

Towards enhancing the carbon stocks in forests: Unravelling the wood production potentials under sustainability conditions for Austria

# Unravel

Presentation at the Klimatag

12. April 2023

Karlheinz Erb



# Today

- Introduction: Aims and objectives
- Starting point: stakeholder interaction
- First results
  - Towards a dynamic view on wood production in Austria
  - Global origin of forest biomass processed in Austria
  - Imports and carbon sinks in originating countries
- Outlook: next steps

# Aims of the Project

The starting motivation of UNRAVEL is to turn around the conventional direction of research (“what are the carbon implications of using wood”) and to choose an alternative point of departure: “How much wood is available under sustainability conditions and what are best uses for climate protection”

## Work packages:

1. Biophysical accounting of wood production and use
2. Modelling forest C sequestration potentials under climate change
3. Scenarios of C sequestration targets for Austria under different rationales of emission allocation
4. Exploring interlinkages between wood provision, C sequestration and other ecosystem services
5. Knowledge co-production and knowledge re-integration
6. Project Management

# Starting point: Stakeholder interaction

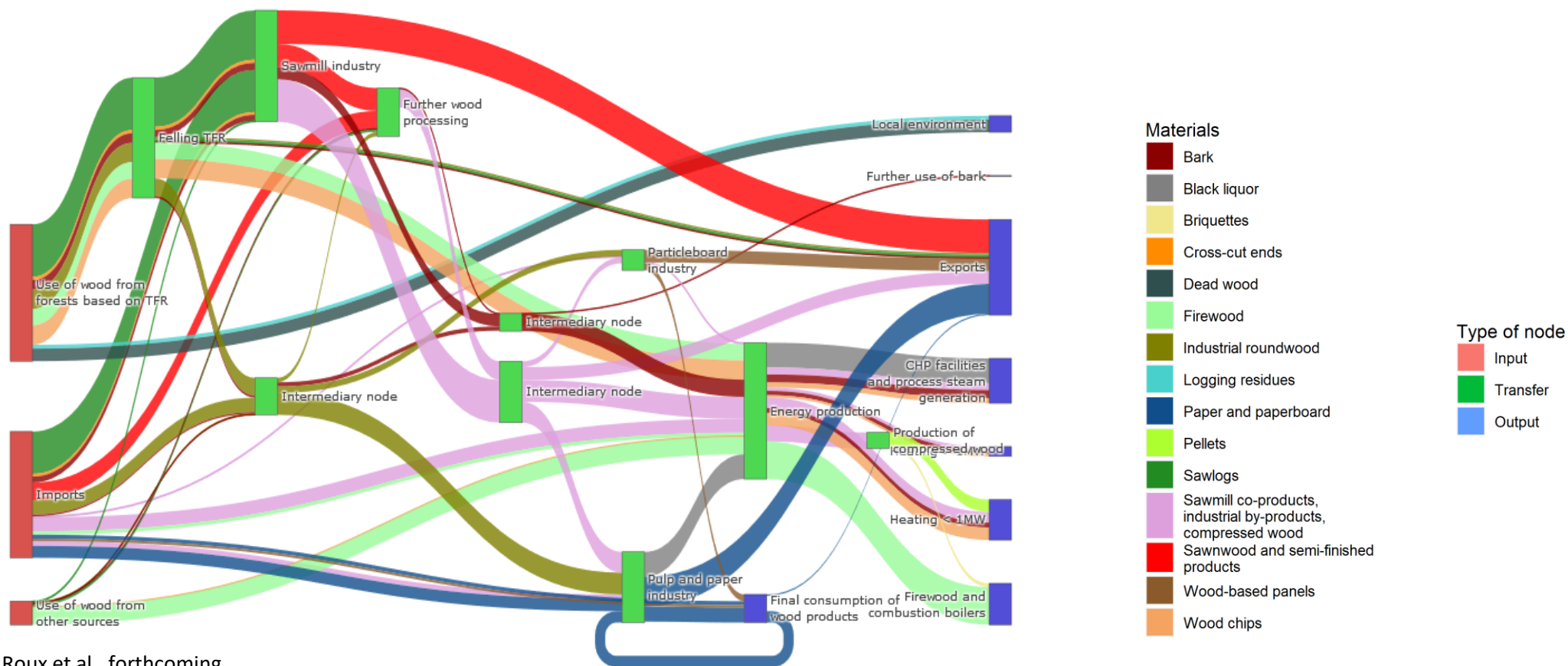
Particular knowledge needs of interview partners which were named by two or more interview partners include:

