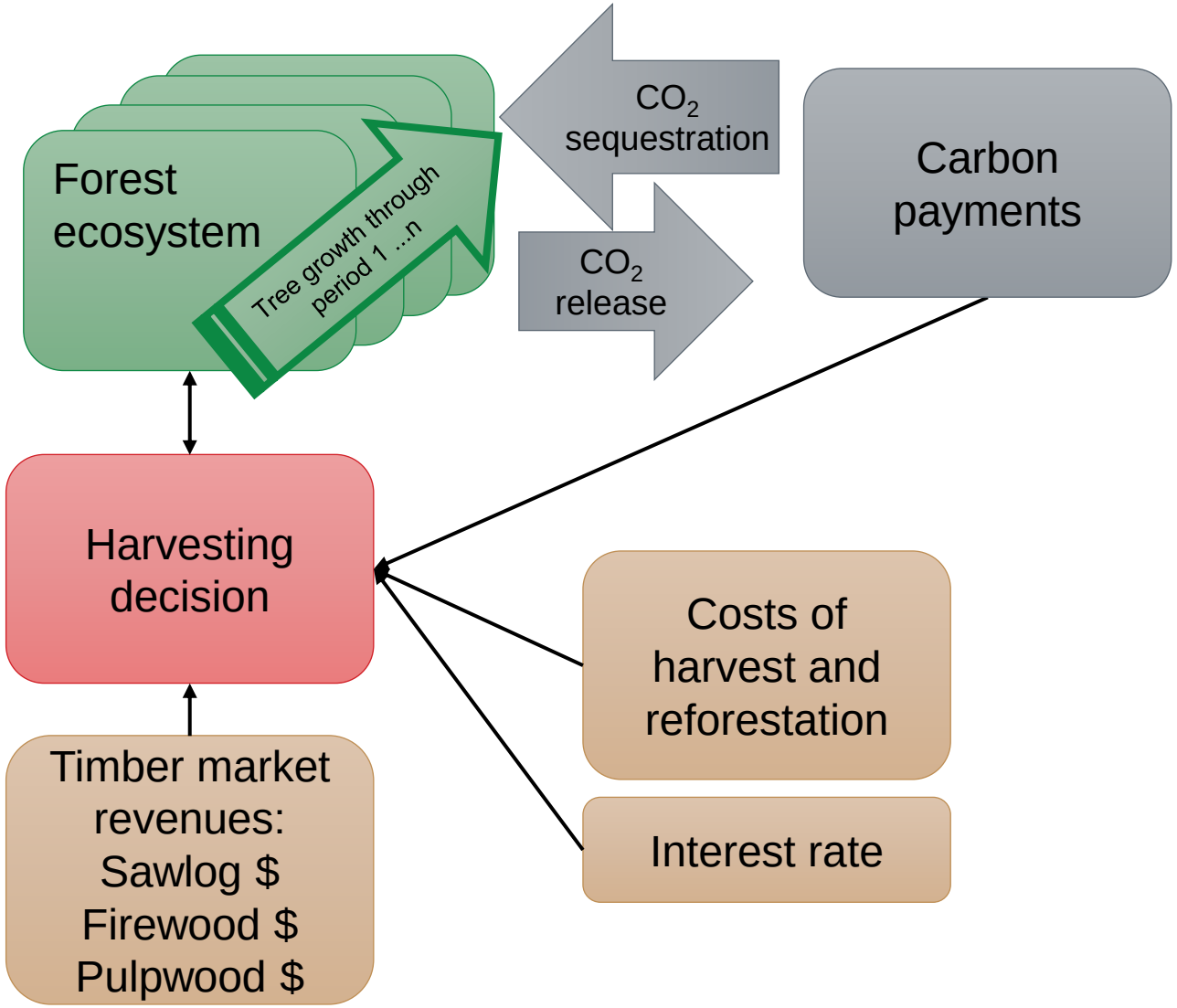
FOX
FOrest Carbon Sink Optimization Model

Introducing REKK's bio-economic model

2023. 04. 20.

