ForestPaths

Co-designing holistic forest-based policy pathways for climate change mitigation

Öko-Institut

How much can we steer natural sinks in EU forests considering reporting methods?

Hannes Böttcher, Anna Repo, Aleksi Lehtonen et al. | LULUCF Workshop JRC | 06.05.2025

Background and Motivation

- Potentials for enhancing natural sinks in EU forests informed by results from literature, trials, modeling etc.
- However, means for assessing compliance with targets are national Greenhouse Gas Inventories (GHGIs)
- Ability of GHGIs to reflect changes in forest carbon stocks depends on the method of reporting (accuracy, completeness, temporal and spatial resolution)
- We analyse reported data of 2024 on carbon stock changes in living forest biomass and HWP
  - Relationship between the two pools
  - Development over time
  - Conclusions for mitigation measures and their visibility in GHGIs

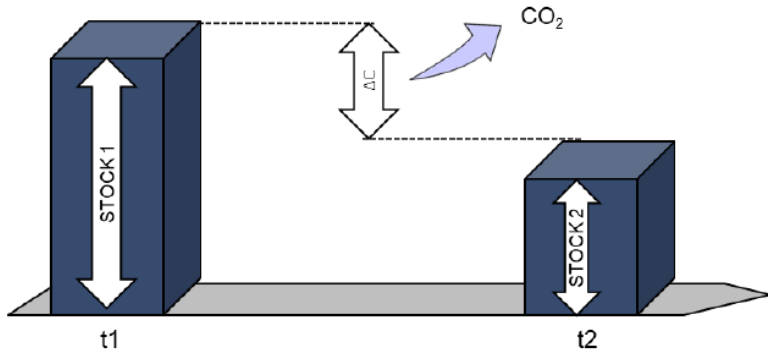
Mitigation options related to forests based on literature

Strategy	No.	Type of activity (based on Verlerk et al. 2022)	Expected effect on living biomass	Expected effect on dead biomass	Expected effect on SOC	Expected effect on HWP
Increasing wood production	1a)	Increasing wood harvest	Short- to medium-term: decrease Long-term: neutral	Short-term: increase Long-term: decrease	Short-term: increase Long-term: decrease	Short- to medium-term: increase Long-term: neutral
	1b)	Wood use, shifts in wood use to more long-lived products and increased efficiency	Neutral	Neutral	Neutral	Short- to medium-term: increase Long-term: neutral
Increasing forest carbon stocks	2a)	Decreasing wood harvest	Short- to medium-term: increase Long-term: neutral	Short- to medium-term: increase	Short- to medium-term: neutral to increase	Short- to medium-term: decrease (depending on how efficiently wood was used…) Long-term: neutral
	2b)	Forest conservation	Short- to medium-term: increase Long-term: neutral	Short-term: decrease Medium- to long-term: increase	Short- to medium-term: neutral Long-term: increase	Short- to long-term: decrease
	3b)	Hydrology	Depends	Depends	Increase	Depends
	3c)	Forest soils	Depends	Depends	Depends	Depends
Increasing forest area		Afforestation	Short- to long-term: increase	Short-term: neutral Long-term: increase	Short-term: decrease to neutral Medium- to long-term: increase	Short-term: neutral Long-term: increase

