Supplement of Hydrol. Earth Syst. Sci., 28, 3037–3050, 2024
https://doi.org/10.5194/hess-28-3037-2024-supplement

Hydrology and Earth System Sciences
Open Access
EGU

Supplement of

Regional patterns and drivers of modelled water flows along environmental, functional, and stand structure gradients in Spanish forests

Jesús Sánchez-Dávila et al.

Correspondence to: Jesús Sánchez-Dávila (jesus.sanchez.davila0@gmail.com)

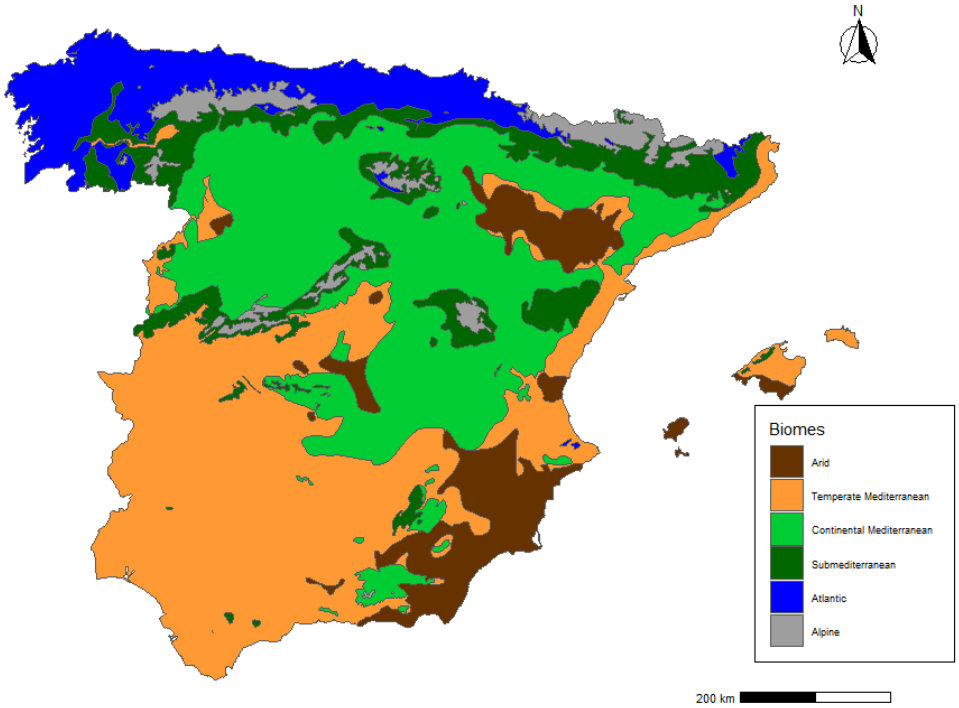

Figure S1. Climatic biomes in the Spanish Peninsula and Balearic Islands.

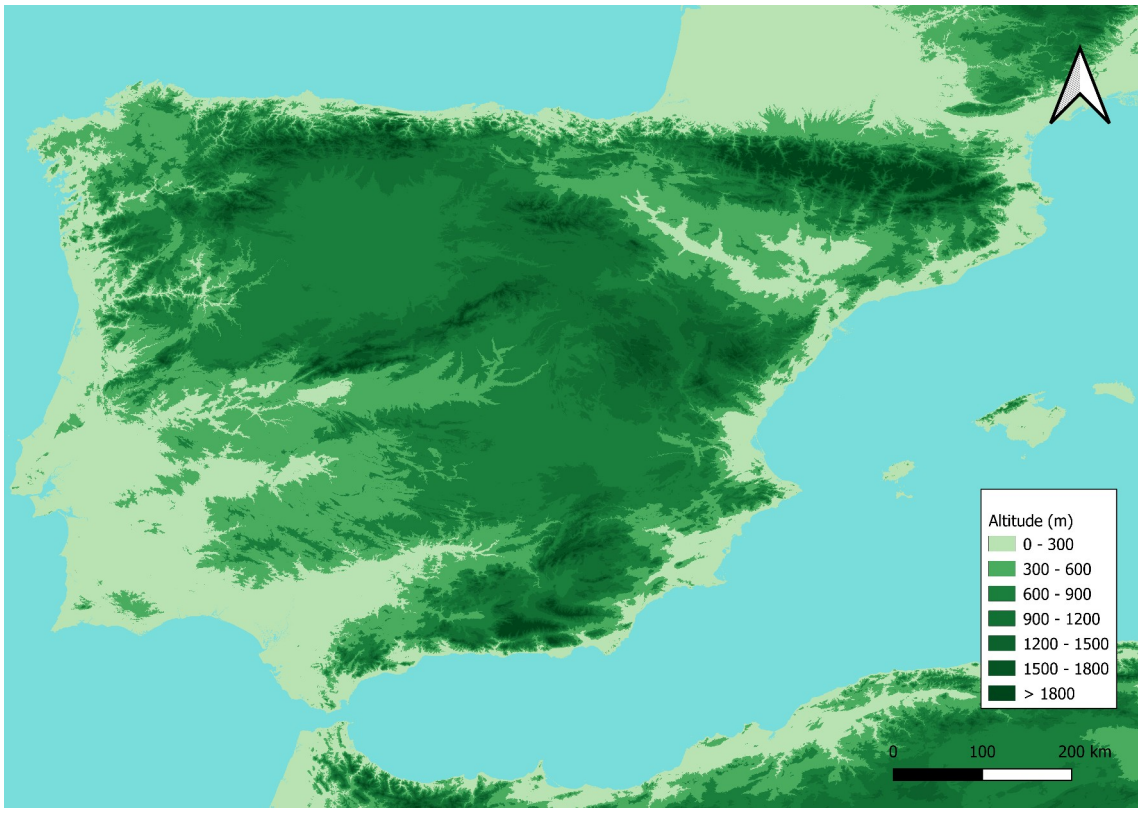

Figure S2. Altitude in the Iberian Peninsula and Balearic Islands.

