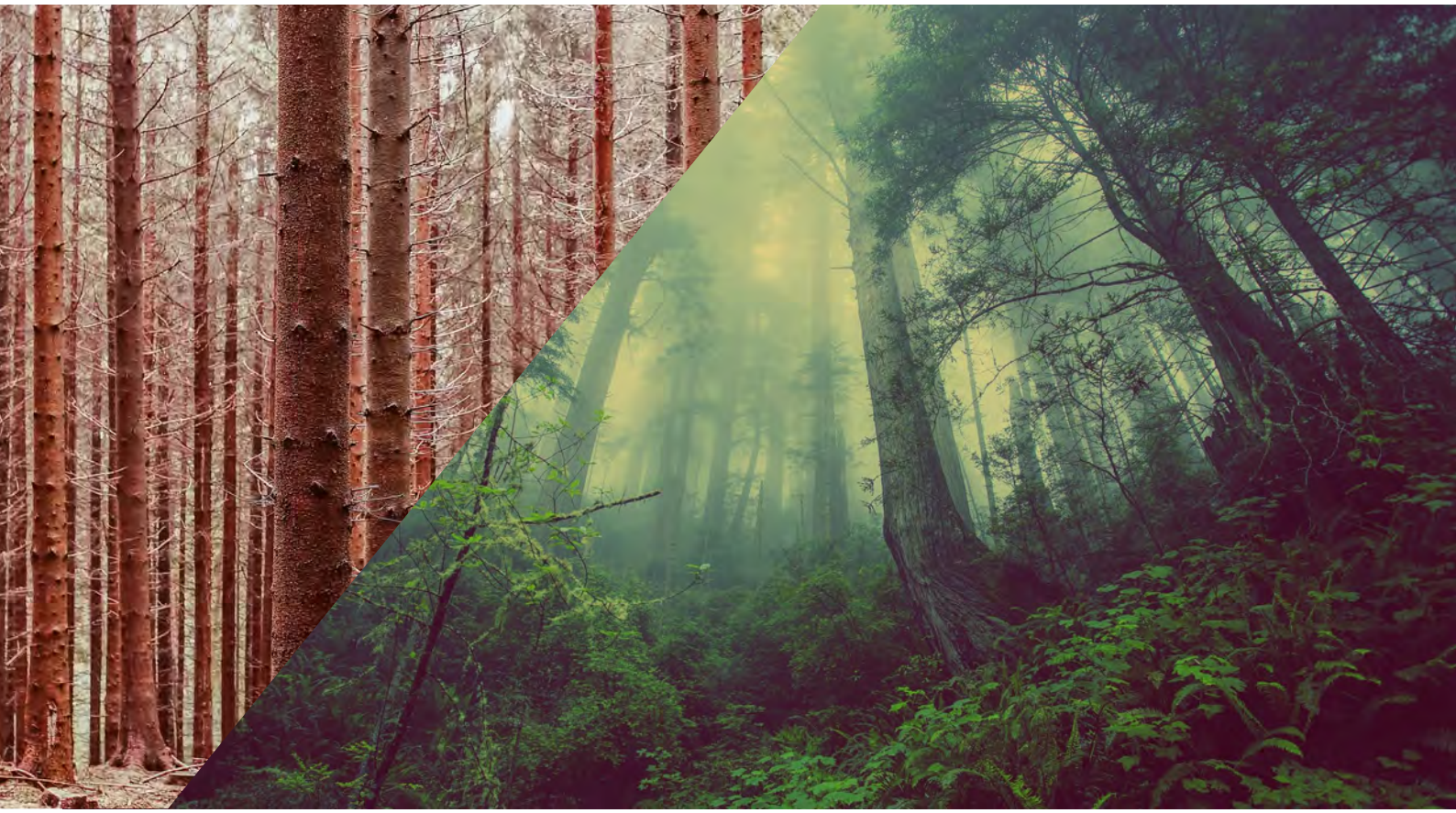


COUPLED POLICY BRIEF

# Land use, land use change and forestry emissions: changing the EU's accounting schemes

The European Commission (EC) has committed to increase its target to reduce net greenhouse gas emissions below 1990 levels by 2030. To implement this plan, the EC wants to amend its carbon emissions accounting rules in the Land Use, Land Use Change, and Forestry (LULUCF) sector (Regulation 2018/841). The Regulation aims to incentivize EU Member States to enhance their carbon sink and decrease greenhouse gas emissions from the LULUCF sector. Here, we recommend a novel accounting scheme to increase the effectiveness and fairness of the Regulation 2018/841.

