Forest biodiversity under different management and climate change scenarios

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Introduction

In this use case, we study the impact of various forest management strategies (regimes or treatment options) and climate change scenarios on forests and biodiversity.
The objective of this use case is to determine the most appropriate (optimal) management strategies for the forest, considering ecological, economic, and social objectives and the stakeholders' preferences simultaneously (Fig. 1).

Models

1. The **LANDIS-II** spatial explicit forest landscape model is utilised to predict future forest characteristics.
2. **HMSC**, predictive species distributions model, is used to project future distributions of boreal forest birds.

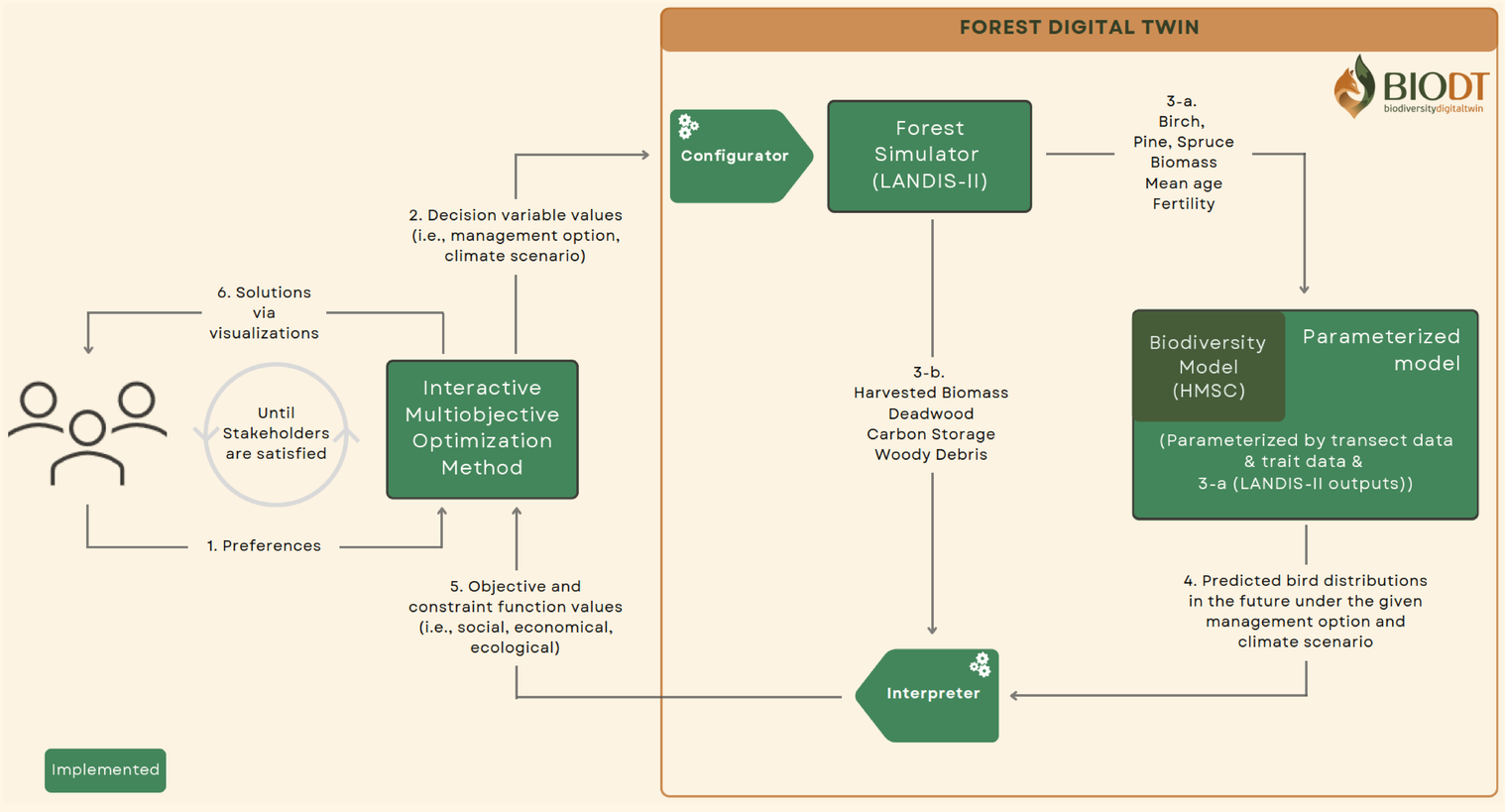


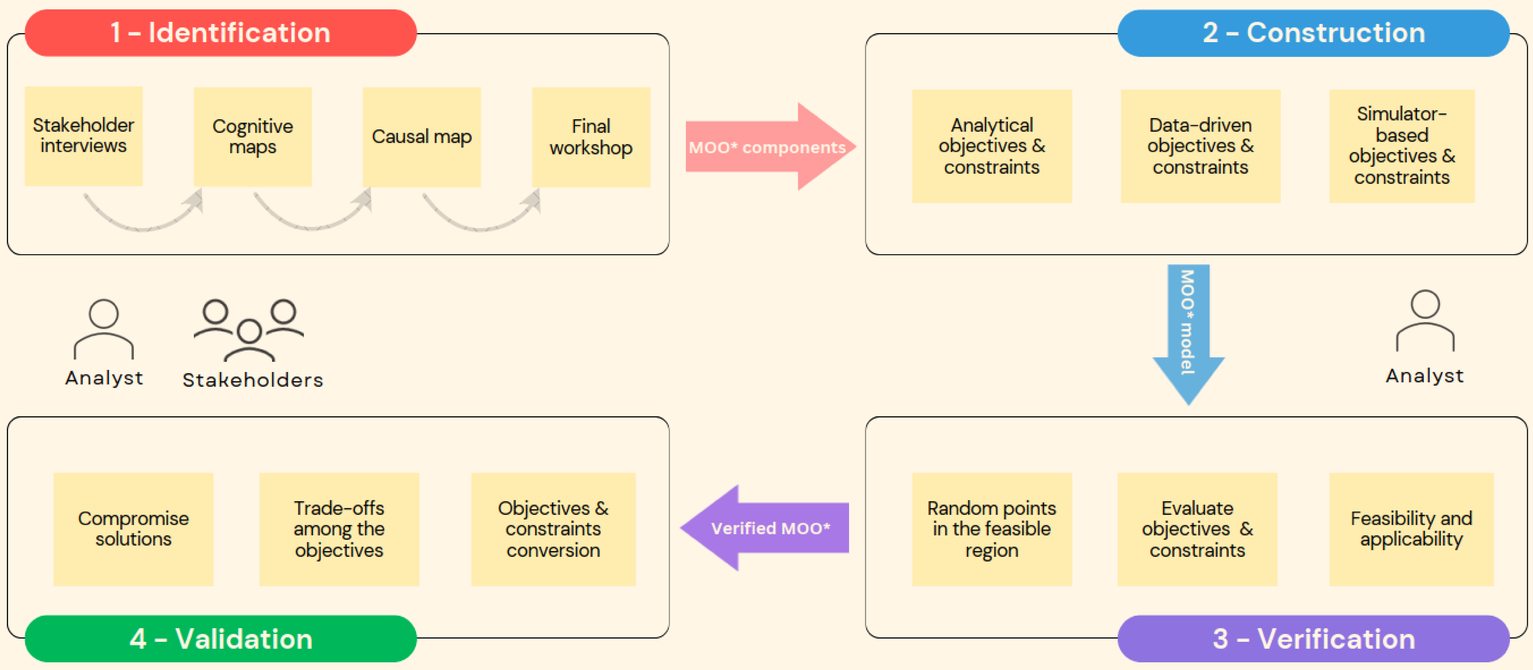
Fig. 1 Digital Twin Application: Finding the most appropriate forest management strategy

Pilot study:

- Our initial focus is on Finnish forests and bird species.
- The study covers the entire country of Finland, which totals 33.8 million hectares, 77% of which is covered by forests.
