

[P1.55] Downscaling Planetary Boundaries: setting sub-national limits to food systems

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1. INTRODUCTION

Agricultural production demands land - often coming with the expense of forests. However, relatively little information on Earth system (ES) interactions is included in global forest assessments.

We consider these interactions at multiple scales from local to global. This aids in creating local safe operating spaces that are based on Planetary Boundaries (PBs).

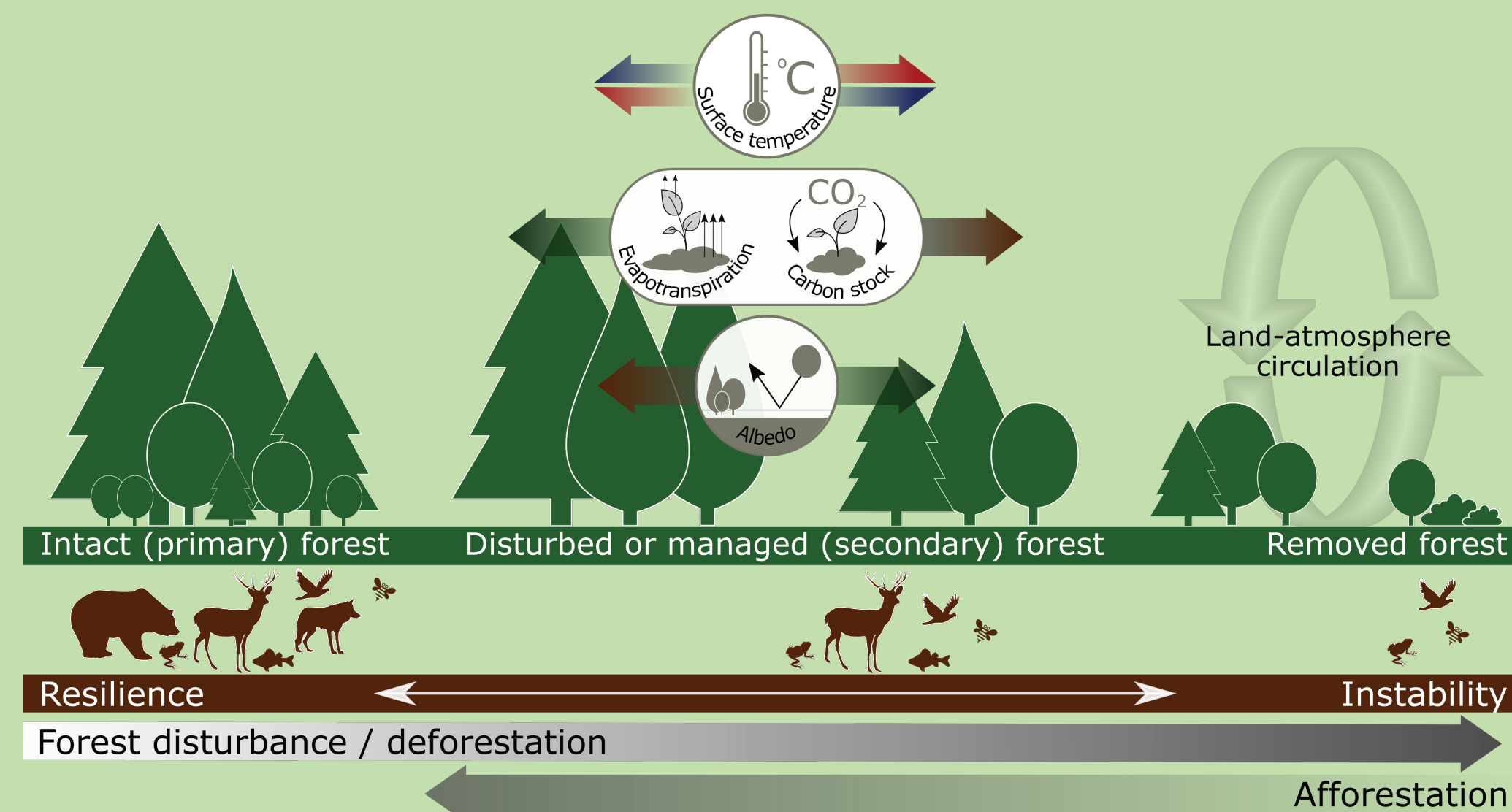
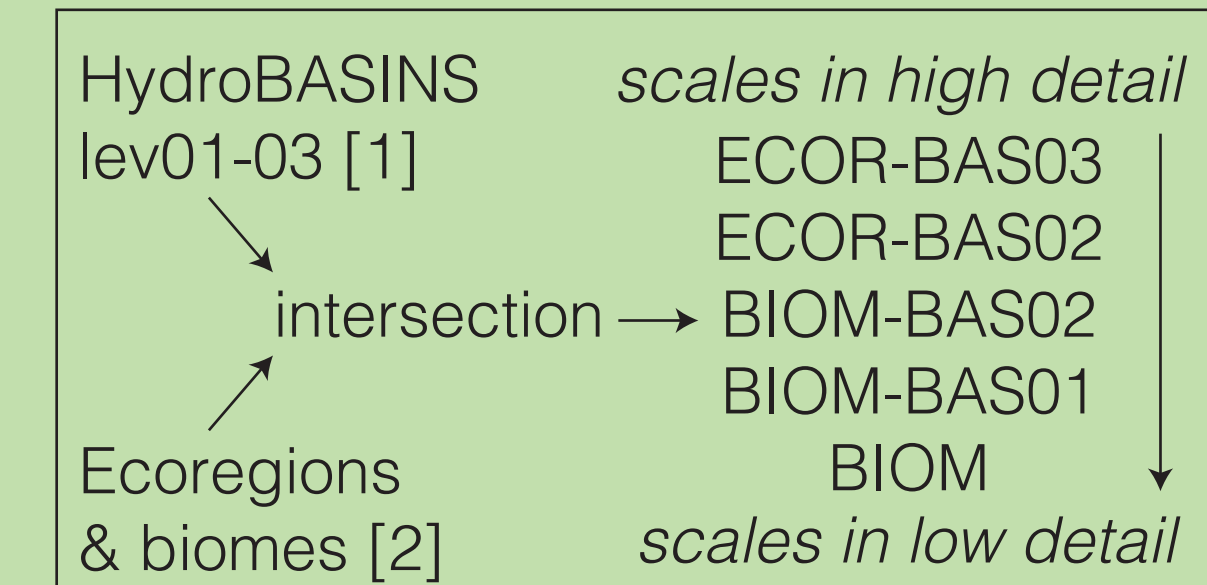


