

**Table S1** Agreement of year-to-year changes in ring width series of *Alnus alnobetula* among study plots. Percentage of sign agreement ( $W$ , “Gleichläufigkeit” [51]), correlation coefficient ( $t$  [52]) and number of overlapping years ( $n$ ) are shown in the sequence  $W / t / n$ . \*\*\* =  $P < 0.001$ ; \*\* =  $P < 0.01$ ; \* =  $P < 0.05$

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Plot 1	-	77**/1.0/23	54/0.5/27	54/1.3/14	81**/0.8/17	89***/3.0/19	71*/3.1/22	59/0.9/33
Plot 2	77**/1.0/23	-	43/0/24	50/2.6/15	59/0.8/18	79**/1.8/20	55/0.3/23	57/0.2/24
Plot 3	54/0.5/27	43/0/24	-	93***/5.5/15	65/1.9/18	68*/3.7/20	55/2.1/23	70*/4.1/28
Plot 4	54/1.3/14	50/2.6/15	93***/5.5/15	-	50/1.0/15	71*/4.4/15	50/1.6/15	86**/2.8/15
Plot 5	81**/0.8/17	59/0.8/18	65/1.9/18	50/1.0/15	-	82**/1.3/18	82**/0.9/18	59/0.5/18
Plot 6	89***/3.0/19	79**/1.8/20	68*/3.7/20	71*/4.4/15	82**/1.3/18	-	68*/4.1/20	74*/2.8/20
Plot 7	71*/3.1/22	55/0.3/23	55/2.1/23	50/1.6/15	82**/0.9/18	68*/4.1/20	-	54/2.8/25
Plot 8	59/0.9/33	57/0.2/24	70*/4.1/28	86**/2.8/15	59/0.5/18	74*/2.8/20	54/2.8/25	-

**Table S2** Anomalies in January precipitation and summer (June through August) air temperatures in extreme growth years (see Fig. 2c) of *Alnus alnobetula* with respect to the long-term mean (GrDev = growth deviation in units of standard deviation (SD); LTM = long-term mean during 1991–2020).

Year	GrDev	January precipitation		Summer air temperature (°C)		
	SD	mm	%	T <sub>mean</sub>	T <sub>max</sub>	T <sub>min</sub>
2003	+2.4	+17	+39	+2.8	+3.0	+2.6
2012	+3.2	+45	+102	+0.8	+0.9	+0.6
2015	+1.3	+11	+26	+1.8	+2.0	+1.6
2016	-1.9	+1	+3	+0.2	+0.3	+0.2
2020	-1.8	-31	-69	+0.1	+0.2	±0
LTM	--	45	--	8.3	11.9	5.5