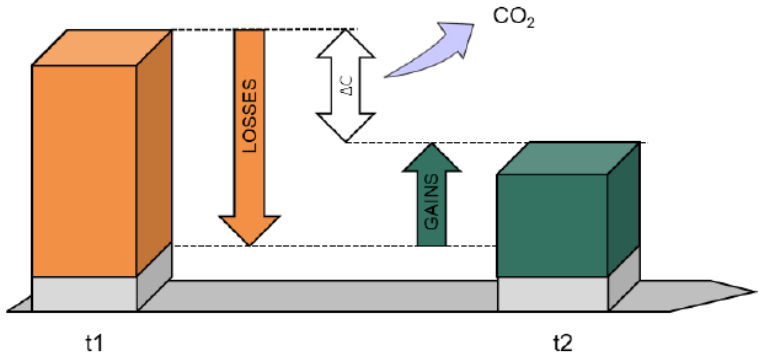
Verkerk et al. 2022

Methods to estimate carbon stock changes in forest living biomass

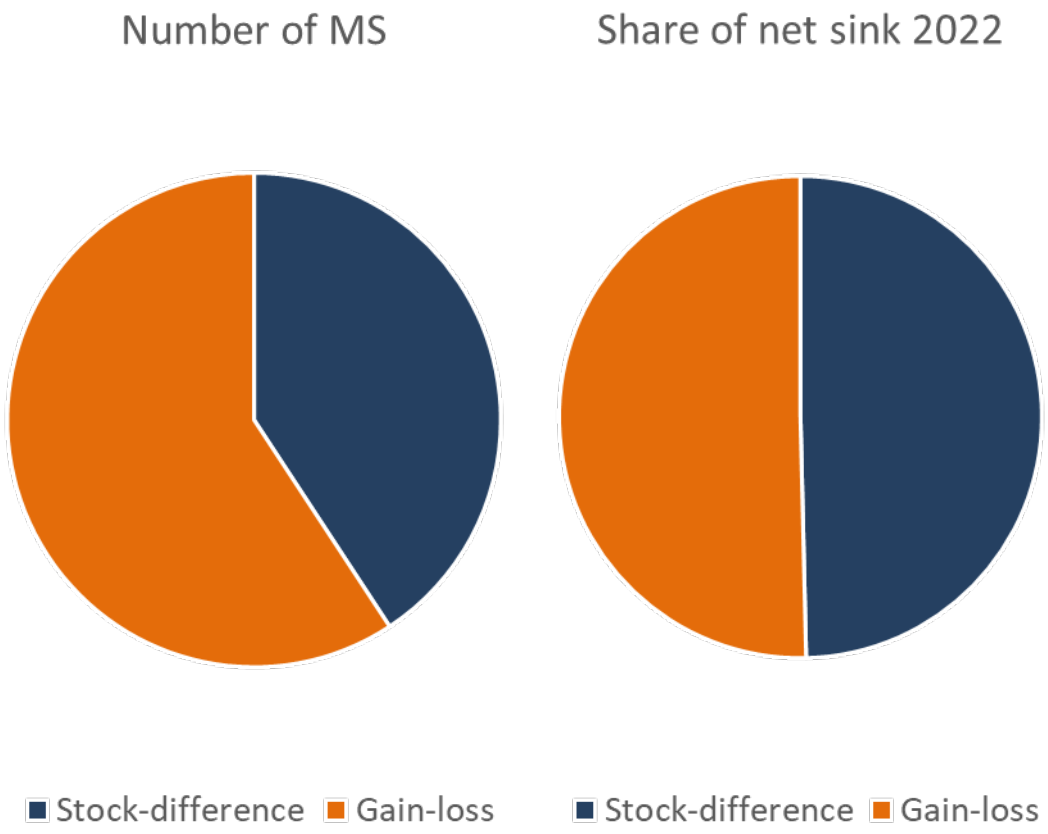
Stock difference method (ΔC = STOCK2 – STOCK1)



Gain loss method (ΔC = GAINS – LOSSES)

