Carbon neutrality and its connection to the substitution effects of forest products

(5/21/2020 version)

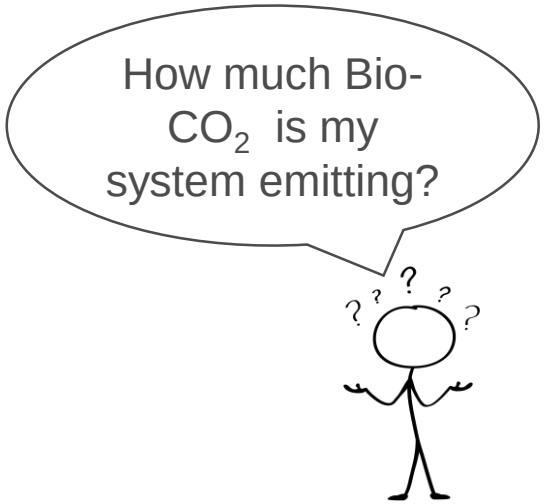
Reid Miner, Retired NCASI

Carbon neutrality of forest products

- “Carbon neutrality” implies net zero emissions of biogenic carbon from the product system
- No agreement on the definition or calculations (as you will see)
- Best to avoid the term and refer instead to the net emissions of biogenic carbon
- Carbon neutrality does not consider substitution effects and is focused only on biogenic emissions (e.g., CO_2 from biomass)

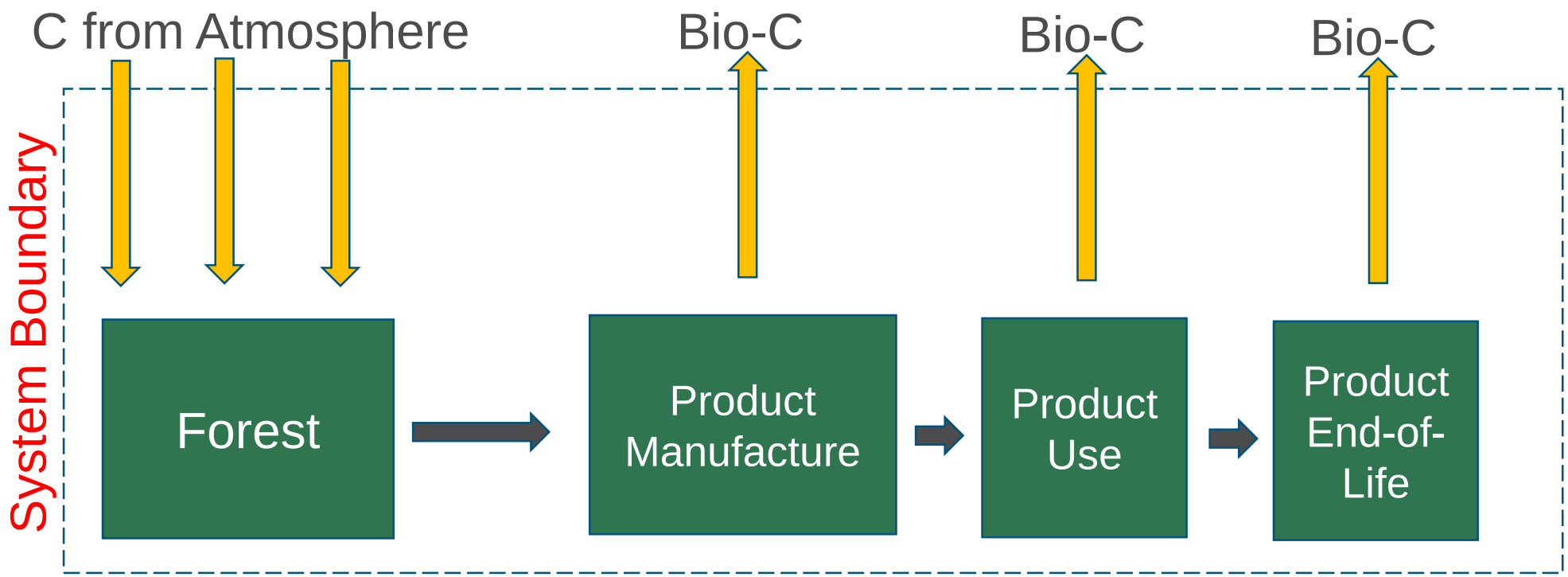
We will describe 4 general approaches to the calculations:

These are not comprehensive but are intended to capture some of the key elements of the debate about how to characterize biogenic carbon fluxes

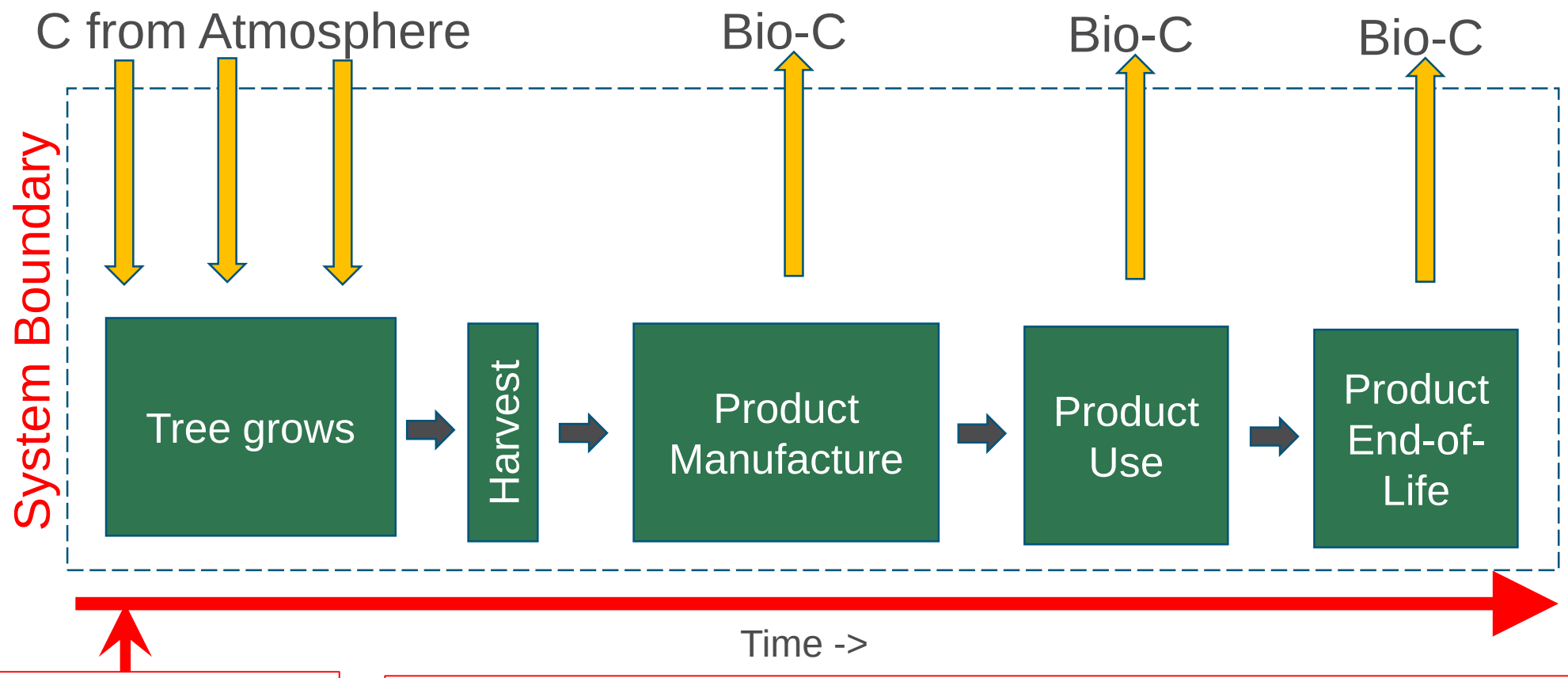


- Approach 1: CO_2 is removed from the atmosphere before harvesting while the tree is growing
- Approach 2: CO_2 is removed from the atmosphere after harvest by the trees that replace the tree that was harvested
- Approach 3: CO_2 is removed from the atmosphere in the year of harvest by non-harvested trees growing across the landscape
- Approach 4: Any of the previous approaches adjusted to account for foregone sequestration

Emissions of biogenic C = net flow across system boundaries



Approach 1: CO_2 is removed from atmosphere by the growing tree before it is harvested



