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Swamp alder woodlands in Galicia (NW Spain): phytosociological interpretation. Ecological and floristic contrast to western European swamp woodlands and delimitation versus riparian alder woodlands in southern Europe and northern Africa

by Javier Amigo, Jesús Izco, Santiago de Compostela, and Inmaculada Romero, Lugo

with 2 figures and 3 tables

Abstract. This phytosociological study gives a report about swamp woodlands dominated by *Alnus glutinosa* in Galicia (northwest Spain). All the woodlands studied belong to the association Carici lusitanicae-Alnetum glutinosae T. E. Díaz & F. Prieto 1994, of the class Alnetea glutinosae. These are azonal woodlands requiring a higher level of waterlogging than riparian alderwoods. The latter communities are included in a different class, the Salici purpureae-Populetea nigrae. We recognize a typical subassociation, as well as a new subassociation caricetosum pendulae occurring on more silty and less persistently waterlogged soils. Carici lusitanicae-Alnetum is the most widespread Alnetea glutinosae community in the Iberian Peninsula, extending from the Bidasoa river basin at Spain's frontier with France in the north, to the Tejo valley north of Lisbon in the south.

In comparison with other swamp alderwood communities of Central and northern Europe, Carici lusitanicae-Alnetum shows interesting examples of floristic vicariance within the main physiognomic groups of swampy woodlands: willows (*Salix* sp. pl.), large sedges (*Carex* sp. pl.), large ferns and hygrophilous meadow herbs. To clarify the identification of *Alnus*-dominated woodlands in the southernmost part of their distribution, we have collated phytosociological information on various Alnetea glutinosae communities from the Iberian Peninsula, Italy and North Africa, and have compared these communities with the riparian woodland alliance Osmundo-Alnion, distributed in southwestern Europe and northwestern Africa. The synthetic table clearly shows that riparian alderwoods contain more typical Querco-Fagetea species, as well as diverse Iberian endemic species not shared with swamp alder woodlands, like *Galium broterianum, Carex elata* subsp. *reuteriana* and *Clematis campaniflora*. By contrast, in communities of Alnion glutinosae (Alnetea glutinosae) the characteristic species of Magnocarici-Phragmitetea are present with high diversity and high frequency. The interesting endemic floristic group within Osmundo-Alnion suggests a rather more restrictive interpretation of this alliance than has been accepted until now: namely, a basically Iberian and western North African distribution, excluding the riparian alderwoods of Corsica, though including the alderwoods of the Algerian region of Kabylia perhaps as an independent (sub)unit.

Keywords: alluvial forests, *Alnus glutinosa, Carex lusitanica,* fen woods, Osmundo-Alnion/Alnion glutinosae, phytosociology.

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1 Introduction

Swamp woodlands/forests dominated by alders and willows, with prolonged waterlogging of the rhizosphere by stagnant or very-slow-flowing water, are a well-known phenomenon in much of Central and northern Europe (DIEKMANN 1999; KELLY & IREMONGER 1997; NOIRFALISE & DETHIOUX 1980; OBERDORFER 1992; RODWELL 1991). In phytosociological terms, these woodlands have been defined as the class Alnetea glutinosae, to clearly delimit them from alluvial and riparian formations, typically assigned to the order Populetalia albae within the class Querco-Fagetea, or more recently the order Salici purpureae-Populetea nigrae (RIVAS-MARTÍNEZ et al. 2001). The ecological characteristics differentiating these flooded woodlands (fen woods or swamp woods in English, *Bruchwald* in German, *bosques pantanosos* in Spanish) and riparian woodlands are a) development on swampy soils, with water table close to the surface (and thus never drying out), and b) little import of mineral sediments during periods of flooding (so that there is little mineral fertilization, and little rise in soil level) (ELLENBERG 1988).

This useful distinction between Alnetea glutinosae and Salici-Populetea albae has often been disregarded, by authors from several European regions including Spain and Portugal: thus there are numerous references to Alnetea glutinosae which in fact do not accurately reflect the concept of this class (CASASECA 1959; BELLOT 1968; DALDA 1972; NAVARRO 1974; DÍAZ 1975). We have previously remarked on this confusion in a study of the Iberian Cantabro-Atlantic riparian alder woodlands (AMIGO et al. 1987), in which we noted that swamp alder woodland required consideration in a future study. It seems likely that the erroneous interpretations of riparian woodland as Alnetea glutinosae originate from CASASECA (1959), a study of the vegetation of the Santiago de Compostela area in northwest Spain, in which the association Carici laevigatae-Alnetum glutinosae (Allorge 1922) Schwickerath 1937 was recognized; this association was described as an Atlantic vicariant of the well-studied central European Carici elongatae-Alnetum glutinosae, with presence of Atlantic species such as *Osmunda regalis* and *Carex laevigata*, but also with swamp species such as *Thelypteris palustris* and *Dryopteris cristata* (SCHWICKERATH 1937). The presence of the former two species (relatively common in the riparian Osmundo-Alnion woodlands of Galicia) may have encouraged CASASECA to interpret these formations as Carici laevigatae-Alnetum, although these species are in fact probably best seen as "atypical aspects of the Galician-Portuguese association Senecio bayonnensis-Alnetum glutinosae" (AMIGO et al. 1987).

The first unequivocal reference, backed up by relevés, to alder swamp woodlands in northern Spain, is that of DÍAZ & FERNÁNDEZ-PRIETO (1994) from Asturias. This study described the association Carici lusitanicae-Alnetum glutinosae; the publication includes only one relevé, but states that this association is present at various levels in the thermocoline belt (thermotemperate according to the current proposals of RIVAS-MARTÍNEZ

et al. 2002a) of Asturias (i.e. the Galician-Asturian Sector) and also the Cantabrian-Basque Sector. Its presence in the Cantabrian-Basque Sector has been confirmed in several subsequent studies from areas including Santander (HERRERA 1995) and Alava and Navarra (BIURRUN 1999). We have reported the presence of Carici lusitanicae-Alnetum glutinosae in Galicia at a Congress, but the published abstract does not include the corresponding relevés. It has also been recognized recently in central Portugal (ESPIRITO-SANTO et al. 2001) in a specific version denominated Carici lusitanicae-Alnetum glutinosae subassociation fraxinetosum angustifoliae within the Mediterranean Region (specifically the Ribatagan-Sadensean Sector of the Lusitan-Andalusian Litoral Province), confirming its azonal nature. In this same sector interesting swamp woodland formations are present, but these are dominated by willows rather than alders, and have been described as Carici lusitanicae-Salicetum atrocinereae (NETO et al. 1996), to date known only from this sector.

In the present study, we report an extensive series of alder swamp woodland relevés from Galicia (NW Spain), with consideration of floristic composition, among-site variation, and territorial distribution.