Viktor Rácz, Gabriella Szajkó, András Kis, László Paizs

How bio-economic forestry models work



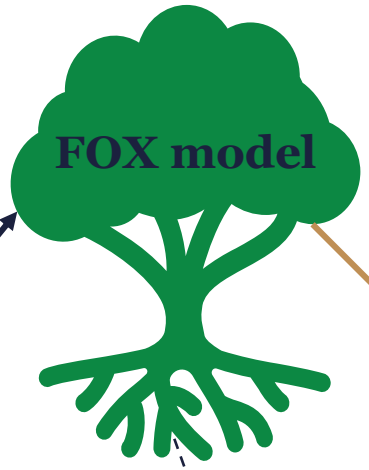
Economic optimisation of the volume and timing of harvest based on biological, environmental and economics aspects:

- Forest growth
- Net CO_2 sequestration
- Revenues (timber, CO_2 payments)
- Costs (cutting, reforestation)
- Interest rates

How the FOX model works

Model inputs:

- Current stock (m^3/ha) and yield ratio (as the share of standing growth)
- Share of product segments within final cut (sawlogs, pulpwood, firewood)
- Area distribution of forest, wood density (t/m^3) and carbon content (t/t)
- Cutting age (used as a basis for calibration)
- Thinning as a function of main standing stock
- „optimized" + protected stock = total standing stock
- Timber prices by demand segments €/m3 (sawlogs, pulpwood, firewood)
- Cutting cost €/m3,
- Regeneration cost €/ha,
- Discount rate %



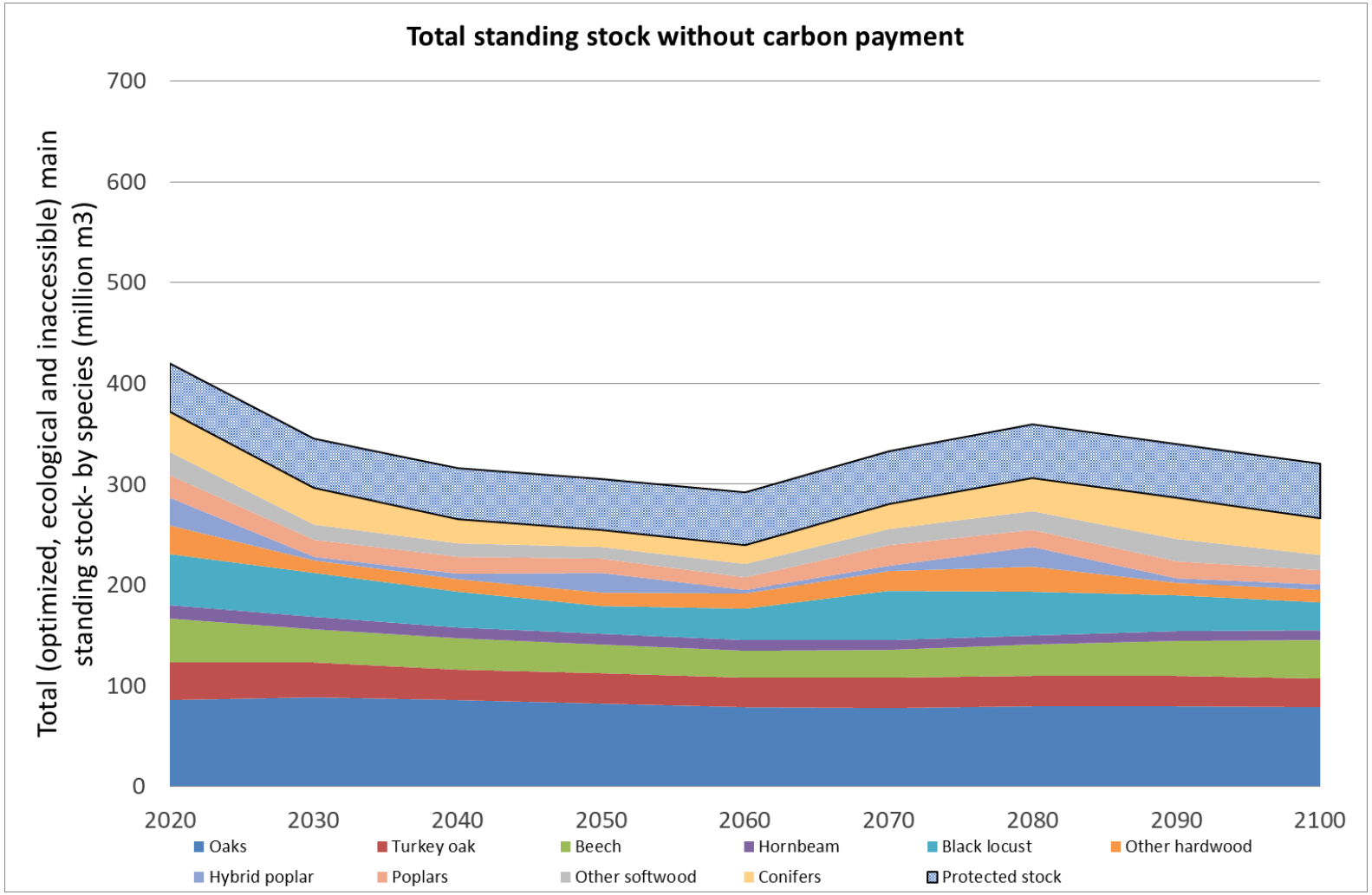
Model outputs:

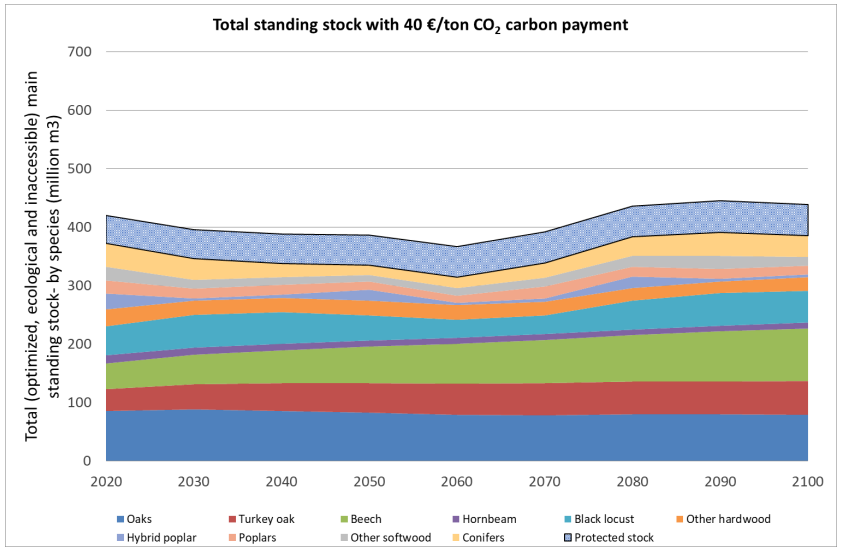
- Timing and volume of harvest (m^3) /for each species, demand segment, final cut and thinning/
- Changes in main stocks and thinning (m^3) /diff. between tree species groups and age classes/
- Alternate scenario:
  - Changes in the aforementioned output parameters as a function of carbon payments (€/ton CO_2)
  - Carbon sequestration supply curve: carbon sequestration „supplied" at a given quota price

Control variable:

