

Extended Data Table 1 | Dominant ring- and diffuse-porous species at the Smithsonian Conservation Biology Institute (SCBI) and Harvard Forest, along with sample sizes included in this analysis.

	species	dendrometer bands		tree cores	
		n trees	n tree-years	n cores	date range
<b>SCBI</b>					
ring-porous	<i>Carya cordiformis</i>	0	0	18	1917-2009
	<i>Carya glabra</i>	0	0	39	1901-2009
	<i>Carya ovalis</i>	0	0	24	1896-2009
	<i>Carya tomentosa</i>	0	0	17	1926-2009
	<i>Fraxinus nigra</i>	0	0	16	1901-2016
	<i>Fraxinus americana</i>	0	0	69	1910-2009
	<i>Quercus alba</i>	34	197	66	1904-2009
	<i>Quercus montana</i>	0	0	67	1893-2009
	<i>Quercus rubra</i>	35	229	71	1870-2009
	<i>Quercus velutina</i>	0	0	83	1902-2009
diffuse-porous	<i>Fagus grandifolia</i>	13	89	81	1932-2009
	<i>Liriodendron tulipifera</i>	41	354	109	1920-2009
<b>Harvard Forest</b>					
ring-porous	<i>Fraxinus americana</i>	9	27	34	1901-2008
	<i>Quercus alba</i>	118	575	179	1901-2014
	<i>Quercus velutina</i>	11	50	0	
diffuse-porous	<i>Fagus grandifolia</i>	8	45	0	
	<i>Betula lenta</i>	8	44	0	
	<i>Betula populifolia</i>	5	24	0	
	<i>Betula papyrifera</i>	3	13	0	
	<i>Betula alleghaniensis</i>	21	90	44	1952-2013
	<i>Prunus serotina</i>	9	37	0	
	<i>Acer rubrum</i>	144	669	59	1930-2014
	<i>Acer pensylvanicum</i>	4	16	0	

Extended Data Table 2 | Summary of parameters describing the phenology and temperature sensitivity of ring- and diffuse-porous species groups at the Smithsonian Conservation Biology Institute (SCBI) and Harvard Forest.