2 Methods

Relevés were obtained by BRAUN-BLANQUET (1979) methodology as updated by GÉHU & RIVAS-MARTÍNEZ (1981) from various swamp alder woodland formations. The criteria for plot selection were 1) a continuous arboreal physiognomy dominated by *Alnus glutinosa*, or rarely *Salix atrocinerea*; 2) flat or depressed topography, favouring the continued presence of standing water during periods of flooding; 3) understorey without excessive anthropic impacts (as revealed for example by abundant herbivore droppings, or indications of mowing); and 4) presence of large shade-tolerant clump-forming or non-clump-forming *Carex* species.

In most cases plot area was sufficient for a woodland community (at least 100 m^2), but in some cases it was necessary to use a smaller plot (40–80 m^2) in order to achieve optimal balance of the above criteria; in all such cases the plot formed part of a larger stand. In addition to the topographic position of each stand, we also took into account microtopography; in all plots we confirmed the presence of peaty soil, observable because herb cover is never complete, in part because of the frequent presence of pools of standing water.

In Galicia, swamp alder woodlands occur in two types of position: firstly, on coastal flats in association with the slowing of small watercourses because of the zero slope, and often because of the damming effect of coastal dunes; and secondly in inland flat areas or depressions, associated with wide valley bottoms or endorheic basins filled with Tertiary or Quaternary sediments.

The relevés presented here are from three of Galicia's four administrative provinces (A Coruña, Pontevedra and Lugo). Chorological terminology

follows RIVAS-MARTÍNEZ (1987), though with certain modifications as proposed by RIVAS-MARTÍNEZ et al. (2002a).

In addition to classical phytosociological procedures, we also performed a hierarchical cluster analysis of the relevés, using the statistics package SPSS (2001), with nearest-neighbour linkage and squared Euclidean distance as measure of similarity. Braun-Blanquet indices of abundance were transformed to numerical values by the method of VAN DER MAAREL (1979).

3 Results

Table 1 lists 38 relevés from Galician swamp alder woodlands, which we shall denominate "alderwoods" although in some cases the only dominant tree species is the willow *Salix atrocinerea*; we consider that such cases are best considered as a seral stage prior to clear alder dominance. All relevés are interpreted as belonging to the association Carici lusitanicae-Alnetum glutinosae.

Key floristic features, apart from the total domination of the tree layer by alders and/or willows, include the high proportion of palustrine helophytes whose phytosociological optimum is in the class Phragmito-Magnocaricetea. Of these, the most visually evident are large cyperaceans, particularly when they reach high cover-abundance values, as in the case of the clump-forming taxon *Carex paniculata* subsp. *lusitanica*, or less commonly *Cladium mariscus* on soils with somewhat higher pH than is normal in this region. We define relevés in which *Carex pendula* is abundant, at the expense of these other two species, as the subassociation caricetosum pendulae subas. nova (relevés 32–38, holotypus relevé 38); as detailed below, this subassociation approaches the Alnion incanae riparian alderwoods.

The main group of relevés (nos. 1–31) are of the subassociation alnetosum glutinosae. The floristic composition of this subassociation includes a well-defined group of hygrophilous meadow species of the order Molinietalia caeruleae (class Molinio-Arrhenatheretea). These species are generally absent from the subassociation caricetosum pendulae.

Within the subassociation alnetosum glutinosae, a number of internal divisions are apparent. First, there is a group that we denominate the *Carex lusitanica* variant (relevés 1–13), representing the most typical aspect of this association, with understorey physiognomy dominated by dense clumps of this cyperacean. Second, there is a group that we denominate the *Deschampsia cespitosa* variant (relevés 14–19), which in view of the abundance *Deschampsia cespitosa s.l.* shows a close relationship with a particular type of Juncion acutiflori meadows, not yet fully characterized in Galicia, though we would provisionally assign them to Deschampsio-Juncetum effusi. Finally, there is a third group that we denominate the *Laurus nobilis* variant (relevés 23–31), whose thermophilous character is stressed by the presence of *Laurus nobilis* and *Tamus communis*, in line with its occurrence on coastal flats in the thermotemperate belt, as typical of the final stretches of rivers in sites also favourable for the subassociation caricetosum pendulae, which may thus include *Laurus nobilis* and *Tamus communis*.

As regards chorology, Carici lusitanicae-Alnetum is present in both subsectors of the Cantabrian-Atlantic Subprovince that extend into Galicia (Fig. 1). It occurs only in the thermotemperate and mesotemperate belts, in line with its strictly low-altitude topographical distribution (depressions, valley bottoms, coastal flats).

The grouping of the relevés obtained by hierarchical cluster analysis (Fig. 2) supports the classical phytosociological analysis, as follows.

Firstly, the 13 relevés of the typical subassociation alnetosum glutinosae were assigned to an exclusive group (A–1). All of these relevés contain clumps of *Carex lusitanica*, and the remaining differential species are often not present. These relevés are likewise those showing most presences of species characteristic of Alnion glutinosae (*Thelypteris palustris*, *Dryopteris carthusiana*, *Carex pseudocyperus* and to lesser extent *Carex laevigata*).

Secondly, the 6 relevés of the *Deschampsia cespitosa* variant were likewise assigned to an exclusive group (A-2), paired with A-1. This grouping is reinforced by the fact that these relevés are those with the highest presences of the indicator species of Molinietalia caeruleae.

Thirdly, the 7 relevés of the subassociation caricetosum pendulae were assigned to a single group (B-2), though this group also contained relevé 31 (classified phytosociologically as the *Laurus nobilis* variant of the subassociation alnetosum glutinosae), probably placed in B-2 because of the abundant presence of *Carex remota*. The frequent presence of species such as *Carex remota* and *Circaea lutetiana* in these relevés reinforces the idea of their closeness to the alluvial woodlands of Alnion incanae.

The remaining relevés were grouped into branch B-1, divided into two sub-groups, one comprising all relevés of the *Laurus nobilis* variant (B-1a) and the other three relevés without differential species (B-1b), which are probably best classified as immature in view of the scant presence or absence of *Alnus glutinosa*, together with low species richness (mean 17 species per relevé).

4 Discussion

4.1 Floristic characteristics

Although very few characteristic species have been reported for the class Alnetea glutinosae (MUCINA 1997; RIVAS-MARTÍNEZ et al. 2002b), our assignment of the alderwood relevés in Table 1 to this class is consistent with floristic composition patterns observed in other communities of this class in western and Central Europe, as summarized in Table 2. Key aspects of floristic composition are as follows:

1) Minimal diversity as regards both dominant tree species and shrub species in the understorey. Note the replacement of the Central European

Table 1. Carici lusitanicae-Alnetum glutinosae T. E. Díaz & F.-Prieto 1994. Subassociation alnetosum glutinosae (relevés 1–31). Typical variant (relevés 1–13). *Deschampsia cespitosa* variant (relevés 14–19). *Laurus nobilis* variant (relevés 23–31). Subassociation caricetosum pendulae subas. nova (relevés 32–38, holotypus relevé 38).

