Supporting information

Land use legacies and climate interact to drive higher growth, lower wood density and enhanced sensitivity to climatic extremes in recently established forests

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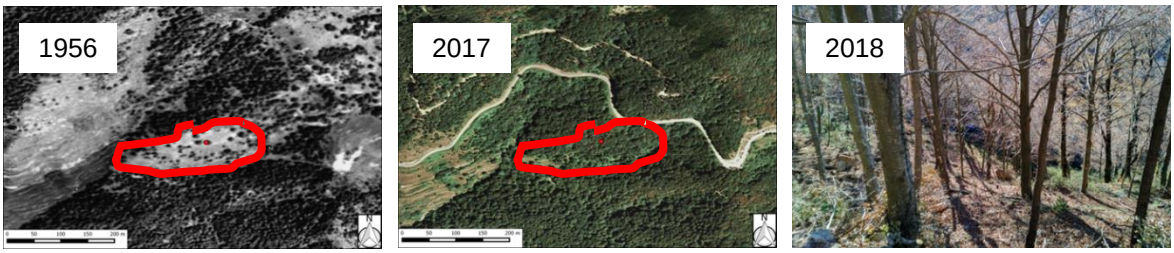
Supplementary Figures

Figure S1. Orthoimages and descriptive pictures from recently and long-established forests in 1956 and 2017-2018.

a. Recently established forest



b. Long-established forest

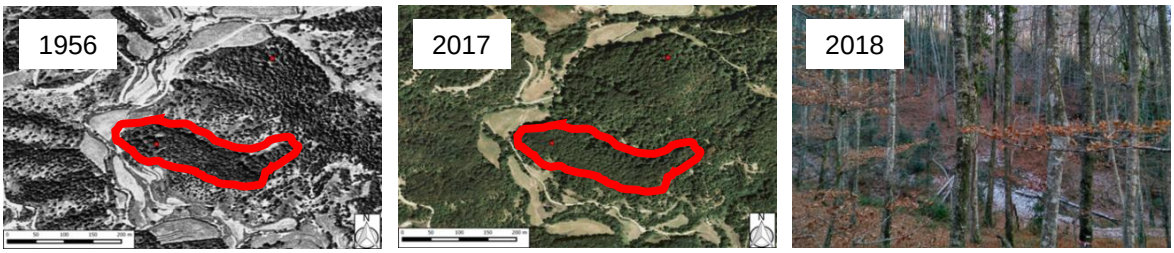


Figure S2. Difference on tree ages in mean growth for both type of forests. Red dashed lines indicate the comparable age subset between 45 and 61 years.

