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).

2. METHODS

1. Biophysically feasible areal divisions at five scales
   - HydroBASINS (lev01-03)
   - Ecoregions
   - Forest cover at the highest detail
   - Forest cover at aggregate scales

2. Weighting variables with respect to Earth system interactions
   - Growing season albedo
   - Forest evapotranspiration
   - Biomass carbon density
   - Biomass carbon utilisation
   - Primary lands
   - Old secondary lands
   - Geographical area

3a. Forest cover at the grid scale
    - Forest cover within HydroBASINS
    - Forest cover within Ecoregions

3b. Forest cover at aggregate scales
    - Compute weighted average of forest cover building on previous scale areas and weights.

3. RESULTS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Weighting Method</th>
<th>Ecological Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM-BAS02 (n = 276)</td>
<td>Grouping of weighting variables in global top and bottom quantities</td>
<td>Total ES importance weight, including Warea (ensemble median)</td>
</tr>
<tr>
<td>ECOR-BAS03 (n = 1676)</td>
<td></td>
<td>&lt; 10% forest</td>
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<tr>
<td>ECOR-BAS02 (n = 1108)</td>
<td></td>
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<tr>
<td>Figure 1. Interactions between forests and the Earth system.</td>
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</tbody>
</table>

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

Figure 3. Discrepancies between simple and weighted approaches of assessing global forest cover.

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.

Reforesting 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