Species present in only 1 relevé:
Alisma plantago-aquatica: r in 3; *Arrhenatherum bulbosum*: 2 in 15; *Bidens frondosa*: + in 1; *Brachypodium pinnatum*: 3 in 32; *Carex divisa*: + in 30; *Carex leporina*: + in 1; *Corylus avellana*: r in 27; *Crocosmia* × *crocosmiflora*: 2 in 33; *Cruciata glabra*: r in 19; *Danthonia decumbens*: + in 23; *Epilobium obscurum*: + in 7; *Epilobium parviflorum*: + in 13; *Epilobium tetragonum*: 1 in 15; *Erica erigena*: + in 19; *Erica tetralix*: r in 19; *Erica vagans*: 1 in 12; *Euphorbia amygdaloides*: + in 19; *Genista berberidea*: r in 14; *Geum urbanum*: 1 in 32; Gramineae sp.: r in 20; *Heracleum sphondylium*: + in 26; *Humulus lupulus*: + in 37; *Hypericum elodes*: + in 7; *Hypochaeris* sp. (cf.): 1 in 13; *Juncus bufonius*: r in 7; *Lotus corniculatus*: 1 in 13; *Menyanthes trifoliata*: 2 in 13; *Poa trivialis*: 1 in 15; *Populus nigra*: 1 in 33; *Potamogeton polygonifolius*: + in 19; *Primula vulgaris*: + in 26; *Prunus laurocerassus*: + in 18; *Ranunculus bulbosus*: r in 14; *Ranunculus* sp.: + in 15; *Robinia pseudacacia*: 1 in 35; *Rosa* cf. *canina*: 1 in 12; *Rosa* sp.: r in 33; *Rubia peregrina longifolia*: + in 21; *Salix cf. viminalis*: + in 6; *Schoenus nigricans*: 1 in 19; *Senecio bayonensis*: + in 8; *Silene* cf. *dioica*: 1 in 30; *Stenotaphrum secundatum*: + in 34; *Teucrium scorodonia*: r in 27; *Veronica montana*: + in 36; *Viburnum opulus*: 3 in 12.

Relevé locations:
(Administrative province codes: C = A Coruña; LU = Lugo; PO = Pontevedra)
1. PO: Porriño; between Cerquido and Alvelas, 29T NG3059; 2. PO: Porriño; close to *braña de Cerquido*, 29T NG3060; **3**. LUGO: Begonte; "Ollos de Begonte", 29T PH0479; **4**. LU: Meira, Fonmiñá, 29T PH3687; **5**. C: Cedeira, Pantín; Rimayor stream valley; below relevé No. 13, 29T NJ7131; **6**. C: Fisterra; very close to relevé No. 14, 29T MH7852; 7. LU: Outeiro de Rei, between Bonxe and S. Clodio, 29T PH1773; **8**. LU: Cospeito, Paincega, 29T PH2789; **9**. LU: Begonte; Damil, 29T PH1279; 10. LU: Pastoriza; Abegas, 29T PH3689; **11**. LU: Pastoriza. Baltar, Miñoto, close to relevé No. 15, 29T PH3491; **12**. LU: Vilalba, close to *Lagoa do Home Morto*, 29T PH0886; **13**. C: Cedeira, Pantín; Rimayor stream valley, 29T NJ7131; **14**. C: Fisterra, 29T MH7852; **15**. LU: Pastoriza. Baltar, Miñoto, 29T PH3491; **16**. C: Tordoia; between Bardaos and Cabaleiros, 29TNH3672; **17**. C: Vimianzo; between Xova and Treos, 29T NH0272; **18**. C: Vimianzo; Gándara, 29T MH9672; **19**. C: Santa Comba, Xesteira, 29T NH1467; **20**. C: Coristanco. Between Cereixa and Arixón, 29T NH2275; **21**. C: Carballo, close to Miñata along Rosende stream valley, 29T NH2382; **22**. LU: Begonte; "Ollos de Begonte", 29T PH0479; **23**. C: Narón; Mandia, *Polígono Río do Pozo*, 29T NJ6321; 24. C: Ortigueira, between Ponte Mera and Santa Marta, 29T NJ9335; **25**. C: Ortigueira, 2 Km before Santa Marta from the west, 29T NJ9335; 26. C: Ortigueira. Playa de Morouzos, 29T NJ9339; **27**. C: Ortigueira. Playa de Morouzos, close to the small lagoon, 29T NJ9339; **28**. C: Ortigueira, Playa de Morouzos, 29T NJ9339; 29. C: Ortigueira, 2 Km before Santa Marta from the west, 29T NJ9335; **30**. C: Ortigueira, close to the As Pontes road cross, 29T NJ9335; **31**. C: Valdoviño; *Lagoa Frouxeira*, 29T NJ6828; **32**. PO: Porriño; O Fial, from Budiño wetland to the north, 29T NG3064; **33**. C: Coristanco; close to Veo river, 29T NH1981; **34**. C: Ortigueira, exit from Espasante, 29T NJ9742; **35**. C: Valdoviño; *Lagoa Frouxeira*, close to relevé No. 31, 29T NJ6828; **36**. C: Valdoviño; Frouxeira river, at the bottom of Laguna Frouxeira, 29T NJ6827; **37**. C: Ponteceso, Anllóns 29T NH0885; **38**. PO: Porriño; Centeáns, 29T NG3064.

