150 Effects of mountain biking versus hiking on trails under different environmental conditions

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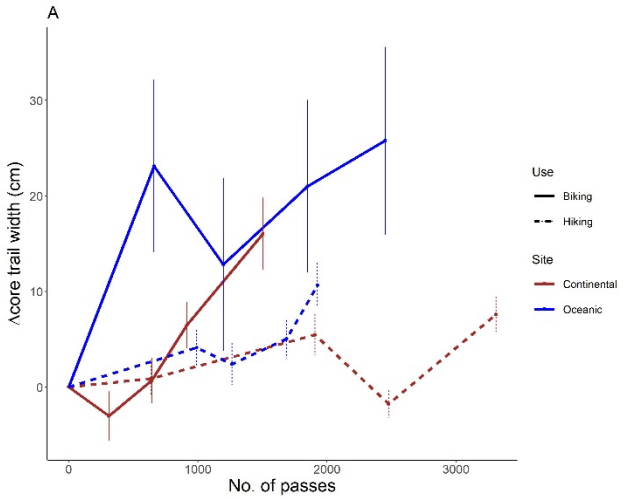
Recreational use of nature areas is increasing worldwide. All trail-based activities have a certain degradation effect on vegetation and soil, and conflicts between conservation values and recreation may occur. Controversy still exists regarding the relative impact of mountain bikers compared to hikers on trails. In Norway, mountain biking is allowed on existing, multiuse trails outside of protected areas, but within protected areas restrictions vary, whereas hiking is allowed. A governmental proposal suggests to allow for mountain biking on trails in national parks in line with hiking, but restrictions could be introduced if effects from biking are more severe than from hiking and in conflict with conservation values. For managers, knowledge about the effects of opening trails for new user groups in national parks is highly needed: will mountain biking cause other and more severe effects on trails, and thus provoke higher and other trail maintenance needs, or are effects similar to that if hikers?

In this study, we investigated trail degradation from increased use of trails from hikers and ountain bikers under different climatic conditions. Two study sites were selected, one located in an oceanic climate zone and the other in a continental zone. In each site, two trails were selected, one to be predominantly used by hikers and one by mountain bikers. The trails were natural-surfaced, occurring in natural vegetation, and with a variation in topography and plant communities. We contacted local groups through different channels (personal contact, e-mails, announcements on Facebook groups) and encouraged the use of the study trails throughout the summer of 2019. Mountain bikers were informed of the designated biking trails only, and we created Strava segments that were distributed to bikers. The oceanic biking trail was used for a local Endoru race from May-August, whereas the continental trail was part of a mountain bike race in end-August. Hikers were informed of the designated hiking trails only, and we mounted information signs in each end of the trails encouraging people to take a detour. Passes were counted with TRAFx counters.



We permanently marked sampling segments every 100 m along the trails. A sampling segment was a 15 m long part of the trail with homogenous vegetation and terrain. Three transects were placed perpendicular to the trail, at 2.5, 7.5 and 12.5 m from the segment starting point, with transect end points located in undisturbed vegetation. Trail width (core trail, and total trail width including the width of the transition zones between core trail and undisturbed vegetation, where signs of trampling were visible) and depth were recorded at early in the growing season (April-May), and then repeatedly approximately every fourth weeks to the end August-September. Environmental conditions were recorded at each sampling point (trail slope alignment) or transect (dominant soil substrate, soil moisture, trail slope). In total, our dataset included 1305 observations of 261 transects on 87 segments. We analyzed data with linear mixed models, using change in trail width and trail depth from the first sampling time as response variables, as a function of number of passes, proportion of bikers and environmental conditions along the trail.

Use intensity increased through the season, but varied between the trails: the continental hiking

trail had the highest use (c. 3300 passes), whereas the continental biking trail had the lowest use (c. 1500 passes). The study design was successful in directing bikers to the designated biking trails: On the biking trails, the proportion of bikers averaged 47.3% (± 8.6SD), whereas on hiking trails, the proportion was on average 13.2% (± 2.4 %).

Trail width, both the core trail without vegetation and the total area influenced by trampling and biking, showed on average small, but highly variable increases with enhanced use (figure 1). The most parsimonious models for core trail width change showed an increase in core trail width with increasing use, and a significant positive interaction between use intensity and proportion of bikers; core trail width increased more with increased use when the proportion of bikers was high. The most important predictor variable was soil moisture, core trail increased more in wet parts of the trail. Significant two-way interactions between soil moisture and both the proportion of bikers and use intensity revealed that core trail width increased particularly in wet parts of the trail with increased use and when a large proportion of users were bikers. The same pattern was found for total trail width. Trail depth did not change much throughout the study period, suggesting that the soils along the trails were already compacted and to a limited degree prone to soil movement and subsequent soil loss.

Our study is a necessary supplement to existing literature, as the first study to compare relative effects of mountain biking and hiking on natural-surfaced trails throughout a whole growing season, accounting for the number of passes by each user type. At the start of the study, trails were wider in moist and flat compared to dry and steep parts. Our study shows that on-trail use by hikers and mountain bikers had relatively limited overall effects in terms of trail widening and deepening. However, that effects depend highly on environmental conditions; we found soil moisture to be the most important predictor for trail widening. Enhanced use of trails in wet areas is likely to result in greater trail degradation, and more so if a large proportion of the users are mountain bikers. Management and maintenance of trails, in terms of re-routing or trail surface hardening, could thus be necessary to avoid negative impacts of increased use. For such management actions to be successful, they need to be targeted towards the actual user groups and the natural conditions in the area.

References

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