Figure 1. Interactions between forests and the Earth system.

2. METHODS

1. Biophysically feasible areal divisions at five scales



2. Weighting variables with respect to Earth system interactions

- W_{albedo} ~ Growing season albedo
- W_{ET} ~ Forest evapotranspiration
- W_{carbon} ~ { Biomass carbon density, Biomass carbon utilisation }
- W_{prim} ~ { Primary lands, Old secondary lands }
- W_{area} ~ Geographical area

Aggregate and normalise weights. Normalise within biomes except W_{area} .

Compute total weight

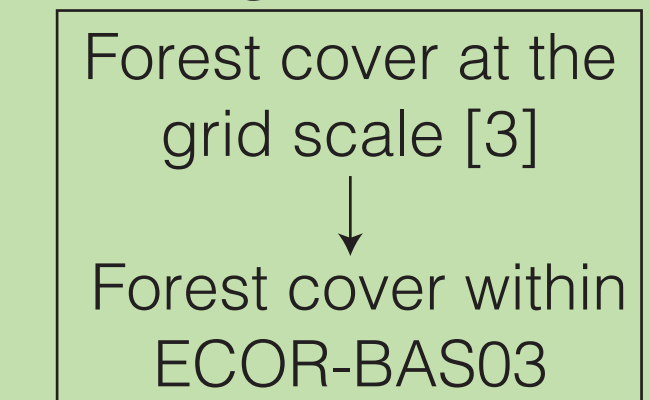
$$W = aW_{albedo} + bW_{ET} + cW_{carbon} + dW_{prim} + xW_{area}$$

ensemble of many (a,b,c,d)

3b. Forest cover at aggregate scales weighted by Earth system importance

Compute weighted average of forest cover building on previous scale areas and weights. Compare to model with no weight except area.