Relevé nº	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Altitude (m a.s.l.)	10	10	395	430	10	<5	400	420	420	440	440	405	440	350	190	130	340	400	90	395	<5	<5	<5	<5	<5	10	5	10	<5	<5	<5	<5	100	5	<5	<5	5	15
Cover (%)	80	95	80	100	100	100	100	100	80	75	85	100	100	100	100	95	95	100	90	100			100	100	100	100	100			100	100	100	100	100	100	95	95	
Plot area (m^2)	150	250	50	50	200	40	80	50	120	60	75	150	80	75	100	100	150	150	200	60	-	-	120	100	140	80	80	-	40	50	150	250	150	100	-	250	200	200
No. of species	27	21	17	14	18	13	27	24	22	19	22	41	33	20	28	20	28	33	39	16	19	16	36	33	34	26	32	17	29	24	19	30	28	19	27	20	30	23
Association, alliance, order & class characteristic species																																						
Alnus glutinosa	4	5	4	4	4	5	2	4	4	4	5	3	3	3	5	5	4	4	1	2	.	.	5	4	3	5	4	1	2	4	5	5	5	5	5	2	5	5	36
Salix atrocinerea	3	2	2	1	3	.	4	2	2	.	1	4	4	4	1	2	4	4	5	3	5	5	2	4	4	3	3	5	5	3	2	2	1	1	2	5	1	1	36
Athyrium filix-femina	1	2	.	+	1	+	.	.	+	1	.	.	.	.	.	1	2	1	1	1	.	.	.	100	100	100	100	100	.	r	1	2	.	1	1	+	+	1	3	26
Galium palustre	+	+	r	.	1	.	2	+	1	r	+	+	1	.	+	.	.	1	1	.	r	1	1	.	1	2	.	1	.	1	.	3	.	r	1	1	+	.	.	25
Solanum dulcamara	.	+	1	1	+	.	+	1	.	.	2	+	+	1	.	.	.	1	r	1	r	+	.	.	.	.	1	1	.	.	1	.	.	+	+	1	+	+	24
Lythrum salicaria	+	.	.	.	+	1	.	+	+	.	.	.	.	.	.	.	.	1	1	+	2	+	.	r	.	+	+	1	.	r	.	1	.	.	+	+	.	1	+	22
Lycopus europaeus	1	1	r	.	.	.	+	1	.	.	+	1	1	+	.	.	.	1	2	2	.	+	.	.	.	.	.	.	.	.	1	+	+	1	.	.	+	2	1	20
Iris pseudacorus	.	+	.	r	.	1	3	1	.	+	.	+	.	.	.	.	.	.	.	+	.	.	1	.	.	1	2	.	.	.	+	2	+	.	3	1	.	+	1	19
Carex paniculata lusitanica	4	5	4	4	4	3	3	4	4	1	2	3	1	2	+	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	19
Mentha aquatica	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	2	2	2	+	.	1	+	.	.	1	.	2	.	+	+	+	1	1	1	+	+	.	17
Osmunda regalis	2	3	.	+	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	+	.	.	1	r	.	.	1	1	11
Carex laevigata	.	.	+	.	.	.	.	r	.	.	.	.	.	+	+	+	.	+	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	9
Oenanthe crocata	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	r	+	.	1	7
Sparganium neglectum	1	.	.	2	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	5
Carex pseudocyperus	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	5
Dryopteris carthusiana	1	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Thelypteris palustris	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Cladium mariscus	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Differential species																																						
Laurus nobilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	1	2	1	+	1	1	2	1	1	+	1	1	1	+	.	.	16
Tamus communis	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	+	+	.	.	+	r	1	+	r	+	+	.	.	.	.	.	11
Carex remota	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	3	4	.	1	3	+	2	2	11
Carex pendula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4	4	5	4	1	3	7
Circaea lutetiana	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	+	1	5
Deschampsia cespitosa	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4	4	4	3	3	2	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	8
***Molinietalia caeruleae* species**																																						
Juncus effusus	1	r	.	+	.	.	1	+	1	.	+	1	1	+	1	.	1	+	r	.	.	.	+	.	.	.	.	.	+	+	+	.	+	.	.	+	.	.	21
Peucedanum lancifolium	+	.	.	.	.	.	+	+	+	.	+	+	1	1	2	+	1	1	1	+	.	.	.	+	+	.	.	.	+	.	r	+	.	.	.	.	.	.	19
Cirsium palustre	.	.	+	.	+	+	+	.	.	.	.	+	r	1	1	+	.	2	1	.	.	.	+	+	r	.	+	.	+	+	.	r	.	.	.	.	.	.	18
Scutellaria minor	+	+	r	.	.	+	1	.	.	.	.	+	+	r	1	+	1	.	.	+	.	.	+	1	1	.	.	.	+	.	.	.	.	.	.	.	+	.	.	17
Valeriana dioica	.	.	.	.	.	.	+	.	1	2	.	1	2	.	+	.	.	1	1	.	.	.	.	2	1	.	2	.	+	+	.	.	.	.	.	.	.	.	.	12
Carex flacca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	1	2	+	.	1	.	2	+	.	.	.	.	.	.	.	.	.	.	9
Molinia coerulea	2	+	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	2	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	3	+	8

Tabla 1. Localidades de los inventarios: (ordenación de DEFINITIVA)

1. 020606/1. PO: Porriño; entre Cerquido y Alvelas, por el lado sur de la pista que cruza la masa arbolada. 29T NG3059.
2. 020606/2. PO: Porriño; contigua a la braña de Cerquido. 29T NG3060.
3. 971010/2. LU: Begonte; "Ollos de Begonte", orillas del Ollo pequeño. 29T PH0479
4. 970718/2. LU: Meira, Fonmiñá, Nacimiento del Miño. 29T PH3687
5. 960806/6. C: Cedeira, Pantín; valle del arroyo Rimayor; por debajo del nº 13. 29T NJ7131.
6. 960817/2. C: Fisterra; contiguo al invt. 14, algo más inundado. 29T MH7852
7. 970718/1. LU: Outeiro de Rei, entre Bonxe y S. Clodio. 29T PH1773
8. 970718/3. LU: Cospeito, Paincega. 29T PH2789
9. 971010/3. LU: Begonte; Damil. 29T PH1279.
10. 971010/4. LU: Pastoriza; Abegas. 29T PH3689
11. 971010/6. LU: Pastoriza. Baltar, Miñoto. Separado del nº 15 por una pradera higrófila con abundante *Carex lusitanica*. 29T PH3491.
12. 000614/8. LU: Vilalba, c. Lagoa do Home Morto; junto al límite con el municipio de Begonte. 29T PH0886
13. 971010/5. LU: Pastoriza. Baltar, Miñoto. Fondo de valle que apenas se hunde. 29T PH3491
14. 000606/1: C: Tordoia; entre Bardaos y Cabaleiros. Aliseda rodeada de pradera de *Deschampsia*. 29TNH3672
15. 000612/2. C: Vimianzo; entre Xova y Treos. 29T NH0272
16. 000617/1. C: Vimianzo; Gándara. 29T MH9672
17. 000527/1. C: Santa Comba, Xesteira. Pequeña depresión paralela al río Xallas. 29T NH1467
18. 000608/1. C: Coristanco. Entre Cereixa y Arixón. 29T NH2275
19. 001005/2. C: Carballo, c. Miñata cerca de la depuradora, junto al río Rosende. 29T NH2382
20. 971010/1. LU: Begonte; "Ollos de Begonte", orillas del Ollo grande. 29T PH0479
21. 960806/2. C: Narón; Mandia, Polígono Río do Pozo, c.N-646, km. 5,5. 29T NJ6321
22. 960805/1: C: Ortigueira, C.N. 642; entre Ponte Mera y Santa Marta. 29T NJ9335.
23. 960805/3: C: Ortigueira, 2 Km antes; rio junto a carretera de As Pontes. 29T NJ9335
24. 960806/3. C: Ortigueira. Playa de Morouzos, contiguo al invt. 27. Fase más seca. 29T NJ9339.
25. 960806/5. C: Cedeira, Pantín; valle del arroyo Rimayor. 29T NJ7131
26. 960817/1. C: Fisterra; en la recta previa a la entrada del pueblo. 29T MH7852
27. 960806/2. C: Ortigueira. Playa de Morouzos, arenal junto a la laguna. 29T NJ9339.
28. 960806/4. C: Ortigueira, Playa de Morouzos. 29T NJ9339.
29. 960805/4: C: Ortigueira, 2 Km antes; rio junto a carretera de As Pontes. 29T NJ9335
30. 960805/2: C: Ortigueira, 2 Km antes; rio junto a carretera de As Pontes. 29T NJ9335
31. 960806/7. C: Valdoviño; Lagoa Frouxeira. Depresión junto a la laguna. 29T NJ6828.
32. 001005/1. C: Coristanco; junto al área de recreo del rio Veo. 29T NH1981
33. 960806/1. C: Salida de Espasante (Ortigueira). 29T NJ9742.
34. 960806/8. C: Valdoviño; Lagoa Frouxeira.Contiguo al invt. 31. 29T NJ6828.
35. 960806/10. C: Valdoviño; Río de Frouxeira, cola de Laguna Frouxeira. 29T NJ6827.
36. 000916/1. C: Ponteceso, Anllóns; paralelo al tramo final del rio Anllóns. 29T NH0885
37. 020606/3. PO: Porriño; O Fial, al norte del humedal de Budiño. 29T NG3064.
38. 020606/4. PO: Porriño; Centeáns, un poco hacia el sur desde O Fial. 29T NG3064.

