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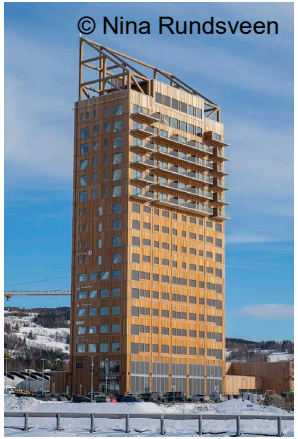
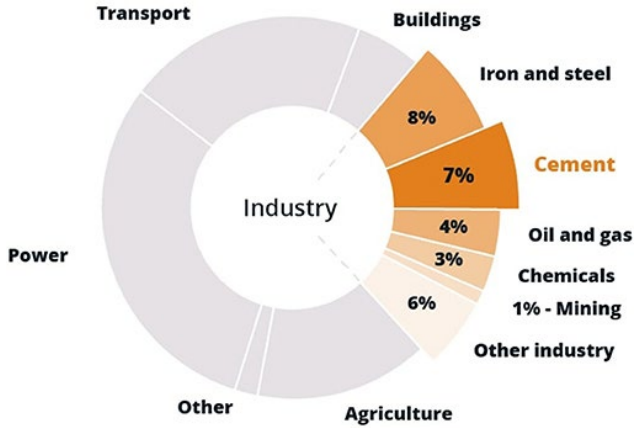
Carbon Mitigation Potential of Forests





- Mitigation = Forest sink + Product sink + Substitution effects

  Europe: 315 + 40 + 410 $MtCO_{2e}$ / yr

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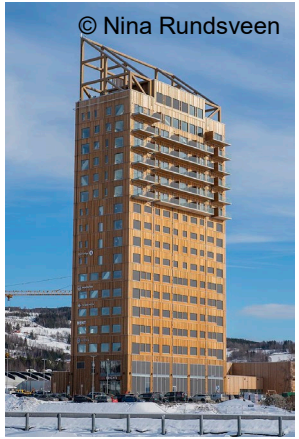
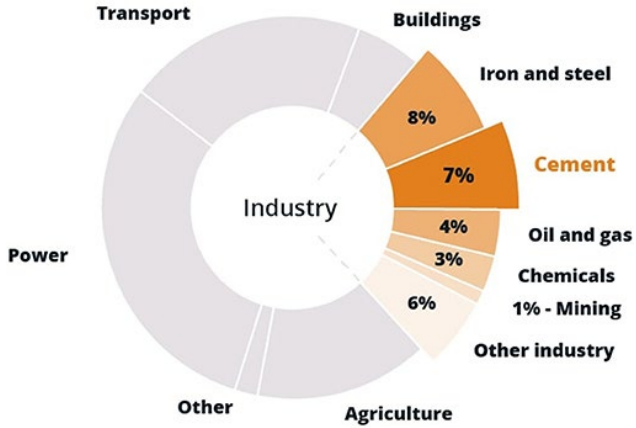
Carbon Mitigation Potential of Forests





- Mitigation = Forest sink + Product sink + Substitution effects

  Europe: 315 + 40 + 410 $MtCO_{2e}$ / yr

Theoretical value only!! Assuming substitution effect for every created wood product

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Forests are more than carbon!

- Forests offer **numerous other ecosystem services**
- It is crucial to consider all ecosystem services!

Earth's Future

RESEARCH ARTICLE
10.1029/2022EF002796

Key Points:

- Strategies for climate-smart forestry under a range of climate scenarios always lead to trade-offs between different ecosystem services (ESs)
- Higher shares of unmanaged and broad-leaved forests are beneficial for numerous ESs, but lead to decreased

Trade-Offs for Climate-Smart Forestry in Europe Under Uncertain Future Climate

Konstantin Gregor[1], Thomas Knoke[1], Andreas Krause[1], Christopher P. O. Reyer[2], Mats Lindeskog[3], Phillip Papastefanou[1,3], Benjamin Smith[3,4], Anne-Sofie Lansø[5,6], and Anja Rammig[1]

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Managing forests for mitigation **and** other ecosystem services

- Idea: create management portfolios that
- 1. offer multiple ecosystem services
  2. regardless of the climate scenario
- How to do that?
- → **Robust multi-criteria optimization**

