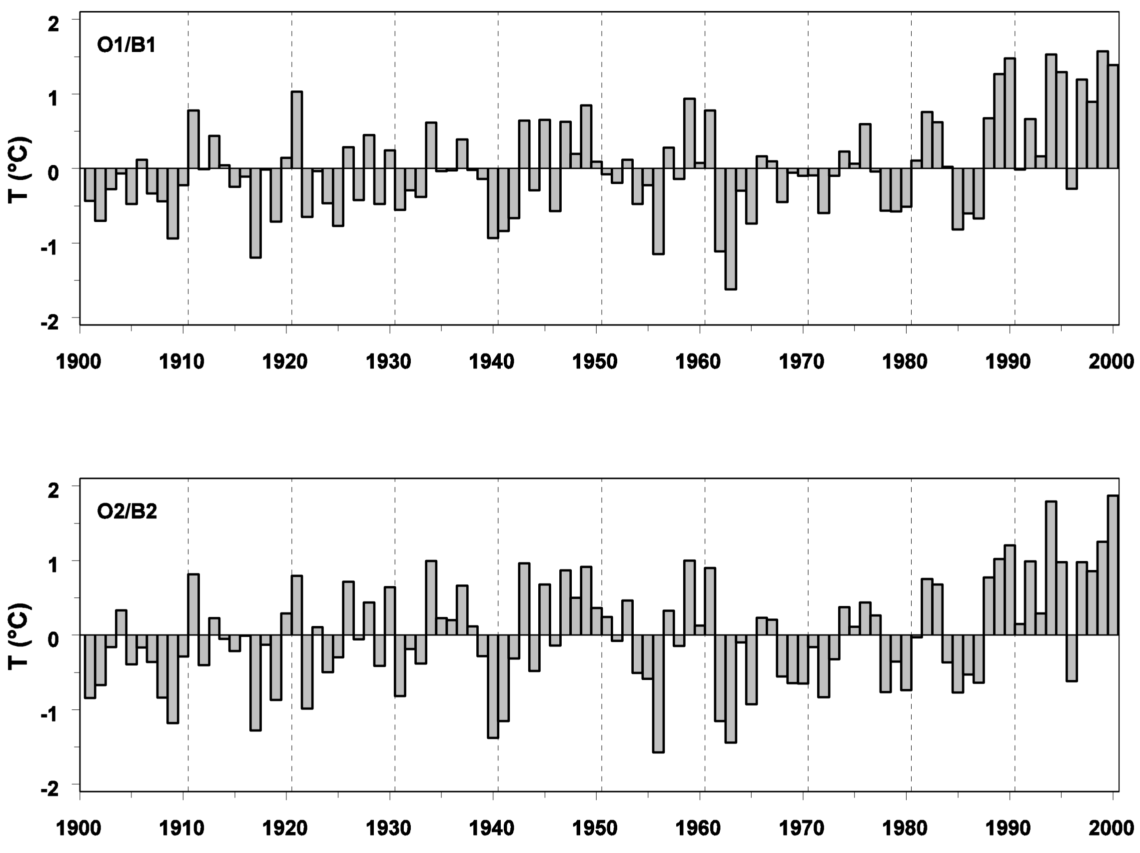
Oikos

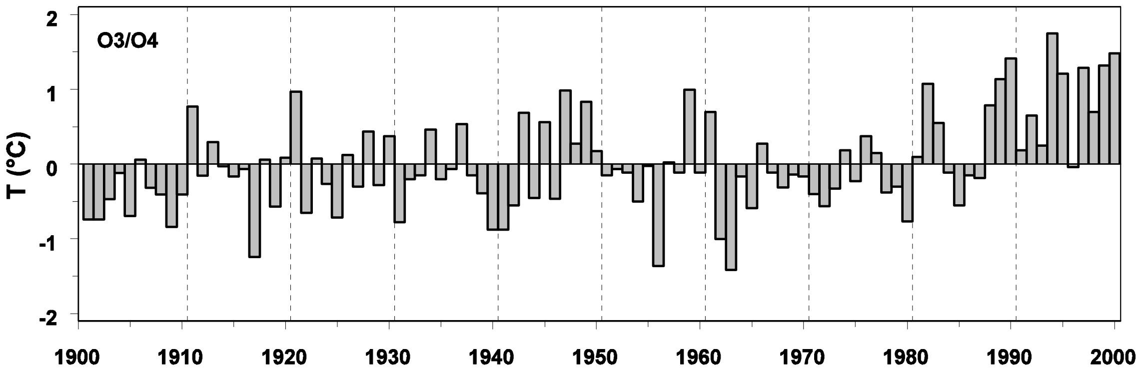
o20080

Bontemps, J.-D., Herve, J.-H., Duplat, P. and Dhôte, J. F. 2011. Shifts in the height-related competitiveness of tree species following recent climate warming and implications for tree community composition: the case of common beech and sessile oak as predominant broadleaved species in Europe. – Oikos 121: 1287–1299.

