

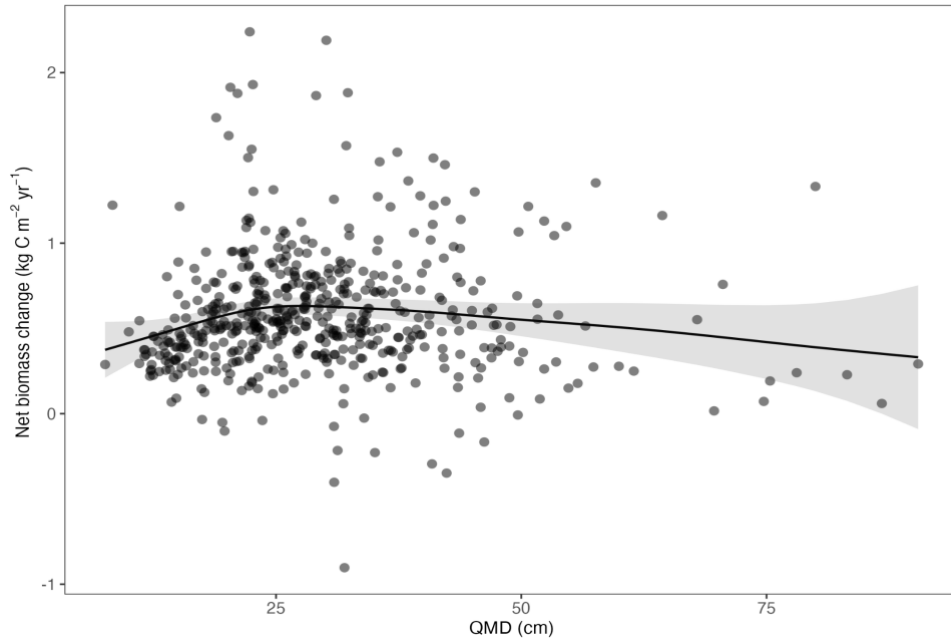
1 **Tree growth enhancement drives a persistent biomass gain in unmanaged**  
2 **temperate forests**