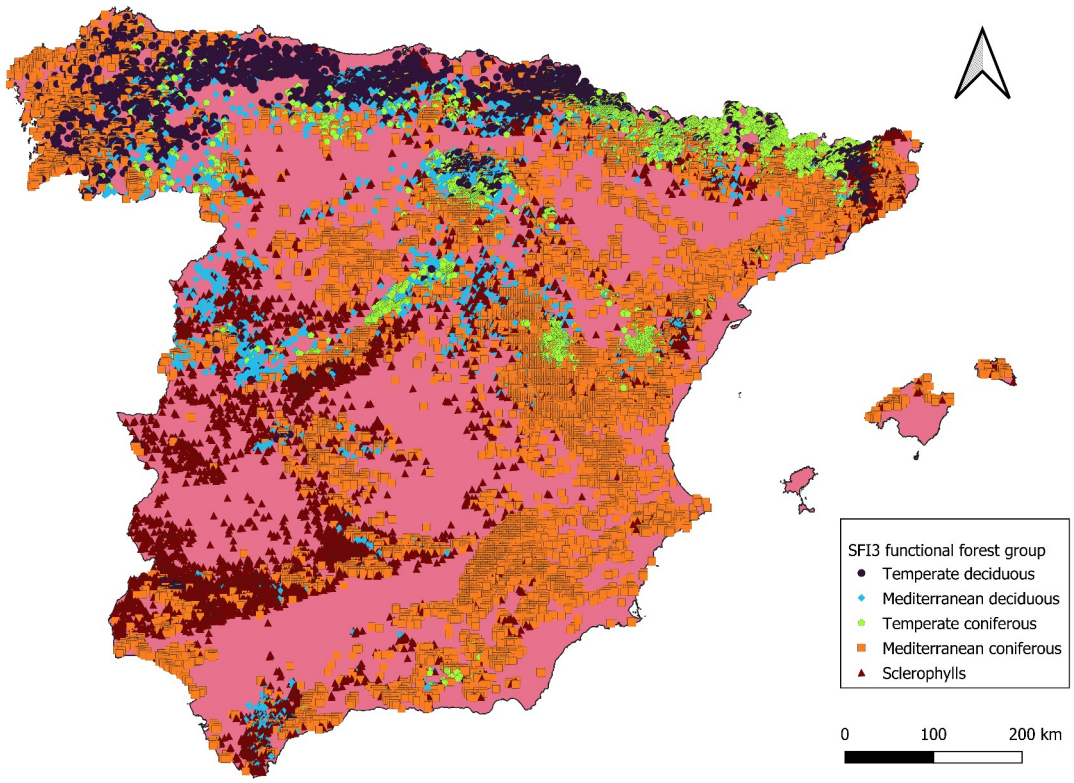

Figure S3. SFI3 plots by functional forest group

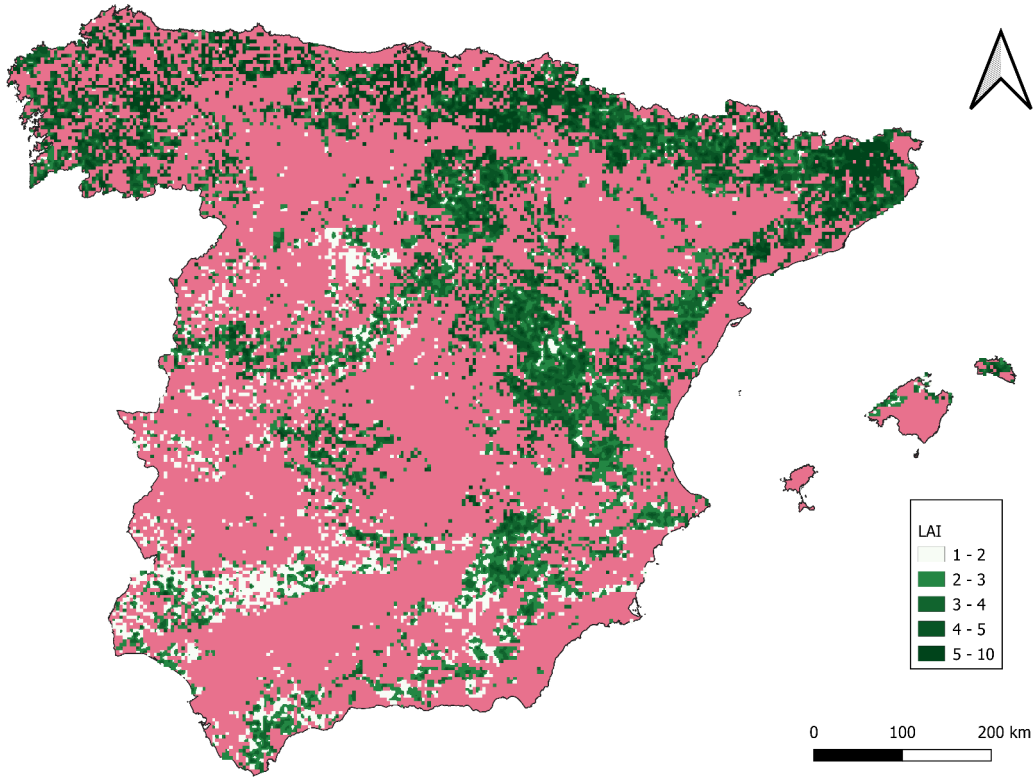

Figure S4. LAI of the Spanish Peninsula and Balearic Islands forest.

