide visitors with immersive and interactive experiences, allowing them to virtually explore the natural wonders, cultural sites, and historical landmarks within national parks and other natural areas. This part presents the benefits and provides steps towards implementation of 360 tours as a powerful tool for enhancing heritage interpretation and visitor engagement in national parks.

The use of ICT in heritage interpretation through the creation of 360 tours is a valuable addition to other interpretive tools available at national parks. These immersive and interactive experiences offer numerous benefits:

- **Immersive Experiences**: 360 tours offer a sense of immersion, enabling visitors to feel like they are physically present at the location. Through panoramic views and high-quality images, visitors can enjoy a virtual "walk" through the park, enhancing their understanding and connection to its heritage.
- **Access to Remote Areas**: Some national parks have remote or sensitive areas that are difficult for visitors to access. 360 tours bridge this gap, allowing people from all around the world to virtually visit these areas without causing physical impact on the environment.
- **Enhanced Engagement**: Interactive elements within 360 tours, such as clickable information points and hotspots, encourage active exploration and deeper engagement with the park's heritage. Visitors can access in-depth information, historical facts, and audio-visual materials, enriching their learning experience.
- **Year-Round Availability**: Unlike traditional guided tours that may have seasonal limitations, 360 tours can be accessed at any time of the year. This feature is especially valuable for parks that experience extreme weather conditions or have limited visitation during specific seasons.
- **Accessibility and inclusion:** 360 tours cater to a wide range of audiences, including those with physical disabilities or geographical constraints. They offer an inclusive experience, ensuring that everyone can access and appreciate the park's heritage.
- **Conservation and education**: By providing virtual experiences, 360 tours contribute to conservation efforts. Minimizing foot traffic in sensitive areas helps protect delicate ecosystems, while informative content raises awareness about the park's importance and the need for conservation.

Step by step guide to creation of 360 tours

This part will take you through the process of creating your own immersive and captivating 360 tours (fig. 6). Throughout this guide, we'll provide you with step-by-step instructions, tips, and tricks, and recommendations for equipment and software to ensure you create stunning and professional-grade 360 tours. Furthermore, this guide is designed to be accessible and user-friendly for all skill levels.

This are the steps to follow:

- **Create a plan.** Here you should pose a question: "Which locations or areas should I include in a 360 tour?". In the first phase, list all the locations that you consider worth being presented within the tour.
- **Providing equipment**: In order to independently create a 360 tour, you need certain equipment. This includes:
  - 360° camera with tripod - we suggest Insta360 ONE R which proved to be the best quality for its price range. Also, a tripod should be used for better stability and obstructed view by the shooter. Tripod prices can range from professional to those cheaper which can do the job.
  - Mobile application for taking photos - easy to use and free to download is Insta360 application which is available both on GooglePlay and App Store.
  - Software that transfers 360 photos to your computer - we propose using Insta360 Studio which is also easy to use and free to download to PCs. This software imports and stitches together footage from insta360 cameras automatically and creates photos for further processing.
  - Software that creates a tour out of 360 photos - there is a wide range of software from free to paid. The latter has functions to create professional-level tours. We suggest 3D Vista for professional use, and ThingLink for a free application.
- **Content Creation - taking 360 photos**: The first practical step in developing a 360 tour is to create high-quality content. This involves capturing 360-degree panoramic images, videos, and audio recordings at various points of interest within the

Fig. 6. Equipment for creation of 360 tour: 1) Insta360 ONE R on tripod; 2) Insta360 mobile application for taking 360 photos; 3) Insta360 Studio software that transfers 360 photos to a computer; 4) 3D Vista professional software for creating 360 tours; 5) ThingLink free-of-charge software for creation of 360 tours

park. When taking 360 content, try to place a tripod on the stable and flat ground. Use a timer (at least 10 seconds) so you will not obstruct the photo. Before taking the photo, find the place to hide. When all photos are taken, they should be transferred to a computer (Insta360 Studio) where they can be easily processed by chosen 360 tour creation software.

- **Interactive Design**: The content is then integrated into an interactive platform that allows visitors to navigate through the park virtually (photo 14). Interactive elements, such as clickable hotspots or multimedia overlays, should be strategically placed to provide additional context and information about specific sites. For this step you should search for tutorials on YouTube for your chosen 360 software to learn how to create a tour.

You can upload the tour on the NP website or connect it to a touchscreen that can be placed within the NP visitor center. To enhance the experience further, you can provide visitors with affordable VR goggles that support 360 tours, making the tour even more immersive and enjoyable.

Furthermore, there are a couple more pieces of advice to make your 360 tour even better:

- **User-Friendly Interface**: The user interface of the 360 tour platform should be intuitive and user-friendly, ensuring that visitors of all ages and technological backgrounds can easily access and navigate the tour.
- **Multi-Language Support**: Consider offering the 360 tour in multiple languages to cater to international visitors and promote inclusivity.
- **Promotion and Accessibility**: National parks should actively promote the availability of the 360 tour through their website, visitor centers, and social media channels. Ensuring compatibility with various devices (e.g., smartphones, tablets, VR headsets) increases accessibility and reach.
- **Integration with Interpretive Programs**: To maximize the impact of 360 tours, they can be integrated with on-site interpretive programs. Park rangers and guides can refer visitors to specific 360 tour locations, enhancing the overall visitor experience.
- **Regular Updates**: Heritage interpretation is an evolving process, and national parks should keep

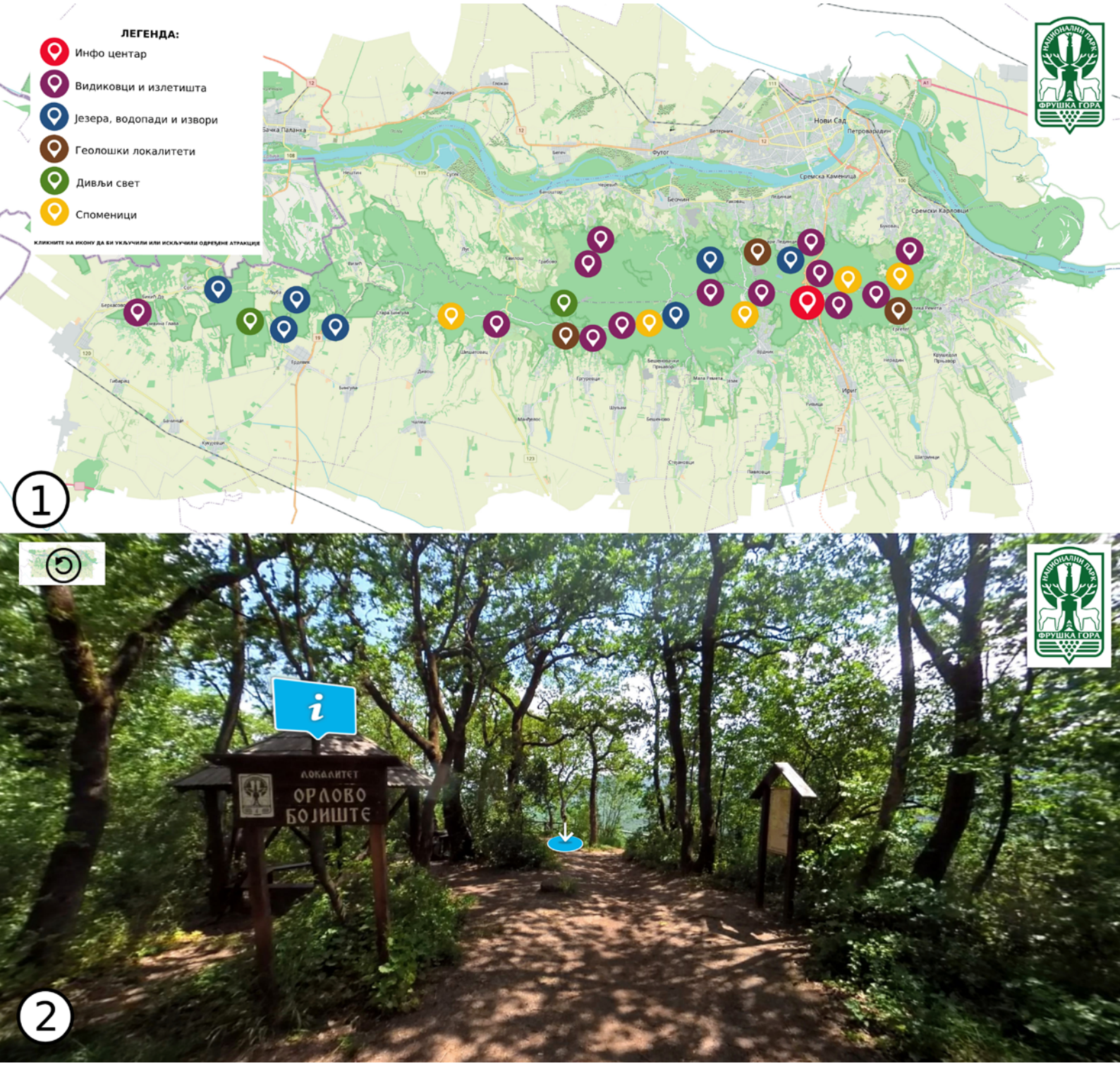


Photo 14. Screenshot of the 360 tour of National Park Fruška Gora (Serbia): 1) The interactive map of the park with sites of attraction, 2) 360 tour of the chosen site

Photo: Đ. Vasiljević and V. Marković.

the 360 tour content updated with new discoveries, research, and developments to maintain its relevance.

Finally, by embracing the potential of 360 tours, national parks can provide a truly captivating and educational experience, encouraging a deeper appreciation for their heritage and fostering a stronger commitment to preserving and promoting natural and cultural treasures for generations to come.

3.5. Final remarks

Heritage interpretation and experience design play pivotal roles in enhancing visitors' satisfaction in national parks. By effectively conveying the park's natural and cultural significance, heritage interpretation fosters a deeper connection between visitors and the park's unique heritage. Pairing this with thoughtful experience design ensures that visitors have memorable and meaningful experiences that resonate long after their visit.

To boost visitors' satisfaction, national parks should consider the following key points:

- **Engaging Interpretive Strategies**: Utilize diverse and engaging interpretive strategies, such as storytelling, interactive exhibits, audio guides, and virtual reality, to captivate visitors and cater to different learning styles and preferences.
- **Understanding Visitor Demographics**: Conduct thorough research on visitor demographics and preferences to tailor interpretive content and experience design specifically to their needs and interests.
- **Conservation and Sustainability Focus**: Align interpretive messages and experience design with the park's conservation goals, fostering an understanding of the importance of preserving the park's natural and cultural heritage.
- **Accessibility and Inclusivity**: Ensure that interpretation and experience design are accessible to all visitors, regardless of physical abilities or language barriers, fostering a sense of inclusivity and equal opportunity for enjoyment.
- **Integration of Technology**: Leverage technological advancements to create immersive and interactive experiences that enhance visitors' understanding and emotional connection to the park.
- **Continuous Evaluation and Improvement**: Regularly evaluate visitor feedback and conduct assessments to identify areas for improvement and to adapt interpretation and experience design accordingly.
- **Empowered and Knowledgeable Staff**: Equip park staff and interpreters with comprehensive training and resources, enabling them to effectively communicate the park's heritage and engage with visitors.

By prioritizing these aspects and adopting a visitor-centric approach, national parks can elevate visitors' satisfaction and foster a lasting appreciation for the park's unique heritage. The positive impact of enhanced visitor experiences extends beyond individual satisfaction; it contributes to greater awareness and support for conservation efforts, helping to safeguard these national treasures for future generations to cherish and enjoy. Ultimately, the seamless integration of heritage interpretation and experience design creates a harmonious and unforgettable encounter between humans and nature in our precious national parks.

4. Communications tools and approaches to promote natural areas and attract visitors

4.1. Introduction

Effective communications can play a significant role in supporting conservation efforts and managing visitors in protected areas. In this chapter, we will explore various communication tools and methods that the staff of the protected areas can use to their advantage.

Initially, we will provide an overview covering the fundamentals that any communications-related initiative ought to consider, including not only the development of a communications strategy and planning of activities, but also necessary monitoring throughout a campaign to identify any potential need for updates to said strategy.

Subsequently, we will examine specific methods that national parks can adopt to promote protected areas, attract visitors, and enhance their overall experience while efficiently managing visitor flows. Additionally, we will explore three approaches as case studies that may serve as best practices to be considered: the implementation of QR coding, geotagging, and geocaching.

4.2. Theoretical background

Communications play a crucial role in the context of protected areas for several reasons. The implementation of appropriate communication tools and methods can support conservation efforts of the natural environment, preservation of biodiversity, and ecological balance. It can also increase visitor experience and engagement, as well as the overall attractiveness and perception of protected areas.

A successful communications strategy can educate the public on the value of these areas, fostering a sense of responsibility and encouraging support for conservation efforts. Appropriate use of communication tools helps raise awareness of the protected areas' conservation goals and efforts, as well as support the involvement of visitors and local communities in environmental protection and restoration endeavors. Furthermore, by promoting the natural values of protected areas, visitors are more likely to be drawn to explore and appreciate these areas and sights.

Effective communications may further enhance visitor experience by creating appropriate information materials, such as brochures, signs, study trails or guided experiences, which provide valuable information. Ultimately, communications can contribute to an enhanced appreciation of the natural and cultural values of protected areas. This, in turn, elevates the overall visitor experience.

In essence, communications' primary objective is to have a meaningful impact on our audience by conveying our mission and purpose while fostering 7a connection that leads them to embrace our values.

In this subsection, we will explore how a strategic approach, communications planning and strategies should be designed to deliver the aforementioned benefits to protected areas and support national park managers in facing challenges related to visitor flow management, monitoring and enhancing visitor experience.

Strategic planning

When it comes to communications planning, much like other businesses and organizations, national parks and protected area managers can benefit from long-term planning and strategic development. When adopting a strategic approach, a national park should also define the vision, long-term goals and objectives of their respective protected areas, taking into consideration their strengths, weaknesses, opportunities and threats, and identify the necessary steps needed to achieve the desired outcomes.

Communications strategies are often developed as part of organizational development strategies, as there are strong interlinkages between the two. **Strategic communications are frequently defined in line with organizational development methodologies**: these strategies are often used for long-term planning: typically 5-to-15-year strategic documents are developed. However, **long-term strategic documents often overlook the continuously changing environment**. Consequently, there is an ever-present **need to create more adaptive and agile plans** capable of responding to these continuously changing circumstances (Ruler 2021).

This idea has been further reinforced by communications expert Mr. András Sztaniszláv during the VIMOMA Communications Workshop, held in Pomáz, Hungary on 24-25 April 2023. He emphasized that the **traditional, predictable planning methods are becoming outdated, as foreseeing long-term outcomes is becoming more and more difficult**. However, predictability can and should be replaced by adaptivity, as **adaptive planning methods are more capable to ensure that communication activities reflect current circumstances**. Adaptability in communication involves flexibility and responsiveness to dynamic situations and diverse audiences (Sztaniszláv 2023).

The strategic approach to communications includes **thorough planning, clear objectives, tailored messages to target audiences, and deliberate choices of communication methods and channels** to achieve the specific objectives visualized in the communications plans. The identified specific goals and objectives should be aligned with the conservation objectives and visitor management needs. Strategic communication planning should also focus on the proper and responsible use of resources in achieving its objectives; desired outcomes may take shape in changes in policies, visitor behavior or enhanced involvement of local communities (Hesselink 2007).

Moreover, according to Sztaniszláv (2023), the significance of a strategic approach should be considered in the planning of communications efforts of any given entity: several communications aspects should be aligned with each other. Developed messages (i.e., *What you say?)* should be produced in accordance with the actual activities (i.e., *What do you do?*), keeping in mind the perception we aim to create among the target audience (i.e., *What do they think about you?*). Incorporating the following steps may be useful and serve as a guide in communication planning:

1. Know your audience
2. Become genuine
3. Speak through actions
4. Establish creditability
5. Make it count

The strategic approach can be further supported by the implementation of several steps along the planning process (see fig. 7). First, the analysis and

Fig. 7. Steps for planning
Source: Sztaniszláv 2023.

mapping of main stakeholders can be helpful in defining target audiences. The stakeholder map may also include competitors as NPs can gain insights and knowledge of the market by identifying and analyzing the entities they are competing with. Once the stakeholders are properly mapped and grouped, appropriate communication channels need to be defined. Creative messaging is crucial to catch attention, while a continuous assessment of the outreach and success of the communication methods is also invaluable (Sztaniszláv 2023).

