VISITOR MONITORING IN PROTECTED AREAS:
CONCEPTS, METHODS AND TRENDS

Abstract. The objective of this paper is to present a systematic overview on methods used for visitor monitoring in recreational areas. Emphasis is given on quantitative methods such as direct observation, video observation, counting devices and registration books. The various approaches are discussed with regard to practical, legal and organisational aspects, such as costs, maintenance requirements, dependence on infrastructure, risk of vandalism or suitability for remote and ecologically sensitive locations. As visitor monitoring can also be regarded as an interference with the privacy of the persons being monitored, ethical aspects of the application of the various methods must also be addressed. This article reviews the possibilities of using visitor monitoring in the management of a protected area using the example of the Moravian Karst Protected Landscape Area (PLA). The Moravian Karst is the largest and most significant Karst area in the Czech Republic. The disadvantages of visitor monitoring in protected areas are analysed in the discussion part.

Keywords: visitor management; protected areas management; visitor monitoring; visitor monitoring methods; tourism impacts; visitor impacts; sustainable tourism.

Introduction. Monitoring of vegetation and wildlife in recreational and protected areas has a long tradition. Growing demand for tourism and recreation opportunities in protected areas has led to an increase in visitor numbers worldwide (Hammit & Cole 1998; Newsome et al. 2002; Hadwen et al. 2007, p. 177). Numerous techniques are available for the monitoring of visitor flows in recreational areas. Understanding the number of visitors in national parks and other natural areas
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is essential for their management and marketing. An increase in tourist numbers may result in a higher disturbance of biodiversity (e.g., trampling on plants, disruption of feeding and breeding and decrease in species’ reproductive success) and pressure on the environment (e.g., resource consumption, pollution, erosion, loss of habitats), which challenges the sustainability of tourism (Tenkanen et al. 2017). Nevertheless, visitor growth has the potential to increase revenue for commercial businesses and park management authorities (Gormsen 1997; Weiler & Seidl 2004; Hadwen et al. 2007, p. 177).

Particularly in national parks, the scientific interest in the invention of monitoring methods and in observing the development of ecosystems has often been a driving force for the establishment of monitoring schemes. In many countries, systematic long-term research programmes are seen as part of the duty of a national park service (Muhar et al., 2002).

1. What do we need to know about visitors?

At present, the extent to which visitor data collection occurs is variable and depends on the staff and financial resources of the protected area, its popularity and the degree to which visitation is seen as either a threat or an opportunity to meeting the management objectives for the park (Buckley 2003).

What should be monitored?

From the definition of the goals of a monitoring scheme, the measurement units can be determined:

- Number of visits
- Number of (individual) visitors
- Visitor load (e.g., visitor hours)
- Visitor flow (e.g., persons/hour/direction)
- Visitor density (e.g., persons/length unit of trails)
- Visitor activities, etc.

According to Muhar et. al., in many cases it will be essential to register not only the visitors themselves and their activities but also some external factors which might have an effect on the visitation such as weather conditions, special events (e.g., sports competitions) or holidays (Muhar et al., 2002, p. 1).
When should monitoring occur?

In most European countries, systematic long-term visitor monitoring is hardly ever carried out. The most frequent type of counting activity is single-day counting. Very often, expected peak visitation days (e.g., Sundays in early summer) are selected for counting campaigns, and the results from these days are then used to alarm the public of excessive visitation. From numerous monitoring projects, carried out in both urban and in rural locations, we were able to learn that, for understanding the dynamics of recreational uses, it is necessary to have data which covers all seasons and all other external influences such as weather, daytime, etc. However, this does not mean that every single visitor has to be counted (Brandenburg 2001; Muhar et al., 2002, p. 2).

Where should monitoring occur?

Very often, monitoring is primarily carried out at entrance points (e.g., park gates, parking grounds) or visitor centres. These are also the locations where counting stations can easily be installed (electricity supply, security, etc.). This leads to an overrepresentation of short-time users or users with minimal activity radius. If the goal of the monitoring activities is to quantify interactions between visitors and the ecosystems, visitor monitoring in the core areas of a park is essential (Muhar et al., 2002, p. 2).

Who should be monitored?

Not every person encountered in a park or recreation area could be a visitor. The typical motives of a visitor are outdoor recreation or cultural appreciation (Hornback & Eagles 1999). Persons just passing through (e.g., by car on their way to work) or persons working in a recreational area such as forest workers, farmers or park employees should therefore not be considered as visitors. In order to report visitor numbers, they should not be included in usage statistics. (Muhar et al., 2002, p. 1).

How could monitoring occur?

