
Climate Change and Forest
How can forests help to meet climate goals?
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Global anthropogenic CO2 emissions

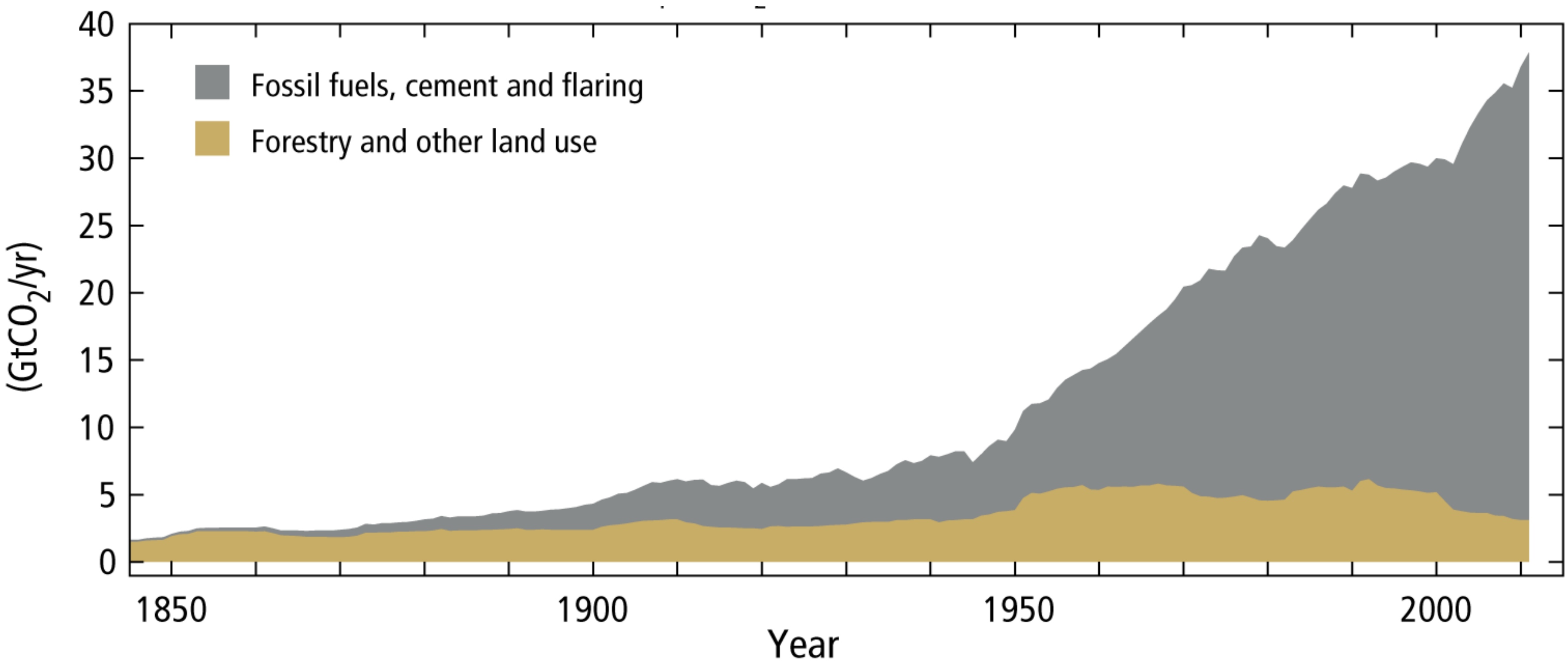
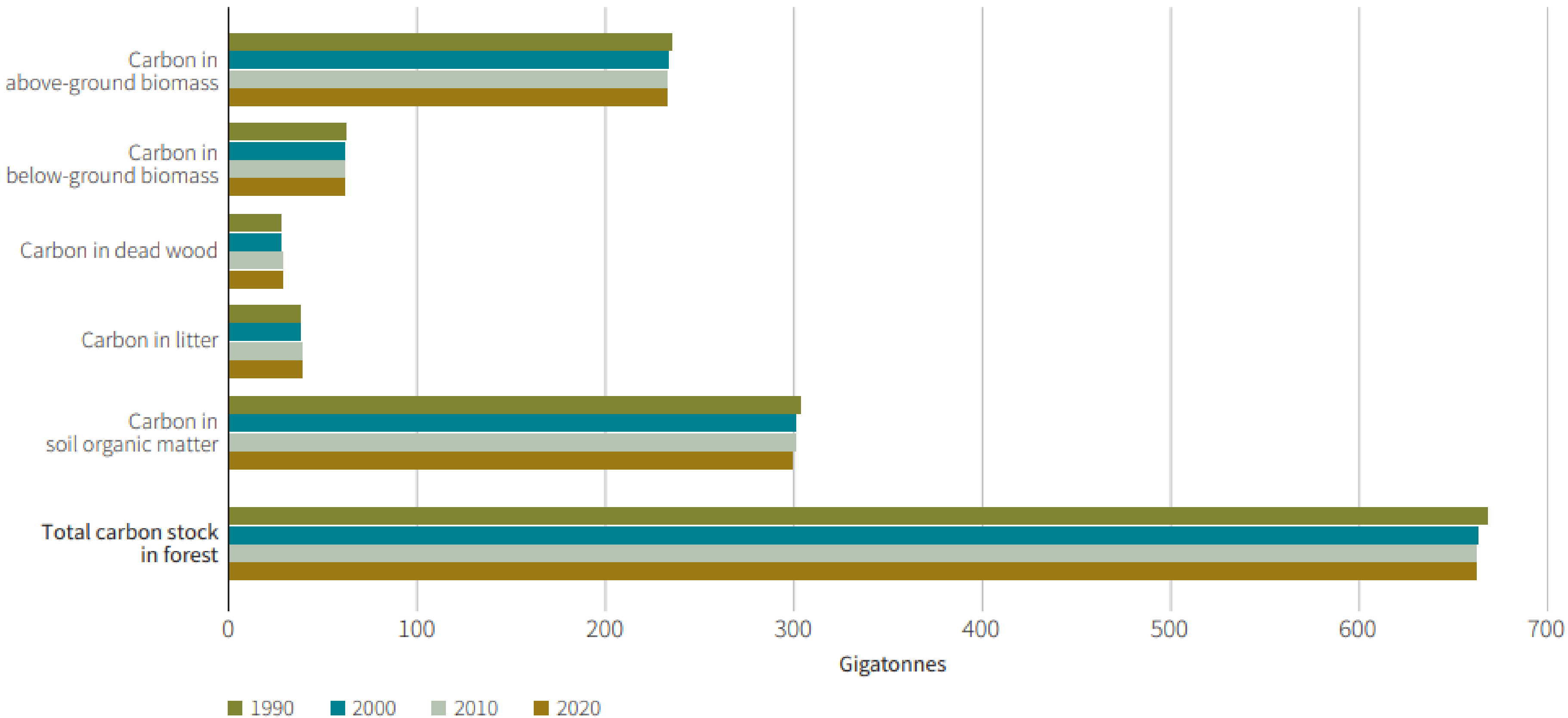


