Looking back at recreational activities in protected areas using VGI from web-share services

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Introduction

Recent literature on recreational uses and Recreational and Protected Areas (R&PA) has shown that VGI from web-share services such as GPSies, Wikiloc, MapMyFitness or Flickr, among others can be used to map outdoor activities such as Mountain Biking (MTB) or Running and Walking. In addition they can be used to map spatial patterns of these activities in these territories (Nogueira Mendes et al 2012; Norman and Pickering 2017, Walden-Schreiner *et al* 2018). The massive use of these services, nowadays through smartphones, photographic cameras and affordable handheld GPS units, has been made available to protected areas' managers and researchers, thousands of tracks and points depending on which service or APP is more popular around each study area or country, leading to the development of new monitoring techniques.

Even in the case where issues of representativeness of these data sources can be raised – i.e. not all users or visitors use such devices or services, many do not upload their tracks or photos, and many of those that do it, do not share them outside their friends or family – the insights produced with these new monitoring methods are a powerful tool for R&PA management, even with the multitude of existing platforms.

Such data, due to the total amount of tracks/photos gathered, has been used to map favorite, informal or even illegal trails, which by itself is useful for recreational managers and planners, but less has been done regarding anything else than mapping uses at a point of time – usually when the data is collected or made available. Some of these web-share services are now over a decade old which might constitute a time series in terms of monitoring. Do these reflect any change in trail uses or visitors' distributions?

The objective of this paper is to explore if datasets from web-share services collected today can also reflect past changes in trails' use within R&PA providing a new added value to these data sources – the ability to look back in time.

Methods

GPSies, one of the oldest web-share services, set in Germany in 2006, holds over 5.3M tracks with a total amount of 515.85M km of which 64% belong to tracks that were uploaded and classified by their owners as suitable for "by wheels" activities (GPSies, 2018). Besides the ability to download up to 250 tracks from each query, this service allows track owners to register up to 95 individual characteristics for each track including country, track and user names, total length, positive altimetry, date of upload, etc. Following Nogueira Mendes *et al* (2014) tracks were downloaded through selective queries from Palmela, and Sesimbra (within Arrábida Natural Park - PNArr, Portugal) to ensure that all publicly shared tracks that crossed the study area (3510) were retrieved. All tracks that were classified by their owners as suitable for other activities besides MTB as well as tracks with extent above Percentile95 (> 124,507 km) were deleted reducing the final dataset to 2847 tracks submitted by over 448 users.

The dataset was then split by years according to the upload date and tracks submitted up to 2010 were merged due to their reduced number. Each sub dataset (holding from 209 to 674 tracks) was rasterized to a grid of 25 x 25 m and reclassified into 10 use classes and combined (using Combine from Spatial Analyst Toolset in ArcGIS 10.5.1) with the next year sub dataset, following Campelo and Nogueira Mendes (2016), producing 7 raster images later used to measure changes within use intensity through confuse matrices.

Results were plotted against the park management plan and the park roads and paths network, and later analyzed with the park rangers to be validated and explained under the objectives of this study.