Moreover, according to the CEPA toolkit, the 10 steps of communications planning are as follows (Hesselink 2007):

1. Analysis of the issue and the role of communication
2. Selecting target groups, audiences and stakeholders
3. Determining the communication targets
4. Developing the strategy and selecting partners.
5. Determining the messages
6. Selecting the communications
7. Organizing communications and briefing partners
8. Planning (in terms of milestones and activities)
9. Budgeting of activities
10. Monitoring and evaluation

In terms of strategic thinking and the development of communication plans, the business model canvas can serve as a valuable tool to outline the key elements of communications strategies (fig. 8). By using the canvas, organizations are able to efficiently draw up the directions for development, considering their available resources, strengths and opportunities. It provides an effective framework that aids in conceptualizing and shaping communication strategies.

To simplify matters, in the following paragraphs we will explore how to **define 1) stakeholders and target audience, 2) suitable communication channels, and 3) crafting tailored messages**.

Whom to reach? – Target Audience

The identification of a target audience is an essential part of creating a communications plan. Target groups consist of relatively homogeneous people; a customized approach is essential for each group and should be tailored to their specific characteristics (Hesselink 2007). Defining target groups may seem difficult at first, but the identification of main stakeholders often proves to be helpful along the process. Several stakeholder groups can be mapped; main classifications often include the identification

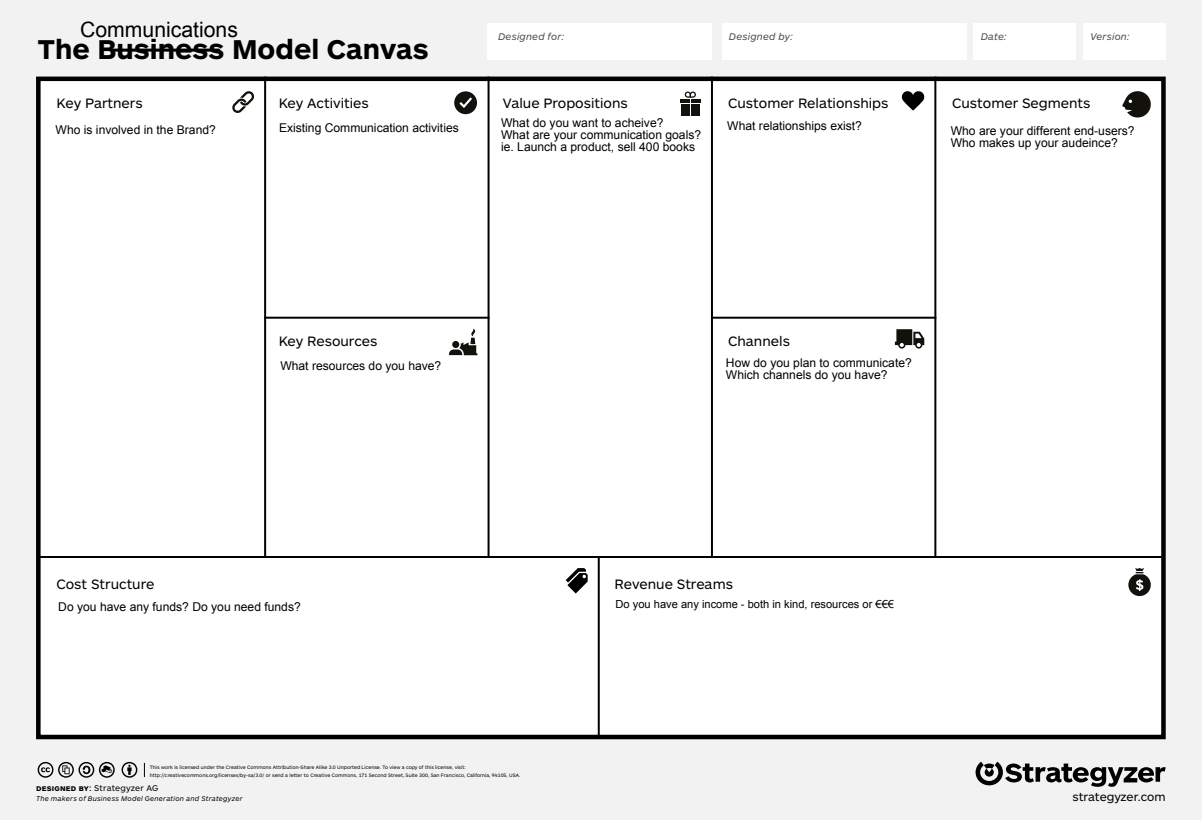


Fig. 8. Communications model canvas
Source: FabLab & Strategyzer 2021.

of clients or customers, competitors, suppliers, media representatives, regulators, etc. Then, stakeholder groups can be prioritized by placing them in the Power-Interest matrix (see fig. 9; Sztaniszláv 2023).

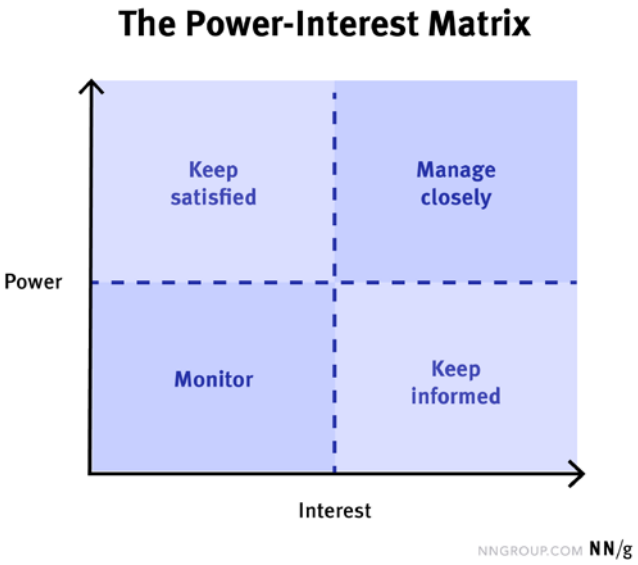


Fig. 9. The Power - Interest Matrix
Source: www.nngroup.com.

Defining a target audience can be reinforced through the creation of personae. These functional characters are developed to gain a deeper understanding of our audience by becoming acquainted with their motivations, needs, experiences, skills, and other relevant aspects (Sztaniszláv 2023). Crafting personae can be accomplished without major effort (see fig. 10). Numerous online tools, including EDIT.org, are available for this purpose.

How to reach them? – Communication channels

The preliminary exercise of creating your targeted persona should guide you to the answer to the question of how to reach your audience. By portraying your potential audience's attributes/perspectives/traits, you may be able to decide on the appropriate outreach channels. For instance, if you decide to make use of social media channels, you will have to decide whether it is necessary to use all of the channels your organization or your protected area is using, or not. If your targeted audience consists of younger people, perhaps using Instagram and TikTok will be a better choice, while Facebook might work better for a millennial audience.

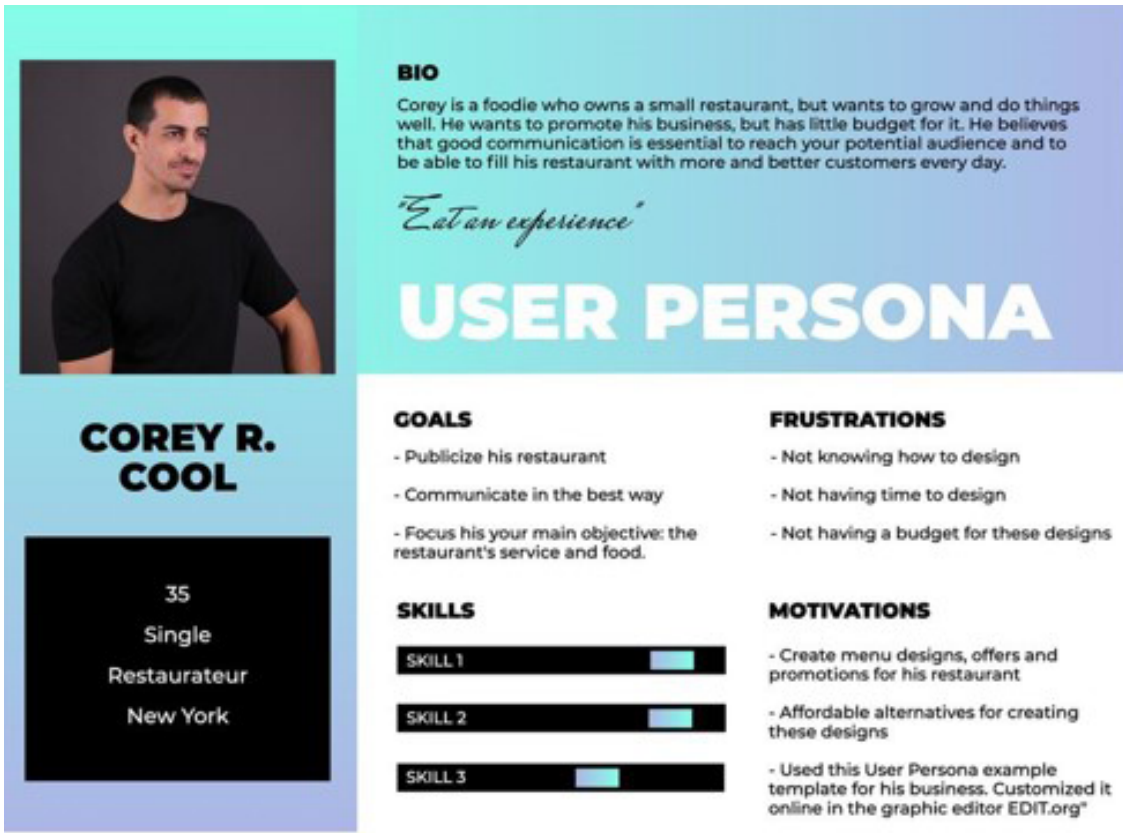


Fig. 10. Persona template
Source: Sztaniszláv 2023.

On the other hand, there are other communication approaches that are not exclusively digital. You may opt for in-person promotion (e.g., a representative with a defined message sent to a school or university to promote visits to your park), production of brochures or leaflets to be given to visitors at the entrance, development of specific types of activities (e.g., geocaching) or interactive information (e.g., QR coding) within the area, and more.

What to tell? – Messaging

Different channels and stakeholders require tailored messaging. Every organization should have a primary message that briefly captures its values, key purpose or mission. Messages should be crafted by first presenting the problem, then offering solutions, and concluding with a clear call to action.

For example, a national park could, as a unique selling point, leverage emotions related to natural values and beauty (Sztaniszláv 2023) by including them in key messages to support the aim of influencing the target group's attitudes. Reliable communication messages are founded on the identity and image of the organization; thus, entities must also consider their values and activities when designing them to ensure creditability. Messages should reflect the communication targets and the communications strategy. Prior to delivering the messages widely, pre-testing of messages is helpful to avoid misinterpretations, lack of clarity, and to test whether the tone of the messages is appropriate to the given target group (Hesselink 2007).

4.3. Methods

Effective communication methods play a vital role in managing protected areas. The implementation of appropriate communication tools contributes to efficient visitor monitoring and increased visitor experience while also promoting sustainable tourism practices in protected areas. In the following paragraphs, we will introduce methods capable of supporting these endeavors.

Among these methods, Quick Response (QR) coding emerges as a powerful tool to enrich the tourist experience. The increasing reliance on technology, particularly ICT (Information and Communication Technologies) tools has spurred travelers' interest in technology-oriented solutions, leading to the adoption of QR technology in various sectors, including tourism. QR codes offer a user-friendly, yet robust, means of conveying information and engaging visitors in real-time interactions. This study investigates the advantages of utilizing QR codes in protected areas for visitor monitoring and access control. Furthermore, based on real-life examples, the study explores the effectiveness of **QR technology** in cultural heritage tourism within protected areas providing valuable insights for its application in nature-based tourism and visitor monitoring within protected areas. Additionally, this research delves into the fundamentals of **geotagging** as another communication method utilizing geospatial metadata to comprehend visitor behaviors and preferences in protected areas. **Geocaching**, an outdoor adventure and educational tool, is also explored for its potential in attracting and involving visitors, while fostering responsible and sustainable interactions with the environment. By integrating QR codes, geotagging, and geocaching practices, a comprehensive approach is presented to enhance visitor experiences and safeguard the ecological integrity of protected areas.

4.3.1. Quick Response (QR) Coding Features

With reference to the usage of social media in visitor monitoring, the use of QR codes shows the involvement of Information Technology in the tourism space (Lee et al. 2021). According to (Gom et al. 2019), travelers, visitors, and tourists in recent years have become technology-oriented and this can be credited to the high growing rate of various forms of technology, especially Information and Communication Technologies (ICT) around the world (United Nations 2023). In tourism, the use of technology to serve visitors and tourists has been regarded to improve the experiences of tourists (Boakye et al. 2022; Neuhofer et al. 2014). Among the growing forms of technologies, QR technology which largely focuses on QR codes is heavily used across many sectors of the economy, not excluding tourism (Katlav 2020). Quick response (QR) codes are 2D images that, when scanned, prompt smartphones to open a web page or display an image, video or text (fig. 11).

QR codes are easy to create, we describe the steps in the latter part of this subsection. Among a number of platforms to create codes, *QR Stuff* and *QR Tiger* are the commonly used ones. The codes are often created at a fee, depending on the type of QR code. The main two types of QR codes are *static* and *dynamic*

Fig. 11 An example of a QR code

codes. Both types are scannable images that serve the general purpose of a QR code; however, they possess differing properties and capabilities (tab. 17; Coleman 2011).

Tab. 17. Static and dynamic QR codes

	Static QR code	Dynamic QR code
Size	large, dense	small, lightweight
Editing Ability	cannot edit and update	can edit and update
Usage Metrics	cannot track usage and scan data	can track usage and scan data

Source: SqroutQR.

The Differences Between Static and Dynamic QR Codes

The process of generating QR codes (fig. 12)

Considering the features of the two types of QR codes, the dynamic version is recommended for visitor-monitoring purposes given its increased functionality compared to the static ones. **In protected area management, QR codes are recently used mostly for visitor monitoring as a tool for access control**, especially when overcrowding has become a problem at many nature parks. After the COVID-19 pandemic, the use of QR technology has become more common and popular. Tourism centers, especially protected areas, were concerned about their carrying capacities since there was an increase in the number of visitor arrivals at nature-based tourism sites. According to Moore and Hopkins (2021), **QR codes were developed to allow people to see the number of visitors at a site in real-time, which indicates a clear relevance for the QR technology to be applied in the management of protected areas**, especially for visitor-monitoring purposes. As a result of the recent advancement in ICT tools, QR codes can to provide real-time updates.