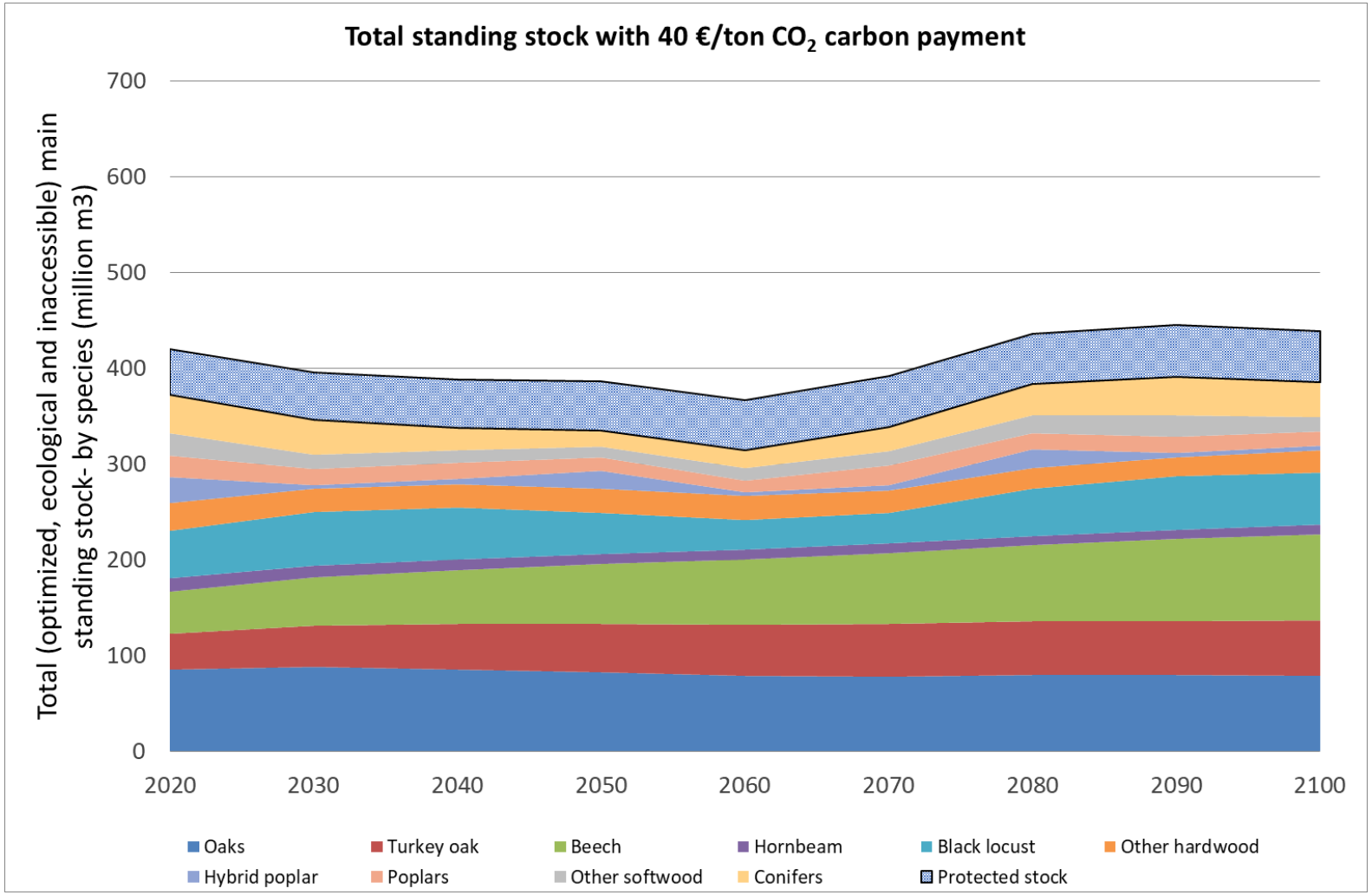
Choose time period for final cut to maximize present value of net benefits.

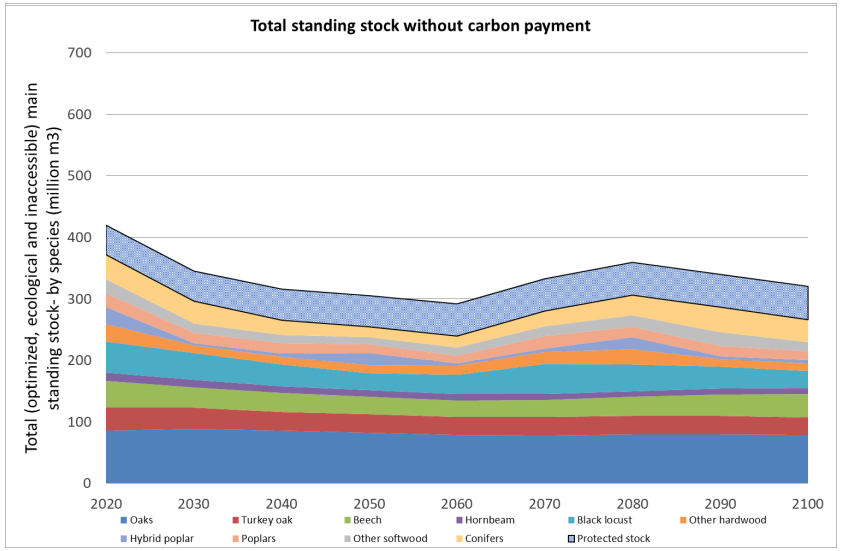
Total standing stock of forest wood in Hungary without and with carbon payments by tree species group