	SCBI		Harvard Forest	
	ring-porous	diffuse-porous	ring-porous	diffuse-porous
critical $T_{max}$ window	3/22-4/9	2/19-5/21	4/2-5/7	3/19-5/7
<b>Stem Growth</b>				
$DOY_{25}$	123 (May 4)	154 (June 4)	132 (May 15)	164 (June 14)
$DOY_{50}$	152 (June 2)	172 (June 22)	159 (June 9)	182 (July 2)
$DOY_{75}$	180 (June 30)	190 (July 9)	186 (July 6)	199 (July 19)
$DOY_{g_{max}}$	152 (June 2)	173 (June 23)	161 (June 11)	183 (July 3)
$g_{max}$ (mm/day)	0.046	0.061	0.03	0.025
$L_{pgs}$	56.5	35.8	54.5	35.1
$\Delta DBH$ (mm/yr)	4.7	3.6	3.1	1.4
<b>Canopy Foliage (ecosystem level)</b>				
Greenup	101 (April 11)		115 (April 25)	
Mid-greenup	120 (April 30)		137 (May 17)	
Peak	173 (June 22)		182 (July 1)	
Senescence	215 (Aug. 3)		218 (Aug. 6)	
<b>Phenological temperature sensitivity* (days/<math>^{\circ}\text{C}</math>)</b>				
Stem growth:				
$DOY_{25}$	1.9	3.5	2.8	7.9
$DOY_{50}$	1.5	3.5	5.0	7.3
$DOY_{75}$	1.1	3.6	7.2	6.6
$DOY_{g_{max}}$				
Canopy foliage:				
Greenup	4.5		2.4	
Mid-greenup				
Peak				
Senescence				

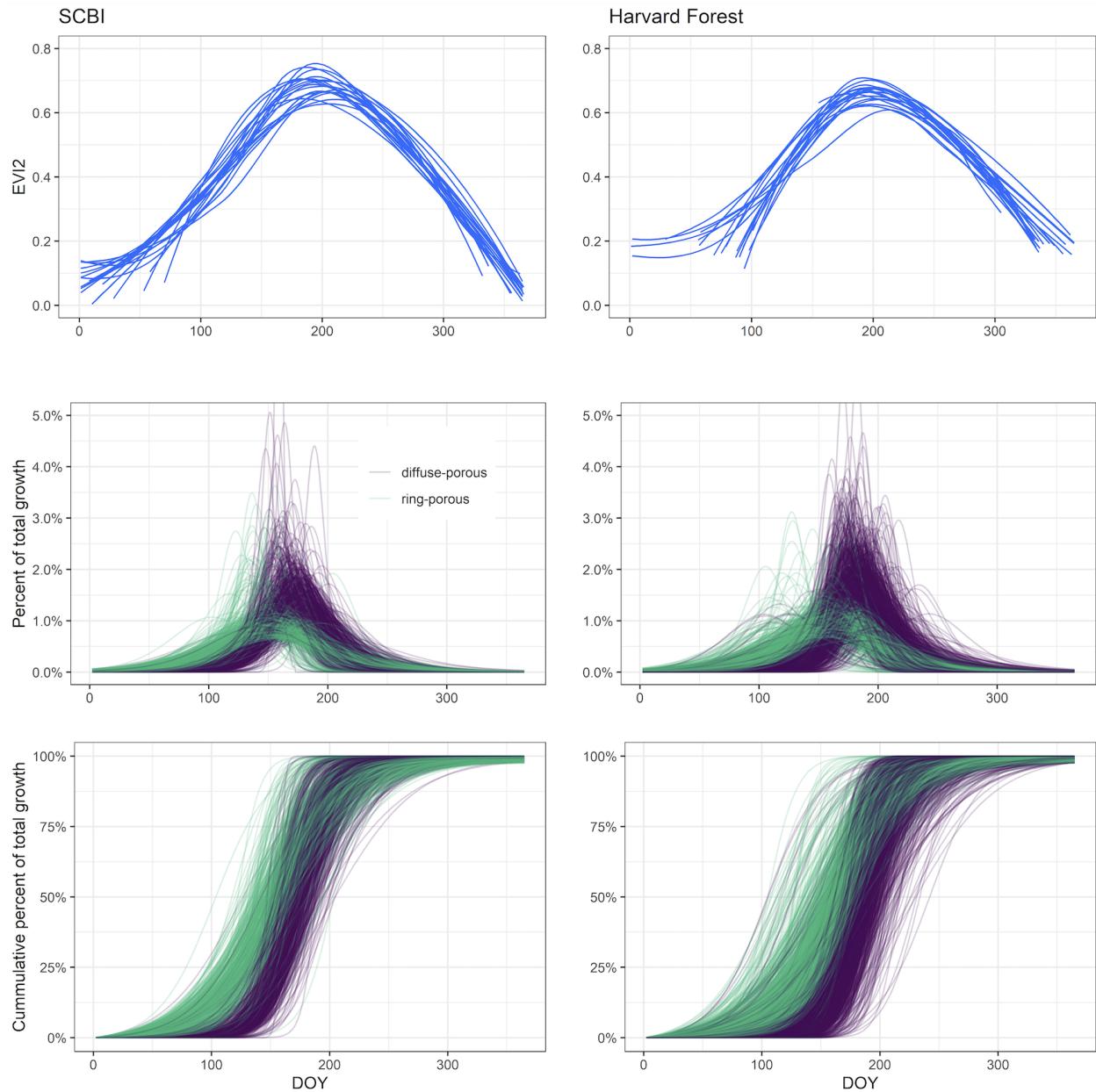
\*Phenological temperature sensitivity refers to the sensitivity of a parameter to the mean maximum temperature ( $T_{max}$ ) during the critical temperature window (Fig. 1).

Extended Data Table 3 | Summary of tree-ring chronologies analyzed and number of significant (at p=0.05) positive or negative correlations of ring width index to monthly  $T_{max}$  in univariate and multivariate analyses.