In literature, not much has been written about the use of QR technology in nature-based tourism. Moreover, as noted in the research, QR technology (QR code) in tourism is mostly used in cultural heritage tourism sites, such as museums (Di Pietro et al. 2018; Solima, Izzo 2018). However, the results from reviews and analyses of such literature suggest the use of QR technology in cultural heritage tourism has some benefits. These studies can be used as an assurance that QR technology can be effectively

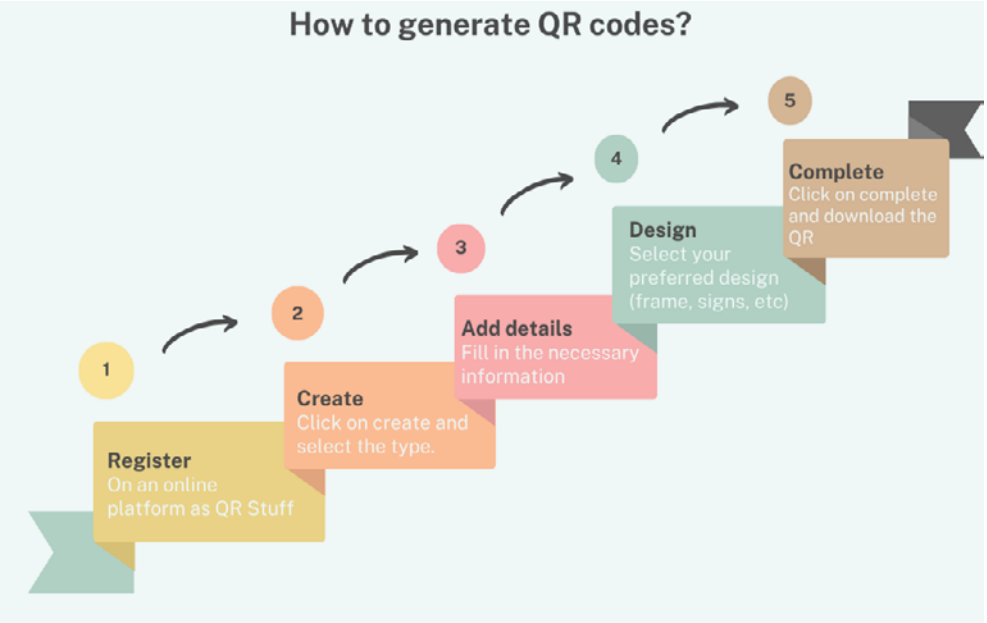


Fig. 12. Generating QR codes
Source: own edit.

implemented in nature-based tourism as well, especially with the aim of monitoring visitors and visits.

Case Study on Cultural Heritage Tourism in Italy and Poland (Solima, Izzo 2018)

In this case study, Solima and Izzo (2018) evaluates the use and effectiveness of QR codes in museum experiences in Italy and Poland. According to Di Pietro et al. (2018), QR codes are a technological innovation regarded to enhance visitors' experience at a tourist destination or site. Through such technologies as QR codes, information about tourism-related features is easily disseminated to visitors and tourists (Cataldo 2011; Solima 2014). The case study recorded significant impact of QR codes in the two cultural heritage institutions: the Royal Palace of Naples (Italy) and the Wilanow Palace in Warsaw (Poland) that were used for research.

The analysis of the case study concluded that:

- QR technology improves visitor experience and enjoyment of the visit.
- The technology is able to provide data on visitors' interest points through the check-in and feedback features where visitors share opinions about their experience.
- QR technology increases the level of involvement of visitors at the sites.
- Visitors are at liberty on how to use their time at the site. Thus, they are able to decide on their experience.

These factors, among others, per the analysis of the case study, show the effectiveness of the system, as **visitors are able to get more information by scanning the QR codes**. **This information can be presented in diverse ways, such as images, videos, and texts** (Dwyer 2007). Moreover, these positive impacts were realized as a result of the effective use of the QR codes at the two cultural heritage institutions. From the case study, the detailed maps of the sites were accessible by scanning a QR code at various points at the institutions. This encouraged the usage of the QR codes among the visitors, and as well identified the points which were of particular interest to the visitors. In addition, the QR codes were positioned well, making them easily accessible to visitors. In some cases, they were placed very close or attached to the objects (photo 15).

Considering the significant impacts of QR codes and their influence on visitors in the cultural tourism domain, it is indicated that the benefits can be replicated in nature-based tourism as well. The growing competition among nature-based tourism centers and the growing alternative use of leisure time (Solima, Izzo 2018) has put a demand on managers of protected areas to modernize the visitor experience. In the process of implementing effective management mechanisms, the concern for visitor monitoring is important because of how sensitive protected areas are. Replicating the case study of Solima and Izzo (2018)'s research on QR codes in visitor monitoring in protected areas, **national park managers can**

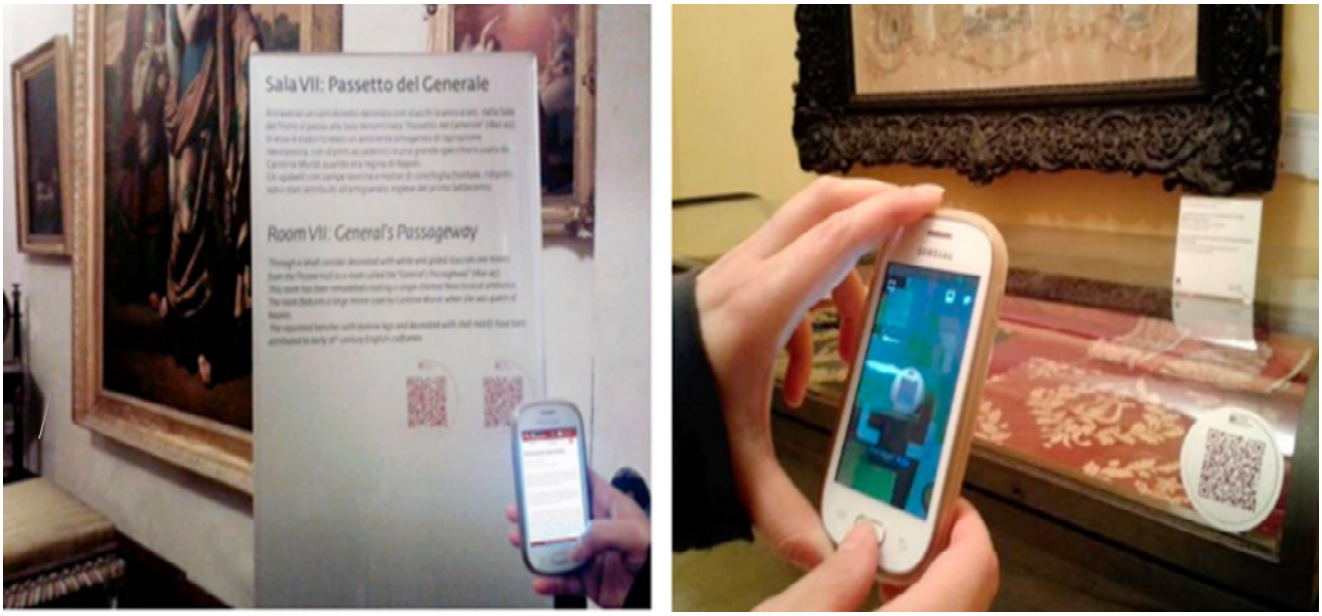


Photo 15. Position of the QR codes at the Cultural centers
Source: Solima, Izzo 2018.

consider displaying QR codes at various vantage points within the parks.

In protected areas, a QR code that **gives visitors access to general information about the parks,including a detailed map of the area, possible recreational activities specific to the area, and also the regulations to be followed at the protected area as a visitor** would be effective. This information has the ability to influence the visitors' behavior, their activities, as well as their route through the park. The QR code to access all this information can be placed at the entry points of the protected area, and also used to check-in the visitors. In addition, just as in the case study where QR codes were attached to various objects in the cultural institutions for visitors to get more information about the objects, protected areas can display QR codes at key locations, such as trailheads, visitor centers, or campgrounds. This will allow visitors to easily access information about specific locations within the area (such as brief information about the vegetation and connecting routes of various locations in the area). The visitors can also check in to specific locations, this provides the management with real-time updates on visits in the area. The QR codes can have feedback features to allow visitors to give their opinion on the visits. In light of these features, managements of protected areas have the responsibility to consider and provide Internet connectivity in the necessary places so that these features function correctly.

4.3.2. Geotagging

Geotagging is the process of adding geospatial metadata to media based on the real-time location of an electronic device. Geotags can be applied to a variety of media sources, including photos, videos, websites, text messages QR codes. Geotagging metadata usually consists of latitude and longitude coordinates, although other metadata such as altitude, bearing, distance, accuracy data and place names can also be used. In Google Maps and similar GPS services, geotagging may also be referred to as "dropping a pin". Pins tagged with contextual information can be used to share information about a specific location. Geotagging can provide key insights into the activities of visitors to protected areas, as geotagging metadata can be used to understand where, why, how, and when users interact with the spaces around them. In turn, understanding the visitation status of protected areas is a crucial aspect of nature-based tourism and the sustainable management of natural resources (Kim et al. 2019).

This section will outline the basic mechanisms of geotagging, provide case studies into the use of geotagging to monitor visitor activities in protected areas, and the advantages and disadvantages of geotagging.

How are Geotags added to photos?

Two main options can be used to geotag photos: capturing GPS information at the same time as a photo is taken, or adding geographical identification metadata after a piece of media has been produced. To capture GPS data at the same time a picture is taken, the camera device must have a built-in GPS, or the user may use a digital camera alongside a standalone GPS. Most cell phones and smartphones have GPS chips alongside built-in cameras, enabling automatic geotagging of photos; some digital cameras also have this function. Geotagging data is saved within the Exchangeable Image File (EXIF) data of photos. This file can also be manually modified in order to add geospatial metadata after a photo has been taken.

Social media is a primary mechanism to use and access geotagging EXIF data. Tourists often choose to tag social media content with a location to share their activities with family and friends. Similarly, people looking to access outdoor spaces may utilize the geotagging function on common social media sites such as Snapchat and Instagram to identify places of interest within outdoor and protected spaces (via a "map" viewpoint produced from EXIF data), which they visit in turn. Alongside social media, Internet users can find location-based news, websites, images and other resources by entering geospatial data (such as latitude and longitude) into a search engine such as Google. Once a location has been registered with Google, customers can check in and post further media such as images, videos, and comments which will be associated with the geographical location (fig. 13).

What can Geotagging be used for?

Geotagging and its associated analyses are growing exponentially: 82% of all digital data generated today contains some form of geotagging, and on Flickr alone, 197M geotagged photos have been posted between 2005 and 2012 (Wood et al. 2013; NewGrove 2020). As such, geospatial data has become a major form of 'social big data', which is analyzed by a number of actors for various purposes. For example, companies may use geotagging information to identify consumer activity, such as when and where specific items are purchased; law enforcement also utilizes geotagging

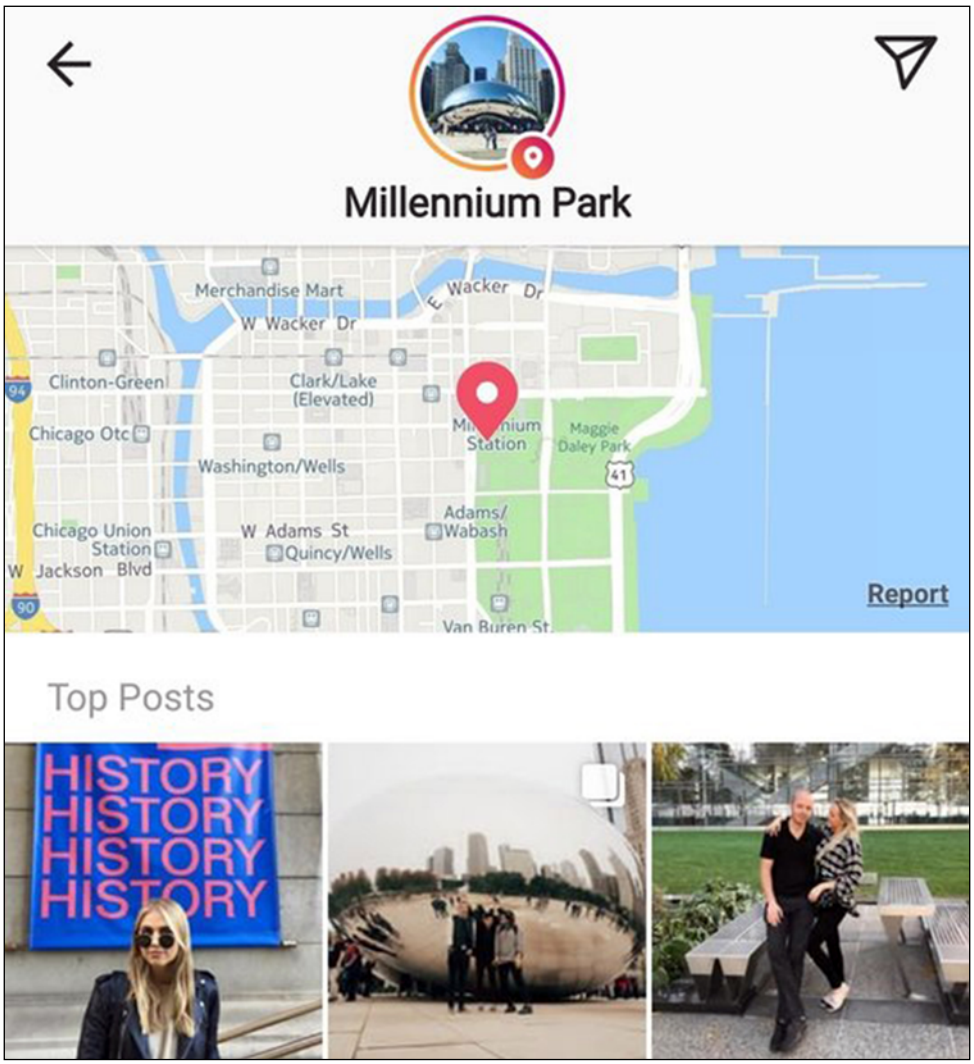


Fig. 13. Geotagged photos on Instagram
Source: Sprout Social (York, 2017).

to better understand suspected criminal activity.

Similarly, Geotagging can be used for the conservation of Protected Areas. **Analyzing geotagged data provides rapid and cost-effective information on the activities and preferences of people visiting protected areas**, overcoming limitations related to sample size, time and location constraints, and non-response bias. Protected area managers may take advantage of social media for a real-time understanding of the ecological and social processes underpinning protected area management. **For example, continuous monitoring of social media feeds would allow the identification of emerging activities or other spatial or temporal patterns**, which cannot be captured by predefined surveys (Hausmann et al. 2018). Further, protected area managers may use geotagged social media data to monitor threatened species (such as location and population dynamics) as well as threats to biodiversity, including the effect of tourism on ecologically fragile areas. **Social media content may also reveal real-time management issues such as traffic hotspots and species** which are exposed to concerning levels of human disturbance (such as breeding sites close to trails and roads), which can be addressed on a real-time basis to minimize visitor impact on biodiversity (Hausmann et al. 2018).

How is geotagged data used to understand visitor behaviors and activities in a protected area?

A number of studies have identified the ability of geotagged photographs to effectively represent overall trends in a geospatial context (García-Palomares et al. 2015; Kurashima et al. 2010; Salas-Olmedo et al. 2018; Wood et al. 2013). More specifically, distributions of crowd-sourced images uploaded on the

photo-sharing site Flickr display a strong correlation with observed visitation data at recreational sites (Wood et al. 2013). Further, analyses by Hausmann et al. (2018) display the utility of geotagged information to understand the preferences of people visiting protected areas. This study compared preferences for biodiversity obtained from a traditional survey undertaken in Kruger National Park, South Africa, with observed preferences assessed from over 13,600 pictures shared on Instagram and Flickr by tourists visiting the park in the same period. The study concluded that there was no significant difference between preferences as stated in surveys and those revealed by social media content. Similar analyses have been undertaken across ASEAN Heritage Parks across Asia, with researchers effectively illustrating the spatial patterns of visitation using 10 years of Flickr geo-tagged photographs. Hotspots of high visitation were identified, as well as the local spatial impact of distributed attributes (Kim et al. 2019). **Evidently, geotagging and wider social media analysis can be used to understand preferences within nature and be leveraged to protect biodiversity**.

However, posting geotagged photos to social media sites can also function as a way of spreading the word about the location of notable sites. **Consequently, geotagging may potentially incentivize visitors to ecologically fragile sites, leading to overtourism and further degradation**. Examples of this are widespread, including the spike in visitors to Horseshoe Bend in Arizona from 1,000 visitors per year to 4,000 visitors per day (photo 16; Spielmaker 2020). Consequently, some managers of protected areas have made efforts to deter visitors from posting geotagged photos, as exemplified by the Jackson Hole Travel and Tourism Board's "Tag Responsibly" campaign (Spielmaker 2020). Furthermore, issues with accuracy from geotagged data may arise, including data quality, potential inaccuracy of posts, biased behavior on social media, and the representativeness of the population using social media (Tufekci 2014). Consequently, geotagging data should be used with caution and alongside other monitoring and management mechanisms.

