Are mixtures a good option to reduce drought-induced risk of forest decline? Carbon accounting and economic approach

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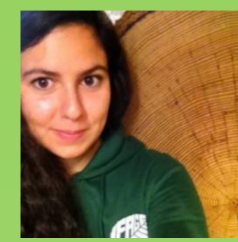


INTRODUCTION

Context

Drought is a **source of stress affecting forest growth** and resulting in **financial losses** for forest owners and **amenity losses** for society.
Such natural events will be **more frequent and intense** in the future due to **climate change**.
A way to cope with this increasing risk is to **implement adaptation strategies through silviculture**.

Objective

Economic comparison of different forest adaptation strategies towards drought-induced risk of decline, in terms of financial balance (forest owner) and carbon balance (society).

MATERIAL AND METHODS

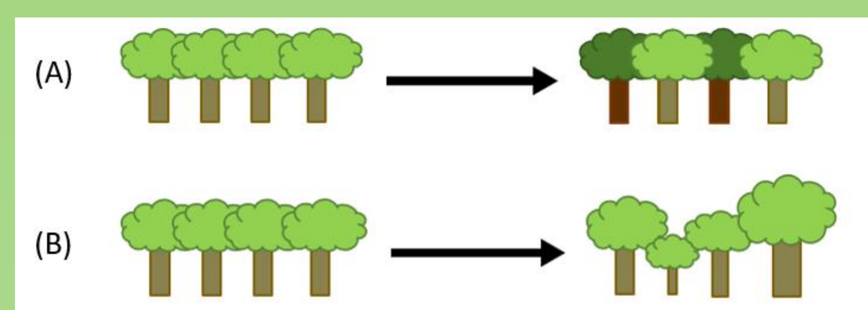
Combination of a tree-level forest-growth model (MATHILDE) with a traditional forest economics approach

Case study

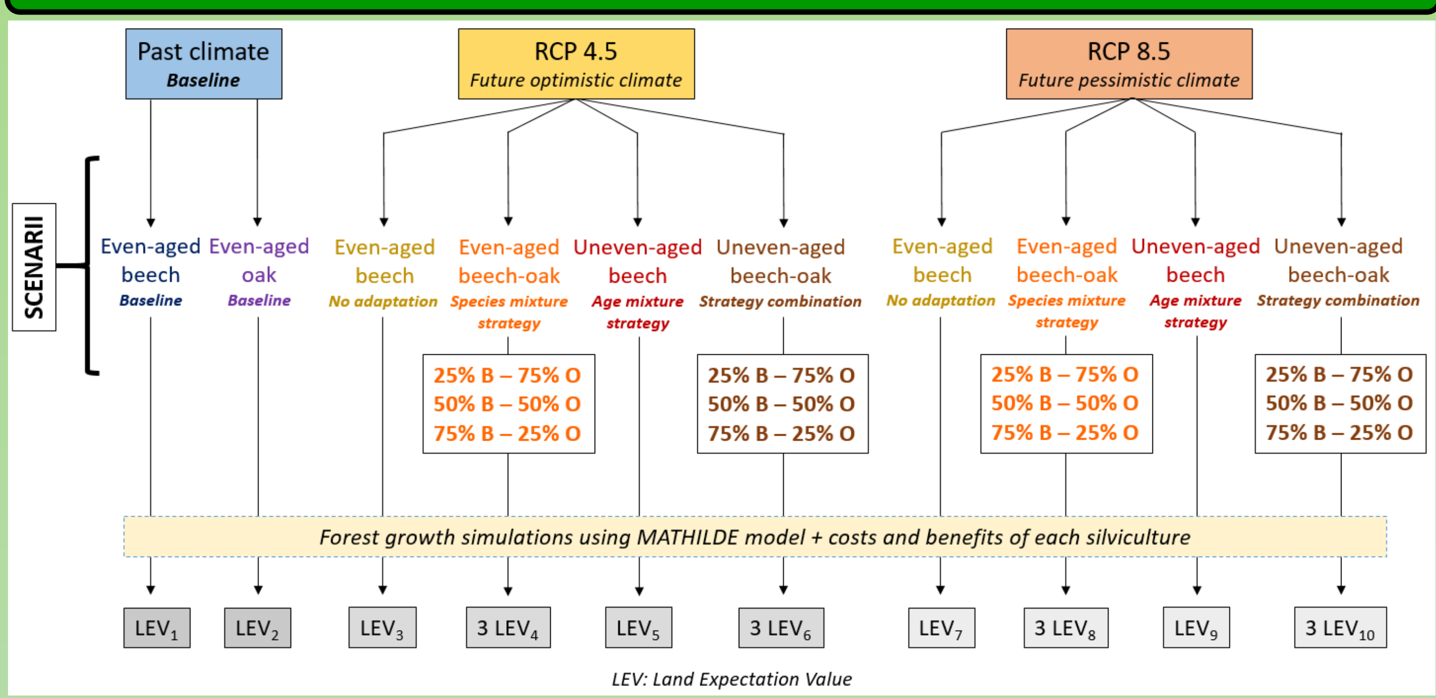
Beech forests in Grand-Est region (France) are predicted to **decline** or even to **disappear**.

