



International Institute for
Applied Systems Analysis

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Wood-based bioeconomy and climate benefits of forests

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WOOD-BASED BIOECONOMY AND CLIMATE BENEFITS OF FORESTS

- 1) Climate benefits of forests are not limited to biogenic carbon **in forests**, but they also include biogenic carbon **outside forests**

- 2) Climate benefits of forests consider the **whole value chain** from forests to wood-based material products and bioenergy, including substitution effects and BECCS
 - > IPCC and UNFCCC reporting attributes substitution effects and BECCS to **other sectors**
 - > Difficult to understand the overall picture of climate benefits of forests
 - > Need for **extended forest-based carbon accounting** (Petterson et al. 2022)
 - > **Climate smart forestry** (CSF) (Nabuurs et al. 2017)
 - > Extended forest-based carbon accounting/CSF has important policy implications how we should utilize forests in the future (Verker et al. 2020)

EXTENDED FOREST-BASED CARBON ACCOUNTING

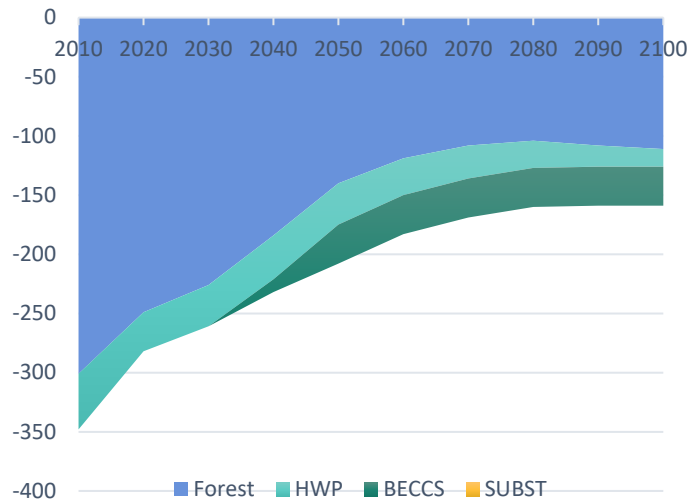
FOREST: forest management+ afforestation +deforestation (method: age-class dynamics, land use change dynamics)

HWP: harvest wood products carbon storage (method: IPCC production approach)

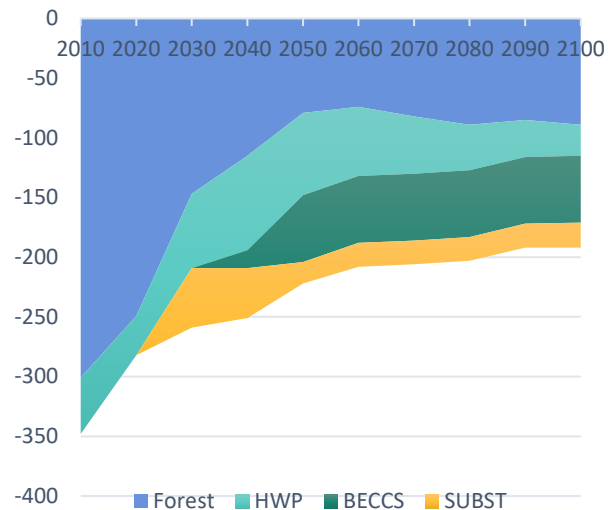
BECCS: bioenergy with carbon capture and storage (method: HWP with ∞ -live time + share of bioenergy with BECCS from PRIMES/MESSAGE)

SUBST: fossil-based products substitution (method: DF from LCA literature + decarbonizing dynamics)

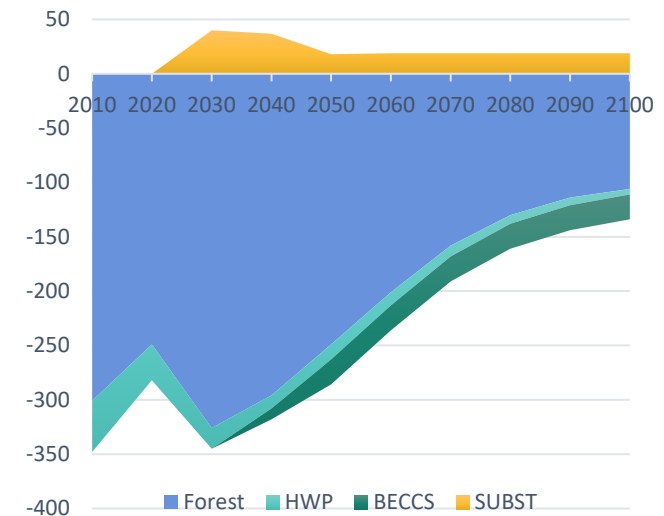
BASE (MtCO₂/yr)