3a. Forest cover at the highest detail



3. RESULTS

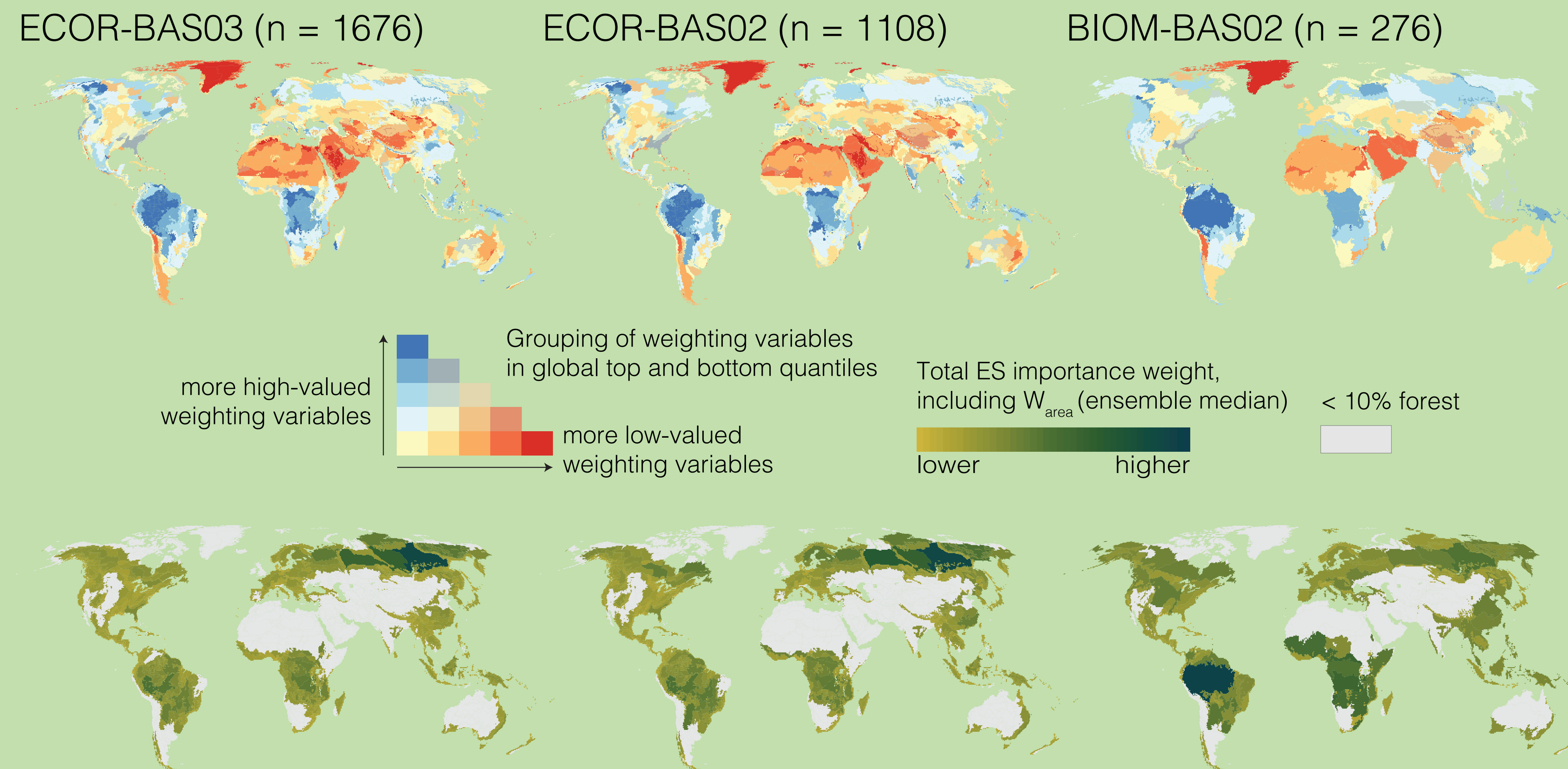


Figure 2. Earth system importance of forests at different scales.

