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# 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

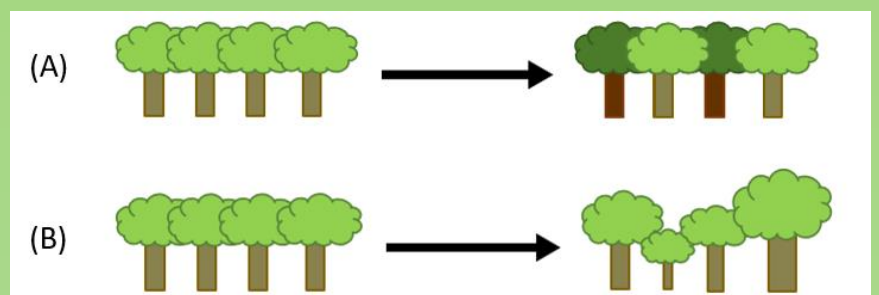
### Combination of a tree-level forest-growth model (MATHILDE) with a traditional forest economics approach

#### Case study

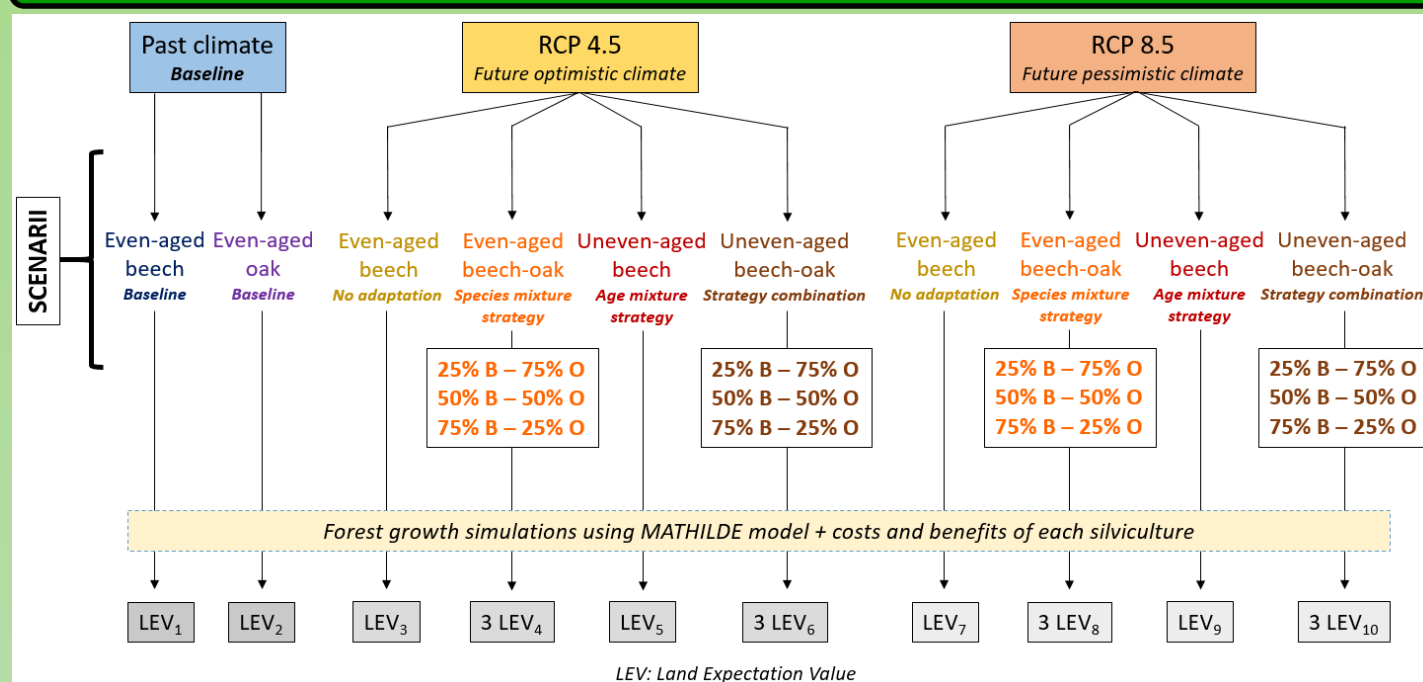
Beech forests in Grand-Est region (France) are predicted to decline or even to disappear.