4.3.3. Geocaching

Geocaching is a real-world, outdoor adventure that is happening constantly. It is essentially the world's largest treasure hunt, with players using real-world coordinates to discover caches, which are small capsules cleverly hidden in different environments. There are millions of these caches hidden all around the world. To participate, players just need the geocaching app and a GPS device, which allows them to see the location of the cache on a digital map. Geocaching is a great way for players to find remarkable destinations that they would not have otherwise discovered, while also being an excellent tool for educating people about different issues.

In order to begin geocaching, first make a user profile on the official geocaching website: www.geocaching.com. The basic membership registration is free and allows you to access non-premium geocaches and

Photo 16. Jackson Hole Tag Responsibly Campaign

Source: Visit Jacksonhole.

navigate using online app mapping. It is then important to download a geocaching app to your mobile device so that you can access GPS coordinates while out and about. There are multiple apps that allow you to do this, for example, C:Geo or Lotus. Once you have done this, you can begin to download offline vector maps and cache coordinates for your desired location.

Several important pieces of information are included on each geocache page. At the top of the page, you will find the cache name, identification number, and type. You will also find the cache difficulty and terrain rating, size, and a basic description of what type of cache it is. When a cache is located, the finder logs this through the geocaching app. On the website, you can see the last time the cache has been interacted with, which can help to identify any changes to the environment since the cache was hidden.

Geocaches come in all different shapes, sizes and difficulties, and are hidden in both rural and urban settings. They range in size from micro caches, which are 100mm or smaller, to large: containers with a volume of over two liters. Each one has a unique geocaching code that allows it to be identified. The capsules usually contain a few different items: a logbook, to track how many times the cache has been found, a pen or pencil, small items for exchange which have been left by other geocachers, and SWAG (the treasure). Tradable items include toys, keychains, unusual coins or even disposable cameras. The general rule is: if you take one of the items, you should leave something of equal or greater value. Then, place the container back exactly how you found it. Sometimes caches also contain small tracking devices known as travel bugs or geocoins. These are special items which travel from cache to cache, collecting stories along the way.

There are multiple types of cache. First, there are traditional caches, which are the simplest type to find and the most common. They are located directly at the listed coordinates. Then there are letterbox caches, which require the player to complete a number of tasks that are included in the online listing. Often, these tasks take the form of a story which, once deciphered, gives the coordinates of the cache. The third type is known as multi-caches. These consist of multiple stages that must be completed in a particular order, with each cache giving the coordinates for the next. Virtual caches are also possible. These involve the player being given coordinates for an interesting or unique location, usually with a notable object, such as a sculpture. Rather than a physical container, with this type of cache the player usually emails the cache hider with proof that they visited the location in order to validate their find. This may mean a selfie of themselves, or perhaps giving a certain piece of information, such as the date on a plaque. The final type of cache is an event cache which is an event with the purpose of meeting other geocachers. Events are typically 1–2 hours long and must be published a minimum of 14 days before the event.

Geocaches are located all over the world! According to www.geocaching.com, there are more than 3 million active geocaches spread across 191 countries on all seven continents. Of the five different countries involved in the project (Poland, Serbia, Slovakia, Hungary and the Czech Republic), the Czech Republic has the most active caches (Groundspeak Inc. 2013), but the caches of Slovakia, Hungary and Poland are also numbered in the thousands. In Slovakia, geocaches have been recognized as a marketing tool to attract visitors to many tourist locations, and they have also attracted a lot of attention in Poland since 2009 due to the large proportion of citizens owning smartphones. Serbia has the least caches out of the project partners, but there are still hundreds of them around the country.

There are rules that govern the placement and location of geocaches, particularly concerning land use, which aim to prevent and resolve conflicts. You must get permission from the owner of the land before you hide a cache there In the case of public land, this means contacting the agency or government that manages the land. Specific rules apply in different countries as well, and it is important to follow local rules.

When you place a cache, you should also be aware that there are minimum required distances between different geocache containers. You should not place a cache within 161 meters of another container or physical waypoint (where a cache owner has placed an item or a tag). To observe this rule, you should not rely only on the Geocache Planning Map to choose a location, because multi-caches can have hidden physical waypoints. However, physical waypoints of the same cache can be within this distance.

Keeping these rules in mind, follow this process to set up your geocache: Once you have placed the cache in the chosen location, make sure your GPS coordinates are accurate, and then submit the location and details of the cache on the geocaching website. The page should not contain any commercial content, or promote a specific agenda or cause, as such content will not be published. When you submit a geocache

page for review, a member of the global team of community volunteer reviewers (also known as reviewers) will check it against the guidelines. They may offer suggestions, if there are additional concerns not fully covered in the guidelines. Once the information is published, it is important to maintain the page to prevent it from being archived. You should also check the physical location of the cache, to make sure it has not been tampered with, and to replace destroyed or stolen components.

Choosing a container for your cache can affect the visitor experience. The ideal container is waterproof, to avoid the contents being damaged, and should be labelled as a geocache, to avoid confusion or suspicion if found by a non-geocacher. If possible, choose a transparent container, to show that the contents are harmless. The container must also be large enough to hold a logbook, as well as any other items that you wish to place in the cache. Do not include any edible, dangerous or illegal material in the container.

Geocaching can be an invaluable tool for educating people about the environment. It encourages people to step out of their comfort zone and explore nature. Compared to older generations, today's youth are increasingly less acquainted with the ways that human beings interact with nature and many lack a general awareness of the natural world and our environment. Young people need to understand and experience nature in a personalized, outdoor setting. **Additionally, the culture of geocaching involves leaving the environment in the same, or a better state than when you arrived, and many geocachers participate in "Cache in, trash out" which involves cleaning up rubbish from the surrounding area**.

Protected areas (PAs) are of special interest to geocaching (Mendes et al. 2004). Not only does the presence of caches in these areas open them to a new and larger audience, it also improves the experience of existing visitors. Caches make visits to these areas more interactive and engaging, allowing people to explore the environment more deeply. Geocaches can serve to educate people or participants about the natural features of the protected area (Mendes et al. 2014; Zecha 2012). Beyond this, geocaching can also be used to manage protected areas, by monitoring the number of visitors, and providing data about days with the most visits.

However, the effects of geocaching are not always positive. **Geocaching often leads to increased traffic in an area, and that has an impact on the surrounding environment. Vegetation can be trampled during the search for the cache, damaging local habitats** (Leung, Marion 2000). Other risks include the widening of trails or the spread of non-native flora because of seeds attached to people's clothing. These effects have been regarded by most researchers as a major challenge. But most geocachers do attempt to minimize their impacts on the environment.

There are also ways for the cache hiders to reduce negative effects on the environment, by following certain best practices when placing caches in a PA (Mendes et al. 2014). First, caches should be hidden no more than two meters away from trails. This serves to minimize disturbances to the natural environment as people search for caches. Additionally, it helps to boost interest in the activity, as people are able to participate more easily and get more finds. Secondly, caches should not be hidden in natural places (such as trees or deadwood) because this can lead to trampling or soil erosion. Instead, focus on hiding caches around or at facilities, or places that do not lead to environmental disturbances (e.g. buildings, signposts, boards, fences, viewing points). Finally, give preliminary information to visitors about the locations of geocaches, for example, by telling them the caches are all located on trails, to avoid them needlessly venturing into undisturbed parts of the area. Make sure the visitors understand the potential impact that their visit could have on the environment.

Keep in mind! To avoid negative effects on the environment:

- Hide caches close to hiking trails.
- Avoid hiding them in natural places, focus on placing them close to facilities.
- Provide preliminary info on caches to avoid unnecessary impact on the area.

Finding the perfect location for your cache is more than just minimizing the impact on the environment, you should also aim to make the treasure hunt fun and interesting for people to play. Try to find a noteworthy feature of the environment, perhaps an interesting rock formation, or an impressive viewpoint and hid the geocache nearby. This way people will be able to see exciting parts of the area that they might have missed. One geocache member says: *When you go to hide a geocache, think of the reason you are bringing people to that spot. If the only reason is for the geocache, then find a better spot.* With this and the

geocaching rules in mind, hiding caches can be simple and straightforward (photo 17).

Photo 17. An example of geocache
Source: Bernabe Colohua.

4.4. Final remarks

In the previous sections we discovered how communication planning and tools are able to support protected areas to improve management of visitors, enhance visitor experience and promote the attractiveness of protected areas.

In conclusion, effective communication plays a vital role in supporting conservation efforts and managing visitors in protected areas. By adopting a strategic approach to communications planning, national parks and protected area managers can achieve several benefits, including fostering a sense of responsibility and support for conservation, raising awareness of conservation goals, and enhancing visitor experiences. A strategic approach to communications involves long-term planning, clear objectives, and tailored messages for target audiences. As a part of communications planning, identification of target audiences, developing tailored messaging and defining appropriate channels, are essential. Additionally, creating persona profiles can deepen the understanding of the audience's motivations and needs, which is a valuable tool in the planning process. By implementing these strategies, protected areas can effectively communicate their values, missions, and conservation efforts, encouraging public engagement and support for the protection and appreciation of natural and cultural values. Ultimately, a well-designed communication strategy contributes to an enhanced visitor experience and the overall attractiveness of protected areas.

The introduction of communications basics was followed by discussion of tools which are able to support communication endeavors in protected areas. One such powerful communication method is Quick Response (QR) coding. QR codes offer a user-friendly way to convey information and engage visitors in real-time interactions and can be effectively used to access control and monitoring in protected areas. For protected areas, placing QR codes at entry points and key locations can provide visitors with essential information about the area, including recreational activities, regulations, and detailed maps. QR codes can also be attached to specific objects or locations within the area, allowing visitors to access detailed information about them. By incorporating feedback features, management can gather real-time updates on visitor activities and experiences, allowing for better monitoring and responsive management.

Geotagging, the process of adding geospatial metadata to media based on real-time location, is a valuable tool for understanding visitor behaviors and activities in protected areas. Geotags provide key insights into where, why, how, and when visitors interact with the spaces around them, making it a crucial aspect of nature-based tourism and sustainable management of natural resources. Geotags can be added to photos by capturing GPS data at the time of taking the photo or by adding geographical identification metadata afterwards. Social media play a significant role in geotagging, with tourists often tagging their content with locations to share their experiences and access outdoor spaces of interest. For protected areas, geotagging offers rapid and cost-effective information on visitor activities and preferences, overcoming limitations of sample size and location constraints. Protected area managers can use social media and geotagged data for real-time understanding of ecological and social processes, as well as to monitor threatened species and threats to biodiversity. This data can also be used to identify hotspots of high visitation and to learn about visitor preferences within the protected areas. However, managers should be cautious about potential issues, such as overtourism and accuracy associated with geotagged data. While geotagging provides valuable insights, it can also inadvertently spread the word about noteworthy sites, leading to overtourism and further degradation.

In the last section, the background for geocaching was introduced. Geocaching is a popular and

engaging outdoor adventure that serves as the world's largest treasure hunt, offering the opportunity to explore remarkable destinations individuals might not have discovered otherwise, while also serving as an educational tool to learn about different issues. Geocaching involves using real-world coordinates to track down hidden caches in diverse environments, creating a sense of excitement and exploration. There are different types of caches, each with unique challenges and rewards, ranging from traditional caches found at the listed coordinates to virtual caches that require validation through email or specific information. However, while geocaching can be a powerful tool to engage people with nature and raise environmental awareness, it can also lead to increased traffic and potential negative impacts on the environment. Therefore, responsible practices are essential when placing caches in protected areas. To minimize negative effects, cache hiders should follow best practices, such as hiding caches close to hiking trails, avoiding natural places to prevent trampling or soil erosion, and providing preliminary information to visitors about the locations of caches. This way, geocaching can be an excellent addition to protected areas, enhancing visitors' experiences, encouraging exploration of nature, and promoting environmental stewardship.

Overall, QR coding, along with other communication methods like geotagging and geocaching, provides a comprehensive approach to managing protected areas effectively, attracting visitors responsibly, and safeguarding the ecological integrity of these vital natural spaces. By utilizing technology-driven communication methods, protected area managers can create a balance between promoting tourism and conservation,w ensuring a sustainable and enriching experience for both visitors and the environment.

5. Visitor impact monitoring in protected areas

5.1. Introduction

Tourism is an important part of national economies and can provide many benefits to protected areas (Leung et al. 2018):

1. **Economic Growth:** Tourism can contribute to the economic growth of protected areas and the surrounding communities. Visitors spend money on accommodation, food, transportation, and other goods and services, which generates income and employment opportunities for local businesses and residents. This can help alleviate poverty and improve the standard of living in the area.
2. **Conservation Funding:** Tourism often generates revenue that can be used for the management and conservation of protected areas. Entrance fees, permits, and taxes on tourism-related activities can be reinvested into conservation efforts, such as habitat restoration, anti-poaching measures, and wildlife conservation programs. This financial support is crucial for maintaining and protecting the ecological integrity of the area.
3. **Awareness and Education:** Tourism provides a platform to raise awareness about the importance of protecting natural and cultural heritage. Visitors who experience and appreciate the beauty and significance of protected areas are more likely to become advocates for conservation. Tourism can also facilitate educational opportunities, such as guided tours, interpretive centers, and workshops, where visitors can learn about the unique ecosystems and cultural values of the area.
4. **Community Engagement:** Tourism can foster community involvement and participation in conservation initiatives. Local communities can benefit from tourism by providing goods and services, serving as tour guides, or selling locally made crafts and products. Engaging the community in sustainable tourism practices can create a sense of ownership and stewardship, leading to increased support for conservation efforts.
5. **Research and Monitoring:** Tourism can support scientific research and monitoring activities in protected areas. Researchers can study wildlife, ecosystems, and cultural heritage, gathering valuable data to better understand and manage these areas. Tourists can also contribute to citizen science initiatives, such as reporting wildlife sightings or collecting data, which can enhance the knowledge base and aid in conservation planning.

However, it is important to note that tourism should be carefully managed in protected areas to minimize negative impacts. Sustainable tourism practices should be implemented to ensure that tourism activities are conducted in an environmentally and socially responsible manner, minimizing ecological disturbance, promoting cultural sensitivity, and supporting local communities. Effective planning, regulation, and monitoring are crucial to strike a balance between tourism development and conservation objectives.

Tourism can have several negative impacts on the natural environment (e.g. Belsoy et al. 2012) and the experience of visitors (e.g. Ferreira, Harmse 2014). Here are some ways in which tourism can negatively affect these components:

1. **Environmental Degradation:** High volume of tourists can put immense pressure on fragile ecosystems, leading to habitat destruction, soil erosion, and loss of biodiversity. Activities such as deforestation for the construction of hotels and resorts, pollution from waste and sewage, and damage to coral reefs and wildlife habitats can significantly impact the natural environment.
2. **Overcrowding and Congestion:** Popular tourist destinations often face issues of overcrowding, particularly during peak seasons. This can result in congested roads, long queues, and crowded attractions, diminishing the quality of the visitor experience. Additionally, overcrowding can lead to increased noise pollution and a sense of intrusion for both tourists and local residents.

3. **Resource Consumption:** Tourism places a high demand on local resources, such as water, energy, and food. In areas where resources are limited, the influx of tourists can strain the available supply, leading to overuse and depletion. This can have adverse effects on local communities and ecosystems, including water scarcity, increased energy consumption, and strain on agricultural practices.
4. **Pollution and Waste:** Tourism generates significant amounts of waste, including plastic bottles, packaging, and other disposable items. Improper waste management and inadequate infrastructure for waste disposal can result in pollution of water bodies, land, and natural attractions. This pollution not only harms the environment but also detracts from the overall visitor experience.
5. **Cultural and Social Impacts:** The cultural heritage of a destination can be negatively impacted by tourism. Large-scale tourism development can lead to the commercialization and commodification of local traditions and customs, eroding their authenticity. Additionally, the influx of tourists can create social tensions, disrupt local communities, and lead to the displacement of residents as land and property prices rise.
6. **Wildlife Disturbance:** Unregulated tourism activities, such as wildlife viewing and interaction, can disrupt the natural behavior and habitats of animals. Tourists may engage in activities that provoke or stress wildlife, contributing to their decline or altering their natural patterns. This can have long-term consequences for biodiversity and ecological balance.

