Ecography

ECOG-04968
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Supplementary material

The supporting information consist of: (1) an overview and illustration of the analysed dataset (for-est stand characteristics, stem radius changes, sap flow, and tree-ring widths), (2) the cross-scale variability of air temperature, vapour pressure deficit, and soil moisture, and (3) the analysis of de-pendences between tree age, elevation and estimated slopes of variability decay with the tree-ring width data.

Appendix 1

1. Datasets

1.1 Overview of observed variables and sample sizes

Table A1. Overview of the sample size for each observed variable per species and sampled elevation at the Lötschental region of the Swiss Alps.

	Sap flow		Stem dendrometers		Tree-ring widths	
	Picea abies	*Larix decidua*	*Picea abies*	*Larix decidua*	*Picea abies*	*Larix decidua*
800 m asl	-	-	2	1	9	10
1300 m asl	3	3	2	2	19	13
1600 m asl	3	3	4	4	15	12
1900 m asl	3	3	4	4	27	28
2200 m asl	-	3	-	4	-	29
Total	9	12	12	15	70	92

Table A2. Forest characteristics across sampled elevations at the study area, including species- and stand-level estimates of densities (stems ha^{-1}). Note that data are not available for the low elevational site at 800 m asl.

Elevation [m asl.]	*Picea abies* [%]	*Larix decidua* [%]	Stand density [stems ha^{-1}]
1300	53	47	605
1600	81	19	410
1900	69	31	431
2200	0	100	207

1.2 Stem radius

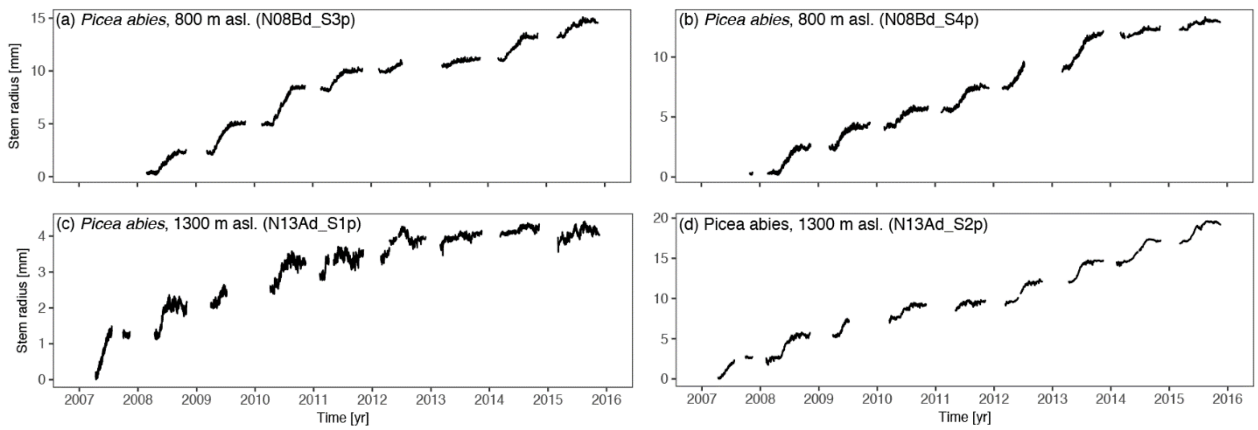

Figure A1. Growing-season hourly stem radius changes, measured with point dendrometers affixed to *Picea abies* at 800 and 1300 m asl. The sensor IDs are given in parentheses.