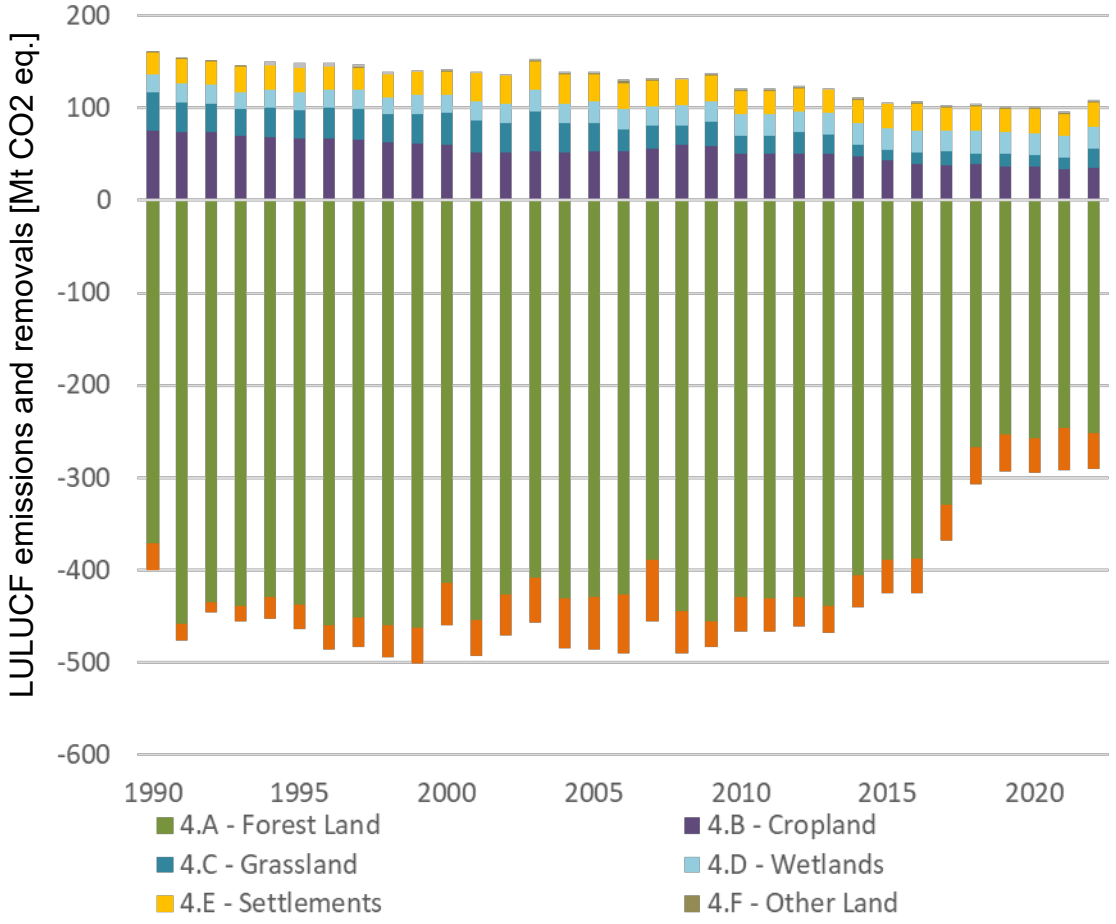


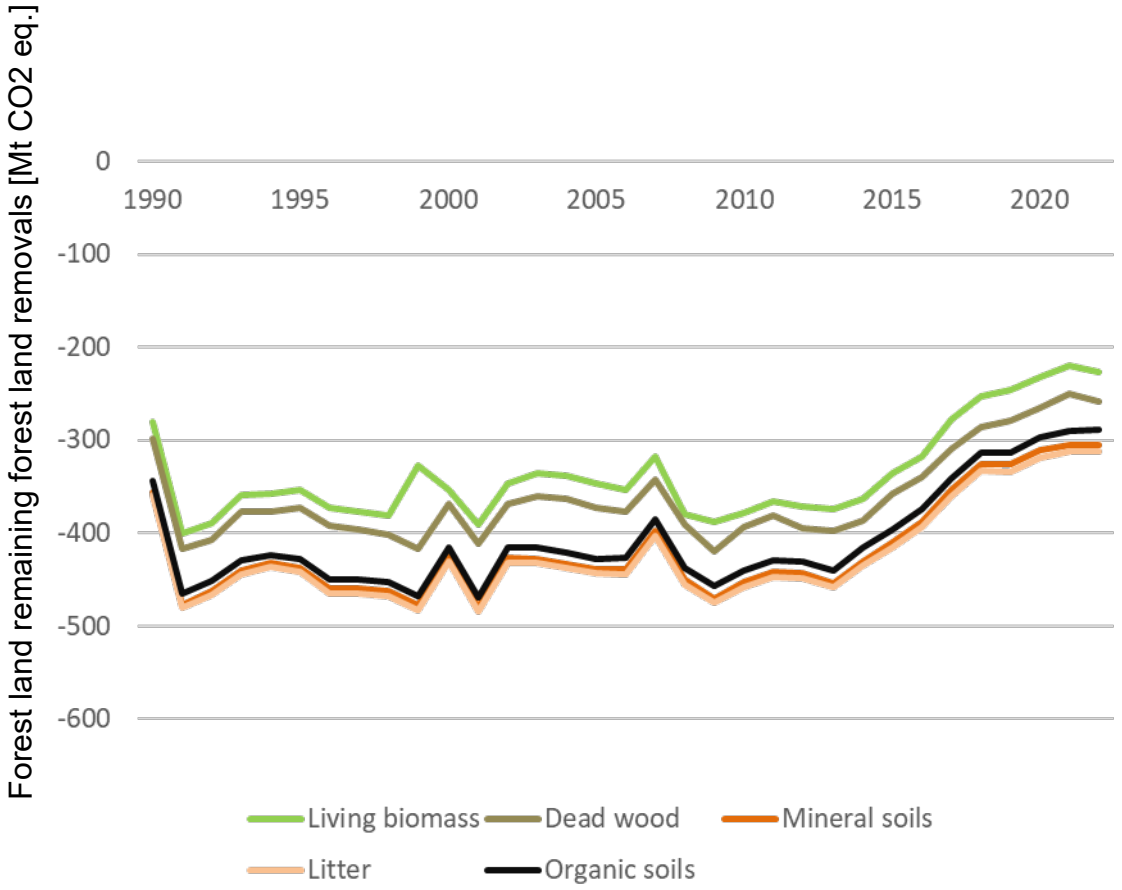
LULUCF Handbook Version 2, https://climate-energy.eea.europa.eu/topics/climate-change-mitigation/land-and-forests/reports/handbook-on-the-update-lulucf-regulation-v2



