Different responses of beetle biomass, diversity and functional groups to retention forestry

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ConFoBi – Conservation of Forest Biodiversity in Multiple-Use Landscapes of Central Europe

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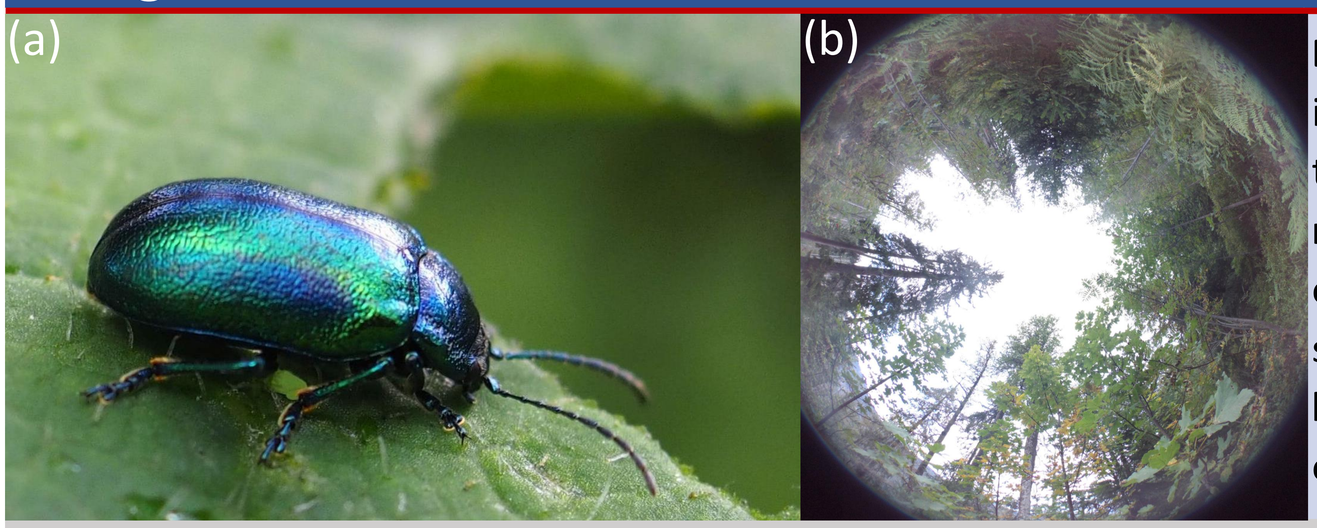
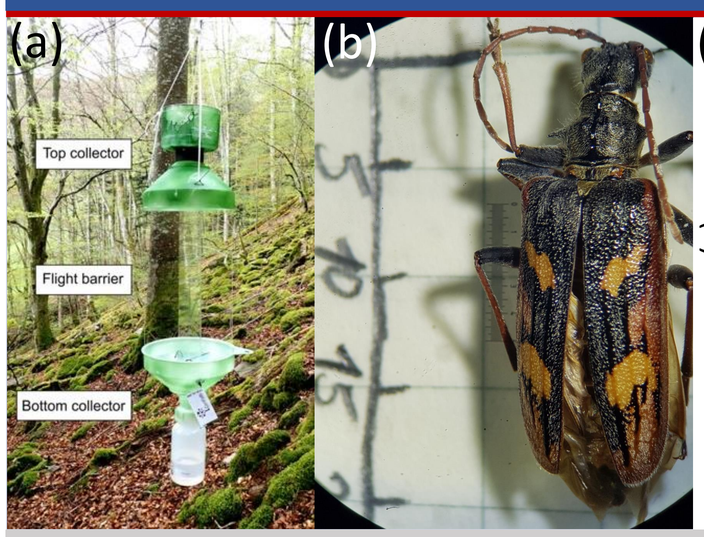
Background



Declines of insect biomass and diversity have been well-documented in recent years[1, 2], with several anthropogenic **land-use drivers**[3, 4]of these trends. Surprisingly little research has focused on **forest management practices** to mitigate this trend, despite clear declines observed among beetles (Coleoptera)[5]. **Retention forestry** is a strategy aiming to conserve forest elements for the **benefit of biodiversity**. Here we examine the relationships between the retention of forest elements and the **biomass/diversity of forest beetles**.

Fig. 1. (a) *Oreina cacaliae* on host plant *Adenostyles alliariae*. (b) Hemispherical photo of ConFoBi research plot 003 at southeast corner.

