Supplementary material

Table S1. Common groups of shrub formations in the Portuguese NFI and Spanish NFI. Codes of the formations: (a) according to SFM25 [42]; (b) used by Pasalodos-Tato *et al.* [27]based on the SFM25 codes. For each formation, there are the corresponding species in Portugal and Spain NFIs.

Species in PTNFI	Species in SPNFI	Codes	
		a. SFM25	b. Pasalodos-Tato *et al.* (2015)
Grasses	*Ampelodesmos mauritanicus* (Poir.) T.Durand & Schinz	34	*Ampelodesmos* spp. and other grasses
	Paliurus spina-christi Mill., *Rhamnus lycioides* L., *Rhamnus myrtifolia* Willk., *Rhamnus oleoides* L., *Rhamnus saxatilis* Jacq.	101	
Pyrus spp., *Rubus* spp., *Ruscus aculeatus* L.	*Berberis vulgaris* L., *Clematis flammula* L., *Clematis* spp., *Clematis vitalba* L., *Coriaria myrtifolia* L., *Cotoneaster* spp., *Daphne laureola* L., *Daphne mezereum* L., *Hedera helix* L., *Ligustrum vulgare* L., *Lonicera implexa* Ait., *Lonicera periclymenum* L., *Lonicera pyrenaica* L., *Lonicera* spp., *Lonicera xylosteum* L., *Prunus mahaleb* L., *Prunus ramburii* Boiss., *Rhamnus alpina* L., *Ribes alpinum* L., *Ribes rubrum* L., *Ribes* spp., *Rosa* spp., *Rubus caesius* L., *Rubus idaeus* L., *Rubus ulmifolius* Schott, *Ruscus aculeatus* L., *Rubus* spp., *Smilax aspera* L., *Spiraea* spp.	110	
Arbutus unedo L., *Ilex aquifolium* L., *Phillyrea angustifolia* L., *Phillyrea latifolia* L., *Rhamnus alaternus* L., *Quercus lusitanica* Lam.	*Bupleurum fruticosum* L., *Phillyrea angustifolia* L., *Quercus lusitanica* Lam., *Rhamnus* spp., *Rhododendron ponticum* L., *Rhododendron* spp., *Viburnum rigidum* Vent., *Viburnum tinus* L., *Viburnum* spp.	140	Machias, terebinths, garrigues
	Euphorbia aphylla Brouss. ex Willd., *Euphorbia handiensis* Burchard, *Euphorbia* sp., *Kleinia neriifolia* Haw.	160	
Quercus coccifera L.	*Quercus coccifera* L.	170	*Quercus coccifera* and *Pistacia lentiscus*
Pistacia lentiscus L.	*Pistacia lentiscus* L.	180	
Calluna spp., *Erica* spp.	*Arctostaphylos uva-ursi* (L.) Spreng., *Calluna vulgaris* (L.) Hull, *Daboecia cantabrica* (Huds.) K.Koch, *Erica arborea* L., *Erica australis* L., *Erica ciliaris* L., *Erica cinerea* L., *Erica erigena* R.Ross, *Erica multiflora* L., *Erica scoparia* L., *Erica umbellata* L., *Erica vagans* L., *Erica* spp., *Vaccinium myrtillus* L.	210	Heathers, *Ericaceae* shrubs and related groups
Cistus salviifolius L.	*Cistus clusii* Dunal, *Cistus crispus* L., *Cistus salviifolius* L., *Halimium atriplicifolium* (Lam.) Spach, *Halimium halimifolium* (L.) Willk., *Halimium lasianthum* (Lam.) Spach, *Halimium* spp.	220	a. Small size *Cistaceae* shrubs
Cistus ladanifer L.	*Cistus albidus* L., *Cistus ladanifer* L., *Cistus laurifolius* L., *Cistus monspeliensis* L., *Cistus populifolius* L., *Cistus symphytifolius* Lam., *Cistus* spp.		b. Big size *Cistaceae* shrubs
Adenocarpus spp., *Cytisus* spp., *Genista* spp., *Pterospartum tridentatum* (L.) K.Koch	*Adenocarpus decorticans* Boiss., *Adenocarpus* spp., *Anagyris foetida* L., *Chamaecytisus prolifer* (L.f.) Link, *Cytisophyllum sessilifolium* (L.) O.Lang, *Cytisus grandiflorus* DC., *Cytisus scoparius* (L.) Link, *Cytisus striatus* (Hill)	230	Mixture of broom leguminous shrubs