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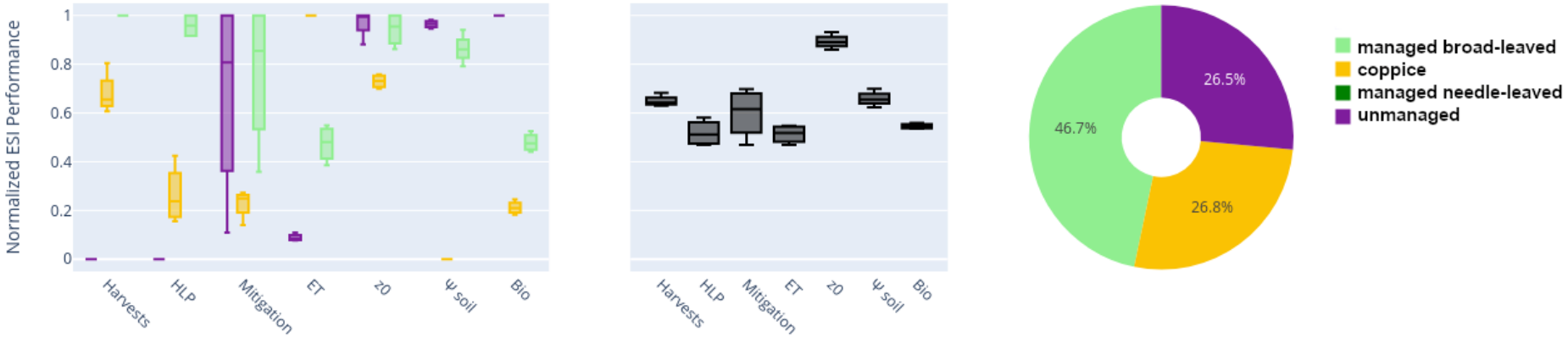
Robust Multi-Criteria Optimization

Southern Sweden (13.75, 55.75)

a) ESI Performance 2100-2130 (indiv. management) **b)** ESI Performance 2100-2130 (optimized portfolio) **c)** Optimized Portfolio Shares



Gregor et al. (2022)

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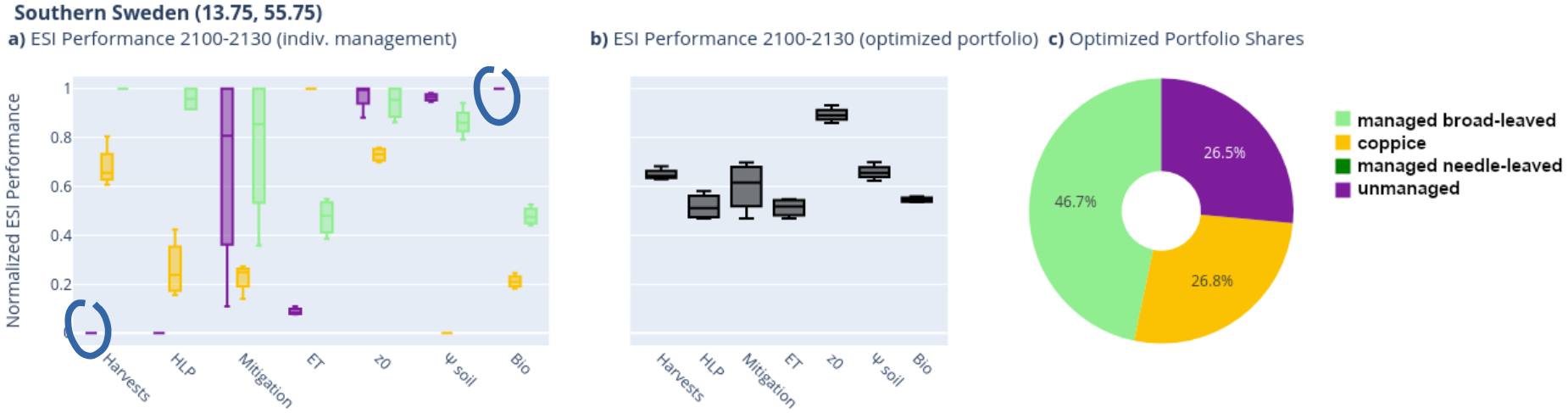
Robust Multi-Criteria Optimization



Some management forms are **good for some ecosystem services, but bad for others**
Example: unmanaged forest: good for biodiversity, bad for harvests