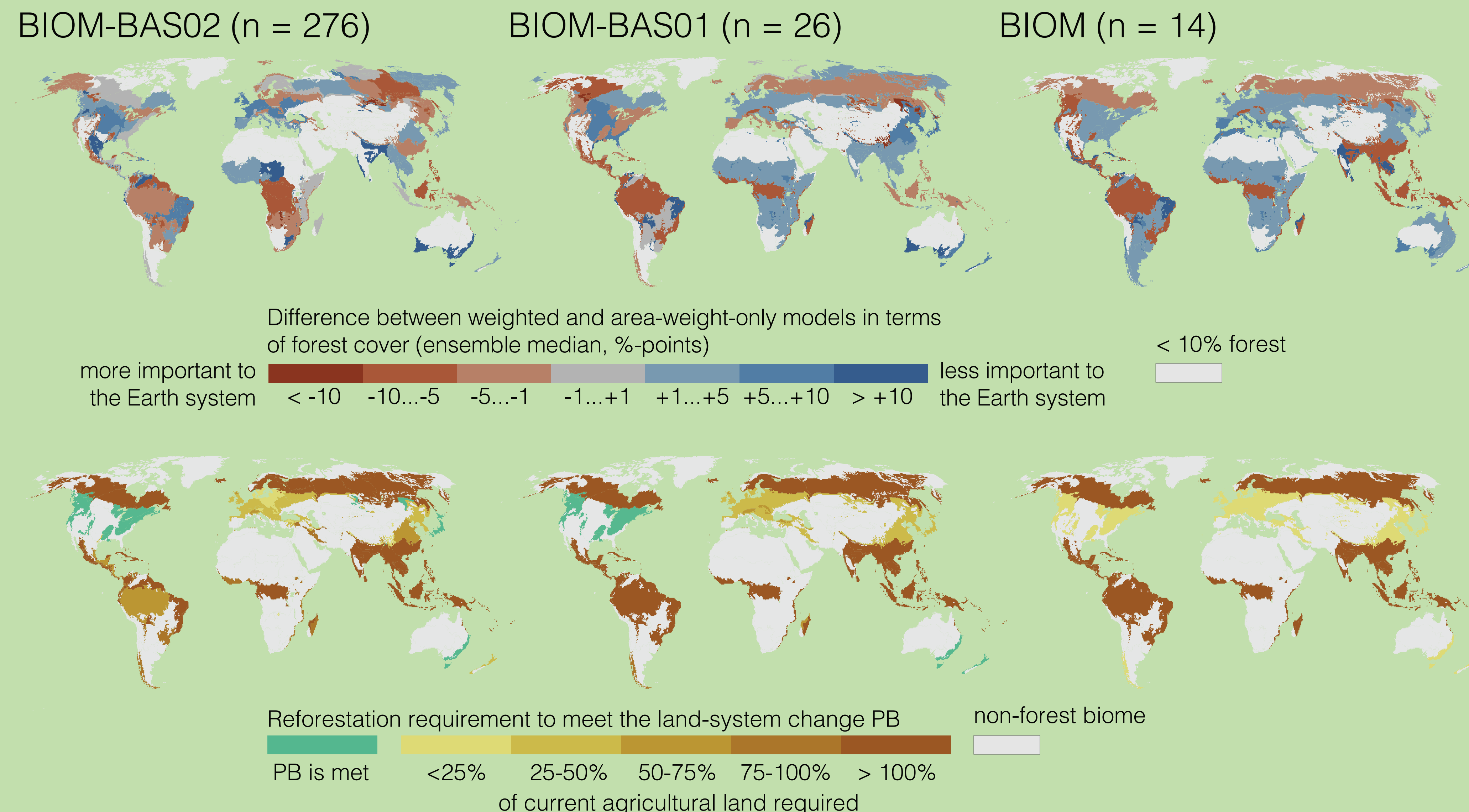


Figure 3. Discrepancies between simple and weighted approaches of assessing global forest cover (upper). Reforestation requirement proportional to current agricultural land area [4], considering Earth system interactions of forests (lower).

4. DISCUSSION

The selected weighting variables are representative of ES interactions.

Tropical and parts of boreal forest regions emerge as the most important.

Agricultural expansion potential must be examined at multiple scales.

Reforestation of agricultural lands alone is not enough to meet the land-system change PB.

Quantifying remaining forest is ridden with considerable uncertainty.

5. CONCLUSIONS

Omitting ES interaction may give a false impression on the size of local safe operating spaces.

Sustainable food systems should take local SOSs into account.

Two main avenues for further research:

- 1) Consider the ES interactions of forests in cropland reallocation research.
- 2) Incorporate the local variation in ES interactions of forests in land-system change PB development.

REFERENCES

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