## KEY MESSAGES

- The current regulation relies on the actual carbon sink, and compares it to a recent reference period.
- This approach faces three problems:
  1. The negligence of land use change happening between the reference period (2000-2009) and the accounting period (2021-2030).
  2. The negligence of historical legacies.
  3. The maturation of existing forests
- We suggest an alternative accounting approach, based on the potential carbon sink concept.
- The potential carbon sink approach enhances a fair distribution of effort based on historical responsibility.

## Change from an actual to a potential carbon sink accounting

Currently, the European LULUCF sector sequesters approximately 300 Mt $CO_2$ per year[1]. The current Regulation 2018/841 relies on an actual carbon sink account, i.e. where the objective is to maintain the carbon sink actually observed in a recent reference period in each member state, called the forest reference level. An actual forest sink larger than the reference implies an "accounting credit", a smaller sink implies an "accounting debit". The no-debit rule ensures that credits should at least outweigh debits (considering the possibility to trade credits across countries).

## The actual carbon sink approach (current EU scheme)

The objective of the actual carbon sink approach in Regulation 2018/841 is that all member states must achieve at least the same carbon sink as in the reference period (Figure 1). We identify three problems with the current accounting scheme based on an actual carbon sink approach (Figure 3).

### Problem 1: the unaccounted intermediate land use change

The actual carbon sink approach neglects land use change happening between the reference period (2000-2009) and the accounting period (2021-2030). This is especially problematic, as deforestation has increased again in certain European countries in the recent past (Ceccherini et al. 2020), leading to the replacement of slow-growing old-growth forests with younger, faster growing stands. Consequently, the current scheme favors those countries that faced deforestation between the reference and the accounting period, as they would benefit from a higher sink in the accounting period than in the reference period, despite their smaller carbon stock.

### Problem 2: the unaccounted legacy

The actual carbon sink approach neglects historical legacies, favoring countries that are currently undergoing a forest transition, over those that either never deforested or faced a forest transition earlier in the past. This might reduce incentives of countries currently facing a forest transition, to rapidly let their forests regrow.

### Problem 3: maturating forests

The actual carbon sink approach neglects the effect that maturating forests growing slower than young forests.

## The potential Carbon sink approach

Therefore, we suggest an alternative accounting approach that enhances a fair distribution of effort based on historical responsibility (Figure 2). Instead of using forest reference levels as a benchmark, the accounting would rely on the potential carbon sink, i.e. the difference between “actual” carbon stocks (carbon stocks currently existing in landscapes) and “potential” carbon stocks (carbon stocks in the theoretical absence of land use but under similar environmental conditions, calculated by veg- etation models). A target based on the potential carbon sink is time-agnostic: it not only accounts for historical land use changes (which have shaped contemporary forest sinks), but also accounts for contemporary forest management regimes. Land cover change and land management as an outcome of human use has had significant impacts on carbon stocks in the EU: actual carbon stocks are less than half of potential carbon stocks (Erb et al. 2018). However, the difference between actual and potential carbon stocks is not the same for all EU member states.

In a potential carbon sink approach, all Member States should reach a fixed percentage of their potential carbon stock by the end of the accounting period (in this case, 2030). This percentage would be the same for all Member States.

Further enhanced approaches should consider forest age, by requiring member states with still young forests to increase their carbon stocks faster. The approach should as well mitigate potential adverse effects on ecosystem resilience, as countries should not be incentivized to force intensive forest growth on little productive but still highly biodiverse and important ecosystems, even if this implies reducing the target for that given country.