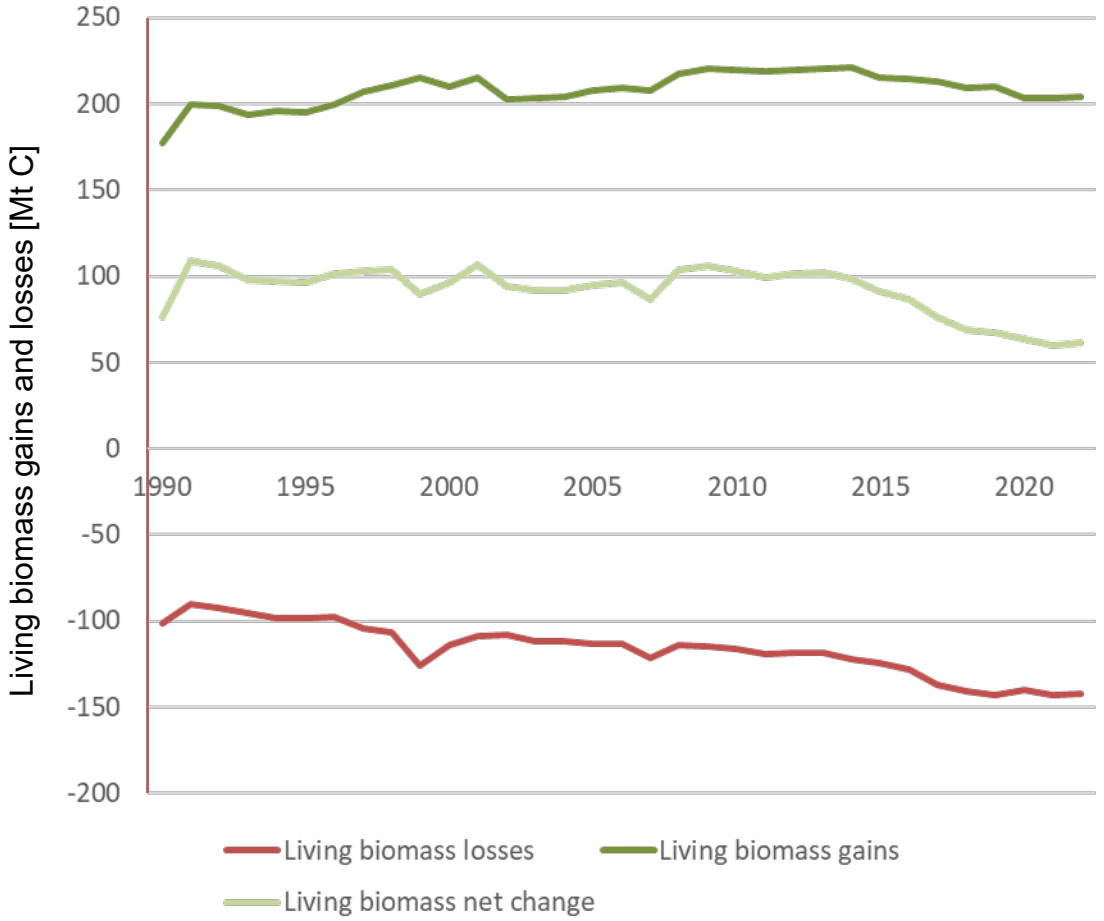
European Union 2024: National Inventory Document (NID), https://unfccc.int/sites/default/files/resource/EU%20NID%202024_F.pdf?download