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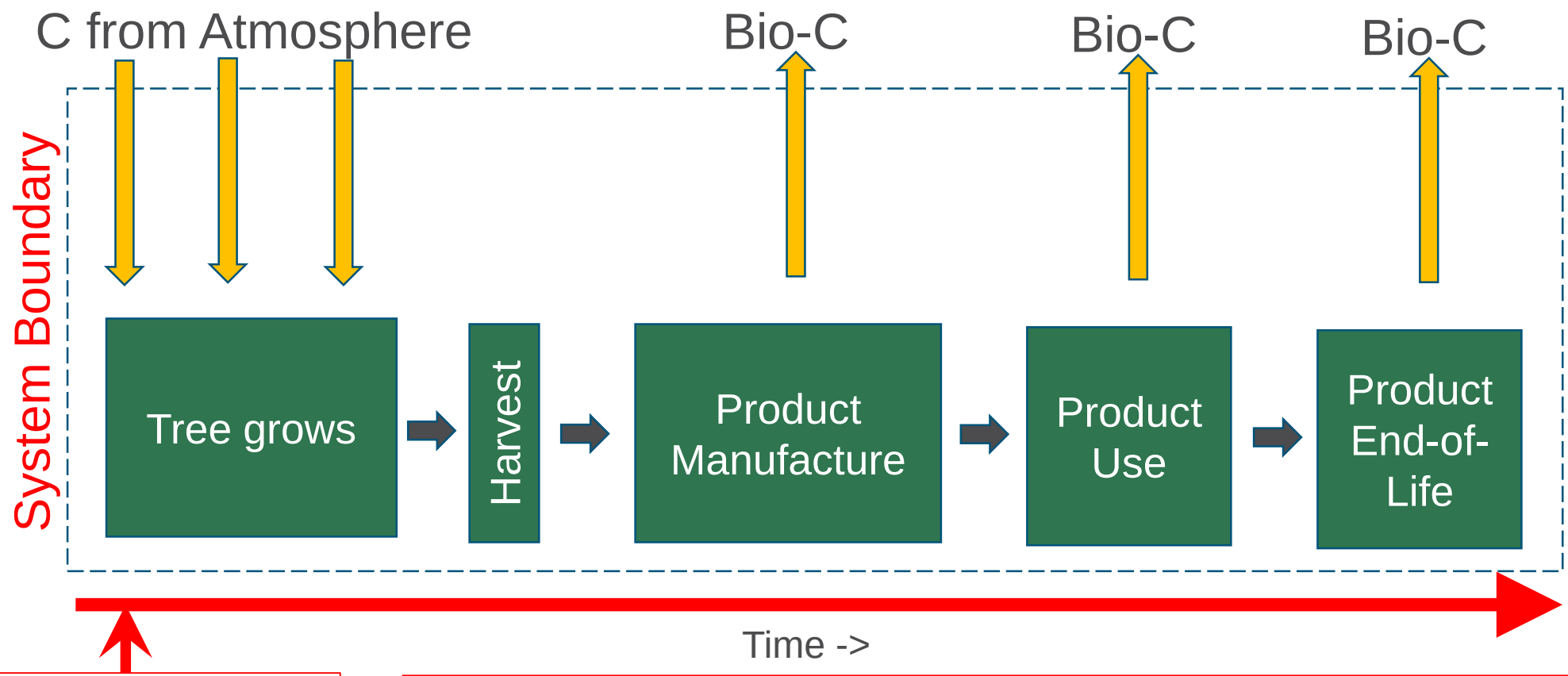

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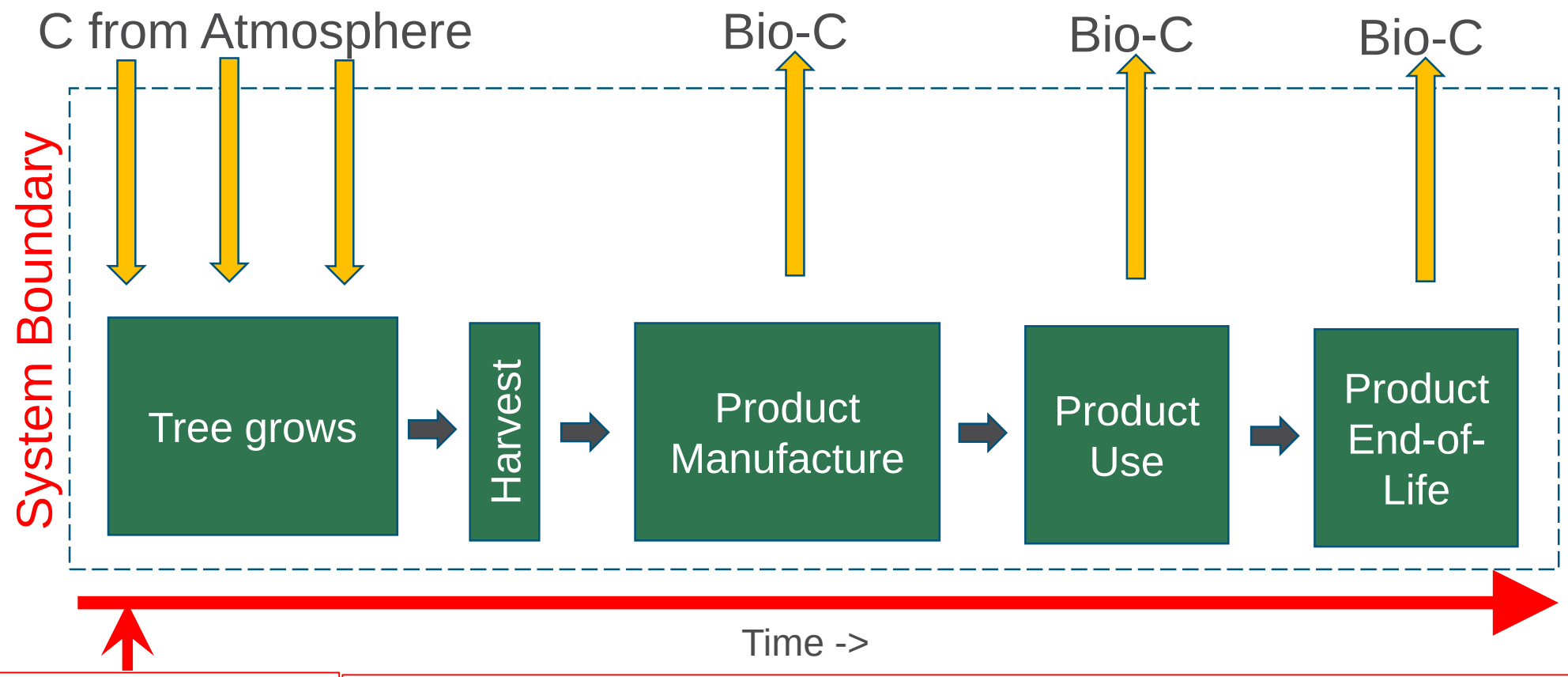
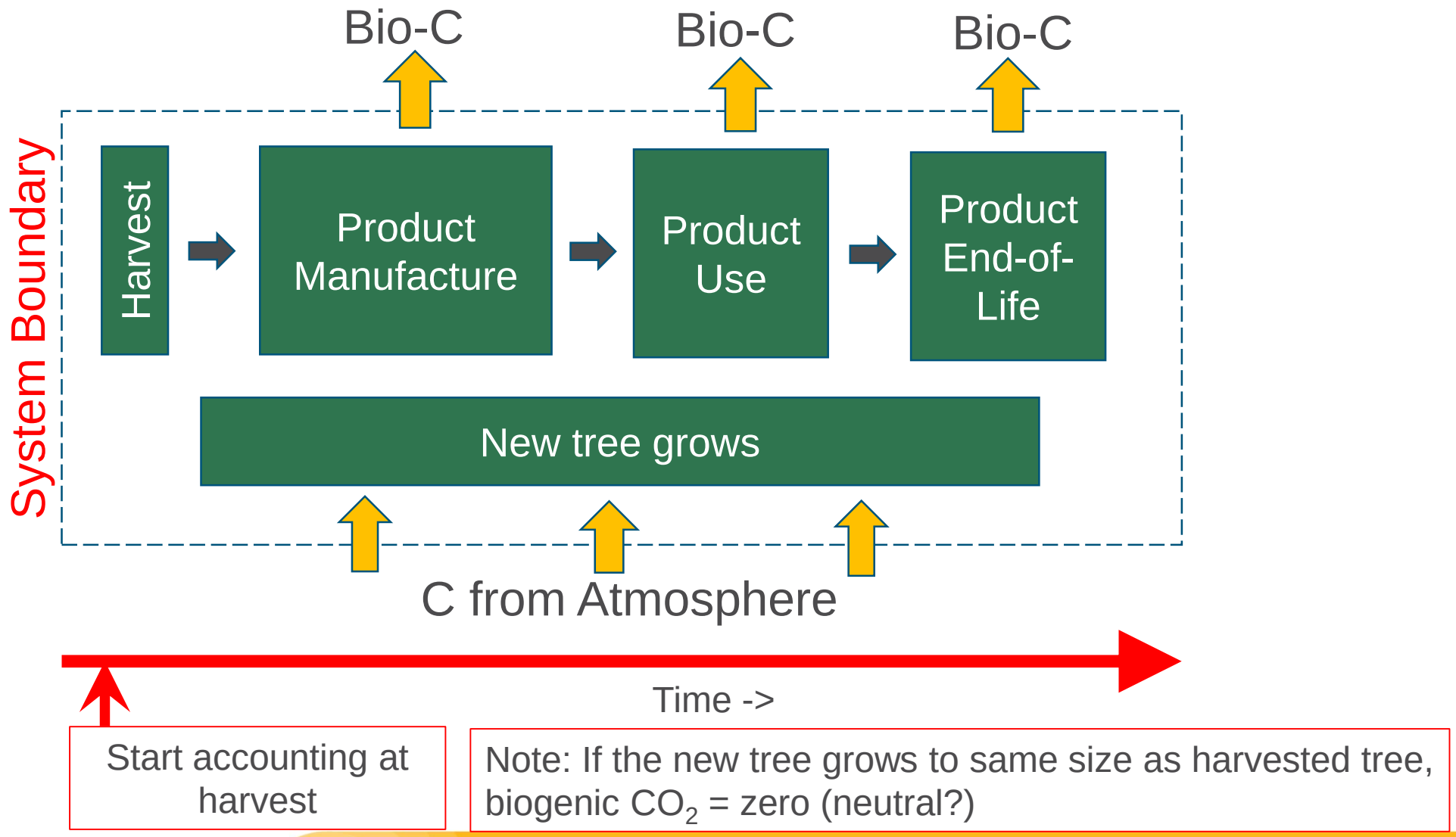


Note: With this approach wood obtained via deforestation can be determined to be "neutral". Constraints can be placed on the use of Approach 1 to help prevent this.

