



Greenways associated with riparian forest habitats in the Natura 2000 network: Portugal and the European context

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**The importance of the
European context in the
Evaluation of
Biodiversity in
Forests**

ECOLOGICAL BULLETINS 50



Biodiversity Evaluation Tools for European forests

Coordinated by Tor-Björn Larsson





Forest Types for Biodiversity Assessment

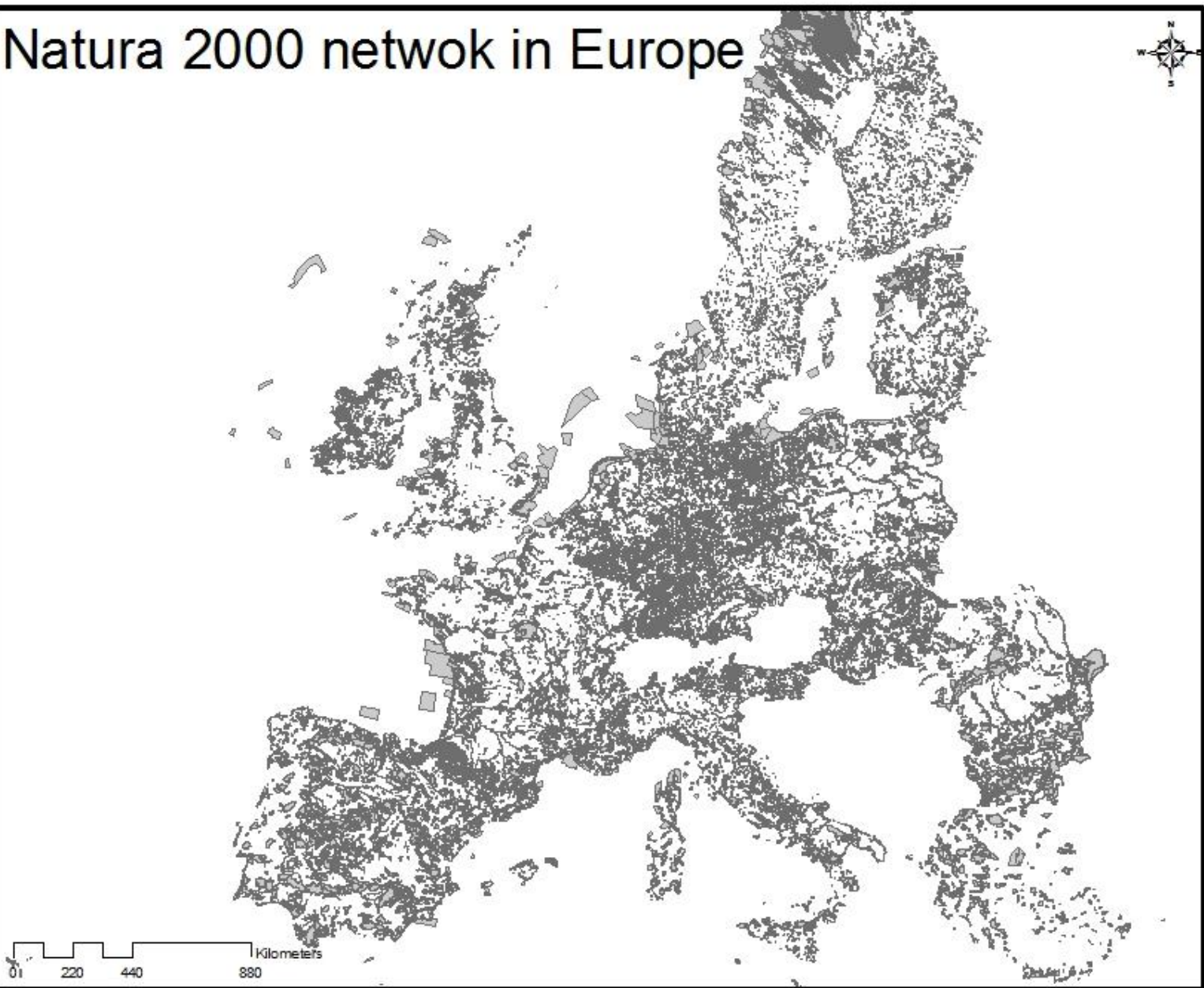
Forest Types for Biodiversity Assessment FTBA	Corresponding Potential natural vegetation type(s) Main formation, first division *)	Occurs in the following Biogeographic Region (Council Directive 92/43/EEC)					
		Boreal	Atlantic	Conti- nental	Alpine A=Alps P=Pyrenees C=Carpathian S=Scandinavian Alps	Mediterranean	Macaronesian
1. Subalpine conifer vegetation in nemoral zone	C3				A, P, C		
2. North boreal spruce forest	D1	•			S		
3. North boreal pine forest	D10	•			S		
4. Middle boreal spruce forest	D2	•			S		
5. Middle and south boreal and hemiboreal pine forest	D11	•			S		
6. South boreal forest	D3	•					
7. Hemiboreal spruce and fir-spruce forests	D8 + D12	•		(•)			
8. Mixed spruce and fir forest	D9			•	A, C		
9. Mixed oak forest	F1	•	•	•			
10. Ashwood	F2		•	•			
11. Mixed oak-hornbeam forest	F3		•	•			
12. Lowland and submontane beech forest	F5 a		•	•	A, P, C		
13. Montane beech and mixed beech-fir-spruce forest	F5 b			•	A, P, C	•	
14. Mediterranean and Submediterranean mixed oak forest	G2+G3		•	(•)		•	
15. Mediterranean broad-leaved sclerophyllous forests and shrub	J1-J8					•	•
16. Mediterranean and Macaronesian coniferous forests, woodlands	K1-K4					•	•
17. Atlantic dune forest	P1		•				
18. Ombrotrophic mires	S1	•	•				
19. Arctic-subarctic mires	S2				(S)		
20. Minerotrophic mires incl. swamp forest	S3	•					
21. Swamp and fen forests, alder	T1	•	•	•	(A)		
22. Swamp and fen forests, birch	T2	(•)	•	•			
23. Flood plain (alluvial and riverine) forests	U1+U2		•	•			
24. Mediterranean and Macaronesian riverine woodlands and gallery forests	U4					•	3 •
25. Laurel forest	–						•



**The geographical distribution
of some Forest Types
(Natura 2000 Habitats) in
Europe and Portugal
illustrates very different
situations**



Natura 2000 network in Europe



0 220 440 880 Kilometers

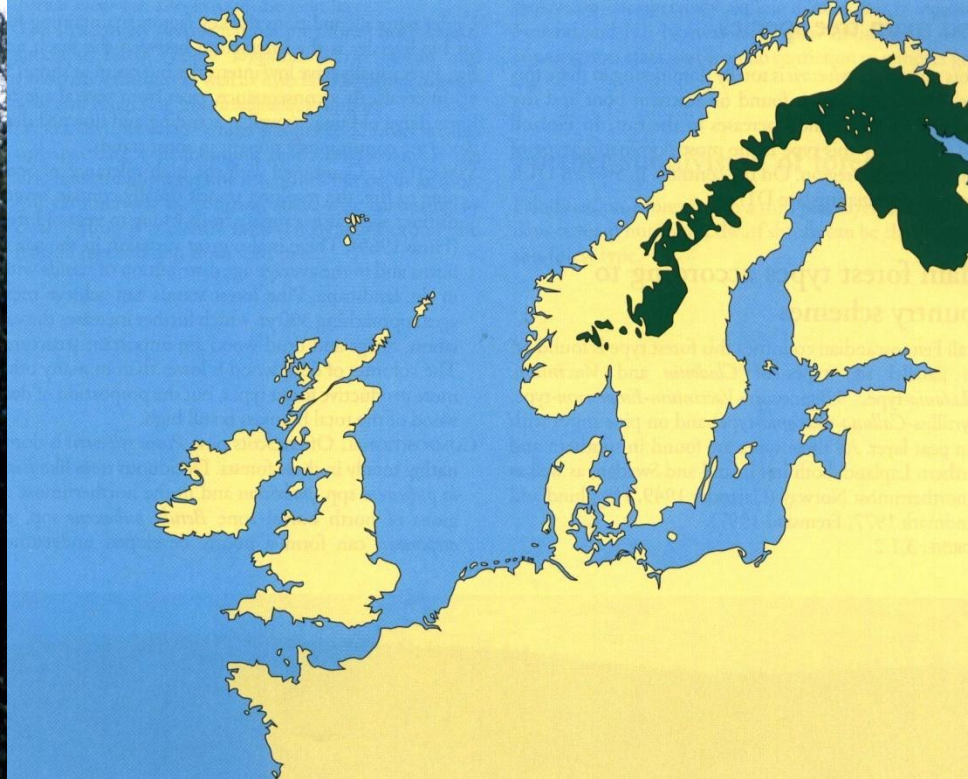
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***Picea abies* forests with
herbaceous component
(habitat 9050)**

