

Response Letter

Dear Dr. Stocker,

Thank you for your time and effort in dealing with the revision of our manuscript “*Assessing forest biomass and productivity with data-driven vegetation indices: insights from 900,000 simulated forest stands*”. We appreciate the opportunity to submit a further improved version of our manuscript for re-evaluation and would like to thank the you and the reviewers for your constructive comments and helpful suggestions.

We have considered and responded to all comments and adjusted the manuscript accordingly. In particular, we have addressed the last point by Colin Bloom by adding a clarifying statement to the limitations section and by listing environmental factors to be considered in potential follow-up studies.

Below we respond to the reviewers’ points in greater detail. We hope that our improvements of the manuscript qualify it for publication in Biogeosciences.

Yours sincerely,

Samuel Fischer on behalf of the authors

Response to RC1

Re-Review of Assessing forest biomass and productivity with data-driven vegetation indices: insights from 900,000 simulated forest stands

I have now re-examined the manuscript of Fischer et al. The focus of the work and the underlying analysis remain largely unchanged from the previous iteration, but the revised text offers a much stronger motivation in the introduction and a clearer methodology. These changes, along with revisions to the discussion, largely address my major concerns from the original manuscript. I also appreciate the updated title which is more indicative of the actual analysis.

- Thank you for taking the time to review our manuscript a second time. We greatly appreciate your many helpful comments!

One point I would still stress regards the large-scale applicability of the Hohes Holz site to different environmental conditions across Central Europe. I agree that Hohes Holz seems representative of many sites and the (now much clearer) variability scenarios address several of the most important factors affecting forests in Central Europe. However, factors like forest structure, climate and soil wetness are only a few of many which control forest condition and productivity. For instance the supplement suggests that rooting depth and soil type were taken directly from Hohes Holz but this will vary strongly across sites. Sites with different slope, aspect, tree species composition, understory, etc. may act differently. Of course, it is not necessary to evaluate all factors here and Lines 357 to 363 partially clarify limitations, but I think a more general clearly stated point of limitation is still missing. Something to the effect of: The findings here may only apply to sites with similar environmental conditions to Hohes Holz and additional studies are required to further assess the impacts of a wider range of environmental site characteristics on vegetation index performance.

- Thank you. We have revised the corresponding paragraph accordingly. In fact, we have already taken into account factors such as tree species composition and forest structure. However, we were indeed unable to vary all relevant site factors (slope, aspect, soil type, etc.). In the revised version, we now list the specific factors whose impact should be considered in future studies (L363-366).

Additionally, there are a number of small points (mostly grammar and language choice) that I would recommend addressing for clarity prior to publication. I will do my best to identify them line-by-line below:

Lines 2 to 3: Here, data-driven VIs could help, which yield information based on correlations identified in large datasets of forest and reflectance data. --> Data-driven VIs, which yield information based on correlations identified in large datasets of forest and reflectance data, could help.

- Fixed.

Lines 6 to 9: “Particularly VIs combining near infrared with shortwave infrared light yielded good estimates, with biomass, LAI, and GPP often being well inferable reflectances of similar wavelength combinations.” The meaning is not completely clear to me. NIR and SWIR wavelengths yield good estimates of biomass, LAI, and GPP?

- The intended meaning is that (1) NIR and SWIR yielded good results for all forest characteristics and (2) there is a strong overlap of the wavelength pairs best suited for estimating biomass, LAI, and GPP. We have revised the abstract and clarified this.

Lines 12 to 13: I do not follow the logic here. Linear models constrained the effective wavelength range not the data driven indices, right? I think the wording just needs to be clarified.

- We have adjusted the text to make a more general statement about the functional form “*affecting*” the effective wavelengths.

Line 17: However, they are also... --> However, temperate forests are also... (to clarify that forests not ecosystem services are affected by climate change)

- Fixed.

Line 33: Although being used as inputs in these complex analysis pipelines, vegetation indices were... --> Although they were used as inputs in these complex analysis pipelines, vegetation indices were...

- Fixed.

Line 42: Especially NPP is difficult to estimate... --> NPP is especially difficult to estimate...

- Fixed.

Lines 69 to 70: As such datasets are often not available for NPP and other forest characteristics of interest, we bridged the data gap using forest models... --> Because such datasets are often not available for NPP and other forest characteristics of interest, we bridged the data gap using forest models...

- Fixed.

Line 216: “NPP was best estimable based on wavelengths in the SWIR range combined with any other range.” I learned a new word, but I still think this causes unneeded confusion for the non-statistically inclined audience. I would recommend ‘best estimated’

- Thanks. This may have slipped through in our previous revision. We meant to replace all occurrences of “estimable” in response to your initial revision. We have fixed this now.

Line 392: That way, it might be possible... --> For example, it might be possible

- Fixed.

Line 401: 'estimable' same comment as above.

- Fixed.

Together all changes should amount to no more than a very minor revision. Thank you for the opportunity to re-review this manuscript and I look forward to seeing it published.

- Again, thank you for your thorough review and helpful comments. They have greatly improved the quality of our manuscript.

Colin Bloom

Response to RC2

Thank you for the point-by-point responses. Most of my concerns have been addressed. Please clarify the meaning of the black line in Figure S7.

- Thank you! In the revised version of the supplement, we have clarified the meaning of the line (total biomass) in the figure caption.