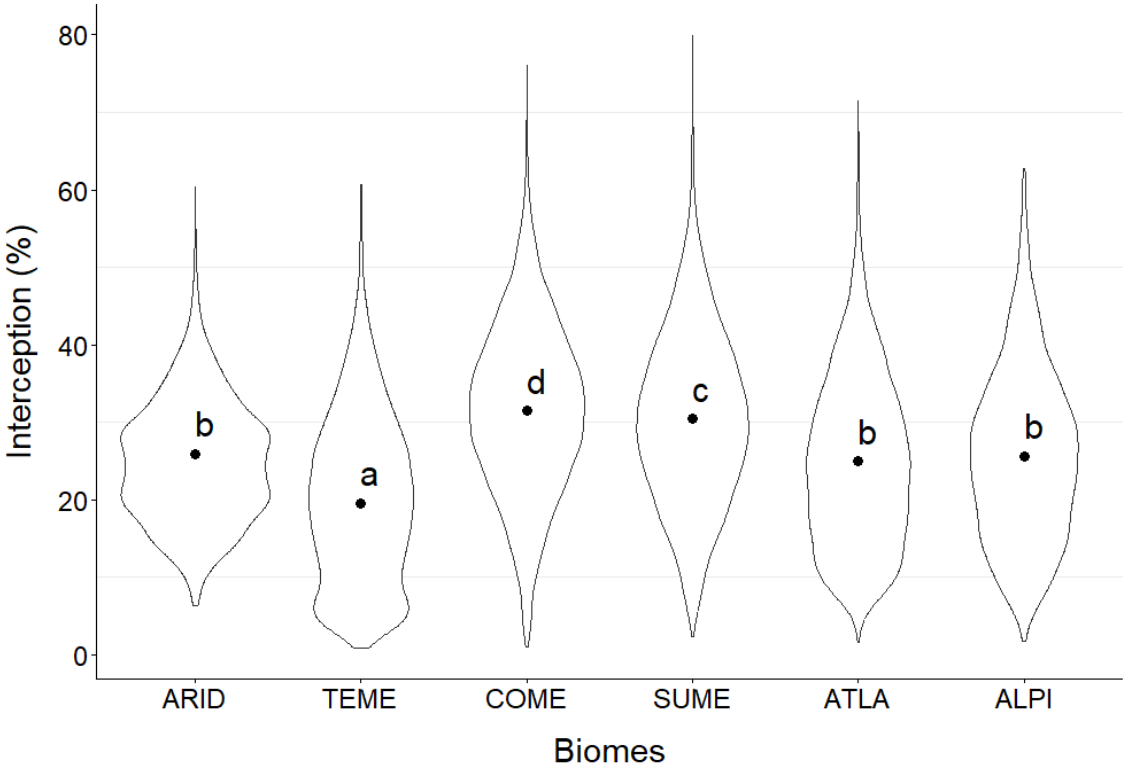

Figure S5. Percentage of interception in the different biomes. Different letters denote significant differences among biomes (*p* < 0.01) after Tukey's test. Abbreviations of the biomes: ARID, Arid; TEME, Temperate Mediterranean; COME, Continental Mediterranean; SUME, Submediterranean; ATLA, Atlantic; ALPI, Alpine.

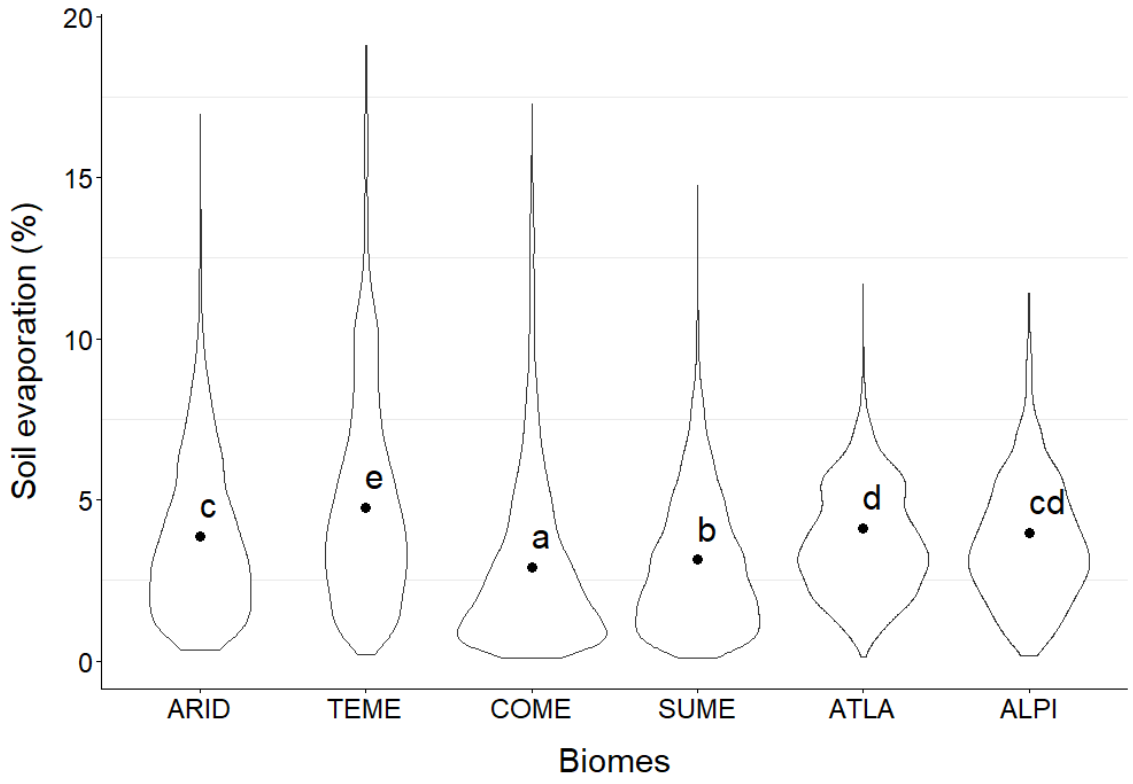

Figure S6. Percentage of soil evaporation in the different biomes. Different letters denote significant differences among biomes ($p < 0.01$) after Tukey's test. Abbreviations of the biomes: ARID, Arid; TEME, Temperate Mediterranean; COME, Continental Mediterranean; SUME, Submediterranean; ATLA, Atlantic; ALPI, Alpine.