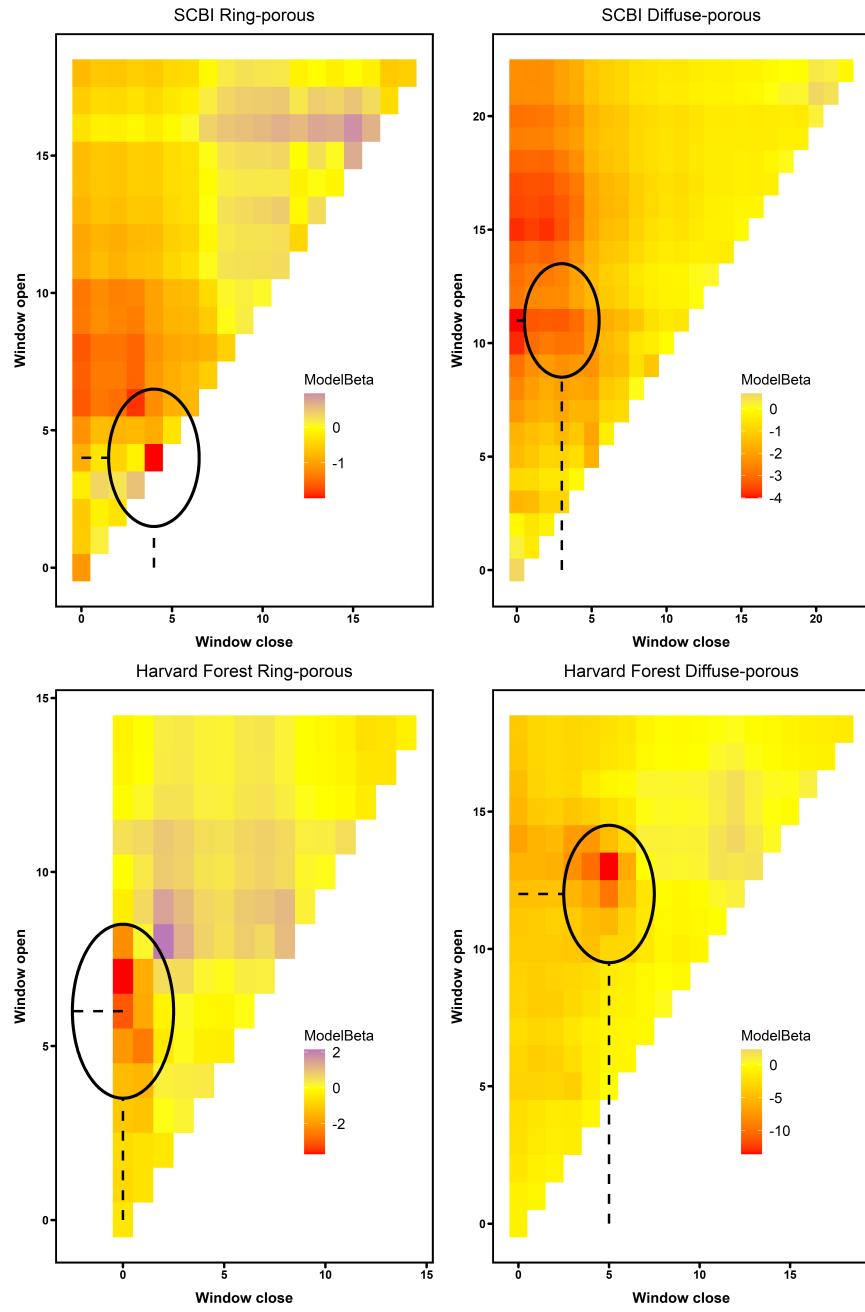
species	n	n. correlations to monthly mean max. T significant at p=0.05													
		univariate analysis										multivariate analysis			
		April		May		June		July		Aug		April		June-July	
		+	-	+	-	+	-	+	-	+	-	+	-	+	-
<b>Ring-porous</b>															
<i>Carya cordiformis</i>	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1
<i>Carya glabra</i>	7	0	0	0	3	0	5	0	5	0	0	0	0	0	5
<i>Carya ovalis</i>	1	1	0	0	1	0	0	0	0	0	1	0	0	0	0
<i>Carya ovata</i>	21	0	0	0	5	0	20	0	17	0	12	2	0	0	20
<i>Carya tomentosa</i>	2	0	0	0	1	0	2	0	0	0	2	0	0	0	1
<i>Fraxinus americana</i>	5	0	0	0	4	0	3	0	2	1	0	0	0	0	3
<i>Fraxinus nigra</i>	2	0	0	0	0	0	1	0	1	0	1	0	0	0	1
<i>Quercus alba</i>	36	0	4	0	18	0	31	0	30	0	24	0	2	0	33
<i>Quercus macrocarpa</i>	1	0	0	0	0	0	1	0	1	0	1	0	0	0	1
<i>Quercus mongolica</i>	16	0	2	1	3	0	10	0	9	0	3	1	2	0	11
<i>Quercus montana</i>	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
<i>Quercus pagoda</i>	1	0	0	0	1	0	1	0	1	0	1	0	0	0	1
<i>Quercus rubra</i>	37	0	2	1	4	0	25	0	18	1	5	1	1	0	22
