# Climate-smart forestry under uncertainty and external constraints in Europe

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## What challenge does the contribution address?

We need to develop forward-looking forest management strategies now. These strategies need to aim for multi-functional forests that are also resilient to future climate change. Furthermore, external constraints like EU legislation demand clear targets for, e.g., strictly protected areas and the forest carbon sink which need to be considered in these strategies.

To address this, we propose a method based on ecosystem modeling and robust multi-criteria optimization (Gregor et al., 2022). This method develops forest management portfolios that offer numerous ecosystem services under a wide range of climate scenarios, and that also adhere to the given external constraints (Gregor et al., 2024b). It can guide the development of multi-functional forestry strategies under climate change in Europe, helping minimize risks, and maximize ecosystem service provision. Furthermore, we can assess the impact of various drivers on the climate change mitigation potential of a forest strategy (Gregor et al., 2024a).

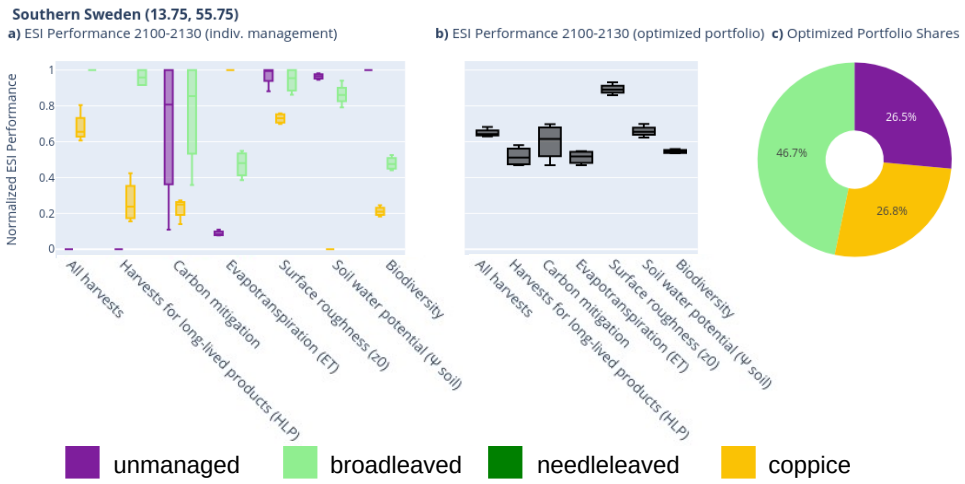


*Figure 1:* ***a)*** *Various management options provide ecosystem services in different qualities and with a large spread across climate scenarios. Our multi-criteria optimization creates management portfolios* ***(c)*** *that provide a more balanced provision of ecosystem services and with a smaller uncertainty* ***(b)***

## How do you assess the innovation potential?

Forward-looking forest planning is a crucial challenge of today. We use state-of-the-art ecosystem models (e.g., LPJ-GUESS) and modern robust multi-criteria optimization. Our methodology is, however, model-agnostic and can be applied to any ecosystem model that is deemed most suitable for a specific region. Furthermore, our method utilizes multiple climate inputs, thereby minimizing risks from climate model uncertainty and climate scenario uncertainty.

## Which stakeholders are affected?

- Forest owners
- Forest planners / agencies
- Reforestation agencies
- Governments requiring to create regional and national strategies for forestry

## What added value or use should be generated for the conference participants?

Our methodology can help develop climate-smart forestry strategies. While it is currently aimed at regional strategy development, the core idea can also be applied on a local scale. We therefore believe that presenting our work can be beneficial for forest stakeholders of all kinds.

## What feedback do you expect from the participants?

- We want to bring our methods from science into practice, therefore we'd like to discuss with other participants of *SmartForest2025* how we can bring our method into practice
  - what are challenges of practitioners that we need to consider, especially on a local scale?
    - For instance, considering the feasibility of applying our method at a specific forest site?
  - What other aspects need to be considered on a regional scale?
  - How could we bring our method into practice?
    - Where should we promote it to reach the relevant stakeholders?
    - How should we deliver it? E.g., as a software tool or in a consulting approach?

References:


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