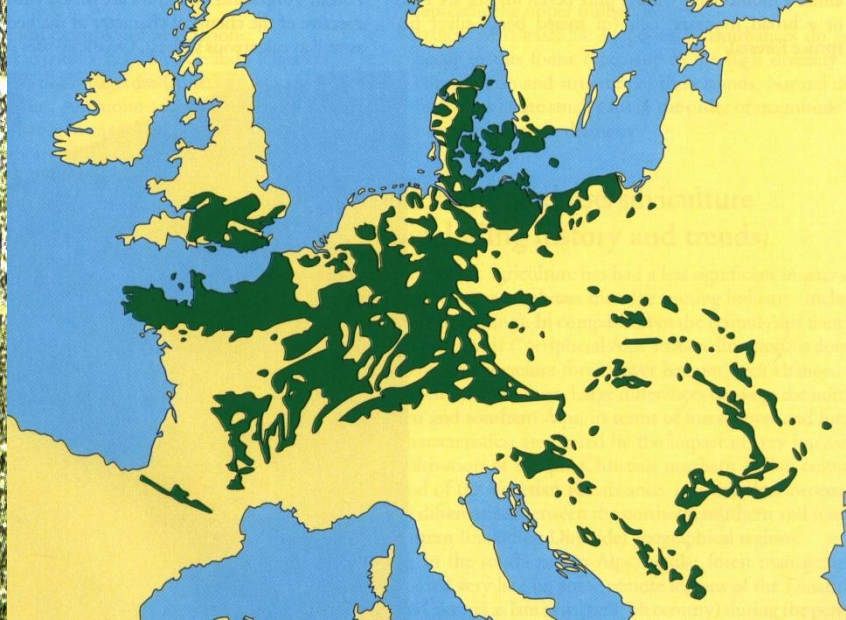
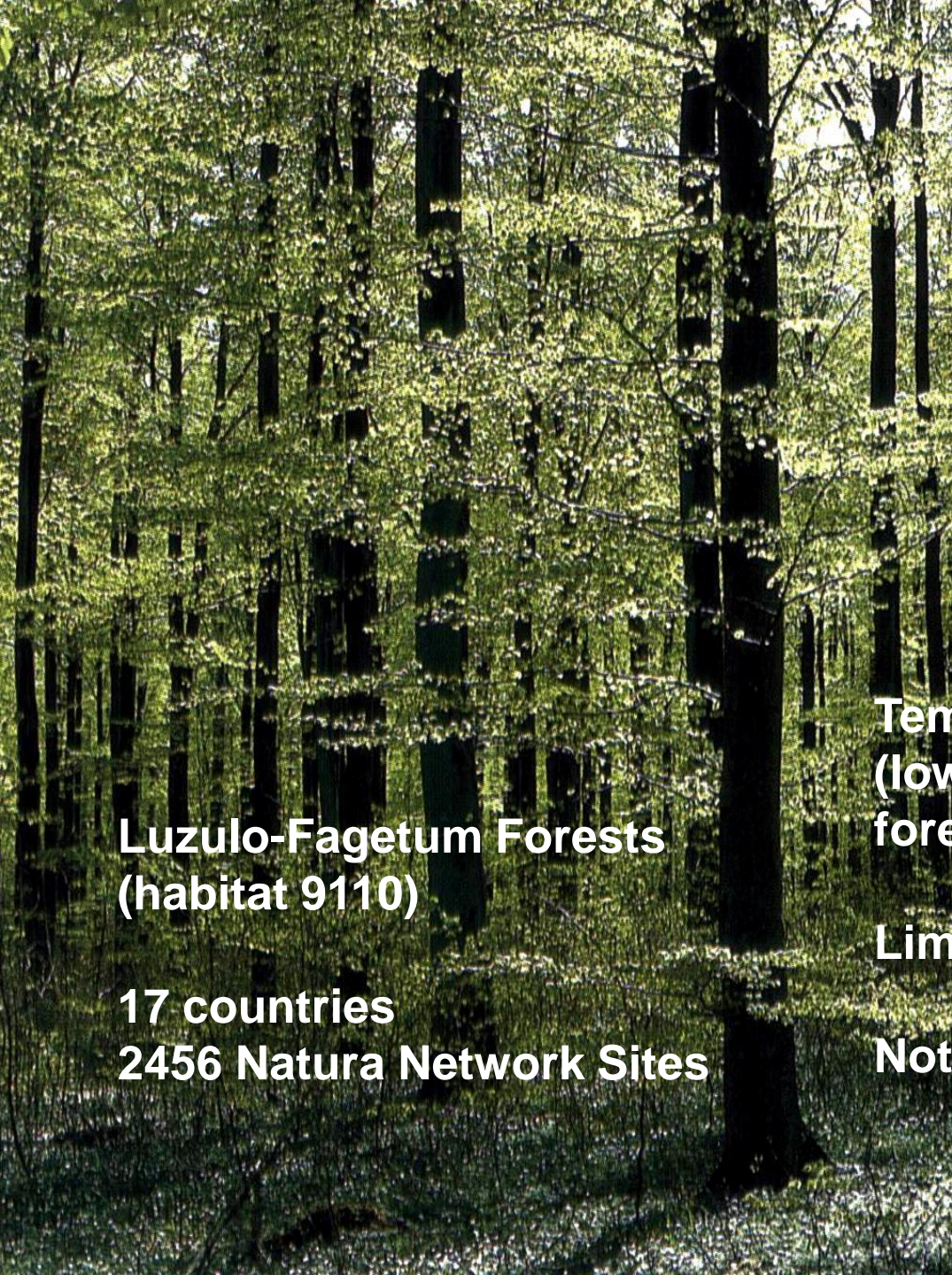
**4 countries
1086 Natura Network Sites**



**Boreal Forests (90)
(North)**

Limited to northern regions

Not in Portugal



**Luzulo-Fagetum Forests
(habitat 9110)**

**17 countries
2456 Natura Network Sites**

**Temperate Forests (91)
(lowland and submontane beech
forests)**

Limited to central regions

Not in Portugal

Temperate Forests (91)

Limited to specific site conditions



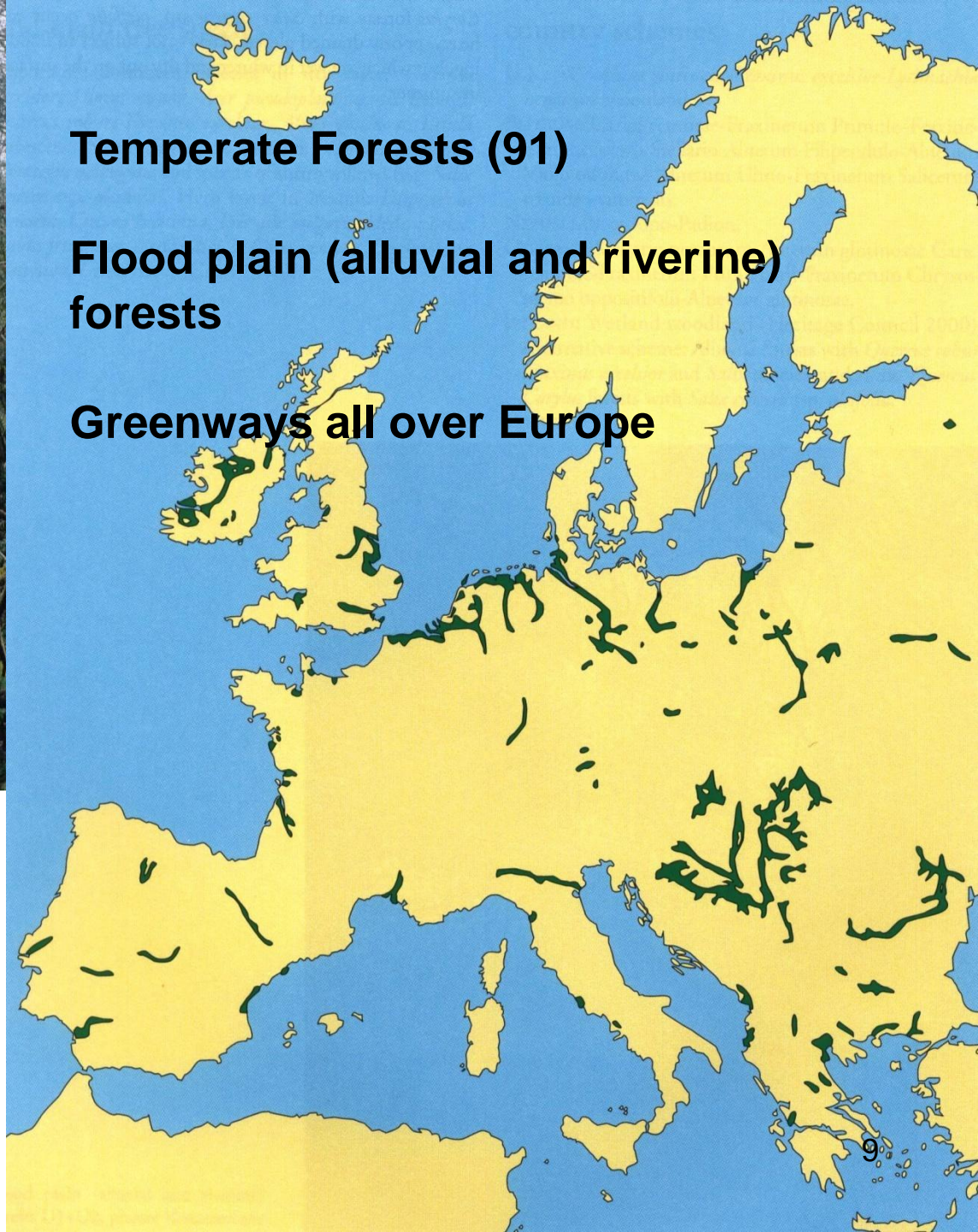
**Ombrotrophic mires
(habitat 91D0)**

**21 countries
3382 Natura Network Sites
3 Sites in Portugal (Açores)**



**Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*
(habitat 91E0)**

**23 countries
4836 Natura Network Sites
19 Sites in Portugal (mainland)**





Oak forests with *Q. robur* and/or *Q. pyrenaica* (habitat 9230)

