

ARE FORESTS THICKENING DUE TO RISING CO₂?

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Insights from Swiss forests and mechanistic modelling

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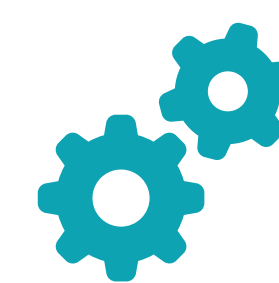
BACKGROUND

- Increased leaf-level **C assimilation** due to elevated CO₂, temperature effects, and/or extending growing seasons leads to enhanced tree growth rates (Huang et al 2007).
- Tree growth enhancement** could...
 - ...be translated into an increase in biomass stocks, or...
 - ...be associated with a reduction in tree longevity to a degree that nullifies any change in biomass.
- However, **changes in mortality**, and the implications for **forest stand density** are still debated.



RESEARCH QUESTION

- Does an increment in the leaf-level C assimilation lead to an increase in the biomass stocks in forest stands?



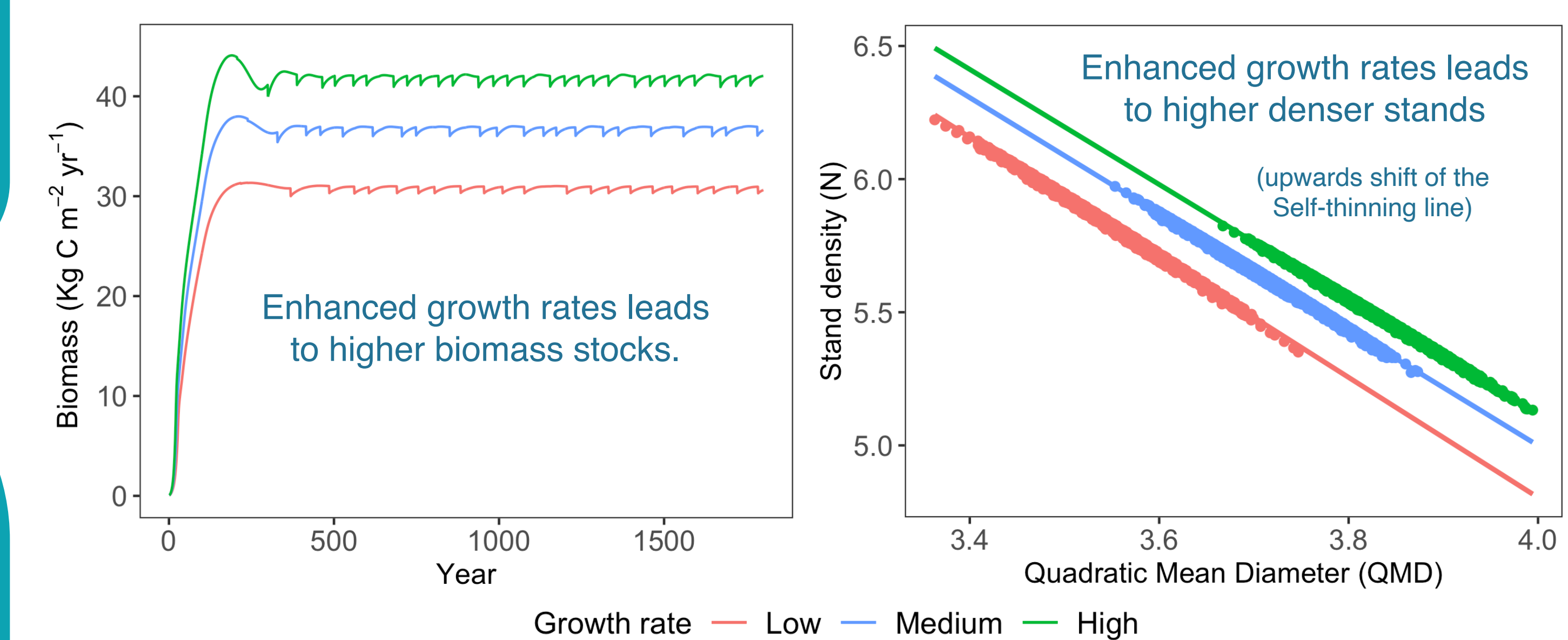
METHODS

- Mechanistic modelling (LM3-PPA)**
Vegetation demography cohort-based model which links leaf physiology, tree-level C balance, demographic rates and stand dynamics (Weng et al. 2015).
 - ✓ Size-dependent U-shaped mortality
 - ✓ Model calibrated for Switzerland (Lägeren, LWF programme)
- Empirical forest data**
 - Swiss National Forest Inventories (Fisher & Traub 2019)
 - Experimental Forest Management (Forrester et al. 2019)
 - Swiss Natural Forest Reserves (Hobbi et al. 2020)
 - ✓ Self-thinning trajectories: the negative relationship between stand density and average size as a result of competition.