- Quantify C dynamics of forest extensification (reduced harvest) and conservation (put areas out of use): what yield levels (under which management strategies) are compatible with which biomass stocks (climate-change mitigation effects)
- Investigate co-benefits between carbon sequestration and biodiversity conservation: Which management strategies are favourable for both? What is the C uptake of old forest stands?
- International “responsibility” of Austria for forest change abroad: locate and quantify the impact of the Austrian forest sector on forest areas abroad





# Extension of the „Holzflussdiagramm“ (Strimitzer et al., 2010-2020)

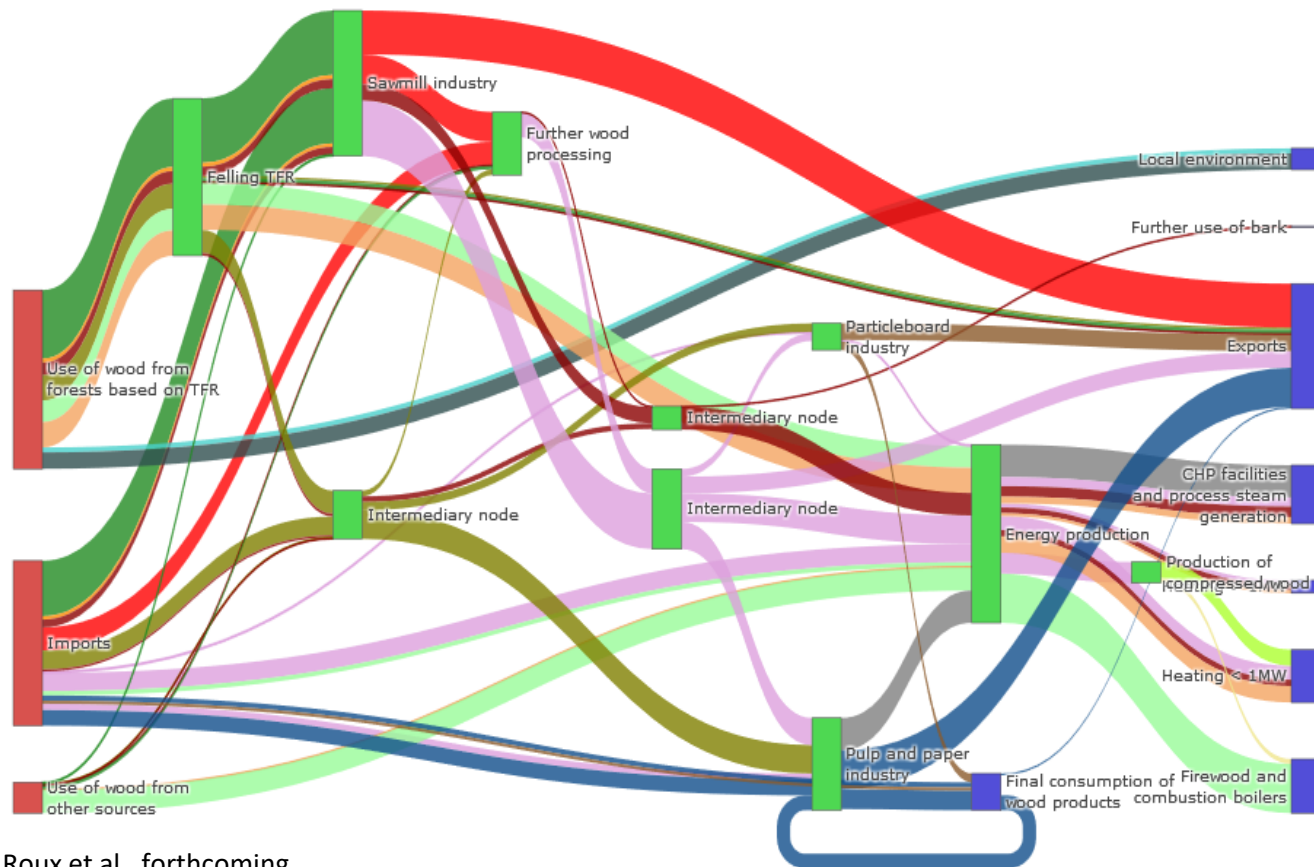


Roux et al., forthcoming

# Wood flows in Austria

Extension of the „Holzflussdiagramm“ (Strimitzer et al., 2010-2020)