	Rothm., *Cytisus villosus* Pourr., *Cytisus* spp., *Cytisus balansae* (Boiss.) Ball, *Genista cinerea* (Vill.) DC., *Genista monspessulana* (L.) L.A.S.Johnson, *Genista patens* DC., *Genista triflora* (Lam.) Rouy, *Genista umbellata* (L'Hér.) Poir., *Genista* spp., *Genistella* spp., other big size *Papilionoideae*, *Retama sphaerocarpa* (L.) Boiss., *Retama* spp., *Spartium junceum* L., *Teline* spp., *Pterospartum tridentatum* (L.) K.Koch		
Ferns, *Ulex* spp.	*Astragalus* spp., *Bupleurum fruticescens* L., *Bupleurum spinosum* Gouan, *Bupleurum* spp., *Calicotome villosa* (Poir.) Link, *Colutea arborescens* L., *Echinospartum* spp., *Erinacea anthyllis* Link, *Genista scorpius* (L.) DC., other small size *Papilionoideae*, *Ulex baeticus* Boiss., *Ulex eriocladus* C.Vicioso, *Ulex minor* Roth, *Ulex parviflorus* Pourr., *Ulex* spp., *Vella spinosa* Boiss., *Vella* spp.	240	*Ulex* spp. shrubs and related groups
Rosmarinus officinalis L.	*Rosmarinus officinalis* L.		a. *Rosmarinus officinalis* L.
Lavandula spp., *Rosmarinus officinalis* L., *Thymus vulgaris* L.	*Artemisia canariensis* Less., *Artemisia* spp., *Dorycnium hirsutum* (L.) Ser., *Dorycnium pentaphyllum* Scop., *Dorycnium* spp., *Helianthemum* spp., *Helichrysum stoechas* (L.) Moench, *Helichrysum italicum* (Roth) G.Don, *Lavandula lanata* Boiss., *Lavandula latifolia* Medik., *Lavandula stoechas* L., *Lavandula* spp., *Phlomis lychnitis* L., *Phlomis purpurea* L., *Phlomis* spp., *Rosmarinus officinalis* L., *Santolina rosmarinifolia* L., *Santolina* sp., *Teucrium fruticans* L., *Teucrium* spp., *Thymus mastichina* (L.) L., *Thymus zygis* L., *Thymus* spp.	250	b. *Lavandula* spp., *Rosmarinus officinalis*, *Thymus* spp. shrubland and *Phlomis purpurea*
Other shrub species		270	
Daphne gnidium L., *Dittrichia viscosa* (L.) Greuter, Other herbaceous species, *Juniperus* spp.	*Anthyllis cytisoides* L., *Asparagus* spp., *Atriplex* spp., *Calicotome spinosa* (L.) Link, *Corema album* (L.) D.Don, *Coronilla emerus* L., *Coronilla glauca* L., *Coronilla juncea* L., *Coronilla* spp., *Daphne gnidium* L., *Daphne* spp., *Echium* spp., *Ephedra fragilis* Desf., *Ephedra* spp., *Globularia alypum* L., *Hypericum canariense* L., *Jasminum fruticans* L., *Lonicera etrusca* Santi, *Maytenus canariensis* (Loes.) G.Kunkel & Sunding, *Medicago arborea* L., *Nerium oleander* L., *Ononis tridentata* L., *Ononis* spp., *Osyris alba* L., *Osyris quadripartita* Salzm. ex Decne., *Osyris* spp., *Rumex lunaria* L., *Thymelaea* spp., *Ziziphus lotus* (L.) Lam., *Juniperus sabina* L.	280	

Table S2. Common groups of tree species in the Portuguese NFI and Spanish NFI.