Results and discussion

Use intensity within Arrábida for each year raster shows similar patterns, which is confirmed by the combined analysis. On average, 92,493% of grid cells had no change (i.e. use intensity in one year was exactly within the same use class of the next year), 3,897% were less used and 4,076% were more used than the previous year. When plotted against the road and paths network, small changes were detected. For example, one abandoned path taken by Macaronesian flora (the ecological climax of Arrábida's habitats) after the last big fire on the park in 2004 was less, and less used and also abandoned by mountain bikers (Figure 1a). On other hand, illegal trails used for downhill in Serra de São Luis (one of the highest points of PNArr) were more or less used depending on how much work was done by local bikers in order to keep the trail functional – cutting tree branches or clearing vegetation, etc. (Figure 1b).
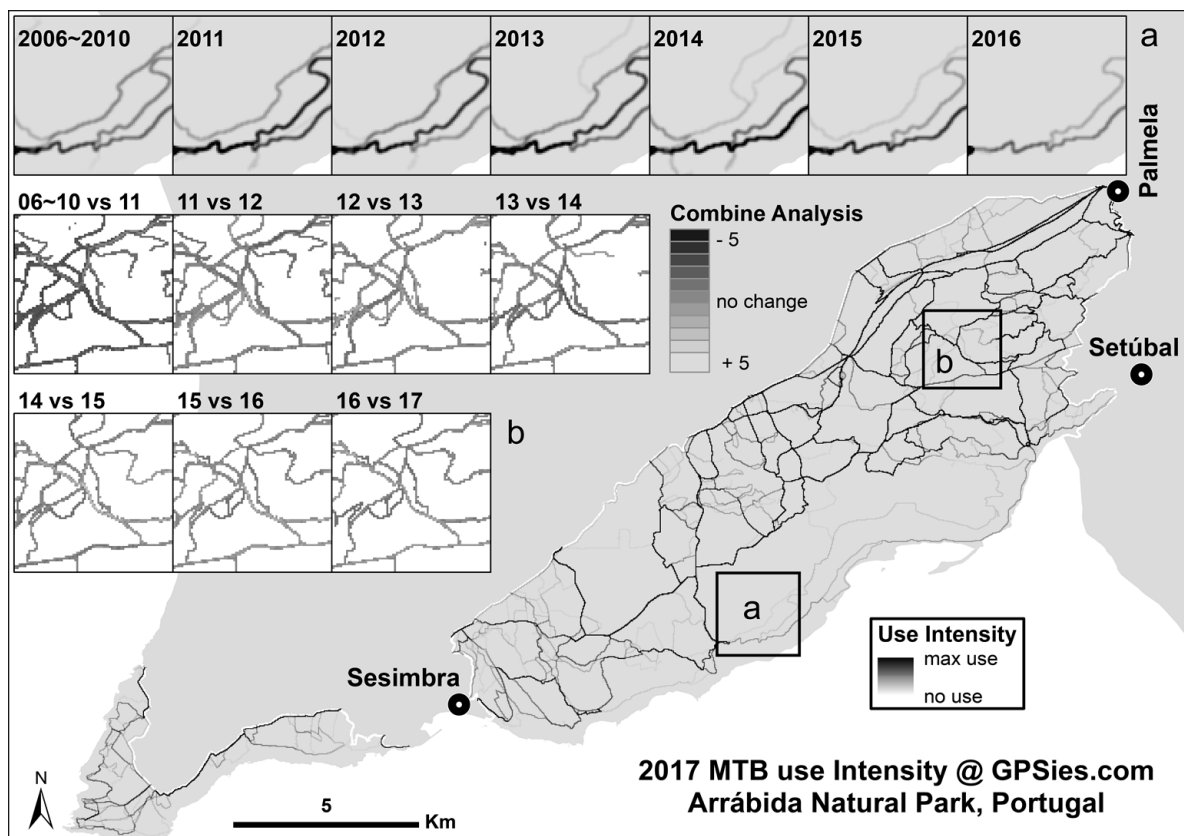

Figure 1 - Use intensity of MTB in Arrábida Natural Park, Portugal. a) detail zooms on an abandoned path. b) combined analysis of downhill on illegal trails.

Park staff reported that illegal rides and trails interventions have happen, and years of higher use resulted on more complains by land owners. Informal, illegal trails or trespassing, three of major conflicts of MTB within natural areas can be easily spotted and confirmed using these data sources.

Conclusions

The ability to look back to R&PA use trough web-share services may be limited due to such services characteristics discussed previously. Nevertheless, due the massive use of these services, results are easy and fast to achieve, making such data sources a valuable resource for managers and recreational researchers. Within public open share services like GPSies where most of the tracks can be linked to a single user, there are still other topics to be tested and explored, such as user's displacement for example.

As shown on previous works, detailed monitoring regarding spatial use of these territories can be made, especially for the most popular recreational activities such as MTB, hiking and nowadays trail running. Making use of Web2.0 and current ways of life where almost every outdoor activity is immediately reported on-line, could be fast and easy to access and identify for example new informal or illegal trails allowing quick action with all its advantages.

Acknowledgments

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