HIGH (MtCO₂/yr)



LOW (MtCO₂/yr)



WOOD-BASED BIOECONOMY: IIASA IBF-program (GLOBIOM-team)



Modelling framework: Global spatial explicit AFOLU sector partial equilibrium model (GLOBIOM) combined with soft link to energy sector model (MESSAGE/POLES/IEA/PRIMES)

Projects connected to wood-based bioeconomy:



Global forest sector outlook 2050

Assessing future demand and sources of timber for a sustainable economy

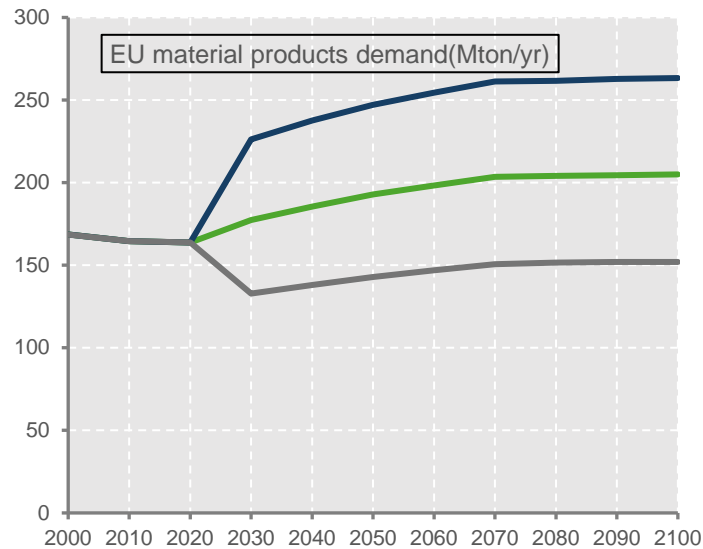


WOOD-BASED BIOECONOMY: Example analysis

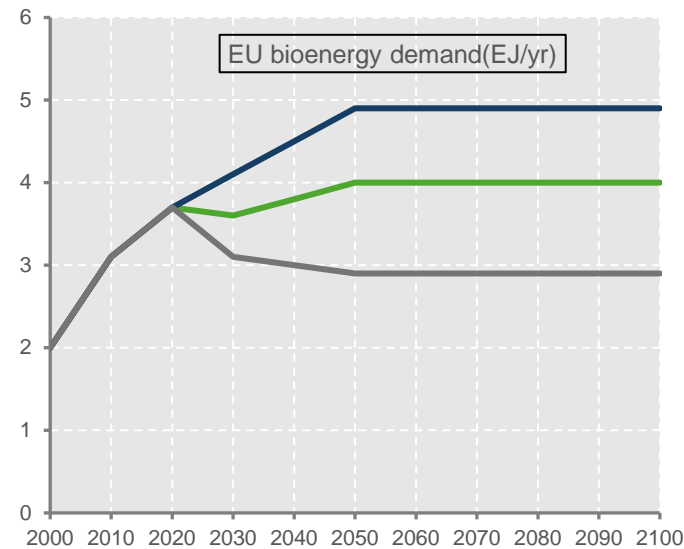


Three different **EU wood-based bioeconomy scenarios** under EU 2050 net zero target:

- 1) **BASE** : PRIMES base, wood-based construct and textiles SSP2
- 2) **HIGH** : PRIMES high, wood-based construct +100% and textiles+200% relative BASE
- 2) **LOW** : PRIMES low, wood-based construct -50% and textiles -50% relative BASE