Data collection



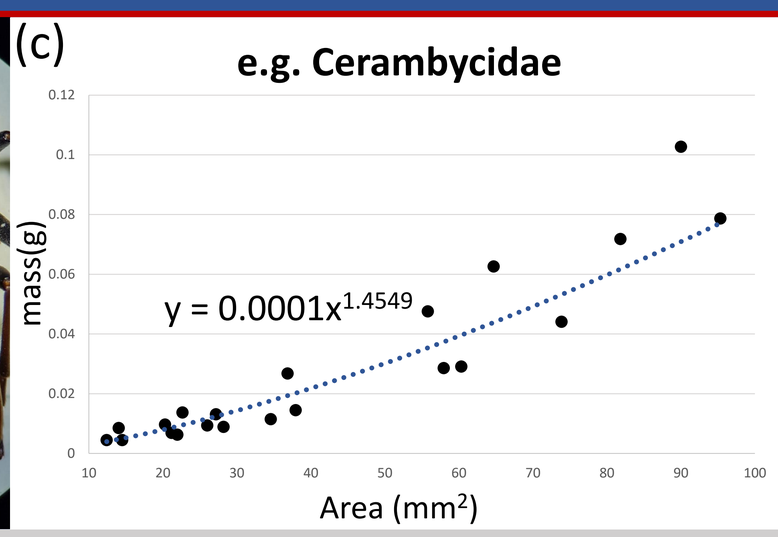
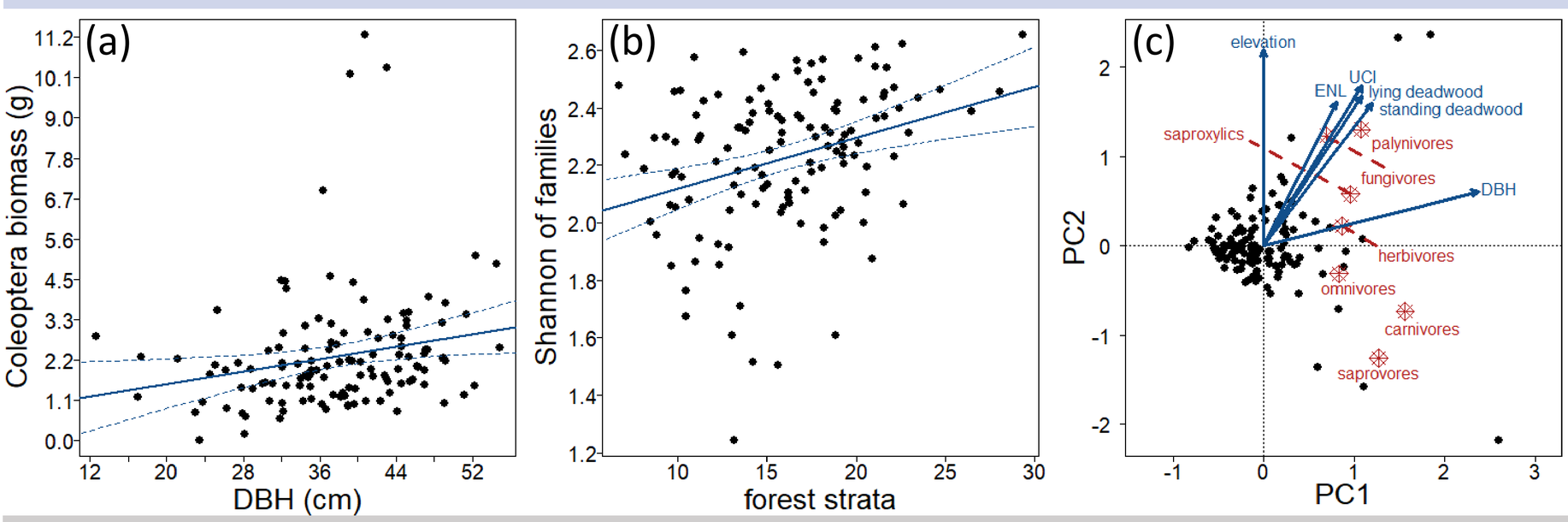


Fig. 2. (a) window trap on forest plot. (b) *Rhagium bifasciatum* (Cerambycidae) for measurement, drying and weighing. (c) allometric regression of area (lengthXwidth) against biomass.

- Tree diameter (DBH), tree richness, deadwood counts/volumes, and terrestrial laser scanned variables (forest strata, structural complexity, understory complexity) measured on 135 1-ha research plots in the southern Black Forest
- Insects collected using 2 window traps[6] on each plot[7] (Fig. 2a)
- Families and functional groups identified
- Biomass calculated using allometric regressions[8] for families (Fig. 2b & c)

Results



- Beetle biomass increased with tree diameter (DBH, fig. 3a)
- Family diversity increased with effective number of layers (ENL, fig. 3b)
- Functional groups' responses differed depending on environmental variables (fig. 3c)
- Specialized functional groups aligned with resources used

Fig. 3. (a) Biomass of all beetle families plotted against mean diameter at breast height (DBH). (b) Shannon diversity of beetle families plotted against number of forest strata (ENL), or 1 meter forest strata. (c) RDA ordination of research plots' biomasses of beetle functional groups. Species' scores are plotted in red for each functional group while environmental variables are shown as blue arrows. The abbreviation "UCI" represents understory complexity index.

Summary

Forest beetle biomass increased with only DBH. Diversity increased with more forest strata, likely as this drives diversity of resources. Various retention elements were related to higher biomass of functional groups such as the effect between lying deadwood volume and saproxylic taxa, as well as understory complexity and palynivorous taxa. Interestingly, the biomass of saproxylics decreased with increasing stand structural complexity, likely due to more extreme microclimatic variations.

The qualities of having larger trees, more forest strata, a more complex understory and larger deadwood volumes are often associated with older forests with longer disturbance legacies, which may be the best target for promoting beetle biomass and diversity.

Acknowledgements & References

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