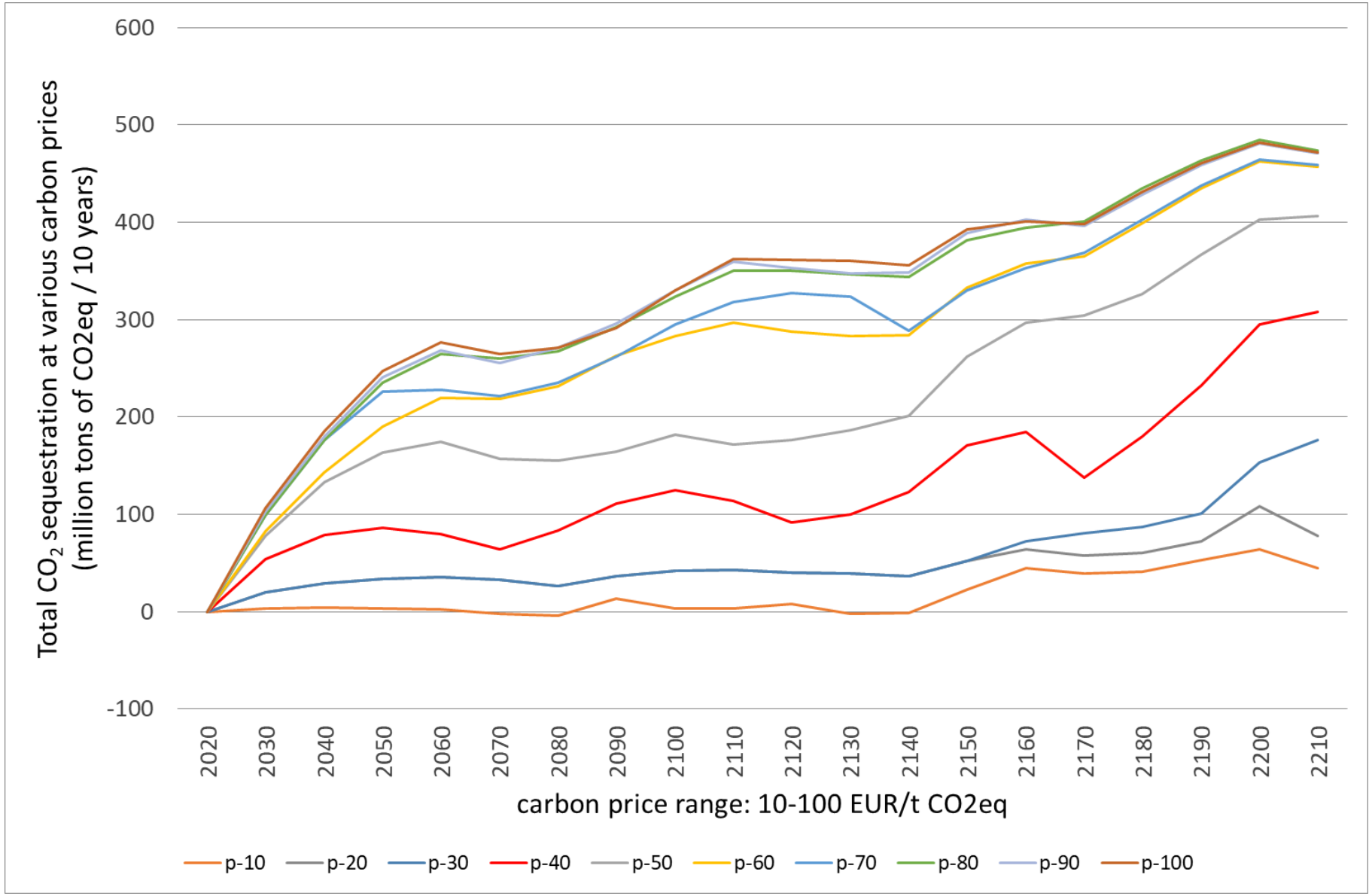


Total standing stock of forest wood in Hungary without and with carbon payments by tree species group