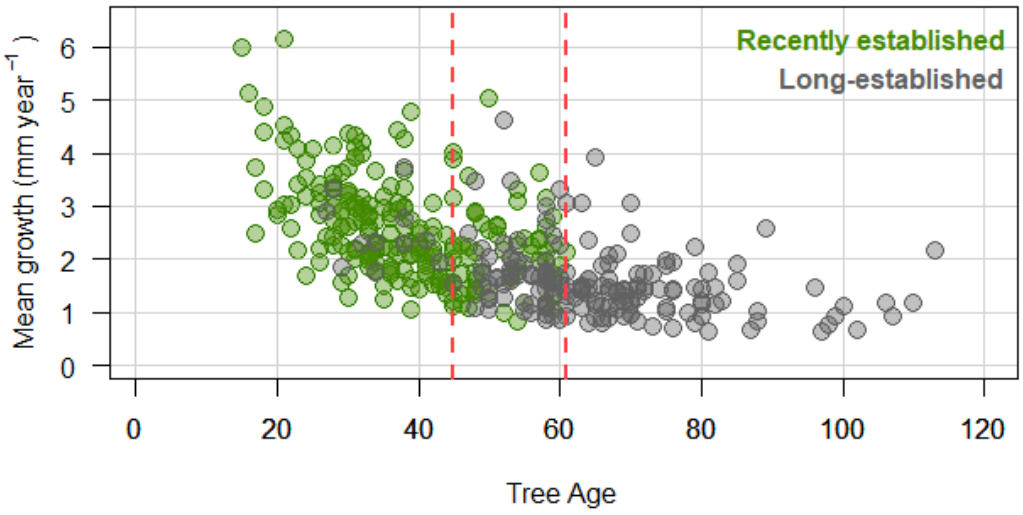
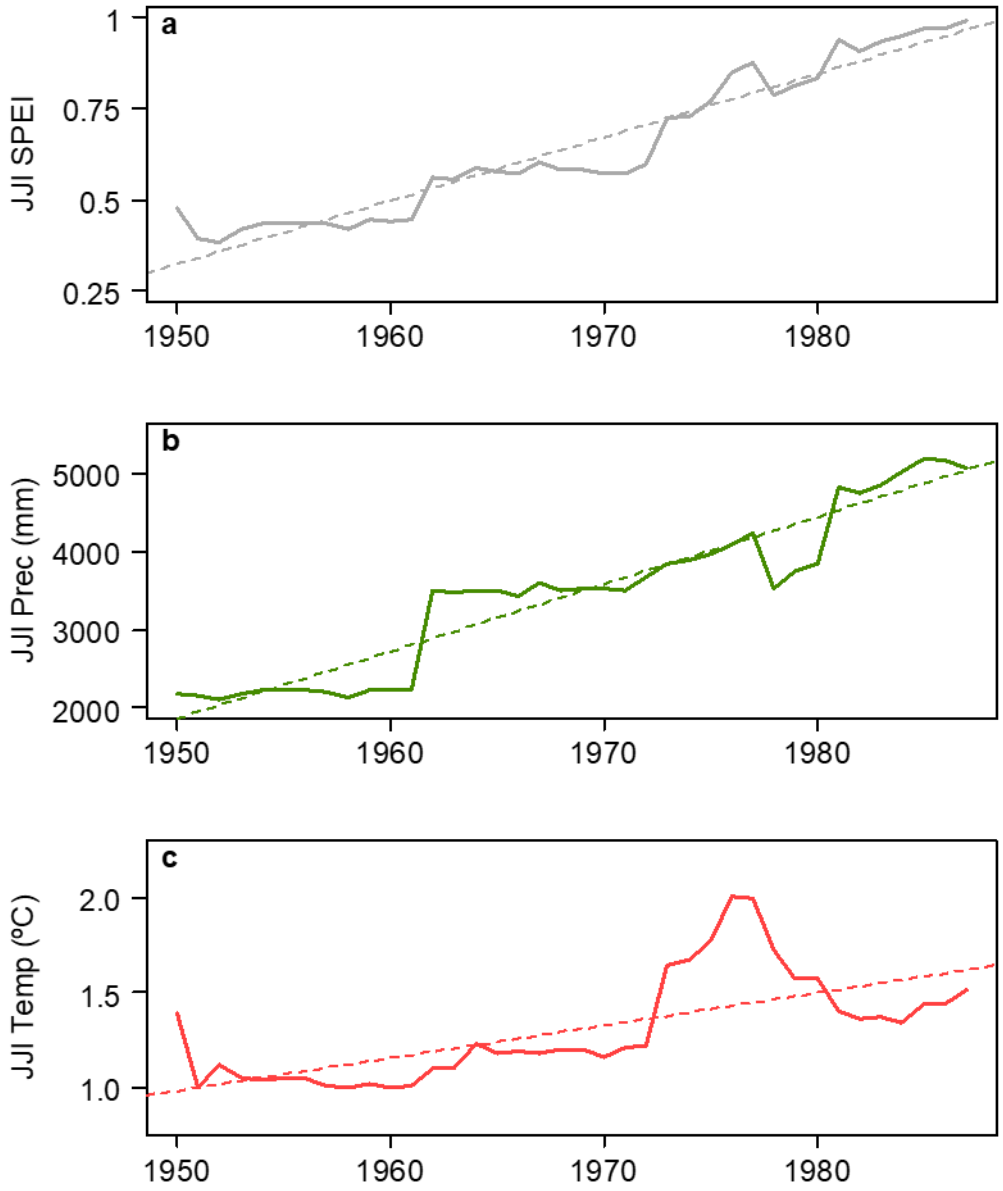


Figure S3. Thirty-one years running variation for June-July SPEI (a) precipitation (b) and temperature (c) derived from E-OBS v.17.0 dataset for the period 1950-2016 and averaged over the four 0.25° spatial resolution grids covering the study region (2.125-2.625 E and 41.125-43.375 N). Dashed lines represent the trend obtained in linear regression models (significant at P<0.05 in (a) and (b)).



