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Session: T5.6
Continuing Challenges and Novel Solutions:
Adapting Growth and Yield Modelling to the Global Change Paradigm

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A Novel Construction Principle for Yield Tables – combining recent observations and growth simulation data

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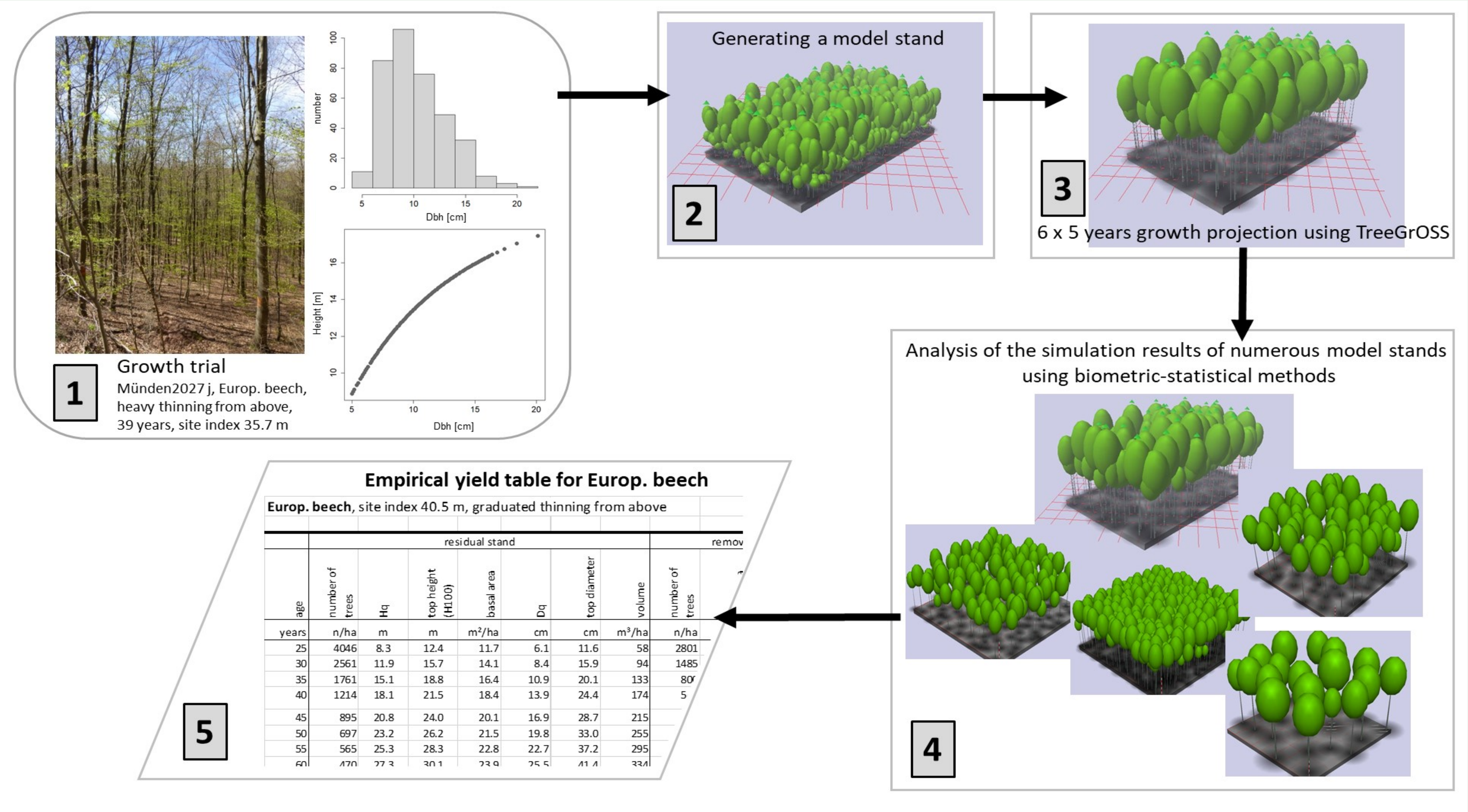
Introduction

- Yield tables are useful tools for forest planning
- Rapid dynamics in site conditions caused by climate change and adaptive silvicultural management concepts require regular revision of yield tables
- Traditionally, yield tables are derived from data of long-term growth and yield experiments
- This centuries-old concept has flaws as observations from experimental plots measured in periods of the far past cannot be used to derive the common yield table attributes as changing site conditions result in shifts of growth dynamics
- Using only recent data as a consequence will result in a heavily reduced data set not being sufficient to derive a yield table in most cases
- This issue is exacerbated looking at the prerequisite to have balanced data over site index and age

Research question 1: How can we derive empirical yield tables which reproduce the current growth level?