3 countries
297 Natura Network Sites
26 Sites in Portugal (mainland)

Oak forests with *Q. faginea* and/or *Q. canariensis*
(habitat 9240)

2 countries
320 Natura Network Sites
18 Sites in Portugal (mainland)



**Deciduous Mediterranean
Forests (92)
(mixed oak forests)**

*A Floresta Laurissilva
da Madeira
Património Mundial*

*The Laurisilva of Madeira
World Heritage*



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Serviço do Parque Natural da Madeira

**Mediterranean Sclerophyllous
Forests
(93)**

**Macaronesian Laurisilva (*Laurus*,
Ocotea)
(habitat 9360)**

2 countries

70 Natura Network Sites

**8 Sites in Portugal (Madeira and
Açores)**



Mediterranean Sclerophyllous Forests (93)

***Olea* and *Ceratonia* Forests (9320)**

7 countries

311 Natura Network Sites

3 Sites in Portugal (mainland)

***Quercus suber* – Cork Oak Forests (9330)**

4 countries

248 Natura Network Sites

32 Sites in Portugal (mainland)

***Q. ilex* and/or *Q. rotundifolia* forests (9340)**

7 countries

1403 Natura Network Sites

27 Sites in Portugal (mainland)



***Pinus uncinata* Forests
(habitat 9430)**

3 countries

140 Natura Network Sites



**Conifer Forests in Temperate
Mountains (94)**

Limited to subalpine areas

Not in Portugal



**Conifer Forests of Mediterranean and
Macaronesian Mountains (95)**

***Juniperus* spp. Forests
(habitat 9560)**

7 countries

256 Natura Network Sites

**13 Sites in Portugal (8 mainland and 5
Açores)**

J. brevifolia (Açores)



Riparian Forests are important Greenways!

What is the situation of Riparian Forests in Europe?



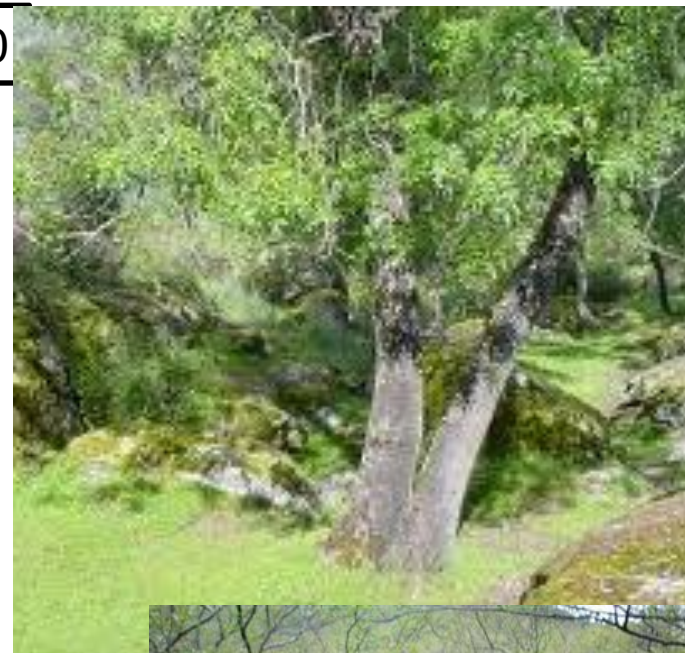


91B0

Riparian Forest Habitats

Forests of Temperate Europe

- **91B0** - Thermophilous *Fraxinus angustifolia* woods
- **91E0*** - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion*, *Alnion incanae*, *Salicion albae*)
- **91F0** - Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmunion minoris*)



91E0*



91F0





92A0

Riparian Forest Habit

Mediterranean deciduous forests

- **92A0** - *Salix alba* and *Populus alba* galleries
- **92B0** - Riparian formations on intermittent Mediterranean water courses with *Rhododendron ponticum*, *Salix* and others
- **92D0** - Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)



92B0



92D0





Area of the different	Habitat	Area (ha)
Riparian Forest Habitats of Europe	91B0	61375
	91E0*	454314
	91F0	145676
	92 A0	218219
	92 B0	7185
	92 D0	98221
	TOTAL	984990



Habitat	Area (hectares)	Percent	Rarity Value $\ln(1/\pi)$	Contribution to total diversity $\pi \ln(1/\pi)$
91B0	61375	6%	2,78	0,17
91E0*	454314	46%	0,77	0,36
91F0	145676	15%	1,91	0,28
92A0	218219	22%	1,51	0,33
92B0	7185	1%	4,92	0,04
92D0	98221	10%	2,31	0,23
Total	984990	100%		1,41