Especies presentes en 1 inventario:

Alisma plantago-aquatica: r en 3; *Arrhenatherum bulbosum*: 2 en 15; *Bidens frondosa*: + en 1; *Brachypodium pinnatum*: 3 en 32; *Carex divisa*: + en 30; *Carex leporina*: + en 1; *Corylus avellana*: r en 27; *Crocosmia x crocosmiflora*: 2 en 33; *Cruciata glabra*: r en 19; *Danthonia decumbens:* + en 23; *Epilobium obscurum*: + en 7; *Epilobium parviflorum*: + en 13; *Epilobium tetragonum*: 1 en 15; *Erica erigena*: + en 19; *Erica tetralix:* r en 19; *Erica vagans*: 1 en 12; *Euphorbia amygdaloides:* + en 17; *Genista berberidea:* r en 14; *Geum urbanum*: 1 en 32; *Graminea sp.*: r en 20; *Heracleum sphondylium*: + en 26; *Humulus lupulus*: + en 37; *Hypericum elodes*: + en 7; *Hypochaeris sp.* (cf.): 1 en 13; *Juncus bufonius*: r en 7; *Lotus corniculatus*: 1 en 13; *Menyanthes trifoliata*: 2 en 13; *Poa trivialis*: 1 en 15; *Populus nigra*: 1 en 33; *Potamogeton polygonifolius*: + en 19; *Primula vulgaris*: + en 26; *Prunus laurocerassus*: + en 18; *Ranunculus bulbosus*: r en 14; *Ranunculus sp.*: + en 15; *Robinia pseudacacia*: 1 en 35; *Rosa cf. canina*: 1 en 12; *Rosa sp.*: r en 33; *Rubia peregrina longifolia*: + en 21; *Salix cf. viminalis*: + en 6; *Schoenus nigricans*: 1 en 19; *Senecio bayonensis*: + en 8; *Silene cf. dioica*: 1 en 30; *Stenotaphrum secundatum*: + en 34; *Teucrium scorodonia*: r en 27; *Veronica cf. montana*: + en 36; *Viburnum opulus*: 3 en 12.

Relevé nº	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
Ranunculus flammula	.	.	.	.	.	.	1	.	.	.	r	+	+	.	.	.	1	+	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
Caltha palustris	.	.	.	.	.	.	.	.	1	.	+	.	+	1	2	.	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Senecio aquaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	r	.	r	.	.	.	.	.	.	.	r	.	+	.	.	.	5
Centaurea nigra rivularis	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+	.	.	.	.	.	+	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Lychnis flos-cuculi	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	r	.	.	.	.	r	.	.	.	.	.	4
Companion species																																							
Rubus sp.	.	+	.	1	r	.	.	3	+	1	1	.	.	.	2	1	+	2	+	.	1	+	2	3	2	3	.	1	+	1	1	3	+	1	+	2	1	+	29
Hedera helix s.l.	.	+	.	.	.	+	+	1	.	+	1	+	+	.	.	1	+	1	+	.	4	+	3	4	3	5	2	2	2	2	.	4	1	.	2	2	+	+	28
Lonicera periclymenum	.	.	.	.	1	.	+	+	.	.	+	1	+	r	1	1	+	.	+	r	1	+	.	+	+	1	1	1	.	.	.	+	.	.	+	.	+	+	23
Angelica sylvestris	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	+	1	+	+	+	.	r	1	.	2	1	r	.	1	.	r	16
Dryopteris dilatata	.	.	r	2	2	.	.	.	+	.	+	.	+	.	.	.	.	1	1	.	.	.	2	1	1	.	+	+	+	+	.	.	.	.	.	.	.	.	15
Ranunculus repens	.	.	.	.	.	.	.	+	+	r	+	+	+	.	.	.	+	.	.	.	+	+	.	.	1	.	.	.	.	.	.	.	+	.	.	1	+	.	13
Scrophularia balbisii	.	.	.	r	.	.	.	1	+	1	.	.	.	.	+	+	+	+	+	.	.	.	.	.	r	.	.	.	r	.	.	.	.	.	.	.	.	.	11
Viola palustris	+	+	.	.	.	.	+	+	.	.	.	1	.	.	1	3	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	.	11
Holcus lanatus	.	.	r	.	.	.	1	+	.	.	.	.	.	2	.	.	.	.	.	.	.	.	r	+	r	.	r	.	.	+	r	.	.	.	r	.	.	r	11
Brachypodium sylvaticum	.	.	.	.	.	.	+	+	.	1	.	.	2	.	.	.	.	.	1	.	.	.	.	r	+	1	.	2	+	.	.	.	.	.	.	.	.	.	10
Blechnum spicant	.	.	.	.	.	.	.	.	r	.	.	r	.	.	.	1	.	1	+	.	.	.	+	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.	10
Frangula alnus	1	1	.	.	.	.	1	.	.	.	.	1	.	.	.	1	.	.	1	.	.	.	.	.	.	+	+	.	.	.	.	1	.	.	.	.	1	.	10
Filipendula ulmaria	.	.	r	.	.	.	+	.	.	4	3	1	r	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	2	.	.	9
Cardamine pratensis	.	.	.	.	.	.	.	.	r	r	+	.	1	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	9
Calystegia sepium	+	+	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	r	.	.	.	.	.	.	+	+	.	.	+	.	8
Agrostis stolonifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	2	.	.	1	.	.	.	1	.	+	.	+	.	.	.	7
Hypericum tetrapterum	.	.	.	.	.	.	.	+	r	.	.	+	r	.	+	.	r	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Hydrocotyle vulgaris	+	.	.	.	.	.	+	1	.	.	.	+	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Betula celtiberica	.	.	1	.	.	.	.	2	.	.	.	1	.	1	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Ajuga reptans	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	r	.	.	.	.	.	1	.	.	.	.	+	.	6
Eupatorium cannabinum	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	.	+	.	r	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.	6
Dryopteris affinis	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	+	1	.	.	.	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	6
Apium nodiflorum	.	.	.	.	.	.	.	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	r	+	1	.	.	.	6
Polygonum hydropiper	.	.	.	.	.	+	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	r	.	+	1	.	.	6
Rumex obtusifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	r	.	.	.	.	.	.	.	.	.	+	.	r	.	1	.	.	r	6
Geranium robertianum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	1	.	.	.	.	.	.	5
Quercus robur	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	.	r	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	+	.	5
Thuidium tamariscinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	1	.	.	2	.	1	.	.	.	.	.	.	.	.	5
Potentilla erecta	.	.	.	.	.	.	.	+	.	.	.	+	.	.	1	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Sambucus nigra	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+	.	.	+	.	.	r	.	.	.	5
Myosotis scorpioides	r	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	2	.	r	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	5
Agrostis cf. tenuis	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	5
Glyceria fluitans	.	.	.	.	.	.	3	.	3	+	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	5