Approach 2: CO_2 is removed from atmosphere by a growing tree that replaces the tree that was harvested



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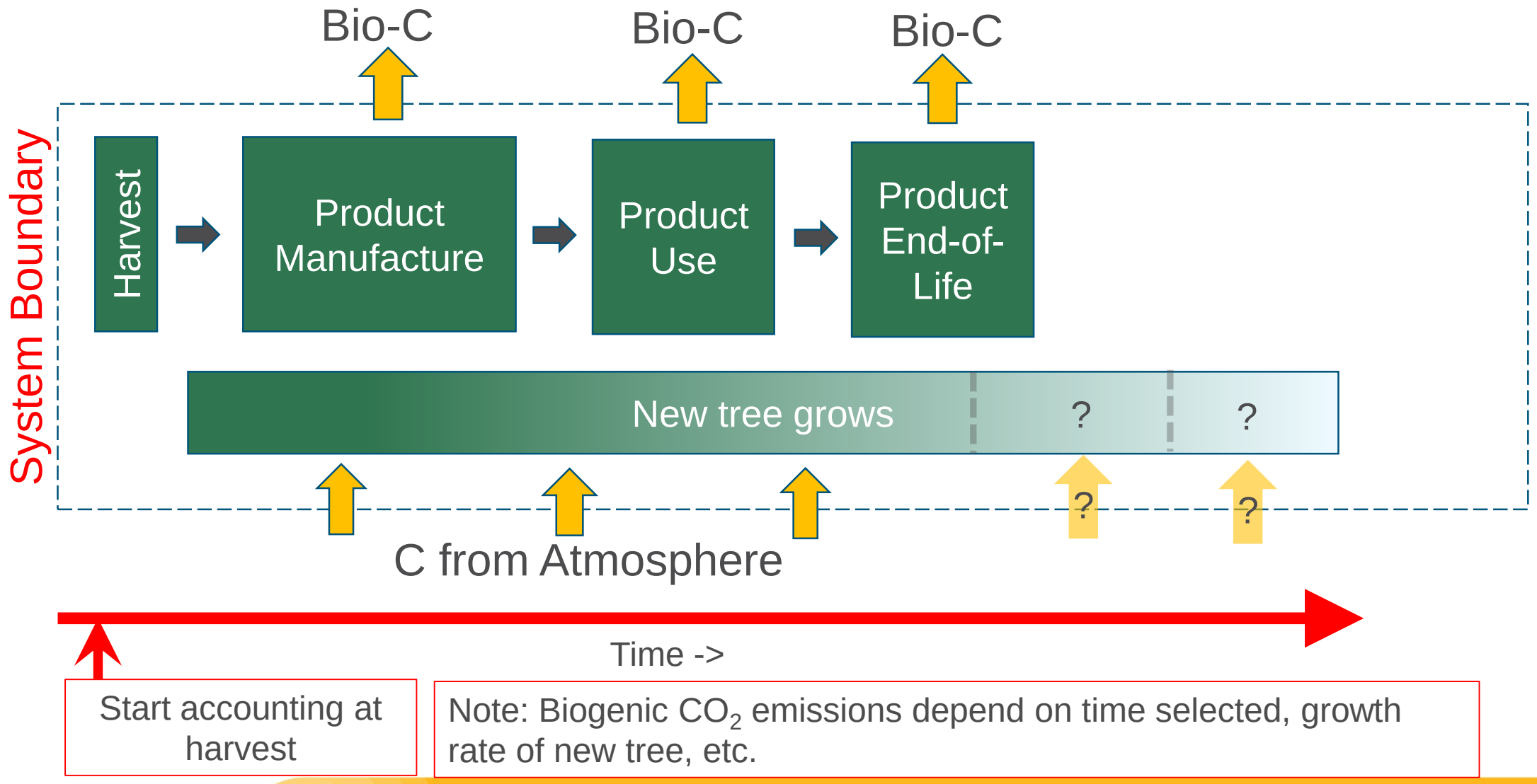

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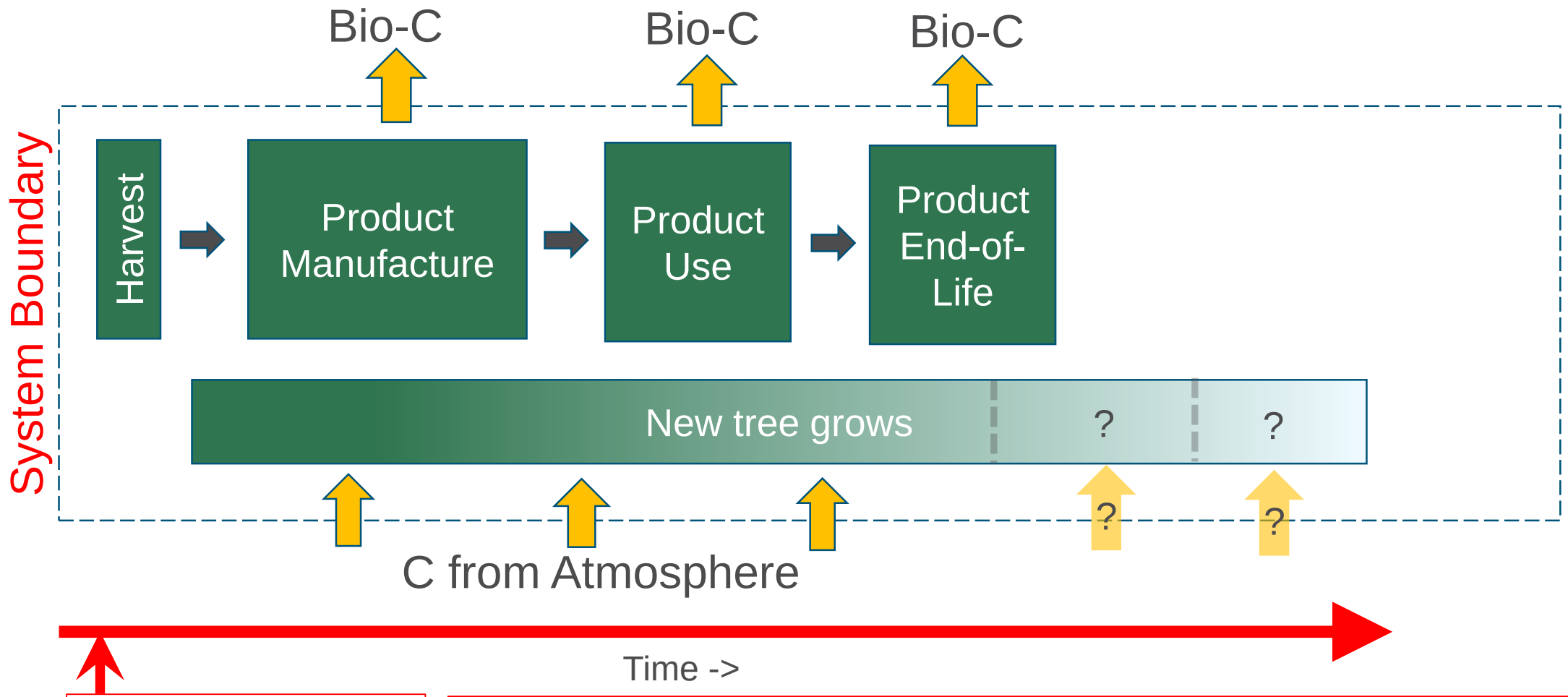

