

Use of wildlife crossing structures by ungulates and humans

Pros and cons of multifunctional passages

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Previous research



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Temporal patterns of humans and ungulates at bridges

Co-existence or disturbance?

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TRIEKOL report, TR-Dev-2019

Introduction

Fencing combined with crossing structures is widely accepted to be an effective solution to reducing wildlife-vehicle accidents and barrier effects of transportation corridors on wildlife (Clevenger et al. 2001, van der Ree et al. 2015, Huijser et al. 2016). To address the growing pressure towards an open and accessible landscape for both humans and wildlife, and to improve cost-effectiveness of crossing structures, there is an increased tendency to permit human use of wildlife crossing structures, or to construct human and wildlife co-use structures (van der Grift et al. 2011).

The effectiveness of crossing structures and non-wildlife passages to provide habitat connectivity may depend on many different factors, such as dimensions, substrate and vegetation, location and surroundings, and human disturbances (Rodriguez et al. 1997, Clevenger & Waltho 2000, Ascensão & Mira 2007). Human disturbance is usually quantified as the abundance of humans or distance to housings, but the effect of human activity or human-use of crossing structures on the use of crossing structures by wildlife is rarely quantified (see van der Grift et al. 2011, van der Ree & van der Grift 2015). Humans can have a big influence on the behavior of animals, not least of hunted species (Paton et al. 2017, Gaynor et al. 2018). Human use of structures may impact the frequency and the temporal pattern of the use of crossing structures by wildlife (Singer 1978, van der Grift et al. 2011, Barrueto et al. 2014, van der Ree & van der Grift 2015, Trocme & Krause 2019). Results from these studies are inconsistent, as animal use of structures increases (Ng et al. 2004), decreases (Rodriguez et al. 1997, Clevenger & Waltho 2000, Grilo et al. 2008) or remains consistent (Rodriguez et al. 1996, Gloyne & Clevenger 2001, van der Grift et al. 2011, van der Ree & van der Grift 2015) with increasing human use or proximity to human infrastructure. Thus, local studies are required to evaluate the relationship between human use and wildlife use of crossing structures.

To investigate the temporal patterns of animal use and human activities at crossing structures, we compared crossing structures build either for wildlife or for humans, but used by wildlife with different frequencies of human use and evaluated the influence that human presence had

TRIEKOL – Applied Road and Rail Ecology

Universität für Bodenkultur Wien
University of Natural Resources
and Life Sciences, Vienna

Master Thesis

Human influence on ungulates' usage of crossing structures

Submitted by
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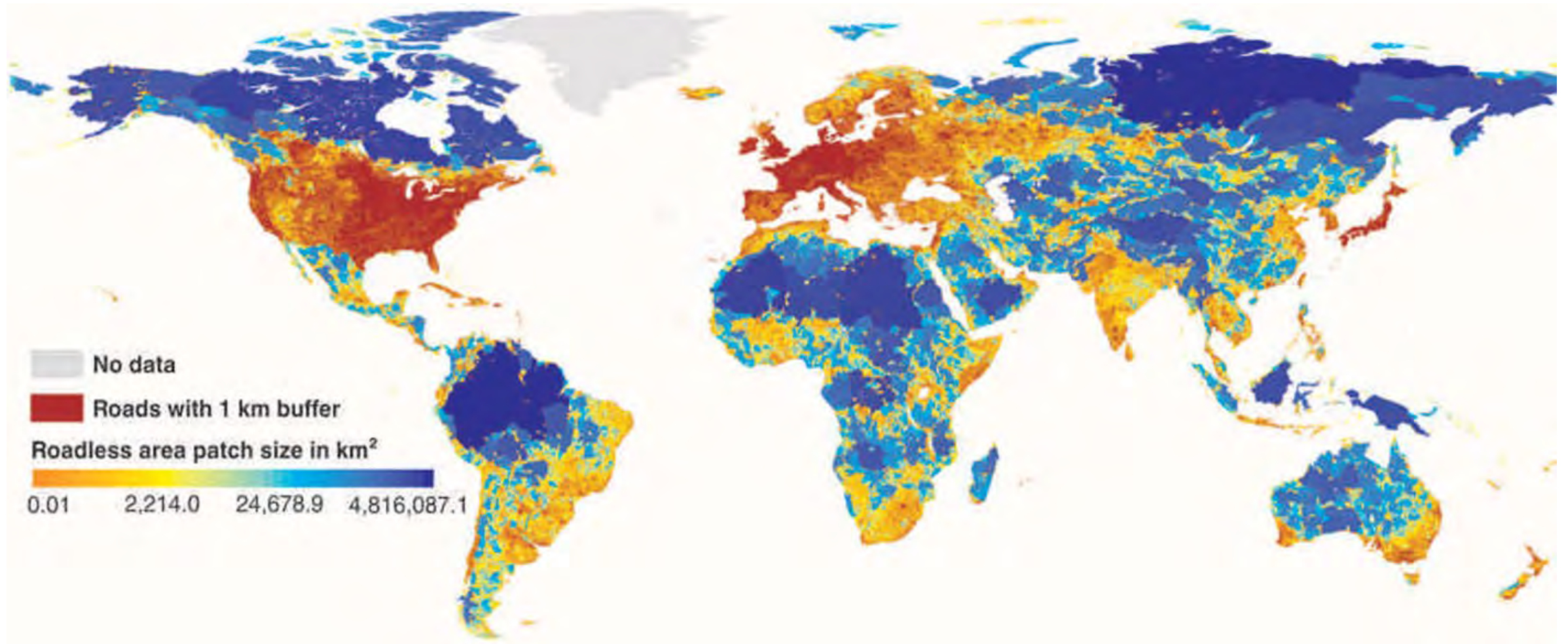
in the framework of the Master programme
Wildlife Ecology and Wildlife Management

