

## The use of crowdsourced (spatial) data in visitor management Discussed by the example of a visitor hotspot in Berchtesgaden National Park

Sabine Hennig

### Abstract

Availability of (spatial) data is a key concern in visitor management. Crowdsourcing initiatives which involve the general public in data collection are considered a new source of data and information, and an alternative to traditional data collection approaches. But, how can visitor management benefit from crowdsourced data? Literature and Internet review as well as analysis of platforms and data reveal several advantages, but also challenges regarding the use of crowdsourced data. To benefit e.g. from crowd mapping platforms, GPS/ GPX sharing platforms, and multimedia sharing platforms certain skills must be build up among visitor managers. Moreover visitors must be motivated to contribute to crowdsourcing platforms in order to increase the amount of data available.

---

### Keywords

visitor management, crowdsourcing platforms, multimedia, GPS tracking, spatial data, crowd mapping, geotagging

### Introduction and research questions

Visitor management is a sub-domain of protected area management. Its objectives are:

1. to protect and improve natural resources in the context of visitor use,
2. to increase visitor enjoyment, and
3. to maintain and enhance the economic benefits that visitors have on a region.

Various strategies are applied to reach these goals. They refer to hard or restrictive actions such as prohibitions, limited access, and entrance fees, and, to soft actions based on the well-considered use of infrastructure, environmental education, and nature interpretation elements designed to guide, inform and sensitize visitors (see, e.g., HENNIG 2017).

For protected area management including visitor management to decide on appropriate measures the availability of data and in particular of spatial data is a key concern. Obtaining (spatial) data is often laborious and expensive. Due to the advances in information and communication technologies, the high Internet user penetration rate worldwide, and the steadily rising numbers of mobile Internet users, new approaches allow the general public to be involved in (spatial) data collection. These methods are an interesting addition to traditional data collection methods. In many domains, crowdsourced data is seen as an alternative method for obtaining and maintaining authoritative data (HERFORD et al. 2015). But, how can visitor management benefit from crowdsourced data and media and which challenges are related to the use of crowdsourcing applications? This is discussed by the example of a visitor hotspot in the German Berchtesgaden National Park (i.e. Alpine hut Kärlingerhaus at lake Funtensee)?

### Study Area

The Berchtesgaden National Park is situated in South-East Germany, 30 km south of the Austrian city of Salzburg. It covers an area of 210 km<sup>2</sup> at an elevation ranging from 600 m a.m.s.l. (Lake Königssee) to 2,700 m a.m.s.l. (Watzmann Massif). Berchtesgaden National Park – established in 1978 – is the only German national park in the Alps. The main management objectives are nature conservation, environmental education, providing the public with requirements for recreation, and scientific research (BAYSTMLU 2001).

The region is one of the oldest holiday destinations in the Alps. To this day tourism and recreational use play a fundamental role in the region, and Berchtesgaden National Park is one of its main attractions (BAYSTMLU 2001). Over the last few years, in particular several days lasting hiking tours with overnight stays at Alpine huts have been receiving increasing attention. A main destination for this is the Alpine hut Kärlingerhaus at lake Funtensee (1,638m a.m.s.l.; 47° 29'44" N, 12° 56' 14" O).

## Methods

To gain insight into the use, potential, and challenges of crowdsourced data and crowdsourcing platforms different methods were applied. Based on the results of a literature and Internet review, crowdsourcing applications being of interest for visitor management purposes were identified and categorized. Using an especially elaborated list of criteria applications and data available were analyzed. The spatial focus was on the Alpine hut Kärlingerhaus and its surroundings.

## Categories of crowdsourcing platforms and potential benefits for visitor management

Crowdsourcing platforms being of particular relevance for visitor managers encompass, among others, crowd mapping platforms, GPS/ GPX sharing platforms, and media sharing platforms.

Crowd mapping platforms allow the general public to add, i.e. provide spatial data on all kinds of infrastructure. Among existing initiatives OpenStreetMap (OSM; [www.osm.org](http://www.osm.org)) is the world's largest public collection of spatial data. To describe features to be mapped, OSM provides a specific tagging system. It allows the user to describe recreational infrastructure and to characterize these features in detail (OSM Wiki). Benefits of using OSM refer e.g. to data's up to datedness, provision of data on elements that are hard to collect, and insight into people's individual perspectives and preferences (HENNIG 2017).