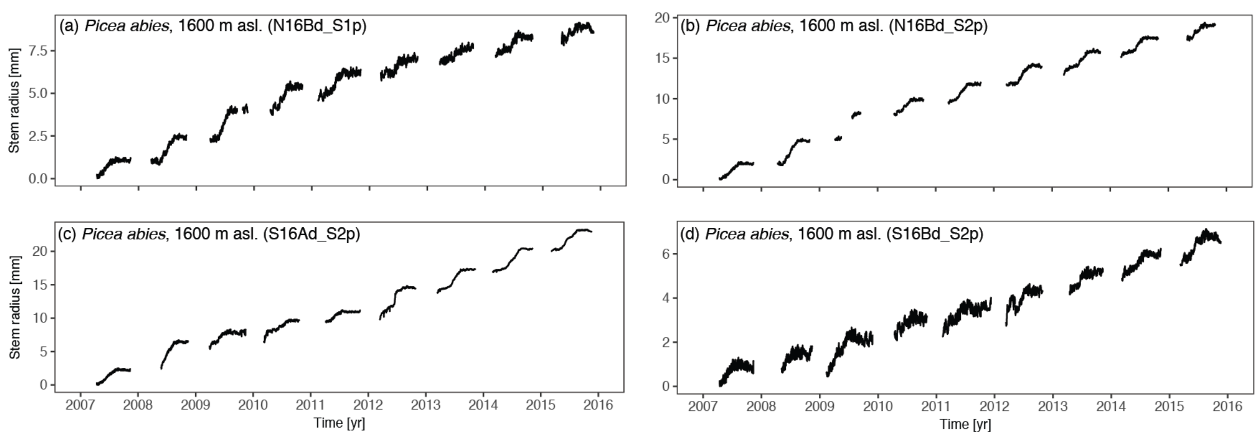

Figure A2. Same as Figure A1, but for 1600 m asl. The sensor IDs are given in parentheses.

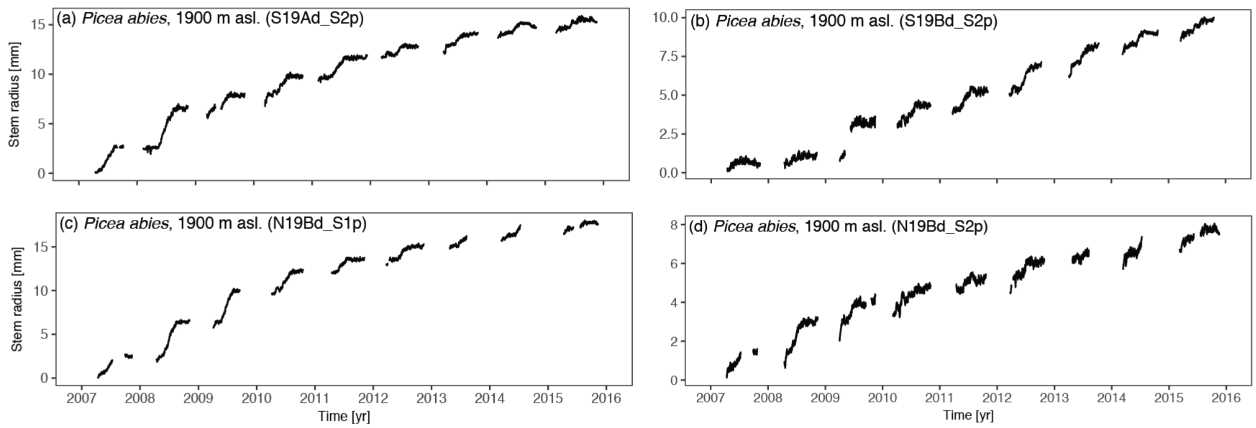

Figure A3. Same as Figure A1, but for 1900 m asl. The sensor IDs are given in parentheses.

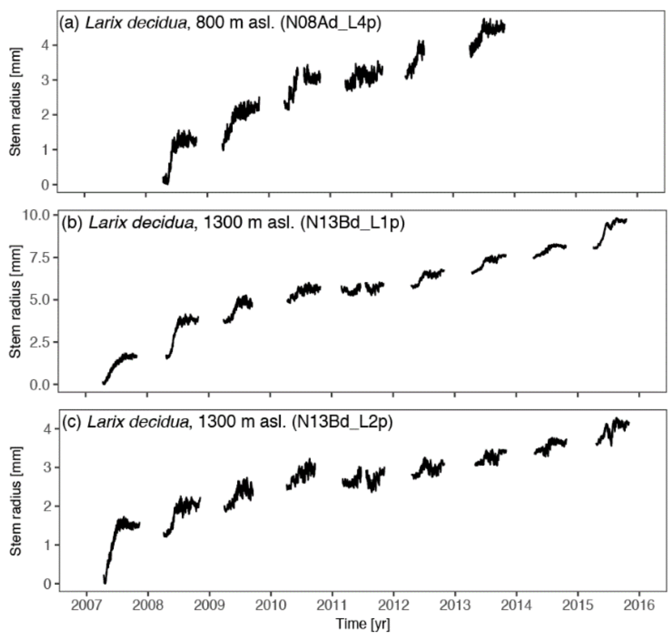

Figure A4. Same as Figure A1, but for *Larix decidua* at 800 and 1300 m asl. The sensor IDs are given in parentheses.