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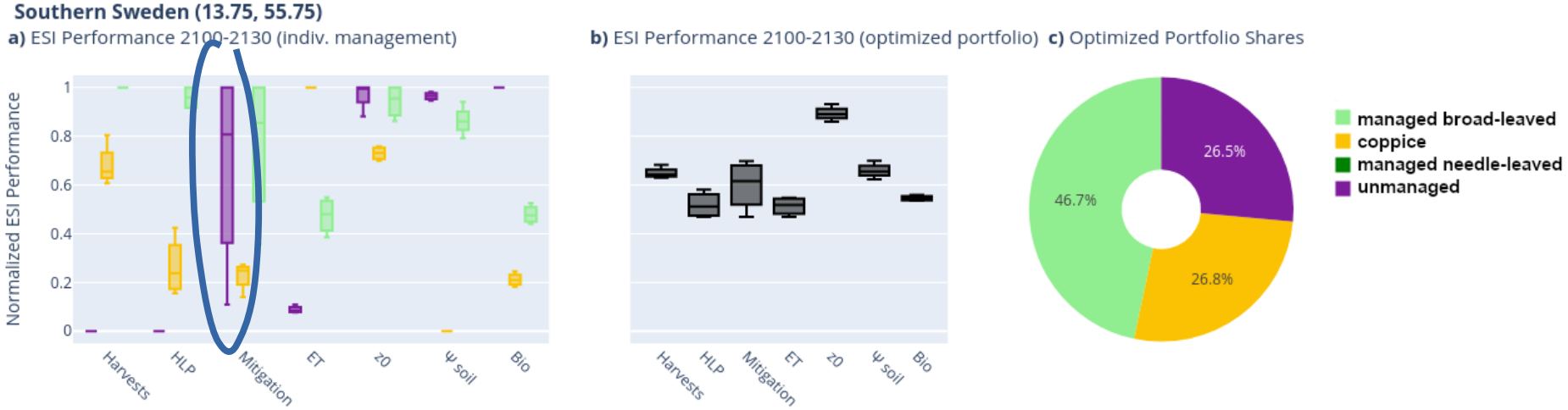
Robust Multi-Criteria Optimization



The spread shows: **a management form might be good or bad for an ecosystem service, depending on the climate scenario!**

Example: unmanaged forests: low mitigation in high-emissions scenario (no wood products),
Gregor et al. (2022) high mitigation in low emissions scenario (forest carbon sink is more important)

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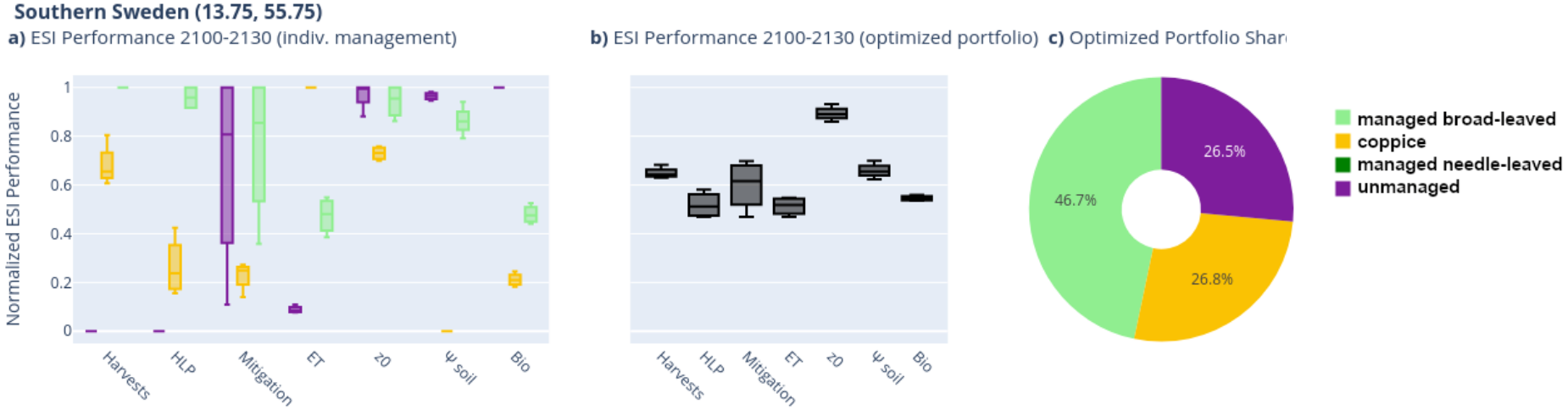
Robust Multi-Criteria Optimization



Our methodology creates management portfolios,
that provide best possible balance of **all ecosystem services under all climate scenarios**

Gregor et al. (2022)