**Total Diversity
Shannon Wiener**



**What is their
geographical distribution
in European countries ?**

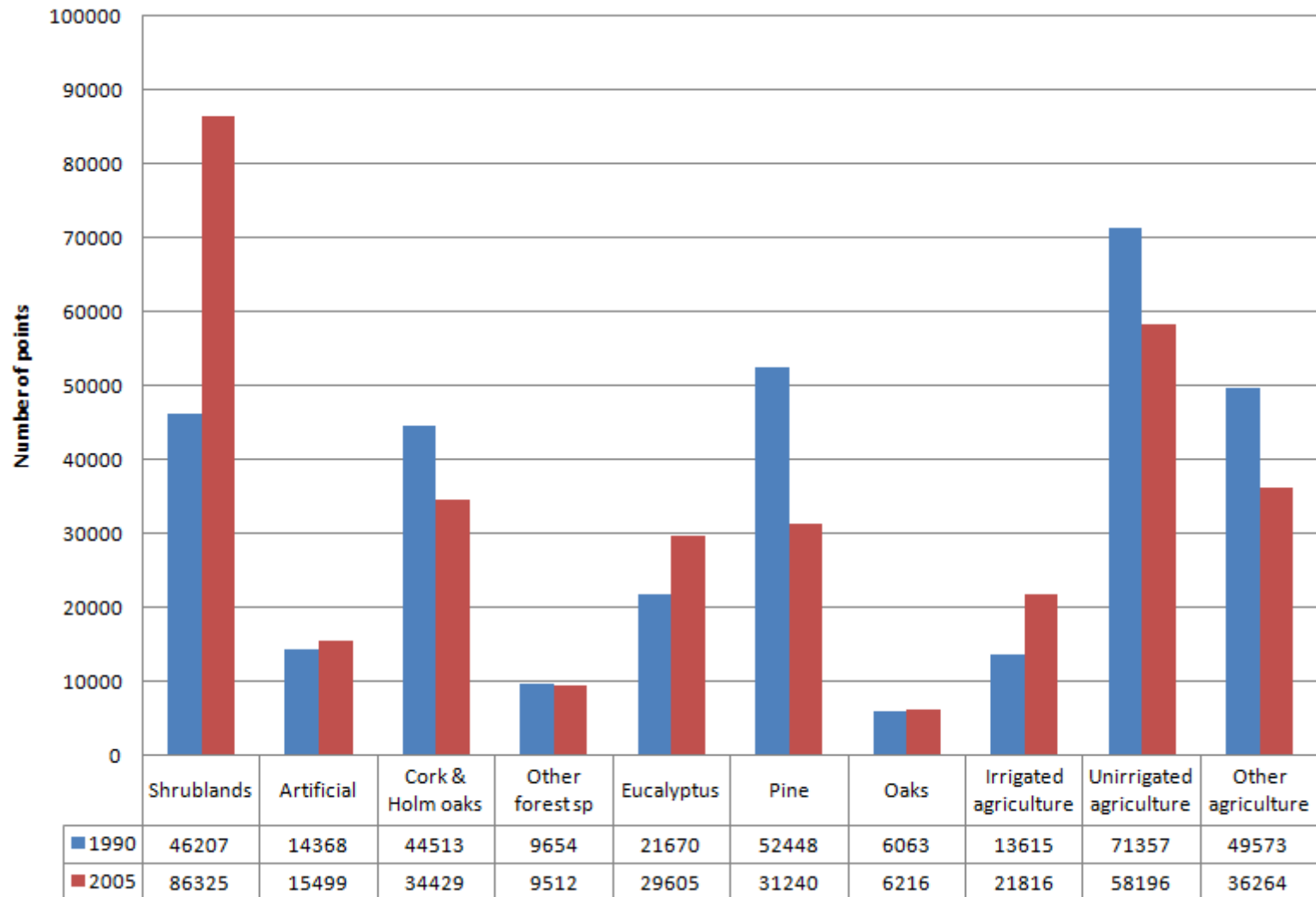




Methodology

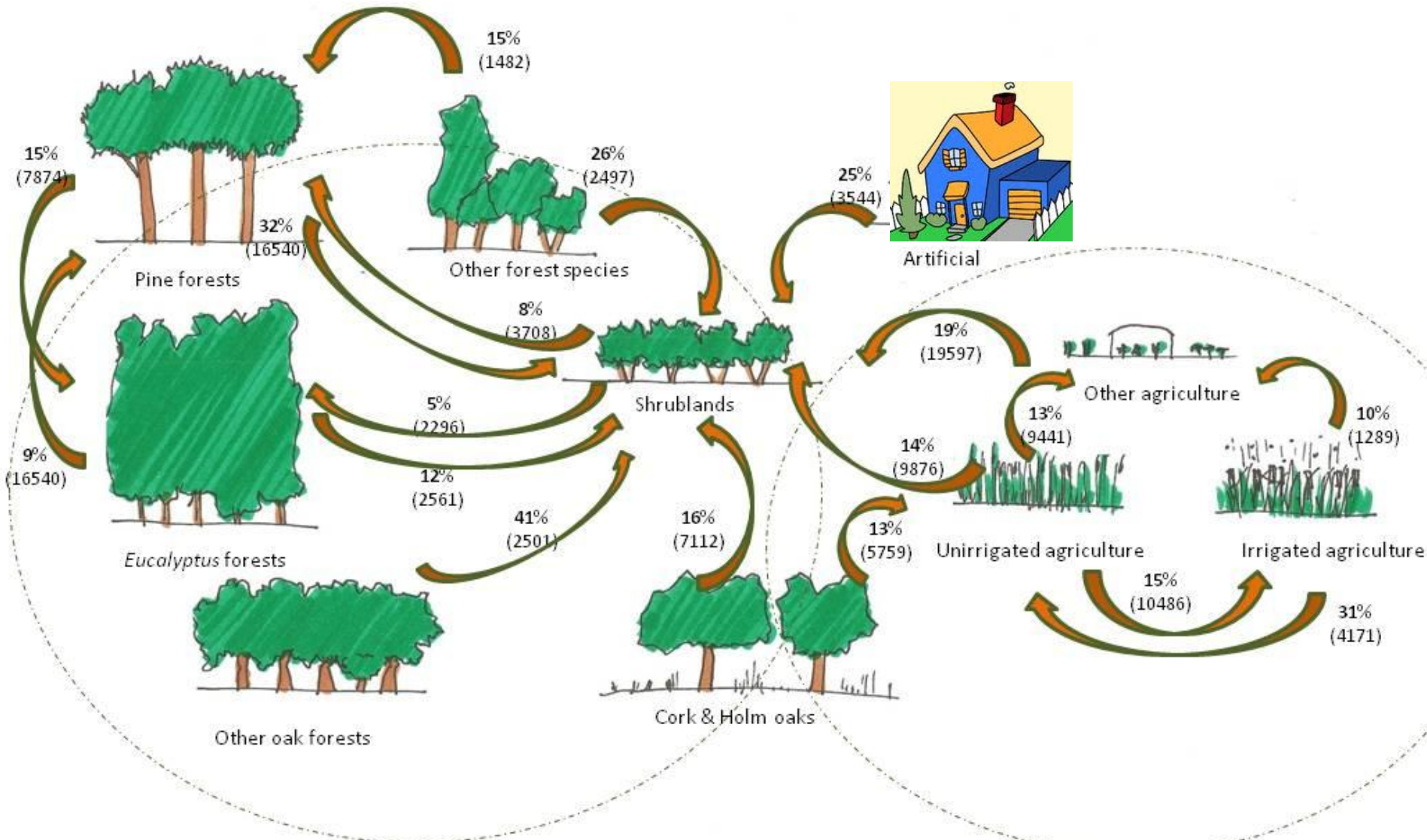
- 1- Select the Natura 2000 Network habitats that correspond to riparian forests
- 2- 24 European countries considered (excluded: UK and Austria - data not readily available and Czech Republic -no data from habitat areas)
- 3- Countries grouped in three geographical regions: Baltic, Central and Mediterranean
- 4- Comparison of distribution, composition, diversity and mean habitat area per site in each country
- 5- Analysis of dependence of habitat diversity in site area
- 6- Analysis of degree of endemism (rarity)

We know that landscape changes: Land use changes in Portugal (Mainland)



(Duarte e Rego, 2010)

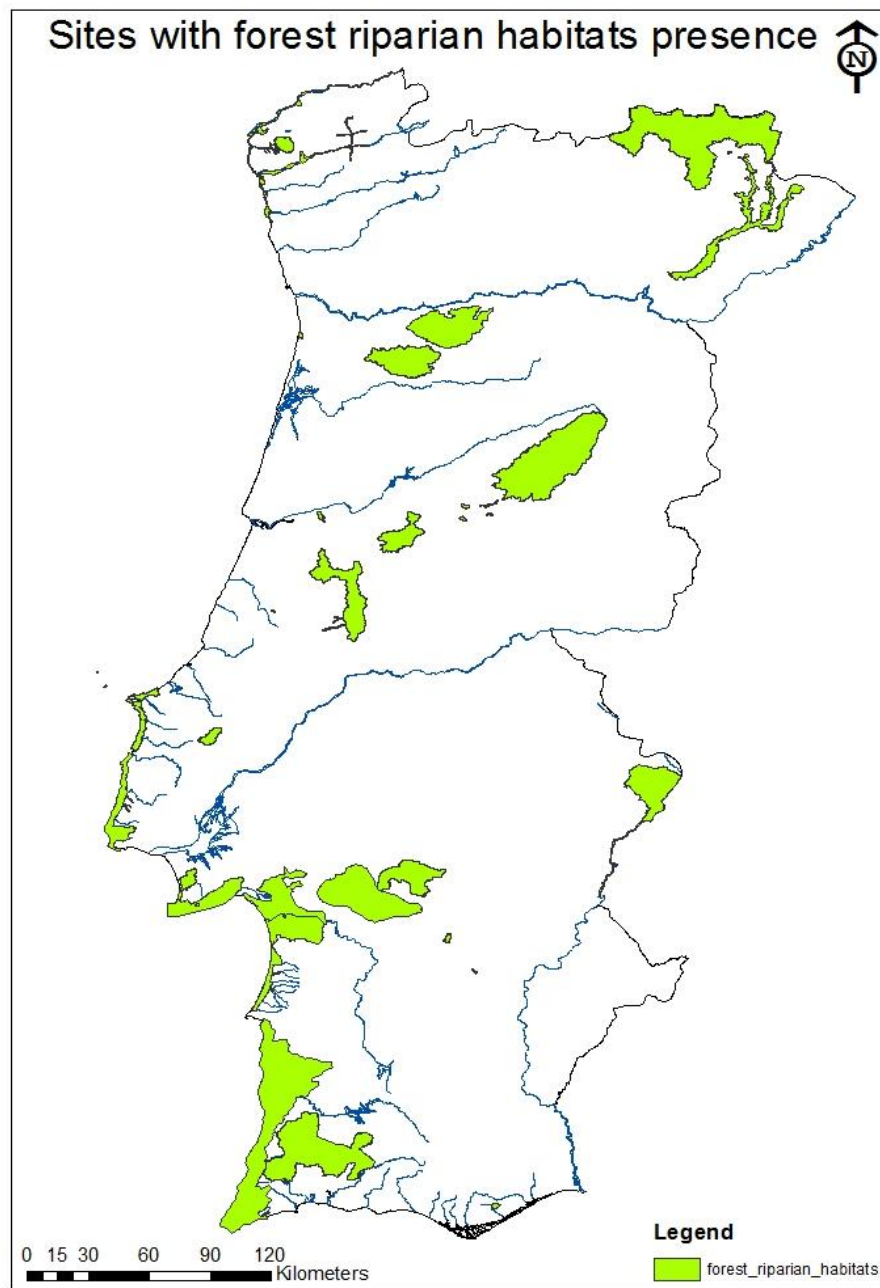
Land use changes in Portugal (Mainland) – dynamic model