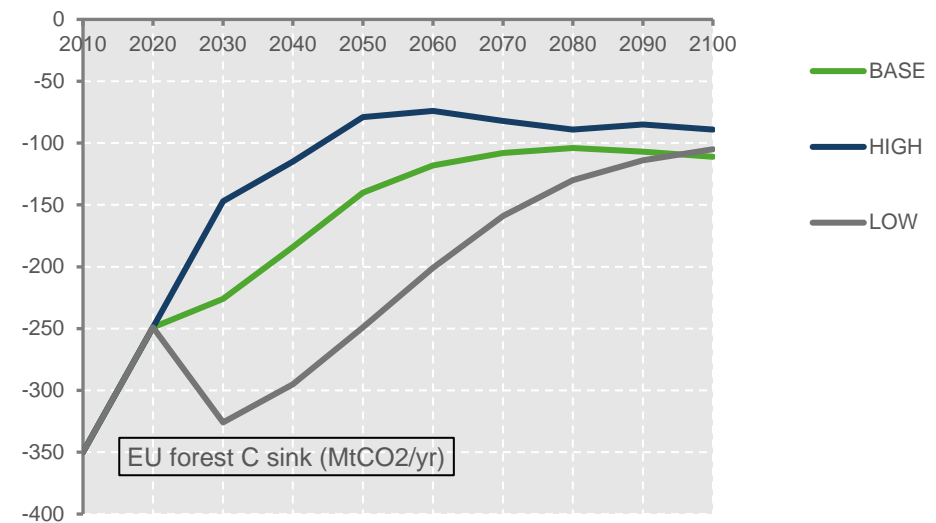
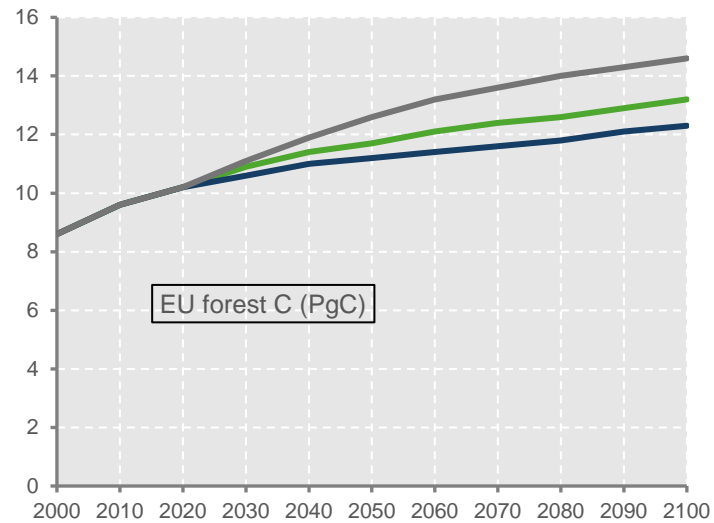
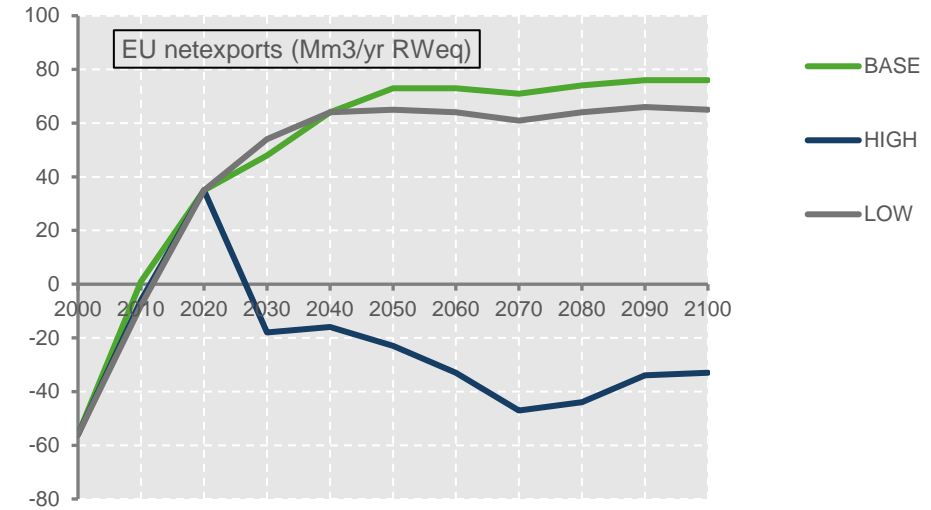
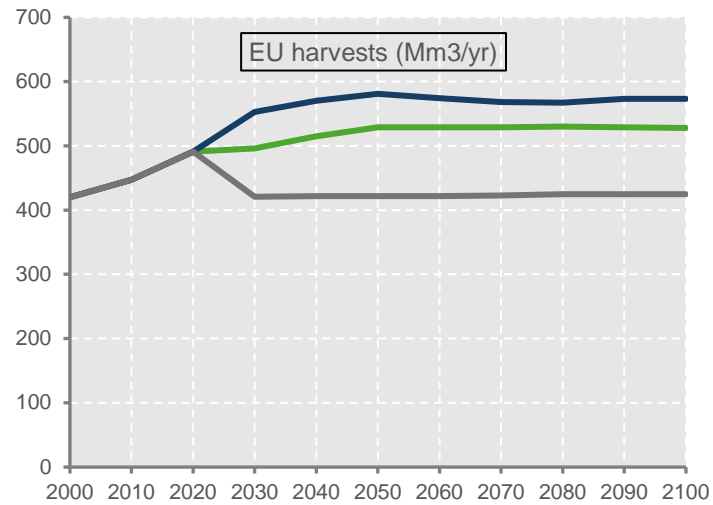