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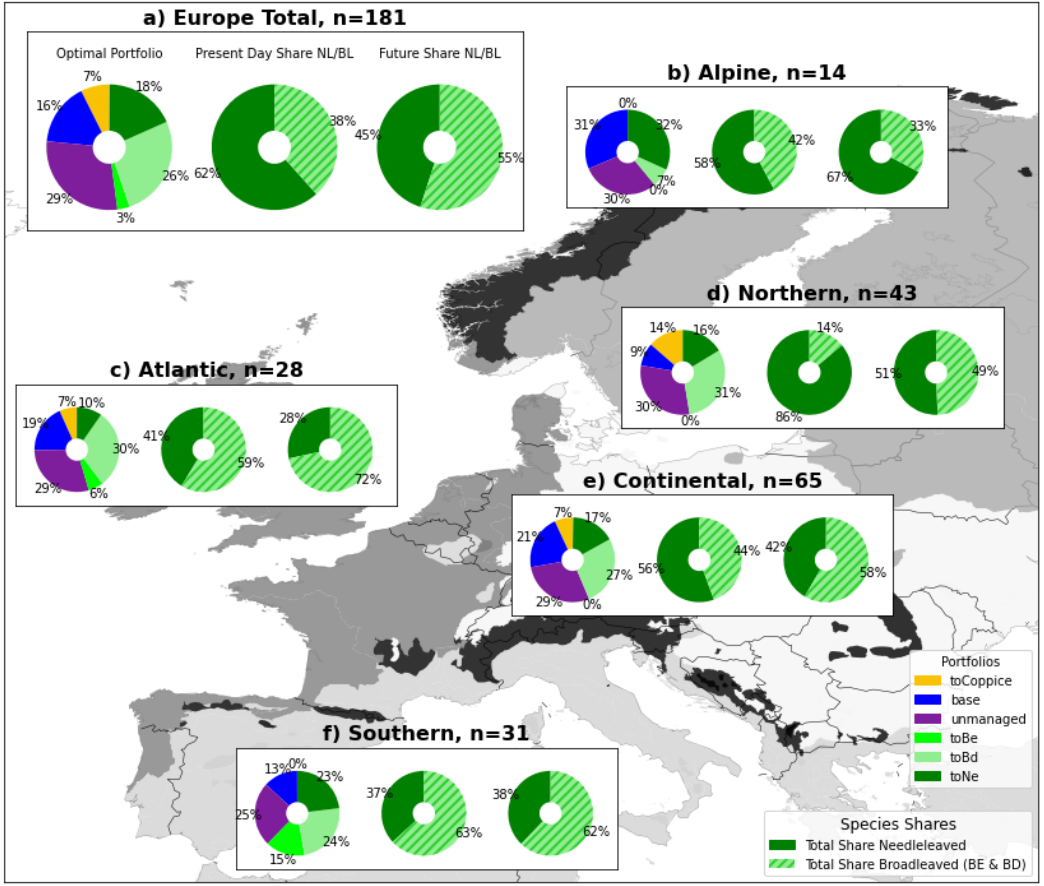

Gregor et al. (2022)

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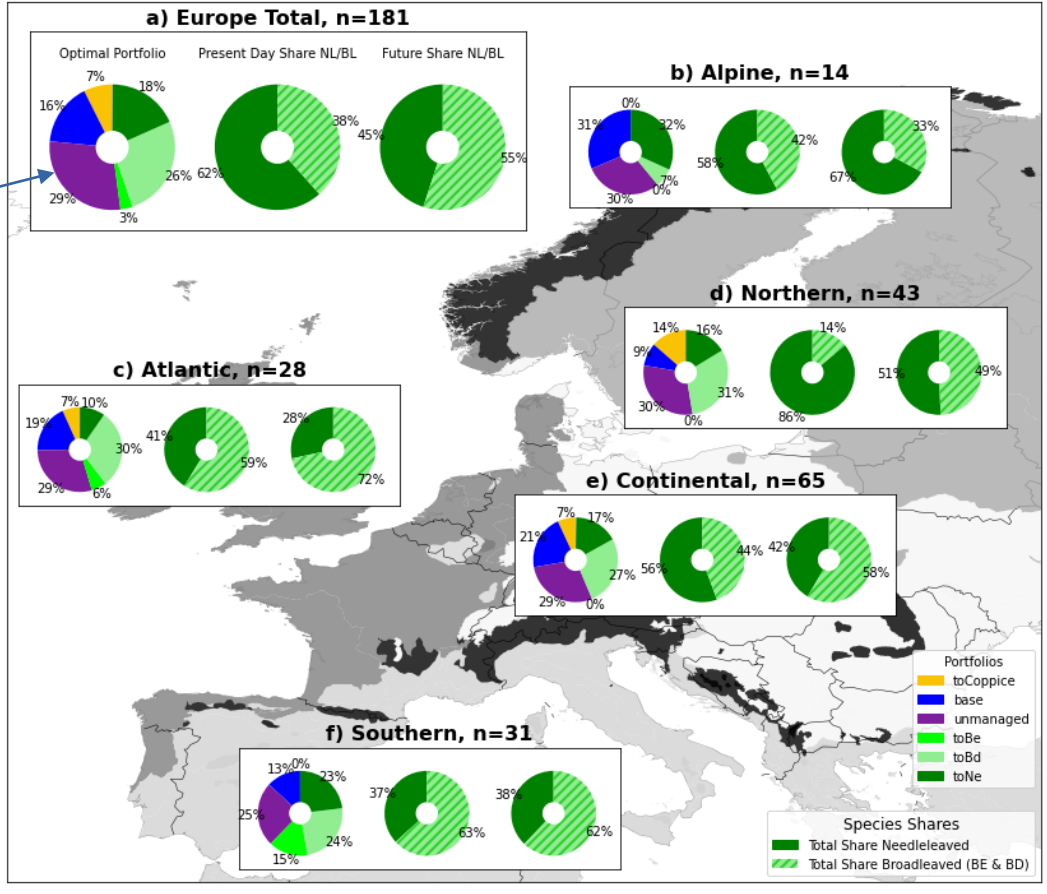
How to reconcile large fractions of unmanaged forests with the idea that material wood usage can be beneficial for climate change mitigation?