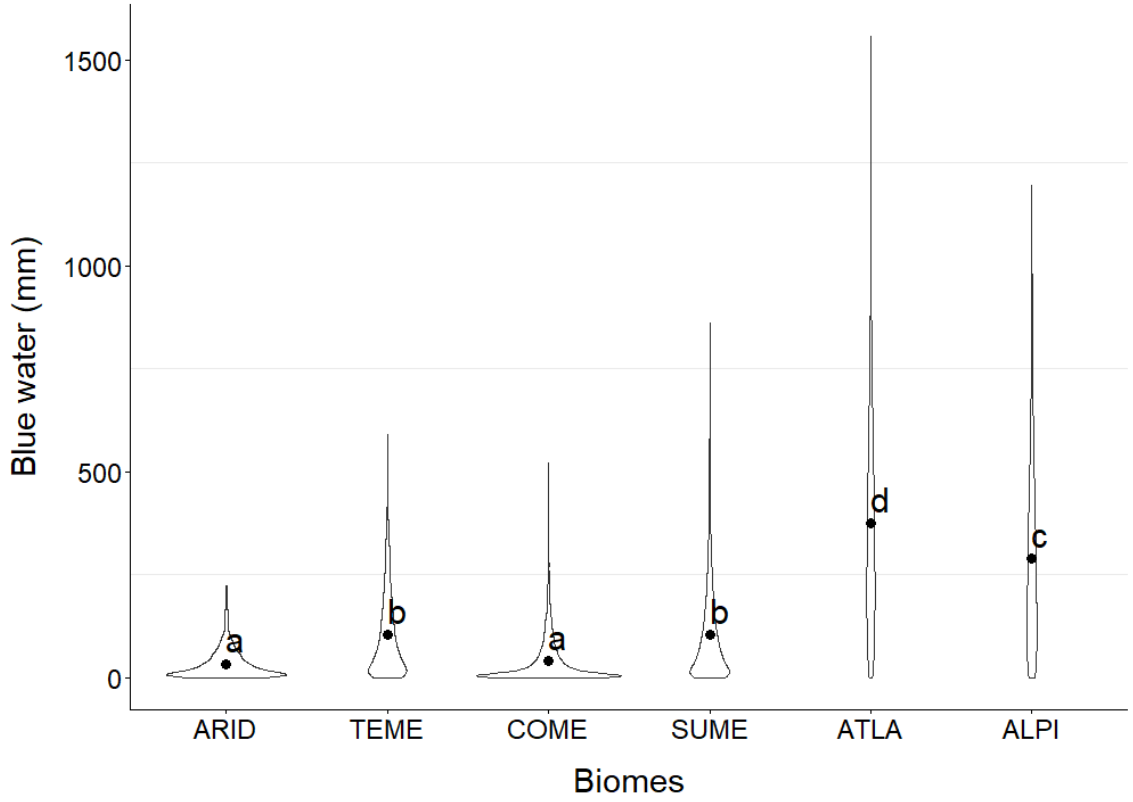

Figure S7. Blue water amount in the different biomes. Different letters denote significant differences among biomes ($p < 0.01$) after Tukey's test. Abbreviations of the biomes: ARID, Arid; TEME, Temperate Mediterranean; COME, Continental Mediterranean; SUME, Submediterranean; ATLA, Atlantic; ALPI, Alpine.

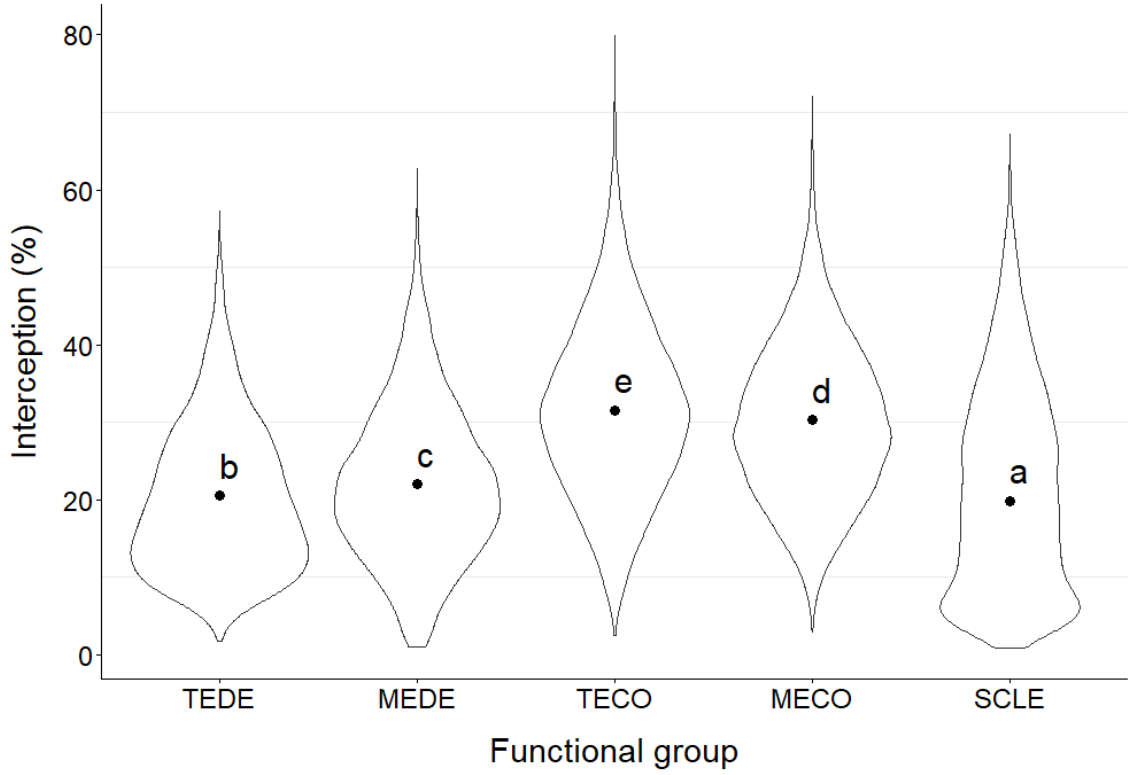

Figure S8. Percentage of interception of the different functional groups of species. Different letters denote significant differences among forest types ($p < 0.01$) after Tukey's test. Abbreviations of the functional groups: TEDE, Temperate deciduous; MEDE, Mediterranean deciduous; TECO, Temperate coniferous; MECO, Mediterranean coniferous; SCLE, sclerophylls.