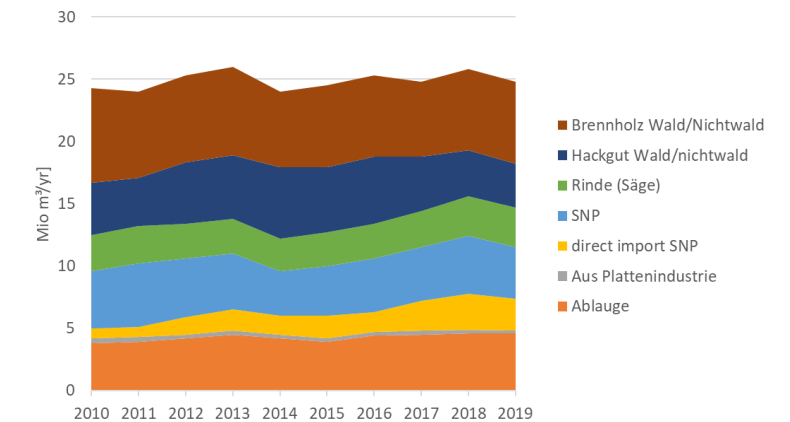
## Dynamic Sankey Implementation



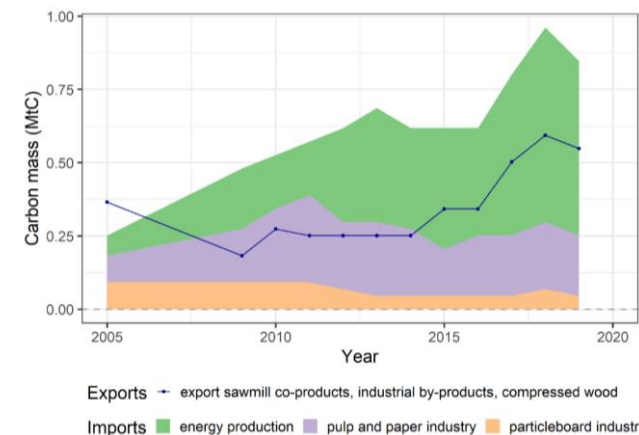
Roux et al., forthcoming

## Temporal dynamics

### Energy production

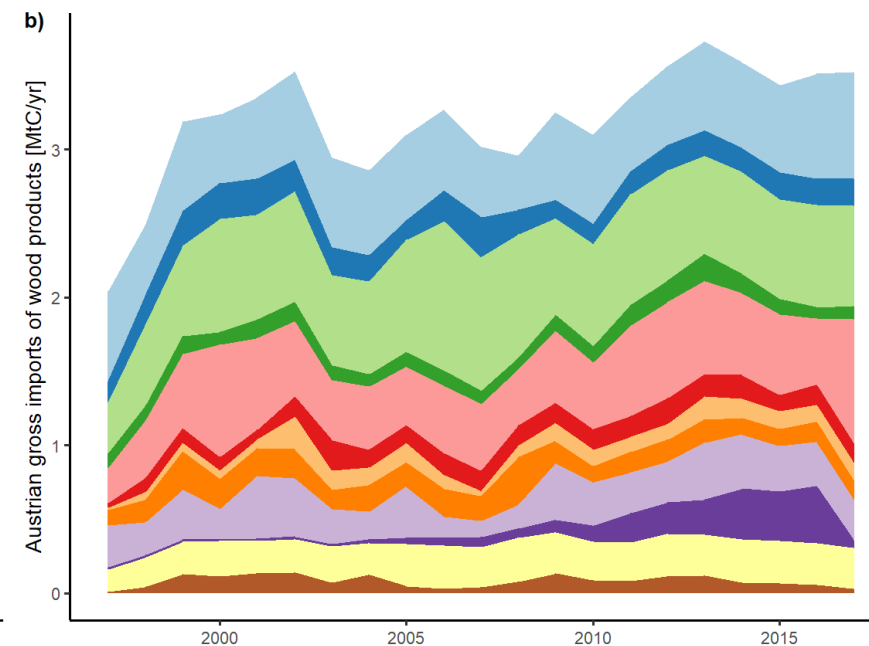
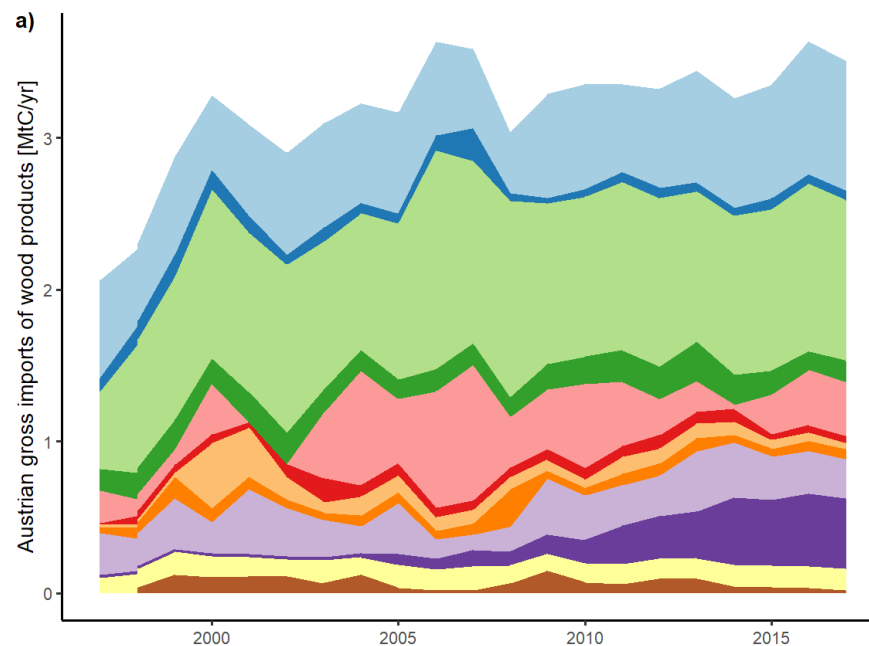


### International trade



# Countries of Origin of Wood imported to Austria

- International trade statistics refer to countries of last origin (added value), and not ecosystem origins