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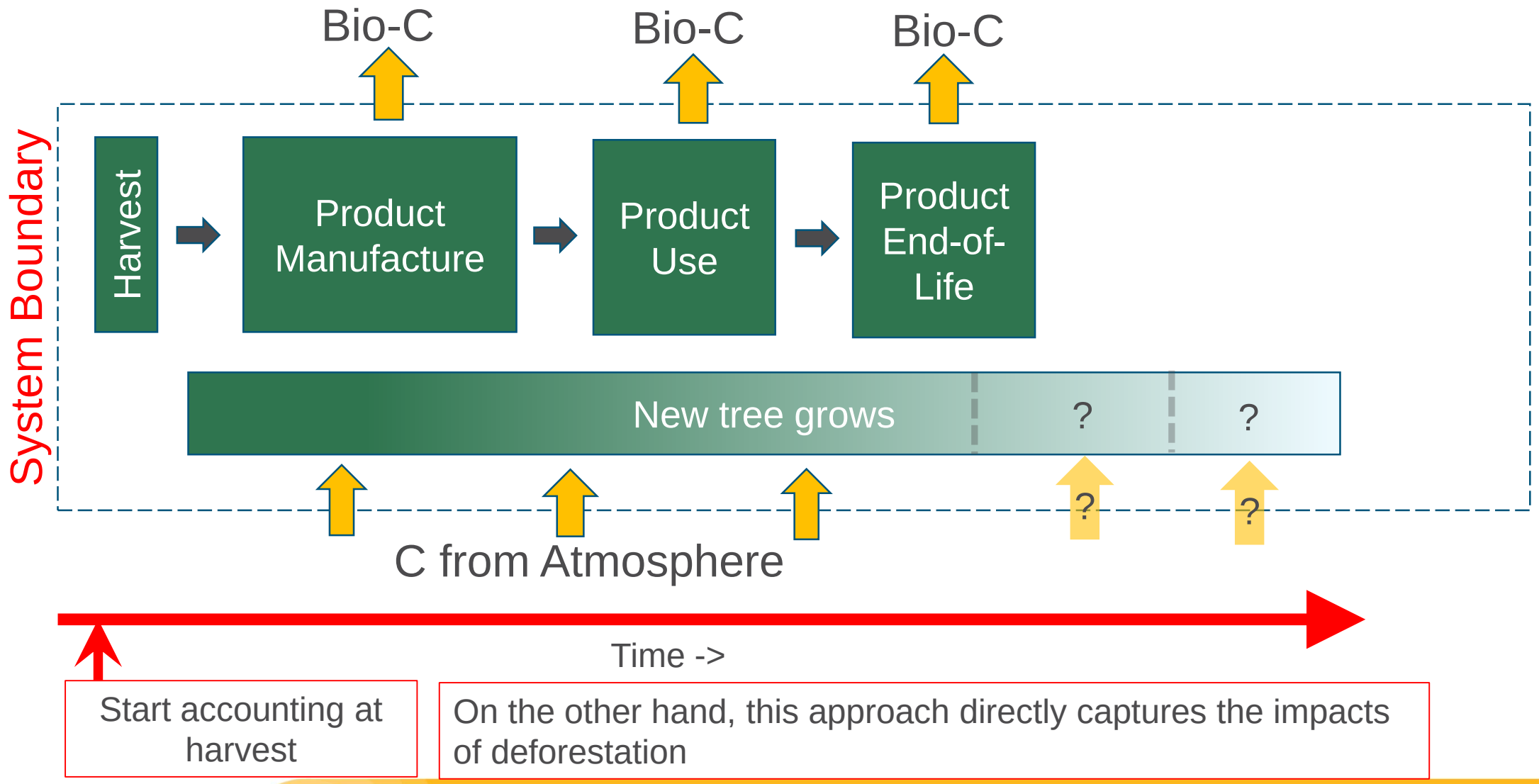
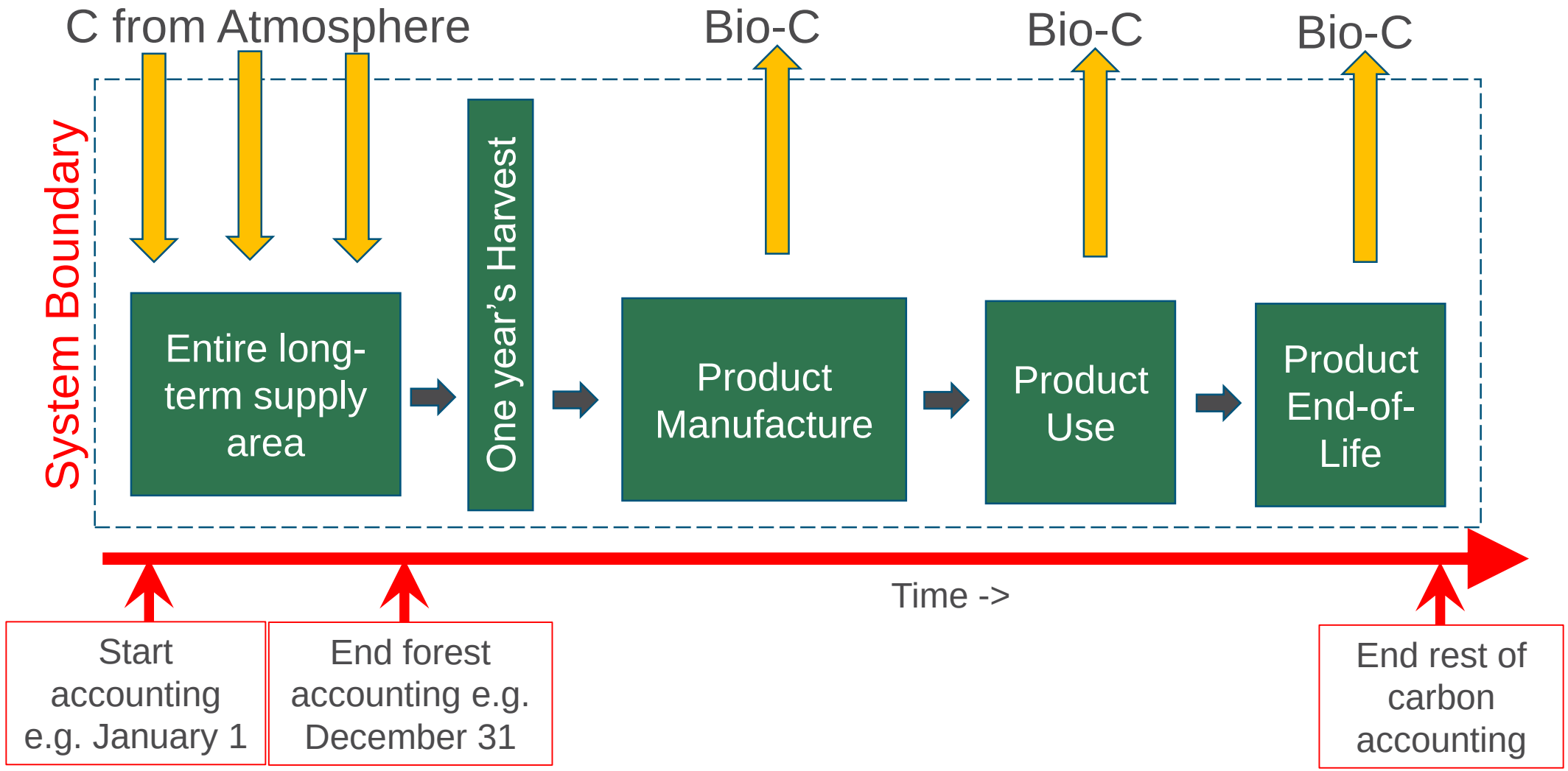


Approach 3: CO_2 is removed from the atmosphere in the year of harvest by non-harvested trees growing across the supply area



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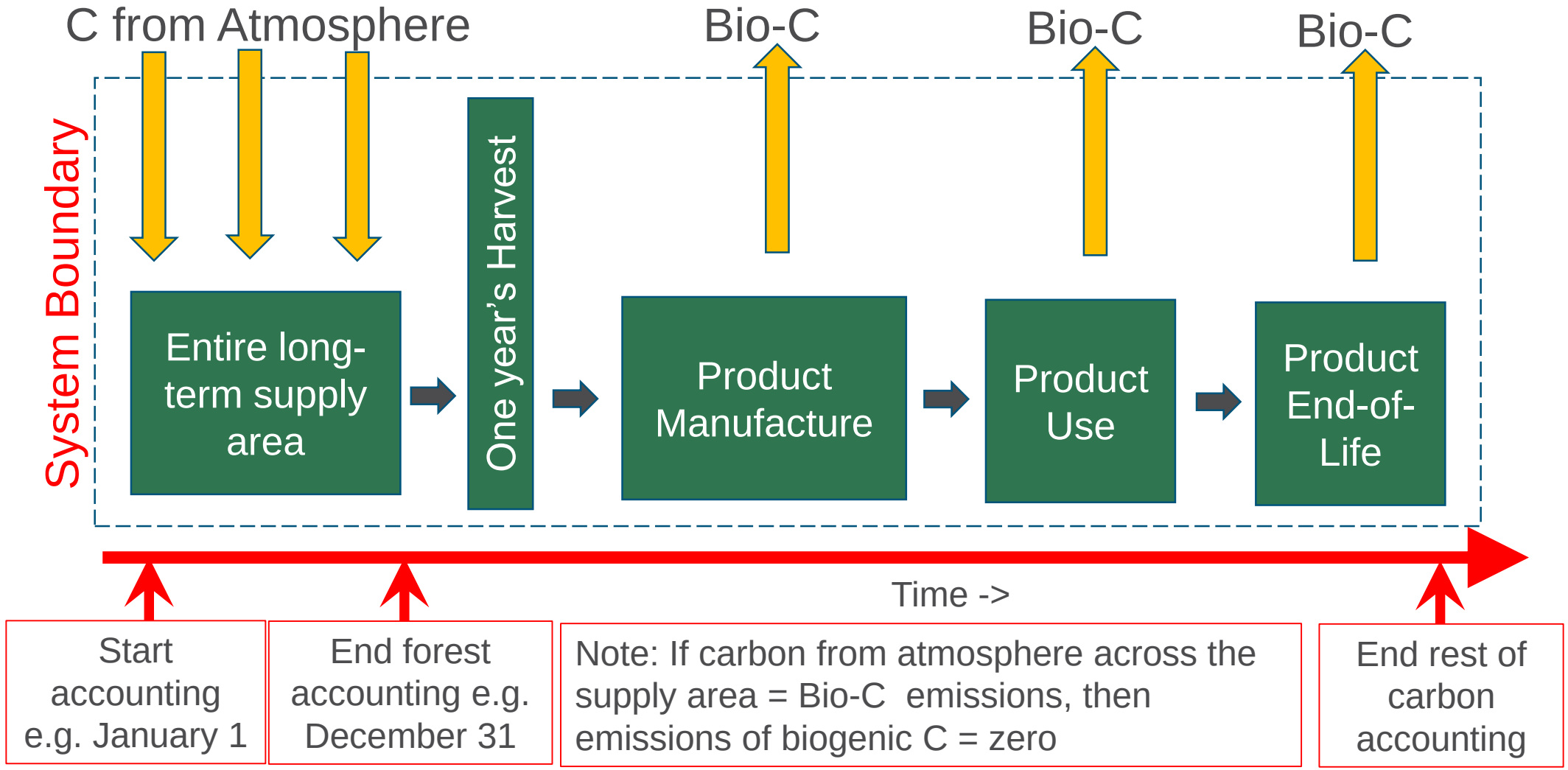