These negative impacts are not inherent to all forms of tourism, and sustainable practices can help mitigate these issues. Responsible tourism management, community engagement, and environmental conservation efforts are crucial to minimize the negative effects and promote sustainable tourism practices.

Ecotourism and nature-oriented tourism offer alternative approaches to mass tourism that prioritize sustainability, environmental conservation, and engagement with local communities (Eagles et al. 2002). These forms of tourism aim to minimize the negative impacts on the natural environment and enhance the visitor experience. Key characteristics and benefits of ecotourism and nature-oriented tourism are:

1. **Environmental Conservation:** Ecotourism and nature-oriented tourism focus on protecting and preserving the natural environment. They promote responsible practices that minimize ecological footprints, such as reducing waste, conserving energy and water, and supporting local biodiversity conservation efforts.
2. **Education and Awareness:** These forms of tourism emphasize the importance of environmental education and raising awareness about conservation issues. Visitors have the opportunity to learn about local ecosystems, wildlife, and conservation efforts, fostering a deeper understanding and appreciation for the natural environment.
3. **Community Engagement:** Ecotourism and nature-oriented tourism actively involve local communities in tourism development and decision-making processes. This approach ensures that local people benefit economically and socially from tourism activities while preserving their cultural heritage and traditions.
4. **Sustainable Development:** These forms of tourism prioritize sustainable development, aiming to create long-term economic opportunities for local communities without compromising the integrity of natural resources. Revenue generated from ecotourism can support local economies, provide employment, and contribute to community development projects (fig. 14).
5. **Small-scale and Low-impact:** Ecotourism and nature-oriented tourism often favor small-scale operations that limit the number of visitors and minimize negative impacts. This allows for a more intimate and immersive experience for tourists while reducing overcrowding and ecological stress.
6. **Conservation Funding:** Many ecotourism initiatives allocate a portion of the tourism revenue to conservation efforts and community projects. These funds can be used for habitat restoration, wildlife protection, and the implementation of sustainable practices.
7. **Enhanced Visitor Experience**: Nature-oriented tourism provides opportunities for visitors to engage in activities like hiking, wildlife spotting, bird watching, and nature photography. These experiences allow for a deeper connection with nature, personal growth, and memorable experiences that differ from mass tourism offerings.

By promoting sustainable practices, supporting local communities, and fostering environmental awareness, ecotourism and nature-oriented tourism offer a more responsible and meaningful way to experience and appreciate the natural world.

Fig. 14. National parks are priceless not only for their natural beauty and historical significance but also for the economic benefits they provide. When people visit parks, they are contributing to the community around them. Spending in communities near national parks in 2022 resulted in a record high $50.3 billion benefit to the nation's economy and supported 378,400 jobs
Source: www.nps.gov.

5.2. Theoretical background

Management problems of outdoor recreation in national parks can have significant impacts on various resources, experiences, and facilities and services (Manning, Anderson 2012). The main challenges and impacts (fig. 15) associated with outdoor recreation in national parks include:

Impacts to Resources

- **Soil:** Unplanned or excessive foot traffic can lead to soil erosion and compaction, which can degrade the quality of the soil and affect vegetation growth.
- **Water:** Increased visitor use can result in water pollution from litter, human waste, and runoff from roads and parking areas, harming aquatic ecosystems.
- **Vegetation:** Trampling, off-trail hiking, and unauthorized camping can damage or destroy fragile plant communities and disrupt ecological processes.
- **Wildlife:** Improper behavior such as feeding wildlife, approaching too closely, or disrupting their habitats can disturb and stress animals, potentially leading to negative impacts on their populations.
- **Air:** High levels of visitor traffic, especially from vehicles, can contribute to air pollution and diminish air quality in sensitive areas.
- **Natural Quiet:** Noise pollution from recreational activities, such as motorized vehicles or loud gatherings, can disrupt the natural soundscape and impact wildlife behavior and visitor experiences.
- **Natural Darkness:** Artificial lighting and development associated with recreation can lead to light

Fig. 15. The scope of management problems in protected areas related to outdoor recreation
Source: based on Manning and Anderson 2012.

pollution, obscuring views of the night sky and affecting nocturnal animals and ecosystems.
- **Historical and Cultural Resources:** Uncontrolled access and inadequate protection can result in vandalism, looting, or damage to cultural and historical sites within national parks.

Impacts to Experience

- **Crowding:** High visitation rates, particularly during peak seasons, can lead to overcrowding, long wait times, and congestion, reducing the quality of the visitor experience.
- **Conflict**: Competition for limited resources, such as campsites or parking spaces, can result in conflicts among visitors, compromising their enjoyment and safety.
- **Depreciative Behavior:** Improper waste disposal, graffiti, vandalism, and other forms of depreciative behavior can negatively impact the aesthetic appeal of natural and cultural landscapes, as well as visitor satisfaction.

Impacts to Facilities and Services

- **Attraction Sites:** Heavy foot traffic and inadequate management can cause wear on popular attractions, leading to the degradation of natural and cultural features.
- **Trails:** Insufficient maintenance, improper use, and trail erosion can result in trail degradation (photo 18), safety hazards, and harm to surrounding ecosystems.
- **Campgrounds and Campsites**: Increased demand for camping facilities can lead to overuse, damage to vegetation, soil compaction, and strain on sanitation systems.
- **Roads and Parking:** Congestion, traffic, and inadequate parking facilities can disrupt the flow of vehicles, create safety concerns, and harm nearby habitats.
- **Interpretive Facilities and Programs:** Insufficient funding or staffing for interpretive services can limit educational opportunities and visitor understanding of park resources and values.

These management problems require effective planning, resource allocation, visitor education, enforcement of regulations, and sustainable practices to mitigate the impacts and maintain the ecological integrity and visitor experience in national parks.

To effectively manage outdoor recreation in national parks and address the mentioned challenges and impacts, several strategies and practices can be implemented (Manning, Anderson 2012). These strategies aim to balance visitor use and enjoyment while minimizing negative impacts on resources, experiences, and facilities. Here are some common management strategies:

Photo 18. The absence of regular maintenance of hiking trails is the cause of the creation of secondary paths (High Tatras NP) Photo: Juraj Švajda.

Limit Use

- **Alternative Sites and Times:** Encourage visitors to explore less crowded areas of the park, or visit during off-peak seasons to distribute visitation and reduce crowding at popular sites.
- **Set Capacity:** Establish visitor capacity limits for sensitive areas or attractions to prevent overcrowding and protect resources. Implement a reservation (photo 19) or permit system to manage access.
- **Require Fee:** Implement entrance fees or user fees to manage demand, fund visitor services, and support conservation efforts.
- **Limit Group Size:** Set maximum group size limits for certain activities to minimize the impact on resources and enhance visitor experiences.
- **Zoning:** Designate specific zones within the park for different activities or levels of use, ensuring that sensitive areas are protected and visitor experiences are optimized.
- **Sanctions:** Enforce regulations and impose penalties for violators to deter depreciative behavior and ensure compliance with park rules.

Increase Supply

- **Infrastructure Development**: Improve and expand visitor facilities, such as campgrounds, trails, parking areas, and restrooms, to accommodate increased visitation and distribute the impacts.
- **Visitor Information and Communication:** Enhance communication and dissemination of information to visitors, providing guidance on park rules, recommended practices, and alternative recreational opportunities.
- **Visitor Services:** Increase the availability of visitor services, such as interpretive programs, guided tours, and educational resources, to enhance visitor experiences and foster a deeper understanding of park resources.

Photo 19. One of the ways to limit use is to allow a limited number of entries based on permits (Pico del Teide, Tenerife)
Photo: Juraj Švajda.

Reduce Impact of Use

- **Education and Outreach:** Implement visitor education programs to raise awareness about the importance of responsible outdoor recreation, Leave No Trace principles, and specific park regulations.
- **Trail Management:** Develop and maintain sustainable trail systems, including proper signage, trail markers, and erosion control measures, to minimize impacts on vegetation, soil, and wildlife habitats.
- **Waste Management:** Provide sufficient trash receptacles, recycling facilities, and proper waste disposal methods throughout the park to reduce litter and pollution.
- **Restoration and Rehabilitation:** Implement restoration projects to rehabilitate damaged areas and restore ecosystems affected by recreational activities.
- **Monitoring and Research:** Conduct regular monitoring and research to assess the impacts of outdoor recreation and inform management decisions and adaptive strategies.

Harden the Resource and Experience

- **Designated Viewing Areas:** Establish designated viewing areas or platforms to concentrate visitor use in specific locations, reducing impacts on sensitive habitats and cultural resources.
- **Visitor Use Management Techniques:** Implement infrastructure or design features, such as boardwalks, barriers, and signs, to direct visitor flow and protect sensitive areas.
- **Interpretive Signage:** Install interpretive signs and displays at key locations to provide information and enhance visitor understanding without direct physical interaction with resources.
- **Technology Solutions:** Utilize technology, such as virtual reality, mobile applications, or interactive exhibits, to provide immersive experiences and reduce physical impact on resources.

Implementing these strategies often requires collaboration among park management, staff, local communities, and visitors. Continuous evaluation,

adaptive management, and stakeholder engagement are essential for ensuring the long-term sustainability of outdoor recreation in national parks.

There are many different concepts involved in visitor regulation and sustainable tourism support (Hammitt el al. 2015). These steps typically include planning, active management with concrete measures, monitoring, and adaptation of measures. The **Limits of Acceptable Change (LAC)** approach is one method used to determine the level of human activity that a particular area or ecosystem can sustain without incurring significant damage.

The LAC approach assumes that human use of an area, to varying degrees, can lead to detrimental effects on the environment. After identifying anthropogenic changes to the territory, measures are implemented to minimize or eliminate these impacts. The goal is to establish limits that prevent excessive harm to the natural resources and maintain ecological integrity.

In addition to the LAC model, there are other frameworks used in visitor management and sustainable tourism (fig.16). One such framework is the **Visitor Impact Management (VIM)** approach, which focuses on mitigating the negative impacts of visitors while maximizing the positive ones. VIM involves identifying, assessing, and managing the impacts of visitor activities on the environment, local communities, and the visitor experience.

Another model is the **Visitor Experience and Resource Protection (VERP)** framework, which aims to balance the protection of natural and cultural resources with providing high-quality visitor experiences. VERP considers factors such as visitor enjoyment, resource preservation, education, and collaboration with stakeholders to achieve sustainable tourism outcomes.

It is important to note that the concept of ecological carrying capacity acknowledges that the impact of visitor attendance is not solely determined by the number of visitors but also by various other factors. These factors can include visitor behavior, the state of infrastructure, the resilience of soil and vegetation, and the overall condition of the ecosystem. This broader perspective recognizes that managing visitor impacts requires a comprehensive understanding of the ecological, social, and economic dynamics of a destination.

By considering these models and concepts, destination managers and policymakers can develop strategies and implement measures that promote sustainable tourism and minimize negative impacts on the environment and local communities.

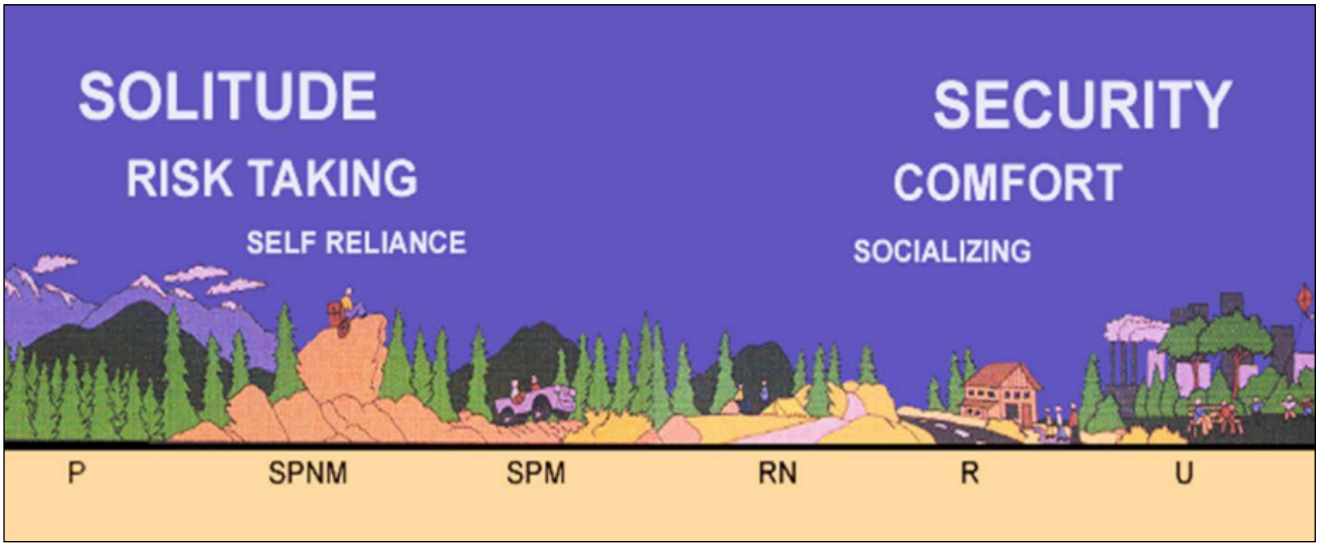


Fig. 16. Since the early 1980s, the Recreation Opportunity Spectrum (ROS) has been used as a framework to identify, classify, plan, and manage a range of recreation settings for both existing and desired conditions. ROS remains the best available framework for recreation planning. Six distinct settings: urban, rural, roaded natural, semi-primitive motorized, semi-primitive non-motorized, and primitive are defined using specific physical, social, and managerial setting criteria

Source: fs.usda.gov.

5.3. Methods

The impacts of tourism on protected areas should be carefully assessed, considering that different species and ecosystems can have varying tolerance levels to human presence and activities. The intensity of visits, particularly in wilderness tourism settings, can significantly influence these impacts.

Implementing an ecosystem approach and adaptive management (Worboys et al. 2015) can help in understanding the long-term effects of tourism on wildlife behavior, stress levels, reproduction, and overall animal health. This approach involves monitoring and evaluating the ecological dynamics within the protected areas, considering the interactions between species, their habitats, and the influence of tourism activities.

By continuously monitoring and assessing the impacts of tourism, managers can gather data on changes in animal behavior, stress responses, reproductive patterns, and overall health. This information enables them to make informed decisions and adapt management strategies to minimize negative impacts and ensure the long-term conservation of the protected area and its biodiversity.

For example, if it is observed that certain species are experiencing increased stress or alterations in their reproductive patterns due to tourism activities, management actions can be taken to mitigate these effects. This might involve implementing visitor use restrictions, adjusting visitor routes or timing, providing education and interpretation programs to promote responsible behavior, or enhancing infrastructure to minimize disturbance.

Adaptive management also allows for flexibility and responsiveness to changing conditions. This involves setting management objectives, implementing strategies, monitoring the outcomes, and adjusting management actions based on the information gathered. This iterative process helps in refining and improving management practices over time, ensuring that the impacts of tourism on protected areas are continually evaluated and managed effectively.

By taking a comprehensive approach that considers the ecological impacts of tourism on wildlife and ecosystems, protected area managers can strive to maintain the balance between sustainable tourism and the conservation of natural resources. This approach promotes responsible tourism practices that minimize negative effects on wildlife, while still providing visitors with meaningful and enjoyable experiences in protected areas.

The statement: *you can't manage what you don't measure*, emphasizes the importance of quantifiable data in effective management. By measuring and tracking key metrics, businesses and individuals gain valuable insights into their performance, identify areas for improvement, and make informed decisions (Hadwen et al. 2007).

When it comes to management, measurement provides several benefits:

1. **Performance evaluation:** Metrics enable managers to assess the performance of individuals, teams, or departments objectively. Measuring key performance indicators (KPIs) helps identify areas of strength and areas that require attention, allowing for targeted improvement strategies.
2. **Goal setting and progress tracking:** Clear and measurable goals provide a basis for setting expectations and defining success. By tracking progress against these goals, managers can identify if they are on track or need to adjust strategies to achieve desired outcomes.
3. **Data-driven decision-making:** Quantitative data provides a factual foundation for decision-making. When managers have access to reliable measurements, they can evaluate options, prioritize initiatives, and allocate resources more effectively.
4. **Identifying trends and patterns:** Regular measurement and analysis of data can reveal trends and patterns that might not be immediately apparent. These insights can uncover potential opportunities or issues that need to be addressed, helping managers take proactive steps.
5. **Accountability and transparency:** Measurement promotes accountability by providing an objective basis for evaluating performance. When employees understand how their work is being measured and monitored, it fosters transparency and encourages a results-oriented culture.