in partial fulfilment of the requirements for the academic degree
Master of Science

Vienna, November 2021

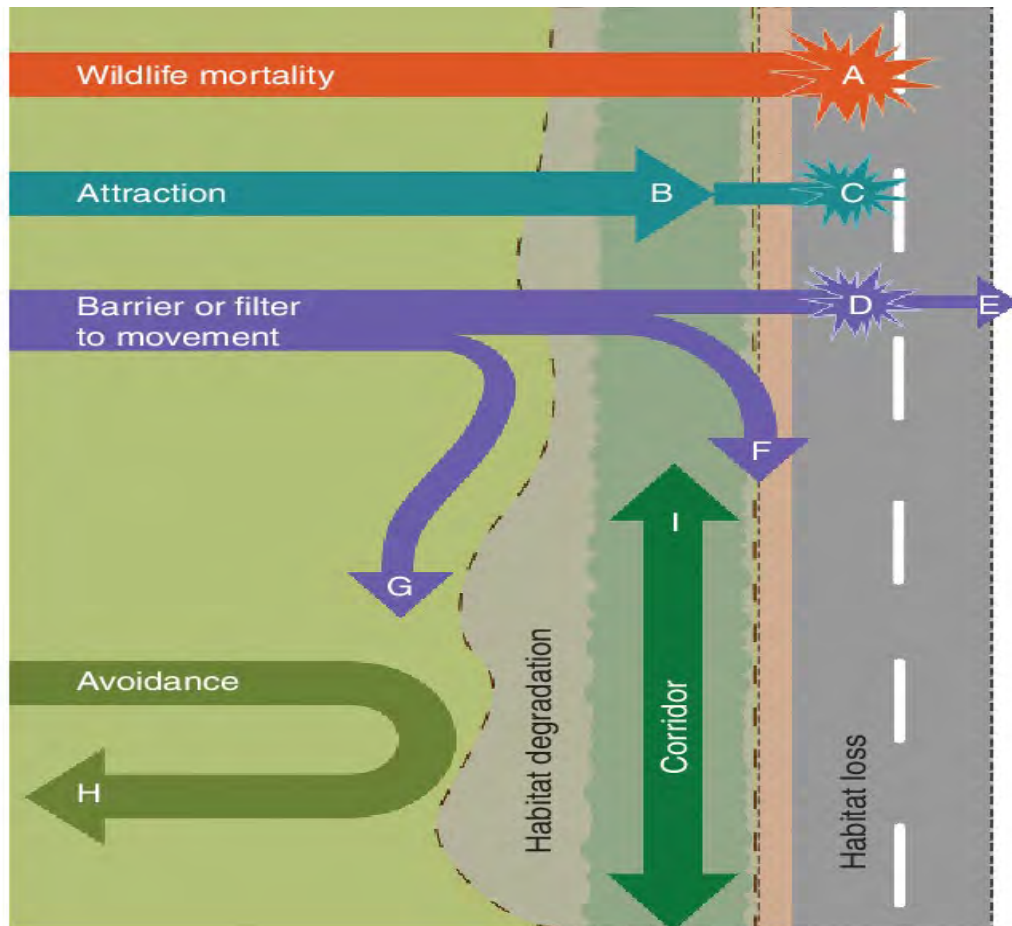
Supervisor:
Univ.-Prof. Dipl.-Biol. Dr.rer.nat. Klaus Hackländer
Institute of Wildlife Biology and Game Management
Department of Integrative Biology and Biodiversity Research