— BASE
— HIGH
— LOW



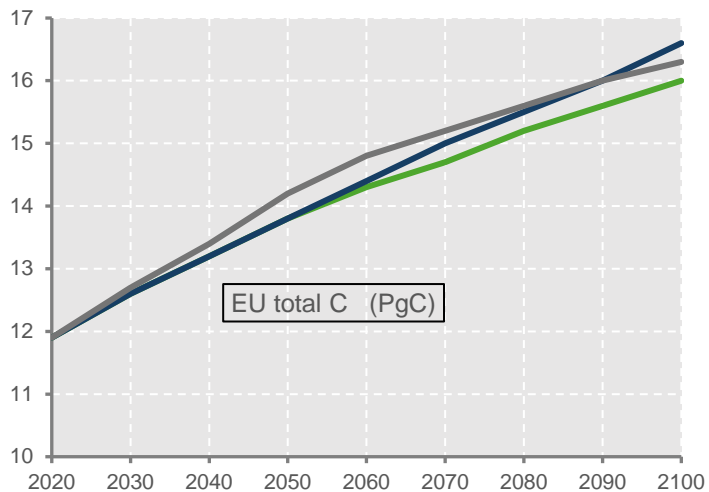
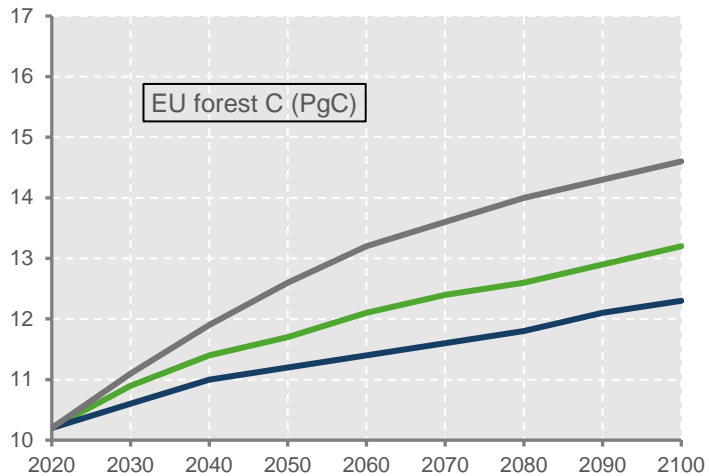
— BASE
— HIGH
— LOW

HARVESTS, TRADE AND FOREST CARBON



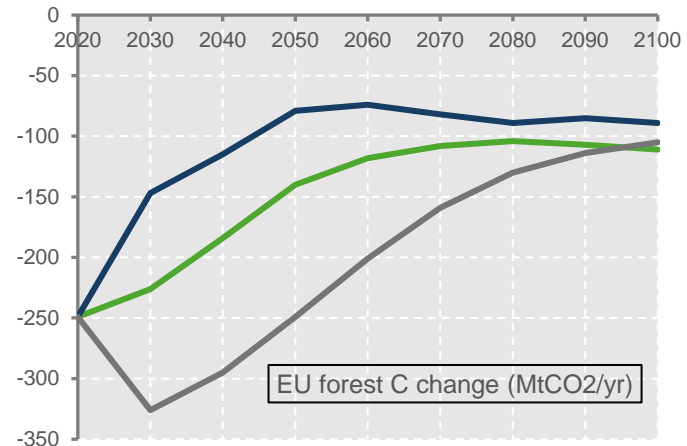
WHY LOOKING SHORT-RUN FOREST C CAN BE MISLEADING ?