It's important to note that not all aspects of management can be easily measured, especially when dealing with subjective or qualitative factors. However, where possible, incorporating measurement into management practices provides a solid foundation for improvement and decision-making.

Visitor impact monitoring in protected areas involves assessing and evaluating the effects of visitor activities on the natural environment, cultural heritage, and overall visitor experience (Hadwen et al. 2008). Similar to biodiversity monitoring programs in conservation areas (see Dalton et al. 2023), several key components should be considered, to establish

a conceptual framework and methods for visitor impact monitoring:

1. **Identify monitoring objectives:** Clearly define the objectives of the monitoring program. This may include assessing the ecological impacts, understanding visitor behavior patterns, evaluating the effectiveness of management strategies, or ensuring compliance with regulations.
2. **Select indicators:** Choose indicators that reflect the specific impacts of visitor activities on the protected area. These indicators should be measurable, relevant, and scientifically sound. Examples of indicators include changes in vegetation cover (photo 20), wildlife disturbance, visitor satisfaction levels, or visitor use patterns.

Photo 20. Assessment of the hiking trail - identification of the current state of changes in vegetation and ground cover

Photo: Juraj Švajda.

3. **Establish a baseline:** Before monitoring impacts, establish a baseline of conditions to serve as a reference point for future comparisons. This may involve conducting initial assessments of the protected area's resources, visitor numbers, visitor activities, or other relevant factors.
4. **Design monitoring methods:** Determine the appropriate monitoring methods based on the identified objectives and indicators. Monitoring methods can include field observations, surveys, remote sensing techniques, data collection through technology (e.g. cameras, sensors), or a combination of approaches. Consider the resources, expertise, and logistical constraints when selecting monitoring methods.
5. **Develop data collection protocols:** Define standardized protocols for data collection to ensure consistency and comparability of data over time. This includes specifying sampling methods, data recording techniques, and quality control measures. Protocols should be detailed and easy to follow for consistent data collection by trained personnel.
6. **Analyze and interpret data:** Once data is collected, analyze and interpret the findings. Statistical analyses, trend analysis, spatial analysis, and other relevant techniques can be used to assess the impacts and identify patterns or trends. Consider involving experts in data analysis to ensure robust interpretation.
7. **Communicate and report:** Share the monitoring results with relevant stakeholders, including protected area managers, policymakers, local communities, and visitors. Present the findings in a clear and understandable manner, using visual aids and non-technical language whenever possible. The reports can help guide management decisions, enhance visitor education programs, and foster stakeholder engagement.
8. **Adapt management strategies:** Utilize the monitoring results to inform adaptive management strategies. If significant impacts are identified, managers can modify visitor use plans, adjust infrastructure, implement visitor education initiatives, or revise regulations to mitigate the negative effects.

Regular monitoring and periodic reassessment of impacts are essential to track changes over time, evaluate the effectiveness of management actions, and ensure the long-term sustainability of protected areas. By following a robust conceptual framework and employing appropriate monitoring methods, the process can provide valuable insights for effective protected area management.

5.4. Practical implications

5.4.1. Case study GetDiv experiment

Due to predominately local problems and issues related to nature tourism, the research is in similar fashion predominantly focusing on the local scale. When studying how visitors affect nature when using nature trails, or what are the nature conservation or other regulatory actions that can be implemented for preserving certain species or habitat – the study objects are almost always one or a few trails on protected areas in developed countries (Ballantyne, Pickering 2015). This means that the range of habitats and ecosystems studied is relatively limited – constrained mostly to Northern hemisphere temperate zone habitats (Barros et al. 2013; Ballantyne, Pickering 2015; Godtman Kling et al. 2017) as this is where majority of developed countries are geographically located. In addition, visitor effects are often studied through changes in locally specific indicator or protected species (Niu, Cheng 2019; Wraith, Pickering 2017). Therefore, the comparability of the existing nature tourism studies on how visitors affect the nature along the nature trails (which is the most common way tourists experience nature) is very low (Ballantyne, Pickering 2015; Laanisto et al. 2023).

Nevertheless, a methodologically comparable assessment of the effects of visitors on nature in different habitats and ecosystems on a global or at least regional scale could answer many important questions of which we do not yet have basic understanding: What is the overall effect of visitors on nature on and around nature trails? What is the intensity, range and persistence of these effects? Is there a threshold for visitor load beyond which a significant turn towards negative effects would result? Does it depend on the trail length, width, remoteness, or habitat type? Do the effects vary by different habitat types, biomes, or social and cultural regions? Having a larger scale understanding of the patterns how visitors affect nature when experiencing it, would also provide useful information for understanding the same processes on a local scale, and in making informative decisions about visitor regulations etc. This would help to put the results into a wider context, but it could also help to better predict changes on a local scale. In order to achieve that, comparable ecological data together with quantitative information about visitors is needed (Laanisto et al. 2023).

For that there is an ongoing meta-experiment (which means that anyone can participate if they are willing to carry out fieldwork using the exact same methodological approach) GetDiv – Global experiment on trail diversity (Laanisto et al. 2023). GetDiv is a global collaboration – everyone can participate by filling out the field protocol in one or more nature trails of their choice. The focus of GetDiv is in observing the changes in the vegetation along nature trails. A detailed description on how to do that can be found on the GetDiv webpage: https://getdiv.wordpress.com/. For participation, basic knowledge of how to survey plant species richness on 1x1m quadrat transect is needed (fig. 17). Knowledge of plant species is strongly recommended. Minimum contribution per

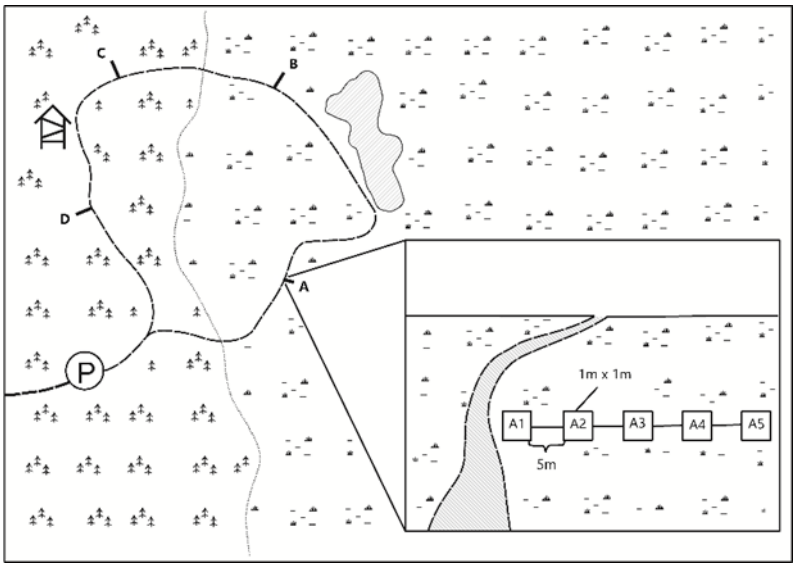


Fig. 17. Example of placing transects along a hiking trail with different types of habitats and number of visitors. Plant species list and cover, mean height of vegetation and trampling are registered on individual quadrats
Source: GetDiv methodology.

one person to qualify as a co-author is data from at least two transects from the same habitat type from the same trail. In order to qualify for co-authorship in the first GetDiv publication, the deadline for contribution is 31st of December 2024. Data sent after that will be used for subsequent studies.

Preliminary results on applying this methodology in Estonian nature trails indicated that there is a significant negative relationship between plant diversity along the trail and the annual number of visitors (Laanisto et al. 2023).

5.4.2. Measuring sustainability and quality of ecotourism in PAs

Formally launched in 2018, the MEET Network is a registered association of Mediterranean protected areas (PAs) that supports park managers with ecotourism development through knowledge exchange, capacity building, advocacy, and tools for product development and management. To date, MEET has worked with nearly 40 protected areas in 12 countries on creating an innovative model for ecotourism itinerary development in Mediterranean Protected Areas, promoting ecotourism products in and around protected areas, in a way that is coherent and applicable to the Mediterranean region's unique assets and particularities.

The MEET Network model has a product-based approach that places quality, participatory process, capacity building and sustainability at the core of every ecotourism itinerary. This product-based model boosts collaboration between protected area staff and local tourism service providers. Ultimately MEET enables parks to advance their own ecotourism efforts locally while engaging in meaningful exchanges and marketing their products under a common regional brand.

MEET products differentiate themselves from others through the following features:

- Parks and Conservation Focus: it ensures that nature conservation remains at the core of the product offerings.
- Community-Based Approach: MEET mandates that all products are developed and managed in a participatory manner, considering the needs of the local communities and market demands.
- Integration of Conservation Activities: it requires conservation to be an integral part of the developed activities, fostering a direct connection with conservation efforts.
- Local Supply Chain Management: MEET expects the entire supply chain of its products to be managed by local service providers, including local tour operators, ensuring local engagement and economic benefits.

For this purpose, MEET has developed several tools and resources that can be adapted to fit into different contexts of sustainable tourism development, such as:

- The Governance Model: a framework for facilitating public-private collaboration in ecotourism development, specifically focusing on Local Ecotourism Clusters.
- The MEET standard: a set of guidelines and standards that assist destinations in measuring and managing the quality, sustainability, and social impact of ecotourism products they create.
- The Online Monitoring Platform: an online tool designed that allows ecotourism destinations in and around protected areas to conduct self-assessments of the sustainability and quality of their multi-day tourism products, aligning them with the comprehensive criteria of the MEET Standard.
- The Ecological Footprint Calculator: a methodology for measuring the Ecological Footprint of ecotourism itineraries and identifying key drivers of environmental impact.

These tools empower destinations and stakeholders to develop ecotourism products while prioritizing quality, sustainability, and community well-being.

The MEET Standard

Ecotourism is frequently portrayed as an environmentally friendly alternative to traditional tourism. To substantiate this perspective, it is necessary to measure the sustainability of ecotourism packages in Protected Areas. MEET has developed a complete set of criteria and indicators to measure this.

The MEET Standard is an integrated approach, that deals with all the relevant aspects necessary to set up an ecotourism offer in Protected Area destinations, from assessing governance and conservation within the Protected Areas, to the quality of ecotourism product design and development; from the assessment of the product's Ecological Footprint, to the evaluation of the socio-economic performance of the service providers involved in the ecotourism product.

This standard has been tested in nine pilot actions located in nine different protected areas of the Mediterranean basin in the framework of the European project DestiMED PLUS.

The standard is organized around two main pillars: one dealing with the **destination** and one with the **ecotourism product** (e.g.: the package). Both pillars (fig. 18) consist of a set of indicators, grouped according to different criteria, that are used to assess the performance of the destination and of the defined ecotourism product against the standard.

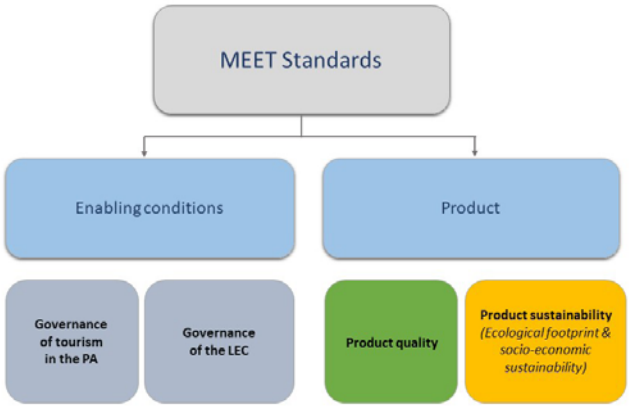


Fig. 18. The MEET Standard
Source: MEET network.

.Data is collected on each of the indicators using questionnaires, and the results of the standard assessment are quantitative, scoring from -2 to 2, in a Likert scale (fig. 19):

2	Ideal performance
1	Intermediate positive performance
0	Compliance
-1	Intermediate negative performance
-2	No data or non-acceptable performance

Fig. 19. Linkert scale used in MEET
Source: MEET network.

In order to comply with the standard, the results must be at least a 0 for each criterion. Alongside with these quantitative values, a series of guidelines and recommendations are given, in order to support destination managers to improve the performance of the destination and thus increasing the quality of the final ecotourism product.

There are four MEET standard monitoring tools, possible to measure, being:

- **Social Impact Assessment of Ecotourism Suppliers** - measures the social impact of diverse suppliers and facilities across critical social topics, encompassing four key stakeholder groups: workers, local communities, value chain, and visitors.
- **Enabling Conditions in the Destination: Governance and Conservation** - This tool assesses the enabling environment, ensuring that tourism effectively benefits both conservation efforts and local communities, while proactively preventing any adverse impacts.
- **Product Quality Assessment of an Ecotourism Itinerary** - This questionnaire allows to ascertain whether or not the itinerary aligns with the expectations of customers, buyers, and local stakeholders. It ensures compliance with the MEET Network's products, covering crucial aspects such as tour leading, guiding and interpretation, supplier selection, and itinerary design.
- **Ecological Footprint Calculator** - The calculator measures and comprehensively analyzes the ecological footprint of the itinerary, considering the four fundamental components of an ecotourism package: accommodation, food & beverages, transfers, and activities.

These tools can be found online at the MEET monitoring platform: https://monitoring.meetnetwork.org/

These monitoring tools allow ecotourism destinations in and around Protected Areas to self-assess the sustainability and quality of multi-day tourism products in Protected Areas against the comprehensive criteria of the MEET Standard.

Conclusions

Nature conservation is not a new paradigm, however, the reasons for the protection of nature evolved through the history of humanity. Firstly, the particular areas were protected for religious or economic reasons. Much later, nature came to be protected for "itself" (for aesthetic reasons), or to save endangered species. Nevertheless, it must be emphasized that the first national park, the Yellowstone National Park, was established not only for nature conservation, but also for human well-being and for the future generations (Mika et al. 2015).

Nature areas have become very popular destinations all over the world, thus nowadays we observed that the number of visitors in such vulnerable areas consequently increase, which may lead to overload of some sensitive areas. Overtourism negatively affects not only nature, but also the tourists' level of satisfaction (Somarriba-Chang, Wallentinus 2012; Belsoy et al. 2012; Ferreira, Harmse 2014). Having an effective management plan is crucial for striking a balance between increasing the number of visitors and conserving nature. However, Peter Ducker said: *You can't manage what you don't measure*, which means that effective visitor monitoring and managing is not possible without the knowledge of visitor numbers, behaviors, attitudes, spatial dispersion, etc. Visitor counting and surveying are crucial in the general visitor management plan (Cessford, Muhar 2003; Kajala et al. 2007). Moreover, it is crucial to conduct such research regularly and using comparable methods.

Responsible tourism management cannot be efficient without the engagement of visitors and the local community. However, people will not feel the necessity to care for and protect nature, if they do not appreciate it, and people will not appreciate nature, if they do not understand why it is important for them. They will not understand nature's importance, if someone does not effectively interpret the value of such areas to them. Heritage interpretation plays an important role in enhancing visitors' satisfaction in protected areas, which may lead to a deeper connection between visitors or the local community, and the unique heritage of each protected area. Effective communications can also play a significant role in supporting responsible tourism management. A successful communication strategy can educate the visitors and the local community on the value of such areas, raise the ecological awareness, and foster a sense of responsibility for a particular protected area.

We hope that this guidebook will provide readers with comprehensive knowledge on effective tools and methods, which can be practically used for responsible visitor monitoring and management strategy.

References

Anderson M., 2012, *New Ecological Paradigm (NEP) Scale. 2012,* Available online: https://umaine.edu/soe/wp-content/uploads/sites/199/2013/01/NewEcologicalParadigm-NEPScale1.pdf

Arnberger A., Brandenburg Ch., Haider W., 2005, *Evaluating Visitor-Monitoring Techniques: A comparison of Counting and Video Observation Data*, Environmental Management 36 (2), 317-327.