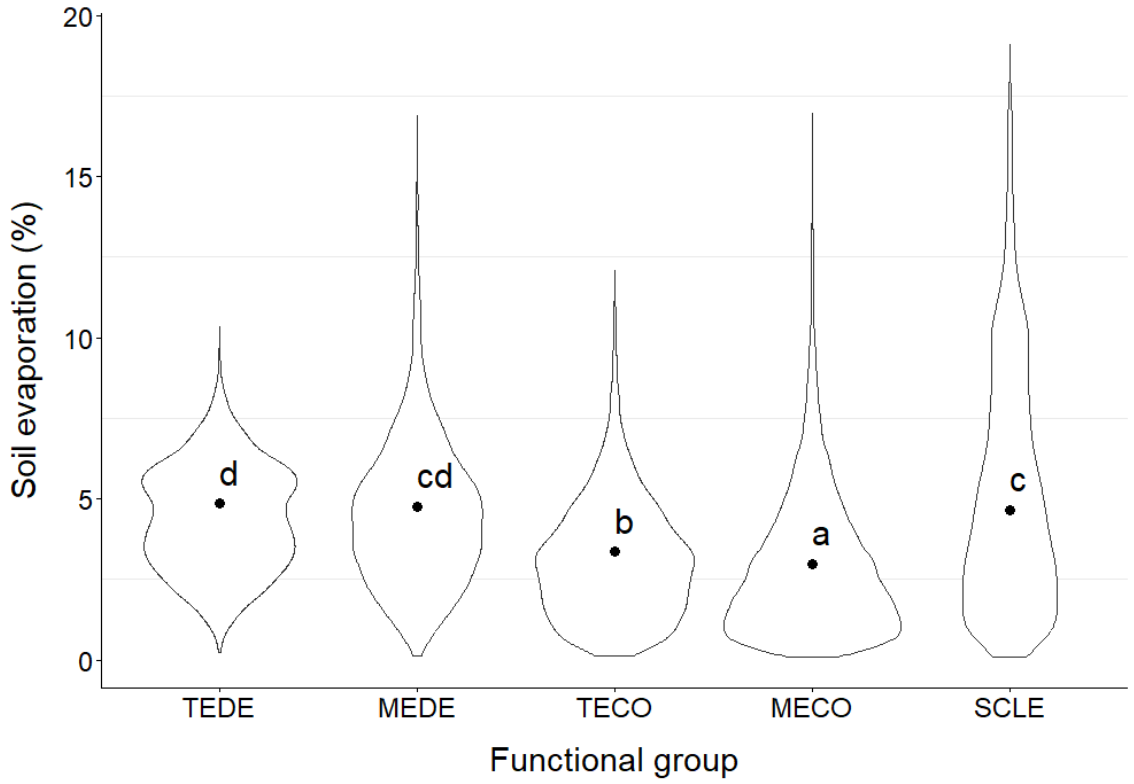

Figure S9. Percentage of soil evaporation of the different functional groups of species. Different letters denote significant differences among forest types ($p < 0.01$) after Tukey's test. Abbreviations of the functional groups: TEDE, Temperate deciduous; MEDE, Mediterranean deciduous; TECO, Temperate coniferous; MECO, Mediterranean coniferous; SCLE, sclerophylls.

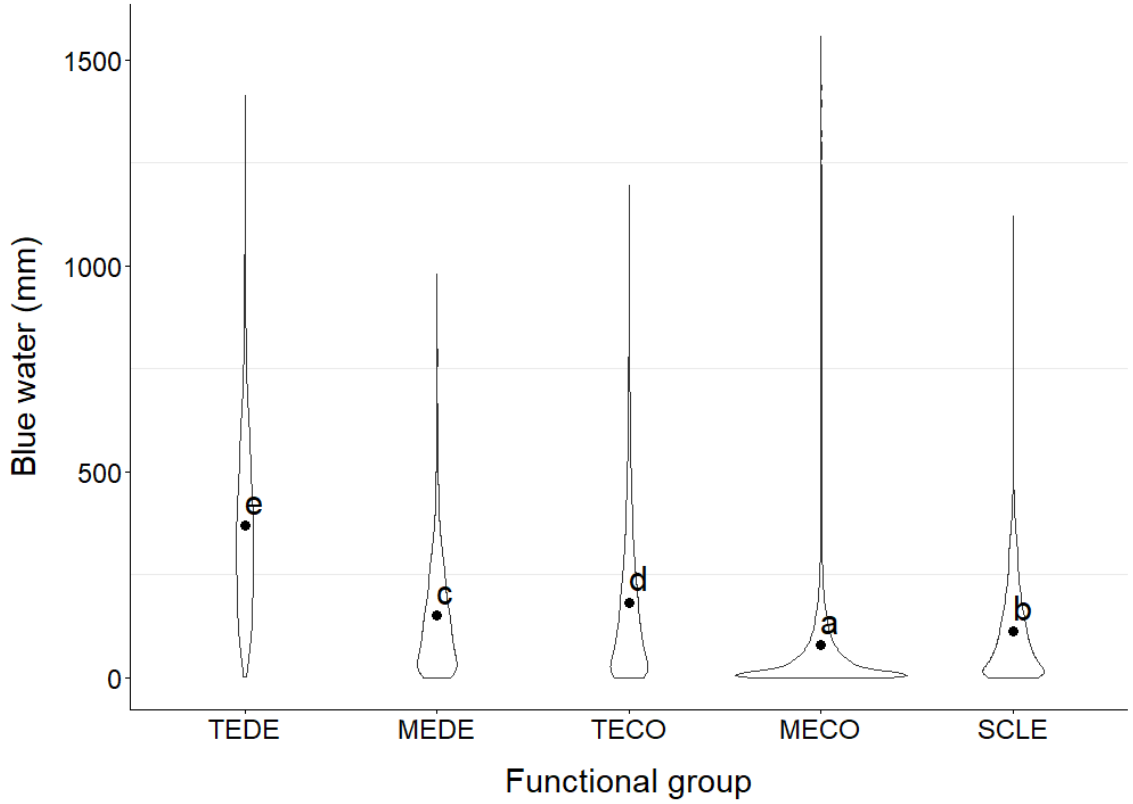

Figure S10. Blue water amount of the different functional groups of species. Different letters denote significant differences among forest types ($p < 0.01$) after Tukey's test. Abbreviations of the functional groups: TEDE, Temperate deciduous; MEDE, Mediterranean deciduous; TECO, Temperate coniferous; MECO, Mediterranean coniferous; SCLE, sclerophylls.

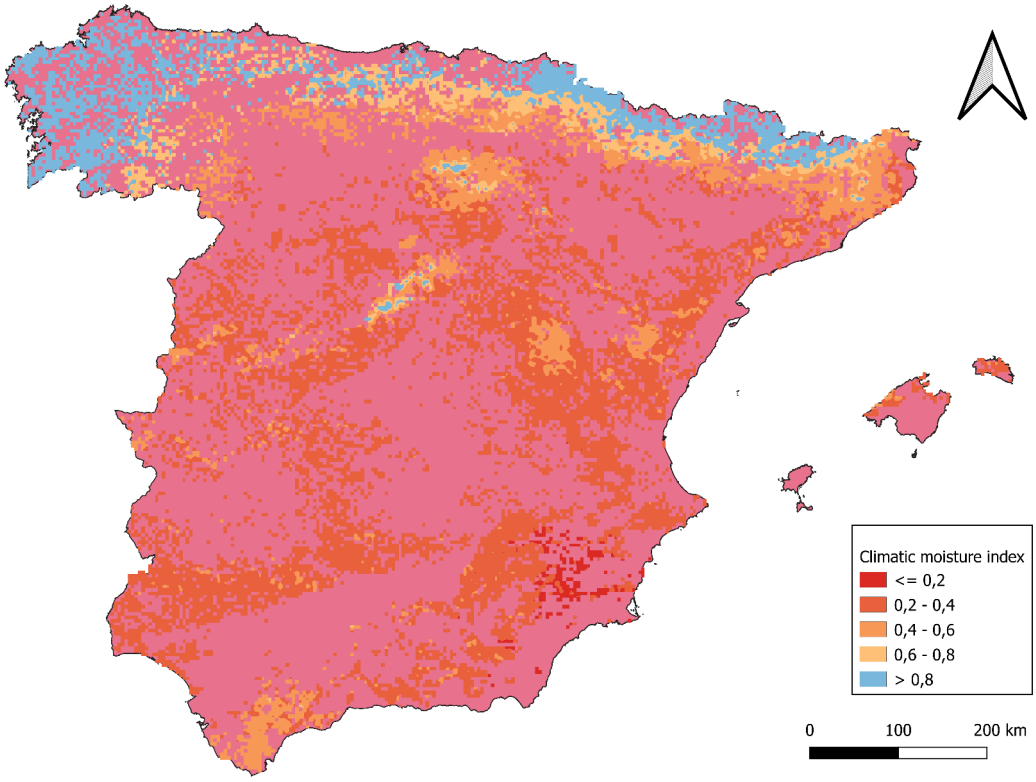

Figure S11. Climatic moisture index in Spanish Peninsula and Balearic Islands.