Relevé nº	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
Crataegus monogyna	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	+	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Omphalodes nitida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	2	+	.	+	.	.	.	.	.	.	.	.	.	.	.	4
Deschampsia flexuosa	.	.	.	.	.	.	.	.	r	.	.	1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	4
Urtica dioica	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	4
Arum cf. italicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	r	r	.	.	.	.	1	.	.	.	.	.	.	.	4
Fraxinus excelsior	.	.	+	.	.	.	.	.	.	2	.	.	.	.	.	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Festuca sp.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Rumex acetosa	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	4
Pteridium aquilinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	1	.	.	.	.	.	.	.	.	.	.	3
Ruscus aculeatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	r	r	.	.	.	.	.	.	.	.	3
Viola riviniana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	r	.	.	.	3
Ulex europaeus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Digitalis purpurea	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Prunella vulgaris	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	3
Dactylis glomerata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	3
Tradescantia fluminensis	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	.	3
Equisetum arvense	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Lysimachia nemorum	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	r	.	.	.	.	.	.	3
Carex echinata	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Lysimachia vulgaris	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Carex demissa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Euphorbia dulcis	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	2
Prunus spinosa	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	2
Fraxinus angustifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2
Stellaria holostea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	2
Scirpus cernuus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	r	.	.	.	.	.	.	.	.	.	.	2
Salix fragilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Stellaria gr. media	.	.	.	.	.	.	.	.	.	.	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Dactylorhiza elata	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Serratula seoanei	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Myrica gale	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Scirpus fluitans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	2
Wahlenbergia hederacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	2
Sphagnum sp.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2
Cardamine flexuosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	2
Leersia oryzoides	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2
Lamium maculatum	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Ranunculus cf. bulbosus	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2

Salix cinerea by *Salix atrocinerea* in the Cantabro-Atlantic territory. In the Iberian Peninsula *Salix aurita*, a characteristic species of Alnetea glutinosae, appears to occur only in turbophilous environments at a certain altitude: above 1000 m according to BLANCO (1993), above 850 m in the Basque Country according to AIZPURU et al. (1999). Such altitudes are above the optimal range for Carici lusitanicae-Alnetum; its putative presence in Galicia (see SILVA-PANDO & RIGUEIRO 1992) is based on old reports, but its current presence has not been confirmed (BLANCO 1993).

2) Presence of large *Carex* species (i.e. shoots frequently exceeding 1 m in length, normally cespitose). The most representative species of this floristic type is *Carex paniculata* subsp. *paniculata*, which in the western Iberian Peninsula is replaced by *Carex paniculata* subsp. *lusitanica*.
3) Frequent presence of rosette-forming long-frond ferns, notably *Dryopteris cristata*, *D. carthusiana* and *Thelypteris palustris*, all of which can be considered useful characteristic species of Alnion glutinosae (GUINOCHET & VILMORIN 1973; OBERDORFER 1992; MUCINA 1997), though note that *D. cristata* does not occur in Spain. In addition, *Blechnum spicant* and *Osmunda regalis* are useful differential species of the Atlantic/Subatlantic alderwoods with respect to Central European alderwoods; *Osmunda regalis* in particular shows great vigour, forming large clumps, in the more acid-soiled of these alderwoods, characterized by the abundant presence of *Sphagnum* (MÉRIAUX & TOMBAL 1976), as can be seen from Table 2, which compares lists of relevés of Sphagno-Alnetum Lemée 1937, a concept embracing that of Blechno-Al-

Table 2. Floristic comparison of the European swamp alderwood associations. The single plus sign (+) indicates species present in less 20 % of relevés. Sources:
1. Carici elongatae-Alnetum (**Cel-Aln**): northwest Germany, DÖRING-MEDERAKE 1990. 79 relevés.
2. Carici elongatae-Alnetum (**Cel-Aln**): southern Germany, OBERDORFER 1992. 56 relevés.
3. *Alnus glutinosa-Carex paniculata* woodland (**Cpa-Aln**): United Kingdom, RODWELL 1991. Number of relevés not specified.
4. Sphagno-Alnetum (**Sph-Aln**): Southern Germany, OBERDORFER 1992. 14 relevés.
5. Carici laevigatae-Alnetum (**Cla-Aln**): Compilation from various sources (Germany, Belgium, Ireland, France), BODEUX 1955. 28 relevés.
6. Sphagno-Alnetum (**Sph-Aln**): Brittany (French Atlantic), GLOAGUEN & TOUFFET 1985. 19 relevés.
7. Carici lusitanicae-Alnetum (**Clu-Aln**): Galicia (Spanish Atlantic), AMIGO et al. (2004, present study). 38 relevés.

[1] The symbol ¿? indicates that the authors in fact reported presences of the *D. carthusiana* group (or *D. spinulosa* group), which may correspond to *D. carthusiana*, *D. dilatata* or *D. carthusiana* x *dilatata* hybrids. For differentiation of *Dryopteris* species see VIANE (1985).

[2] The infraspecific taxonomy of the Iberian populations of *Deschampsia cespitosa* s.l. is considered in the Discussion section.

	1	2	3	4	5	6	7
Association and provenance country ?	**Cel-Aln** Northwestern Germany	**Cel-Aln** Southern Germany	**Cpa-Aln** United Kingdom	**Sph-Aln** Southern Germany	**Cla-Aln** Ger + Belg + Irl + Fran	**Sph-Aln** Brittany	**Clu-Aln** Galicia
Trees and shrubs							
Alnus glutinosa	++	++	++	++	++	++	++
Salix cinerea	++	++	++	++	+	.	.
Betula pubescens	++	+	++	++	++	++	.
Salix aurita	++	+	+	++	+	++	.
Ribes nigrum	++	+	+	.	+	.	.
Salix atrocinerea	.	.	.	.	++	++	++
Betula celtiberica	.	.	.	.	.	.	+
Big Sedges							
Carex paniculata	++	+	++	++	.	++	.
Carex elata	++	+	+	.	.	.	.
Carex acutiformis	++	++	++	++	.	.	.
Carex appropinquata	+	+	+	.	.	.	.
Carex elongata	++	++	+	+	.	.	.
Carex vesicaria	++	++	.	++	.	.	.
Carex riparia	++	.	+	.	.	.	.
Carex pseudocyperus	++	.	+	.	.	.	+
Carex lasiocarpa	+	.	.	.	.	.	.
Carex laevigata	.	.	.	.	++	++	++
Carex lusitanica	.	.	.	.	.	.	++
Carex pendula	.	.	.	.	.	.	+
Ferns							
Athyrium filix-femina	++	+	++	++	++	++	++
Dryopteris carthusiana	++	++	+	++	++	++	+
Thelypteris palustris	++	++	++	++	.	.	+
Dryopteris dilatata	¿? [1]	¿? [1]	++	¿? [1]	.	++	++
Dryopteris cristata	.	++	+	.	.	.	.
Osmunda regalis	.	.	+	++	++	++	++
Blechnum spicant	.	.	.	++	++	++	++
Hygrophilous herbs & grasses							
Caltha palustris	++	++	++	++	++	.	+
Deschampsia cespitosa s.l.	++	++	+	++	++	.	++ [2]
Iris pseudacorus	++	++	++	++	.	.	++
Calamagrostis canescens	++	++	+	+	++	.	.
Peucedanum palustre	++	++	+	++	.	.	.
Scutellaria galericulata	++	++	+	.	.	.	.
Oenanthe crocata	.	.	++	.	.	.	+
Scutellaria minor	.	.	.	.	++	++	++
Peucedanum lancifolium	.	.	.	.	.	.	++