Roads are a global problem



Ibisch, Pierre L.; Hoffmann, Monika T.; Kreft, Stefan; Pe'er, Guy; Kati, Vassiliki; Biber-Freudenberger, Lisa et al. (2016): A global map of roadless areas and their conservation status. In: *Science* 354 (6318), S. 1423–1427. DOI: 10.1126/science.aaf7166.

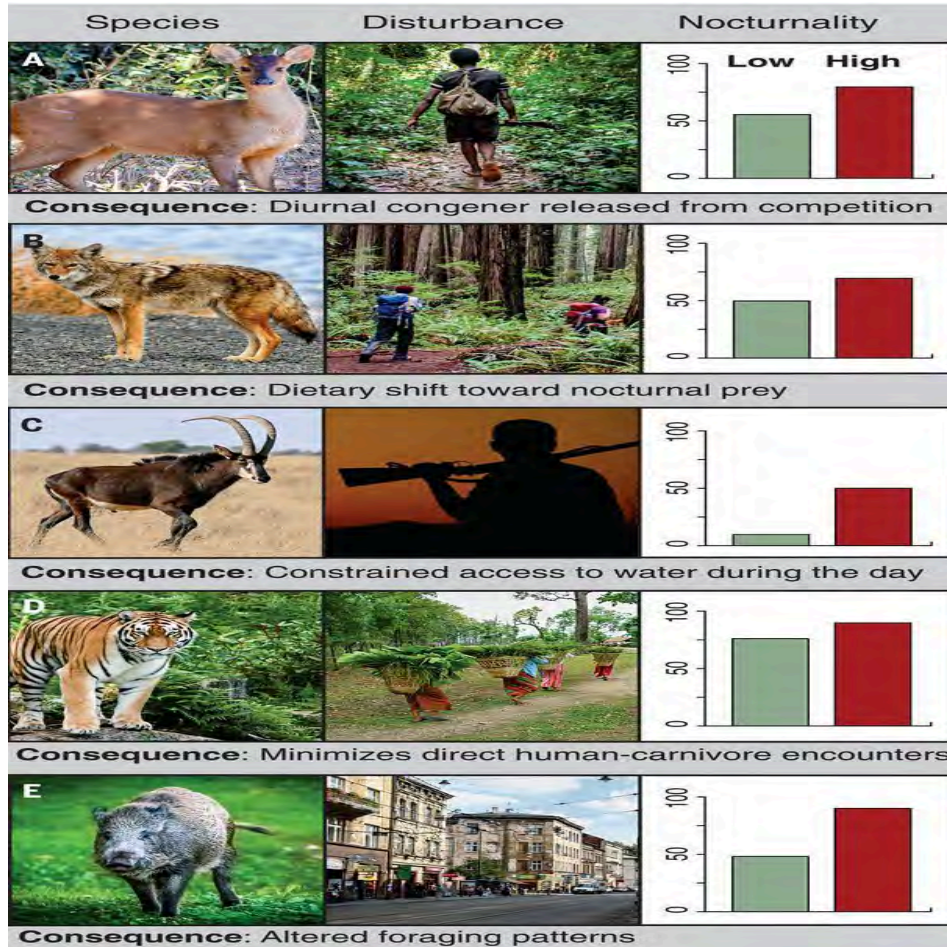
Road effects on wildlife and are crossing structures a solution?