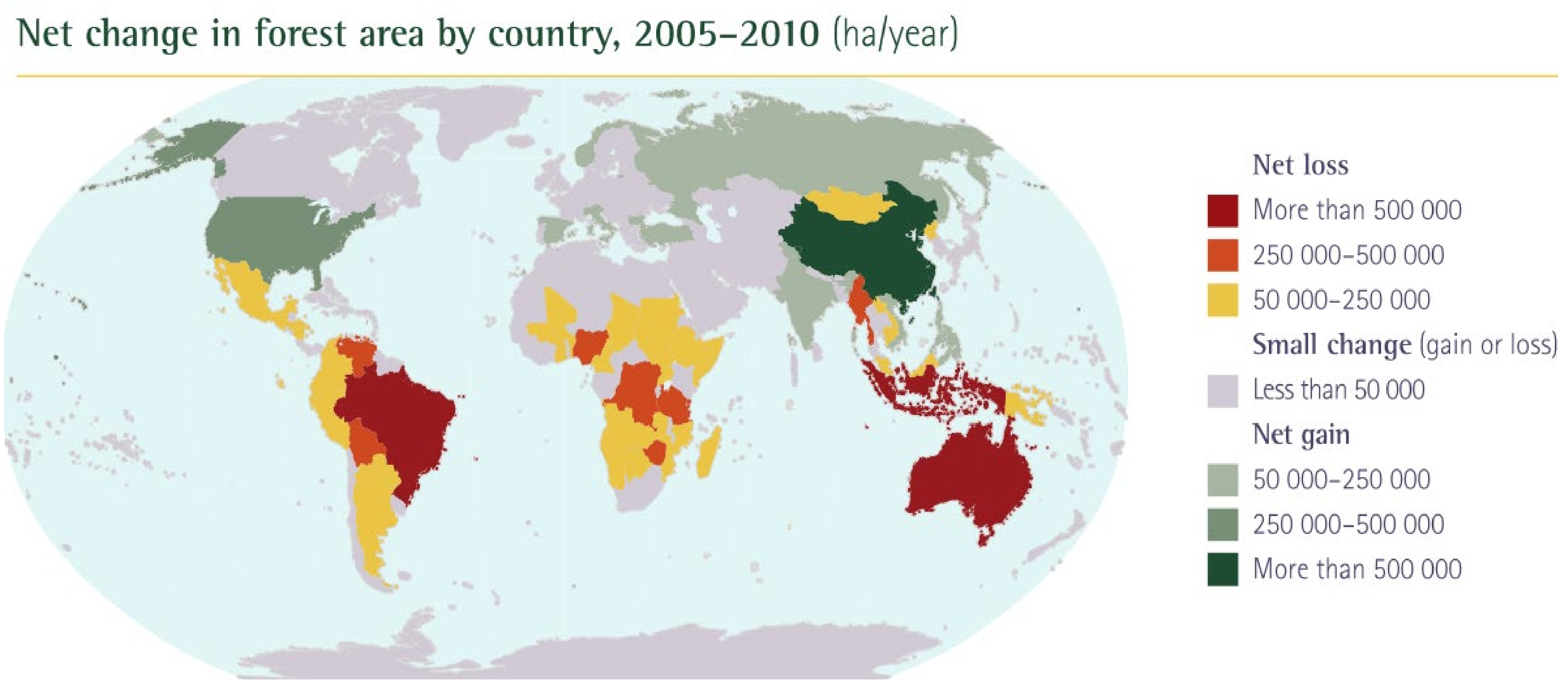
Figure 1.5 | Annual global anthropogenic carbon dioxide (CO_2) emissions (gigatonne of CO_2-equivalent per year, $GtCO_2/yr$) from fossil fuel combustion, cement production and flaring, and forestry and other land use (FOLU), 1750–2011. IPCC, 2014

