

The PhD thesis of Lucie Ambrožová titled “Dung beetles of Central Europe: Diversity and conservation” comprises three chapters as well as a general introduction and summary. The thesis focuses primarily on the main factors determining dung beetle diversity in Central Europe and those of particular concern for dung beetle conservation, especially from a pasture and forest management standpoint.

The introduction is divided into several sections that discuss dung beetle biology, their role in the ecosystem, their diversity in Central Europe, the major threats facing the dung beetle and their conservation needs. I think that this is the weakest chapter of the thesis. Several aspects of dung beetles, such as “Dung beetle biology” and their “Ecosystem role,” are treated somewhat superficially. Moreover, there are some small imperfections and perhaps too much information that is not properly contextualized or examined in terms of its implications. Also the section on the “Diversity of Central European dung beetles” could have explored the topic in greater depth by focusing more on the fauna of the area actually analysed in the thesis. However, I found the section on the major threats facing dung beetles to be well written and contextualised (although I would have avoided talking about climate change, a topic that is not subsequently addressed in the thesis). It also flows nicely into the next chapter, introducing the main factors that will be analysed and clearly stating the aims of the thesis.

Chapter 1, which was published in *Agriculture, Ecosystems & Environment* (2021, 321: 107634), examines the effects of the use of antiparasitics, namely ivermectin, (differentiating between areas where cattle have only recently begun receiving ivermectin treatments and those where cattle have been receiving treatments over the long term), on the following four dung beetle parameters: species richness, abundance, biomass and functionality (i.e. dung removal ability). The sampling was done in 26 sites in four different regions of the Czech Republic and one site in Austria. The results confirm that ivermectin use negatively affects dung beetle species richness, abundance and functionality, but not total biomass. Although the results are mainly confirmatory, I think that the wide distribution of the sampling makes them robust; hence, this investigation could be a very important step towards achieving dung beetle conservation goals in the Czech Republic. Moreover, I like the idea of splitting the ivermectin treatment into long and short-term, a distinction that is rarely made but should be taken into consideration and investigated. Although I do not agree with some of the guild assignments for the dung beetle species (there are at least four species that are not dwellers but relocators to my knowledge), I found the “visitors” category for the species that have saprophagous larvae, such as *Melinopterus*, *Chilothorax* and *Nimbus* among the others, to be very interesting. Truth, if it exists, is in the details. I think this could be a very important detail for future investigations using dung beetle functional groups.

Chapter 2 was published in *Agriculture and Forest Entomology* (2022, 24: 104-113). It focuses on a manipulative field experiment, testing for the effects of coppicing as well as coppicing and topsoil removal on communities of dung-inhabiting beetles (dung beetles and rove beetles) compared to closed forest. The sampling was done in 27 plots (three plots x three treatments x three blocks). The results show that alpha diversity does not differ among the treatments, but the gamma diversity of dung beetles in the coppice was higher than in the forest. Six dung beetle and six rove beetle species were significantly more abundant in the manipulated plots (coppicing or coppicing and topsoil removal), whereas three dung beetle and six rove beetle species were more abundant in the forest habitat. Dung beetle functional diversity is higher in the forest, while rove beetle functional diversity is higher in the manipulated habitats. Moreover, dung fauna composition differed between forest and manipulated habitats. I liked the idea of using a manipulative experiment to test what happens to dung fauna. Indeed, these findings could improve our ability to manage land and make policy recommendations. The discussion of the results is logical. I would like to suggest also taking into account the landscape level for possible future investigations. The only possible methodological problem that I found was the average distances between

plots (60 m on average). This, in fact, could be too small to avoid interference between baited pitfall traps, especially during a long exposition time of traps in the field (1 week).

Chapter 3 was published in *Biological Conservation* (2022, 273: 109682) and examines the relative importance of environmental variables (i.e. space, temperature, precipitation, elevation and season) and cattle management variables (i.e. grazing herbivores and antiparasitic treatment) for dung beetle β -diversity in the Czech Republic. Moreover, the author simulated what could be the optimal grazing regimes (i.e. the best combination of different herbivores and different seasons) to achieve the highest level of dung beetle γ -diversity. This chapter, mainly showed that environmental factors (spatial distance, season and temperature) were the primary drivers of dung beetle β -diversity, while herbivore type and antiparasitic treatments had less impact. Nevertheless, antiparasitic treatment increased nestedness and resulted in an overall lower γ -diversity. Finally, the best grazing regimes seem to be achieved by multiple species (i.e. cattle, horses and sheep) and year-round grazing. I found this chapter to be of great scientific quality. The results are very interesting from a scientific point of view, and could be very useful for political decision makers or stakeholders involved in grazing land management. Moreover, I think the narrative is very good, the message is clear and the extensive sampling range makes it possible to extend your conclusions to at least a national level. I might just suggest avoiding the dweller, roller and tunneler categories for future investigations, as, especially the dweller category, could be semantically and ecologically confusing.

In summary, I think this is a very good PhD thesis that makes a significant and interesting contribution to the field of dung beetle ecology and conservation. Overall, the thesis is well written and clear, and its quality is underscored by the fact that all the chapters have been published in international scientific journals. The broad range of sampling (chapter 1 and 3) make it possible to reach conclusions that are applicable at least on a national level, allowing to apply the most appropriate land management approaches that take into account dung beetle conservation. Moreover, the statistical analysis is top level. I think the author should explore relevant bibliographical resources on dung beetle biology, especially to improve discussion and to ensure the correct categorization of some species in functional groups for future investigations.

Questions:

Chapter 1: Do you think that measuring functionality as a proxy of the biomass of different functional groups can provide reliable results, replicable in other contexts?

Chapter 2: As the major differences for dung fauna exist between manipulated habitats and forest, what do you think could be the best approach to adopt for their conservation, coppicing or topsoil removal? In your opinion, what kind of experiment should be carried out to help us understand what the best management approaches are for dung fauna conservation?

Chapter 3: In this chapter you propose several conservation actions in order to achieve a good level of dung beetle conservation. However, we know that there is a large gap between research and implementation in conservation. In your opinion, what kind of strategy could be successful to translate your research into concrete actions in your country?

Do not hesitate to contact me if you have any questions.

Yours sincerely,

Città di Castello, 04/02/2023

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