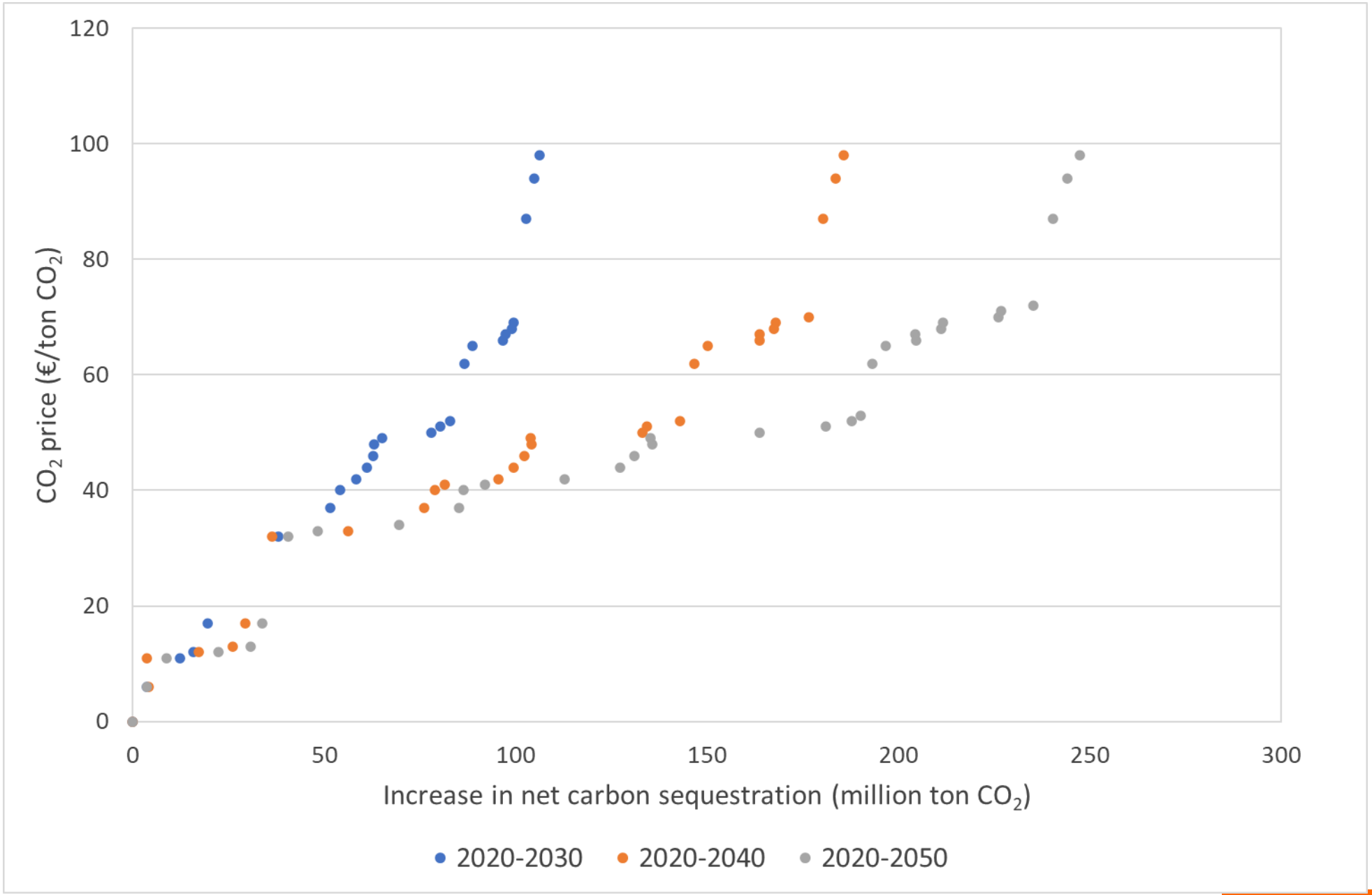




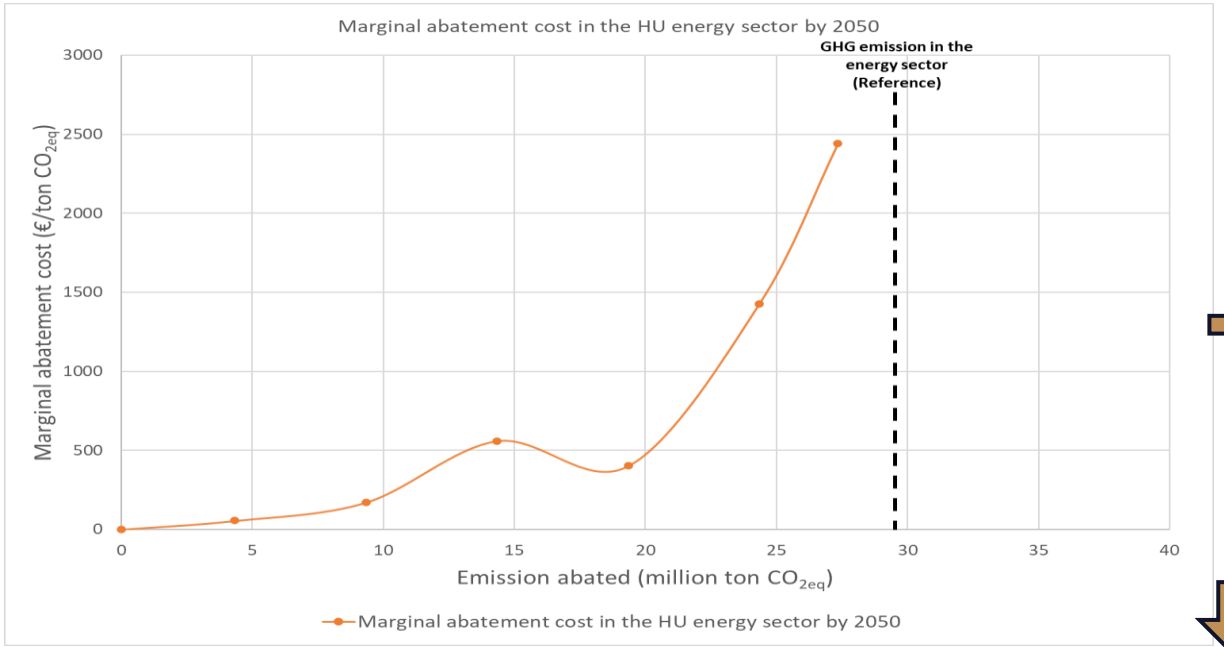
CO2 sequestration by forests of Hungary induced by