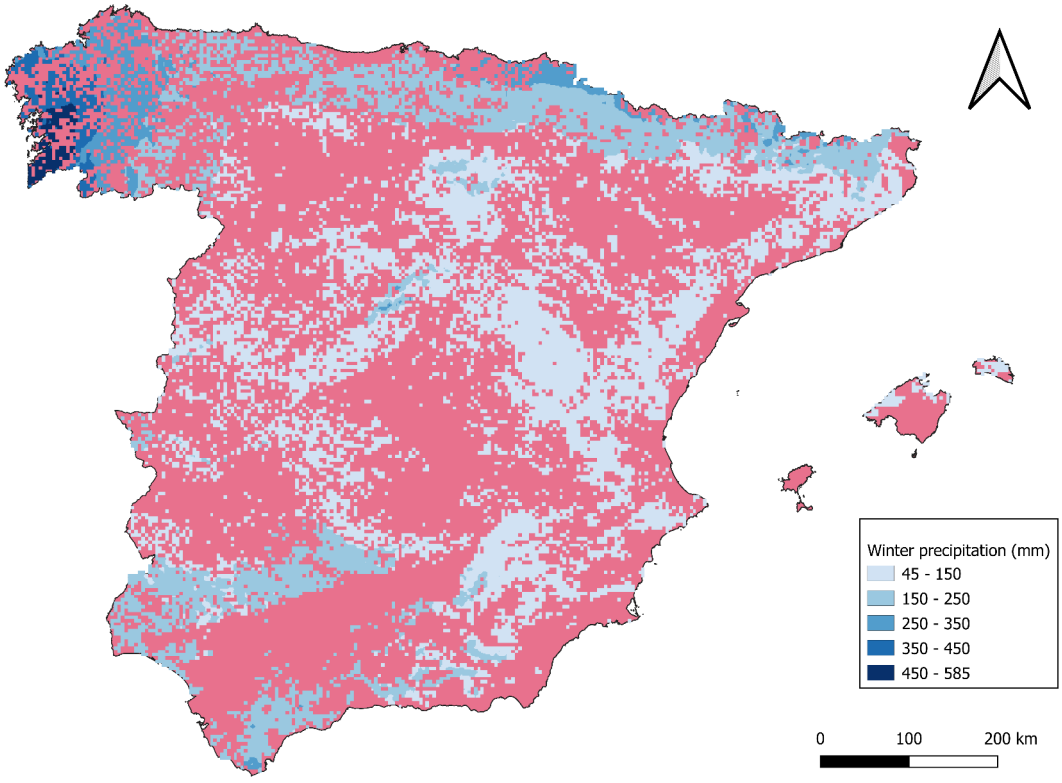

Figure S12. Winter precipitation in Spanish Peninsula and Balearic Islands.

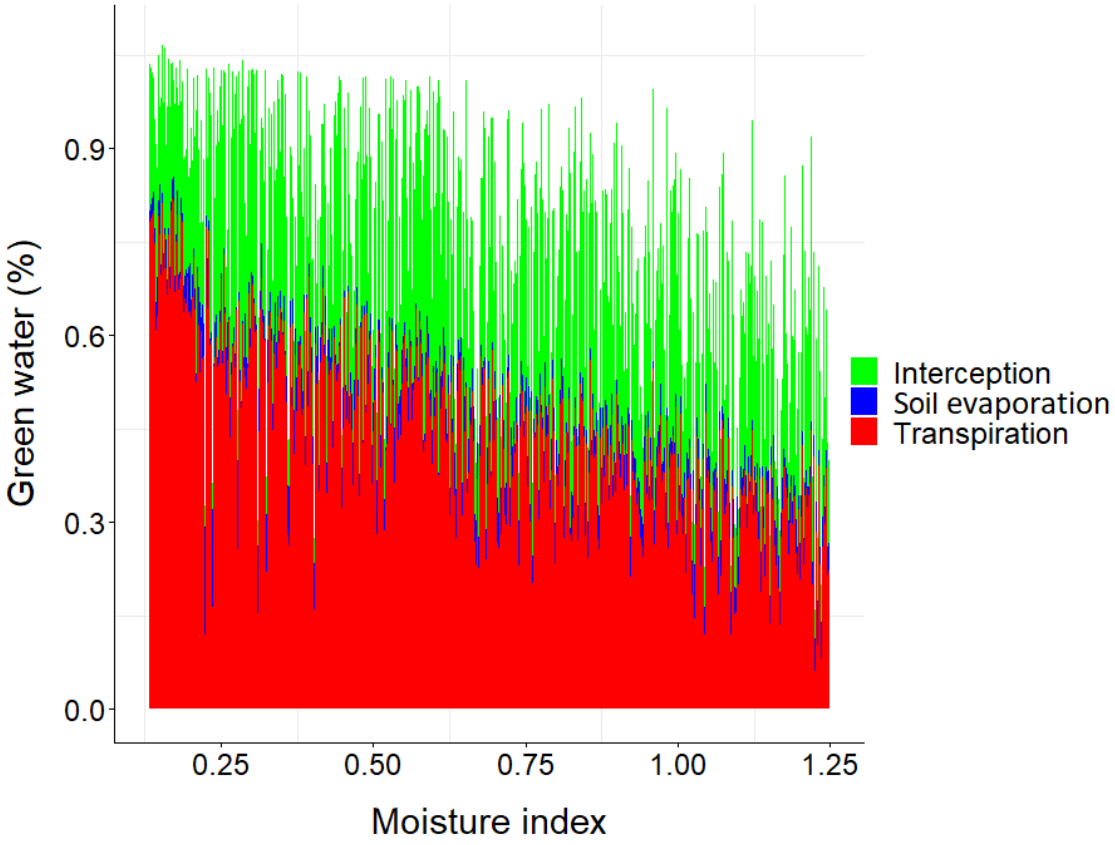

Figure S13. Green water partitioning (interception, soil evaporation and transpiration) along the moisture index gradient.

