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Editorial

Wildlife crossings and road impact on mammals

Highways are essential for countries' economic growth; therefore, the provision of road infrastructure services is undergoing rapid and permanent expansion. In current strategies, these communication routes are considered a fundamental element in economic reactivation, fostering many ambitious road modernization and expansion projects worldwide (CEPAL 2021). Despite their usefulness, roads are also a threat with significant environmental consequences. In recent decades, they have been considered one of the main threats to wildlife globally (van der Ree *et al.* 2015), mainly due to their impact by favoring habitat fragmentation and causing the mortality of multiple species of fauna due to collisions with vehicles.

In this issue, it is recognized that landscape connectivity is essential for maintaining the flow of mammalian individuals, their genetic variability, and allowing access to resources. An irruption of the connectivity brings, as a consequence, threats at the species and population level. However, despite the topic's relevance, there is little legislation on the maintenance of ecological connectivity. As indicated by Fernández-Buces *et al.* (2022), no laws, regulations, or agreements require means to maintain the connectivity of the landscape on the roads in a planned manner. As an example, there is an absence of specific laws to design wildlife crossings as a strategy to maintain said connectivity. It is necessary to understand that when building this type of communication routes, it is necessary to avoid or mitigate to a minimum the impacts that may be generated due to the construction activities and their subsequent operation.

Monitoring is another critical element that is part of a correct prevention and mitigation of the effects of roads. In this issue, we find studies that show the record of priority species that have suffered accidents against vehicular traffic and that show the need to take actions aimed at maintaining species as charismatic and relevant to natural ecosystems as the jaguar (*Panthera onca*; Rubio-Rocha *et al.* 2022b). We also found other infrequent species in the samplings due to the effect of the monitoring techniques used, but which are also affected by the existence of this infrastructure, as occurs with the spectral vampire (*Vampyrum spectrum*; Pacheco-Figueroa *et al.* 2022). In addition, reports are presented in which mammals present a differentiated use according to the different times of the year (Ruíz-Ramírez *et al.* 2022) or type of road (Ruíz-Ramírez *et al.* 2022; Rubio-Rocha *et al.* 2022a). All this is essential information for the design of mitigation measures (Cervantes-Huerta and Durán-Antonio 2022). Despite all the relevant information concentrated in this issue, there are still many information gaps on the effects of the roads, leaving great unknowns about what is happening on them due to the effects of run over.

On the other hand, monitoring wildlife crossings is another key element that can provide information on their effectiveness and the adaptation measures they require. This is evidenced in the study by González-Gallina *et al.* (2022), where the differentiated use of these structures is reported, according to the preferences of each species of mammal, as well as by the season of the year, or the time of existence of a fauna pass since it was built.

Also, some species clearly avoid highways, and easily adapt to the culverts used on these roads, even though they are not properly designed to be used as wildlife crossings; such is the case of the sereque or guatusa (*Dasyprocta punctata*) on the Inter-American Highway in Costa Rica (Monge-Velázquez and Sáenz 2022).

In the same way, we have evidence at the population level, which shows a reduction in a wildlife population when highway expansions were carried out, as occurred in Catazajá, Chiapas (Pozo-Montuy and Bonilla-Sánchez 2022), as well as a consequent and rapid adaptation to use of aerial wildlife crossings by howler monkeys (*Alouatta pigra*).

It is clear that roads remain a major threat to mammals. Current studies increasingly include the analysis of impacts on wildlife and analyze the effectiveness of the measures implemented in road projects. However, measures adapted to each region are not yet implemented, but they continue to use those that have been effective in temperate zones of the world.

The justification for the use of strategies in such areas is based on a cost-benefit analysis and are explicitly created for megafauna that is not distributed in tropical areas. Therefore, medium or small-sized fauna do not justify the construction of wildlife crossings for certain sectors of the population and decision-makers. In reality, it is not the economic cost of the accidents that should justify the construction of these structures to protect wildlife, but rather the environmental cost caused by the consequent loss of biodiversity. The measures must be created in a particular way for each region, espe-

cially in tropical zones, and analyze their cost-benefit for the recovered environmental services, considering a design adapted to the particular region. Faced with the current growth and modernization of communication routes globally, mammals will only have an opportunity if appropriate designs are implemented for each region and the species that inhabit it and that ensure the maintenance of landscape connectivity. Monitoring before, during, and after the construction of the infrastructure should be considered in the planning, in order to implement short, medium, and long-term measures that help maintain the diversity of mammals and their habitats adequately. Also, an effort to create an integrated legal framework that considers landscape connectivity as an essential element should be included. Road studies on the effects of communication routes on mastofauna are highly relevant. Collaboration between authorities, consultants, builders, researchers, and academia can lead to better informed and more efficient decision-making for the conservation of biodiversity and the ecosystems in which it is distributed.

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