various levels of a carbon price incentive



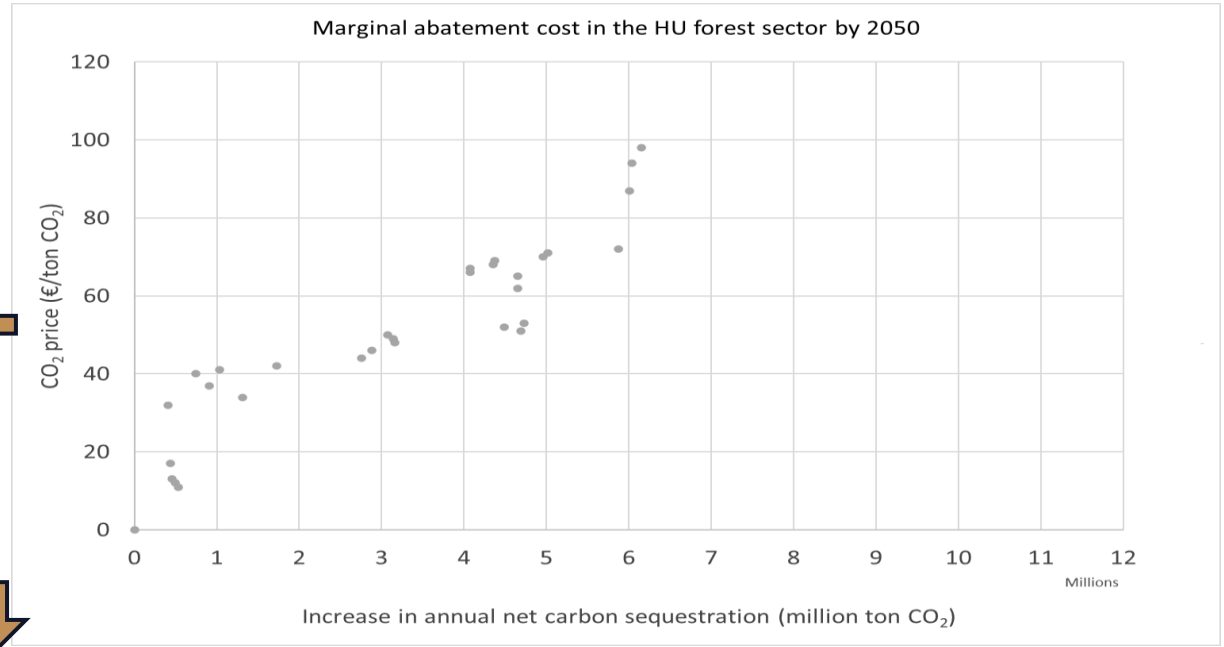
Carbon sequestration supply curves between 2020-2050



