

Review of the PhD-thesis entitled “Disturbance dynamics of mountain temperate primary forests of the Western and Southern Carpathians and its effect on forest structure and bird assemblages” presented by Mgr. Ondrej Kameniar.

Reviewer: Grzegorz Mikusiński, Swedish University of Agricultural Science SLU.

I found the thesis written by Ondrej Kameniar being a stimulating lecture with many interesting findings. As its structure differs largely from Swedish and Polish theses that I read earlier, initially I had a problem to orientate myself in the text. In general, the thesis delivers to large degree novel evidence concerning threatened types of montane forests with disturbance dynamics, structure and bird assemblages in focus. I congratulate Ondrej this achievement and hope that he will continue his studies in future. As usual, many issues in the thesis could be further explored concerning scientific stringency, interpretation of findings or even factual problems in the text presented. Below, I provide a list of ten questions/issues that I hope could be further discussed during the defence.

1. Primary forests as defined in the thesis are stands with very limited human impact and as such could be considered as a kind of continuity forests (i.e. forest with continuous tree cover. I am aware about different forest development phases described for Central European forests. However, I still wonder how good is the forest age as parameter describing primary forests. I also wonder how this age was technically described for the purpose of your studies.
2. You propose that large continuous and attitudinally diversified forest landscapes should be protected/restored as a necessary measure to ensure the temporal and spatial structural heterogeneity. I agree with that. However, since particularly the area of subalpine, spruce dominated forest is highly dependent on topography and in addition threatened by climate change, some kind of prioritisation should be applied to be effective. How would you do that?
3. Thorough the thesis I had a hard time to accept the term “synchronisation”, as it is used. I somehow feel that synchronisation refer to relation that exists when things occur at the same time with some purpose (human-driven or ecological/evolutionary) and I was expecting such a phenomenon even here. Still, as you show in your thesis, disturbances have been partially “synchronised” in your study system. What could it mean for forest bird assemblages in the region and how, in practice, you envision emulating such “synchrony” in biodiversity conservation.

4. I was struck by very small total area of primary forests in Slovakia (little over 10 500 ha) that, in addition, is divided into many, often isolated parts. Even if it would be just in a few big chunks, it is still far from so-called “minimum dynamic area” (e.g. Leroux, et al. 2007. *Biol. Conserv.* 138, 464–473 or Potapov et al. 2017. *Science Advances* 3, e1600821) suggested as self-sustaining in terms of natural processes (including disturbances). In this perspective even the entire Białowieża Forest (150 000 ha) is considered too small. What is your advice concerning long-term conservation of your tiny primary forests in Slovakia?
5. You write that increased intensity and frequency of disturbances can be seen as an opportunity to increase the adaptability of ecosystems. Do you see some limits here and why? Please develop this, also in relation to disturbances occurring simultaneously over large areas and possibly illustrate the issue with forest bird species.
6. Are you aware of the “intermediate disturbance hypothesis” and in what way it could be relevant to your study system in general and bird assemblages in particular?
7. The aims of your thesis are pretty descriptive. But, I imagine, that you have some initial ideas, expectations and hypotheses concerning what you expect to find in your study system. Which results surprised you most and why?
8. I could not find what numbers of birds were used in the analyses. Were the highest numbers of birds per species per visit used? What 4 745 individuals in third paper comes from?
9. Birds are affected by local forest characteristics but also by the impact of the surrounding landscapes through e.g. so-called “spill-over” effect (see e.g. Basile et al. 2021. *Ecol Indicators* 133, 108402). What is your opinion concerning the effect of the surrounding landscapes on bird assemblages/particular species in your study?
10. I am confused around the reasoning concerning the cavities. What count as cavity in your study? Non-excavated cavities in spruce are rather rare; what high number of tree cavities in spruce dominated in your third paper comes from? Are foraging cavities included? I guess that woodpeckers matter a lot as producers of cavities and their impact must be very different in the two types of forest. The total number of woodpeckers is the same but their species composition very different (in spruce dominated forests almost exclusively three-toed woodpecker that is a spruce specialist also in terms of cavity excavation; see Hardenbol et al. 2019 *Forest Ecology and Management* 450, 117530). Please elaborate on the origin of cavities and link them to tree species, snags and woodpeckers in your study system.