On GPS/ GPX sharing platforms such as GPSies or Wikiloc users publish tracks usually captured while performing certain outdoor activities such as hiking, biking, or ski-mountaineering (using a GPS device or a tracking app installed on a GPS capable smartphone). The created files (GPS/ GPX) are uploaded to the according platforms and attributes describing the track (e.g. degree of difficulty, beauty of scenery) might be added. Besides the tracks (download), track attributes as well as number and content of comments on the individual tracks might be a valuable source of information for visitor managers to gain insight into visitor hotspots and visitor preferences (see, e.g., MONTEIRO 2016).

On media sharing platforms (e.g. Flickr, Instagram, Twitter, Youtube, Freesound) users provide media such as photos, videos, and sounds. Information on the location (i.e. pair of coordinates, so called geotag) is added while creating/ capturing the media or by using specific applications (e.g. Geosetter). Regarding the use of geotagged media in the context of visitor management some examples can be found in literature. Thus, for instance, WALDEN-SCHREINER et al. (2016) and LUPP et al. (2016) used geo-tagged photos posted on photo-sharing platforms to collect data on visitors, their activities, preferences and needs.

In brief, the described crowdsourcing platforms provide attribute and spatial data relevant for visitor managers (Tab. 1). The data allows to gain understanding on visitors and their visits as well as knowing activities performed, sites visited and recreational infrastructure available.

Platform	Attribute data	Spatial data
<b>Crowd mapping</b> (e.g. OSM)	primary tag: feature type, secondary tags: feature characteristics	Mapped recreational infrastructure
<b>GPS/ GPX sharing</b> (e.g. GPSies)	Track characterization (quality, length, landscape, etc.), number of views/ downloads, comments, ratings	GPS tracks
<b>Media sharing</b> (e.g. Flickr)	Media content, comments, rating	Due to geotagging

Table 1: Data provided by crowdsourcing platforms

## Availability and usability of crowdsourced spatial data regarding the study area

Regarding the visitor hotspot Alpine hut Kärlingerhaus extensive crowdsourced (spatial) data can be found on the different platforms. Nevertheless, there is room for improvement. This is outlined by some examples.

The OSM tagging system allows describing all relevant infrastructures regarding hiking trips (trails, Alpine huts, shelters, availability of drinking water, viewpoints, sign posts etc.). Despite this, the data hold in the OSM database remains inferior to existing authoritative data (see, e.g., management plan of the Berchtesgaden National Park; BayStMLU 2001). A pivotal benefit refers to tags reflecting visitors' assessment on infrastructure. Thus, for instance, by the tag `trail_visibility` it becomes obvious which trails (from visitors' perspective) are regarded excellent or good and which provide potential for improvement (based on the classification of the Swiss Alpine Club SAC; Fig. 1a).

On the GPS/ GPX sharing platform GPSies, more than 100 tracks related to the visitor hotspot Kärlingerhaus were uploaded by the users (to August 2017). Due to the data, insight into trails most popular to reach the Alpine hut Kärlingerhaus can be gained. Further, the data reveals which non-official trails are used (Fig. 1b). Track attributisation outlines that, on average, users consider the quality of the trails as good (rating: 4 out of 5 stars).

Moreover, the number of photos taken in the surrounding of the Alpine hut and uploaded to the photo sharing platform Flickr can serve as an additional indicator for the popularity of this site (compare Fig. 1a and 1c). The pictures themselves (incl. time of capturing the image) give insight on the fact that the Alpine hut Kärlingerhaus is also a popular visitor destination between Middle of October to end of May (not operating time of the hut, visitors stay in the so called winter room).