1. Monitoring with the help of social media platforms

There is a sufficient amount of popular social media platforms. The most popular platform in the world, Facebook, is difficult to use for extensive research as
access to data is limited. Hence, scientists have used other platforms providing more easy access to public data. Among these, Flickr is one of the oldest social media platforms (established in 2004), popular especially for sharing pictures, whereas Twitter (established in 2006) is probably the most used short-text discussion forum in the world. Other platforms, such as Instagram (established in 2010) have recently gained popularity among people who own smartphones with high-quality cameras. Instagram remains a relatively unexplored source of data for research (Tenkanen et al. 2017). Comparison between social media posts and official visitor statistics shows us that all social media platforms can reveal the popularity of the parks relatively well. This means that, officially, parks which are more visited are more popular in social media and vice versa (Tenkanen et al. 2017). The popularity ranking of the parks, as revealed in social media platforms, is most precise for the most visited parks. For less popular parks, the ranking becomes less accurate. For instance, in South Africa, Instagram correctly reveals the park popularity rank order of the 4 biggest national parks, but tends to over- or underestimate the popularity of the less visited parks (Tenkanen et al. 2017).

2. **Aerial and satellite imagery**

Air photos can only be used for the detection of users in open areas such as beaches, lakes, grasslands or roads (Tenkanen et al. 2017).

3. **Counting of access permits and tickets**

Where access to an area is restricted either by a quota or by selling entrance tickets, it is very easy to keep records of the permits or tickets issued to visitors. Records from commercial facilities such as cable-cars, ferries, or even restaurants (number of meals served) also are a good source of information, provided that private enterprises and park administrations are willing to cooperate (Muhar et al., 1995, p. 3).

4. **Direct observation**

According to Muhar et. al., in many national parks, rangers also record the number of people they meet during their inspections of the area. These data can be used as additional information within a data gathering process, in particular in remote areas, but need to be treated cautiously, unless the roaming is set up in a systematic way.
counting stations are also often used, but specific manned counting stations are usually only set up for short observation periods (Muhar et al., 2001, p. 2).

5. **Indirect observation**

Automatic cameras and time-lapse video can be used for indirect observation. Video recordings or photographs are an excellent source of information for visitor monitoring. In order to maximise the operating time without maintenance (change of tapes), time-lapse video recorders can be used, which take images at fixed intervals (e.g., 5 seconds). Most of the devices available commercially had been developed for security surveillance of homes, public buildings, factories, etc. and usually depend on a standard electricity supply (Muhar et al., 2002, p. 2).

6. **Mapping of traces of use**

Although it is obvious that there is a correlation between the intensity of recreational use and “traces” left by the users in the landscape, it is very difficult to draw conclusions about actual visitor numbers from the mapping of these traces (Coch & Hirnschal 1998; also Muhar et al., 2002, p. 4).

7. **Interviews and questionnaires**

Oral and written interviews are an integral part of visitor monitoring concepts. They provide mainly qualitative information about the needs and the motivation of visitors, their origins, habits and activities as well as their routes within a recreational area. When combined with quantitative data from counting stations, important conclusions can be drawn for management uses (Muhar et al., 2002, p. 2).

8. **Monitoring with the help of individual protected and recreational area Apps**

Many protected and recreational areas also possess their own Apps, which can be used to monitor visitors.

For visitor monitoring, it might be easy to select counting points in recreational areas with a limited number of entrance points or key attractions. In the European context, the more typical situation is an open road or trail network with multiple entrance points. This is particularly the case in urban forests. In such situations, numerous pre-tests will be necessary to determine the most significant nodes in the trail network for the placement of counting stations (Muhar et al., 2002, p. 2).
2. Example: Moravian Karst Protected Landscape Area

The Moravian Karst Protected Landscape Area is located in the south-eastern part of the Czech Republic, close to Brno. The PLA was established there in 1956, covering an area of almost 100 km²; it is the largest and most extensive Karst area in the Czech Republic featuring Devonian limestone cliffs and more than 1,100 caves. Five cave systems are open to the public and are visited every year by approximately 400,000 people (Pachrová et al. 2020).

As part of the primary research carried out by Pachrová et al. utilising the questionnaires method, 2,100 questionnaires were properly completed by visitors of the Moravian Karst ($N = 2,100$). The socio-demographic characteristics of the respondents are shown in Table 1, which indicates that, in a representative sample of visitors to the PLA, the share of men is 51% and women 49%. It can be concluded from this result that men and women visit the Moravian Karst in (nearly) equal proportion (Pachrová et al. 2020).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Sociodemographic Structure of Respondents</th>
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</thead>
<tbody>
<tr>
<td>Respondents characteristics</td>
<td>$N$</td>
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<tr>
<td>Gender</td>
<td></td>
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<tr>
<td>Women</td>
<td>1,028</td>
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<tr>
<td>Men</td>
<td>1,072</td>
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<tr>
<td>Total</td>
<td>2,100</td>
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<tr>
<td>Age</td>
<td></td>
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<tr>
<td>Up to 24 years</td>
<td>294</td>
</tr>
<tr>
<td>25–34 years</td>
<td>512</td>
</tr>
<tr>
<td>35–49 years</td>
<td>843</td>
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<tr>
<td>50–59 years</td>
<td>285</td>
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<tr>
<td>60+</td>
<td>166</td>
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<tr>
<td>Total</td>
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<tr>
<td>Education</td>
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<tr>
<td>Without high school</td>
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<tr>
<td>High school</td>
<td>1,217</td>
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<tr>
<td>University</td>
<td>431</td>
</tr>
<tr>
<td>Total</td>
<td>2,100</td>
</tr>
</tbody>
</table>

All age categories were represented in the research. People aged 35–49 were the predominant group in the structure of visitors, accounting for 40% of the total
number of respondents (Table 1). Nearly a quarter of visitors (24%) were in the age segment of 25–34. The age categories of 24 years old and less, and 50–59 had an equal share of 14% of the total number of respondents. The least numerically represented age category of visitors were seniors (i.e., 60 and older). The age structure of visitors is very similar to the one observed by Lorencová et al. (2014) in 2013, so we can conclude that, in a long-term view, the majority of the visitors is between 25 to 49 years of age (Pachrová et al. 2020).