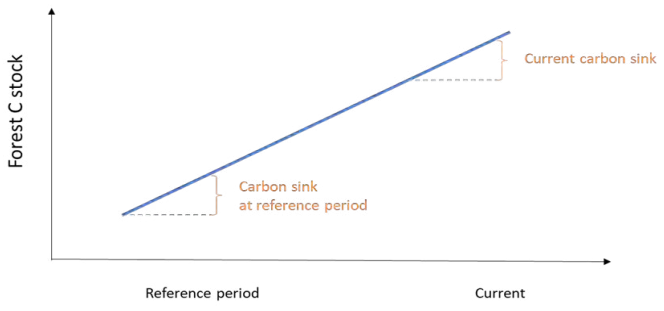



**Figure 1. The actual carbon sink approach (EU scheme)**
*Obective: All member states must achieve at least the same carbon sink as in the reference period.*

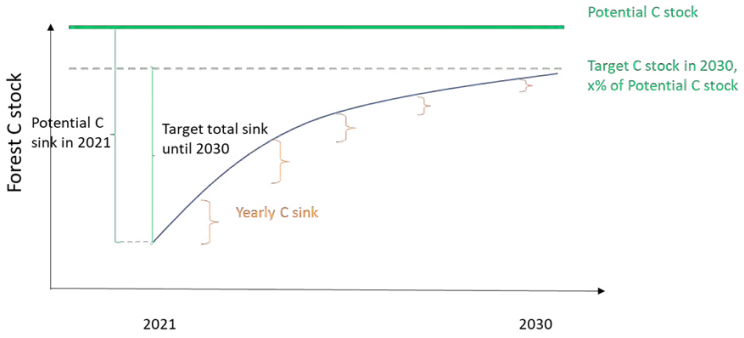
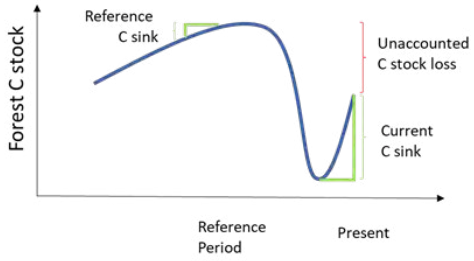
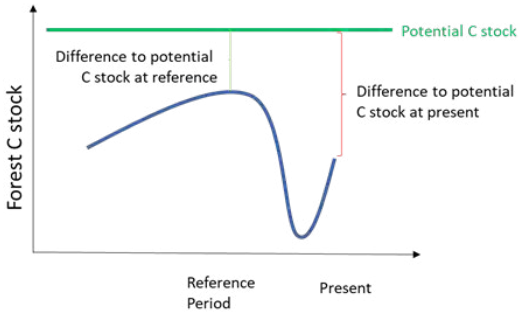



**Figure 2. The potential carbon sink approach**
*Objective: All member states must achieve a given percentage of their potential carbon stock by 2030, the percentage is the same for all member states (e.g. 70%). The function to downscale the targeted total sink to all years is determinded according to the forest age structure.*

## *Problem 1: the unaccounted intermediate land use change*

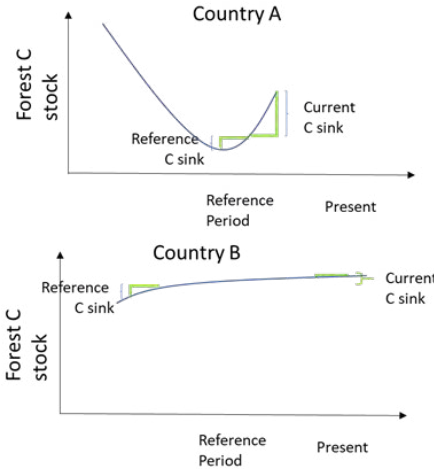



***EU actual C sink accounting:***
The current C sink is higher than in the reference period, although the carbon stock is lower, because of unaccounted deforestation between the reference and the present.

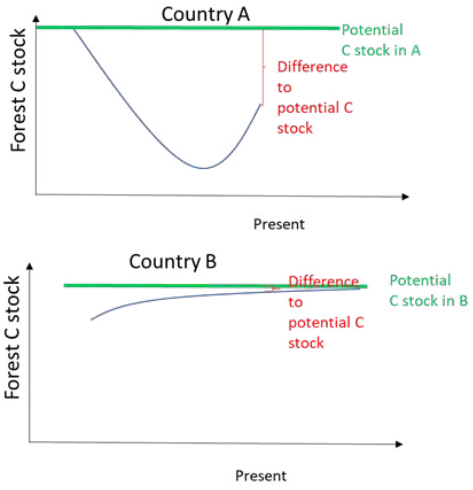



***Potential C stock approach:***
The C stock approach accounts for all land use changes across time. If deforestation happens at some point, even in a non accounted period, it will worsen the indicator.