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5 **Content:**

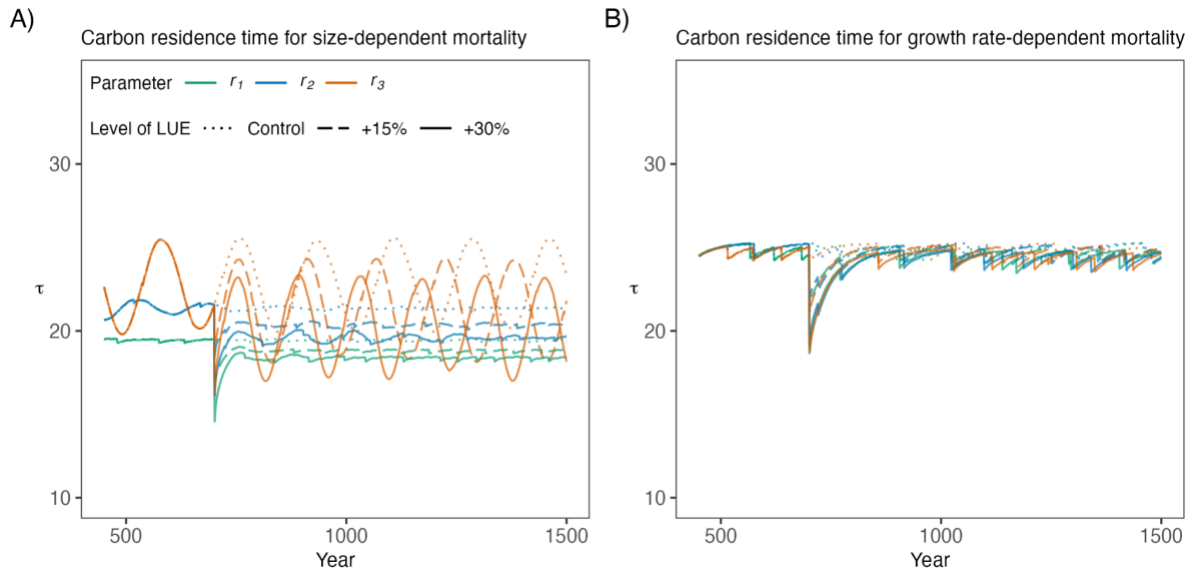
6 Supplementary Figures S1-S5

7 Supplementary Tables S1-S2



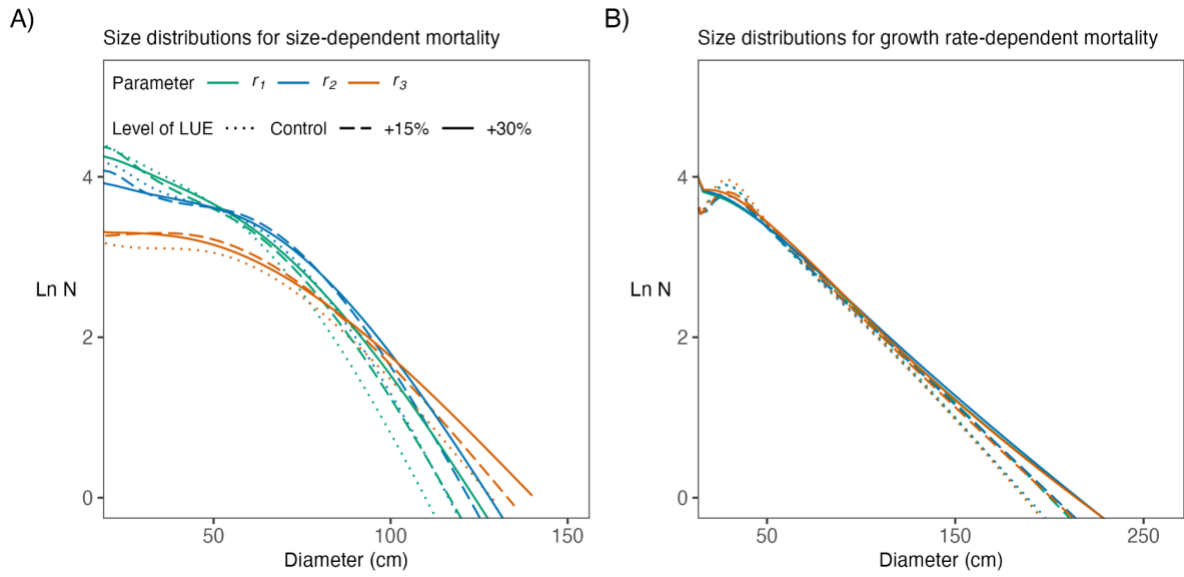
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9 **Fig. S1.** Effect of mean DBH (cm) on net biomass change ( $\text{kg C m}^{-2} \text{ yr}^{-1}$ ) according to the  
10 GAMM fitted for the selected stands. The shaded area represents the standard error of the fit.  
11 Residuals of the model were calculated as the difference between observed and predicted  
12 values.