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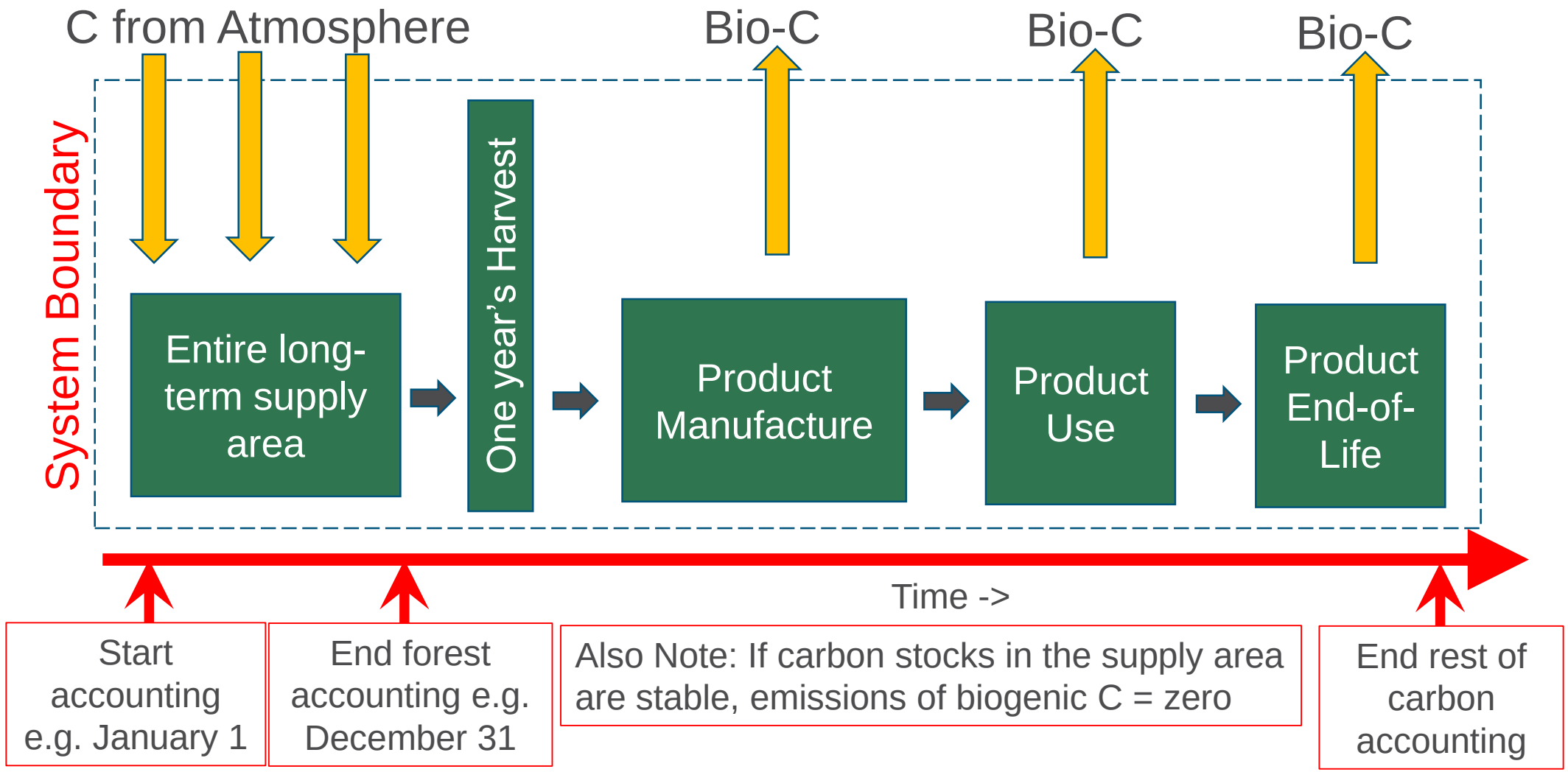

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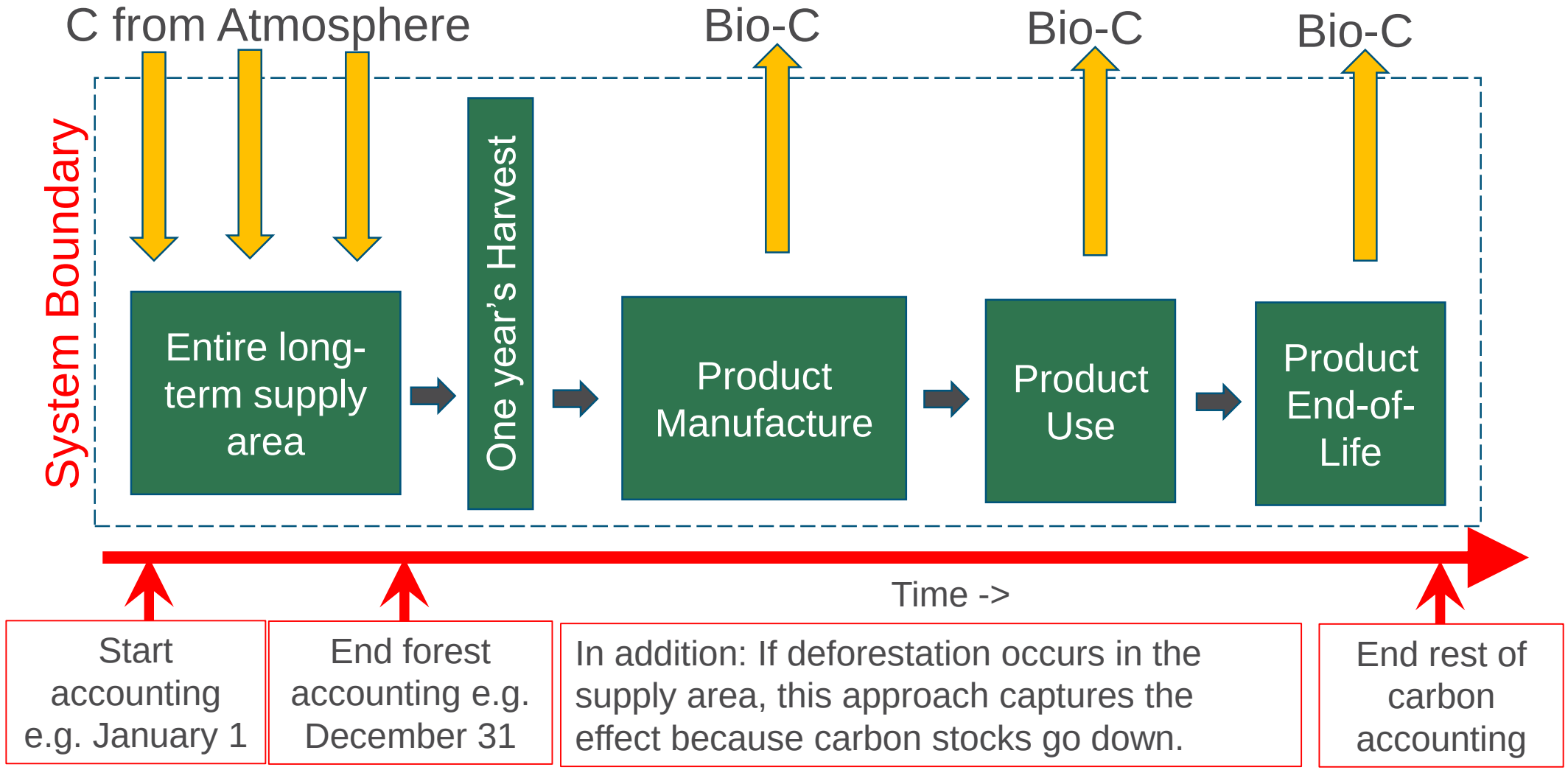