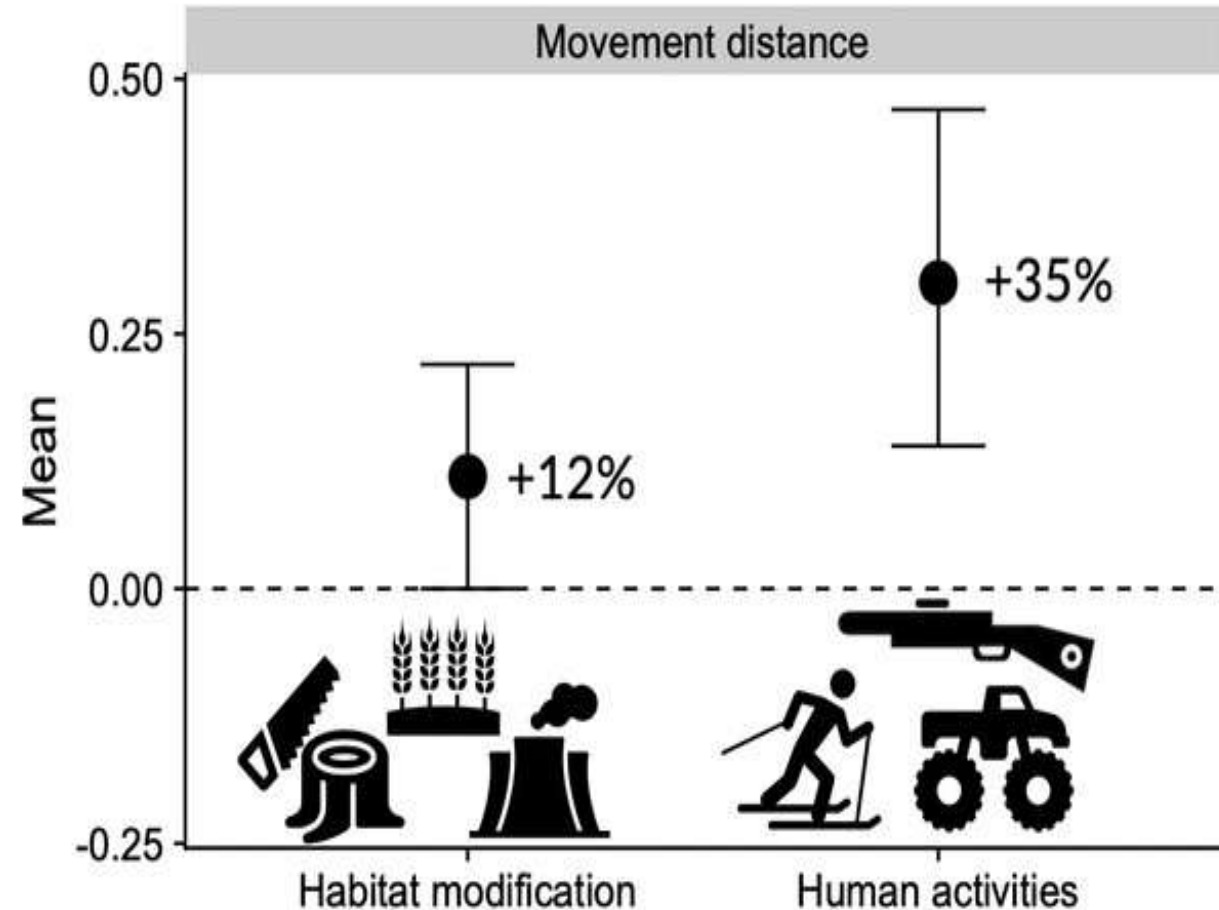
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van der Ree, Rodney; Smith, Daniel Joseph; Grilo, Clara (Hg.) (2015):
Handbook of road ecology. Chichester, West Sussex: Wiley Blackwell,
Illustration by Zoe Metherell

Human influence on wildlife movement behaviour & nocturnality



Green bars represent the percentage of species nocturnality in areas with low human disturbance, red bars in areas with high human disturbance



Gaynor, Kaitlyn M.; Hojnowski, Cheryl E.; Carter, Neil H.; Brashares, Justin S. (2018): The influence of human disturbance on wildlife nocturnality. In: *Science* 360 (6394), S. 1232–1235. DOI: 10.1126/science.aar7121.

Doherty, Tim & Hays, Graeme & Driscoll, Don. (2021). Human disturbance causes widespread disruption of animal movement. *Nature Ecology & Evolution*. 5. 1-7. 10.1038/s41559-020-01380-1.