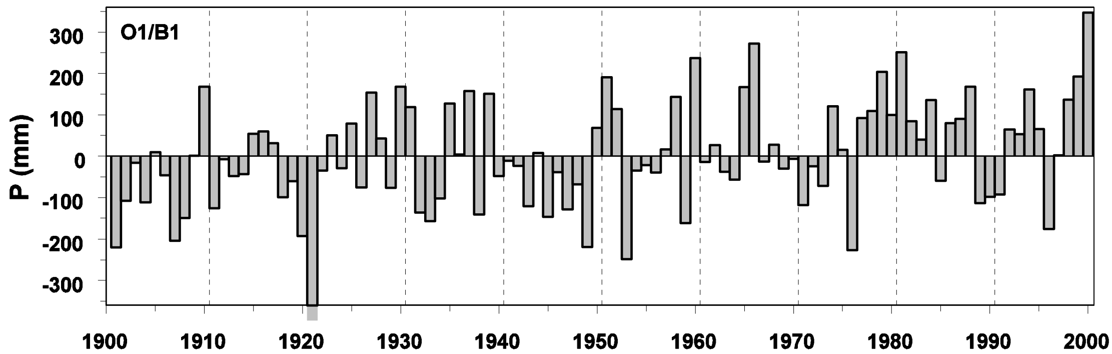
Appendix 1

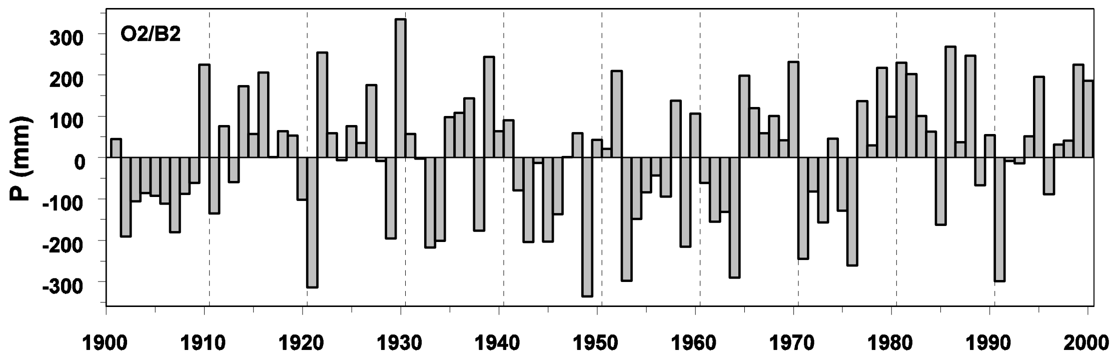
(a)




O3/O4
T (°C)
2
1
0
-1
-2
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

(b)


O1/B1
P (mm)
300
200
100
0
-100
-200
-300
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000


O2/B2
P (mm)
300
200
100
0
-100
-200
-300
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