Forest C=AG and BG living biomass

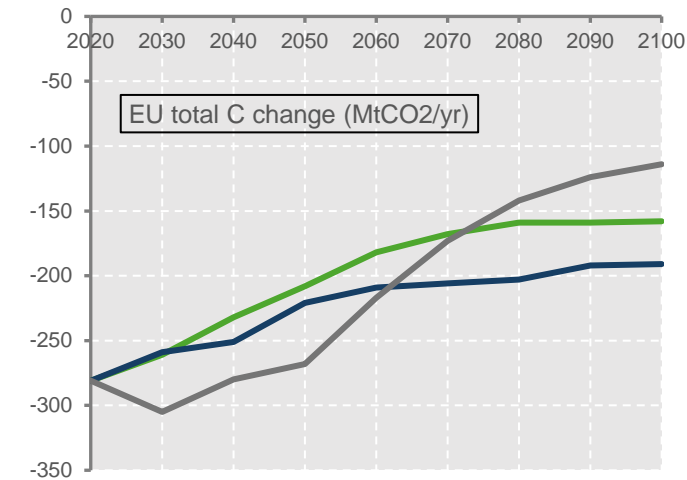


Total C=Forest C+HWP+BECCS+SUBST

— BASE
— HIGH
— LOW



— BASE
— HIGH
— LOW



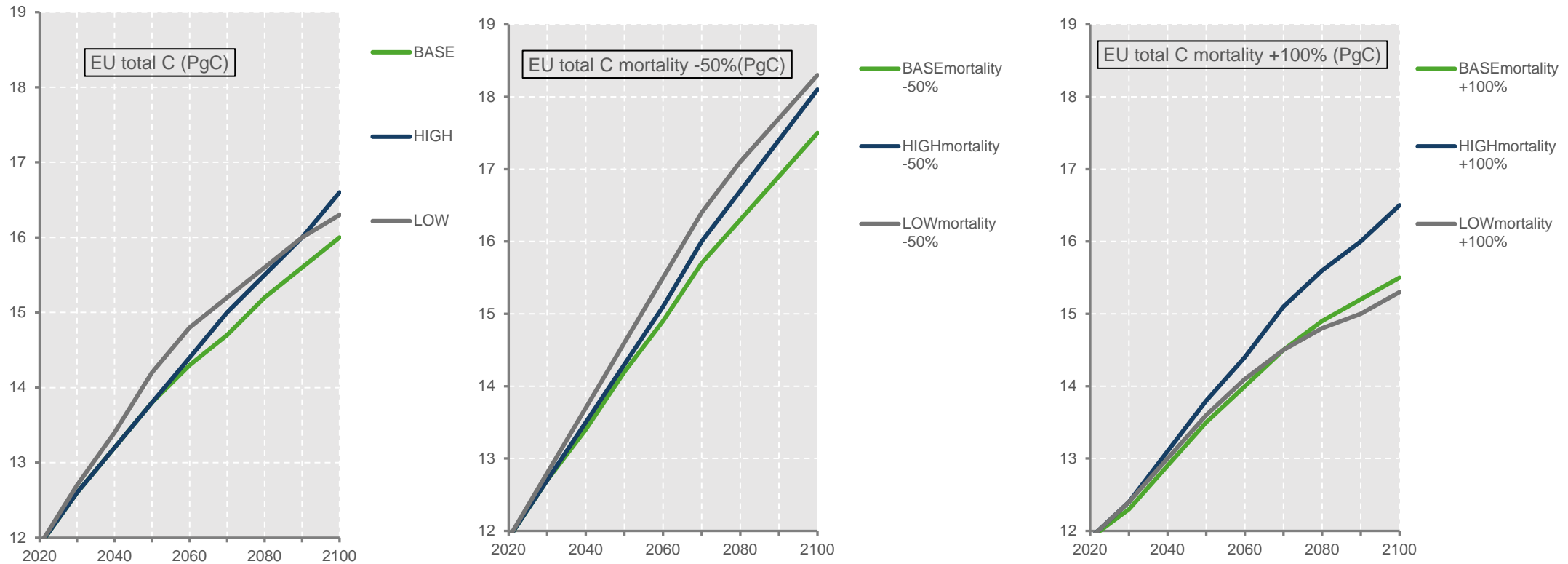
— BASE
— HIGH
— LOW

— BASE
— HIGH
— LOW

SENSITIVITY TO MORTALITY (INCREASED FOREST DISTURBANCES)

Mortality -50%: adaptation by forest management -> LOW bioeconomy becomes more attractive