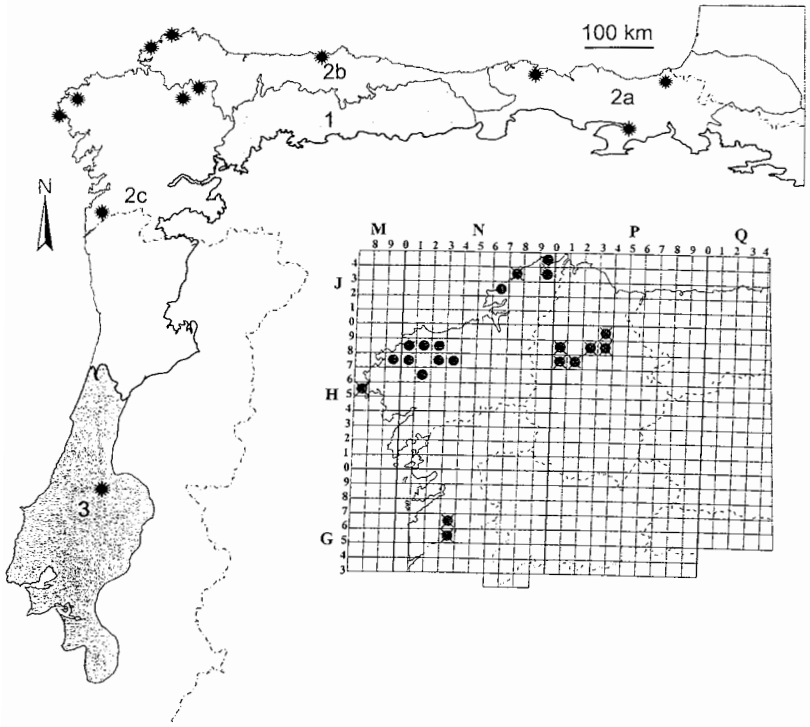


Fig. 1. Locations showing presence of Carici lusitanicae-Alnetum glutinosae in the Iberian Peninsula, on the basis of published relevés. The Galician locations are indicated in greater detail on a 10 × 10 km grid: this map distinguishes between the typical variant of Carici-Alnetum subass. alnetosum glutinosae (⊗) and other variants and subassociations (●). Chorologic units follow RIVAS-MARTINEZ et al. (2002a): Eurosiberian Region, Atlantic European Province, Orocantabric Subprovince (1), Cantabrian-Atlantic Subprovince (2) subdivided in Cantabrian-Basque Sector (2a), Galician-Asturian Sector (2b) and Galician-Portuguese Sector (2c). Mediterranean Region, Coastal Lusitan-Andalusian Province, Sadensean-Dividing Portuguese Subprovince (3).

netum Oberd. 1957, and Carici laevigatae-Alnetum sphagnosum Schwickerath 1937 (OBERDORFER 1992).

4) Abundance of hygrophilous herb and grass species characteristic of Molinietalia caeruleae or Phragmito-Magnocaricetea. Some of these species are present as vicariants, such as *Peucedanum palustre* and *Scutellaria galericulata* in Central European alderwoods, replaced by *Peucedanum lancifolium* and *Scutellaria minor* respectively in Iberian alderwoods.

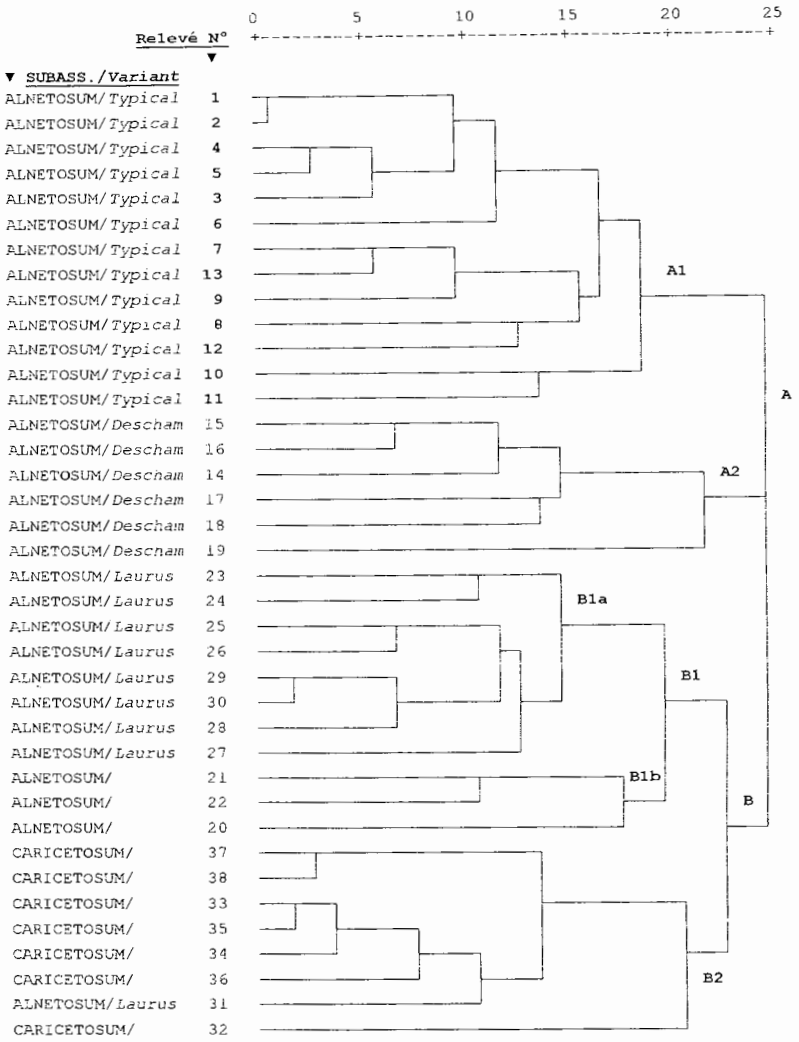


Fig. 2. Dendrogram obtained by hierarchical clustering of Carici lusitanicae-Alnetum glutinosae. Numbering follows Table 1 (for details, see Methodology).

