After reviewing the authors' responses, I find that two of my original comments have been adequately addressed. However, one critical concern regarding the upscaling approach remains insufficiently addressed, and the resultant LIA at the ecosystem or grid scale is still rather confusing. Additionally, the authors' major responses are not clearly reflected or integrated into the revised manuscript. Below are my specific comments:

1). Upscaling LIA from the leaf level to the canopy or larger ecosystem scales is inherently challenging. Although the authors provide some clarification, their initial upscaling step remains overly simplistic, making it difficult to grasp what the "ecosystem-level LIA" truly represents. Traditionally, LIA at the canopy scale can be defined as the average LIA of each leaf (Eq. 1). However, because counting individual leaves (N) is often impractical, the authors employ a leaf-area-weighted approach for MLA. If I understand right, this equation can be defined by Eqs. 2 & 3.

$$MLA = \frac{\sum_i \mathrm{LIAi}}{\mathrm{N}} \qquad (1)$$

$$MLA = \frac{\sum_j \mathrm{LIAi*LAj}}{\mathrm{N*LAmean}} = \frac{\sum_j \mathrm{LIAi*LAj}}{\mathrm{LAI*Canopy\_size}} \qquad (2)$$

$$\mathrm{LAI} = \mathrm{N*LAmean/canopy\_size} = \mathrm{EVI2*a + b} \qquad (3)$$

Where MLA is mean inclination angle, j is the jth leaf, LIA is leaf inclination angle, N is number of leaves within a canopy, LA is single leaf area, LAI is the ecosystem-level standard leaf area index (m2/m2), canopy_size is the projected area onto the ground for a specific canopy; a and b are the linear coefficients between EVI2 and LAI (if the linear relationship holds true).

Eqs. (2) and (3) theoretically support the upscaling of LIA from the leaf to the canopy level, and by extension from the canopy to 30 m and from 30 m to 500 m. However, the authors used a simplified form of Eq (1) in the manuscript to upscale from 30m to 500m. It is hard to persuade me this equation is equivalent to the Eqs (2-3) mentioned above, especially given the existence of the interception of b and missing variable of leaf number.

In addition, the authors did not mention the details of upscaling from the canopy to 30m. As a result, the MLA on the 500m derived here and further used to training the model is difficult to interpret, which is apparently different from the LIA at the leaf level. I encourage the authors to more rigorously evaluate their upscaling methodology, discussing the assumptions and uncertainties introduced at each scale and from different data sources.

2). The authors argued that "higher LIA means lower radiation interception, more NIR downward radiation, and lower NIR reflectance", thus negatively correlated with NDVI. However, a higher LIA could also reduce red reflectance, potentially complicating how

NDVI encapsulates leaf angle information. Moreover, as NDVI is designed as a normalized index, one might expect it to diminish the effects of incidence angles in BRDF data (MCD43A1). Considering the global availability of GEDI lidar (with a 25 m footprint) and its known sensitivity to canopy structure (e.g., height), it would be worthwhile to test whether GEDI can provide stronger signals of LIA than optical-only approaches. Such an investigation could bolster the validation or derivation of the first global MLA map.

3). In Table 1, MCD12Q1 and MCD43A4 are listed as Collection 6, while other MODIS products are Collection 6.1. The discrepancy in MODIS versions needs clarification. Furthermore, MODIS BRDF (MCD43) and surface reflectance products can be contaminated by clouds, especially in tropical regions. The manuscript should explicitly describe how these cloud gaps or low-quality observations were handled to ensure their usage in the subsequent modeling.

4). As the first global MLA product, it would be valuable to include an uncertainty assessment layer. This might account for the uncertainties stemming from (1) the upscaling approach, (2) the machine learning model, and (3) data inputs. Presenting an explicit uncertainty layer would markedly improve the credibility and potential applications of this novel dataset.