













# Improving connectivity is key for restoring large mammals and human safety. A response to “Introducing European bison in Iberia: Road safety concerns. A comment to Nores et al., 2024”

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We appreciate D'Amico and colleagues for raising an additional point to the debate initiated by Nores et al. (2024) on the introduction of European bison in the Iberian Peninsula. Although we did not include the issue of human safety in our piece, we agree that it is also relevant to consider the potential risk that free-ranging bison would pose to road safety. This concern, however, would not be exclusive to the hypothetical case of introducing European bison to the Iberian ecosystems, but should be extended to any location within the species' current and historical range. As a result, road safety could be used as an argument against conservation actions to restore the bison populations within their known and estimated range. However, context-specific corrective and preventive measures, together with collaborative approaches, are available and could mitigate this potential conflict (Grilo et al., 2020; Psaralexi et al., 2022; Ribeiro et al., 2025; Rytwinski et al., 2016; Seoanes et al., 2024).

While ensuring human safety, effective connectivity is key to restore the populations of large mammals, such as European bison across the human-dominated landscapes of Europe (Bluhm et al., 2025). Even though habitat destruction and degradation are the worldwide leading causes of biodiversity loss (Jaureguiberry et al., 2022), and their reversal is probably one of the most effective conservation

actions (i.e., habitat restoration) (Langhammer et al., 2024), ecological connectivity is essential to restore ecological processes and functions for these megafaunal species (Brodie et al., 2025). However, most rewilding projects involving large mammals in Europe, such as those using European bison or even domestic breeds of horses or cattle, are still fenced (Pettorelli et al., 2018). This limits the restoration of functional roles and associated ecological processes, which in turn constraints the core principles of rewilding.

Globally, 46% of extant ungulate species are migratory, particularly the larger ones, which inhabit higher latitudes and are on average more dependent on grass (Abraham et al., 2022). European bison partially migrate between seasons (e.g., Kowalczyk et al., 2013; Perzanowski et al., 2019). The restoration of ecological processes associated to seasonal movements and migrations would be essential if we truly aim to restore their populations in the human-dominated Europe, and the functional role this species plays in the ecosystems it belongs. The fact that most rewilding initiatives had been carried out in fenced areas, so far, inadvertently reinforces land-sparing strategies to conserve megafaunal species (Navarro et al., 2019). Paradoxically, this approach could foster the emergence of artificial conservation interventions (e.g., assisted connectivity

between isolated fenced reserves, supplementary feeding). A truly rewilding approach around European bison should be aimed to restoring their ecological connectivity at different scales (e.g., Bluhm et al., 2025), which necessarily involves making linear infrastructures permeable to bison (Balčiauskas et al., 2025; Psaralexi et al., 2022; Rytwinski et al., 2016); and where the risks for human safety should be properly mitigated. Even accepting the introduction of unfenced European bison to the Iberian Peninsula, these populations would still be completely isolated from the nearest populations in the rest of Europe.

If Europe really aims for rewilding, we must take advantage of the possibilities offered by the new Global Biodiversity Framework (CBD, 2022) and the recently approved EU Nature Restoration Regulation (EU, 2024), which include ecological connectivity at their core. The complex and widespread network of livestock roads likely linked to the past migratory routes of wild ungulates in the Iberian Peninsula (Fernández-García et al., 2024; García-Fernández et al., 2019; Ruiz & Ruiz, 1986) offers an illustrative example of large-scale connectivity approaches. Extending from north to south of Spain, with a total length of >125,000 km and covering an area of >425,000 ha, this ancient network had been pivotal in developing the Spanish strategy of green infrastructure and ecological connectivity and restoration (MITERD, 2024), and could be inspirational in adopting similar strategies to restore seasonal and migratory movements of native large wild ungulates across Europe (BDN, 2024; Mangas Navas, 2012). However, it is worth noting that they are not exempt of its own threats, such as being illegally occupied for other land uses or not fully identified in the landscape (BOE, 1995). Restoring functional populations of large mammals, and their associated ecological processes, will require political will to re-establish large-scale ecological connectivity.

## AUTHOR CONTRIBUTIONS

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