The geographic origin of the respondents, i.e., whether they came from the Czech Republic or from abroad, was also determined. The questionnaire showed that the Moravian Karst is a destination mainly for domestic tourism. Of the total respondents, only 4% were foreign visitors. In the structure of foreign visitors, most respondents were from Slovakia; the second most frequently cited country of origin was Poland; the third was Russia (Pachrová et al. 2020). In the surveyed area of the Moravian Karst, the trend of increasing numbers of visitors can be seen: visitors numbers increased between by more than 22% between 2010 and 2018. As stated by Pachrová et al. (2019), one of the main problems of tourism in the Moravian Karst is its pronounced seasonality: most visitors come to the PLA in the summer to visit the accessible caves and the Macocha gorge. In these locations, tourism levels are very high and damage is occurring to this unique environment. The PLA management, therefore, needs to take corrective measures within the scope of visitor management of the area. (Pachrová et al. 2020).

For visitor management and maintaining the sustainable tourism of the PLA, the research implies the positive fact that almost 70% of visitors return to this protected area, 30% even repeatedly (i.e., they had been there at least five times at the time of data collection) (Table 2) (Pachrová et al. 2020).

Karst areas are not typical tourist attractions; most of them have extraordinary scientific and social importance, not only because they represent remarkable geological and geomorphological phenomena, but they also preserve valuable evidence about the origin and evolution of life or the origin and development of human culture. The Moravian Karst area is a good example of this (Pachrová et al. 2020).
Knowledge of the temporal variability in visitor loads in any given protected area is particularly important in the context of examining (and mitigating) visitor impacts. For example, protected areas with strongly seasonal visitation may suffer from acute impacts during peak visitation periods, yet there may be few impacts in low visitation periods (Hadwen et al. 2007, p. 178).

3. Discussion

The monitoring process can pose the following issues:

1) Ethical aspects
Some visitor monitoring methods can be seen as an intrusion into the private sphere of a visitor. This is true for most methods where images are taken (video recordings, automatic cameras), but also for other methods of hidden observation (human observers), in particular in remote locations, where visitors do not expect to be watched. In urban environments, people are already quite familiar with video surveillance and this can even be seen as a motive to visit remote areas where one can behave more freely, without being monitored (Muhar et al., 2002, p. 5).

2) Costs vs. accuracy

Many devices currently used for monitoring are mass-produced products from the security surveillance sector. Therefore, the hardware costs are no longer a big issue. The main cost factor is labour costs: for the installation and maintenance of counting devices, for conducting interviews or for the analysis of data (e.g., video interpretation). It is crucial for the success of a monitoring concept that, from the outset, the required accuracy level is clearly identified. Reasonable accuracy can be defined as the level good enough to detect changes that are significant for management decisions (Hendee et al. 1990, also Muhar et al., 2002, p. 5).

4. Conclusion

Protected areas, such as national parks, help meet the local and international biodiversity targets. They often have high recreational value and hence are significant for national and local economies. Monitoring of visitor numbers in PAs has been helpful in giving insights into visitor motivation and ways to control visitor impact.

In the paper it was shown that we can monitor the amount of visitors in protected and recreational areas with the help of a large number of different monitoring techniques and devices. Out of these methods, the most efficient method for visitor monitoring was found to be the counting of access permits and tickets because it provides concrete and irrefutable information. Questionnaires and interviews were also found to be highly effective because they give qualitative (personal) information about the motivation and goals of the visitors. Social media platforms were likewise found to be effective, yet they were only found to be accurate for the most popular tourist destinations. The effectiveness of direct
monitoring is restricted by the need to extrapolate results. Aerial and satellite imagery as well as indirect observation are effective, yet pose ethical problems because of the intrusion into visitors’ private space. Trace of use mapping was not found to be effective because use does not always correlate with visitor numbers. The use of Apps has shown the potential to be effective, however, it has not been implemented widely.

The example of the Moravian Karst has shown the effectiveness of the tickets and questionnaires method, which determined the high seasonal nature of tourism there (peak of tourism during the summer) and the primary target tourist group of domestic, educated, middle-aged visitors (35-49 years of age) who will most likely revisit the PLA. This is valuable information both for marketing and nature conservation purposes and the PLA administration will need to analyse it in order to manage future tourism there.

Surveillance with the use of photo or video cameras remains controversial because of the violation of visitors’ privacy and these methods will likely need to be replaced with the abovementioned alternatives.

References:


