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3 **Figure S1:** Flowchart of study

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5 **Text S1: Sample method based on a greedy algorithm**

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We randomly sampled n samples (X_1, X_2, \dots, X_n) to fit by linear regression. If the P-value of the slope of the regression equation is greater than 0.05, this samples is selected. Otherwise reselect. Then we randomly sampled a point (X_{n+1}) to fit with (X_1, X_2, \dots, X_n). If the P-value of the slope of the regression equation is greater than 0.05, the number of total samples plus one. Otherwise, this random sample is discarded and the number of total sample grid cells is unchanged. If the number of total samples reaches the maximum, then stop and finish.

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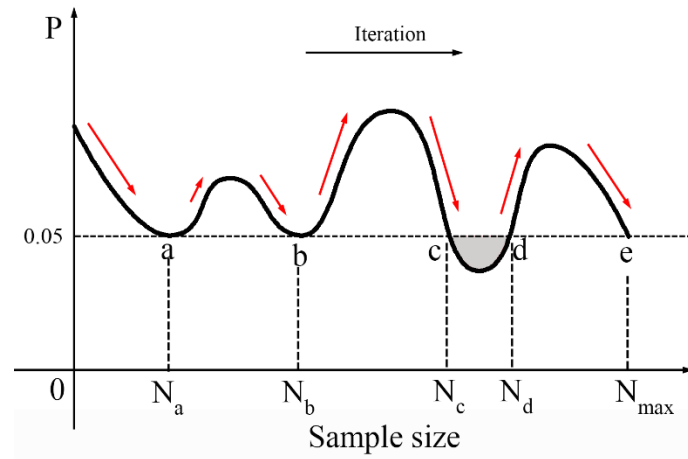


Figure S2: Schematic diagram of the sampling method. The samples in the interval $(0, N_a)$, (N_a, N_b) , (N_b, N_c) , (N_d, N_e) are suitable.

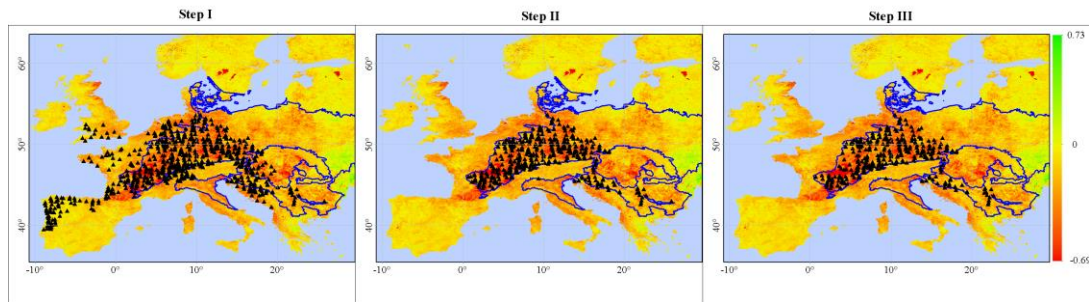


Figure S3: The spatial Distribution of samples after each sampling. This resulted in 1076, 453 and 397 samples for analysis in 2003

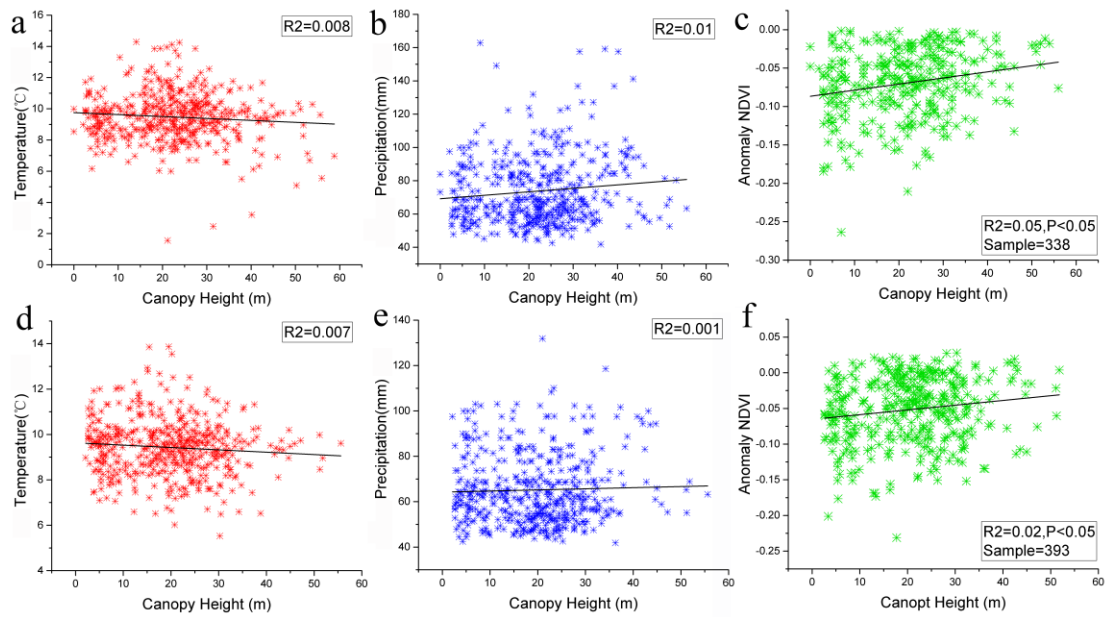


Figure S4: Correlation of tree height with annual average temperature (red scatter plot) and annual average precipitation (blue scatter plot) and NDVI anomalies (green scatter plot). a, b, c Scatter plot for 2003 Europe heatwave. d, e, f Scatter plot for 2018 Europe heatwave. The significance of correlation was calculated using a t-test with a significance level of 0.05.

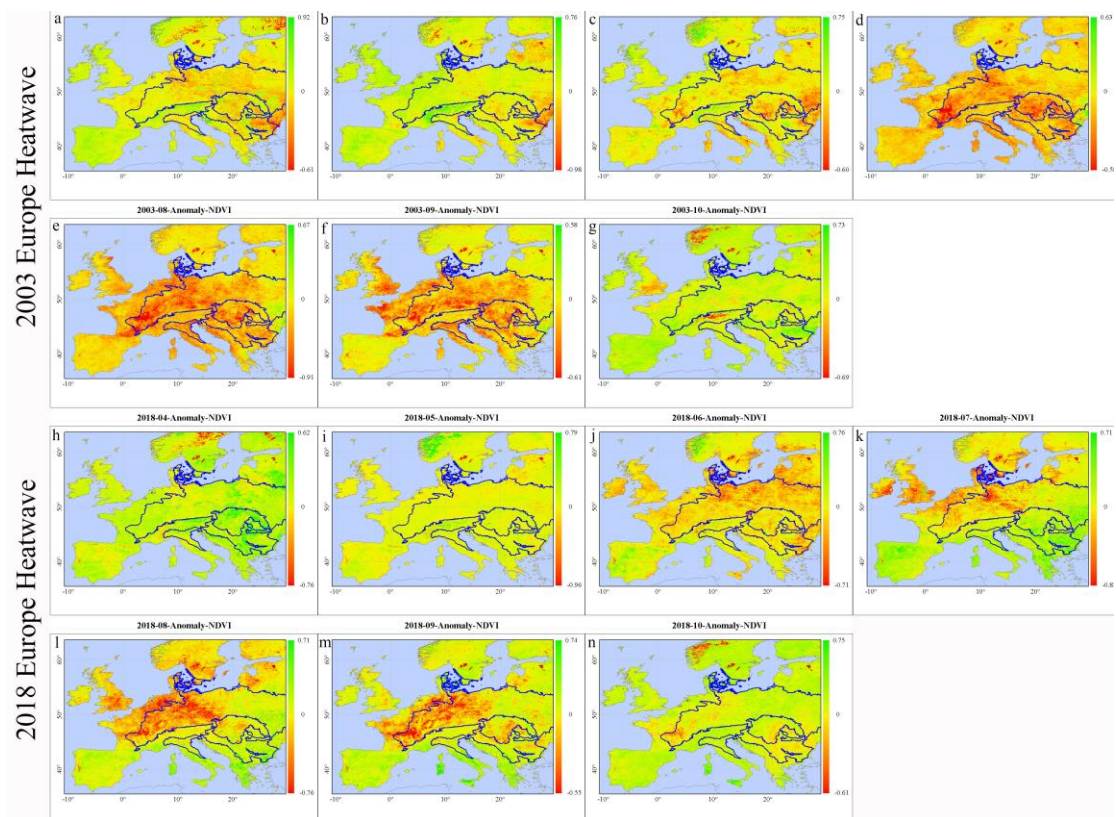


Figure S5: Anomalies in MODIS NDVI from April to October in 2003 and 2018. The anomalies are relative to the mean for that date over the period 2001–2018 excluding 2003 and 2018. Blue Box shows the European Environment Agency (EEA) biogeography regions .

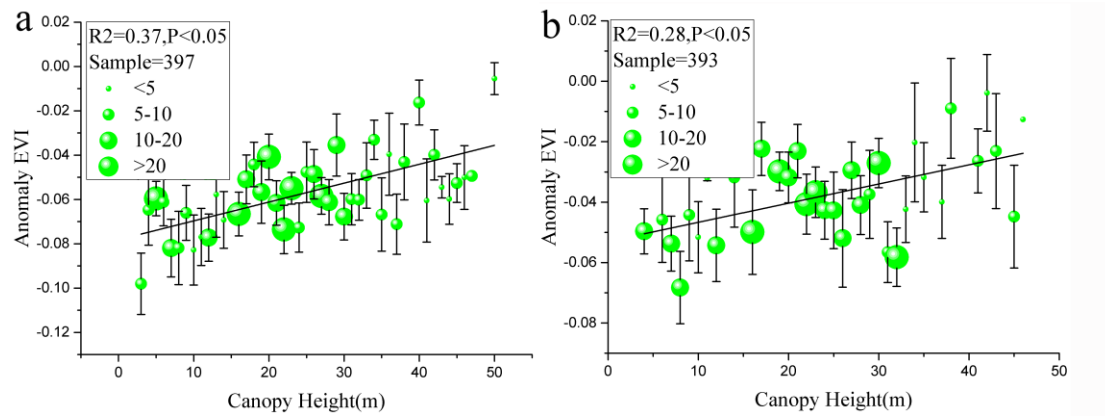


Figure S6: The relationship between anomaly EVI and tree height in 1m height classes for August 2003 and August 2018. The numbers of sample is 397 and 393, respectively. The green dot size reflects number of tree height site in 1m height classes. Error bars are standard deviations. The significance of correlation was calculated using a t-test with a significance level of 0.05. All correlations are significant at $P < 0.001$.

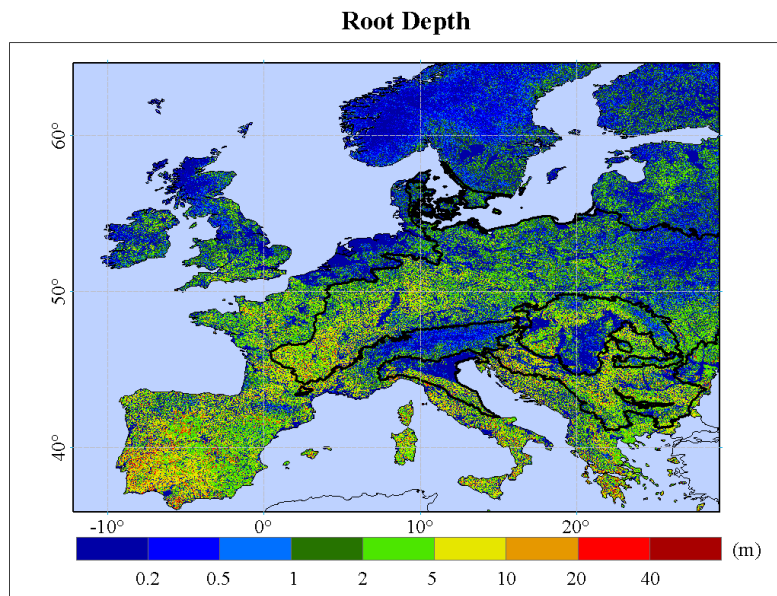


Figure S7: European maximum rooting depth dataset is provided by [Fan et al. \(2017\)](#).

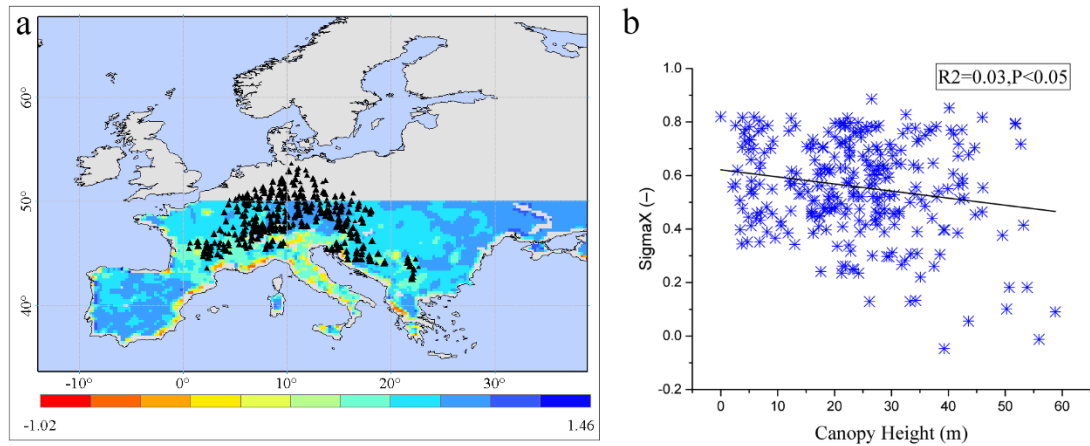


Figure S8: Europe variations in isohydricity and correlation of tree height with canopy characteristics and precipitation. The significance of correlation was calculated using a t-test with a significance level of 0.05.

Table S1: Average NDVI anomalies (%) of four height classes (<10m, 10-20m, 20-30m, >30m) time series in 2003 and 2018. Dark green box represents vegetation green-up, brown box represents vegetation browning, light green box represents vegetation recovery. Gray shaded regions shows the duration (April to October) of heatwave in 2003 and 2018.

Month Height		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	All	-3.1%	-7.8%	-2.9%	-4.9%	1.6%	0.6%	-2.8%	-6.6%	-5.5%	-1.1%	-5.4%	-0.3%
	<10m	-3.6%	-7.4%	-5.1%	-6.4%	1.3%	0.4%	-3.9%	-8.1%	-6.5%	-1.8%	-6.1%	-0.6%
	10-20m	-2.4%	-6.2%	-2.6%	-5.1%	1.1%	0.1%	-3.2%	-6.6%	-5.7%	-1.2%	-5.3%	-0.4%
	20-30m	-1.7%	-8.8%	-2.4%	-4.4%	1.5%	0.6%	-2.6%	-6.7%	-5.7%	-0.8%	-5.5%	-0.8%
	>30m	-5.3%	-8.1%	-2.3%	-4.2%	2.6%	1.2%	-1.9%	-5.1%	-4.0%	-0.8%	-4.6%	0.6%
2018	All	13.6%	8.0%	1.6%	1.1%	3.1%	-0.6%	-2.5%	-5.1%	-4.5%	-2.5%	1.2%	6.7%
	<10m	14.5%	9.5%	1.9%	-0.3%	2.3%	-1.1%	-3.4%	-6.6%	-5.7%	-3.4%	0.7%	7.3%
	10-20m	14.0%	9.0%	2.0%	1.1%	3.1%	-0.8%	-2.4%	-4.5%	-4.7%	-2.8%	1.3%	5.8%
	20-30m	12.9%	6.2%	1.2%	1.2%	3.5%	-0.2%	-2.3%	-4.7%	-3.9%	-1.9%	1.3%	6.6%
	>30m	13.2%	8.7%	1.3%	2.4%	3.2%	-0.3%	-2.1%	-4.9%	-4.2%	-2.1%	1.5%	7.6%

66 **Table S2: Average root depth (m) root depth distribution proportion of four height**
67 **classes (<10m, 10-20m, 20-30m, >30m) in four soil layers in 2003 and 2018** (covering
68 depths of 0–7, 7–28, 28–100, and 100–289 cm). Gray gradient shows the change of
69 root depth and the proportion of root in different soil depth.

	Canopy height Classes	Root Depth			
		Mean root depth(m)	Proportion(%)		
			<1m	1-2.89m	>2.89m
2003 Heatwave	<10m	2.4	47.4%	19.2%	33.3%
	10-20m	3.3	31.8%	17.6%	50.6%
	20-30m	4.1	22.0%	17.4%	60.6%
	>30m	4.2	14.4%	22.2%	63.3%
2018 Heatwave	<10m	2.5	41.0%	26.5%	32.5%
	10-20m	2.9	36.7%	23.5%	39.8%
	20-30m	3.2	24.1%	27.7%	48.2%
	>30m	3.1	23.4%	28.1%	48.4%

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90 **Reference:**

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