Species / groups of species	Species in PTNFI	Species in SPNFI
Pinus pinaster Ait.	*Pinus pinaster* Ait.	*Pinus pinaster* Ait.
Pinus pinea L.	*Pinus pinea* L.	*Pinus pinea* L.
Pinus halepensis Mill.	*Pinus halepensis* Mill.	*Pinus halepensis* Mill.
Pinus sylvestris L.	*Pinus sylvestris* L.	*Pinus sylvestris* L.
Other conifers	*Cupressus* spp., *Pinus* spp., *Pseudotsuga menziesii* (Mirb.) Franco, other conifers	*Abies alba* Mill., *Abies pinsapo* Boiss., *Chamaecyparis lawsoniana* (A.Murray) Parl., *Larix* spp., *Picea abies* (L.) H.Karst., *Pinus canariensis* C.Sm. ex DC., *Pinus nigra* J.F.Arnold, *Pinus radiata* D.Don, *Pinus uncinata* Ram. ex DC., *Pinus* spp., *Pseudotsuga menziesii* (Mirb.) Franco, other conifers
Eucalyptus spp.	*Eucalyptus* spp.	*Eucalyptus camaldulensis* Dehnh., *Eucalyptus globulus* Labill., *Eucalyptus nitens* (H.Deane & Maiden) Maiden
Quercus suber L.	*Quercus suber* L.	*Quercus suber* L.
Quercus ilex L. s.l.	*Quercus ilex* L. s.l.	*Quercus ilex* L. s.l.
Quercus pyrenaica Willd.	*Quercus pyrenaica* Willd.	*Quercus pyrenaica* Willd.
Other oaks	*Quercus faginea* Lam., *Quercus robur* L., *Quercus* spp.	*Quercus canariensis*, *Quercus faginea* Lam., *Quercus petraea* (Matt.) Liebl., *Quercus robur* L., *Quercus rubra* L.
Castanea sativa Mill.	*Castanea sativa* Mill.	*Castanea sativa* Mill.
Other broadleaves	*Acacia* spp., *Alnus glutinosa* (L.) Gaertn., *Betula* spp., *Ceratonia siliqua* L., *Fagus sylvatica* L., *Fraxinus* spp., *Hakea* spp., *Populus* spp., *Pittosporum undulatum* Vent., *Salix* spp., *Ulmus* spp., other broadleaves	*Betula* spp., *Fagus sylvatica* L., *Platanus* x *hispanica* Mill. ex Münchh., *Populus alba* L., *Populus nigra* L., *Robinia pseudoacacia* L., other broadleaves

Table S3. Species and groups of species considered for the adjustments of the equations, with the number of trees sampled in the study with information of crown diameter and crown length in the SNFI2 [48].

Species or groups of species	Number of trees sampled	
	Study on crown diameter	**Study on crown length**
Pinus pinaster	38,311	4,382
Pinus pinea	9,147	1,273
Pinus halepensis	35,194	5,662
Pinus sylvestris	27,961	4,657
Other conifers	35,542	4,956
Eucalypts	9,359	1,263
Quercus suber	8,715	46
Quercus ilex s.l.	38,424	621
Quercus pyrenaica	11,660	1,204
Other oaks	19,904	1,431
Castanea sativa	4,563	122
Other broadleaves	12,336	302
Total	251,116	25,919

Table S4. Characteristics of the sample trees used in the development of the crown length equation (12).