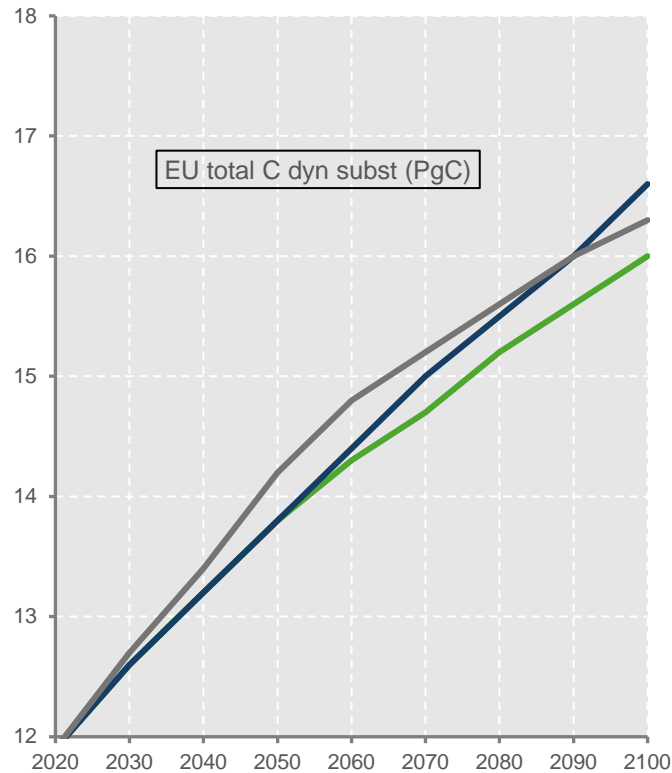
Mortality +100%: no adaptation by forest management -> LOW bioeconomy becomes less attractive



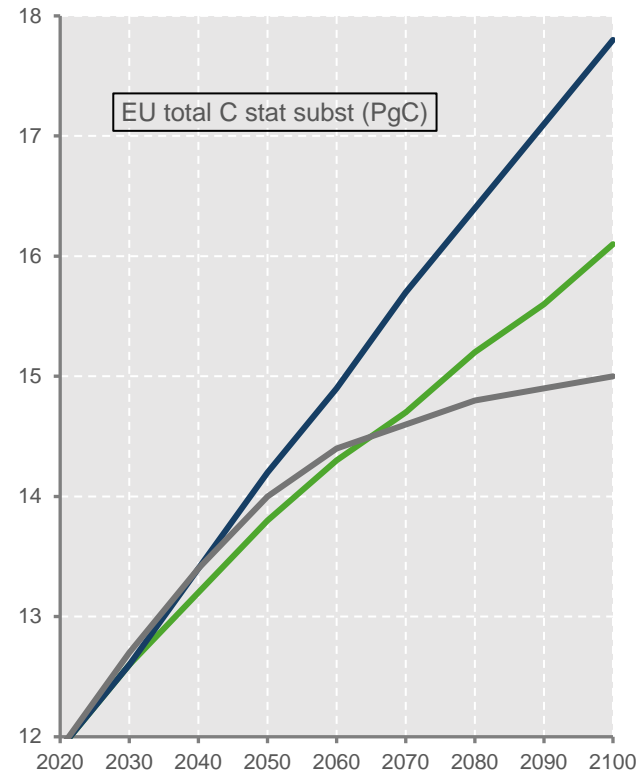
SENSITIVITY TO SUBSTITUTION EFFECT

Dyn subst (default): dynamic DF -> decarbonizing by other renewables (Brunet-Navarro 2021)

Stat subst: constant DF -> decarbonization by biomass -> HIGH bioeconomy becomes more attractive