- We predict forest structure and bird distributions as a response to climate and forest management scenarios for the coming decades (until 2100).
- Objectives: Maximizing timber production, carbon storage, deadwood volume, habitat suitability.

Stakeholder engagement:

- We have identified key stakeholders and have started stakeholder interviews following the systematic way in Fig. 2.
- The purpose is to identify different perspectives and priorities regarding state-owned forest management in Finland.
- At the end, we will have a multiobjective optimization model that considers the actual objectives of real stakeholders.
- We will conduct real decision-making processes by applying interactive methods (e.g., Fig. 3) to find the most appropriate forest management strategies considering the identified objectives.



* MOO: Multiobjective optimization

Fig. 2 Systemic way of structuring forest management multiobjective optimization problem

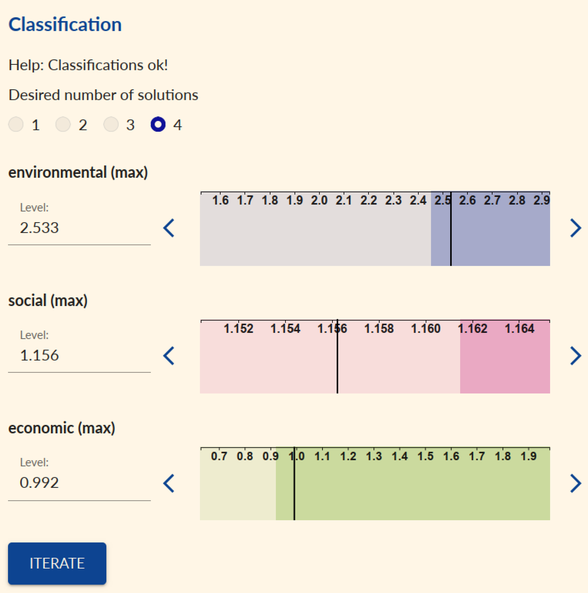


Fig. 3 User interface of an interactive method

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