



Analysis of the impact of recreational trail usage for prioritising management decisions: a regression tree approach

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The dual role of many Protected Natural Areas in providing benefits for both conservation and recreation poses challenges for management. Although recreation-based damage to ecosystems can occur very quickly, restoration can take many years. The protection of conservation interests at the same as providing for recreation requires decisions to be made about how to prioritise and direct management actions. Trails are commonly used to divert visitors from the most important areas of a site, but high visitor pressure can lead to increases in trail width and a concomitant increase in soil erosion. Here we use detailed field data on condition of recreational trails in Gorce National Park, Poland, as the basis for a regression tree analysis to determine the factors influencing trail deterioration, and link specific trail impacts with environmental, use related and managerial factors. We distinguished 12 types of trails, characterised by four levels of degradation: (1) trails with an acceptable level of degradation; (2) threatened trails; (3) damaged trails; and (4) heavily damaged trails. Damaged trails were the most vulnerable of all trails and should be prioritised for appropriate conservation and restoration. We also proposed five types of monitoring of recreational trail conditions: (1) rapid inventory of negative impacts; (2) monitoring visitor numbers and variation in type of use; (3) change-oriented monitoring focusing on sections of trail which were subjected to changes in type or level of use or subjected to extreme weather events; (4) monitoring of dynamics of trail conditions; and (5) full assessment of trail conditions, to be carried out every 10-15 years. The application of the proposed framework can enhance the ability of Park managers to prioritise their trail management activities, enhancing trail conditions and visitor safety, while minimising adverse impacts on the conservation value of the ecosystem. A.M.T. was supported by the Polish Ministry of Science and Higher Education under Grant 927/MOB/2012/0 ("Mobility Plus" program). P.C.L. White received funding under a UK Natural Environment Research Council grant (NE/K001620/1), with support from the Biodiversity and Ecosystem Service Sustainability (BESS) programme. BESS is a six-year programme (2011-2017) funded by the UK Natural Environment Research Council (NERC) and the Biotechnology and Biological Sciences Research Council (BBSRC) as part of the UK's Living with Environmental Change. (LWEC) programme.