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

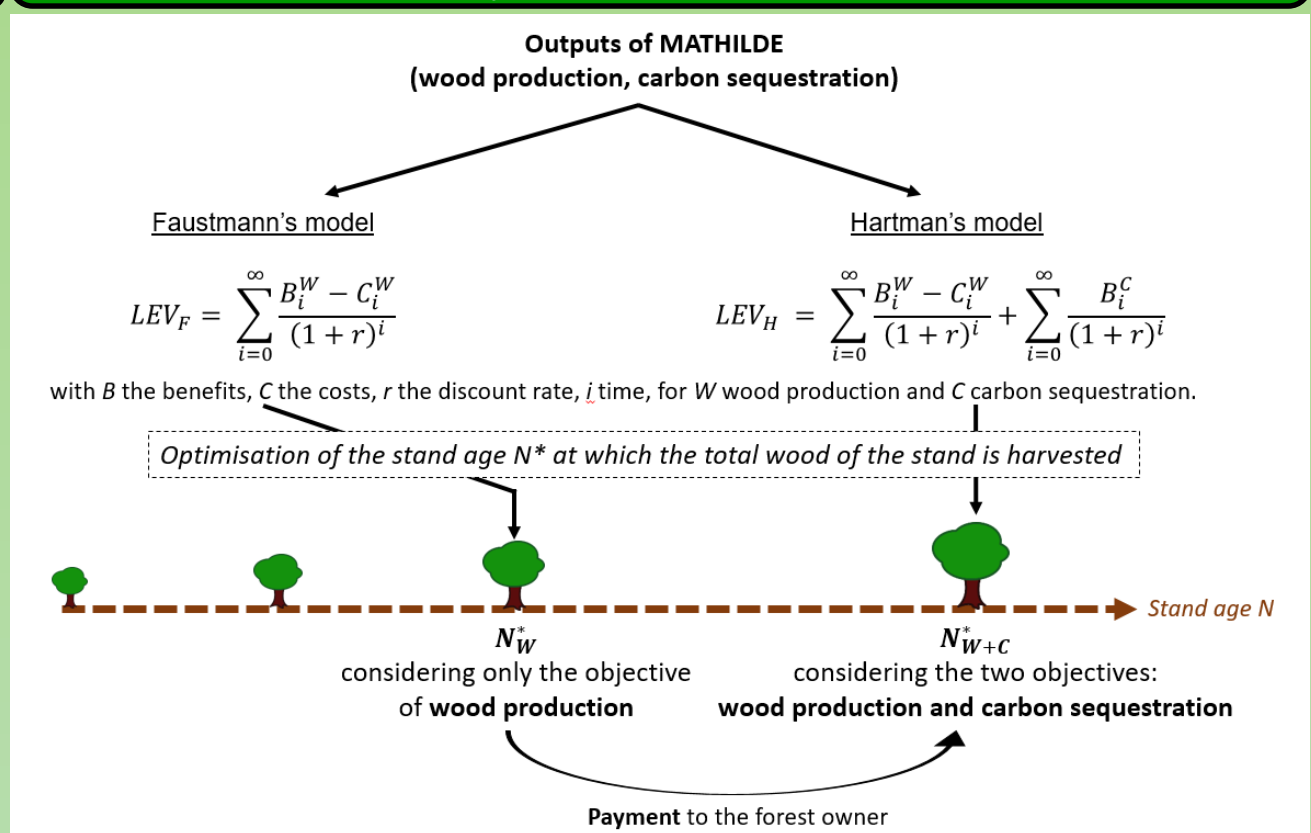
- Species mixture with oak species (A).
- Age mixture, i.e., shifting from even-aged to uneven-aged silviculture (B).



### 18 scenarios tested



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



## MAIN RESULTS

- Drought + Climate change **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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