PAPER PROJECT

Preliminary title:

Influence of forest structure and stand age on biodiversity and carbon stocks in European forests

Target journals:

Ecological Applications, Journal of Applied Ecology

Aims:

We want to find out if a simultaneous mitigation of climate change and biodiversity crisis can take part in European forests. In detail, we want to understand how carbon storage and species richness of multiple taxonomic groups react to changes in forest structure and stand age. For this we analyze data on even-aged high forests from different countries in Central Europe. With this we can give guidance to foresters on how to manage their forests to promote carbon storage and the diversity of different taxonomic groups.

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According to the BOTTOMS-UP Bylaws any member of the BOTTOMS-UP Consortium can declare his/her interest to become opt-in author. The first author is required to preliminarily accept one such offer from each dataset that represents at least 2% of the data in the analysis. It is upon the discretion of the first author whether to accept any opt-in offer beyond this requirement. Persons interested in opt-in authorship can be nominated until 03.03.2024 with e-mail to the first author (and cc: to the BOTTOMS-UP Governing Board), explaining which dataset(s) they represent and preferentially also how they could contribute. Note however that such a nomination only means the option to become co-author. In the end only those persons will be retained as actual co-authors who have made a

significant intellectual contribution to the paper during the course of its preparation (in accordance with BOTTOMS-UP Bylaws and compliance to ethics in academy).

Data to be used/Methods:

The analysis is the product of a two-week Short-term scientific mission at the University of Rome, approved by the Governing Board. Within this STSM, we analyzed data on 326 plots (121 plots DE_PS, 79 plots CZ_JH1, 78 plots DE_ID, 25 plots HU_PO1, 23 plots IT_SB2). For these plots, data on the required 12 variables (stand age, tree richness, mean DBH, Deadwood (DW) type richness, Carbon (C) living wood, C deadwood, Vascular plant richness, Fungi richness, Bird richness, Beetle richness (note that richness is the scaled richness per plot), mean temperature, annual precipitation) was available in the Bottoms-Up database. As the relationship between carbon stocks and biodiversity is likely mediated both directly and indirectly by stand age and different stand structural characteristics, the most appropriate way to approach their influence is the use of structural equation modelling. For the structural equation model, we built eight single models, which serve as the conceptual frame of the analysis:

- DW_type_richness ~ treerich + staage + an_temp + an_prec
- mean_dbh ~ treerich + staage + an_temp + an_prec
- C_living ~ treerich + staage + mean_dbh + an_temp + an_prec
- C_dead ~ treerich + staage + mean_dbh + DW_type_richness + C_living + an_temp + an_prec
- Vasc.Plants ~ treerich + staage + mean_dbh + C_living + an_temp + an_prec
- Fungi ~ treerich + staage + mean_dbh + DW_type_richness + C_dead + C_living + an_temp + an_prec
- Birds ~ treerich + staage + mean_dbh + DW_type_richness + C_dead + C_living + Vasc.Plants + an_temp + an_prec
- Beetles ~ treerich + staage + mean_dbh + DW_type_richness + C_dead + C_living + Vasc.Plants + Fungi + an_temp + an_prec

Timeline:

Short-term scientific mission: 04.02.2024 - 17.02.2024
Data preparation and analysis: 04.02.2024 - 17.02.2024
Raw results to be sent to the wider author team: 04.03.2024
Writing up of the paper (including preparation/optimization of figures): 05.04.2024
Feedback round of co-authors to MS: 26.04.2024
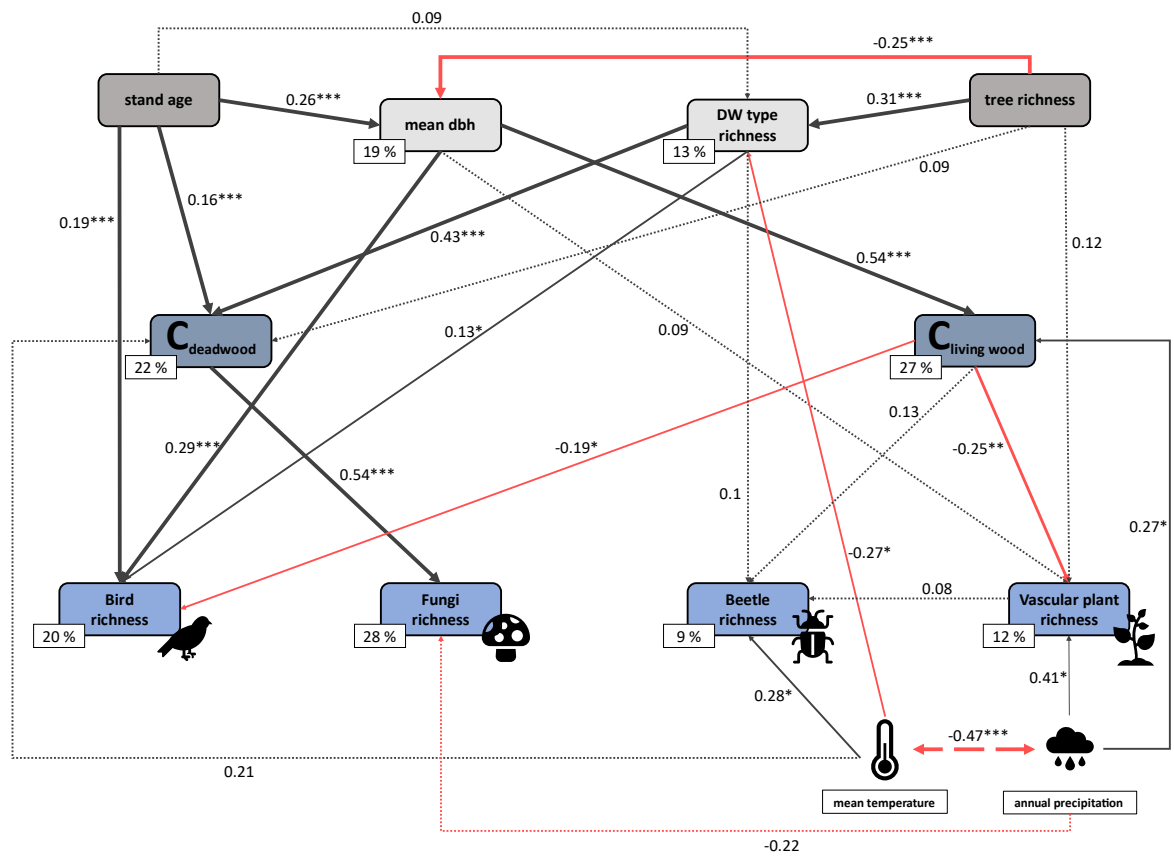*Submission: around 15.05.2024 (end date Bottoms-Up)*

Result of the main model:

Figure 1: Path model (Fisher's C = 21.656, p-value = 0.086) showing the relationship of forest structure (note: deadwood = DW) and stand age with carbon stocks (C) and the scaled richness of different taxonomic groups. The numbers next to the arrows represent the standardized path coefficients (*** p < 0.001, ** p < 0.01, * p < 0.05). The thickness of the arrows is scaling with the significance values, while black and red arrows represent negative and positive relationships. The dotted lines represent marginal significant relationships. The dashed line between mean temperature and annual precipitation depicts the error correction between these two variables. The percentage values indicate marginal variances of the response variables. For clarity, we have omitted the non-significant arrows and path coefficients in the figure.