

General Comments:

The manuscript applied the existing individual-based forest gap model (FORMIND), which was developed using data from an old-growth temperate forest in the northeastern China. Authors present a novel methodology to distinguish between mature and immature trees to understand forest productivity. This approach offers a fresh perspective compared to traditional methods focusing mainly on gross primary production (GPP). The manuscript is well-organized, systematically presenting its research approach, results, and conclusions.

Manuscript is interesting and useful to international audience of the journal. However, there is room for improvement in the manuscript. The approach and conclusions are somewhat limited by the methodological framework and the absence of a comprehensive analysis of the ecological implications. Authors are suggested to address the following issues while making the revision.

- The introduction provides adequate background but lacks a critical review of previous research methodologies (other process-based models) and their limitations. Also, there is a need to introduce the limitation of the current FORMIND model. Suggest to enhance the introduction.
- Different species might exhibit significant variations in growth and carbon dynamics, even within the same maturity classification. The selection and classification of trees into mature and immature categories are not sufficiently justified. More rigorous criteria and a discussion of potential biases in these classifications are needed.
- The choice of the FORMIND model may not fully capture the complexity of forest dynamics, especially in terms of species-specific interactions and responses to environmental variables. For instance, you did not apply any space competition in the model. Suggest to compare results with those obtained from alternative models, particularly those incorporating more detailed species-specific parameters or interactions with abiotic factors.
- The acknowledgment of the model's limitations is a positive aspect, but the discussion lacks a critical assessment of how these limitations might have influenced the study's conclusions. Suggestions for alternative modeling approaches or supplementary methods to address these limitations would provide a more balanced view.
- A lot of supplement information is provided with the manuscript. I'm not sure if it can refer to other fundamental literature previously published. Are the allometric relationships part of the FORMIND model? It would be better to keep concise and easier for the readers to understand.

Detailed comments:

1. Introduction: Consider providing a brief introduction on any challenges or limitations encountered while adapting the FORMIND model to this specific old-growth temperate forest.

2. Introduction: P2 second paragraph: "Nonetheless, it has proven difficult to identify clear relationships between forest structure and NPP (Chisholm et al., 2013) as several factors interact...": Suggest elaborating on the specific factors that complicate the relationship between forest structure and NPP.

3. Method: Page 4 2.1 Field data: I have concerns about the allometry information and biomass equations provided in Supplementary A. (1) A lot of species lack allometry data and biomass equations. How did you address these species in your study? Did you use likelihood-based

analysis similar to the PFTs classification? Please clarify this in the methods part. (2) The biomass equations, adopted from Chojnacky et al. (2014), are generalized primarily for North American species. Since most of the equations are empirical models, I doubt their accuracy when used directly.

4. Methods: Page 6 Model fitting, second paragraph, "We fitted these 18 parameters...": cannot get 18 parameters based on your description, please clarify.

5. Results, first paragraph, "...This contrasts with the basal area of immature trees." please add supporting figures or statistical results.

6. Results: "...These results are depicted in Figures 4 and 5." Figures should be accompanied by the corresponding results in brackets. This will make it clearer for readers to correlate the interpretation with the figures.

7. Results: "...These results are shown in Fig. 6." Similar suggestions as above.

8. Results, Figure 7, does each dot correspond to a forest patch of 0.04ha? Please clarify.

9. Discussion, Page 15, second paragraph, "The proportionality can be explained by the strong connection between the individual-level basal area and GPP in conjunction with the negligible NPP of mature trees." Consider simplifying or re-framing it for better readability.

10. Discussion, Page 15, second paragraph, "On the stand level, however, neither the GPP nor the respiration were correlated with the proportion of immature trees (Fig. 7) ...", in the discussion section, only this sentence refers to the figures. Please maintain consistency.