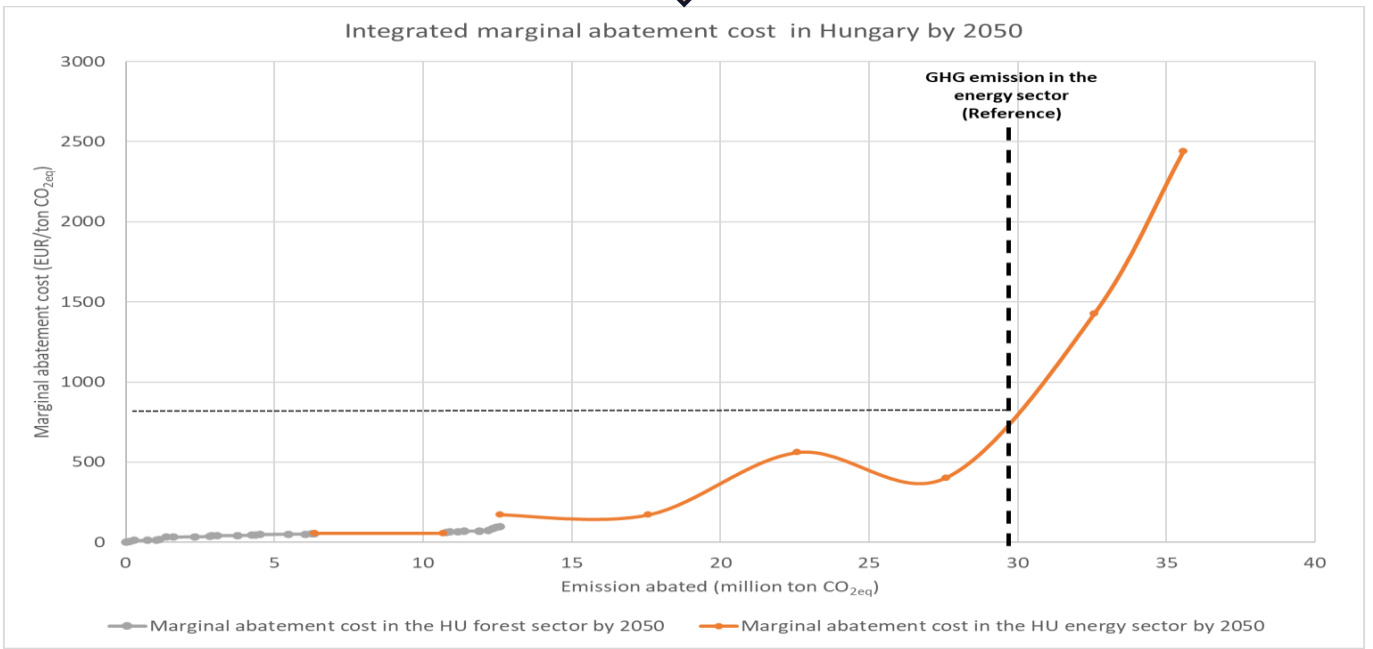
Climate policy context: integrated approach



Source: Mezősi & Rácz (2023)



Source: Szajkó et al. (2023)



Take-away messages

- Integrating the forest sector into the national climate mitigation policy could deliver substantial welfare gains for the society – as demonstrated by the Hungarian case:
  - Forest carbon mitigation would be more cost-efficient than most of the mitigation options in the energy and industry sectors
  - Even low carbon prices could reverse the loss of forest carbon foreseen in the coming decades
  - Carbon prices high as today would more than double the average annual sequestration of the past decade
  - Forests could remove as much as 14 – 20% of the total GHG emission of Hungary
- The FOX model currently includes just one of the forest carbon pools: stem wood only (soil, deadwood, or litter is not considered yet)
- The FOX model has been applied to Hungary and Romania, and we have been working on applications to Bulgaria and Bosnia-Herzegovina

Thank you for your attention!

viktor.racz@rekk.hu
gabriella.szajko@rekk.hu
andras.kis@rekk.hu

References

- Mezősi, A., Rácz, V. (2023) *A klímasemlegesség ára. Az üvegházhatású gázok csökkentésének költségbecslése HU-TIMES modellel.* Közgazdasági Szemle, 70 (1). pp. 55-81. ISSN 0023-4346 http://dx.doi.org/10.18414/KSZ.2023.1.55
- Szajkó, G., Rácz, V.J., Kis, A., Paizs, L. (2023) *The role of price incentives in enhancing carbon sequestration by the forest sector in Hungary,* In Progress