We combine empirical data from long-term growth and yield trials and growth projections using the single-tree growth simulator TreeGrOSS (Hansen and Nagel 2014).

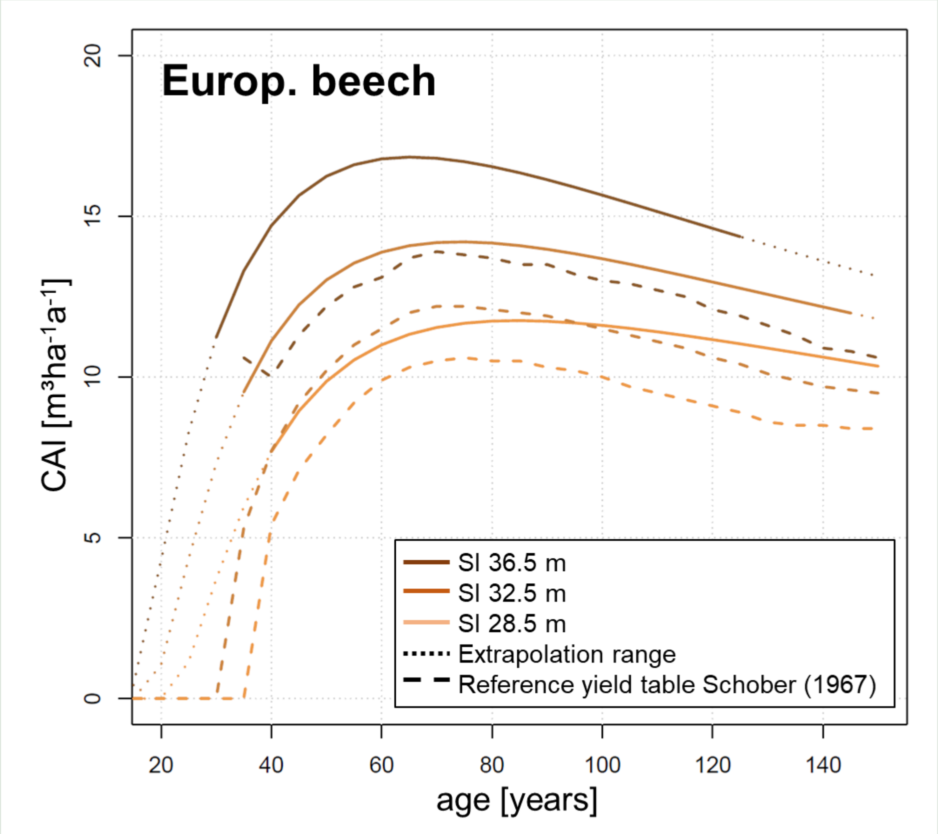


(1) Generate model stands based on observations
(2) Project model stands for 30 years using the current growth level and applying the recommended graduated thinning from above
(3) Convert simulation results into age-dependent yield table values using biometric-statistical functions
(4) The results are yield tables in traditional design

The novel construction principle constitutes a new, fourth generation of empirical yield tables
(for further references see Albert et al. 2021 and 2023, Nuske et al. 2022).

Research question 2: What are the application requirements and limitations for the new yield tables?