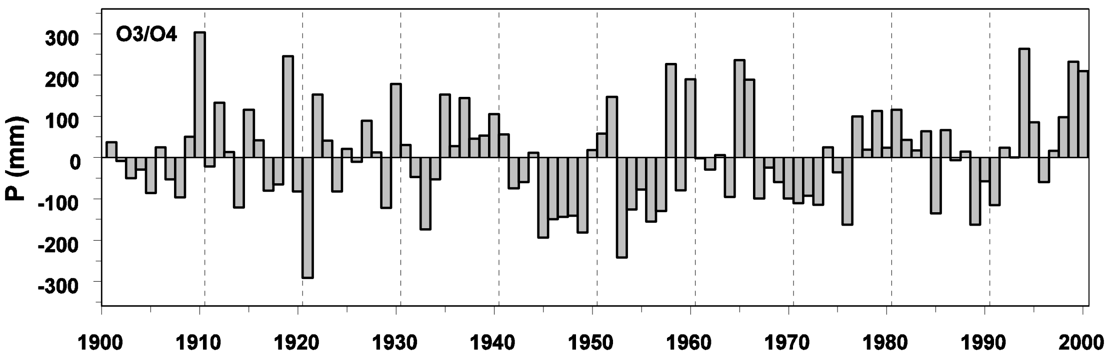


Figure A1. Annual 20th-century chronologies of (a) mean temperature and (b) precipitation anomalies for samples O1/B1, O2/B2 and O3/O4. These chronologies were computed from 12 precipitation and 11 temperature homogenised climatic series produced by Météo-France (Moisselin et al. 2002).

Appendix 2

Growth equations tested to model the effect of ontogenetic stage on growth in sessile oak. These growth equations (Korf equation, and an original equation termed 'IPB equation', for 'inverse-parabolic branch') are presented in the traditional form of an autonomous differential equation: $dX/dt = f(X)$, where f corresponds to f_1 in the present modelling approach (Eq. 1 in the maun text):

Korf: $$S_b f_1(H_0) = S_b (H_0 / K) (ln (K/H_0))^{1+m} C_m \qquad (A1)$$

where H_0 is top height, S_b is the maximal growth rate (m/year), K is the height asymptote (m), m is a shape parameter (dimensionless), and C_m is a constant depending on m: Cm = exp [(1 + m)(1 – *ln* (1+m))],

IPB: $$S_b f_1(H_0) = S_b (H_0/K_S)^{m1\ m2} / [1 - m1 + m1 (H_0/K_S)^{m2}] \qquad (A2)$$

where K_S is the height (m) at which S_b is attained (inflection point), and m1/m2 are 2 shape parameters with m1 < 1 and 0 < m1, m2. When $t >>1$, we have: $H_0(t) \sim (C\ S_b\ t)^{\alpha}$ where $\alpha = (1+m2\ (1 - m1))^{-1} < 1$ (hence height is an inverse-parabolic branch of time), and C is a constant depending on K_s, m1 and m2.

Appendix 3

Statistical modelling steps for sessile oak.

We first compared the Korf and IPB equation accuracies by fitting each equation over the data for each sessile oak sample separately, without any effect of calendar year, and introducing a between-stand pair variation in parameter S_b, which was significant (coefficient of variation of ca 8 to 20% depending on the sample). The IPB equation showed a significantly higher accuracy than the Korf equation in all samples ($p < 10^{-4}$, with a minimum –10.0 AIC units). The introduction of the f_2 cubic spline function of time with a 20 years internode was found very significant in all samples ($p < 10^{-4}$). However, the refined 15 and 10-years internodes did not improve the fits. Heteroskedasticity was identified in the residuals. A general residual variance function, expressed as a power function of the increment time interval, was tested, and was very significant in samples O3 and O4 ($p < 10^{-4}$) and at the limit of significance in samples O1 and O2 ($p = 0.1$). We again compared the Korf and IPB equations, by testing the Korf equation in the latter model structure. The IPB equation remained significantly more accurate than the Korf equation (–3 to –6 AIC units, $p = 0.04$ to 0.02). on parameters K_S, m1, and m2. S_b was identified with the site fertility parameter in Eq. 1.

Reference

Moisselin, J. M. et al. 2002. Les changements climatiques en France au XXe siècle. Etude des longues séries homogénéisées de données de température et de précipitations. – Météorologie 38: 45–56.