<i>Quercus stellata</i>	3	0	0	0	1	0	2	0	1	0	0	0	0	0	2
<i>Quercus velutina</i>	7	0	0	0	2	0	5	0	6	0	3	0	0	0	7
<b>TOTAL</b>	<b>141</b>	<b>1</b>	<b>8</b>	<b>2</b>	<b>45</b>	<b>0</b>	<b>107</b>	<b>0</b>	<b>91</b>	<b>2</b>	<b>53</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>108</b>
<b>Diffuse-porous</b>															
<i>Acer rubrum</i>	4	0	1	0	0	0	1	0	1	0	0	0	1	0	3
<i>Acer saccharum</i>	16	1	0	0	2	0	14	0	12	0	6	3	0	0	14
<i>Betula alleghaniensis</i>	2	0	0	0	0	0	2	0	0	0	0	0	0	0	1
<i>Betula lenta</i>	3	0	0	0	1	0	1	0	1	0	0	0	0	0	2
<i>Fagus grandifolia</i>	6	1	0	0	0	0	4	0	5	0	1	1	0	0	5
<i>Liriodendron tulipifera</i>	32	2	1	0	7	0	30	0	17	0	16	1	0	0	27
<i>Magnolia acuminata</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Nyssa sylvatica</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Populus grandidentata</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>66</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>52</b>	<b>0</b>	<b>36</b>	<b>0</b>	<b>23</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>52</b>