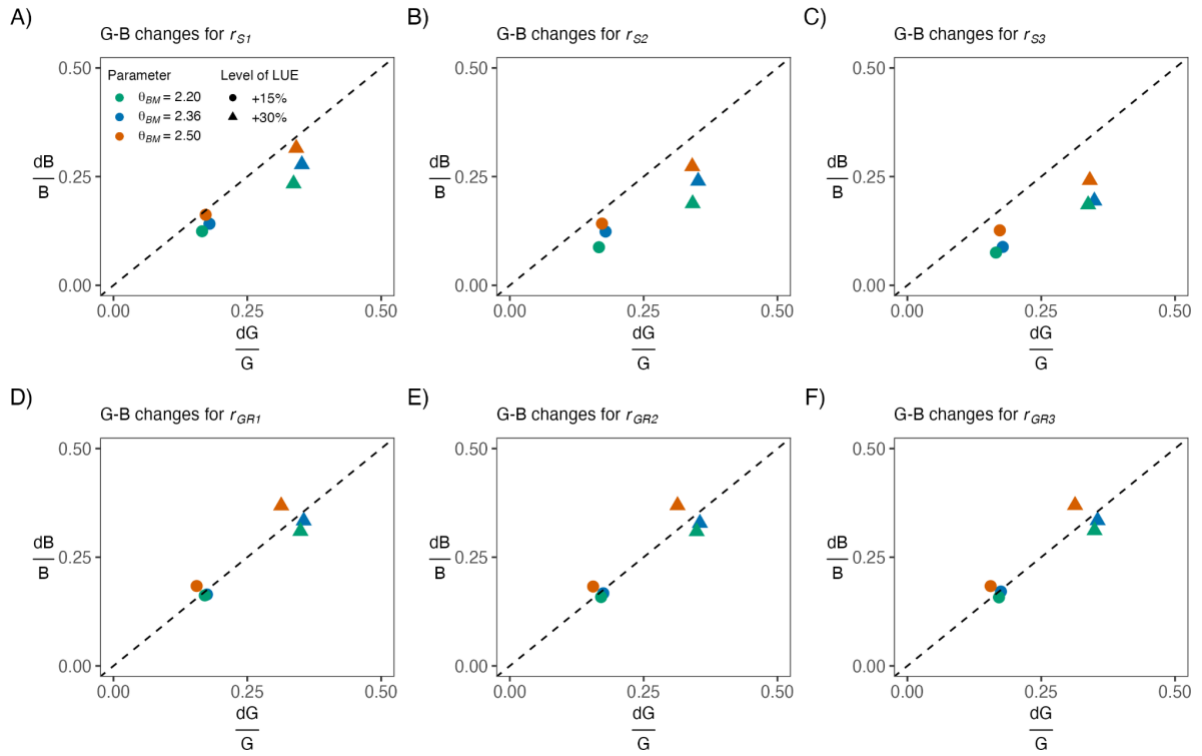
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14 **Fig. S2.** Carbon residence time when mortality is (A) size-dependent and (B) growth rate-  
 15 dependent. Colours represent the mortality parameterizations (curvature of the function) and  
 16 line types represent the increases in LUE (control, +15% and +30%).



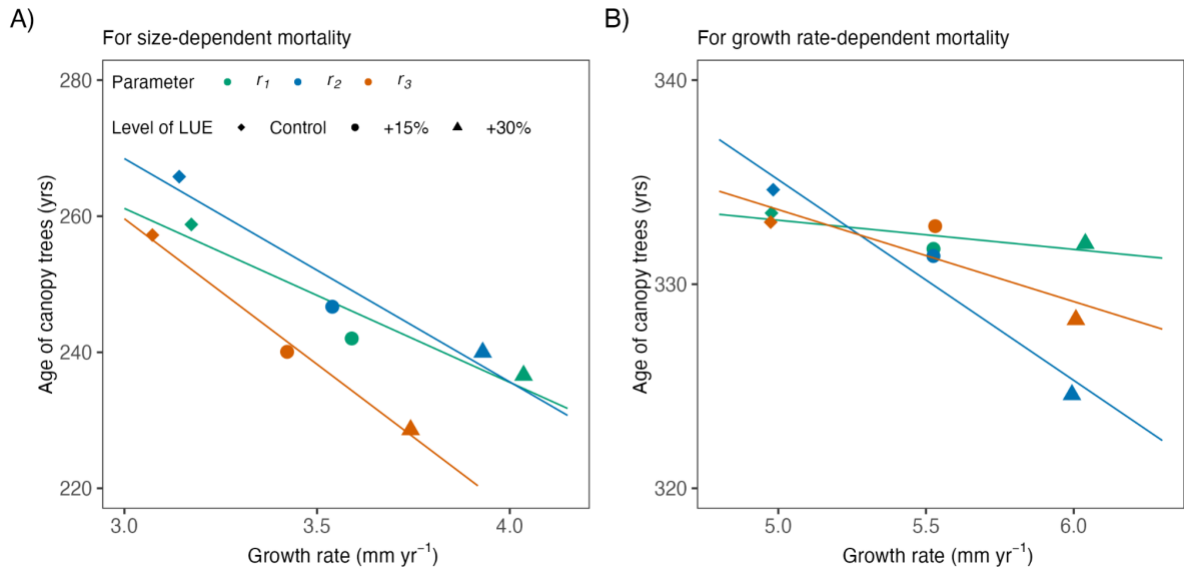
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18 **Fig. S3.** Tree size distributions, i.e., mean number of trees per ha (N, log-scale) and diameter  
 19 (d, cm) for the last 600 years of simulations in the (A) size-dependent and (B) growth-rate  
 20 mortality formulations. Colours indicate the shape of the function and line types represent the  
 21 levels of LUE (control, +15% and +30%).