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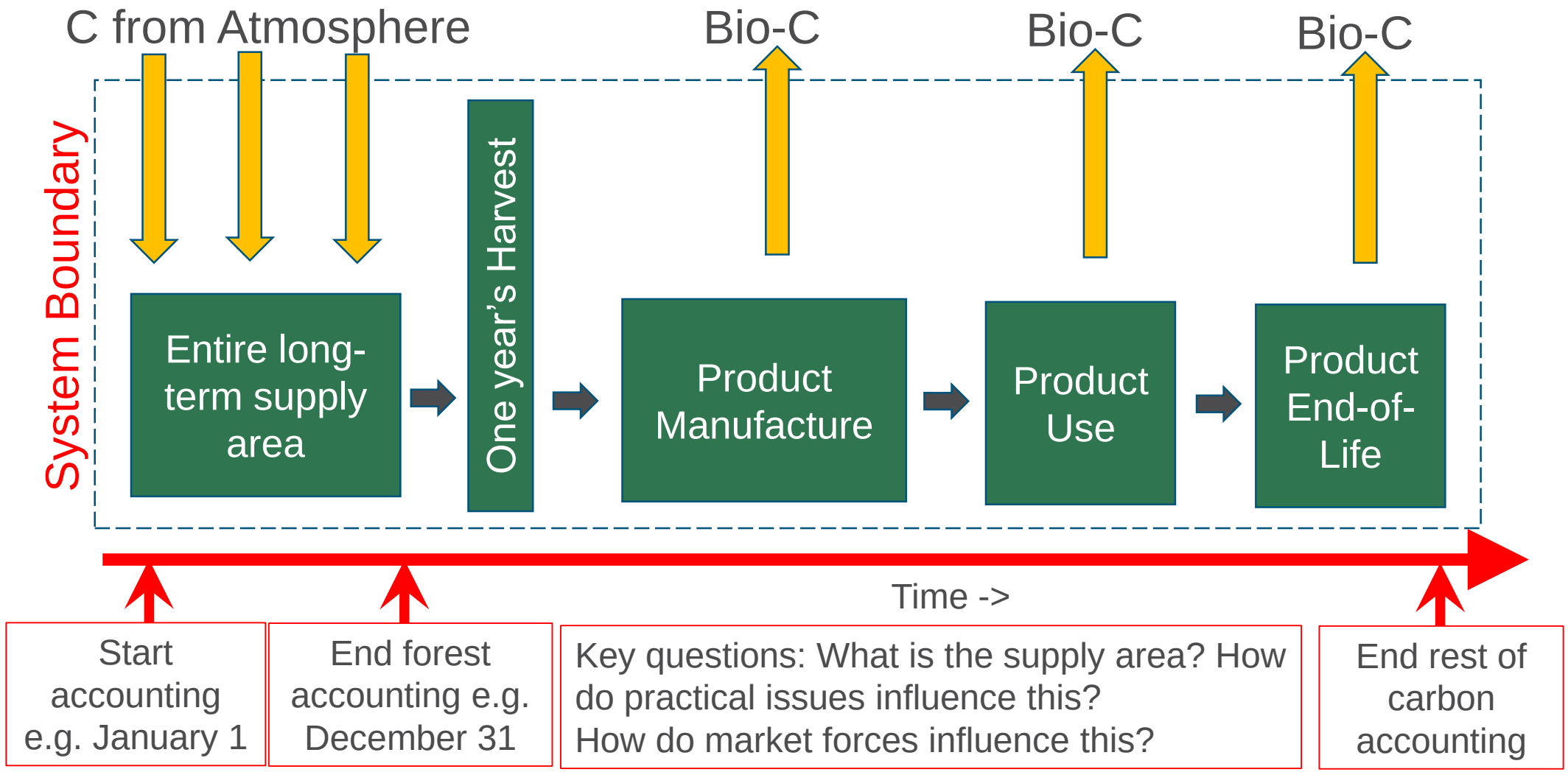
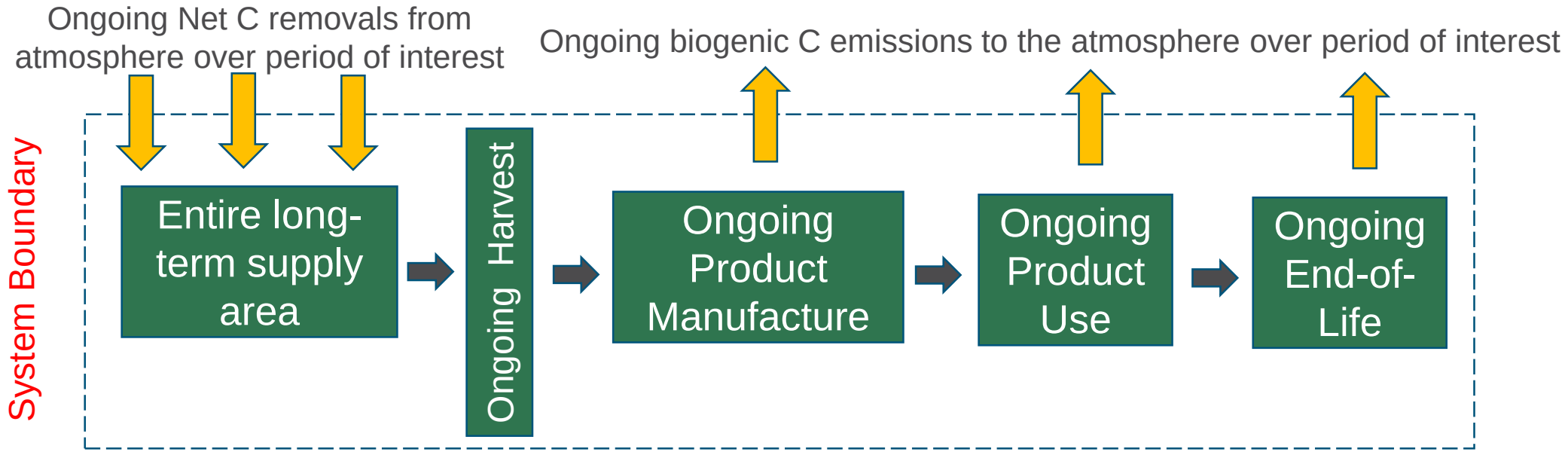


Approach 4: Include foregone sequestration. In this example, include foregone sequestration in Approach 3

Approach 3



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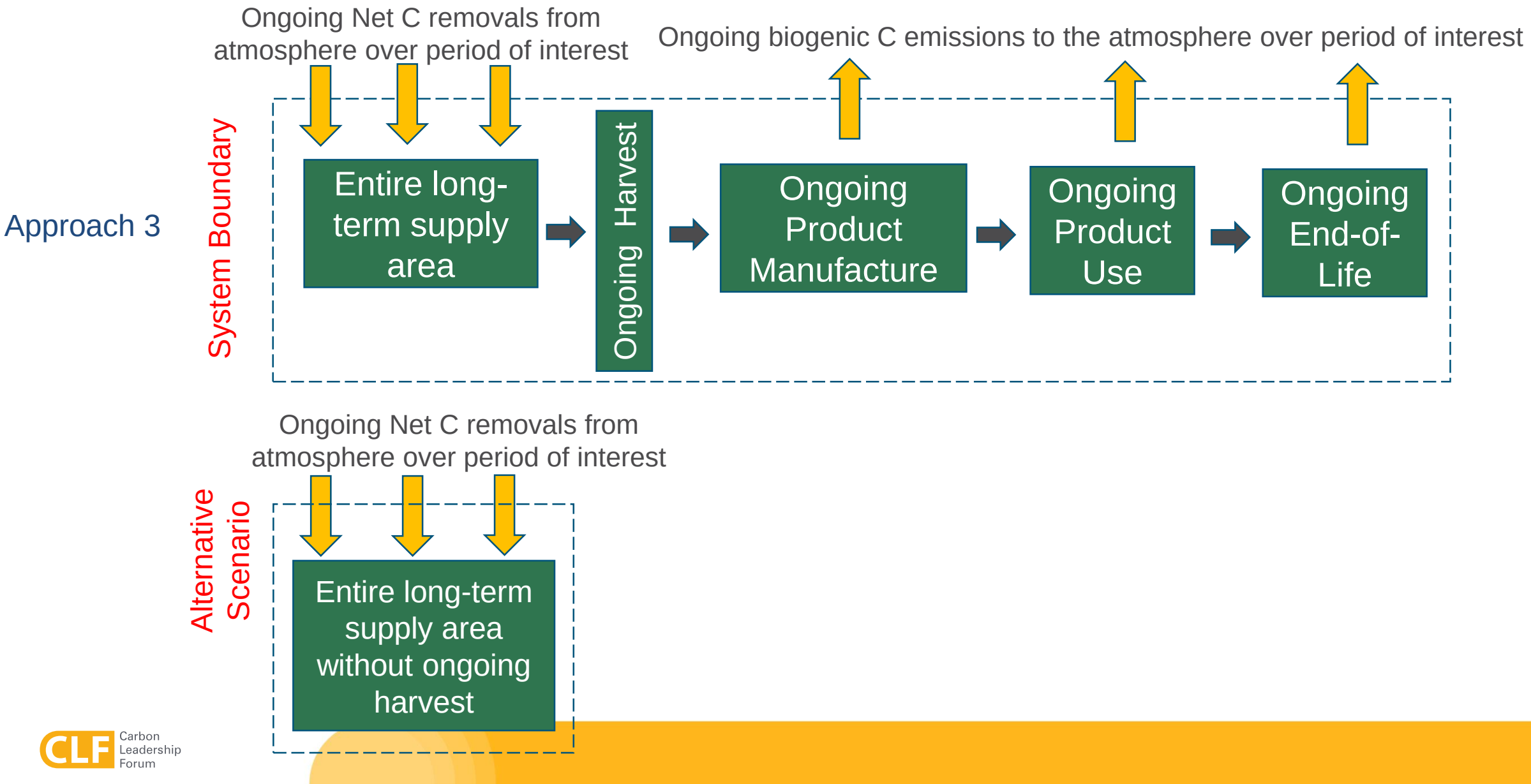