— BASE
— HIGH
— LOW

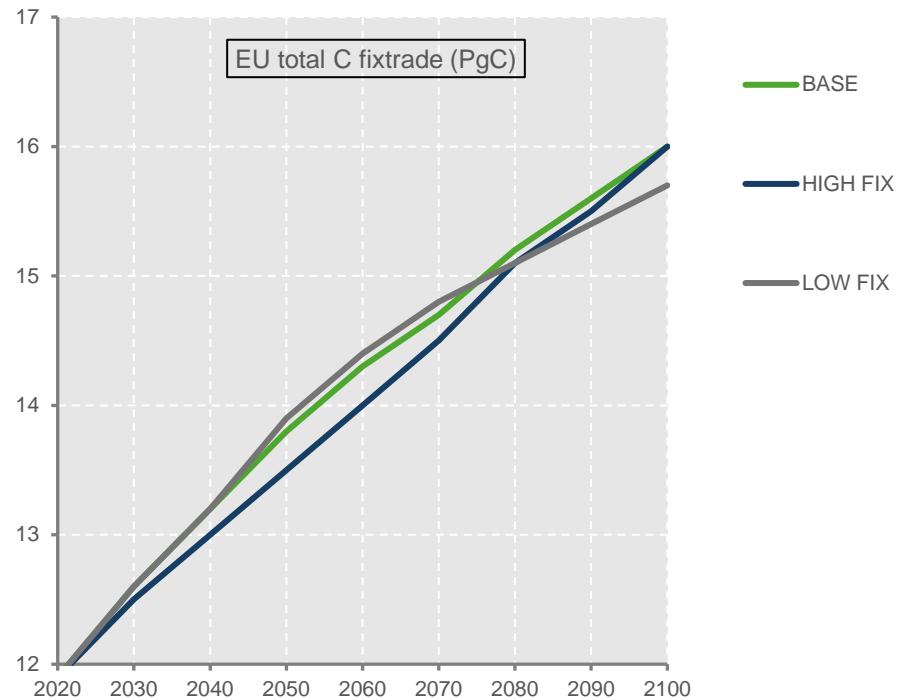
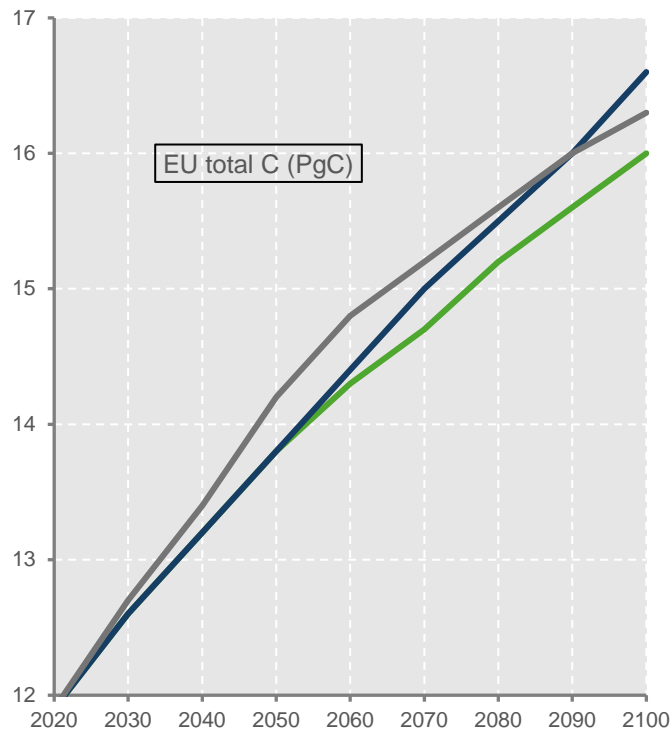