Initial situation for crossing structure

- Structures built for humans, also used by wildlife (Rodriguez et al. 1996; Bhardwaj et al. 2020)
- Structures built for wildlife, also used by humans (Mata et al. 2005; Barrueto et al. 2014; Trocmé and Krause 2019; Caldwell and Klip 2020)
- Structures built for co-usage of humans and wildlife (van der Ree and van der Grift 2015; van der Grift et al. 2021)

Effects of human usage:

- Decreased animal usage of the structure (Rodriguez et al. 1997; Clevenger and Waltho 2000; Grilo et al. 2008)
- Consistent animal usage of the structure (Rodriguez et al. 1996; Gloyne and Clevenger 2001; van der Grift et al. 2011; van der Ree and van der Grift 2015)
- Increased animal usage of the structure (Ng et al. 2004)

Species and camera trapping



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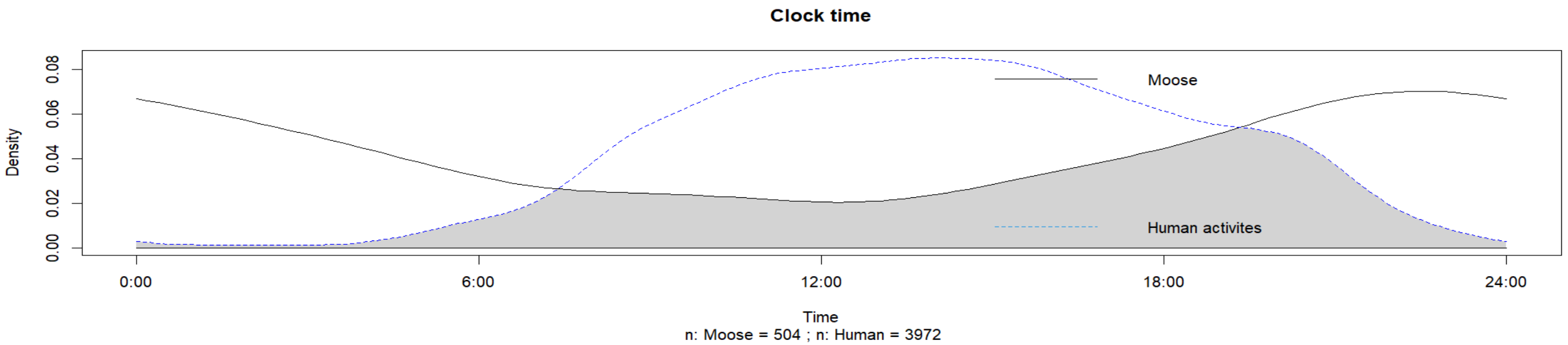
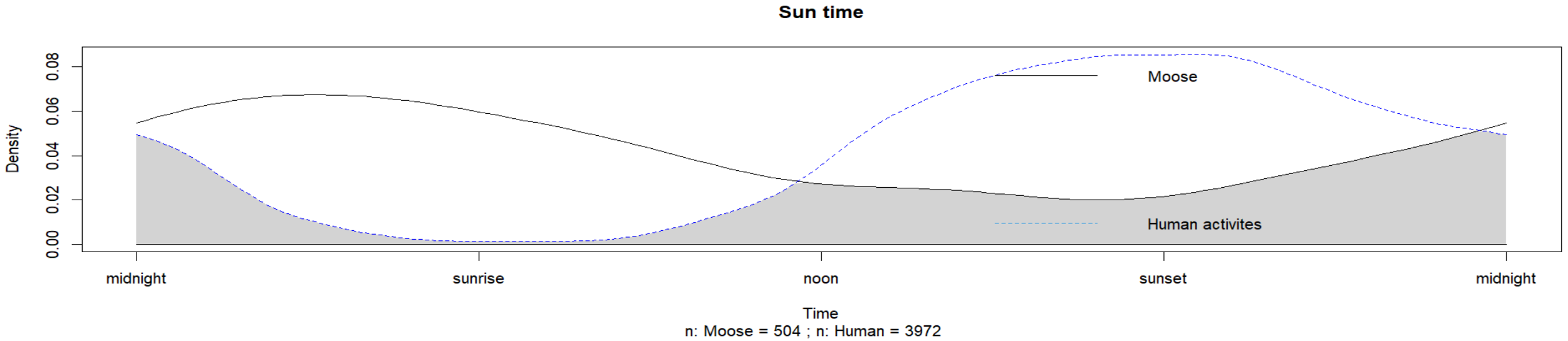