World forest carbon pool
(Global Forest Resource Assessment 2020)

FIGURE 23. Trends in total forest carbon stock, by carbon pool, 1990–2020



Net change in forest area by country



Climate change and forests

Forests are equally players and objectives in the "green-house drama":

- Climate change mitigation
- Climate change adaptation

Adaptation is essential for mitigation!

Droughts and fires

- More extreme weather events induced by climate change
- Forest fires high on the agenda since disastrous fires hit Portugal in 2017
- More fire incidents also in countries north of the Mediterranean (e.g. Germany, Ireland)
- Droughts and heat waves in various European regions (e.g. Greece, Portugal)
- Droughts have an amplifying effect on fire

Storms

- Windstorms are a major disturbance factor in European forests
- Examples like Lothar (1999) and Kyrill (2007) caused widespread damages
- Areas affected by windstorms have a much higher risk to be further damaged by insects or pests
- Windstorms can devastate confined regions (e.g. storm Gudrun in Sweden)
- Smaller events can add-up to significant amounts over multiple countries (e.g. winter 2017/18)

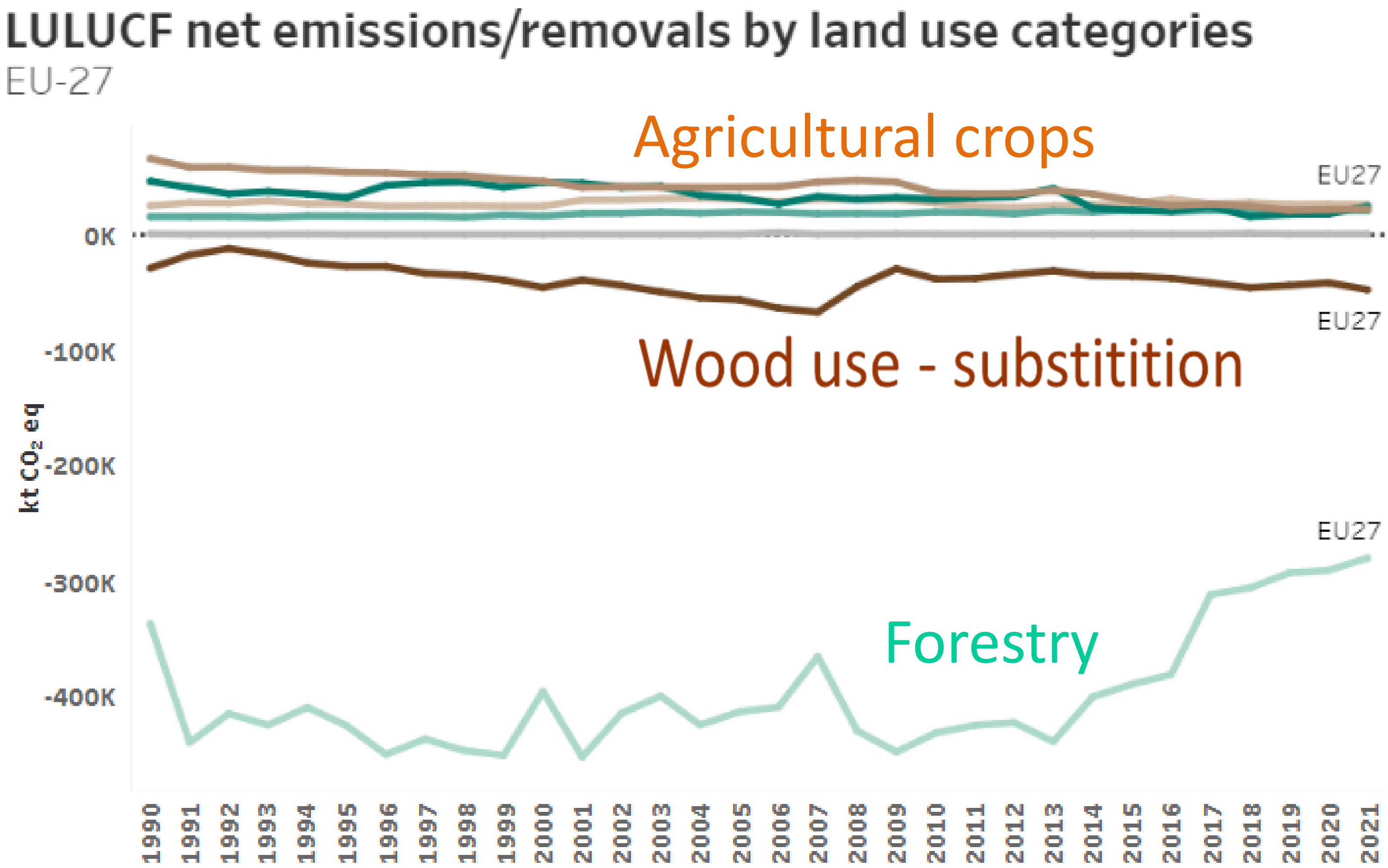
Biotic threats

- Climate change has strong impact on biotic threats (e.g. bark beetle or pests)
- Several European countries are heavily affected by bark beetle (e.g. Poland, Czech Republic)
- Pests typically follow abiotic damages (drought or wind)
- New diseases are difficult to predict but can spread rapidly
- Damage caused by game is a major obstacle to natural forest regeneration in Europe

Forests mitigating climate change by:

- Storing carbon in the forest
  (forest management, afforestation)
- Substituting fossil fuels
  (bioenergy/biofuels)
- Substituting cement and steel in human structures (buildings/architecture)