- Problem are the re-exports
- Can be „cleaned“, approximated by a matrix-solution based on the geographically explicit information of the Direct Material Input (DMI=DE+Imp)



Country of last origin

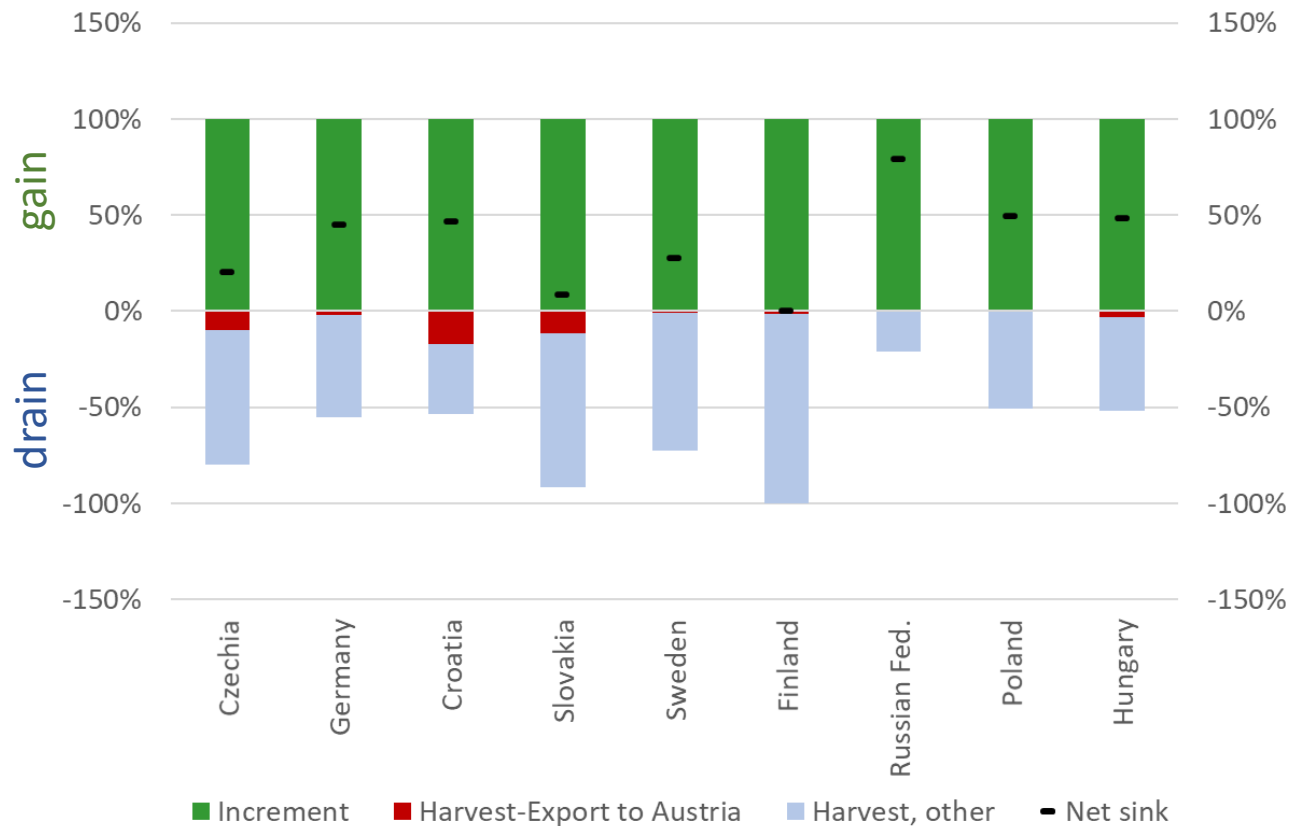
- Czechia
- Finland
- Germany
- Hungary
- Other origins - non tropical
- Other origins - tropical
- Switzerland
- Russian Federation
- Slovakia
- Slovenia
- Sweden
- Ukraine