Reported LULUCF GHG emissions and removals – living biomass largest contributor



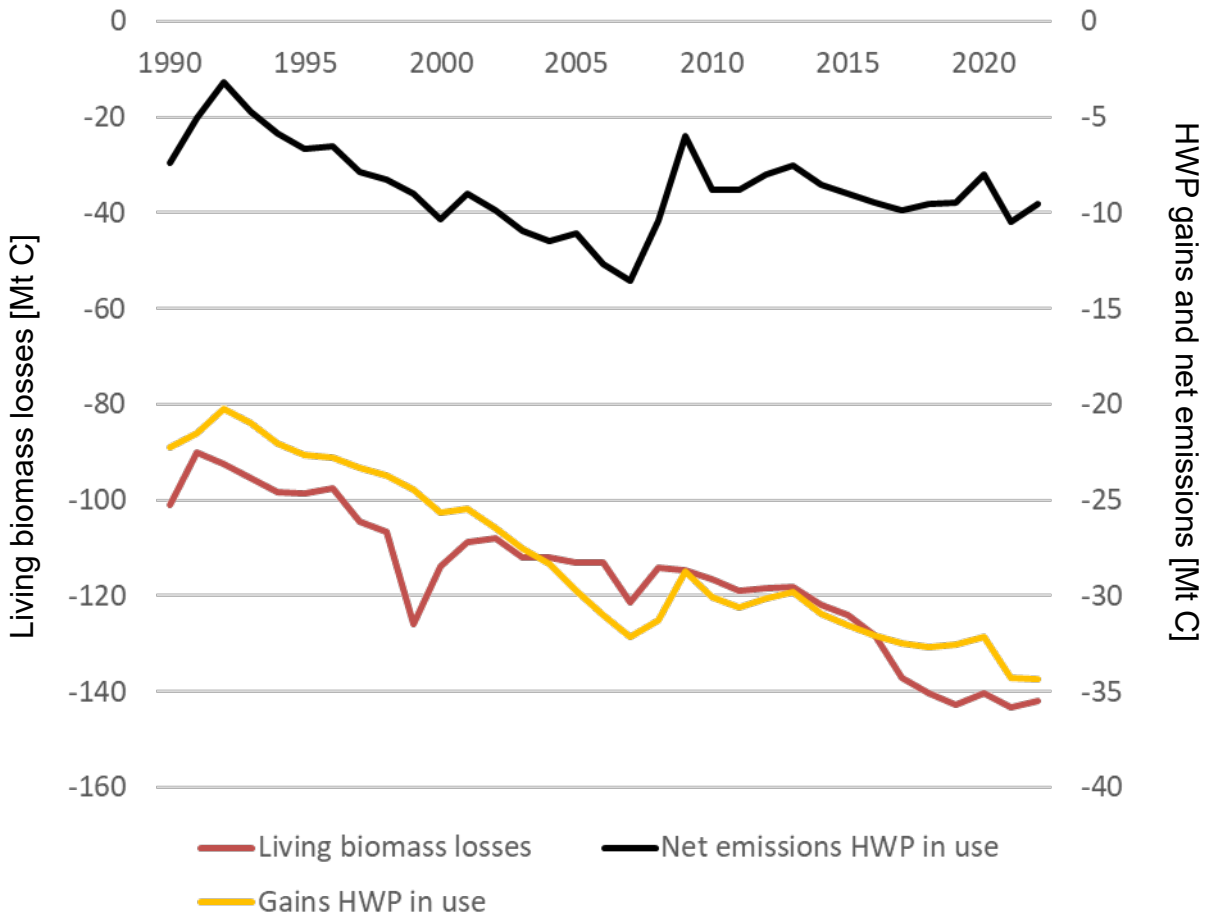


Development of living biomass C gains (+) and losses (-)



- Gains relatively stable, slow decline in last decade
- Almost constant increase of losses
  - Natural mortality
  - Harvest
- Combined: almost a reduction of net carbon stock increases of living biomass by 50% since 2010
- Gains and losses likely to be underestimated due to 40% MS reporting based on stock-difference

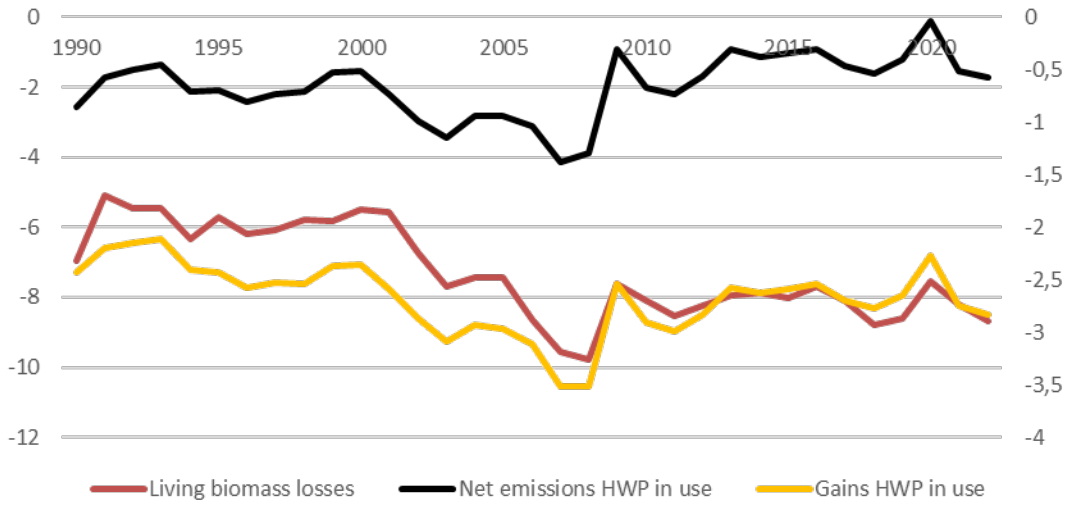
Development of living biomass C losses (-) and HWP gains (-)