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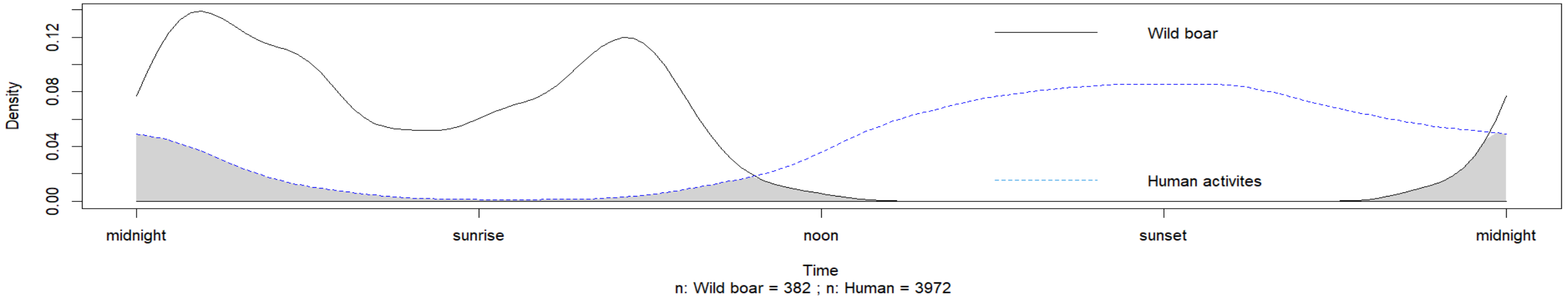
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Species and human activity on the structures – Human and Moose

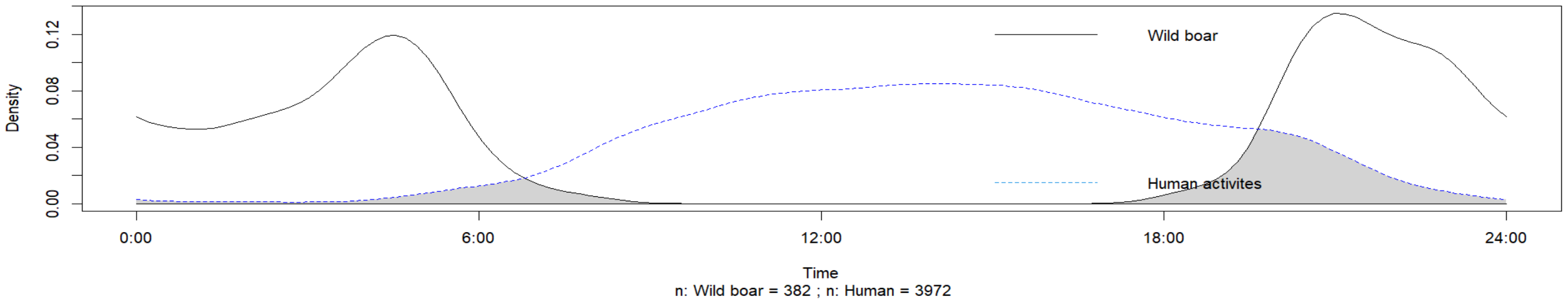


Species and human activity on the structures – Human and Wild boar

Sun time



Clock time



Human usage influences ungulate crossing behavior at Swedish crossing structures

- Lower amount of animal usages directly after a human usage then expected
- Increased latency in different ungulate species between the usages due to:
 - Open hunting season on this species
 - Human usage independent of the activity
 - Pedestrians
 - Snow mobiles



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Discussion & Summary

- Human disturbance can be a limiting factor and counteract the purpose of the structure
- No behavioural changes don't correspond with no disturbance (Gill et al. 2001, Stankowich 2008, Zbyryt et al. 2018)
- High variability in species response to structural factors => prohibition of a “one size fits all approach” (Denneboom et al. 2021)



≈10,000,000 €

≈1,000,000 €

≈100,000 €

Examples of differently sized crossing structures in Sweden used by large wildlife, with rough estimates of investment costs.

Images by courtesy of Trafikverket and PEAB

Helldin, Jan Olof (2022): Are several small wildlife crossing structures better than a single large? Arguments from the perspective of large wildlife conservation. In: *NC 47*, S. 197–213. DOI: 10.3897/natureconservation.47.67979.

Take home messages and take home questions

- Ungulates are disturbed due to human activities
- Reduced ungulate usage after human usage
- What is the aim of the structure?
- How much disturbance is acceptable for the structure to suffice for the aim?
- Which functions does the structure have in a regional/landscape context?
- How should the animals perceive the structure? Which type(s) of behaviour should they exhibit?



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