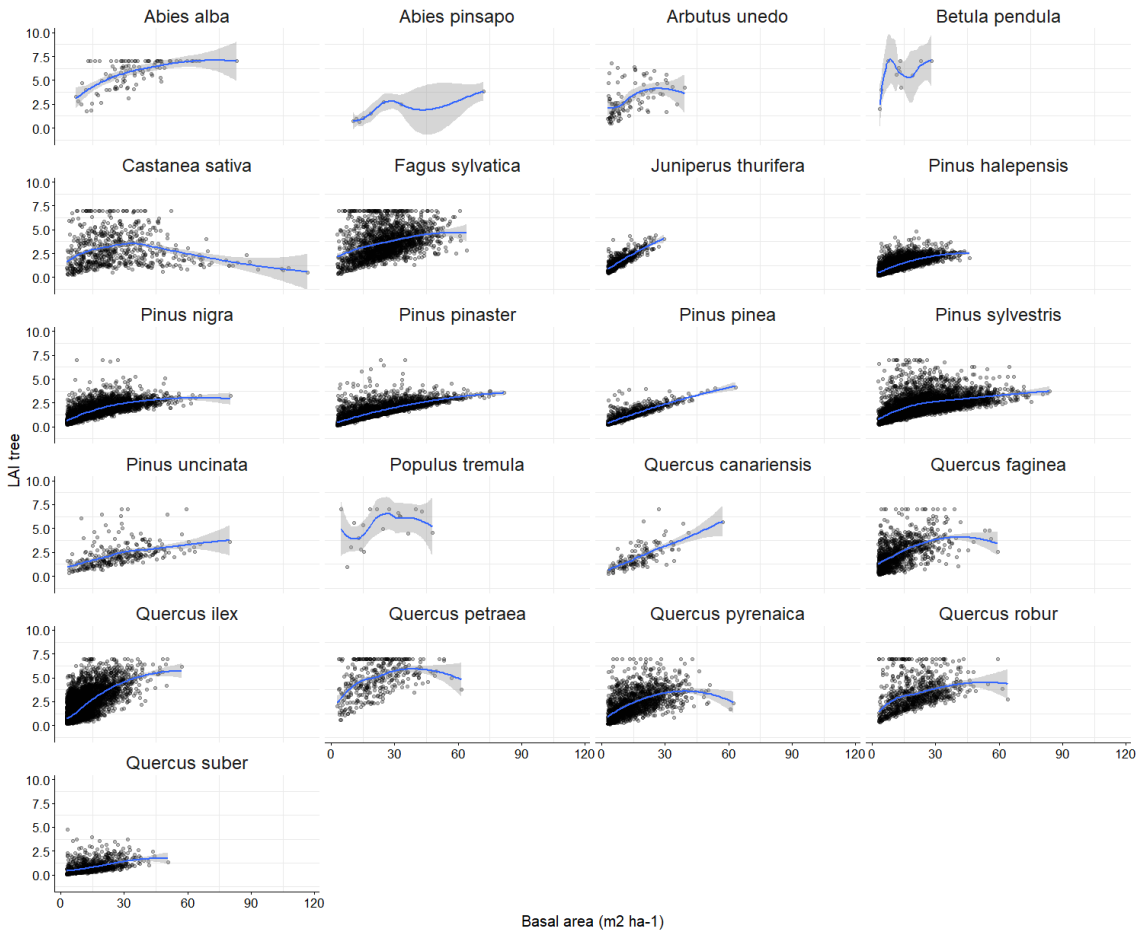

Figure S14. Relationship between the simulated LAI of the trees and basal area from the SFI3 by species.

Table S1. Classification into functional groups of the predominant tree species in the study area and the number of plots of each of them.

Functional group	**Predominant species**	**Number of plots**
Temperate deciduous	*Betula pendula*	11
Temperate deciduous	*Castanea sativa*	611
Temperate deciduous	*Fagus sylvatica*	1864
Temperate deciduous	*Populus tremula*	19
Temperate deciduous	*Quercus petraea*	336
Temperate deciduous	*Quercus robur*	807
Mediterranean deciduous	*Quercus canariensis*	134
Mediterranean deciduous	*Quercus faginea*	1077
Mediterranean deciduous	*Quercus pyrenaica*	1413
Temperate coniferous	*Abies alba*	98
Temperate coniferous	*Abies pinsapo*	8
Temperate coniferous	*Pinus sylvestris*	4312
Temperate coniferous	*Pinus uncinata*	275
Mediterranean coniferous	*Juniperus thurifera*	603
Mediterranean coniferous	*Pinus halepensis*	5746
Mediterranean coniferous	*Pinus nigra*	3439
Mediterranean coniferous	*Pinus pinaster*	4682
Mediterranean coniferous	*Pinus pinea*	1489
Sclerophyll	*Arbutus unedo*	101
Sclerophyll	*Quercus ilex*	4542
Sclerophyll	*Quercus suber*	947

Table S2. Characteristics Mean and standard deviation of stand structure variables and climate variables grouped in the different forest functional forest types groups by biome. Basal area (m^2 ha^{-1}); LAI T = Tree LAI; LAI S = Shrub LAI; MeanT = Mean annual temperature (ºC); TPre = Mean Total annual precipitation (mm). Mean and standard deviation are showed for all the values.

