PAPER PROJECT

Preliminary title: Forest ability to sink carbon is (not) related to multi-taxon biodiversity

Target journals: Nature Ecology & Evolution, PNAS

Outline: Climate change and biodiversity are now widely recognized to be tightly interconnected since climate warming can threaten ecosystem integrity and functioning, which in turns has cascading effects on the entire ecosystem community structure and diversity (Díaz et al. 2019).

Forests are of extreme relevance for both these major environmental challenges. Three-quarters of known terrestrial plant, fungi and animal species need forests as a part of their habitat (FAO & UN, 2020). The IPCC as well as the Paris Agreement recognize that forest provide a fundamental contribution to climate change mitigation goals.

In the last 20 years, global forests stored about 16 Gt of CO2 per year and emitted about half of this amount resulting in a net sink of about 7.6 Gt per year (Harris et al. 2021). As climate change impacts continue to accelerate, and its effects on ecosystems and human society become more and more evident, forest contribution to reduce carbon gains increasing relevance.

Several studies tried to link forest biodiversity with one or multiple ecosystem functions (Ratcliffe et al. 2017) but mostly accounted only for tree diversity (Baeten et al. 2013); whereas, it is now widely accepted that forest biodiversity should encompass multiple taxonomic groups (Sabatini et al. 2016; Burrascano et al. 2018). In general, many studies addressing the biodiversity and ecosystem function topic in forests do not provide sound results since functions are vaguely defined and forest dynamics is not accounted for, as it was highlighted for instance for biodiversity/productivity relationship in a recent review (Sheil 2020).

The use of broad datasets that include information on forest structure and management as well as on multi-taxon biodiversity would allow to overcome these limits and relate properly forest biodiversity and their function.

Here we use the recent maps of forest carbon fluxes (Harris et al. 2021) and the Bottoms-Up platform on forest multi-taxon biodiversity to investigate the effects of biological diversity of forest role as carbon sink. Specifically, we evaluated whether highly multi-taxon diverse forests have an higher ability to store carbon than less diverse forests.

Aim:

Assess the relationships between forest C fluxes and biodiversity accounting for differences across multiple taxonomic groups and between carbon emissions and sinks.

Plot species richness will be standardised through coverage analysis based on rarefaction curves and modelled against carbon sinks and emissions.

Multi-taxon species composition will be related to the carbon flux gradients through principal curve analysis.

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Core authors outside BOTTOMS-UP:

Please note that if the outline changes substantially (more than 1 aim is revised substantially), or co-author(s) are added to the above lists the governing board should re-vote on the project.

Further opt-in authors:
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 …. 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: All the taxonomic information at the species level from all the datasets in the BOTTOMS-UP platfrom.

Please detail which datasets will be used, also reporting specific subsetting procedures if needed.

Time line:
Deadline for permission of data usage from custodians: March 2021
Extraction of data from BOTTOMS-UP: March 2021
Data preparation and analysis: September 2021
Raw results to be sent to the wider author team: October 2021
Writing up of the paper (including preparation/optimization of figures): December 2021
Feedback round of co-authors to MS: January 2022
Submission: January 2022

Confirmation:
I confirm that I will adhere to the BOTTOMS-UP Bylaws.

Date
5 February 2021

Signature

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