- Substituting oil in industrial production
  (bioeconomy)

Land use; land-use change and Forestry



Forestry and wood use mitigation activities

Category	Activity	Mitigation potential ($MtCO_2eq\ yr^{-1}$)*	Interaction with adaptation
Protect	Avoiding deforestation	EU 27 + 3: 11 (11 - 11) EU 27: 10 (10 - 10)	Supports adaptation of surround-ing forests
	Forest conservation	EU 27 + 3: 58 (46 - 69) EU 27: 53 (41 - 63)	Supports natural adaptation but decreases options for active adap-tation
Manage	Forest harvesting (decreased)	EU 27 + 3: 78 (1 - 286) EU 27: 70 (1 - 259)	Can foster drought tolerance but decrease stand stability
	Active management (other than harvesting)	EU 27 + 3: 72 (11 - 186) EU 27: 65 (10 - 169)	Possible trade-off between carbon storage and fitness

Forestry and wood use mitigation activities

Category	Activity	Mitigation potential ($MtCO_2eq\ yr^{-1}$)*	Interaction with adaptation
Restore	Forest restoration	EU 27 + 3: 115 (14 - 245) EU 27: 105 (13 - 222)	Careful selection of species and forest types for restoration improves resilience
	Afforestation/ Reforestation	EU 27 + 3: 54 (19 - 83) EU 27: 49 (17 - 75)	Possible trade-off between establishing resilient forests or maximising sequestration
Wood use	Shifts in wood uses (including by-products)	EU 27 + 3: 15 (-70 - 391) EU 27: 14 (-63 - 354)	Balance between generating revenues to support adaptation actions and increasing harvest pressure which may hamper adaptation
	Cascading (end-of-life)	EU 27 + 3: -1.5 (-26 - 9) EU 27: -1.4 (-24 - 8)	Can reduce harvest pressure on forests to enable focus on adaptation and natural processes
	Increased efficiency	EU 27 + 3: -0.6 (-6 - 8) EU 27: -0.5 (-5.5 - 7.5)	Can reduce harvest pressure on forests to enable focus on adaptation and natural processes

