

Application of GPS-tracking to analyse the spatial behaviour of cable car users – a case study from the summer season in the Tatra National Park, Poland

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Introduction

Cable cars in mountain areas are often associated with winter tourism, in particular with skiing activity. However, cable car operators and touristic regions see large potential in extending their seasonal offers to all-year-round ones (Richins & Hull, 2016).

Easy access of alpine zone may attract large number of tourists. However, in natural vulnerable areas, there is a need to control visitor flows in order to mitigate and/or reduce their environmental impacts. Understanding visitors' behaviour in the proximity of cable car infrastructure is crucial for effective management of such sites. Application of adequate visitor monitoring techniques enables gathering comprehensive information on tourist traffic and its characteristics (Cessford & Muhar, 2003). Within the last decade GPS-tracking has become a well-established data collection method used in various fields for documenting the traces of moving objects and people (Shoval and Isaacson, 2007; Taczanowska et al. 2014)

The aim of this study was to explore the spatio-temporal distribution of visitors in a popular cable car destination - Kasprowy Wierch in the Tatra National Park. The main focus of this paper is the analysis of individual trip itineraries of the most numerous visitor group in the study area – cable car users purchasing return tickets.

Study area

The summit of Kasprowy Wierch (1987 m.a.s.l.) is situated in Central Eastern Europe in the main ridge of the Tatra Mountains, at the national border between Poland and Slovakia. The Tatra Mountains are the highest range within the Carpathian Mountains and lie within two independently managed national parks: Tatrzański Park Narodowy (TPN) in Poland and TatrzańskoNarodny Park (TANAP) in Slovakia.

Kasprowy Wierch (KW) belongs to the most popular destinations in the Tatras. KW can be reached by cable car and hiking trails. In the summer season 2014 (July - September) nearly 300 000 visitors has been registered in the area, making 19,4% of the total tourist traffic in the Polish Tatra National Park (Taczanowska et al. 2014).

Methodology

GPS-tracking of cable car users was a part of a larger visitor monitoring project in the Kasprowy Wierch area comprising several data collection techniques: 1) automatic counting (Eco-Counter pyroelectric sensors), 2) manual counting; 3) on-site interviews; 4) GPS-tracking 5) registry of cable car tickets 6) registry of entries to the national park (TPN).

Between 26.06.2014 and 30.09.2014 at 7 locations a continuous automatic counting of visitors was done. Additionally, on 17 sampling days at 12 locations direct observations (manual counting) of visitor flows was carried out. During the sampling days tourists were interviewed in the field using structured questionnaires (PAPI survey technique). Survey was combined with a documentation of visitors' trip itineraries via GPS-loggers (100 devices: Holux GPS logger) and map sketches.

As a result, visitor load data and 1250 GPS-tracks linked to visitor characteristics were collected in the field. Data were pre-processed and analysed using ArcGIS and SPSS software.

Results

Between July and September 2014 a total number of 292 493 visitors moving towards Kasprowy Wierch (KW) were registered in the cable car and on recreational trails leading to KW. 80% of people used cable car, whereas 20% were using hiking trails to get to the summit and back. Cable car users with return tickets were the most numerous tourist group in the Kasprowy Wierch area. Between July and September 2014 the share of specific ticket types among cable car users was as follows: return tickets „up&down” = 59%, on-way tickets „up” = 26%, on-way tickets „down” = 15%.

In the summer season 2014 on average 3179 visitors per day arrived to KW area. The maximum tourist traffic was observed in August 2014 where daily number of visitors exceeded 7000. Two most intensively used path segments were located next to the upper cable car station (cable car station – Sucha Pass; cable car station – meteorological station/summit of KW). Third most heavily used path segment was located between Sucha Pass and the summit of Beskid. The maximum daily tourist traffic volume in the study area has been observed on 13.07.2014 at a path segment between the cable car station and Sucha Pass (7236 visits/day). Similar tourist traffic was observed at this location several times in July and August 2014 (> 6500 visits/day). Maximum hourly tourist traffic volume was observed here on 13.07.2014 between 1 – 2 p.m. (1250 visits/hour). Visitor load at path segments located next to the cable car station was on average 5-10 times higher than the visitor load at other hiking trails in the area (e.g. trail linking Kasprowy Wierch and Czerwony Wierch or Liliowe Pass and Świnica).

High concentration of visitors on trails in the surrounding of cable car station was caused mainly by tourists with return tickets. In contrary to common opinions,

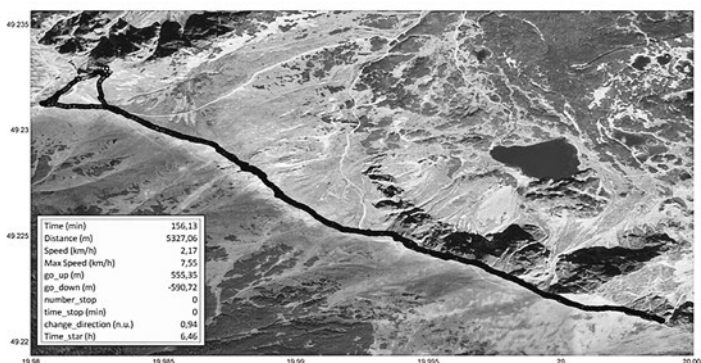


Figure 1. An example of a visitor route recorded via GPS-logger in the KasprowyWierch area in the summer season 2014. Total number of registered routes $N = 1250$.

this group of visitors is rather active and hikes on average 1.6 km during a 1.5 hour stay in the mountains. Among 1250 recorded GPS tracks 140 different trip itineraries were distinguished. 73% of tourists with return ticket directs their first steps towards Sucha Pass, while one quarter of tourists decides to hike up to the meteorological station. 2% of visitors stays in a close proximity of the upper cable car station. Only 27% of tourists with return ticket reach the proper peak of KasprowyWierch; 29% turns back after arriving at meteorological station, and 44% choose other destinations (e.g. Beskid peak). Figure 1 presents an example of recorded visitor route and the movement parameters.

Discussion & Conclusions

Tourism in the KasprowyWierch area is a dynamic phenomenon, characterised by significant spatio-temporal changes. The number of sold cable car tickets (especially return tickets) has the most significant influence on visitor load on trails within 750 m radius from the upper cable car station. The type of individual trip itineraries (influenced by the terrain, tourist information or lack of such information as well as the time restriction of return tickets) also affects the spatio-temporal distribution of visitor flows in the area. Tourist information is mostly dedicated to long distance hikers in the national park and not well-designed for visitors taking a short stroll around the cable car station. Some visitors use selected path segments several times due to lack of adequate information, which causes additional concentration of people on recreational trails. Creation of touristic “retention zones” such as view platforms, dedicated resting places could contribute to a better control of visitor load in a close proximity to cable car infrastructure.

Comprehensive information concerning individual routes contributes to a better understanding of the behaviour of tourists visiting this part of the Tatra National Park. The results can be used as a base for further research concerning environmental and social impacts in the KasprowyWierch area and may assist management of this popular tourist destination in the protected area.



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