Changes also occur in

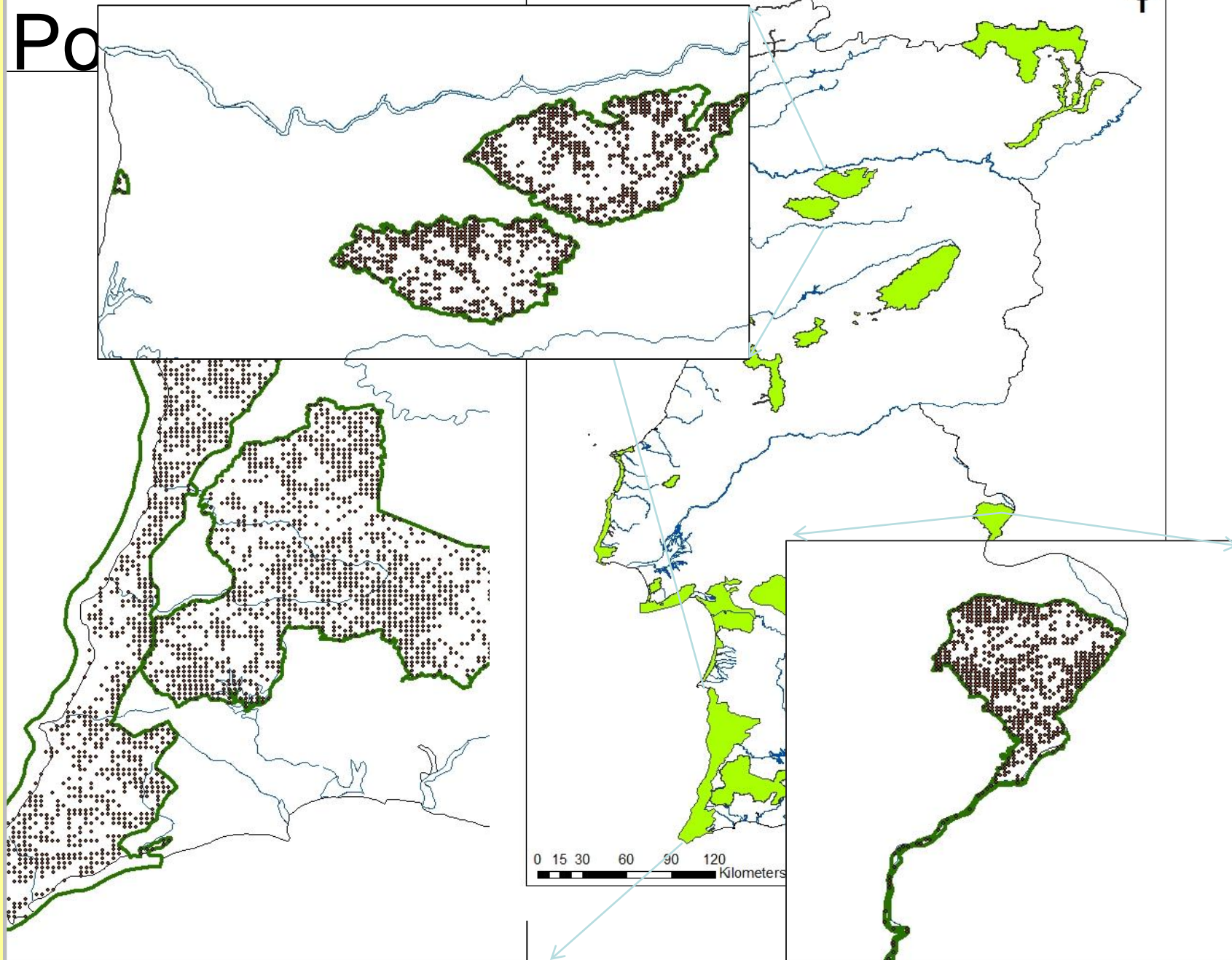
Sites with forest riparian habitats in Portugal





PO

Sites with forest riparian habitats presence



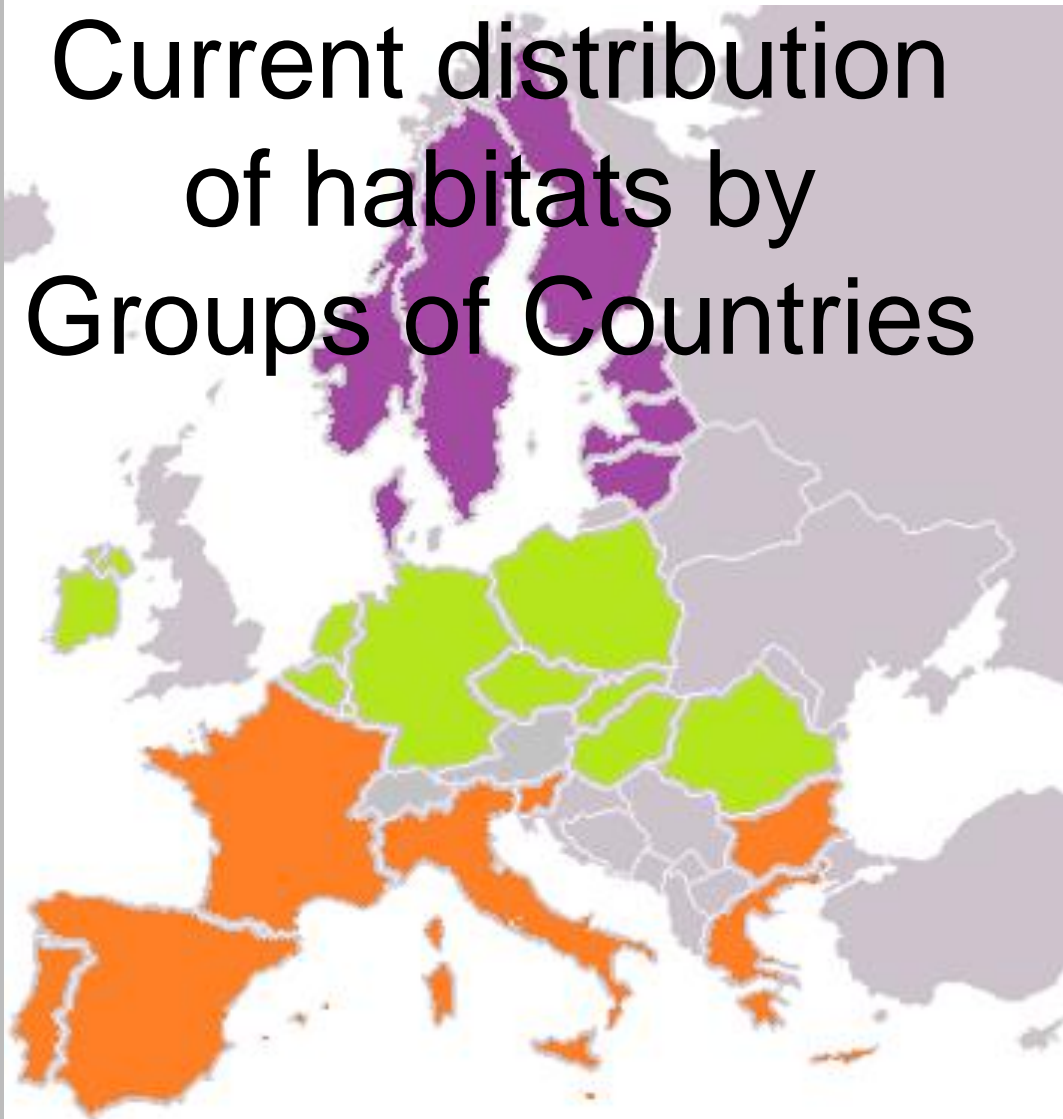
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Current distribution of habitats by Groups of Countries

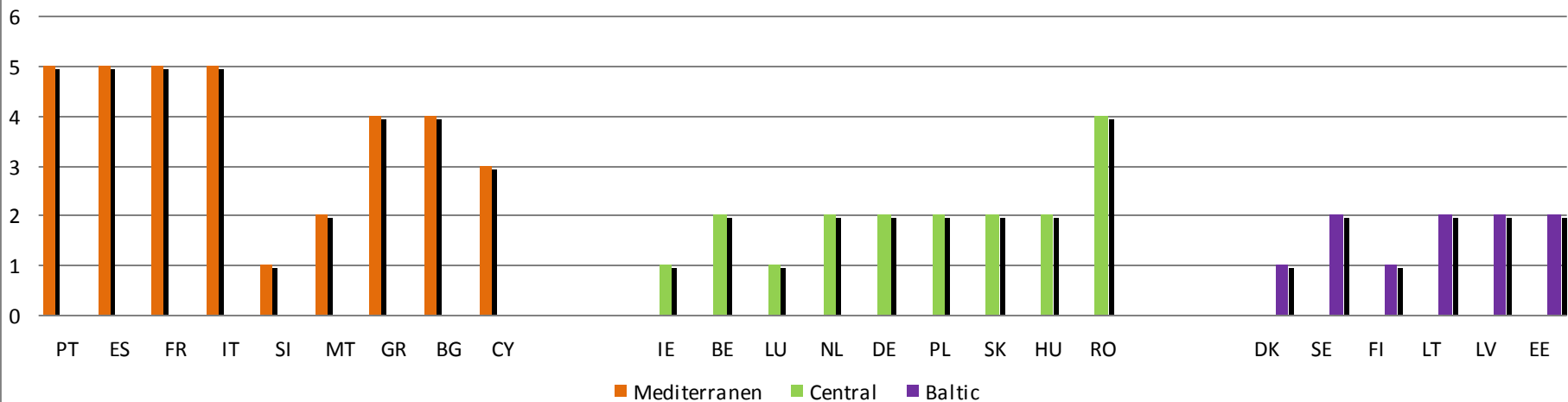


Mediterranean EU	
PT	Portugal
ES	Spain
FR	France
IT	Italy
SI	Slovenia
MT	Malta
GR	Greece
BG	Bulgaria
CY	Cyprus

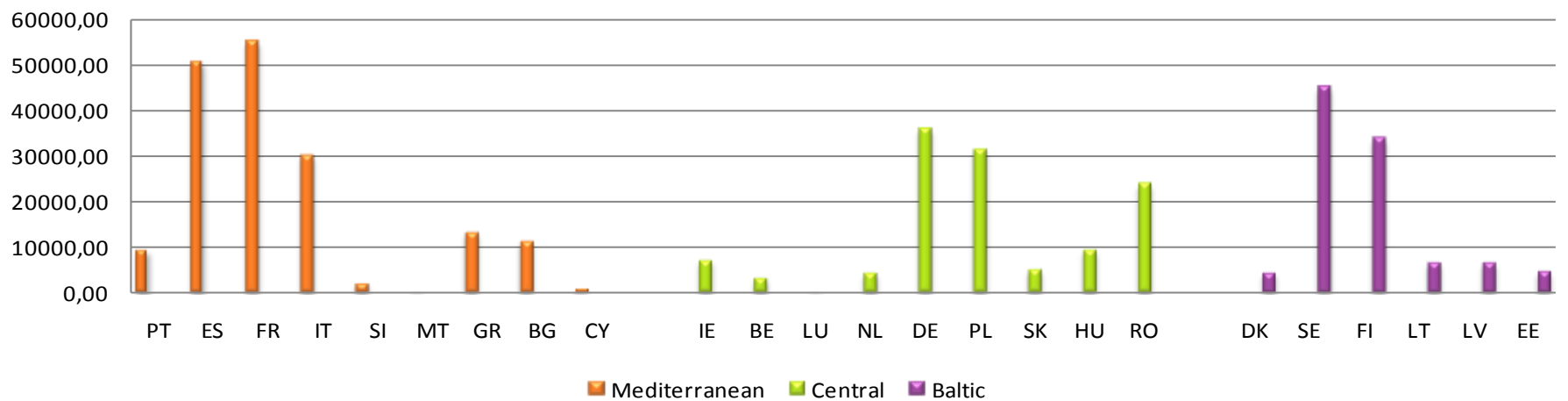
Central EU	
IE	Ireland
BE	Belgium
LU	Luxemburg
NL	Nederland
DE	Germany
PL	Poland
SK	Slovakia
HU	Hungary
RO	Romania