Species /groups	Sample size	Density (N ha⁻¹)				Tree height (m)				Crown length (m)			
		Min	Max	Mean	St.dev.	Min	Max	Mean	St.dev.	Min	Max	Mean	St.dev.
Pinus pinaster	4,382	32	3,823	626	521	2.5	17.0	5.6	1.3	0.1	15.1	3.9	1.1
Pinus pinea	1,273	14	3,965	475	453	2.5	10.0	4.9	1.0	0.6	8.4	3.2	1.0
Pinus halepensis	5,662	14	3,226	486	410	2.5	14.0	5.8	1.2	1.0	12.8	4.4	1.2
Pinus sylvestris	4,657	14	4,202	774	583	2.3	15.0	5.7	1.2	0.1	11.0	4.4	1.2
Other conifers	4,956	14	5,217	651	519	2.5	19.5	5.5	1.3	0.1	19.4	4.4	1.3
Eucalypts	1,263	32	2,737	484	313	4.5	17.0	8.9	1.7	0.5	13.8	5.8	1.9
Quercus suber	46	32	2,033	599	523	2.0	15.5	5.7	2.2	0.5	12.8	3.8	1.9
Quercus ilex s.l.	621	32	3,820	791	627	2.5	12.0	5.5	1.6	1.1	10.5	4.1	1.3
Quercus pyrenaica	1,204	14	3,310	750	567	2.5	13.0	6.4	1.4	1.5	11.0	4.8	1.4
Other oaks	1,431	32	3,820	692	572	2.5	20.0	6.2	1.5	0.9	13.7	4.6	1.4
Castanea sativa	122	32	2,546	624	529	4.5	19.5	8.0	2.0	3.2	17.2	6.0	2.0
Other broadleaves	302	32	2,886	631	532	4.5	18.5	8.2	2.0	2.3	13.7	6.6	2.0

Table S5. Characteristics of the sample trees used in the development of the crown diameter equation (15).

Species /groups	Sample size	Density (N ha⁻¹)				Diameter at breast height (cm)				Crown diameter (m)			
		Min	Max	Mean	St.dev.	Min	Max	Mean	St.dev.	Min	Max	Mean	St.dev.
Pinus pinaster	38,311	5	4,916	554	497	7.5	114.6	26.6	11.4	0.2	16.0	4.2	1.8
Pinus pinea	9,147	5	3,965	386	398	7.5	130.5	27.5	12.7	0.9	23.6	5.1	2.3
Pinus halepensis	35,194	5	4,676	439	400	7.5	102.8	21.5	8.6	0.5	16.2	4.3	1.5
Pinus sylvestris	27,961	5	5,317	759	589	7.5	128.3	24.0	11.0	0.5	15.2	4.4	1.7
Other conifers	35,542	5	5,217	593	527	7.5	174.0	26.6	14.2	0.5	23.6	4.4	2.0
Eucalypts	9,359	5	3,151	661	517	7.5	136.5	21.4	13.1	0.4	22.7	3.8	2.2
Quercus suber	8,715	5	3,070	352	418	7.5	149.6	34.3	17.1	0.8	22.9	6.2	3.2
Quercus ilex s.l.	38,424	5	4,576	391	518	7.5	152.2	27.7	17.7	0.5	24.9	5.5	3.0
Quercus pyrenaica	11,660	5	4,170	681	644	7.5	172.4	23.8	15.8	0.5	40.7	4.7	2.5
Other oaks	19,904	5	4,576	584	526	7.5	203.8	29.0	19.2	0.3	23.0	5.8	3.1
Castanea sativa	4,563	5	3,947	649	602	7.5	222.9	35.8	28.1	0.4	21.5	6.6	3.1
Other broad-leaves	12,336	5	4,870	622	534	7.5	176.7	33.1	18.6	0.4	25.4	6.9	3.4

Table S6. Examples of studies for estimation of Crown Bulk Density (CBD) at stand level in forest ecosystems in the Iberian Peninsula (mean values and standard deviation in parenthesis).