Functional group	Biome	Nº plots	Basal area	LAI of Trees	LAI of Shrubs	MeanT	TPre	Precipitation seasonality	Climatic moisture	Continentality
Temperate coniferous	Alpine	1506	26.9±14.7	2.3±1.3	0.9±0.9	8.3±1.5	872±237	35.3±12.4	0.9±0.4	16.0±1.5
	Atlantic	828	26.3±14.3	2.7±1.3	1.3±1.0	10.5±1.2	910±147	31.0±8.2	0.8±0.2	15.1±0.9
	Continental Mediterranean	451	20.8±12.1	1.9±0.9	1.3±1.0	10.7±1.0	534±77	45.6±9.4	0.4±0.1	17.4±1.6
	Submediterranean	1908	21.8±12.5	2.2±1.1	1.3±1.0	10.2±1.3	685±152	36.5±10.7	0.6±0.2	16.3±1.3
	Alpine	370	25.1±12.2	4.4±1.6	0.7±0.9	8.7±0.9	866±158	32.8±7.6	0.9±0.3	14.8±1.0
	Atlantic	2597	24.2±12.1	3.5±1.6	1.4±1.1	11.5±1.4	995±218	34.5±8.9	0.9±0.2	13.4±1.5
	Continental Mediterranean	56	22.9±10.0	4.0±1.7	0.8±0.9	10.5±0.7	640±92	33.9±6.0	0.6±0.2	15.7±1.0
	Temperate Mediterranean	105	19.8±10.3	1.9±1.2	1.0±0.9	15.1±1.1	616±143	63.9±8.9	0.5±0.2	16.4±1.1
	Submediterranean	541	24.3±14.6	3.6±1.8	1.3±1.1	11.2±1.5	762±189	39.2±11.8	0.7±0.2	15.3±1.2
Mediterranean coniferous	Alpine	103	20.0±13.1	1.8±1	1.5±1.0	10.3±1.3	643±152	40.4±11.3	0.5±0.2	16.9±1.5
	Arid	1244	8.6±5.2	0.9±0.5	1.5±0.8	15.3±1.3	311±47	52.5±4.2	0.2±0	17.8±1.2
	Atlantic	910	22.8±12.1	1.8±0.9	2.0±1.0	13.3±1.2	1365±322	47.7±8.0	1.2±0.3	11.5±2.0
	Continental Mediterranean	5969	15.1±10.1	1.4±0.7	1.7±1.0	12.6±1.4	435±66	47.6±7.3	0.3±0.1	17.9±1.1
	Temperate Mediterranean	4770	13.5±8.7	1.2±0.6	1.5±0.8	15.2±1.5	418±90	57.5±8.4	0.3±0.1	18.0±1.8
	Submediterranean	2971	18.5±12.0	1.7±0.8	1.6±0.9	12±1.6	546±147	44.5±10.5	0.4±0.1	17.3±1.5
Mediterranean deciduous	Alpine	126	16.7±9.7	2.5±1.4	1.4±1.0	9.8±0.9	679±131	42.8±10.0	0.6±0.2	16.5±1.3
	Atlantic	421	17.7±10.3	2.6±1.5	1.8±1.0	11.4±1.1	864±160	37.6±9.6	0.7±0.2	14.1±1.2

	Continental Mediterranean	682	10.0±7.0	2.0±1.3	1.6±0.9	11.7±1.1	501±87	44.1±9.0	0.4±0.1	17.3±1.2
	Temperate Mediterranean	337	12.6±8.3	1.5±1.1	1.3±0.9	15.6±1.5	532±98	65.7±7.5	0.4±0.1	16.5±2.4
	Submediterranean	1176	15.1±9.6	2.4±1.3	1.6±1.0	11.4±1.2	610±140	43.2±11.7	0.5±0.1	16.6±1.3
Sclerophyll	Alpine	45	14.1±8.3	3.0±1.3	1.2±0.7	10.4±0.8	811±124	25.4±6.8	0.7±0.2	14.9±0.9
	Arid	46	6.9±4.0	1.5±0.9	1.1±0.7	13.5±1.1	368±44	56.4±4.4	0.3±0.1	18.3±0.7
	Atlantic	206	18.5±10.5	3.6±1.7	1.9±1.0	12.7±1.1	843±181	32.3±8.1	0.7±0.2	14.0±1.5
	Continental Mediterranean	1754	9.2±5.8	2.1±1.3	1.5±1.0	12.4±1.2	456±67	46.7±8.6	0.4±0.1	17.8±1.2
	Temperate Mediterranean	4229	8.6±5.9	0.9±0.7	1.0±1.0	16.3±1.2	493±86	64.2±7.2	0.3±0.1	17.7±2.0
	Submediterranean	1295	13.6±8.1	2.7±1.4	1.6±0.9	12.6±1.5	591±126	39.0±11.3	0.5±0.1	16.4±1.3

Table S3. Proportion of plots in the different categories of relative blue water in the different biomes. n, number of plots.

Biome	**Distribution of values of Relative blue water (%)**					
	n	**0-15**	**15-30**	**30-45**	**45-60**	**>60**
Arid	1,290	74.6	19.7	4.9	0.8	0.0
Temperate Mediterranean	9,444	39.7	22.0	14.9	11.5	11.9
Continental Mediterranean	8,912	78.0	13.4	5.3	2.0	1.3
Submediterranean	7,891	58.1	24.3	12.0	4.4	1.2
Atlantic	4,962	18.0	24.7	27.1	21.8	8.4
Alpine	2,150	23.1	25.6	25.8	16.8	8.7

Table S4. Importance of the variables retained in the XGBoost models and their R^2 by functional group.

Temperate coniferous (R^2=90,04)

Variable	Gain	Cover	Frequency
LAI	0,592	0,467	0,482
Climatic moisture index	0,286	0,291	0,269
Winter precipitation	0,094	0,136	0,135
Basal area	0,019	0,067	0,079
Precipitation seasonality index	0,006	0,033	0,031
Autumn precipitation	0,002	0,007	0,004

Mediterranean coniferous (R^2=79,85)

Variable	Gain	Cover	Frequency
LAI	0,398	0,476	0,509
Winter precipitation	0,48	0,357	0,211
Climatic moisture index	0,071	0,075	0,158
Precipitation seasonality index	0,019	0,011	0,025
Basal area	0,018	0,07	0,062
Autumn precipitation	0,014	0,012	0,035

Sclerophylls (R^2=89,97)

Variable	Gain	Cover	Frequency
LAI	0,772	0,563	0,55
Winter precipitation	0,089	0,221	0,174

Autumn precipitation	0,065	0,079	0,071
Climatic moisture index	0,058	0,119	0,195
Precipitation seasonality index	0,017	0,018	0,011

Temperate deciduous (R^2=75,49)

Variable	**Gain**	**Cover**	**Frequency**
LAI	0,64	0,507	0,458
Climatic oisture index	0,267	0,304	0,307
Winter precipitation	0,049	0,075	0,077
Basal area	0,031	0,078	0,09
Precipitation seasonality index	0,01	0,025	0,046
Autumn precipitation	0,003	0,011	0,022

Mediterranean deciduous (R^2=77,61)

Variable	**Gain**	**Cover**	**Frequency**
LAI	0,601	0,519	0,491
Autumn precipitation	0,262	0,235	0,191
Climatic moisture index	0,102	0,17	0,194
Precipitation seasonality index	0,026	0,046	0,082
Winter precipitation	0,005	0,007	0,021
Basal area	0,004	0,022	0,02