Baltic EU	
DK	Denmark
SE	Sweden
FI	Finland
LT	Lithuania
LV	Latvia
EE	Estonia

Number of forest riparian habitats per country



Country area (ha)





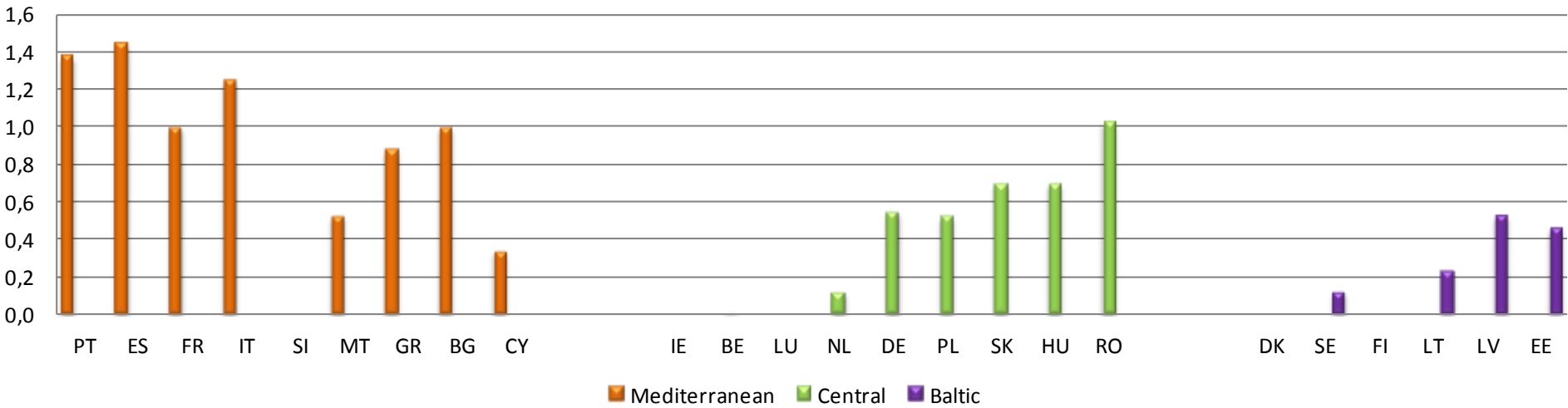
And we can use diversity indices:

The Shannon-Wiener Index:

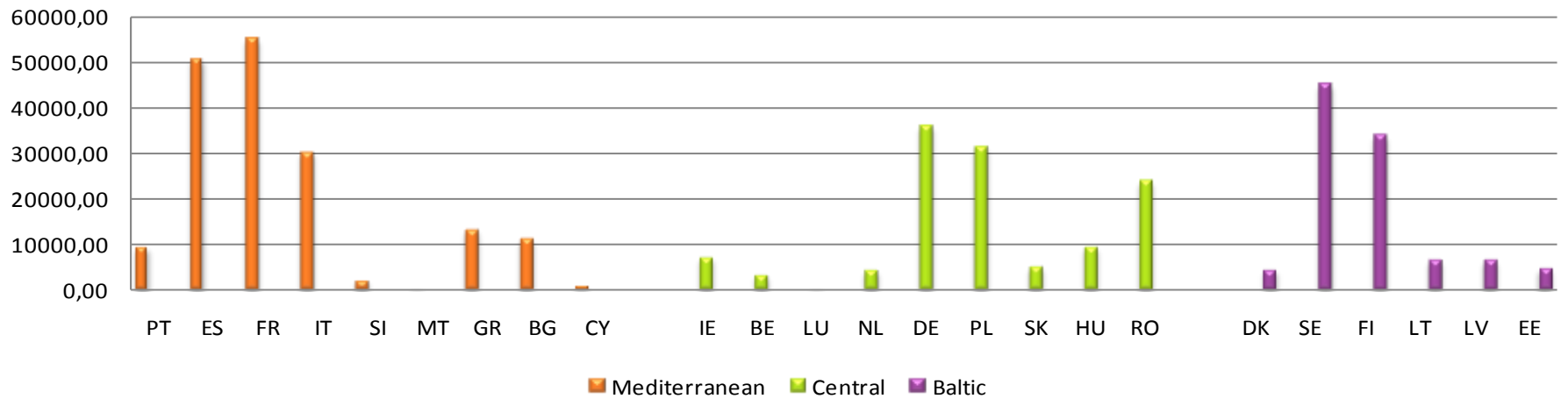
$$I_s = - \sum p_i \ln (p_i)$$

Diversity of forest riparian habitats classified in the country

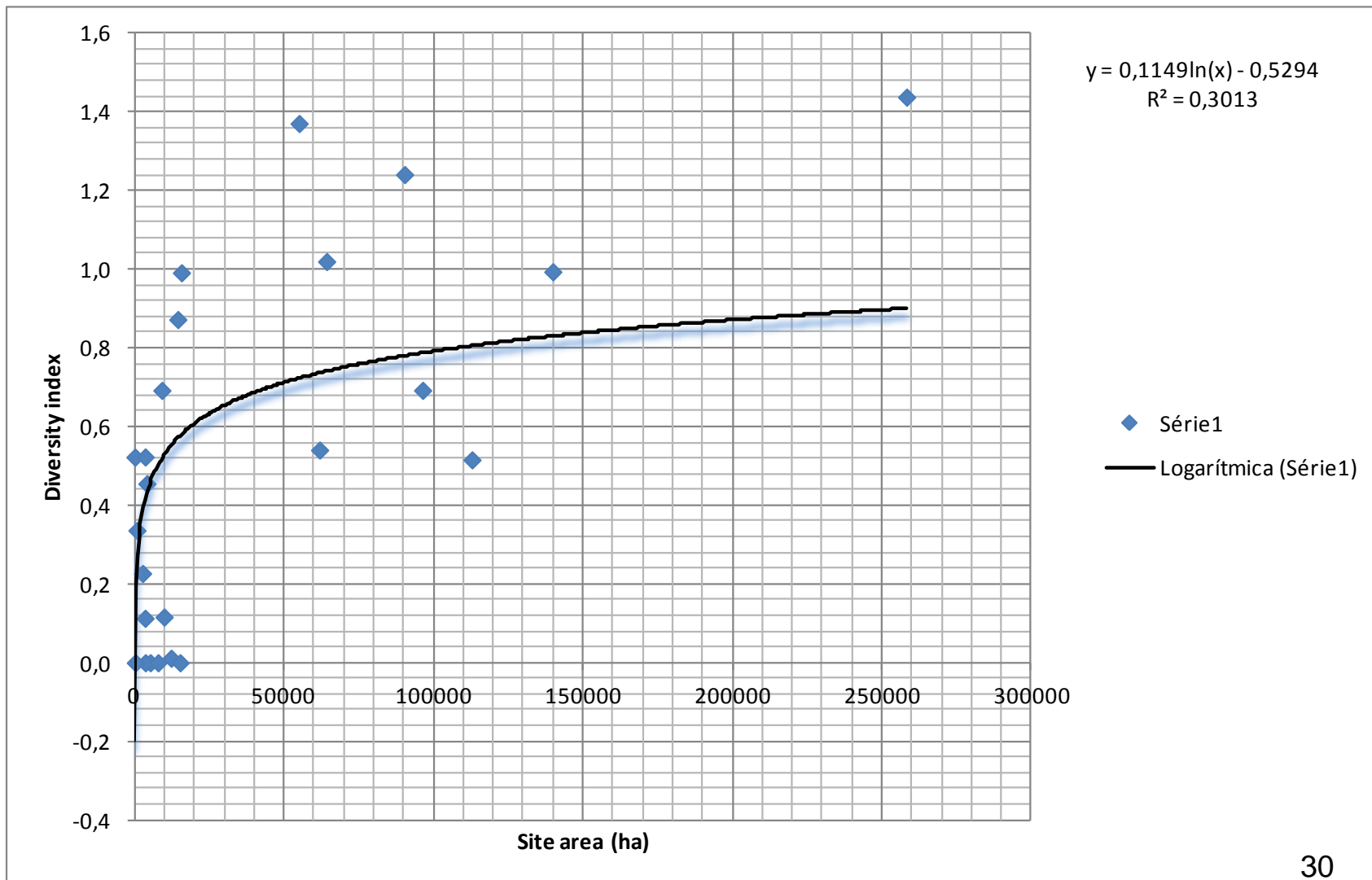
Diversity index per country (Shannon Wiener)