Species	Study area	n	DBH[1] (cm)	HT (m)	NHA (tree ha⁻¹)	G (m² ha⁻¹)	CLBD (kg m⁻³)	Canopy fuels	Methods[2]	Author
	Portugal northern region	4	12.6 (0.5)	9.2 (0.6)	1822 (254)		0.22 (0.02)	Needles	*CFL* from predictive equations [85] based in 56 destructively sampled trees and plot inventory.	[86]
P.pinaster	Galicia (Spain)	82*	17.1 d_g (3.4)	10.6 (2.7)	1346 (417)	30.5 (10.8)	0.18 (0.06)	Needles and fine twigs <6 mm	*CFL* from predictive equations based on 204 destructively sampled trees and plot inventory. Alternatively, *CFL* and *CBD* estimated directly by statistical fitting as a function of *G* and *N* stand variables. *CBD* vertical profile by a Weibull function distribution with parameters predicted by functions of *G*, d_g and H_0 stands variables. *CBD* effective (*CBDe)* following Scott and Reindhardt [19] approach, based on the CBD vertical model.	[87]
	Galicia (Spain)	829	27.9 (12.7)	15.9 (5.9)	936 (865)	23.02 (14.7)	0.11 (0.08)	Needles and fine twigs <5 mm	*CFL* from predictive equations [88], based on 125 destructively sampled trees and plot inventory. Alternatively, *CBD* from statistical fitting as a function of *G* and *N* stand variables.	[96]

Species	Study area	n	DBH[1] (cm)	HT (m)	NHA (tree ha⁻¹)	G (m² ha⁻¹)	CLBD (kg m⁻³)	Canopy fuels	Methods[2]	Author
	Galicia - coastal ecoregion (Spain)	81		11.5 (3.8)	1804 (922)	35 (12.2)	0.30 (0.08)			
	Galicia - interior ecoregion (Spain)	128		9.1 (2.8)	1896 (525)	30.2 (14.8)	0.31 (0.1)	Needle and fine twigs <5 mm	*CFL* from predictive equations [88], based on 125 destructively sampled trees and plot inventory.	[89]
	Galicia-coastal ecoregion (Spain	89 (thinned stands)		10.4 (1.9)	1956 (854)	28.7 (8.1)	0.26 (0.07)			
	Galicia-interior ecoregion (Spain)	166 (thinned stands)		10.3 (2.0)	1561 (535)	31.1 (11.1)	0.27 (0.07)			
	Leiria (Portugal)	546	23.0 d_g (9-48)	14 H_0 (7-29)	821 (125-2110)	20 (9-47)	0.11 (0.04-0.32)	Needles	*CFL* from predictive equations from Faias [90] and plot inventory. *CL* from *CBH* by Torre *et al*. [11] and H_m from plot inventory	[91]
	Galicia, Asturias and León (Spain)	123 (unthinned and thinned stands)	21.1 (6.5)	16.1 (6.7)	1028 (481)	39.1 (9.3)	0.17 (0.05)	Needles and fine twigs <5mm	*CFL* from predictive equations [88], based on 125 destructively sampled trees, and plot inventory. Also, *CBD* by predictive equations based on SENTINEL -2 spectral indexes	[37]
	Extremadura (Spain)	14	>7.5	9.6 (1.6)			0.15 (0.01)	Needles and fine twigs <6mm	*CFL* from Gómez-Váquez *et al*. [87] equations and plot inventory. Also, *CBD* by predictive equations from ALS-derived metrics.	[92]
P.pinea	Extremadura (Spain)	120	>7.5	3.8 (2.3)			0.11 (0.04)	Needles and fine twigs <6mm	*CFL* from Gómez-Vázquez *et al*. [87] equations and plot inventory. Also, *CBD* by predictive equations from ALS-derived metrics.	[92]
	Andalucía (Spain)	30		7.1 (1.8)	483 (292)		0.16 (0.07)	Needles and twigs <6mm	*CFL* estimated from destructively sampled trees and predictive equations fitting.	[93]
P.sylvestris	Galicia (Spain)	176	23.7 (9.1)	13.9 (5.6)	872 (572)	24.4 (16.0)	0.18 (0.12)	Needles and fine twigs<6 mm	*CFL* by predictive equations [17, based on 316 destructively sampled trees and modified to include a correction factor to account only the size interval up to 0.5 cm. Alternatively, *CBD* from statistical fitting as a function of *G* and *N* stand variables.	[96]