Supplementary Tables

Table S1. Structural characteristics for recently and long-established forests (a) and tree-ring statistics for Expressed Population signal (EPS) values above 0.85 for long-established forests, long-established forests younger than 62 years and recently established forests (b). Mean ± SE of tree age, tree density, DBH, basal area (BA), raw tree-ring width and basal area increment (BAI). Asterisks denote significant differences among type of forests for these variables.

a.

	Tree age (years)		Tree density (trees·ha^{-1})		DBH (cm)		BA (m^2·ha^{-1})		Elevation (m)
Type of forest	mean	SE	mean	SE	mean	SE	mean	SE	range
Long-established	65.2*	1.3	1413	36	19.6	0.5	29.7	0.4	831-1333
Recently established	37.8	0.6	1662	56	18.5	0.3	31.3	0.6	1027-1452

b.

							Raw ring width (mm)		BAI (mm^2·year^{-1})	
Type of forest	Period	n trees	n cores	EPS	Interseries correlation	Mean sensitivity	mean	SE	mean	SE
Long-established	1917-2017	179	318	0.98	0.47	0.20	1.50	0.010	558	6
Long-established < 62 yrs	1959-2017	84	155	0.97	0.50	0.20	1.78	0.017	645	12
Recently established	1960-2017	332	617	0.99	0.52	0.30	2.35*	0.013	806*	8

Table S2. LMEMs results for the predictive variable slope (obtained from the linear regression models between detrended growth values and June-July SPEI) and wood density (WD) using all range of ages. Tree density was scaled in the models. The R^2 due to fixed (R^2_m) and due to fixed and random effects (R^2_c) of each selected model is also provided. Significance of the p values is indicated by: ***P < 0.001; **P < 0.01 or **P<0.05.

	Slope				WD			
Fixed effects	Estimate	SE	t value	p value	Estimate	SE	t value	p value
(Intercept)	0.135	0.010	14.25	<0.001***	0.5528	0.0024	7.10	<0.001***
Type of forest: *Long-established*	-0.045	0.016	-2.75	<0.05*	0.018	0.003	6.96	<0.01**
Tree density	n.a.				-0.0064	0.0017	7.13	<0.01**
Random effects	Std. Dev				Std. Dev			
Patch	0.03				0.004			
Residual	0.06				0.016			
R^2_m	0.09				0.28			
R^2_c	0.29				0.33			

Table S3. Results of the LMEMs selected to study Basal Area Increments (BAI) using all range of ages. In the models, age is the year of the life of the tree. Type of forest is a categorical variable to distinguish between recently and long-established forests. BAI and tree density variables were log-transformed to conform normality and tree elevation was scaled. The R^2 due to fixed (R^2_m) and due to fixed and random effects (R^2_c) of each selected model is also provided. Significance of the p values is indicated by: ***P < 0.001; **P < 0.01 or **P<0.05.

	BAI			
	Estimate	SE	t value	p value
(Intercept)	3.58	0.07	54.5	<0.001***
Age (0-10)	2.86	0.07	42.4	<0.001***
Age (10-20)	3.34	0.08	41.2	<0.001***
Age (20-30)	3.27	0.09	38.1	<0.001***
Age (30-40)	2.94	0.10	29.4	<0.001***
Age (40-50)	5.35	0.15	36.5	<0.001***
Age (50-60)	2.22	0.14	16.1	<0.001***
Type of forest: *Long-established*	-0.46	0.09	-5.0	<0.001***
Tree elevation	0.14	0.04	3.7	<0.001***
Jun-July SPEI	0.127	0.003	39.2	<0.001***
Type of forest: *Long-established* × Jun-July SPEI	-0.030	0.007	-4.5	<0.001***
R^2_m	0.41			
R^2_c	0.69			