## *Problem 2: the unaccounted legacy*

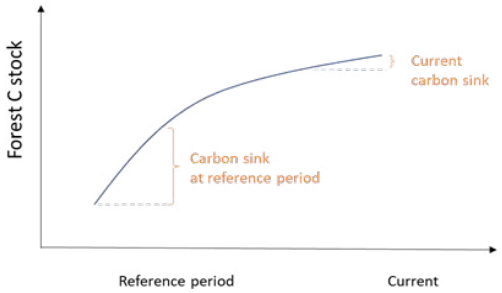



***EU actual C sink accounting:***
In country A the current sink is much higher than the reference, because of past deforestation (high credit). In country B the current sink is lower than the reference, because its C stocks are close to the potential.

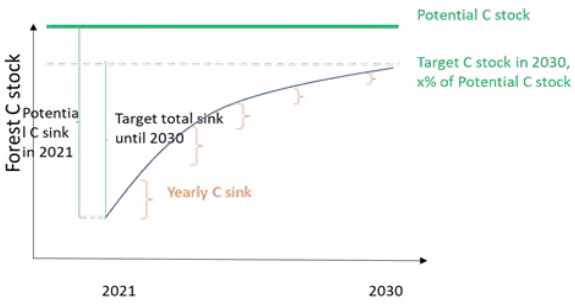



***Potential C stock approach:***
The potential C stock approach corrects for historical deforestation, even far in the past. Here, country B is not in a disadvantage anymore, because despite having a low current sink, its C stock approaches its potential. Country A on the other hand, despite having a current high sink, is still far from its potential

## *Problem 3: maturating forests*




***EU actual C sink accounting:***
As EU forest are maturating, it might become difficult to achieve the carbon sink of the reference period in 10 years from now. Where possible, this can be achieved by reforestation, although it forests should not be "forced" on other natural ecosystems, which can be as important for their biodiversity.




***Potential C stock approach:***
The potential C stock approach is not affected by forest maturation, as the ultimate goal is to achieve a share of the C stock potential. As the actual C stock approaches this target, a lower sink can be accepted.

**Figure 3. Problems of the actual sink approach.**

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*Fellows in HEFT (Hidden Emissions of Forest Transitions (ERC Starting Grant).*

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## Sources and other interesting links

Ceccherini, G. et al. Abrupt increase in harvested forest area over Europe after 2015. Nature 583, 72–77 (2020).

Erb, K. H. et al. Unexpectedly large impact of forest management and grazing on global vegetation biomass. Nature 553, 73–76 (2018).

European Parliament and Council: Regulation (EU) 2018/841 of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU. Current consolidated version: 14/03/2021. ELI: http://data.europa.eu/eli/reg/2018/841/oj

## Selected publications from the COUPLED project that provide further information

Bhan, M., S. Gingrich, N. Roux, et al. 'Quantifying and Attributing Land Use-Induced Carbon Emissions to Biomass Consumption: A Critical Assessment of Existing Approaches'. Journal of Environmental Management 286: 112228. https://doi.org/10.1016/j.jenvman.2021.112228.

Roux, N., et al. Does agricultural trade reduce pressure on land ecosystems? Decomposing drivers of the embodied human appropriation of net primary production. Ecological Economics: 181, 106915 (2021).

COUPLED Policy Briefs feature highlights and policy implications from research conducted under the project Operationalising Telecouplings for Solving Sustainability Challenges for Land Use (COUPLED). COUPLED is a European research and training network that works on topics such as land use processes that link distant places (telecouplings) and how to govern these processes towards sustainability in an interwconnected world. This project receives funding from the European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant agreement No 765408. Responsibility for the content rests entirely with the authors. Neither the COUPLED network nor the European Union's Horizon 2020 Research Executive Agency (REA) necessarily share the expressed views.

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