$$HLCW = \frac{HT}{1+e^{(-0.0041*HT-0.0093*BAL-0.0123*BA6)}} \qquad [1]$$

$$HCB = \frac{HLCW}{1+e^{(0.0078*BA6-0.5488*\log(BA6)-0.0085*BAL)}} \qquad [2]$$

$$LCW = (0.1836 * DBH) * CR^{(0.1594+0.0014*CL)} \qquad [3]$$

where HLCW is height to largest crown width (to nearest 0.1 m), HCB is height to crown base (to nearest 0.1 m), LCW is largest crown width (to nearest 0.1 m). Crown length was computed as the difference between measured total height (HT) and estimated height to crown base (HCB from eq. 2, see text). Crown ratio (CR) was computed as the ratio between crown length (CL) and total height.

As a surrogate for tree leaf area, crown surface area (CSA) was computed assuming that crown shape conformed to a half-spheroid both above and below HLCW. The horizontal radius of each half-spheroid was equal to LCW/2, the vertical radius of the top half-spheroid was equal to difference between HT and HLCW, and the vertical radius of the bottom half-spheroid was equal to the difference between HLCW and HCB. Surface areas were calculated independently for the portion of the crown above HLCW (CSAa) and below HLCW (CSAb) and summed. Crown projection area (CP) was computed assuming a circular cross-section with diameter equal to LCW. An individual-tree leaf area index surrogate (LAIs) was computed as the ratio of CSA to CP.

Figure S1. Procedures to estimate crown dimensions of each tree from Lizarralde's (2008) crown equations

1
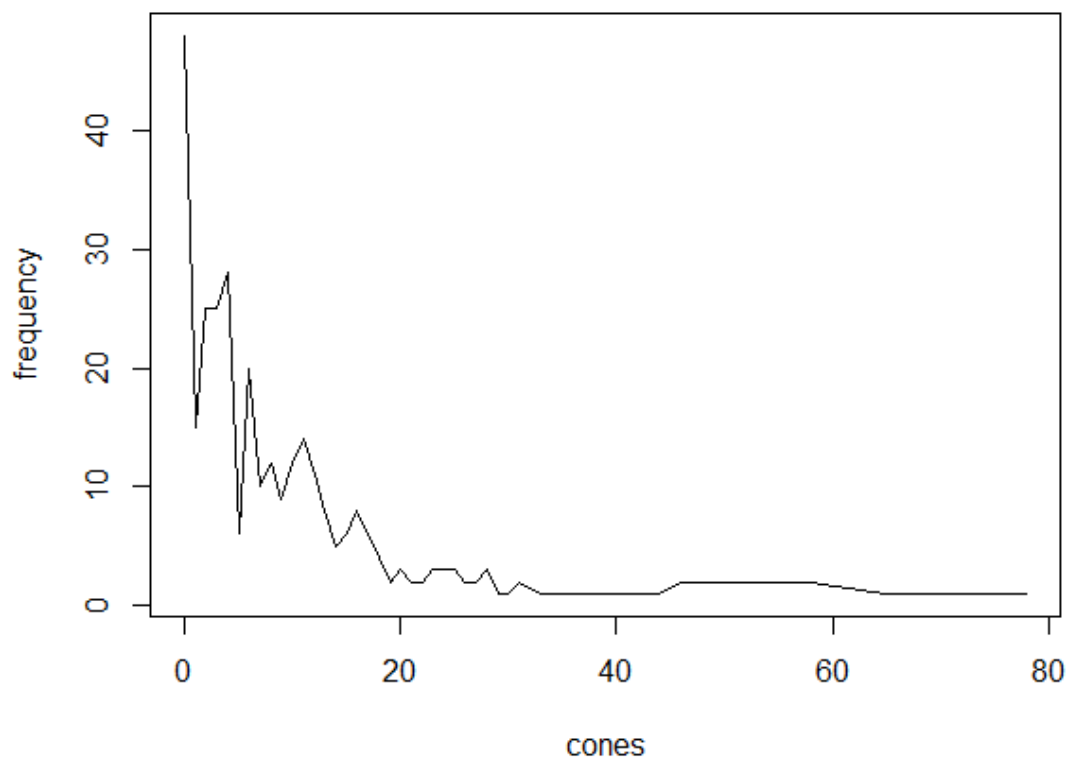
Figure S2. Cone count frequency for 113 *Pinus pinaster* trees analyzed for climate and stand

structural effects.

4

5

1   **Table S1.** Individual crown dimension, radial growth, and growth efficiency variables tested

2   for marginal effects on the base model from hypothesis 1. Models in bold gave the lowest

3   AIC for each category and had all significant variables.

Model	AIC value	% AIC improvement of full model over basic model
Crown variable		
CP	2658	3.10
CR	2654	3.25
CL	**2621**	**4.45**
CSA	2673	2.55
CSA_A	2698	1.64
LAI_s	2629	4.16
Previous growth		
$Growth_0$	**2726**	**0.62**
$Growth_1$	2727	0.58
$Growth_2$	2739	0.15
$Growth_3$	2744	-0.04
Growth efficiency		
Based on CP		
EFI_CP_0	2729	0.51
EFI_CP_1	2717	0.95
EFI_CP_2	2734	0.33
EFI_CP_3	2739	0.15
Based on CSA		
EFI_CSA_0	2722	0.77
EFI_CSA_1	2707	1.31
EFI_CSA_2	2758	-0.55
EFI_CSA_3	2735	0.29
Based on LAI		
$EFI\_LAI_{s\_0}$	**2715**	**1.02**
$EFI\_LAI_{s\_1}$	2719	0.88
$EFI\_LAI_{s\_2}$	2734	0.33
$EFI\_LAI_{s\_3}$	2741	0.07

4