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# Disturbance from roads negatively affects Andean condor habitat use

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## ABSTRACT

Human disturbance can be a severe problem for some animal species. Behavioural ecology theory predicts that sensitivity to mortality risks, and thereby to disturbance, will be related to life-history characteristics. Long-lived species with low reproductive rates are expected to have a high cost of predation and therefore avoid risks strongly. In this paper we quantify the effect of roads on the Andean condor (*Vultur gryphus*) using behavioural indicators. We used a pair wise design, offering condors standardized food patches near and far from roads simultaneously. The patches consisted of dead adult sheep. We recorded condors' behaviour when visiting each patch. This study establishes the versatility of behavioural indicators and their usefulness to study conservation problems. We found that, although near and far patches were discovered after similar times and there were similar numbers of condors in the vicinity of near and far patches, the use of patches differed strongly. In the patches far from roads many more condors came to feed, the average time spent per individual was longer, the proportion of time spent vigilant was lower, and the amount of food left uneaten on the carcasses was lower. These results strongly suggest that Andean condors clearly avoid roads, and behave in a way predicted from theory if they trade off safety for energy. This study shows that roads have stronger influence on the habitat use of Andean condors, than previously thought, and may be a significant problem for the species in populated areas.

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## 1. Introduction

Measuring how human activities may affect natural habitats is important for the assessment of environmental quality and for planning conservation strategies. In many cases, direct human disturbance can be a problem for animals, and road traffic is one example. Conservation biologists and managers in different parts of the world have been interested in the ecological effects on wildlife of roads and traffic (Spellerberg, 1998; Caro, 1999; Row et al., 2007; Bissonette and Adair,

2008; Eigenbrod et al., 2008). For example, car traffic diminishes habitat quality for breeding birds in forests over distances of 100–1500 m away from main roads in Netherlands (Reijnen et al., 1995). It also reduces species richness of insectivorous birds and abundances of passerines (Clark and Karr, 1979; Canaday, 1996). The complex road-traffic impact is generally greater than expected even on large bird species with large home ranges, often flying high above roads (van der Zande et al., 1980; Bautista et al., 2004). In this paper we aim to quantify the disturbance of roads on the Andean

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