— BASE
— HIGH
— LOW

SENSITIVITY TO TRADE

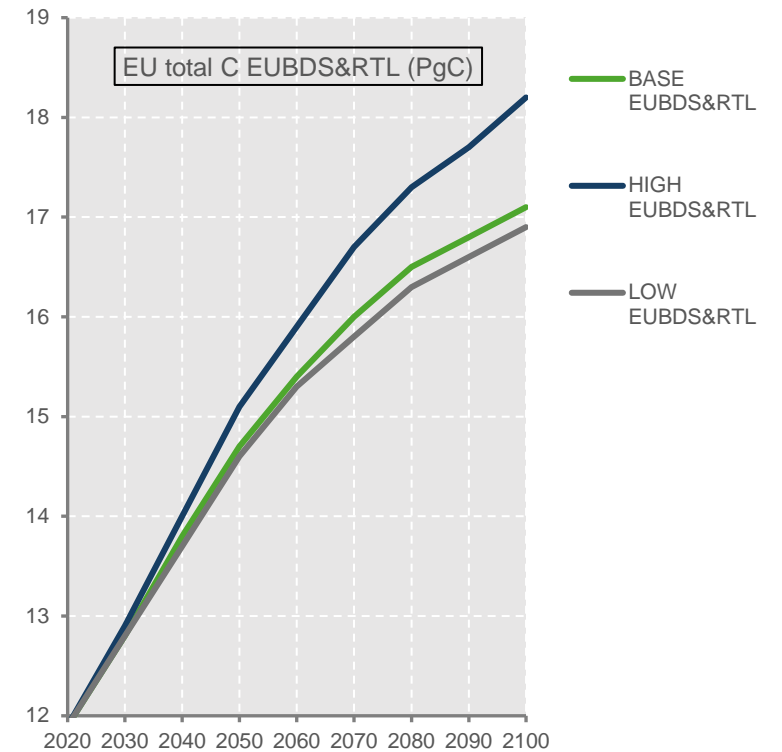
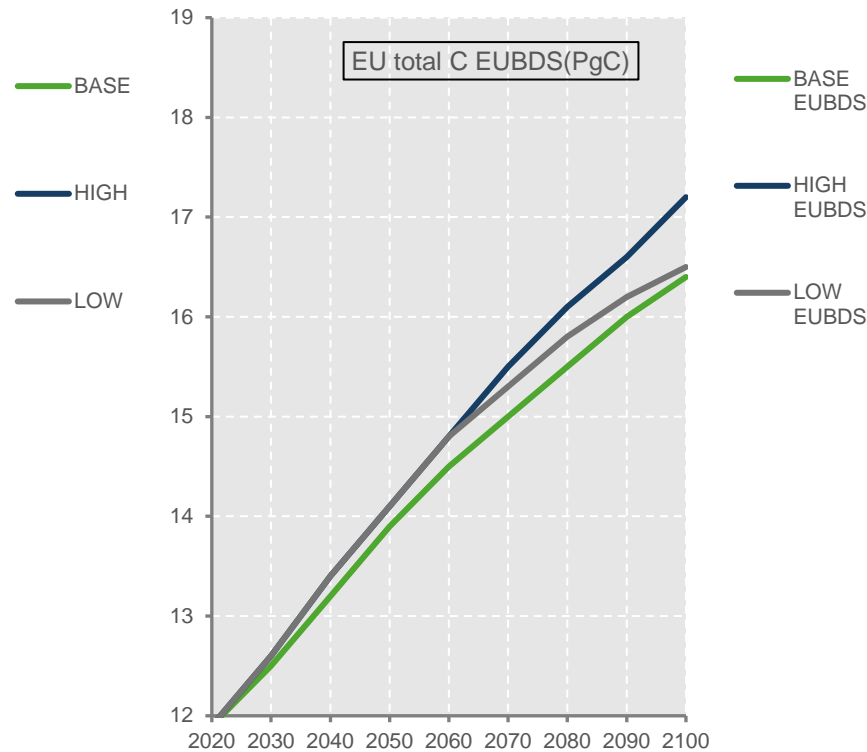
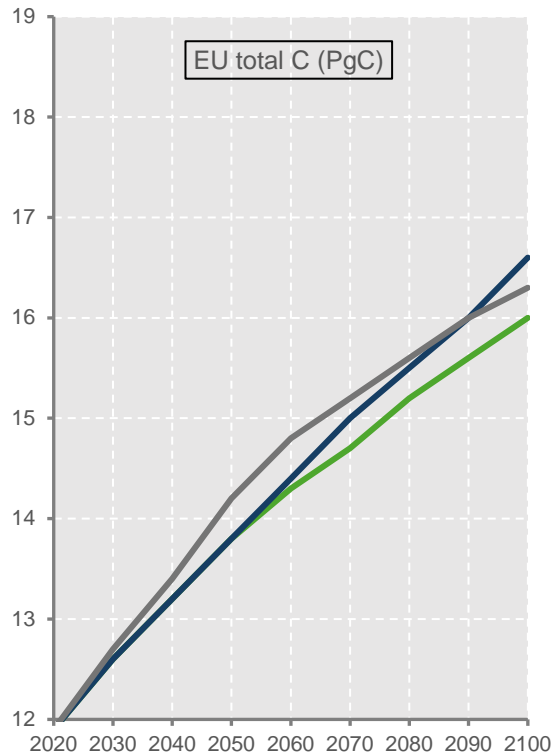
Trade adaption allows EU to avoid negative impacts of increasing demand, but leads trade leakages outside EU

Fixtrade scenario= EU trade with ROW fixed to BASE scenario (no trade adaption) -> HIGH and LOW bioeconomy becomes less attractive relative to BASE



SENSITIVITY TO EU GREEN DEAL (EUBDS&NRL)

EUBDS=EU Biodiversity Strategy -> protect 30% forest area -> benefits more BASE/HIGH due to trade effect
RTL=EU Restoration Law -> restore degraded forest area -> benefits more BASE/HIGH due to trade effect





Summary:

- 1) To understand climate benefits of **bioenergy** needs **integrated modelling approach** which take in account the whole value chain from forests to wood-based products and bioenergy, including BECCS and SUBST
- 2) Looking only **forest carbon** might give wrong idea of climate benefits of bioenergy -> needs **extended forest-based carbon** accounting that goes beyond usual IPCC/UNFCCC reporting
- 3) Extended forest-based carbon accounting not suitable for national reporting (too complex and sensitive), but **useful for policy analysis** to support decision making

Thank you