Ballantyne M., Pickering C. M., 2015, *The impacts of trail infrastructure on vegetation and soils: Current literature and future directions,* Journal of Environmental Management, 164, 53-64.

Barros A., Gonnet J., Pickering C.M., 2013, *Impacts of informal trails on vegetation and soils in the highest protected area in the Southern Hemisphere,* Journal of environmental management, 127, 50-60.

Barros C., Gutiérrez J., García-Palomares J., 2022, *Geotagged data from social media in visitor monitoring of protected areas; a scoping review.* Current Issues in Tourism, 25:9, 1399-1415, https://doi.org/10.1080/13683500.2021.1931053

Beck L., Cable T., 2011, *The Gifts of Interpretation: Fifteen Guiding Principles for Interpreting Nature and Culture,* Sagamore Publishing.

Belsoy J., Korir J., Yego J. 2012, *Environmental impacts of tourism in protected areas,* Journal of Environment and Earth Science, 2, 64–73.

Bieger T., Laesser Ch., 2002, *Market segmentation by motivation: The case of Switzerland,* Journal of Travel Research, vol. 41, 68-76.

Boakye G. O., Frempong F., Wiafe J. O., 2022, *Technology Adaptation in the Travel Industry of Ghana,* Tourism Today, 76.

Cataldo L., 2011, *Dal Museum Theatre al Digital Storytelling. Nuove forme della comunicazione museale fra teatro, multimedialità e narrazione: Nuove forme della comunicazione museale fra teatro, multimedialità e narrazione,* FrancoAngeli.

Carter, J., 1997, A sense of Place: an interpretive planning handbook Tourism and Environment Initiative. Inverness.

Cessford G., Muhar A., 2003, *Monitoring options for visitor numbers in national parks and natural areas,* Journal for Nature Conservation 11 (4), 240-250, https://doi.org/10.1078/1617-1381-00055

Cole D.N., 2004, *Carrying capacity and visitor management: Facts, values, and the role of science*, [in:] D. Harmon, B.M. Kilgore, G.E. Vietzke (eds.), Protecting Our Diverse Heritage: The Role of Parks, Protected Areas, and Cultural Sites, The George Wright Society. Proceedings of the 2003 George Wright Society/National Park Service Joint Conference, Hancock, Michigan, 43-46.

Coleman J., 2011, *QR codes: what are they and why should you care?,* Kansas Library Association College and University Libraries Section Proceedings, 1, 16-23.

Daniel T., Boster R., 1976, Measuring Landscape Esthetics: The Scenic Beauty Estimation Method, USDA Forest Services, Research Paper RM 167.

Dalton D.T., Berger V., Adams V., Botha J., Halloy S., Kirchmeir H., Sovinc A., Steinbauer K., Švara V., Jungmeier M., 2023, *A Conceptual Framework for Biodiversity Monitoring Programs in Conservation Areas*, Sustainability 15, 6779.

Di Pietro L., Guglielmetti Mugion R., Renzi M. F., 2018, *Heritage and identity: technology, values and visitor experiences,* Vol. 13, 97-103, Taylor & Francis.

Dolnicar S., Grün B., 2008, *Challenging "Factor–Cluster Segmentation*, Journal of Travel Research 47, 63-71.

Duan P., Wang Y., Yin P., 2020, *Remote Sensing Applications in Monitoring of Protected Areas: A Bibliometric Analysis,* Remote Sensing, 12(5):772. https://doi.org/10.3390/rs12050772

Dwyer P., 2007, *Measuring the value of electronic word of mouth and its impact in consumer communities,* Journal of Interactive marketing, 21(2), 63-79.

Eagles P. F. J., McCool S., Haynes C. D., 2002, *Sustainable Tourism in Protected Areas: Guidelines for Planning and Management,* IUCN Gland, Switzerland and Cambridge, UK. xv + -1-183.

Fab Lab Barcelona 2021: *Communication Handbook, The Communication Model Canvas based on Strategyzer's business model canvas,* https://books.fablabbcn.org/communication-handbook/how-channels-and-actions/reach-and-engage-your-audience/the-communication-model-canvas, data access: 02.08.2023.

Fairweather J.R., Swaffield S.R., Simmons D.G., 1998, Understanding visitors' experiences in Kaikoura using photographs of landscapes and Q method, Tourism Research and Education Centre, Rep. 5.

Farías-Torbidoni E.-I, Dorado V., Morera S., Nogueira-Mendes R., 2022, *Optimizing the use of automatic counters to monitor visits to protected natural areas: the case study of Montsant Natural Park, Spain,* Current Issues in Tourism, https://doi.org/10.1080/13683500.2022.2119551

Ferreira S., Harmse A., 2014, *Kruger National Park: Tourism development and issues around the management of large numbers of tourists*, Journal of Ecotourism 13(1):16–34.

Frankfort Nachmias Ch., Nachmias D., 1996, *Metody badawcze w naukach społecznych,* 1-615.

García-Palomares J. C., Gutiérrez J., Mínguez, C., 2015, *Identification of tourist hot spots based on social networks: A comparative analysis of European metropolises using photo -sharing services and GIS,* Applied Geography, 63, 408-417.

Garrigós S., Narangajavana Y., Palacios Marqués D., 2004, *Carrying capacity in the tourism industry: a case study of Hengistbury Head*, Tourism Management 25, 275–283.

Godtman Kling K., Fredman P., Wall-Reinius S., 2017, *Trails for tourism and outdoor recreation: A systematic literature review,* Turizam: međunarodni znanstveno-stručni časopis, 65(4), 488-508.

Gom D., Yoag A., Tanakinjal G. H., Siganul R. S., Jiony M. M., 2019, *E-book on Uncovering the Pearl of Borneo–Labuan through our Lens (From the Innovation Perspective).*

Hadwen W.L., Hill W., Pickering C.M., 2007, *Icons under threat: Why monitoring visitors and their ecological impacts in protected areas matters*, Ecological Management & Restoration 8 (3): 177-181.

Hadwen W.L., Hill W., Pickering C.M., 2008, *Linking Visitor Impact Research to Visitor Impact Monitoring in Protected Areas,* Journal of Ecotourism 7 (1). https://www.tandfonline.com/doi/abs/10.2167/joe193.0

Haley R.I., 1968, *Benefit Segmentation: A Decision-oriented Research Tool,* Journal of Marketing 32, 30-35.

Ham, S. 1992, Environmental Interpretation: A Practical Guide for People with Big Ideas and Small Budgets. North American Press, ISBN 1555919022.

Hammitt W. E., Cole D. N., Monz C. A., 2015, *Wildland recreation,* Wiley Blackwell, 3rd edition, 1-313.

Hausmann A., Toivonen T., Slotow R., Tenkanen H., Moilanen A., Heikinheimo V., Di Minin E., 2018, *Social Media Data Can Be Used to Understand Tourists' Preferences for Nature-Based Experiences in Protected Areas,* Conservation Letters, 11: e12343. https://doi.org/10.1111/conl.12343

Hausser Y., Travis T., Finger-Stich A., 2006, *Beyond Carrying Capacity in Recreation Management: In Search of Alternatives,* [in:] D. Siegrist, C., Clivaz, M. Hunziker, S. Iten (eds.), Exploring the Nature of Management, Proceedings of the Third International Conference on Monitoring and Management of Visitor Flows in Recreational and Protected Areas, University of Applied Sciences Rapperswil, Switzerland, 13-17 September 2006, Rapperswil, 191-192.

Hesselink F.J. e. a., 2007 *Communication, Education and Public Awareness, a toolkit for the Convention on Biological Convention,* Montreal.

Hibner J., 2015, *Rola prac terenowych w badaniach natężenia ruchu turystycznego na górskich obszarach chronionych na przykładzie Łomnickiego Stawu,* [in:] J. Balon, P. Krąż, E. Mocior, M. Rechciński (eds.), Problemy Ekologii Krajobrazu. Rola badań terenowych w studiach krajobrazowych XXI wieku, t. 39, IGiGP UJ, Kraków, 129-137.

Hibner J., Taczanowska K., Zięba A., Brandenburg C., Muhar A., Balon J., 2018, *Visitor profiling for cable car mountain destinations as a basis for protected area management: a case study of the summer season in the Tatra Mountains at Kasprowy Wierch (Poland) and Skalnaté Pleso (Slovakia),* eco.mont - Journal on Protected Mountain Areas Research and Management 1 (10), 24-35.

Hornback K. E., Eagles P. F. J, 1999, *Guidelines for public use measurement and reporting at parks and protected areas*, IUCN, Gland, Switzerland and Cambridge, UK, www.iucn.org: 2–83

Imoos U., Hunziker M., 2015, *The effect of communicative and on-site measures on the behaviour of winter sports participants within protected mountain areas – results of a field experiment*, eco.mont - Journal on Protected Mountain Areas Research and Management 1 (7), 17-25.

Jodłowski M., 2020, *Udostępnianie górskich parków narodowych w Europie*, IGiGP UJ, Kraków, 1-508.

Kajala L., Almik A., Dahl R., Dikšaitė L., Erkkonen J., Fredman P., Jensen F., Søndergaard Karoles K., Sievänen T., Skov-Petersen H., Vistad O. I., Wallsten P., 2007, *Visitor monitoring in nature areas – a manual based on experiences from the Nordic and Baltic countries,* TemaNord, 1-207.

Katlav E. Ö., 2020, *QR code applications in tourism.* Handbook of Research on Smart Technology Applications in the Tourism Industry, 89-114, IGI Global.

Kim Y., Kim C.-K., Lee D. K., Lee H.-W., Andrada R. I. I. T, 2019, *Quantifying nature-based tourism in protected areas in developing countries by using social big data,* Tourism Management, 72, 249-256.

Konu, H., Kajala L., 2012, *Segmenting Protected Area Visitors Based on Their Motivations,* Nature Protection Publications of Metsähallitus. Series A 194, 1-74.

Krzymowska Kostrowicka A., 1999, *Geoekologia turystyki i wypoczynku*, PWN, 1-238.

Kulczyk S., 2013, *Krajobraz i turystyka. O wzajemnych relacjach*, Uniwersytet Warszawski Wydział Geografii i Studiów Regionalnych, 1-189.

Kurashima T., Iwata T., Irie G., Fujimura K., 2010, *Travel route recommendation using geotags in photo sharing sites*, Proceedings of the 19th ACM international conference on Information and knowledge management, Toronto, ON, Canada.

Laanisto L., Jaksi P., Härm L., Hallikma T., Kull T., Leung Y. F., 2023, *GetDiv—a call for a global coordinated study on plant diversity changes on nature trails,* Journal of Ecotourism, 1-12.

Lee C.-C., Chen M.-P., Wu W., Xing W., 2021, *The impacts of ICTs on tourism development: International evidence based on a panel quantile approach,* Information Technology & Tourism, 23(4), 509-547.

Leung Y.-F., Spenceley A., Hvenegaard G., Buckley R. (eds.), 2018, *Tourism and visitor management in protected areas: Guidelines for sustainability. Best Practice Protected Area Guidelines*, Series No. 27, Gland, Switzerland: IUCN, 1-120. https://doi.org/10.2305/IUCN.CH.2018.PAG.27.en

Manning R.E., 2002, *How Much is Too Much? Carrying Capacity of National Parks and Protected Areas*, [in:] A. Arnberger, C. Brandenburg, A. Muhar (eds.), Monitoring and Management of Visitor Flows in Recreational and Protected Areas, Conference Proceedings, 306-313.

Manning R. E., Anderson L. E., 2012, *Managing Outdoor Recreation: Case Studies in the National Parks*, 2nd Edition, CABI, 1- 243.

McCool S.F., Lime D.W., 2001, *Tourism Carrying Capacity: Tempting Fantasy or Useful Reality?*, Journal of Sustainable Tourism, 9:5, 372-388.

MEET Manual, 2019. https://monitoring.meetnetwork.org/wp-content/uploads/2023/03/meet2019-1.pdf

MEET Ecotourism Standard, https://static1.squarespace.com/static/5b07c60a96e76f9f641cdad6/t/64cb7ea4565f30169f89202a/1691057829047/3_2_2_Upgraded_DestiMED_Plus_Standard+vF.pdf

Mendes, R. M. N., Martins, G., & Silva, C. P. (2014). Geocaching and protected areas. Proceedings of The 7th International Conference on Monitoring and Management of Visitors in Recreational and Protected Areas: Local Community and Outdoor Recreation.

Mendes, R. N., Rodrigues, T., & Rodrigues, A. (2013). Urban geo-caching. What happened in Lisbon during the last decade. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 4, W1.

Mika M., Zawilińska B., Pawlusiński R., 2015, *Park narodowy a gospodarka lokalna. Model relacji ekonomicznych na przykładzie Babiogórskiego Parku Narodowego*, Instytut Geografii i Gospodarki Przestrzennej UJ, Kraków.

Miller A.B., Leung Y.-F., Kays R., 2017, *Coupling visitor and wildlife monitoring in protected areas using camera traps,* Journal of Outdoor Recreation and Tourism, 17, 44-53. https://doi.org/10.1016/j.jort.2016.09.007

Moore G., Hopkins J., 2021, *Urban parks and protected areas: on the front lines of a pandemic. Parks,* 27, 73-84.

Moscardo G., Pearce P., Morrison A., 2001, *Evaluating Different Bases for Market Segmentation*, Journal of Travel & Tourism Marketing 10(1): 29–49.

Muhar A., Arnberger A., Brandenburg C., 2002, *Methods for Visitor Monitoring in Recreational and Protected Areas: An Overview* [in:] A. Arnberger, C. Brandenburg, A. Muhar (eds.), Monitoring and Management of Visitor Flows in Recreational and Protected Areas, Conference Proceedings, Bodenkultur University of Vienna, Austria, 30.01-02.02.2002 r., 1-6.

Muñoz L., Hausner V.H., Monz CH.A., 2019 *Advantages and Limitations of Using Mobile Apps for Protected Area Monitoring and Management,* Society & Natural Resources, 32:4, 473-488, https://doi.org/10.1080/08941920.2018.1544680

Nasa M., Emphandhu D., 2010, *Visitor perception of crowding at Doi Inthanon summit, Doi Inthanon National Park,* [in:] M. Goossen, B. Elands, R. van Marwijk (eds.), Recreation, tourism and nature in a changing world, The Fifth International Conference on Monitoring and Management of Visitor Flows in Recreational and Protected Areas Wageningen, The Netherlands, 30 May - 3 June 2010, 157-159.

Needham M.D., Rollins R.B., Ceurvorst R.L., Wood C.J.B., Grimm K.E., Dearden P., 2010, *Motivations and Normative Evaluations of Summer Visitors at an Alpine Ski Area,* Journal of Travel Research 20 (10), 1-16.

Neuhofer B., Buhalis D., Ladkin A., 2014, *A typology of technology–enhanced tourism experiences,* International journal of tourism research, 16(4), 340-350.

NewGrove, 2020, *The Incredible Rise of Geotagging,* 4.

https://newgrove.com/the-incredible-rise-of-geotagging/, access data: 24.06.2023.

Niu L., Cheng Z., 2019, *Impact of tourism disturbances on forest vegetation in Wutai Mountain, China,* Environmental Monitoring and Assessment, 191-81.

NNG 2021 – Nielsen Norman Group: *Stakeholder Analysis for UX Projects*, https://www.nngroup.com/articles/stakeholder-analysis/, data access: 25.07.2023.

NPS, 2023, www.nps.gov, access data: 27.07.2023.

Park D-B., Yoon Y-S., 2009, *Segmentation by motivation in rural tourism: A Korean case study,* Tourism Management 30, 99-108.

Pietrzak M. 2010. *Podstawy i zastosowania ekologii krajobrazu – teoria i metodologia*, Leszno.

Przecławski K., 1996, *Człowiek a turystyka. Zarys socjologii turystyki*, Albis, Kraków, 1-160.

Rid W., Ezeuduji I.O., Pröbstl-Haider U., 2014, *Segmentation by motivation for rural tourism activities in The Gambia,* Tourism Management 40, 102-116.