<b>TOTAL</b>	<b>207</b>	<b>5</b>	<b>10</b>	<b>2</b>	<b>55</b>	<b>0</b>	<b>159</b>	<b>0</b>	<b>127</b>	<b>2</b>	<b>76</b>	<b>9</b>	<b>6</b>	<b>0</b>	<b>160</b>



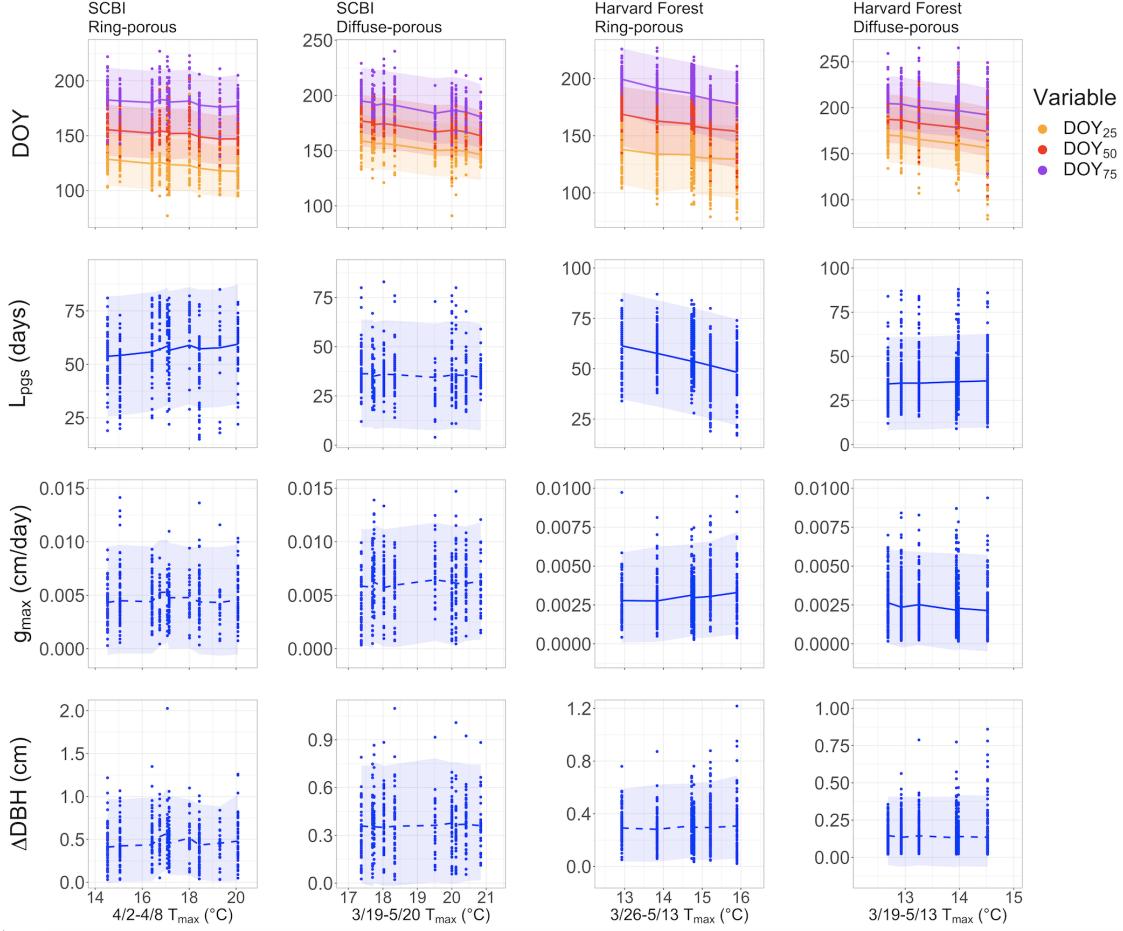
**Extended Data Figure 1 | Map of sampling locations of tree-ring chronologies analyzed in this study.** Sites are colored by the xylem porosity type of species sampled: ring porous (RP), diffuse porous (DP), or both. Sampling details are provided in **SI TABLE NAME**



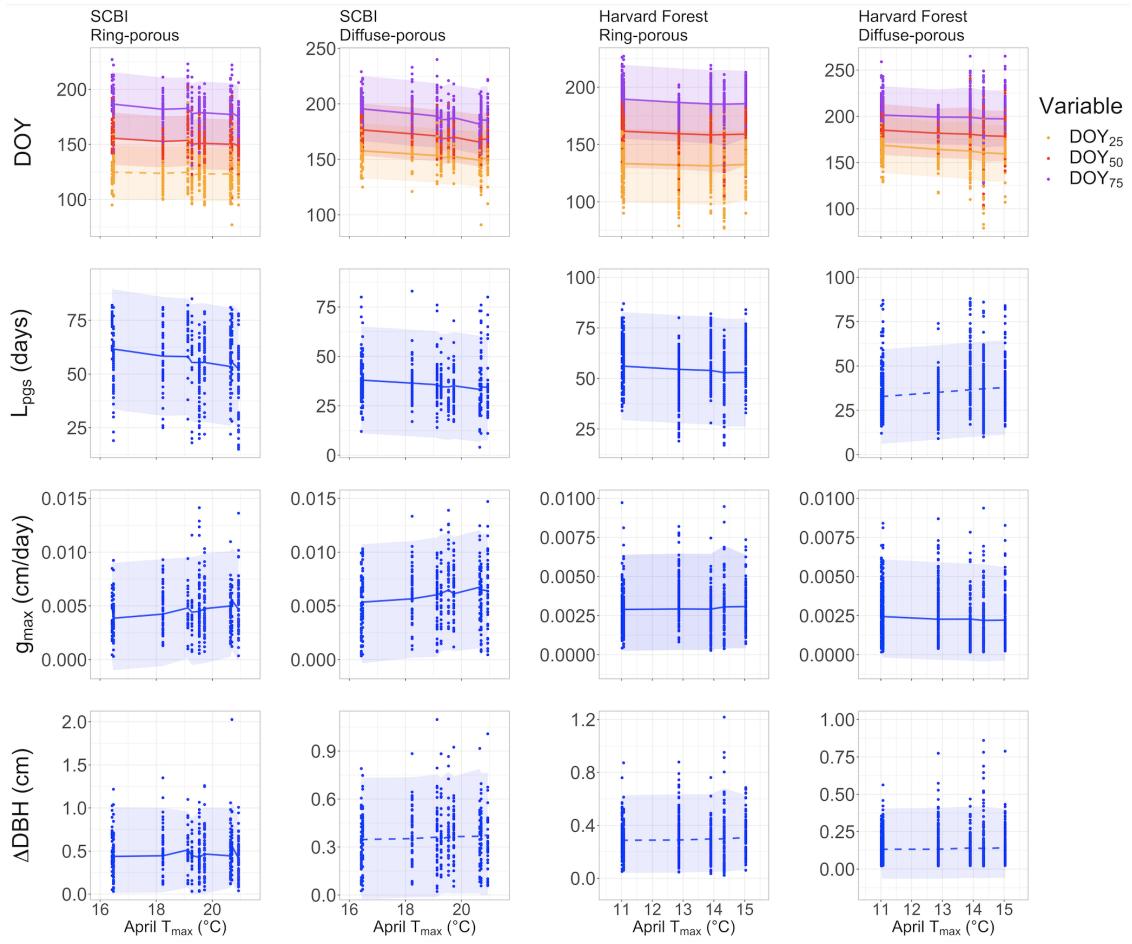
**Extended Data Figure 2 | Phenological patterns of forest canopy greenness (top row) and stem growth of ring- and diffuse-porous trees, represented as both relative and cumulative fractions of total annual growth (middle and bottom rows, respectively), at our two focal study sites** In the top row, canopy greenness is characterized using the two band Enhanced Vegetation Index (EVI2) . . . , with each line representing a year between 2000 and 2018. For stem growth, each line represents one year's growth for a given tree, fit with McMahon model.



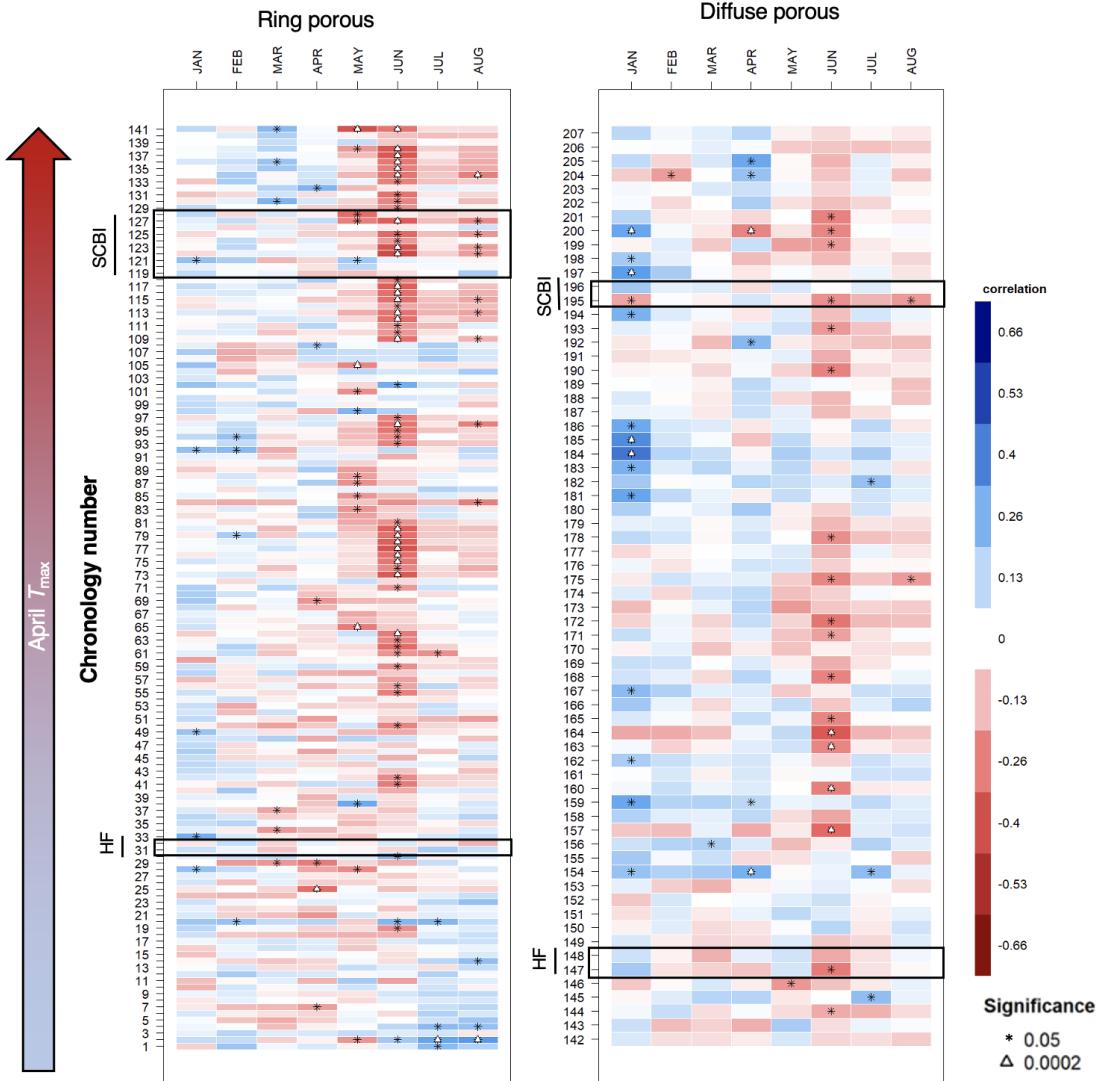