Forest-based mitigation potential

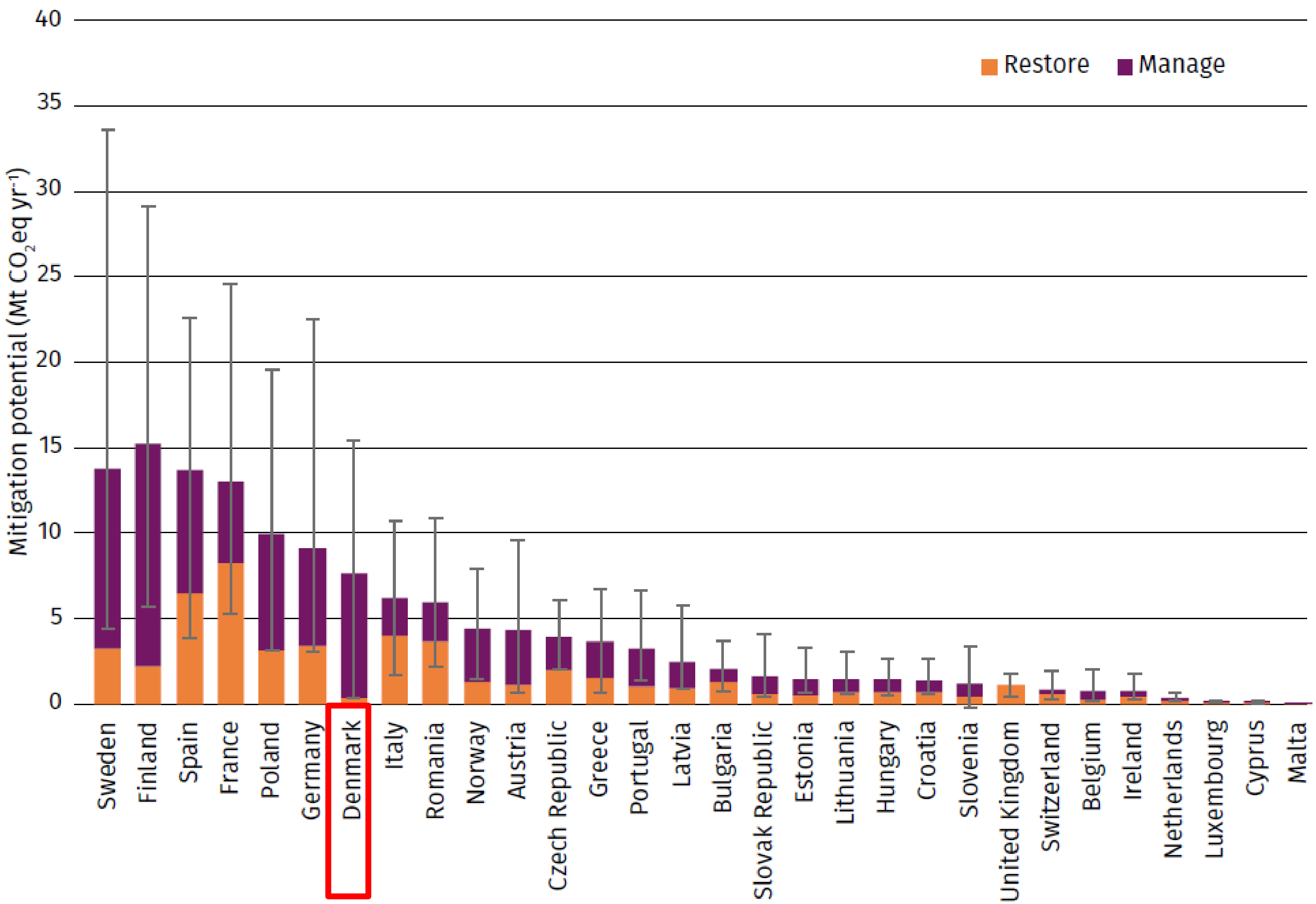


Figure 2. Forest-based mitigation potential by 2050 at the country level.

Forest management options

Untouched forests: high storage, high permanence but no substitution

Plantation forests: low storage, medium permanence and high substitution

Nature-near forests. Intermediate storage, high permanence and high substitution

Silver fir and beech | Douglas fir, Norway spruce and Beech | Beech, sycamore maple and ash

Conclusions

Forests and forestry are key players in CC mitigation

- Deforestation accelerate climate change (stock goes down)
- Afforestation mitigate climate change (stock increases)
- Forest management can to a certain degree increase carbon stock and its permanence
- Proper use of harvested wood can extend storage time (in buildings) and substitute CO2 emitting materials (cement, steel) as well as fossil fuels
- Set-aside forest increases carbon stock but reduce long term mitigation due to loss of the substitution effect