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A multi-method approach to study outdoor recreation interaction with red deer

In Scotland, red deer are distributed in multi-purpose landscapes where they coexist with hikers. This coexistence can impact red deer spatio-temporal distribution and behaviour (e.g. mating, vigilance) which can lead to potential conflict with essential deer management activities. This study aimed to investigate spatio-temporal distribution of red deer depending on the presence of hikers using a novel multi-method approach which associated camera traps and GPS data. We deployed camera traps at different distances from a popular hiking path over three summers. At the same time, we sampled hikers with personal GPS loggers to capture hiking activity. We collected more than 250,000 photos of red deer and more than 250 individual GPS traces of hikers. From these, we estimated the time necessary for a red deer detection following a hiking activity close to a camera trap. We used survival analysis to estimate the time necessary for red deer detection. In a second time, we estimated the distance between a camera trap detection of red deer and a hiker presence. We used logistical regressions to analyse these different distances. We found that the chance of a red deer detection after the detection of a hiker was 50% after 24h. The time necessary to observe a red deer after the presence of a hiker was more important at close distances from the hiking path (<25m) than further away from the hiking path. This suggests that red deer are less resilient to the presence of hikers close to the hiking path than further away. These results are of importance for red deer management in Scotland and for the potential use of camera traps and GPS data together for wildlife management and conservation.