Target basal area related to graduated thinning from above constitutes the empirical stocking degree 1.0

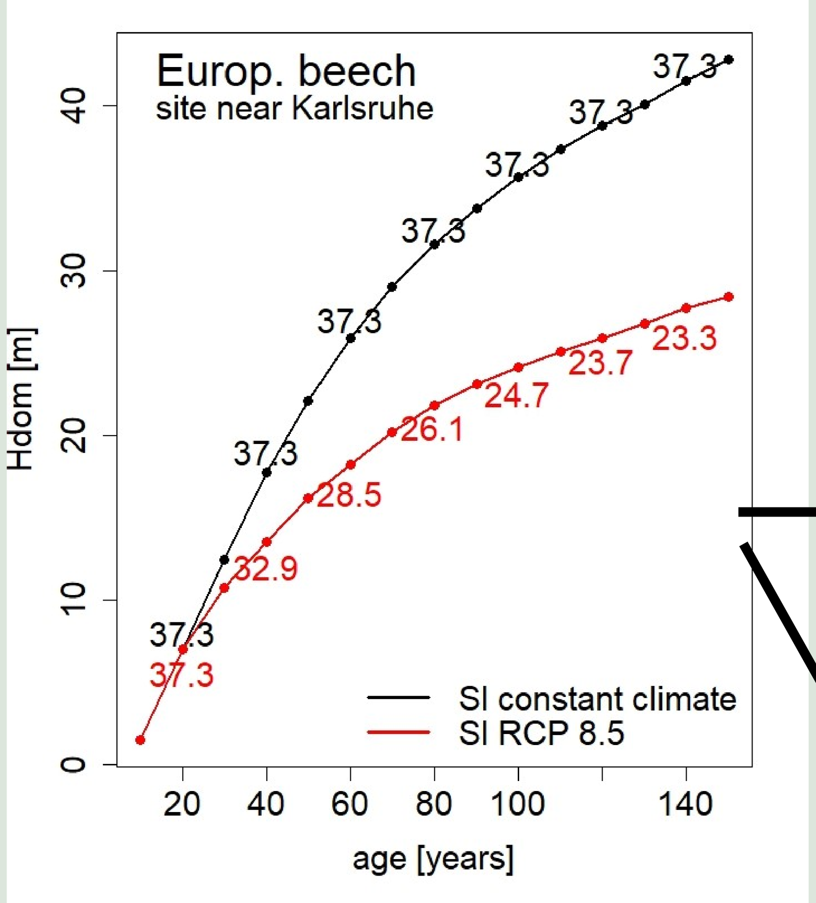


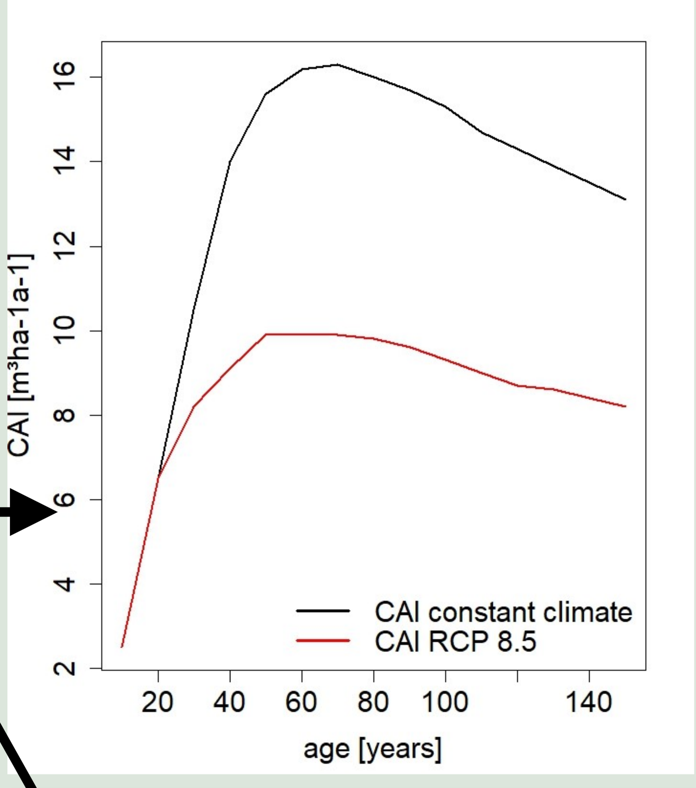
Current annual increment (CAI) reproduces current growth level (here for Europ. beech) which is considerably higher than in the old reference yield table

Limitation: yield tables should only be used for planning periods of up to 20 years due to site dynamics

