Is it possible to reach a 25% biobased carbon share in plastics?

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“Is the target feasible when plastics demand keeps growing?”

“The material flow system and some of its open questions [1]”

Research aim and approach
- Coarse high-level assessment of the feasibility of the 25% target
- Hypothetical scenarios: how could the material flows look like? What would be their implications?
- Internal consistency, and comprehensive account of possible biobased material sources
- Results give ballpark numerical grounds for assessing feasibility and analysing social-technical scenarios further

Why 25%?
- EU target for 2050 is net zero GHG emissions
- According to Plastics Europe and SystemIQ scenario that means 25% feedstock via sustainable bio-based materials or captured carbon and hydrogen [1] [2]

Takeaways:
- Even in high-demand scenarios, the land required for raw materials only reached max 0.6% of global agricultural land.
- Secondary material inputs per source can remain relatively low also in high demand scenarios. For instance, in an all-of-the-above scenario (last row in table), 25% of materials would need to originate from each recycling source.
- As part of a broader sustainability transformation, land use by livestock could downscale to make space for raw materials production and more ecologically efficient (nutrition per ecological impact) foods.

Limitations and future research:
- The analysis is hypothetical and exploratory
- We did not explicate causal chains that would explain transitions
- The realism of each scenario can be further assessed. Possibilities include morphological analysis (checking for narrative consistency) and simulation modeling (explicating and testing complex causal chains).

Assumptions:
- It takes 0.45 ha of land to produce 1 t of raw materials for biobased plastics (0.0045 MKm² for 1 Mt of raw materials) [3]
- Total global agricultural land is 48 MKm² [4]

Global agricultural land, reproduced from [4]

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Land use for biobased plastics</th>
<th>Share of raw materials from primary sources</th>
<th>Share of materials from secondary sources</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today’s state</td>
<td>0.033 Mkm²</td>
<td>0.3%</td>
<td>1.5 Mt</td>
<td>25% from each</td>
</tr>
<tr>
<td>Only primary production</td>
<td>0.23 Mkm²</td>
<td>0.3%</td>
<td>1.5 Mt</td>
<td>25% from each</td>
</tr>
<tr>
<td>Double consumption, primary emphasis</td>
<td>0.61 Mkm²</td>
<td>0.3%</td>
<td>1.5 Mt</td>
<td>25% from each</td>
</tr>
<tr>
<td>Double consumption, chemical recycling emphasized</td>
<td>0.23 Mkm²</td>
<td>0.3%</td>
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*percentages are shares of consumption, as with the secondary sources
*can be read as the mechanical and chemical recycling rate
Blue: current state; Yellow: current demand levels; Orange: double demand levels

References