

# European forests: single or mixed species stands?



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## Introduction

- Forests are multifunctional, providing wood, biodiversity conservation, recreation, CO<sub>2</sub> fixation.
- Many single species, even-aged, forests are transformed into mixed, uneven-aged, forests.
- What are the implications for the management and the various functions across Europe?

## Objectives

- To analyse effects of climate and management on forest production, structure, and composition.
- To contrast stands differing in age structure (even vs. uneven) and species composition
- To (further) develop/enhance a forest growth model for these purposes.



Fig 1 Speulderbos, the Netherlands

## Methods

- Alterra – European database 13 countries >230,000 plots.
- Plot data: e.g. tree height, diameter, basal area, standing volume.
- Pilot study for single- and mixed species stands in Germany:
  - *Quercus robur* (oak) and *Pinus sylvestris* (pine).
  - *Fagus sylvatica* (beech) and *Pseudotsuga menziesii* (Douglas).

## Results

- Species show sigmoid height growth patterns.
- Qualitative differences across species maintained in single and mixed species stands.
- Quantitative differences however appear in mixed stands.
  - Pine and Douglas grow faster in mixed stands, oak and beech in single species stands
  - Maximum height of pine, oak and beech little affected by mixture, Douglas has a higher maximum height in mixture.

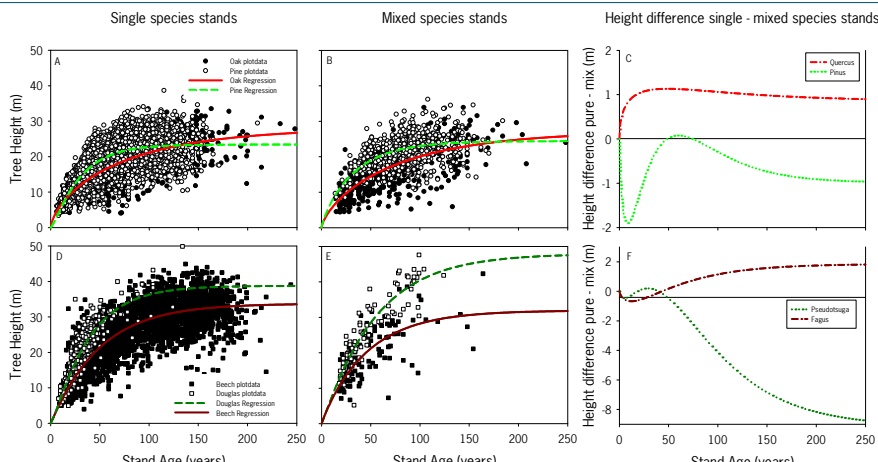


Fig 2 Fig 2 Tree height versus stand age for oak (closed circles) and pine (open circles) in (A) single and (B) mixed species stands; beech (closed squares) and Douglas (open squares) in (D) single and (E) mixed species stands. Height growth curves ( $H = H_{max} \times (1 - e^{-a \times age^b})$ ) were fitted through plot data: oak red, solid line; pine green, dashed line; beech dark red, solid line; Douglas dark green, dashed line. Differences in predicted heights (single – mixed) of (C) oak and pine; and (F) beech and Douglas versus age.

## Conclusions

- A lot of unexplained variation: to be explored (environmental factors!).
- Species growth patterns differ between single and mixed species stands.
- Forest management can strongly influence the long-term development of mixed forests.
- Production and diversity may be mutualistic?

## Ongoing & Future steps

- Contrast forest development in 4 regions: boreal, maritime, continental and Mediterranean.
- Explaining variation between plots with environmental variables and multivariate analyses.
- Modelling forest growth with a plantphysiological model, i.e. ForGEM; Enhancing height growth – site index approach; Scaling up from individual tree to stand level.
- Simulating forest development of mixed vs. single species stands, under different management regimes.

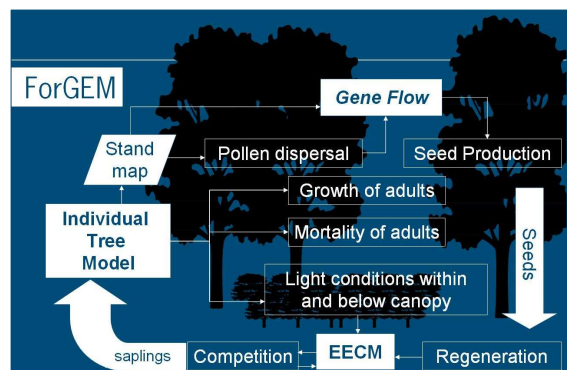


Fig 3 Flow chart of ForGEM: Forest Genetics Ecology and Management (EECM = Early Establishment Competition Model)