Silvicultural options tested to adapt beech forests (separately and jointly):

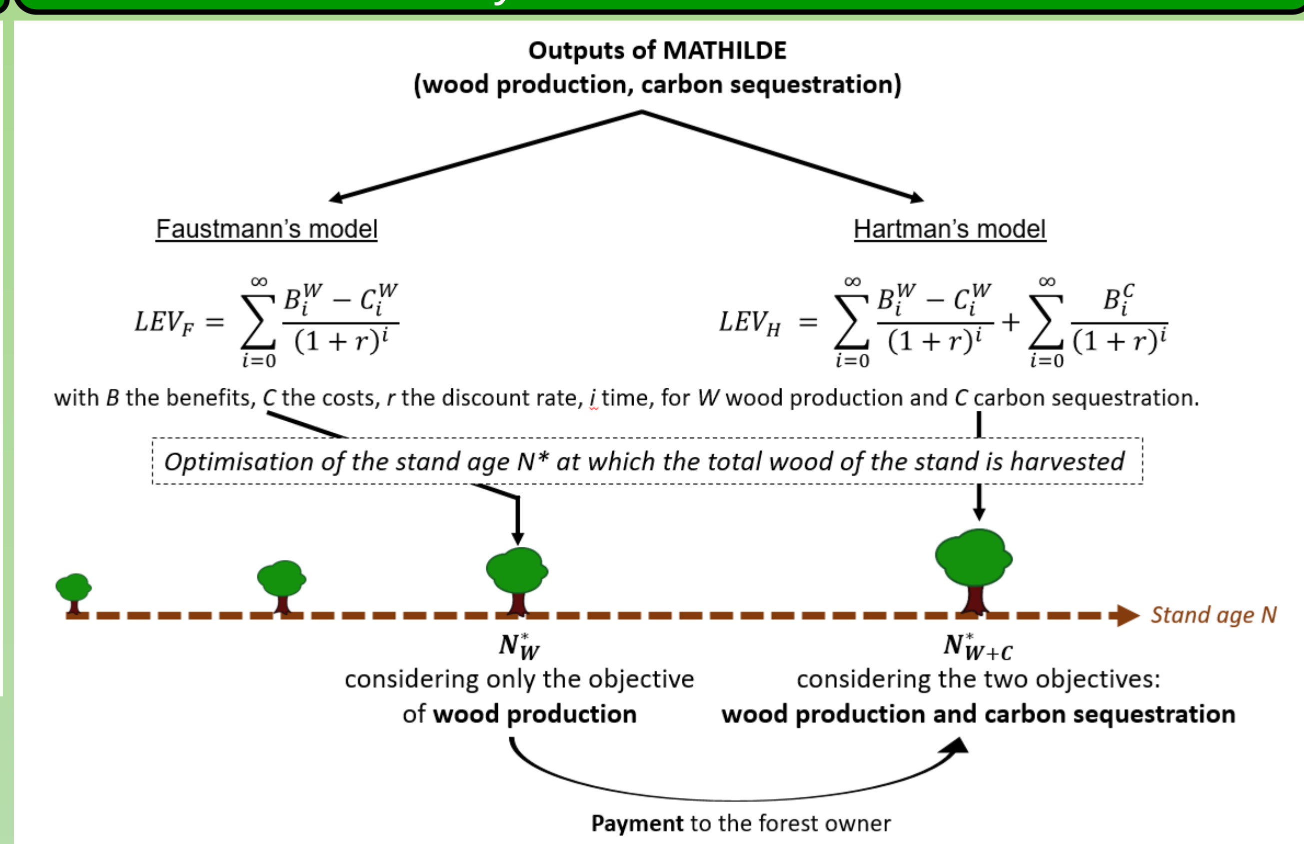
- **Species mixture with oak species (A).**
- **Age mixture, *i.e.*, shifting from even-aged to uneven-aged silviculture (B).**



18 scenarios tested



Cost-benefit analysis for each scenario and analysis of the trade-offs



MAIN RESULTS

- **Drought + Climate change** $\xrightarrow{\text{Impact -}}$ **Optimal stand age** (N_W^*) and **Faustmann's LEV** (LEV_F).
- **Best economic return** provided by **adaptation**: - uneven-aged silviculture with 50% beech and 50% oak (RCP 4.5).
  - even-aged silviculture of pure oak (RCP 8.5).
- **Non-adaptation** is the **worst scenario** (RCP 4.5) **as well as adaptation** (even-aged silviculture with 50% beech and 50% oak in RCP 8.5).
- In process: **variation of carbon prices** with different accounting methods (market value, shadow price, social cost) to focus on the trade-offs between LEV maximization and carbon storage maximization (**adaptation vs. mitigation**) and discussion about the **additivity/synergy of the two adaptation strategies**.

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