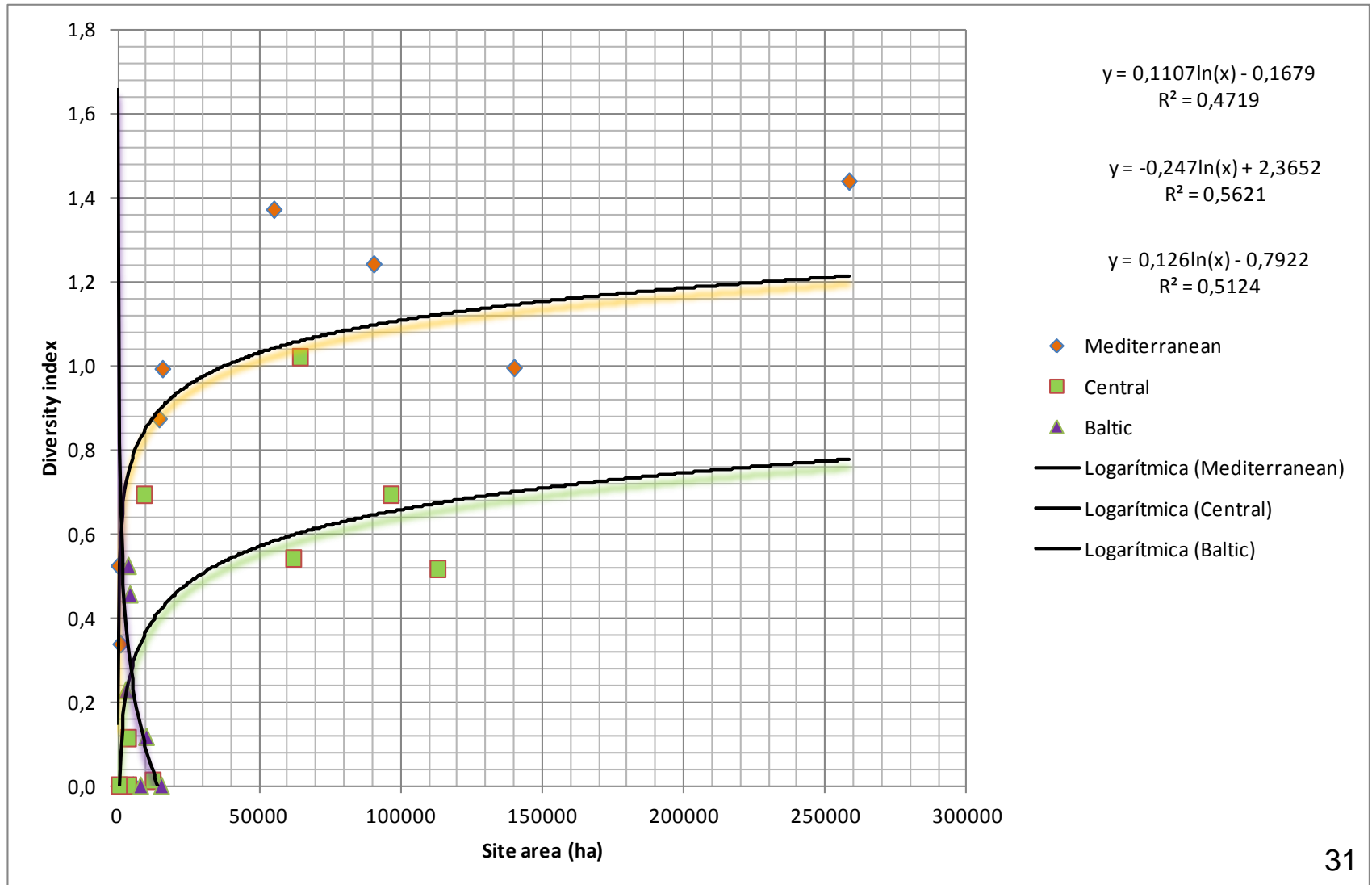
Country area (ha)



General relationship between total area of sites and diversity of forest riparian habitats per country

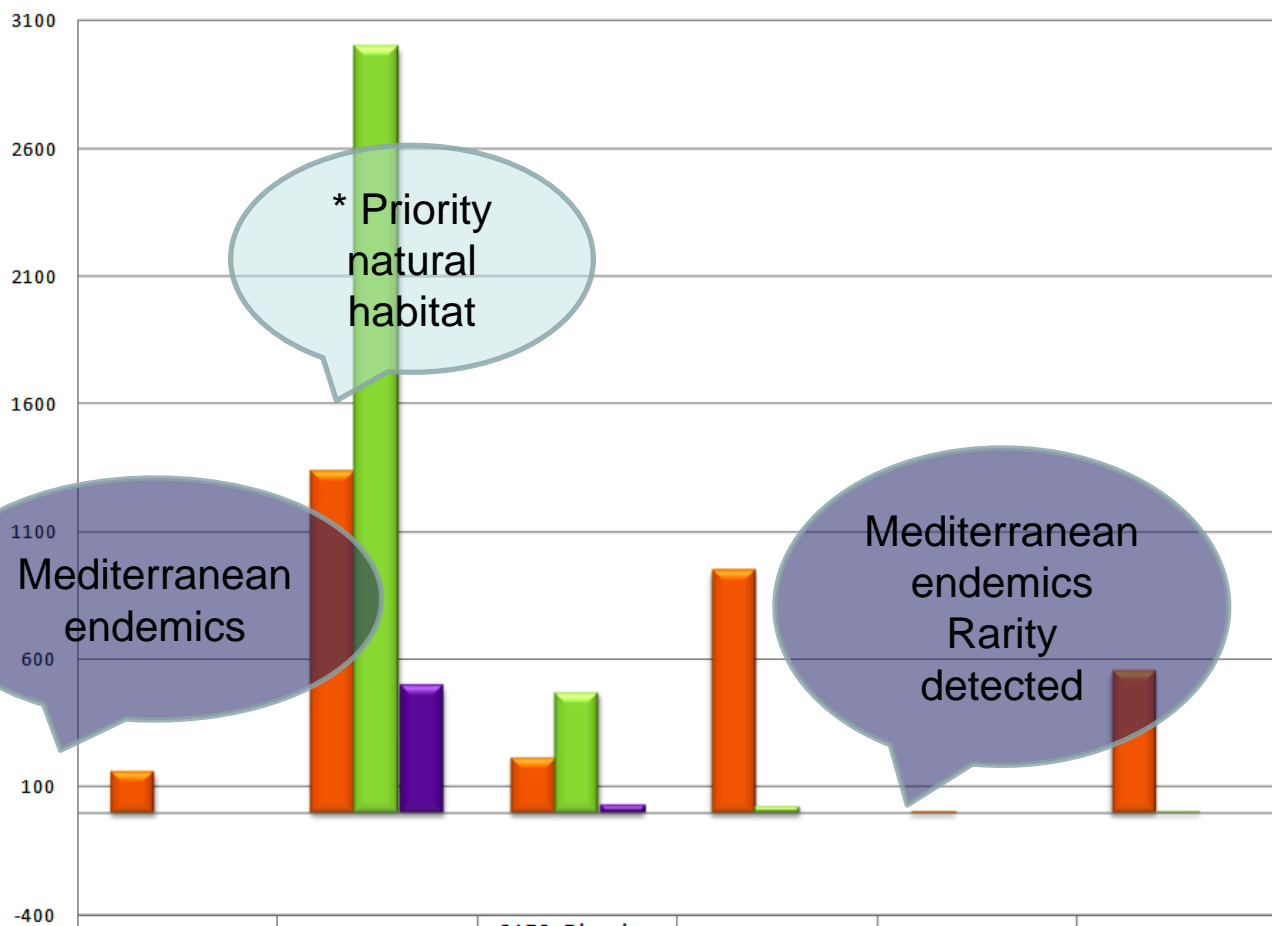


Group relationship between total area of sites and diversity of forest riparian habitats per country