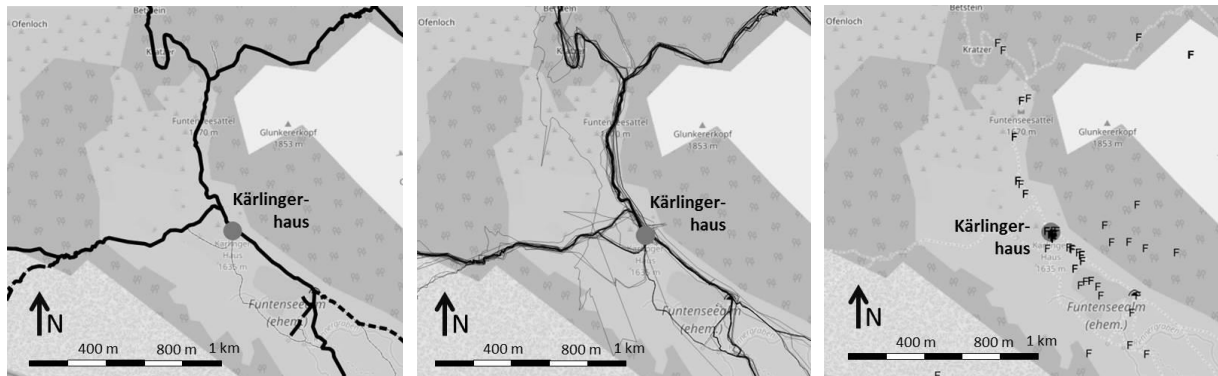


Figure 1: Examples regarding the availability of (spatial) data from crowdsourcing platforms regarding the Alpine hut Kärlingerhaus (a) OSM trail data: solid line: excellent/ good condition; dashed line: intermediate conditions, (b) GPS tracks on GPSies: solid lines. GPS/ GPX tracks, and (c) locations of Flickr photos: F location where photo was taken; (Basemaps: ©OpenStreetMap Contributors).

## Discussion

Even though in literature a wide range of examples can be found outlining the use of crowdsourced (spatial) data, the incorporation of this data seems still be an exception in visitor management and mostly related to research activities. One reason among others might be that accessing crowdsourced spatial data still requires advanced GI geoinformatics skills. Apart from being able to handle GIS, among others, knowledge on the application programming interfaces APIs (regarding the different platforms) is important. In addition, to build up the required skills, visitor managers first and foremost must be aware of the possibilities and benefits of using crowdsourced data in visitor management.

Further, to increase amount of data available on crowdsourcing platforms, visitors (i.e. the general public) must be motivated to contribute on these platforms. As outlined in the context of citizen science, this requires for motivation strategies to have users add content (ENGELS 2015). Moreover, also the users must have certain digital, media and spatial skills. This is particularly relevant for adding data to crowd mapping applications (VOGLER & HENNIG 2013).

## Conclusion and outlook

Crowdsourcing platforms are a rich source of different types of information including spatial and attribute data related to visitor activities and recreational infrastructure. Information is provided that otherwise is difficult to collect. But, to have more data available, visitors must be encouraged to contribute data. Further, it is important to build up GI skills among managers to enable them to leverage crowdsourced data. However, tools and methods to access, prepare and use data must become even easier to handle.

## References

- BayStMLU Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen 2001. Nationalparkplan. Berchtesgaden.
- ENGELS, B. 2015. Citizen Science: An overview of the current state, the possibilities and challenges and the opportunities for the future. Walter.
- HENNIG, S. 2017. OpenStreetMap used in protected area management. The example of recreational infrastructure in Berchtesgaden National Park, *eco.mont*, 2017, 9/2: 16–27.
- HERFORT, B., ECKLE, M., PORTO DE ALBUQUERQUE, P., ZIPF, A. 2015. Towards assessing the quality of volunteered geographic information from OpenStreetMap for identifying critical infrastructure. *ISCRAM*.
- LUPP, G., FEUERSTEIN, M., HEUCHELE, L., KONOLD, W. 2016. Trail use and perception of a diverse mountain farming landscape by in the protected area Allgäuer Hochalpen in the German Alps. *eco.mont* 8/1: 21–28.
- MONTEIRO, L. 2016. Using GPS data from Web 2.0 platforms to assess informal trail network and its impacts in protected areas. *MMV8*: 270–272.
- OSM Wiki. <http://wiki.openstreetmap.org> (accessed at 20.7.2016).

WALDEN-SCHREINER, C. & LEUNG, Y. 2016. Incorporating the digital footprints of visitors in protected areas and impact monitoring: Case studies from the USA and Australia. *MMV8*: 274-276.

VOGLER, R. & HENNIG, S. 2013. Providing geomedial skills beyond (post)secondary education, *GI\_Forum*, 2013: 317-327.

## **Contact**

Sabine Hennig

[sabine.hennig@sbg.ac.at](mailto:sabine.hennig@sbg.ac.at)

Department of Geoinformatics – Z\_GIS, University of Salzburg

Schillerstr. 30

5020 Salzburg

Austria