Country of first origin

- Czechia
- Finland
- Germany
- Hungary
- Other origins - non tropical
- Other origins - tropical
- Poland
- Russian Federation
- Slovakia
- Slovenia
- Sweden
- Ukraine



# Linking imports to the forest-C-sink in countries of origin



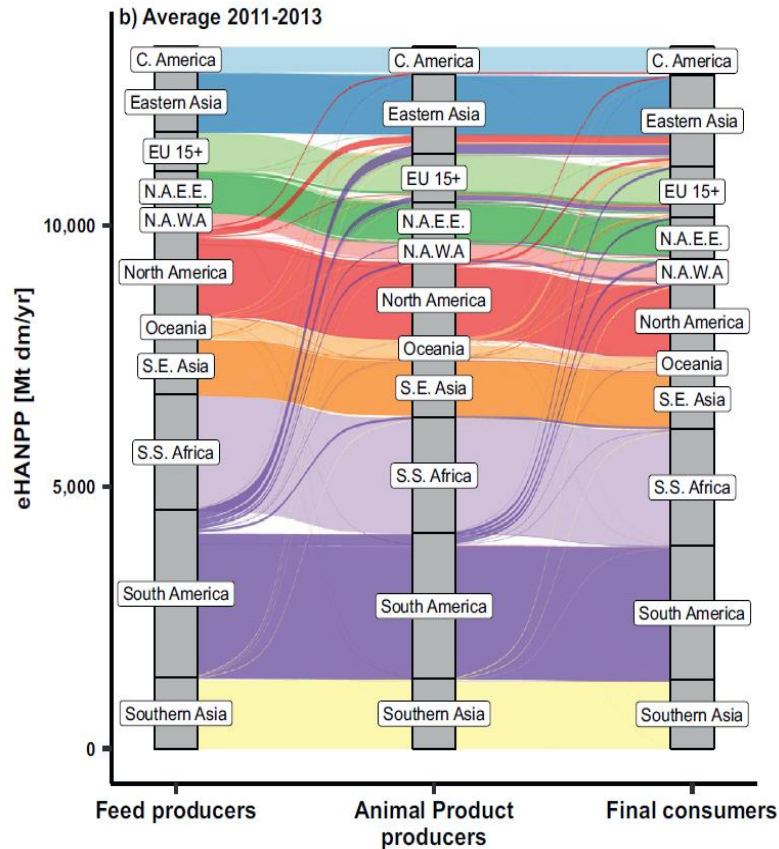
## Top 9 countries

- Simple comparison: the wood C-flux to Austria compared to the remaining sink
- Exports to Austria are significant when compared to the domestic C-sink in some countries
- The 10<sup>th</sup> country is Brazil: massive emissions, „Austrian share“ on harvest is low, but still: 60ktC/yr