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23 **Fig. S4.** Sensitivity analysis of the scaling allometric parameter relating diameter and biomass  
 24 in the LM3-PPA model. Panels show the G-B relationships for the (A, B, C) size-dependent  
 25 and (D, E, F) growth-rate mortality formulations with different structures. Colours indicate the  
 26 parameter values ( $\theta_{BM} = 2.20, 2.36, 2.50$ ) considered and shapes represent the levels of LUE  
 27 (+15% and +30%).



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29 **Fig. S5.** Relationships between mean growth rates and age of canopy trees for the two tallest  
30 cohorts after the spin-up years for the (A) size-dependent and (B) growth-rate mortality  
31 formulations. Colours indicate the curvature of the function and shape represents the levels of  
32 LUE (control, +15% and +30%). Lines are linear regressions for each mortality structure.

33 **Table S1. Characteristics of the plots for the different monitoring data sources.** Values  
 34 are means  $\pm$  SD.

	NFI	EFM	NFR
Number of plots	516	18	269
Plot size (ha)	0.048 $\pm$ 0.006	1.15 $\pm$ 2.57	0.43 $\pm$ 0.41
Timespan	1983-2017	1933-2019	1955-2019
Measurement intervals (years)	10 $\pm$ 2	11 $\pm$ 4	12 $\pm$ 4
Elevation (m a.s.l)	1430 $\pm$ 440	1400 $\pm$ 538	827 $\pm$ 428
DBH (cm)	30.1 $\pm$ 11.4	27.9 $\pm$ 8.9	23.0 $\pm$ 8.8
Stand density (trees ha <sup>-1</sup> )	444 $\pm$ 329	1007 $\pm$ 628	1203 $\pm$ 713
Net biomass change (kg m <sup>-2</sup> yr <sup>-1</sup> )	0.37 $\pm$ 0.38	0.49 $\pm$ 0.42	0.52 $\pm$ 0.25
Bray-Curtis Dissimilarity index	0.26 $\pm$ 0.24	0.14 $\pm$ 0.11	0.20 $\pm$ 0.13

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36 **Table S2. Main statistics of the LMMs fitted to describe the changes in the self-thinning**  
 37 **relationships as a function of calendar year (Year) and growth anomalies ( $G_{anom}$ ).**

38 Variables were standardised, so effect sizes are directly comparable within models. The  
 39 sensitivity analysis includes results for the 55<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup> percentiles of data.  $\sigma_u$  denotes the  
 40 standard deviation of the random intercepts (Plot ID and Dominant species, respectively). The  
 41 marginal  $R^2$  describes the goodness of model fit given fixed effects only, while the conditional  
 42  $R^2$  describes the goodness of model fit including fixed and random effects. Model parameter  
 43 significance is annotated as follows: \*( $p < 0.05$ ), \*\*( $p < 0.01$ ), \*\*\*( $p < 0.001$ ).

Parameters	55 <sup>th</sup> percentile	75 <sup>th</sup> percentile	90 <sup>th</sup> percentile
Intercept	6.684 ± 0.024 ***	6.816 ± 0.031 ***	6.833 ± 0.055 ***
QMD	-0.612 ± 0.011 ***	-0.685 ± 0.013 ***	-0.785 ± 0.023 ***
Year	0.041 ± 0.004 ***	0.034 ± 0.005 ***	0.028 ± 0.009 **
$\sigma_u$	0.250 / 0.083	0.229 / 0.104	0.264 / 0.161
Marg. $R^2$	0.841	0.864	0.851
Cond. $R^2$	0.980	0.985	0.992
Intercept	6.694 ± 0.021 ***	6.815 ± 0.030 ***	6.822 ± 0.055 ***
QMD	-0.635 ± 0.011 ***	-0.673 ± 0.014 ***	-0.786 ± 0.025 ***
$G_{anom}$	0.018 ± 0.004 ***	0.026 ± 0.006 ***	0.029 ± 0.011 *
$\sigma_u$	0.239 / 0.065	0.222 / 0.095	0.239 / 0.157
Marg. $R^2$	0.844	0.867	0.865
Cond. $R^2$	0.979	0.984	0.983

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