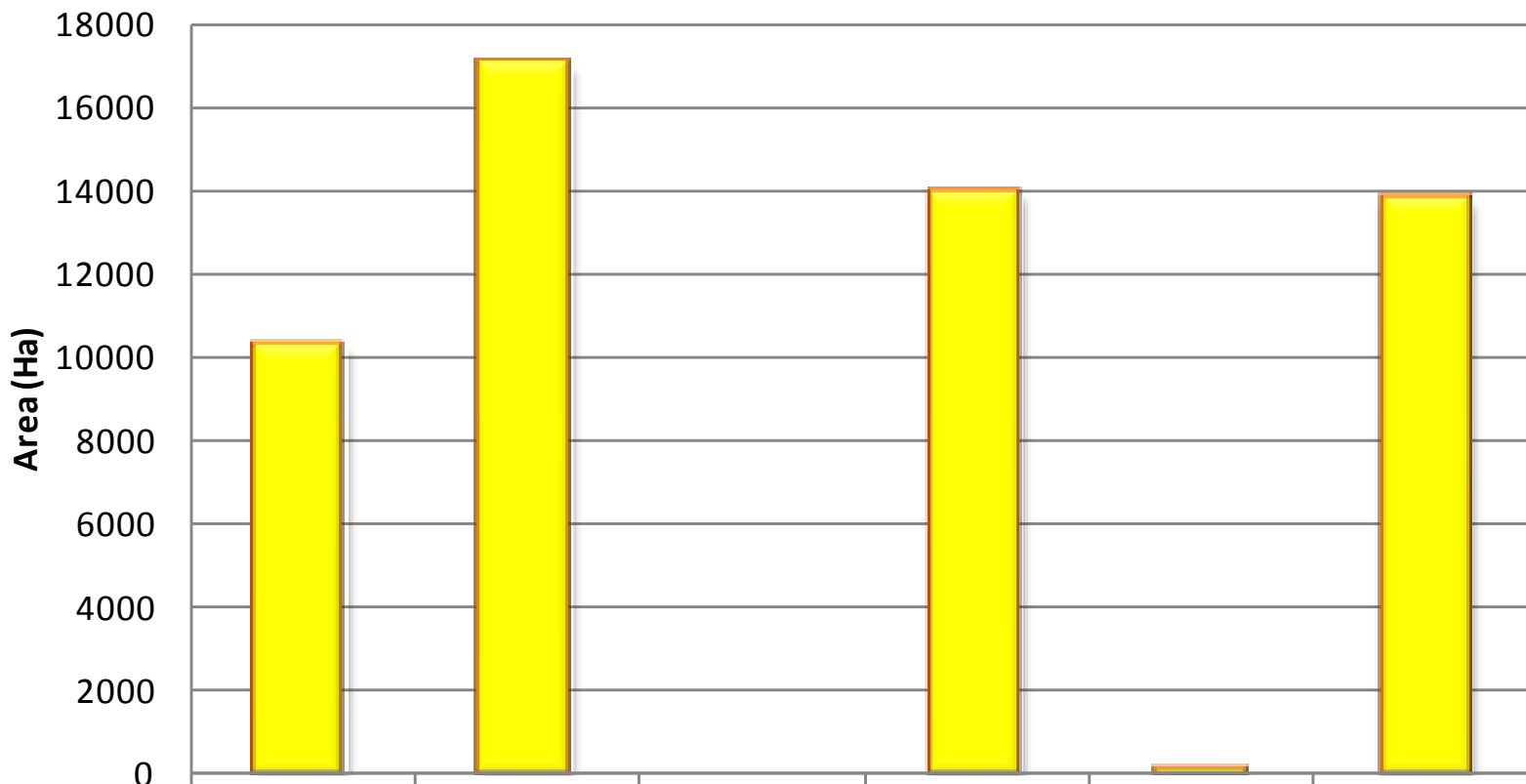
Nr sites with habitat presence



	91B0 - Thermophilous Fraxinus angustifolia woods	91E0*-Alluvial forests with Alnus glutinosa and Fraxinus excelsior	91F0-Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers	92A0 - Salix alba and Populus alba galleries	92B0 - Riparian formations on intermittent Mediterranean water courses with Rhododendron ponticum, Salix and others	92D0 - Southern riparian galleries and thickets																					
<table border="1"> <tr> <td>■ Mediterranean</td> <td>164</td> <td>1338</td> <td>221</td> <td>951</td> <td>10</td> <td>557</td> </tr> <tr> <td>■ Central</td> <td>0</td> <td>3001</td> <td>475</td> <td>31</td> <td>0</td> <td>4</td> </tr> <tr> <td>■ Baltic</td> <td>0</td> <td>497</td> <td>35</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>	■ Mediterranean	164	1338	221	951	10	557	■ Central	0	3001	475	31	0	4	■ Baltic	0	497	35	0	0	0						
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■ Central	0	3001	475	31	0	4																					
■ Baltic	0	497	35	0	0	0																					



Forest riparian habitat area in Portugal



area (ha)	91B0	91E0*	91F0	92A0	92B0	92D0
PT	10.244,64	17.006,63	0	13.929,65	0,92	13.775,55
%med	16,69%	8,70%	0,00%	7,80%	0,01%	14,40%
%tot	16,69%	4,05%	0,00%	6,38%	0,01%	14,03%

91B0 - Thermophilous *Fraxinus angustifolia* woods

91E0*- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion*, *Alnion incanae*, *Salicion albae*)

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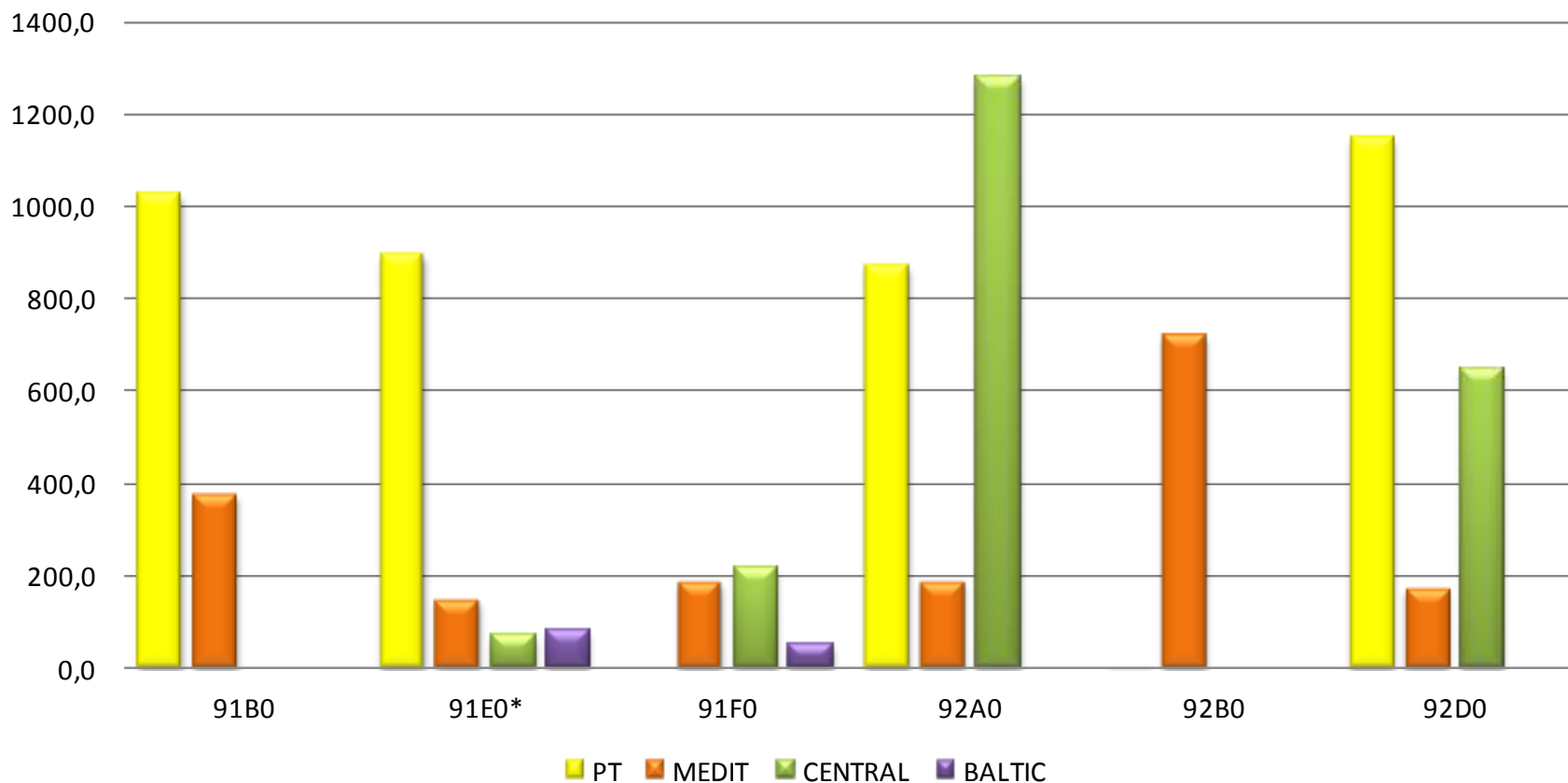
92A0 - *Salix alba* and *Populus alba* galleries

92B0 - Riparian formations on intermittent Mediterranean water courses with *Rhododendron ponticum*, *Salix* and others

92D0 - Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)



Mean habitat area per site (ha)



91B0 - Thermophilous *Fraxinus angustifolia* woods

91E0* - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion*, *Alnion incanae*, *Salicion albae*)

91F0 - Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmion minoris*)

92A0 - *Salix alba* and *Populus alba* galleries

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92D0 - Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)



Conclusions I:

- Site area and diversity of riparian forests habitats in the Natura 2000 are positively related
- Different groups of countries show different types of relations between diversity and area



Conclusions II:

- **91B0** - Thermophilous *Fraxinus angustifolia* woods, a **Forest of Temperate Europe**, is endemic to Mediterranean countries
- **92B0** - Riparian formations on intermittent Mediterranean water courses with *Rhododendron ponticum*, *Salix* and others, is an Iberian endemism with only 10 sites classified



Conclusions III:

- Priority natural habitat **91E0***, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* has a large distribution in the three European country groups
- **92D0** - Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*) has a large distribution in Mediterranean countries, and only 4 sites outside of them



Conclusions IV:

- The forest riparian habitats included in the Natura 2000 network in Portugal are very representative in the total area for Europe
- Portugal has a larger mean habitat area per site than the average in Europe, in four habitat types



Conclusions V:

- Riparian Forests of Portugal are known to be important Greenways for many ecological functions in the landscape and some of the habitats contribute significantly to the European Natura 2000 Network