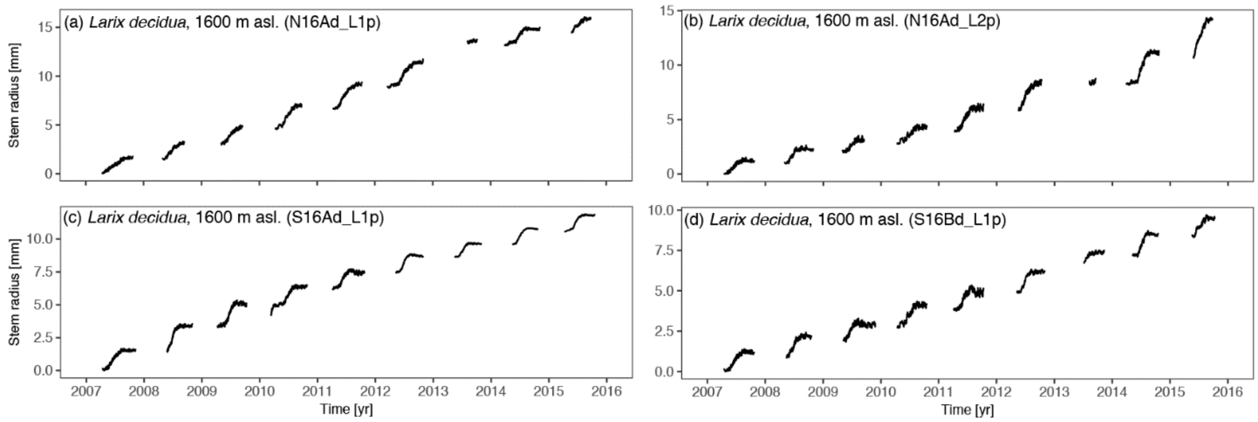

Figure A5. Same as Figure A4, but for 1600 m asl. The sensor IDs are given in parentheses.

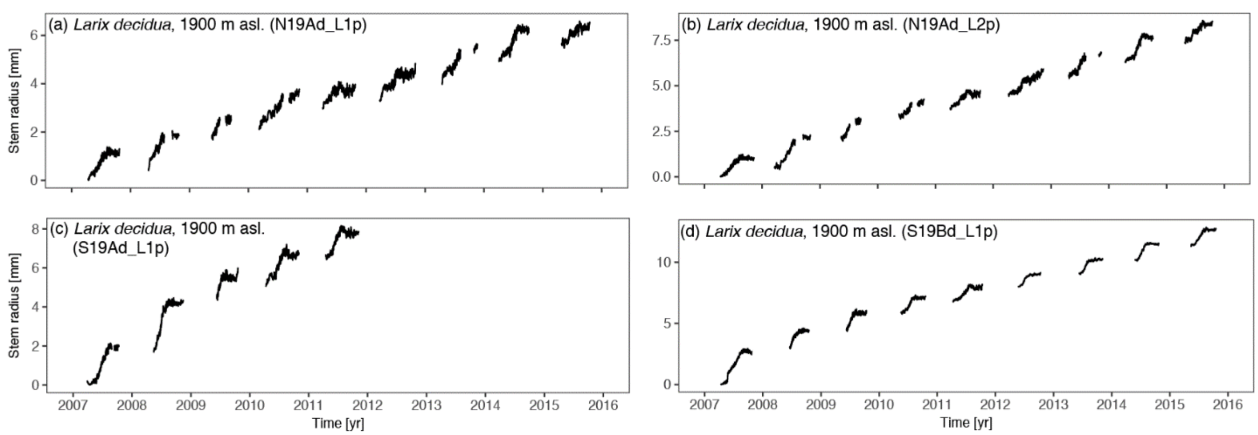

Figure A6. Same as Figure A4, but for 1900 m asl. The sensor IDs are given in parentheses.