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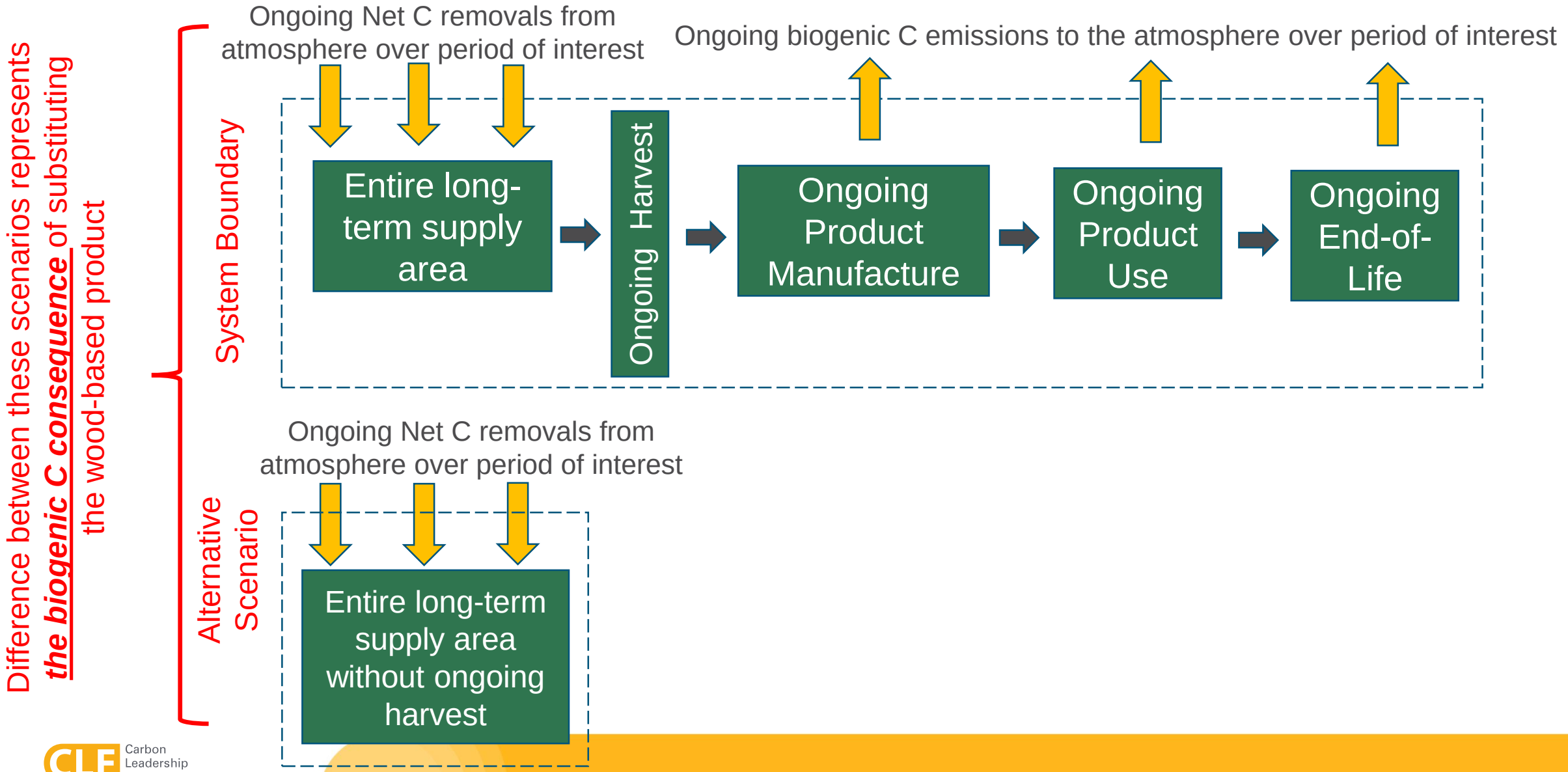

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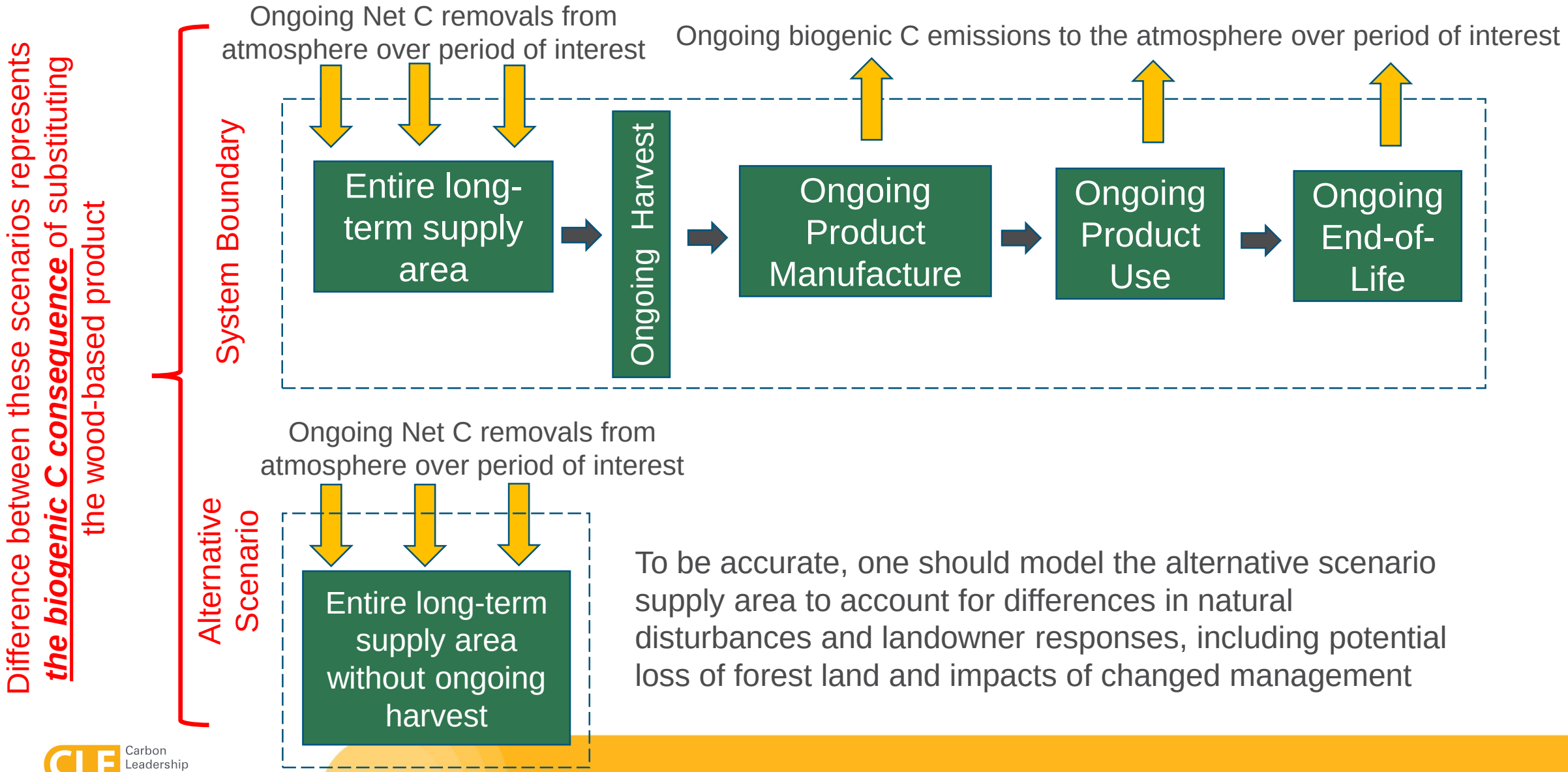
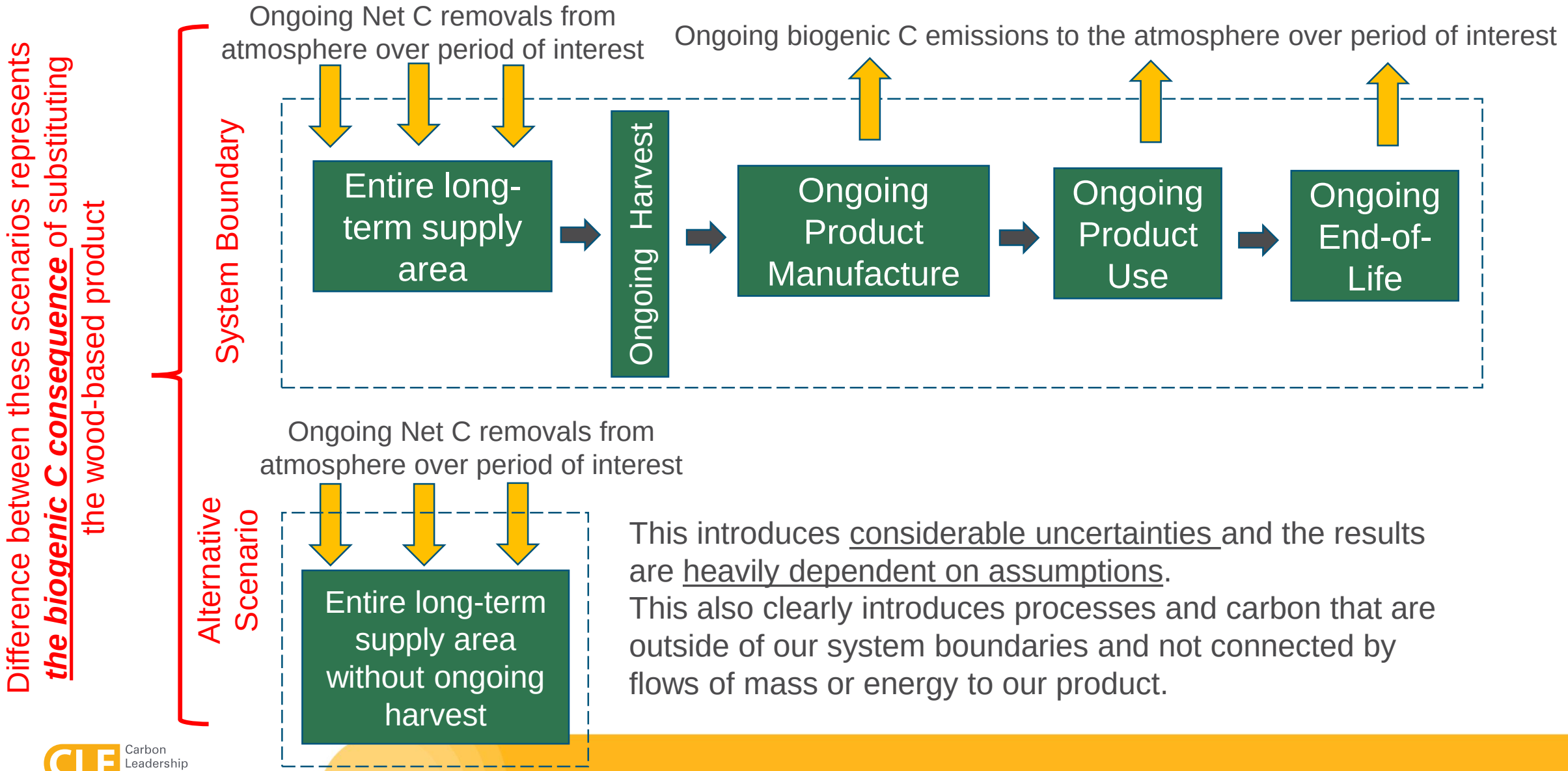