**Extended Data Figure 3 | Landscapes of relationships between the day of year on which 25% of annual growth is achieved ( $DOY_{25}$ ) and temperature in prior weeks for ring- and diffuse-porous trees at SCBI and Harvard Forest.** Shown are matrices of linear coefficients of first-order linear regressions between temperature and  $DOY_{25}$ , where Window Open and Window Close indicate number of weeks prior to  $DOY_{25}$  (ring-porous: May 5 at SCBI, May 13 at HF; diffuse-porous: June 4 at SCBI, June 14 at HF). Black circles indicate the critical  $T_{max}$  window (ring-porous: March 22- April 9 at SCBI, April 2 - May 07 at HF; diffuse-porous: Feb. 19- May 21 at SCBI, March 19 - May 07 at HF).



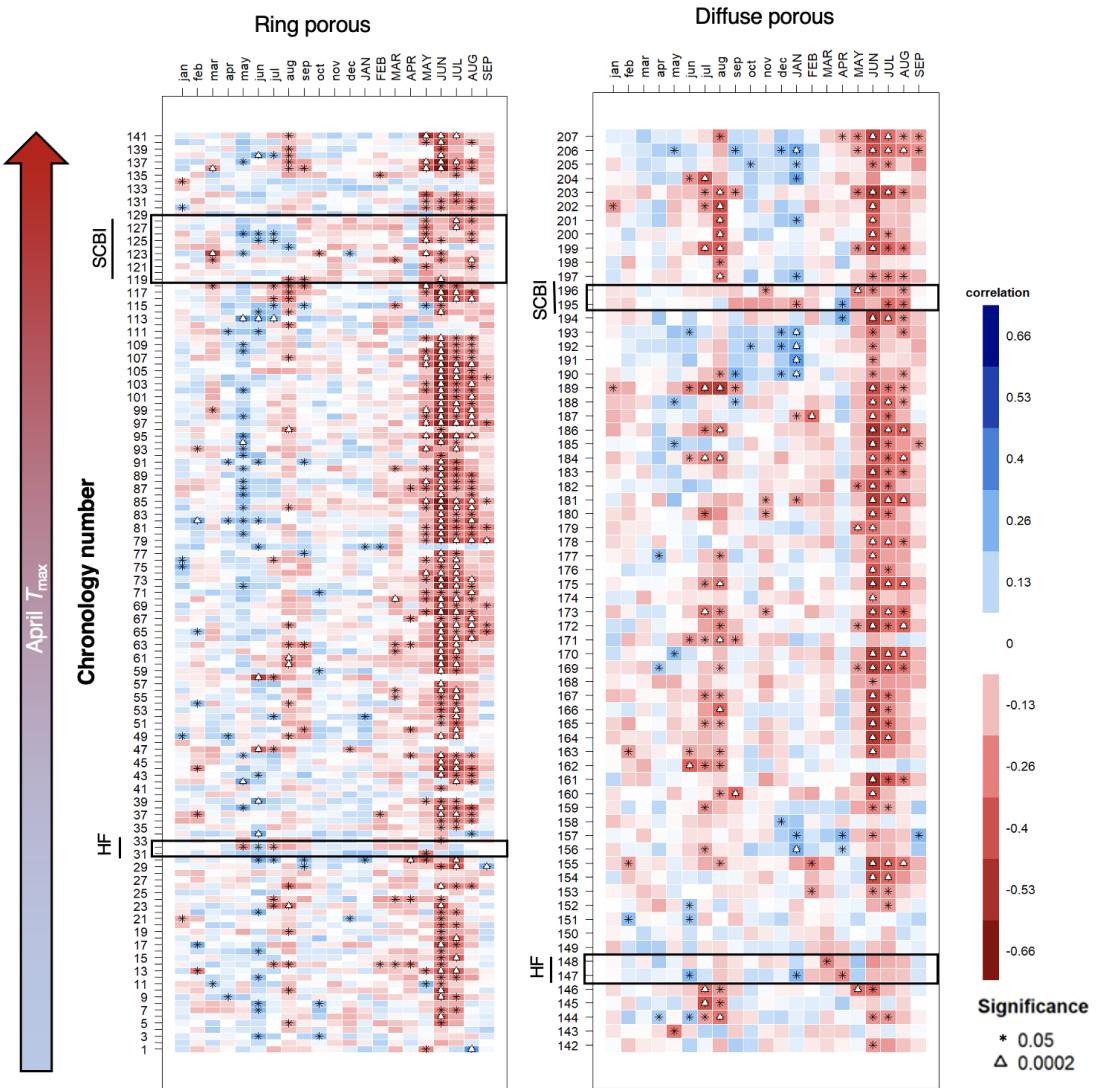
**Extended Data Figure 4 | Response of the timing of stem growth phenology to spring temperatures.