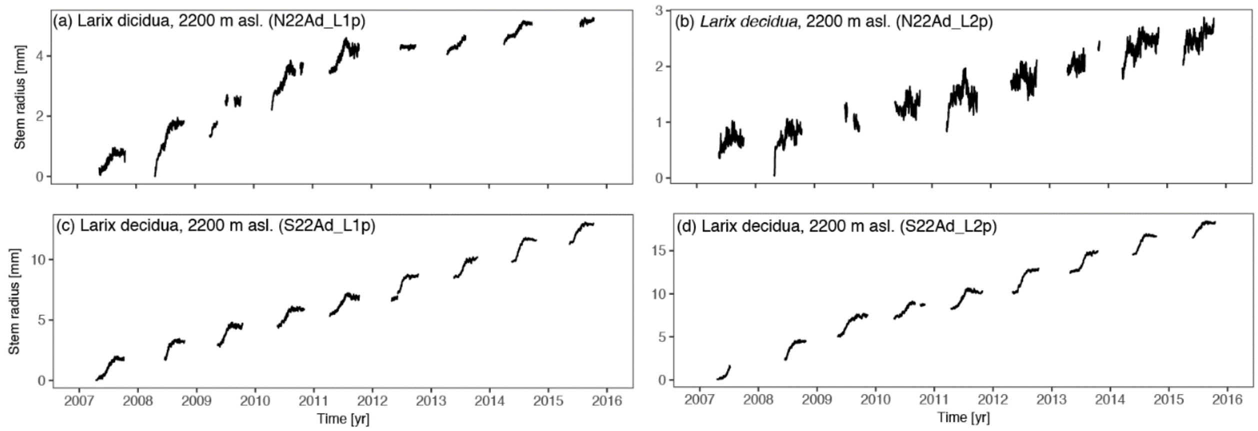

Figure A7. Same as Figure A4, but for 2200 m asl. The sensor IDs are given in parentheses.

1.3 Sap flow

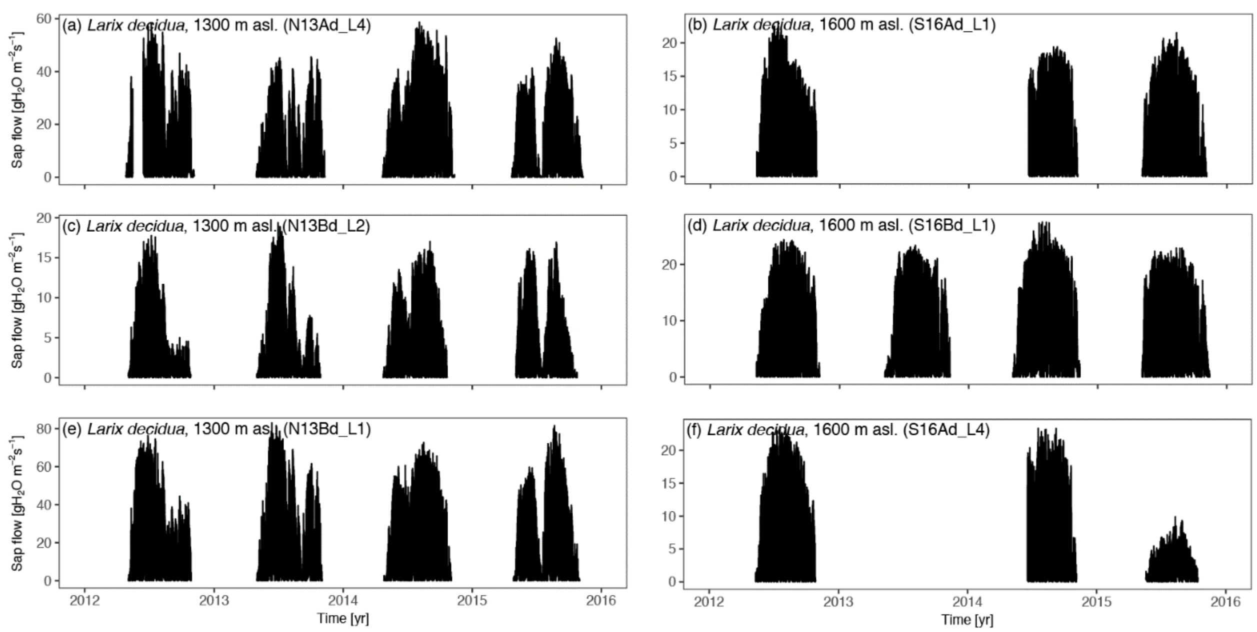

Figure A8. Growing-season hourly sap flux density for *Larix decidua* growing at 1300 and 1600 m asl. The sensor IDs are given in parentheses.

1.4 Tree-ring widths

Figure A12. Tree-ring width chronologies for the period 1900 to 2011 for *Larix decidua* and *Picea abies* at sampled elevations across the study site, corresponding to 800, 1300, 1600, 1900, and 2200 m asl. Chronologies were calculated with the dplR package [*Bunn*, 2008, 2010].