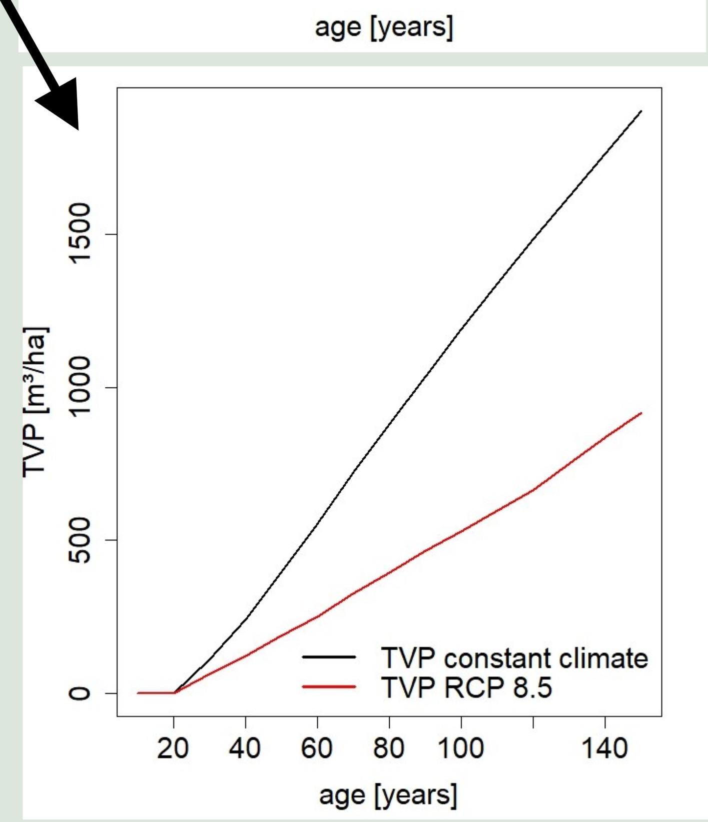
Research question 3: How can we adjust yield table projections for longer-term planning periods under climate change?

We use a climate-sensitive dominant height (Hdom) model (Schick et al. 2023) to predict site index changes for yield table projections of an entire rotation period.





Site index (SI) is 37.3 m under constant conditions; decreases to 24.7 m at age 100 under RCP 8.5. Significant effect on current annual increment (CAI) and total volume productivity (TVP).



Conclusions

- New yield tables available for sessile and pedunculate oak, European beech, Norway spruce, Douglas-fir and Scots pine
- Valid for northwestern Germany
- Novel construction principle can be applied universally to other species and world regions

Conclusions *(cont.)*

- Yield tables are static tools, they can be applied for their primary use, i.e. giving decision support in forest planning for the next 10 to 20 years
- In combination with climate-sensitive SI models they are also applicable for planning periods beyond 20 years

Literature:
Albert M. et al. (2021). Eine neue Generation von Ertragstafeln für Eiche, Buche, Fichte, Douglasie und Kiefer [data set]. Version 1.1. Zenodo. https://doi.org/10.5281/zenodo.6343906
Albert, M. et al. (2023). Konstruktionsprinzip für eine neue Generation von Ertragstafeln erläutert am Beispiel der Baumart Buche. *Allgemeine Forst und Jagdzeitung.*
Hansen, J., & Nagel, J. (2014). *Waldwachstumskundliche Softwaresysteme auf Basis von TreeGrOSS - Anwendung und theoretische Grundlagen.* (H. Spellmann, Ed.). Göttingen: NW-FVA.
Nuske R., Staupendahl K., Albert M. (2022). et.nwfva: Forest Yield Tables for Northwest Germany and their Application [Software]. Version 0.1.1. Zenodo. https://doi.org/10.5281/zenodo.7207596
Schick J. et al. (2023): A new approach for modeling stand height development of German forests under climate change. Front. for. glob. change 6. https://doi.org/10.3389/ffgc.2023.1201636
Schober, R. (1967). Ertragstafel für die Baumart Buche. Schober, R. (Hg.): Ertragstafeln wichtiger Baumarten. 4. Aufl., Frankfurt am Main: J. D. Sauerländer`s Verlag, 1995.

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