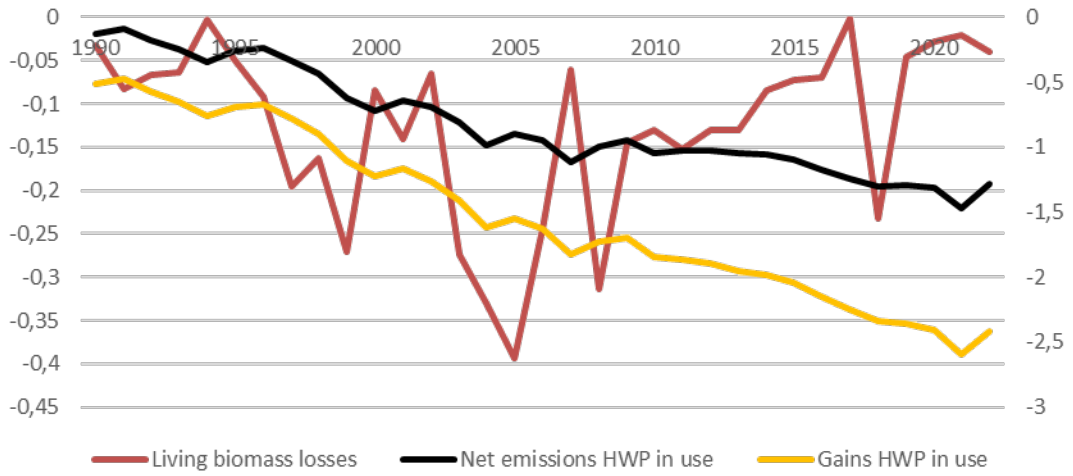
- Close relationship in development between living biomass losses and HWP gains but C losses of 75%
- Increase of HWP gross emissions (reduced net increase) after 2007
- Relatively constant „efficiency“ of HWP sourcing from forest biomass

