

Assessing recreational impact in a protected peri-urban park. The case of Collserola Natural Park (Barcelona - Spain)

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Introduction

The study of the environmental consequences of outdoor recreation/nature-based activities and their effective management in peri-urban protected natural areas is an emerging field of global importance, and more so given the ever increasing pressure of such recreational uses (Monz et al, 2013). Two main input data are needed in order to assess the consequences of environmental impact of recreational use: first, related to the number of people using the specific recreational facility (trail, recreation area, etc.) and secondly, the environmental impact generated by this use. Trail survey methodologies are shown as useful for management of wilderness and backcountry trail networks (Marion et al, 2011). However, few studies corroborate the connection between the results obtained by the trail survey methodology and the actual level of recreational use of the trail system (Monz et al, 2013). Therefore, using Collserola Natural Park as the study area, this research was set out with the aim of assessing the utility and effectiveness of a trail survey methodology in the evaluation of recreational impact in a peri-urban natural park. Collserola Natural Park is a protected Natura 2000 site covering over 8,000 ha of mostly Mediterranean pine and oak woodlands situated directly beside the city of Barcelona, in the centre of its corresponding metropolitan area with a nearby population of 3.2 million inhabitants, 43% of the population of Catalonia.

Methodology

The pilot study was carried out in a sub-section (1,699 ha) of Collserola Natural Park corresponding to the municipality of Barcelona, and based on the consideration of two different reports (Fariás and Morera, 2017) and (Ursul, 2017) which had separately reported the two specific inputs needed to develop this study there: the number of visitors who use the trail and the quantified impact on the trail selected. The first report used two different methodologies: one for estimating the number of visitors and another to characterize the visitor's profile, uses and preferences. The second report also used two different methodologies to analyse trail degradation impact in the study area; first, a linear assessment using qualitative sampling of categorical data, such as trail difficulty, trail erosion, main soil type, drainage presence, etc. Secondly, quantitative impact assessment at sampling points located along the selected trails, mainly considering parameters related to erosion and soil loss based on the calculation of trail cross-sectional area (the CSA method, e.g. see Leonard and Whitney, 1977), as well as other trail characteristics such as its rugosity, maximum incision and width of active tread.

In the case of the linear and point sampling evaluations, and taking into account the variability of the length of the different trails, overall mean impact values obtained were applied to the entire length of the corresponding trail section. In the combined study presented here –trail degradation assessment in relation to visitor numbers–, more than 10km of trails were included, representing 9% of the total trail length in the overall pilot study area.

These 10km of trails concentrate an estimated total of 1,132,588 annual visits by park users, representing more than 25% of the total number of user visits estimated in the overall park area corresponding to Barcelona municipality. The statistical analysis of the relationships between visitor use intensity and trail impact was based on the calculation of the Pearson's correlation coefficient R .

Results

The results obtained from the relationship between the number of users and the environmental impact showed certain variability according to the type of impact assessment (linear or point sampling). Whilst the results of the linear assessment showed a weak relationship ($R^2=0.0439$, $p=0.513$) between use intensity and impact, quantification based on point sampling showed a significant correlation ($R^2=0.8755$, $p=0.002^{**}$) (Figure 1).

In this regard, further examination of the relationship between recreational frequentation and type of activity (whether on foot or mountain biking -MTB-) and the measurement of the environmental impacts obtained from quantitative point sampling, revealed a stronger and significant correlation in the case of activities on foot ($R^2=0.7194$, $p=0.016^*$) in comparison to MTB usage ($R^2=0.406$, $p=0.124$).

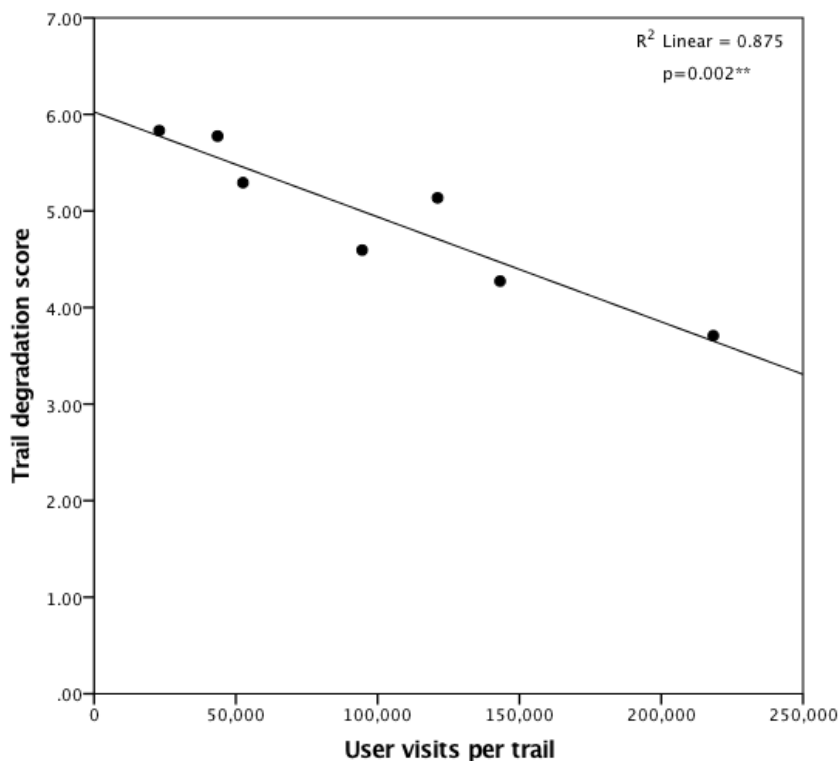


Figure 1. The relationship between recreational use intensity (estimated annual total of user visits per trail) and trail impact assessment based on data from quantitative point sampling (0 being highly degraded and 10 showing no degradation at all).

Conclusions

Based on quantitative point sampling, our results show that observed trail impact is significantly correlated with visitor use intensity, although not so for qualitative linear sampling. Moreover, trail impact in our study area may be more related to use intensity (number of visitors) rather than to the type of activity *per se*. Nevertheless, it should be

recognized that our study is still limited in terms of the number of trails where both assessments -use intensity and impact- were carried out, and *per user* impact might indeed be greater for MTB than for walking activities, as other studies have previously revealed greater trail impacts for recreational MTB activity (Marion, 2006).

As such, further work is needed in order to evaluate more precisely the relationship between public use and recreational impact on trails in Collserola Natural Park.

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