# Expand and apply a novel method: „Trilateral“ trade flows. Example: livestock products

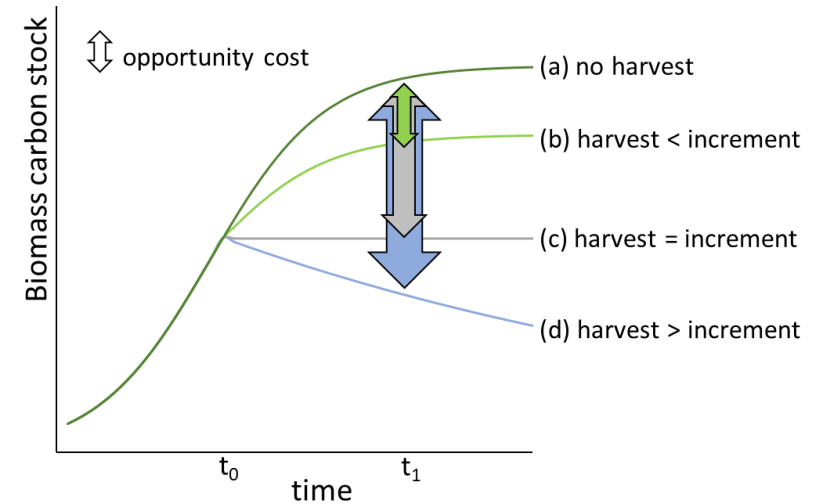
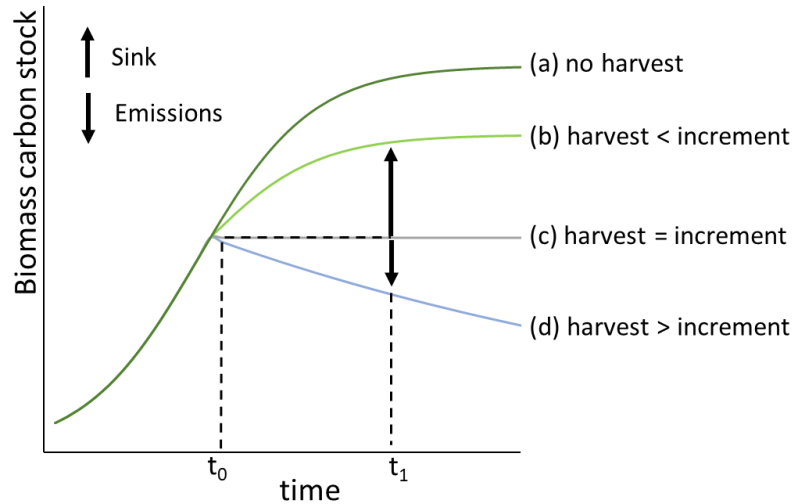
Embodied HANPP of feed and animal products: Tracing pressure on ecosystems along trilateral livestock supply chains 1986–2013

Nicolas Roux <sup>a,\*</sup>, Lisa Kaufmann <sup>a</sup>, Manan Bhan <sup>a</sup>, Julia Le Noe <sup>a,b</sup>, Sarah Matej <sup>a</sup>, Perrine Laroche <sup>c</sup>, Thomas Kastner <sup>d</sup>, Alberte Bondeau <sup>e</sup>, Helmut Haberl <sup>a</sup>, Karlheinz Erb <sup>a</sup>



- Does not only discern countries of origin, but is explicit about the geography of production, processing and consumption
- Allows to move beyond simple „Roundwood equivalent“ calculations, but to draw a more complete picture of the Austrian wood production chain system
- Important for the comparison of territory-based, consumption-based and income-based accounts of wood-related C-fluxes
- Will be applied to Austria (= globally) in the second year

# Opportunity Carbon Cost of Wood Harvest



Erb et al., 2022, 10.1111/gcbb.12921

# Next steps

- The focus of the second year will be on WP2 (model advancement) and WP3 (scenario analysis)
  - Termination of the biophysical database (including detailed trade information)
  - Expansion of the CRAFT model
    - model-based assessment of C-sequestration potentials as well as C-opportunity costs
    - deadwood and soil compartments
    - discerning energy and material wood uses.
  - Appraisal of Austria's negative emissions obligations for 2020-2100 under different CC scenarios
  - Start Integration of ecosystem services, C-fluxes/dynamics and biodiversity
    - establishment of an impact database.
- → towards assessing sustainable yield levels and best wood uses, and co-benefit/trade-off analysis wood use/C-dynamics/biodiversity