Development of living biomass C losses (-) and HWP gains (-) in indiv. MS

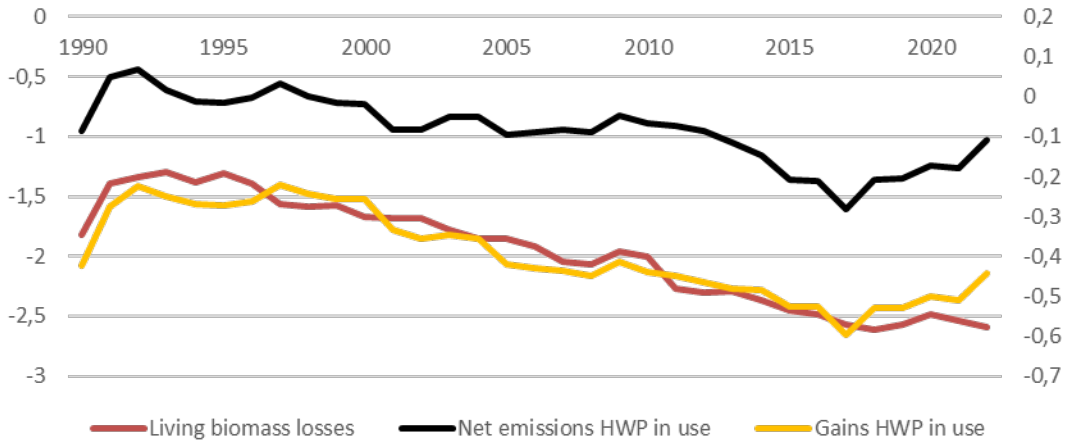
AUT



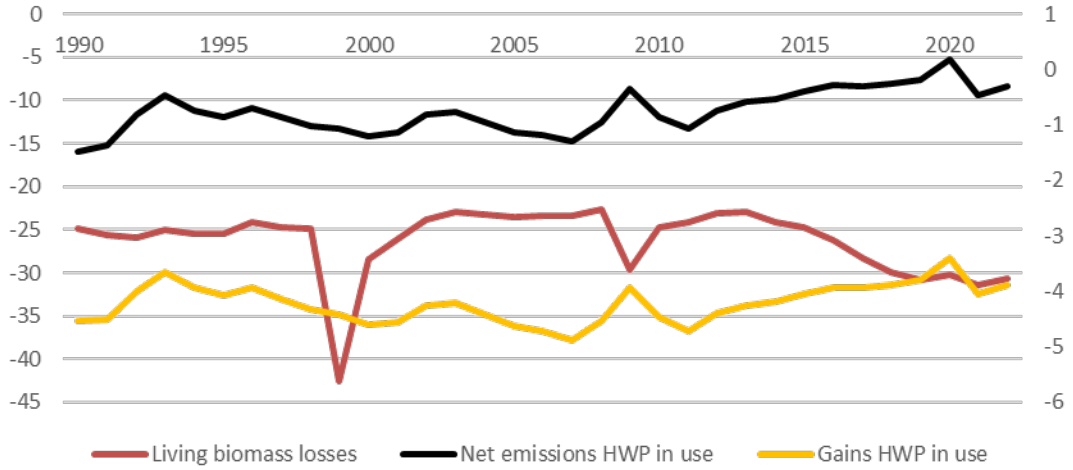
POL



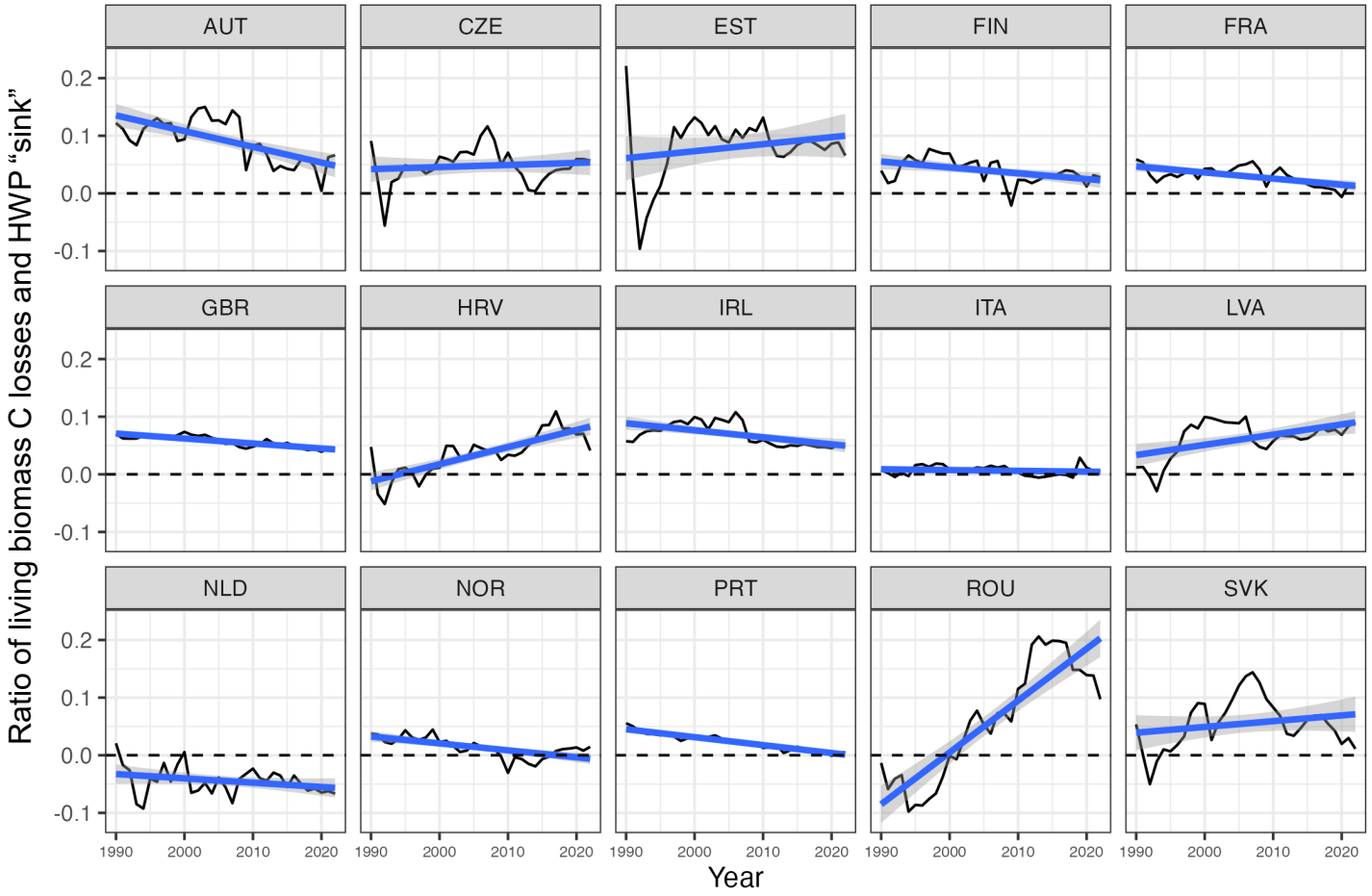
HRV



FRA



Ratio of living biomass losses and HWP net change



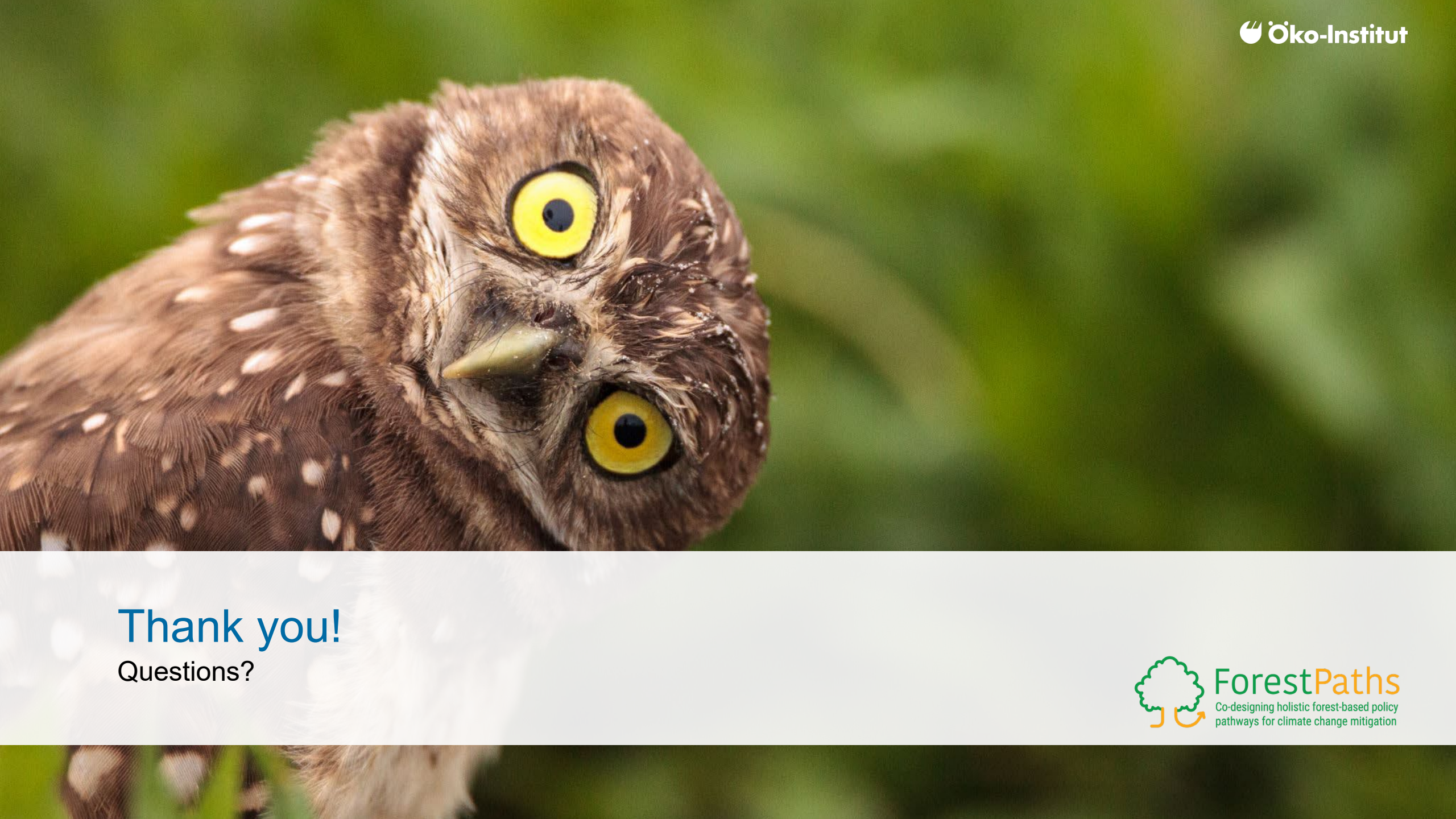
- Can only be calculated for MS that provide estimates for living biomass losses
- In some MS ratio seems to be more stable (CZE, EST, HRV, LVA)
- Downward shift observed for AUT, FIN, FRA, PRT
- Upward trend for POL, ROU
- Negative for NLD due to declining HWP stock

Summary

- Main strategies for increasing natural sinks in EU forests
  - Increase forest carbon stocks
  - Increase wood production and storage in HWP
- The losses of living biomass can be related to gains of the HWP pool
- Ratio ranges on average between 0.1 and 0.15, i.e. 10 to 15% of living biomass losses influence HWP C stocks positively
- MS show different trends in the efficiency of recovering carbon from biomass pool to HWP

Conclusions

- There are limits to the analysis due to different reporting methodologies
  - Not all MS report gains and losses of living biomass
  - HWP net stock changes just proxy for HWP gains
- This also limits options for assessing potentials and implications of mitigation measures
  - Are changes caused by increased gains or decreased losses?
  - Role of disturbances?
- More transparency could be achieved with more detailed reporting
  - Reporting of gains and losses for forest biomass and HWP
  - Differentiation by forest strata (e.g. coniferous, broadleaved)



Thank you!

Questions?

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