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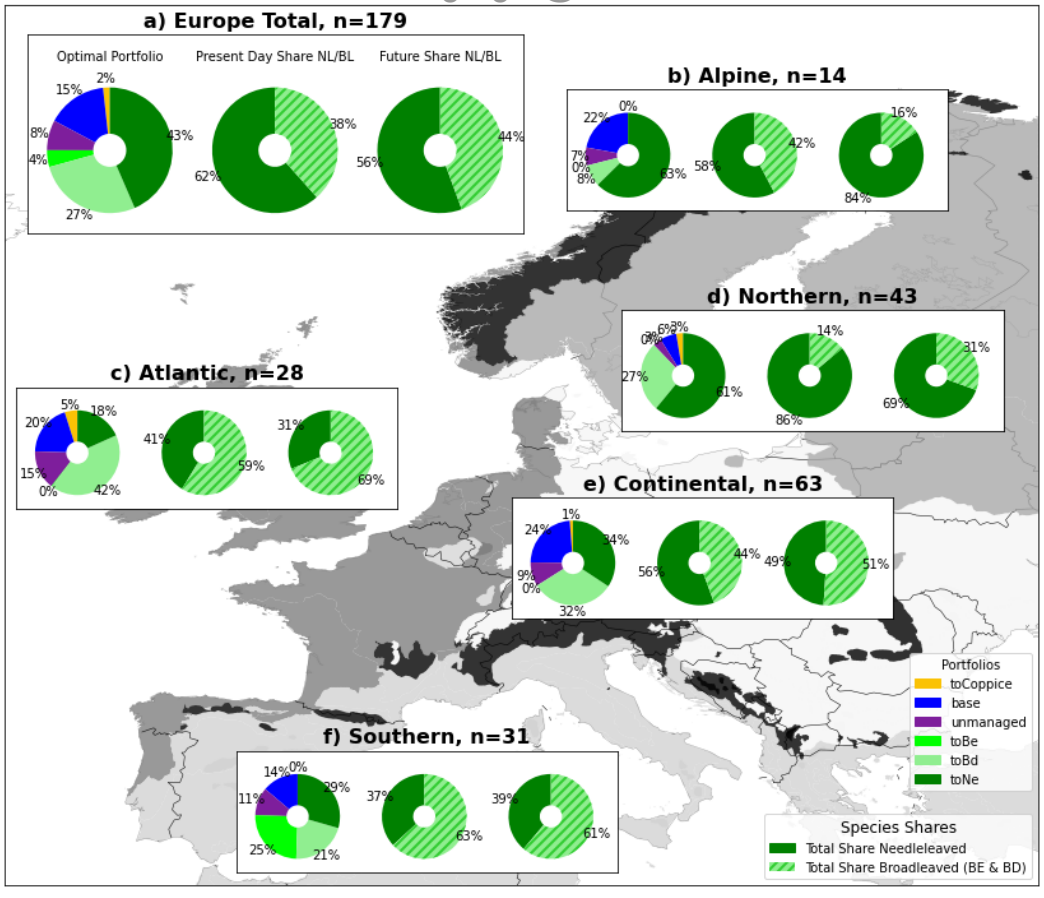

Gregor et al. (in prep.)

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