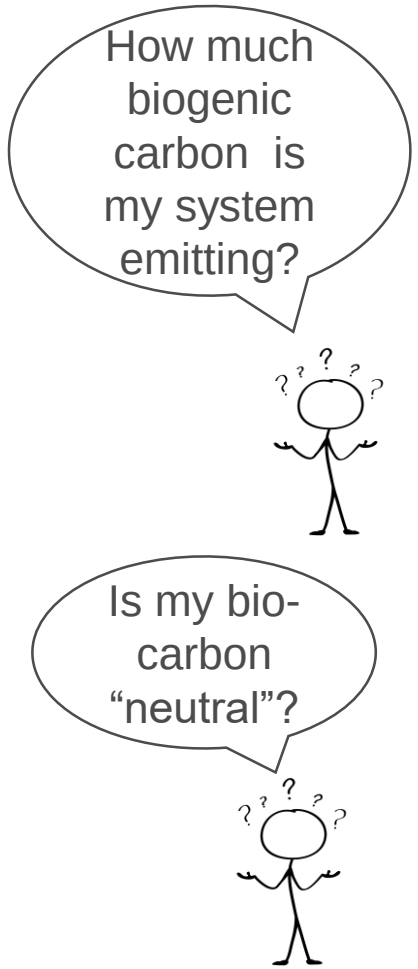
To be accurate, one should model the alternative scenario supply area to account for differences in natural disturbances and landowner responses, including potential loss of forest land and impacts of changed management

Approach 4: Include foregone sequestration. In this example, include foregone sequestration in Approach 3



This introduces considerable uncertainties and the results are heavily dependent on assumptions.
This also clearly introduces processes and carbon that are outside of our system boundaries and not connected by flows of mass or energy to our product.

So the answer to the question is…… it depends



- The traditional LCA approach (Approach 1) results in biogenic carbon being "neutral" in most circumstances
  - but can miss deforestation unless constraints are added
- The landscape or supply area approach (Approach 3) is best aligned with wood procurement practices
  - Where supply area carbon stocks are stable over time, biogenic carbon is "neutral".
  - It includes the effects of deforestation, although the impact depends on the scale used to define the supply area
  - It may be difficult to isolate the C uptake due to our product
- Other approaches are highly dependent on assumptions
  - They can yield useful insights for some circumstances but should be used with a clear understanding of the limitations
  - Often include hypothetical alternative scenarios

And never forget landowner response

*For forest areas, we identified the rise in timber net returns as the most important factor driving the increase in forest areas between 1982 and 1997. (Lubowski, et al. 2008)**

*"…forest land [area] responds positively to increases in pine stumpage prices and negatively to increases in timber production costs . (Hardie, et al. 2000 **)*

- Common assumption: The only response of landowners to increased demand is increased harvesting
  - and there is a perception that this causes deforestation
- But the empirical evidence and modeling studies of the U.S. indicate that demand for wood…
  - Increases forested area
  - Encourages more productive forest management

**What Drives Land-Use Change in the United States? A National Analysis of Landowner Decisions*, Land Economics

***Responsiveness of Rural and Urban Land Uses to Land Rent Determinants in the U.S. South*, Land Economics

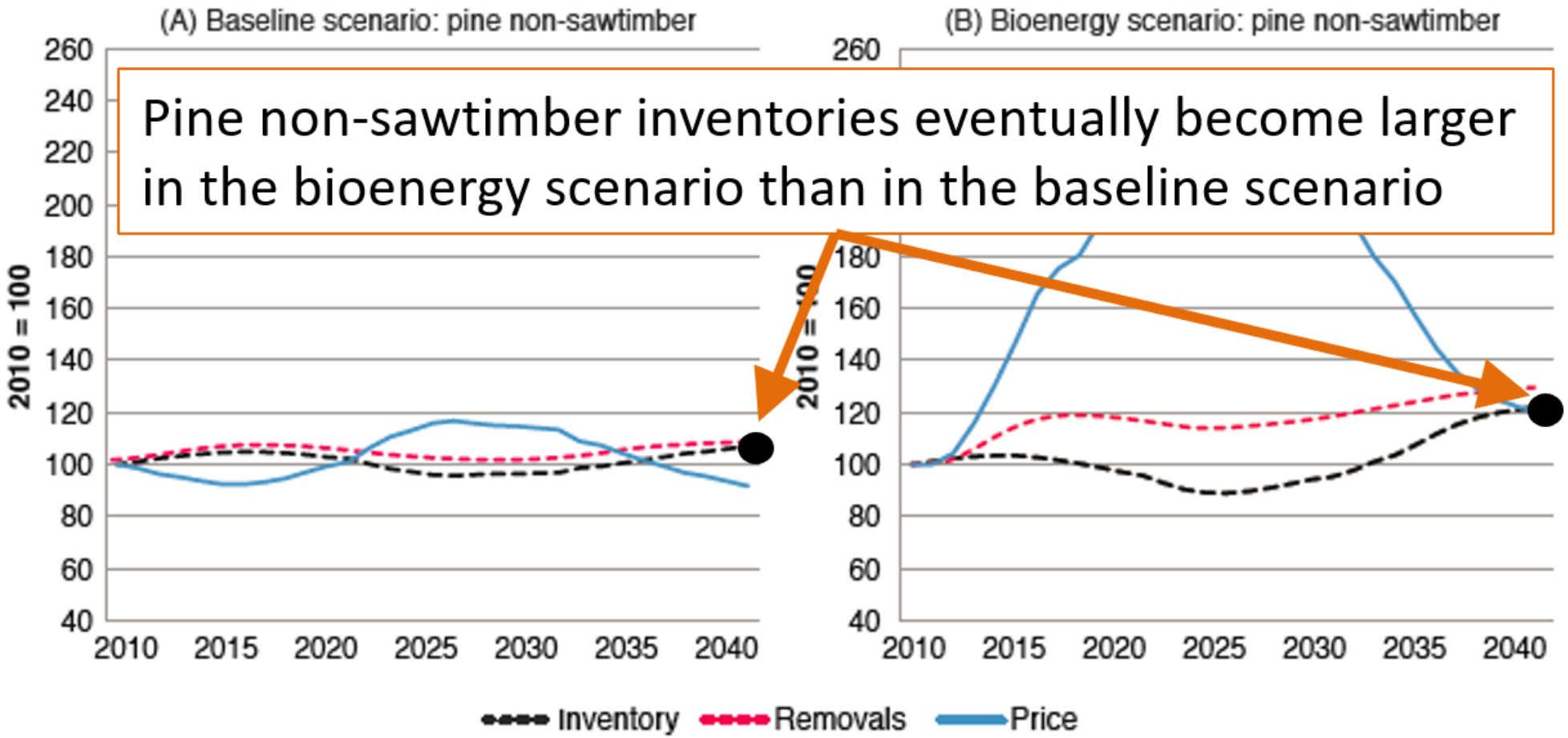
Landowner response and carbon

- Landowner responses have important carbon implications
- In general, increased demand for sustainably produced wood leads to lower forest carbon stocks in the short term with stocks recovering in the longer term
  - This recovery may take stocks to higher levels than existed before demand increased
  - The recovery trajectory varies by location and market

"In all cases [for the US South], … higher prices yield somewhat higher levels of carbon stored in forests when compared to the low-price futures." (US Forest Service, Wear et al. 2013. Forecasts of Forest Conditions in U.S. Regions Under Future Scenarios)

Landowner Response: One Example

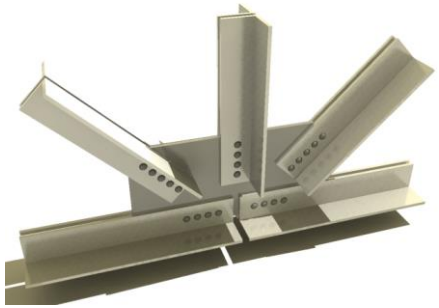
Results for pine non-sawtimber from one study of increased demand for pellets*
Other examples will look different depending on the specifics.



* Abt, et al. 2014. Effect of policies on pellet production and forests in the US South: a technical document supporting the Forest Service 2010 RPA Assessment. Gen. Tech. Rep. SRS-202. U.S. Forest Service.

Substitution effects vs. carbon neutrality

Vs.



Substitution effects vary depending on the products being considered

Vs.

- Substitution effects include much more than an analysis of biogenic GHG emissions
- A bio-based fuel or product can have significant substitution benefits even if the life cycle emissions of biogenic carbon from the bio-based product system are greater than zero (i.e., not “neutral”)

- Thank you