Riungu G.K., Peterson B.A., Beeco J.A., Brown G., 2018, *Understanding visitors' spatial behavior: a review of spatial applications in parks,* Tourism Geographies, 20:5, 833-857, https://doi.org/10.1080/14616688.2018.1519720

Rogowski M., 2020, *Monitoring System of tourist traffic (MSTT) for tourists monitoring in mid-mountain national park, SW Poland,* J. Mt. Sci. 17, 2035–2047 https://doi.org/10.1007/s11629-019-5965-y

Ruler B., 2021, *Communication Planning: Agility is a Game Changer in Strategy Development,* International Journal of Strategic Communication, 15, 113-125, 10.1080/1553118X.2021.1898117.

Salas-Olmedo M. H., Moya-Gómez B., García-Palomares J. C., Gutiérrez J., 2018, *Tourists' digital footprint in cities: Comparing Big Data sources,* Tourism Management, 66, 13-25.

Schamel J., 2012, *Perception of crowding in a high-use German national park*, [in:] P. Fredman, M. Stenseke, H. Liljendahl, A. Mossing, D. Laven (eds.), The 6th International Conference on Monitoring and Management of Visitors in Recreational and Protected Areas Outdoor Recreation in Change – Current Knowledge and Future Challenges Stockholm, Sweden, August 21–24, 2012, 298-299.

Shelby L.B., Vaske J.J., 2007, *Perceived Crowding among Hunters and Anglers: A Meta-Analysis*, Human Dimensions of Wildlife, 12, 241–261.

Solima L., 2014, *Digital resources and approaches adopted by user-centred museums: The growing impact of the internet and social media.* In Handbook of research on management of cultural products: E-relationship marketing and accessibility perspectives, 181-199, IGI Global.

Solima L., Izzo F., 2018, *QR codes in cultural heritage tourism: New communications technologies and future prospects in Naples and Warsaw,* Journal of Heritage Tourism, 13(2), 115-127.

Somarriba-Chang M., Wallentinus H.G., 2012, *Recreational carrying capacity in hiking trails. Three case studies in pro-*

tected areas in Nicaragua, [in:] P. Fredman, M. Stenseke, H. Liljendahl, A. Mossing, D. Laven (eds.), The 6th International Conference on Monitoring and Management of Visitors in Recreational and Protected Areas Outdoor Recreation in Change – Current Knowledge and Future Challenges Stockholm, Sweden, August 21–24, 2012, 292–293.

Spielmaker K., 2020, *Understanding the Impact of Tagging Our Locations on Social Media,* https://greenlivingmag.com/why-nature-should-remain-secret-geotagging/, access data: 24.06.2023.

Spenceley A., Schägner J. P., Engels B., Cullinane Thomas C., Engelbauer M., Erkkonen J., Job H., Kajala L., Majewski L., Mayer M., Metzler D., Rylance A., Scheder N., Smith-Christensen C., Souza T. B., Woltering M., 2021, *Visitors count! Guidance for protected areas on the economic analysis of visitation,* United Nations Educational, Scientific and Cultural Organization, Paris, France and German Federal Agency for Nature Conservation, Bonn, Germany, 1–113, https://unesdoc.unesco.org/ark:/48223/pf0000378568

Staab J., Udas E., Mayer M., Taubenböck H., Job H., 2021, *Comparing established visitor monitoring approaches with triggered trail camera images and machine learning based computer vision,* Journal of Outdoor Recreation and Tourism, 35, 100387. https://doi.org/10.1016/j.jort.2021.100387

Stankey G.H., McCool S.F., 1984, *Carrying capacity in Recreational Settings: Evolution, Appraisal and Application*, Leisure Sciences, Volume 6, number 4, 453–473.

Sterl P., Wagner S., Arnberger A., 2004, *Social Carrying Capacity of Canoeists in Austria´s Danube Floodplains National Park,* Working Papers of the Finnish Forest Research Institute 2, 256–263.

Sterl P., Wagner S., Arnberger A., 2006, *Kanufahrer und ihre Präferenzen für Besucherzahlen - Untersuchungen zur Erholungsqualität im Nationalpark Donau-Auen*, Österreich, Naturschutz und Landschaftsplanung 38/3, 75–80.

Szreder M., 2010, *Metody i techniki sondażowych badań opinii*, Polskie Wydawnictwo Ekonomiczne, Warszawa, 1–254.

Sztaniszláv A., 2023, *Communication Strategy Workshop – Presentation at the VIMOMA workshop in Hungary*, Pomáz at 04.25.2023.

Taczanowska K., Zięba A., Brandenburg Ch., Muhar A., Preisel H., Zięba S., Krzeptowski J., Krajewska A., Kamińska K., Latosińska B., Hibner J., Makaruk W., Hat-Pawlikowska K., Sostmann H., Graf C., Benitez R., Bolos V., Gonzalez L.M., Garcia X., Toca-Herrera J.L., Zmrzlikar S., Ziobrowski Sz., 2016, *Monitoring ruchu turystycznego w Tatrzańskim Parku Narodowym – studium pilotażowe – Kasprowy Wierch 2014. Visitor monitoring in the Tatra National Park – a pilot study – Kasprowy Wierch*, Institute of Landscape Development, Recreation and Conservation Planning, University of Natural Resources and Life Sciences (BOKU), Tatrzański Park Narodowy. Final Report, 03.04.2016, 1–201.

Tilden F., 1957, *Interpreting our heritage: Principles and practices for visitor services in parks, museums, and historic places*, Chapel Hill: University of North Carolina Press.

Tufekci Z., 2014, *Big Questions for Social Media Big Data: Representativeness, Validity and Other Methodological Pitfalls*, Proceedings of the 8th International Conference on Weblogs and Social Media, ICWSM 2014, 8.

United Nations, 2023, *Information and communication technologies (ICT),* https://www.un.org/development/desa/socialperspectiveondevelopment/issues/information-and-communication-technologies-icts.html

Van Marwijk R., Taczanowska K., 2006, Types of Typologies - From Recreationists & Tourists to Artificial Agents, [in:] D. Siegrist, C. Clivaz, M. Hunziker, S. Iten (eds.), *Exploring the Nature of Management. Proceedings of the Third International Conference on Monitoring and Management of Visitor Flows in Recreational and Protected Areas.* University of Applied Sciences Rapperswil, Switzerland, 13-17 September 2006, Rapperswil, 499–501.

Veverka, J. A., 1994, Interpretive Master Planning, Falcon Press, ISBN 1560442743.

Walden-Schreiner C., Rossi S.D., Barros A., 2018, *Using crowd-sourced photos to assess seasonal patterns of visitor use in mountain-protected areas,* Ambio, 47, 781–793. https://doi.org/10.1007/s13280-018-1020-4

Wilkins E.J., Wood S.A., Smith J.W., 2021, *Uses and Limitations of Social Media to Inform Visitor Use Management in Parks and Protected Areas: A Systematic Review,* Environmental Management, 67, 120–132 (2021). https://doi.org/10.1007/s00267-020-01373-7

Winiarski R., Zdebski J., 2008, *Psychologia Turystyki*, Wydawnictwa Akademickie i Profesjonalne, Warszawa, 1–184.

Wood S. A., Guerry A. D., Silver J. M., Lacayo M., 2013, *Using social media to quantify nature-based tourism and recreation*, Scientific Reports, 3(1), 2976.

Worboys G. L., Lockwood M., Kothari A., Feary S., Pulsford I. (eds.), 2015, *Protected Area Governance and Management*, ANU Press, Canberra.

Wraith J., Pickering C.M., 2017, *Quantifying anthropogenic threats to orchids using the IUCN Red List,.* Ambio, 47(3), 307–317.

Wyttenbach M., Haider W., Pröbstl U., Rupf R., 2012, *Too many people in the mountains in the winter time?* [in:] P. Fredman, M. Stenseke, H. Liljendahl, A. Mossing, D. Laven (eds.), The 6th International Conference on Monitoring and Management of Visitors in Recreational and Protected Areas Outdoor Recreation in Change – Current Knowledge and Future Challenges Stockholm, Sweden, August 21–24, 2012, 296–297.

York A., 2017, *How to use Instagram geotag to engage with local followers,* https://sproutsocial.com/insights/instagram-geotag/, access data: 24.06.2023.

Zaręba D., 2010, *Ekoturystyka,* PWN, Warszawa, 1–183.

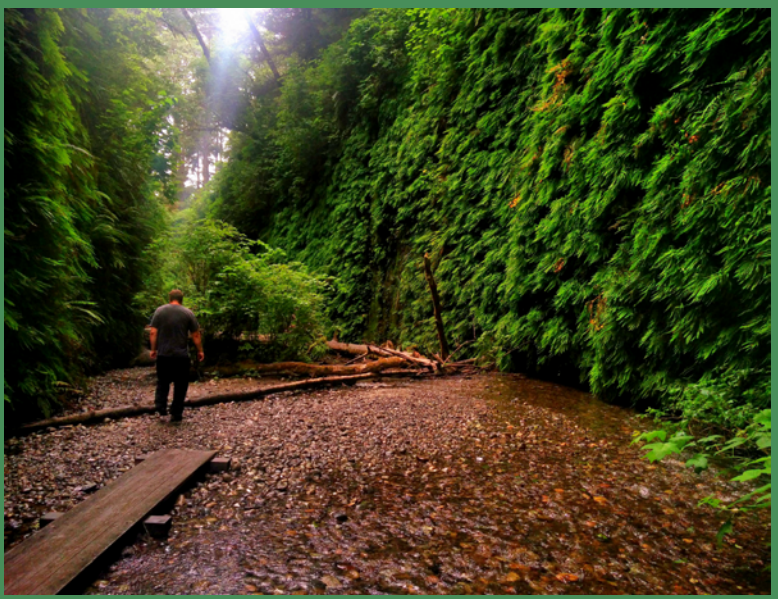
Zawilińska B., 2021, *Metody badania ruchu turystycznego i konsumpcji usług turystycznych w polskich parkach narodowych*, Studies of the Industrial Geography Commission of the Polish Geographical Society, 35. 10.24917/20801653.353.3.

OUR PROJECTS

01 HUMANITA

"The HUMANITA project aims to develop evidence-based and participatory management tools that allow regions to better monitor and evaluate the impacts of tourism in protected areas. Funded by the Interreg CENTRAL EUROPE Programme 2021-2027, HUMANITA (Human-Nature Interactions and Impacts of Tourist Activities on Protected Areas) project aims to address human-nature conflicts, increase understanding of recreational activities, like hiking, mountain biking and skiing with a scientific approach, and test innovative monitoring solutions in 5 pilot sites. Similar to the VIMOMA project, the HUMANITA project supports protected areas in better managing tourist activities and optimizing nature protection endeavors."
https://www.interreg-central.eu/projects/humanita/

02 GETDIV



Despite the growing popularity of nature tourism, and evermore tourism pressure on protected habitats, we have limited systemic knowledge of how it affects nature, from both an abiotic and biotic perspective, and what these effects are in different regions, habitats or trail types. There is a global lack of comparable data for gaining that knowledge. We propose a coordinated global experiment framework – GetDiv – for a comprehensive understanding of the effects of visitor's load on the vegetation of nature trails. This means that there is specific methodological approach for collecting comparable and comprehensive data of diverse aspects of nature trails, with a focus on plant diversity and functionality. And everyone interested can participate in this project and become a co-author in publishing the results. Our preliminary results using the GetDiv methodology, based on 20 nature trails in Estonia, show that plant diversity along the trails is negatively affected by visitoŕs load in both forest and open habitat (Laanisto et al. 2023 Journal of Ecotourism). All the necessary guidelines and protocols to fill out for participating in GetDiv are included in the GetDiv webpage:
https://getdiv.wordpress.com

OUR PROJECTS

TATRA NATIONAL PARK – ITS ECONOMIC FUNCTION AND THE COMMUNITY ATTITUDES

03

The Tatra National Park plays a pivotal role in the local socio-economic landscape. Its nature protection functions, essential from the state's perspective, have a positive ripple effect on the local economy, fostering growth across various sectors. The primary objective of this project was to assess the influence of the Tatra National Park (TNP) on the socio-economic development of the communes (gminas – first-level unit of administration) situated in its immediate vicinity. Furthermore, it aimed to investigate the attitudes and opinions of local community representatives towards the TNP as a form of nature protection and a public institution. This project is the continuation of research related with economic impact of tourism in Babia Góra National Park (Poland) and currently the research related with this topic are conducted in Roztocze National Park (Poland) by the team members.

OUR PARTNERS

Working hand-in-hand towards a better earth

Jagiellonian University

Jagiellonian University is a public institution with more than 650 years of tradition. Geography at the Jagiellonian University also has a long tradition. Faculty of Geography was founded, as first in Poland in 1849. Today Institute of Geography and Spatial Management and especially Department of Tourism and Health Resort Management has extensive experience in research concerning tourism and natural environment. Research regard different aspects with special attention to: tourism in mountainous areas; sustainable development of tourism; development of tourist function of natural protected areas; visitor monitoring at protected areas and economic function of national parks. Within VIMOMA project, Jagiellonian University is responsible for coordinating the project, organizing 1st workshop in Poland, entitled „Visitors survey as a tool for identifying motivations and perceptions of natural and recreational area visitors" as well as inviting PA managers and taking active part in other workshop
https://www.uj.edu.pl

Mendel University in Brno

Mendel University in Brno (MENDELU) is a public institution with a long tradition of excellence in teaching and research that has driven new ways of thinking since 1919 and proudly bears the name of Gregor Johann Mendel, the founder of modern genetics. MENDELU comprises one university institute and five faculties. The Faculty of Regional Development and International Studies (FRDIS) was established in 2008 as an answer to the need to perceive the ever-growing importance of the regions and strengthen their development in the context of economic, social, and environmental perspectives. Within the VIMOMA project, FRDIS MENDELU is responsible for organizing the 2nd workshop "Tools and methodologies for quantitative monitoring of visitors in protected areas" and together with partners from Czech national parks participates in all other workshops. As members of VIMOMA we are active in the exchange of experience and sharing modern approaches to the sustainable development of protected areas.
https://mendelu.cz/en/

OUR PARTNERS

Working hand-in-hand towards a better earth

Matej Bel University

Matej Bel University is a public university which achieved university status in 2010 and is a member of the European University Association. The university provides both high quality university and further education by encouraging creative scientific research. The University is a centre of research excellence and scientific and development projects are funded by means of European Structural Funds. Within the VIMOMA project, the university is responsible for organizing a 5th workshop focused on visitor impact monitoring in protected areas as well as for assisting in preparation of other meetings, inviting participants and taking active participation including discussion.
https://www.fpv.umb.sk/en/

University of Novi Sad

University of Novi Sad Faculty of Sciences (UNSPMF) is an educational and research institution with around 600 employees and 4500 students covering mathematics, physics, computer science, chemistry, biochemistry, environmental protection, ecology and geography. UNSPMF is firmly committed to internationalisation and is participating in available EU and global programmes funding education and research along with many bi- and multilateral education and research projects. Within the VIMOMA project, UNSPMF is responsible for organising 3rd workshop “Heritage interpretation and experience design for boosting visitors satisfaction” and will participate in all other workshops and activities, specially promotion of all VIMOMA outputs within Western Balkans region..
https://www.pmf.uns.ac.rs/en/

CEEweb for Biodiversity

CEEweb for Biodiversity is a network of 33 organisations from Central and Eastern Europe striving to conserve the natural heritage of the region, with a mission to work for biodiversity conservation through the promotion of sustainable development. CEEweb has successfully implemented multiple IVF-funded projects, and has experience in sustainable tourism-related projects, such as the Interreg DTP-funded INSiGHTS project. CEEweb has also experience in policy-making, advocacy and communication activities. Within the VIMOMA project, CEEweb is responsible for communication and dissemination of the project outcomes, as well as organising the workshop on communication tools to attract visitors and the development of the guideline’s chapter on communication.
https://www.ceeweb.org/

VIMOMA

authors

Joanna Hibner, Alice Kozumpliková, Djordjije Vasiljević, Ádám Varga, Thor Morante, Juraj Švajda, Bernadeta Zawilińska, Vladimir Markovič, Joseph Oppong Wiafe, Lauri Laanisto, Daniela Casimiro

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www.ceeweb.org

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