** Relationships between critical temperature window (CTW)  $T_{max}$  and 25%, 50%, and 75% total stem growth (first row), the length of the peak growing season ( $L_{pgs}$ ; second row), maximum growth rate ( $g_{max}$ ; third row), and total seasonal radial stem growth ( $\Delta DBH$ ; fourth row) are shown. Posterior predictions of each variable that did not include zero are represented with solid lines, while those that do include zero use dotted lines. 95% credible intervals are represented by bands. The days of year on which 25%, 50% and 75% of annual growth were achieved (DOY<sub>25</sub>, DOY<sub>50</sub>, and DOY<sub>75</sub>, respectively) declined significantly with mean  $T_{max}$  during their respective CTW. For each CTW  $T_{max}$ . Modeled values from dendrometer band measurements are represented by dots.



\*\*Extended Data Figure 5 | Relationship between growth parameters and mean maximum temperature in April (SCBI) or May (HF). Relationships between critical temperature window (CTW)  $T_{max}$  and 25%, 50%, and 75% total stem growth (first row), the length of the peak growing season ( $L_{pgs}$ ; second row), maximum growth rate ( $g_{max}$ ; third row), and total seasonal radial stem growth ( $\Delta DBH$ ; fourth row) are shown. Posterior predictions of each variable that did not include zero are represented with solid lines, while those that do include zero use dotted lines. 95% credible intervals are represented by bands.



Extended Data Figure 6 | Sensitivity of annual growth, as derived from tree-rings, to monthly minimum temperatures of the current year for 208 chronologies from 114 sites across eastern North America (Extended Data Figure 1). Chronologies are grouped by xylem porosity and ordered by mean April  $T_{\max}$ . Chronology details are given in SI Table 1.



Extended Data Figure 7 | Sensitivity of annual growth, as derived from tree-rings, to monthly maximum temperatures of the current and past year for 208 chronologies from 114 sites across eastern North America (Extended Data Figure 1). Chronologies are grouped by xylem porosity and ordered by mean April  $T_{\max}$ . Chronology details are given in SI Table 1.