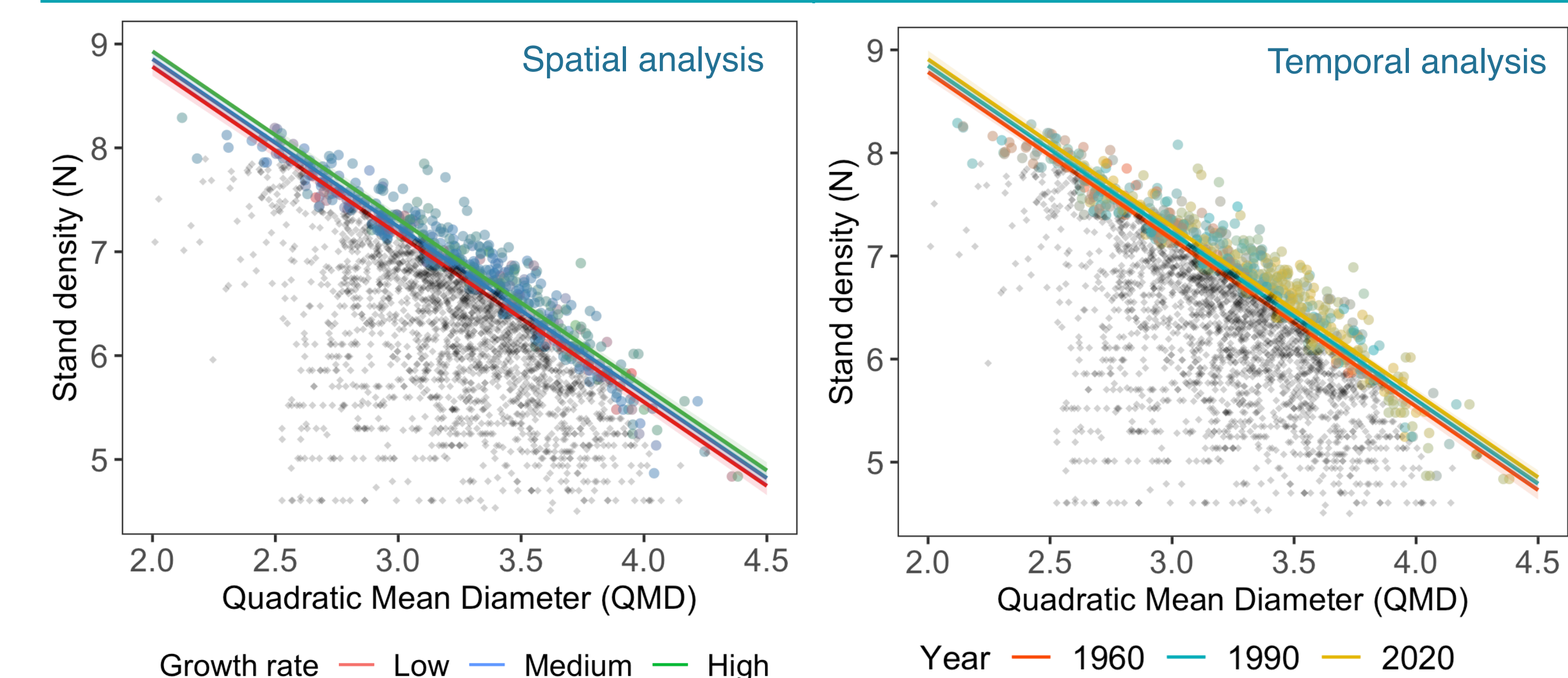


RESULTS

Model simulations



Empirical support



Empirical analysis from Swiss Forest data supports model simulations pointing out to denser stands when increasing growth rate and this pattern is consistent with temporal trends.

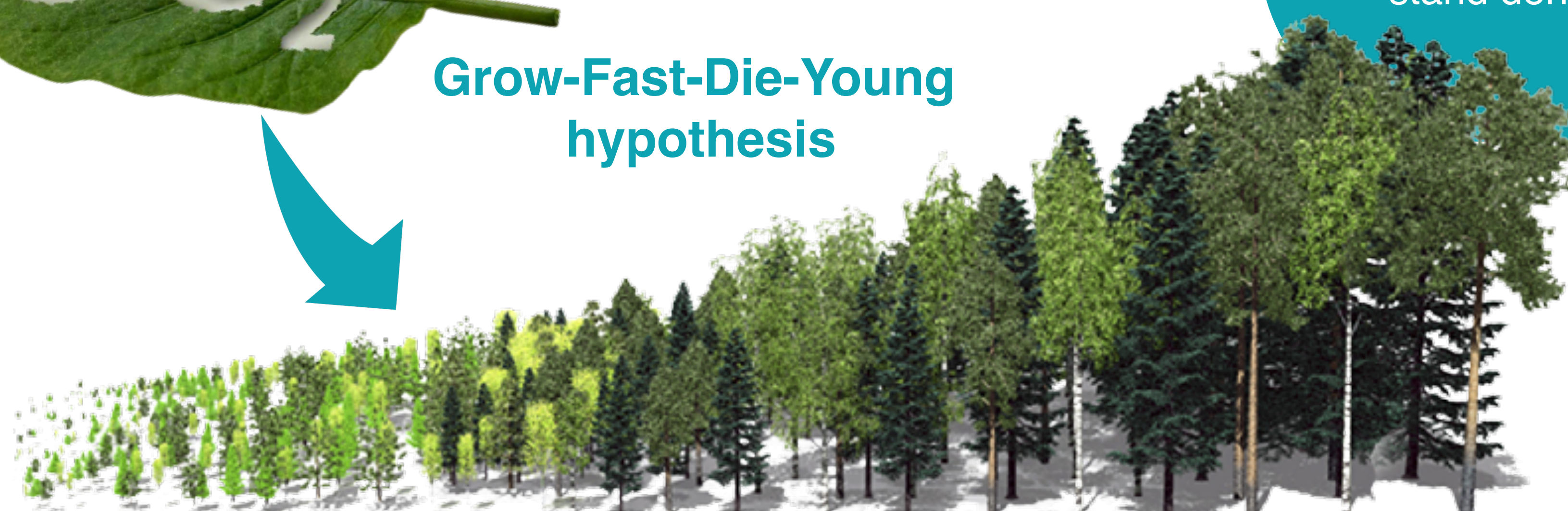


TAKE-HOME MESSAGE

Increasing **growth rate** leads to **higher biomass stocks** and **denser stands**.



Grow-Fast-Die-Young hypothesis



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