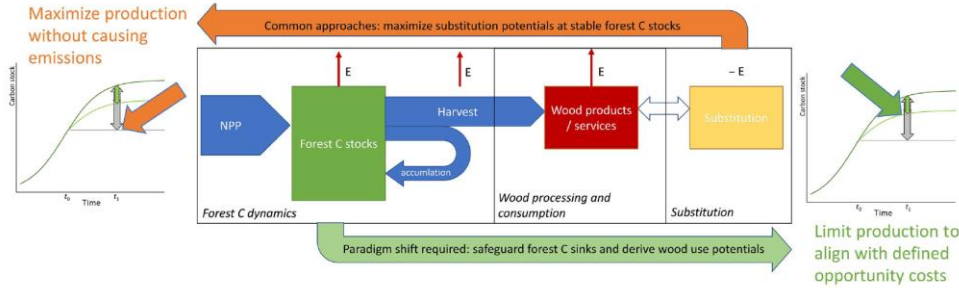
# Products so far: Publications

OPINION



## Changes in perspective needed to forge 'no-regret' forest-based climate change mitigation strategies

Karl-Heinz Erb<sup>1</sup> | Helmut Haberl<sup>1</sup> | Julia Le Noë<sup>1,2</sup> | Ulrike Tappeiner<sup>3,4</sup> | Erich Tasser<sup>3</sup> | Simone Gingrich<sup>1</sup>

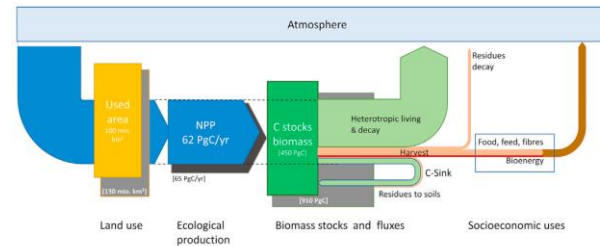
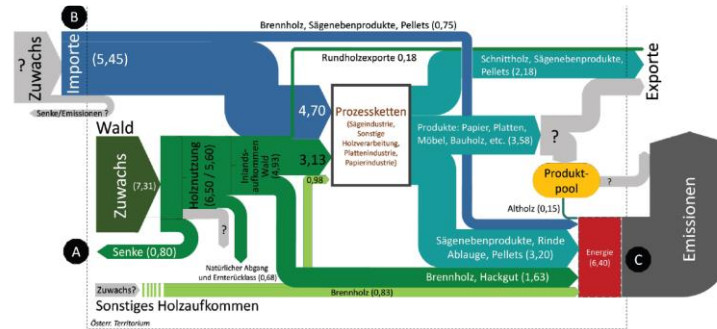


## One Earth



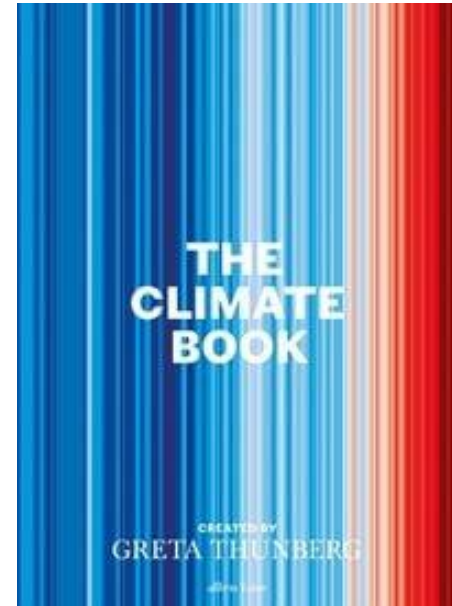
## Commentary Biomass—Critical limits to a vital resource

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<https://doi.org/10.1016/j.onear.2021.12.014>

## Energie aus Holzbiomasse: begrenzte Klimaschutz-Potenziale

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# The End

*Thanks to the team!*



Simone Gingrich, Sarah Matej, Julia Le Noë, Nicolas Roux, Rupert Seidl,  
Ulrike Tappeiner, Erich Tasser