Appendix 2

Cross-scale variability in meteorological conditions

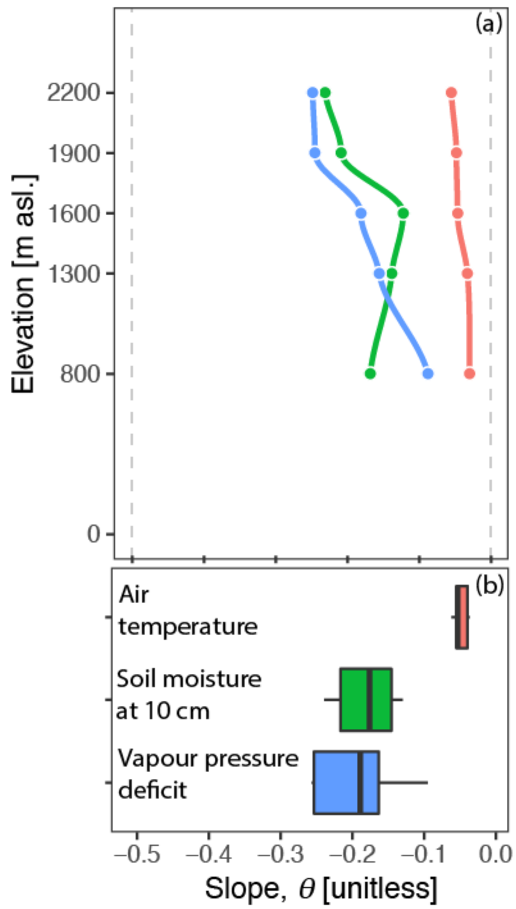

Figure A13. Distribution of the slopes (θ, unitless) describing the decay in standard deviation with averaging time scale for different elevations (a) and across the study area (b) for major environmental variables affecting tree functioning, namely, air temperature, soil moisture at 10 cm depth, and vapour pressure deficit. Coloured points correspond to measurements while solid coloured lines to *loess* smoothing.

Appendix 3

Tree-ring widths, tree age and elevation

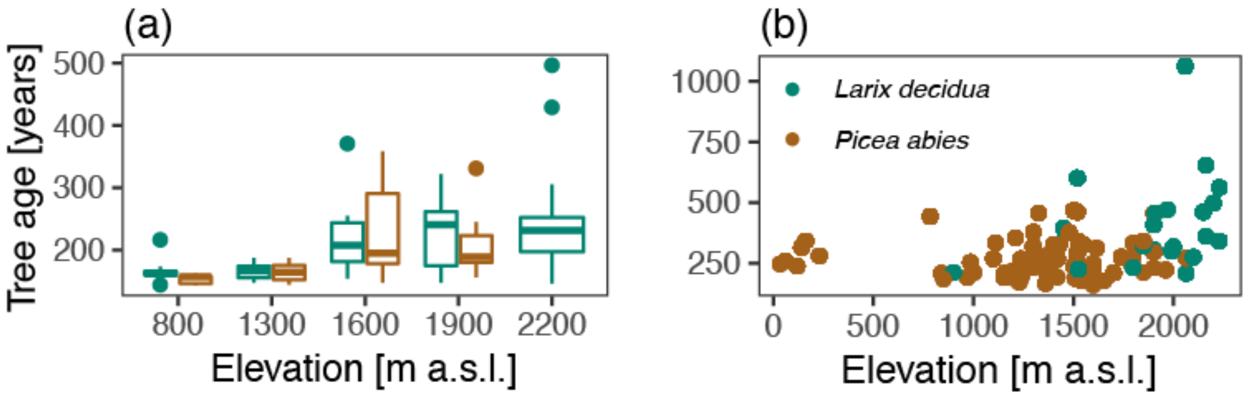

Figure A14. (a) Distribution of the tree age (approximated with the number of tree rings) with elevation for European larch and Norway spruce at the Lötschental region of the Swiss Alps as well as (b) across Europe from the data obtained from the International Tree-Ring Data Bank (ITRDB). The correlation between the estimated slopes of variability decay θ_G^{TRW} and tree age were found weak with low significance, i.e., for European larch: Pearson's correlation coefficient, $r = 0.29$ and p-value = 0.05 for Lötschental, and $r = 0.07$, p-value = 0.062 for the ITRDB data; and for Norway spruce: $r = 0.30$, p-value = 0.01 for Lötschental and $r = -0.06$, p-value = 0.033 for the ITRDB data.

References

Bunn, A. G. (2008), A dendrochronology program library in R (dplR), *Dendrochronologia*, *26*(2), 115–124, doi:10.1016/j.dendro.2008.01.002.

Bunn, A. G. (2010), Statistical and visual crossdating in R using the dplR library, *Dendrochronologia*, *28*(4), 251–258, doi:10.1016/j.dendro.2009.12.001.