Species	Study area	n	DBH[1] (cm)	HT (m)	NHA (tree ha⁻¹)	G (m² ha⁻¹)	CLBD (kg m⁻³)	Canopy fuels	Methods[2]	Author
	Galicia (Spain)	13	18.9 (5.4)	12.2 (4.0)	1190 (667)		0.25 (0.10)	Needles and twigs<20 mm	*CFL* from predictive equations [17], based on 316 destructively sampled trees and plot inventory.	[67]
	Galicia (Spain)	180	23.2 d_g (9.9)	19.2 H_o (5.7)	991 (530)	32.6 (12.3)	0.21 (0.05)	Needles and fine twigs <6mm	*CFL* from the refitted equations from Balboa-Murias [94] based on 54 destructively sampled trees and plot inventory. Alternatively, *CBD* by predictive equation as a function of *G*, *H* and *N*. Also, *CBDe*, following Scott and Reindhardt [19] approach, based on a vertical fuel load model.	[95]
P,radiata	Galicia (Spain)	363*	24.1 d_g (7.6)	19.7 (5.2)	980 (490)	38.1 (10.0)	0.13 (0.03)	Needles and fine twigs <6mm	*CFL* from predictive equations based on 161 trees destructively sampled and plot inventory. Alternatively, *CFL* and *CBD* estimated directly by statistical fitting as a function of *G* and *N* stand variables. *CBD* vertical profile by a Weibull function distribution with parameters predicted by functions of *G*, d_g and *Ho* stands variables.	[87]
	Galicia (Spain)	255	26.6 (11.3)	17.4 (6.2)	765 (515)	24.0 (13.7)	0.08 (0.05)	Needles and fine twigs <5mm	*CFL* from predictive equations [88], based on 125 destructively sampled trees and plot inventory. Alternatively, *CBD* from statistical fitting as a function of *G* and *N* stand variables.	[96]
	Galicia (Spain)	15	20.8 (10.0)	16.4 (7.4)	988 (347)		0.14 (0.05)	Needles and fine twigs <5mm	*CFL* from predictive equations [88], based on 48 destructively sampled trees and plot inventory.	[67]
E.globulus	Galicia (Spain)	16	15.2 (5.4)	18.3 (6.4)	1293 (497)		0.19 (0.07)	Leaves and fine twigs <5mm	*CFL* from predictive equations [88], based on 34 destructively sampled trees, and plot inventory.	[67]
Q.pyrenaica	Galicia (Spain)	7	18.4 (11.5)	13.7 (6.5)	1946 (1693)		0.23 (0.08)	Leaves and fine twigs <20mm	*CFL* from predictive equations [51], based on 141 destructively sampled trees, and plot inventory.	[67]
	Extremadura (Spain)	19	>7.5	7.2 (1.0)			0.01 (0.01)	Leaves	*CFL* from Gómez-Vázquez *et al*. [87] equations and plot inventory. Also, CBD by predictive equations from ALS-derived metrics	[92]

Species	Study area	n	DBH[1] (cm)	HT (m)	NHA (tree ha-1)	G (m² ha-1)	CLBD (kg m-3)	Canopy fuels	Methods[2]	Author
Q.robur	Galicia (Spain)	8	21.5 (10.6)	14.3 (5.4)	1408 (1080)		0.24 (0.13)	Leaves and fine twigs <5mm	*CFL* from predictive equations [88], based on 31 destructively sampled trees, and plot inventory.	[67]

[1] tree diameter. [2] *CBD* by load over depth [17,97]. CL from plot inventory. *Inventories.

Note: n number of sample trees; HT total height; G stand basal area; NHA number of trees per hectare; d_g quadratic mean diameter; H_0 dominant height; *CFL* crown fuel load, *CL* crown length, *CLBD* canopy bulk density.