Similar vicariance is seen in the case of *Deschampsia cespitosa* s.l. In northern and central Europe, *D. cespitosa* subsp. *cespitosa* is widely distributed, whereas the Iberian populations have been interpreted as a different subspecies, *D. cespitosa* subsp. *hispanica* (VIVANT 1978), or even as a different species, *D. hispanica*, with the variety *D. hispanica* var. *gallaecica* in Galicia (see CERVI & ROMO 1981). Subsequently, BAYER & LÓPEZ (1994) have argued that there are no strong grounds for considering the Iberian populations as a separate species, proposing that most of these populations should be treated as *D. cespitosa* subsp. *subtriflora*, with *D. cespitosa* subsp. *cespitosa* not present. However, RUIZ-TÉLLEZ et al. (1998), who question the importance of leaf anatomy for the taxonomy of this group, have recognized the presence of *D. cespitosa* subsp. *cespitosa* at least in northern Spain, supported by herbarium specimens from Galicia. There are thus arguments for viewing the *Deschampsia cespitosa* s.l. taxa respectively present in Central European alderwoods and Iberian alderwoods as vicariants. In the present report we have listed all presences of this taxon as *D. cespitosa*, in view of the lack of definitive criteria for distinguishing between *D. cespitosa* subsp. *cespitosa* and *D. cespitosa* subsp. *subtriflora*.

4.2 Variability

In all studies of North and Central European swamp alderwoods that have considered more or less extensive territories, two principal gradients of variation have been detected: first, a trophic gradient, ranging from base-rich soils to much poorer and generally more acid soils, which are however capable of supporting Alnetea glutinosae; and second, a soil moisture gradient, ranging from persistent waterlogging (Alnetea glutinosae) to less persistent waterlogging (Salici-Populetea nigrae).

4.2.1 Trophic gradient

We have not obtained quantitative data on nutrient levels, pH, humus content or C/N ratio in any of the soils under Carici lusitanicae-Alnetum. We can however draw some inferences on the basis of floristic composition, territorial-scale substrate geology, and comparison with similar habitats in other territories in which soil properties have been studied. On these grounds, the Galician Carici lusitanicae-Alnetum alderwoods typically develop on moderately mineral-rich soils, as expected given their characteristic topographic position; in some cases they may also benefit from base-rich sediments, as in some sites in the Terra Chá area of Galicia's Lugo Province. Such sites can be identified by the presence of *Cladium mariscus* (e.g. relevés 3 and 20, Table 1).

Carici lusitanicae-Alnetum woodlands can be basically considered as mesotrophic, or at least not strongly oligotrophic, in contrast with the common pattern in this biogeographic region. Certainly, in various territories of the Atlantic Province, we very frequently find Alnetea glutinosae woodlands developed on much less nutrient-rich substrates with marked

acidity (generally coinciding with high humus content and high C/N ratio). In these situations large-leaved plants ("megaphorbs") and the large *Carex* species are less frequent, while *Sphagnum* sp. pl. clumps are more frequent. Such communities are comparable to the Swedish "Birch Swamp Woodland" (DIEKMANN 1999), the Irish "*Sphagnum palustre-Betula pubescens* Community" (KELLY & IREMONGER 1997), the Sphagno-Alnetum of Germany (OBERDORFER 1992) and French Brittany (CLÉMENT & TOUFFET 1983, *sub* Alneto-Sphagnetum), or the "*Betula pubescens-Molinia caerulea* Woodland" of the UK (RODWELL 1991). This is not the case with the Carici lusitanicae-Alnetum woodlands, characterized by large *Carex* species (*C. paniculata* subsp. *lusitanica*, *C. pseudocyperus*, *C. pendula*) and megaphorbs (*Lythrum salicaria*, *Mentha aquatica*, *Iris pseudacorus*, *Valeriana dioica*, *Angelica sylvestris*, *Filipendula ulmaria*, etc.), and by very infrequent presence of *Sphagnum* sp. pl. and with very low-cover when present.

4.2.2 Soil moisture gradient

This gradient gives rise to a number of problems of phytosociological interpretation. It seems clear that Carici lusitanicae-Alnetum subass. alnetosum glutinosae occurs on soils with permanent waterlogging, or at least soils in which the water table remains very close to the surface throughout the year. At sites with a lower water table (or at least a lower summer water table), conditions will be more suitable for many geophytes and hemicryptophytes, so that the resulting community will be Alnion incanae/Osmundo-Alnion instead of Alnion glutinosae. Thus we will often find the following species, often with high covers: *Anemone nemorosa*, *Brachypodium sylvaticum*, *Carex remota*, *Circaea lutetiana*, *Corylus avellana*, *Festuca gigantea*, *Fraxinus excelsior*, *Lysimachia nemorum*, and *Stachys sylvatica*, in Galicia often accompanied by *Senecio bayonensis*; all of these species, especially the geophytes, are absent on strongly gleyic soils with anmoor-type humus, as typically occurring under Carici lusitanicae-Alnetum alderwoods. Transitions of this type have been studied throughout Europe (DÖRING-MEDERAKE 1990; KELLY & IREMONGER 1997; NOIRFALISE & DETHIOUX 1984; PRIEDITIS 1997).

Of particular interest in this connection are the results of a study in Ireland by KELLY & IREMONGER (1997), who clearly demonstrated that the water table remained close to the surface throughout the year in an "*Alnus glutinosa-Carex paniculata* woodland", but dropped markedly during the summer in a Carici remotae-Fraxinetum excelsioris (Alnion incanae) alder/ash woodland. Similarly, in a study in Belgium, NOIRFALISE & DETHIOUX (1980) highlight the presence of *Carex pendula*, *C. remota* and *C. strigosa* as indicators of alluvial Carici remotae-Fraxinetum excelsioris woodland.

The low-cover participation of species of Alnion incanae in our relevés (see Table 1) is explicable in terms of purely local manifestations of these soil-moisture-gradient effects. The relevés with abundant *Carex pendula*, almost always accompanied by *Carex remota*, are in our view – as

we have noted above – usefully classified as the separate subassociation caricetosum pendulae, indicative of soils showing a degree of surface desiccation in the summer, and usually siltier than the soils under Carici lusitanicae-Alnetum subass. alnetosum glutinosae.

4.3 Syntaxonomic and chorological aspects

The phytosociological identification of our alderwood relevés (Table 1) with the association Carici lusitanicae-Alnetum glutinosae defined by Díaz & Fernández-Prieto (1994) is in our view uncontroversial and evident. This ratifies this community as the principal association of its class, or at least the most widely distributed, in the Iberian Peninsula, while Carici laevigatae-Alnetum is restricted to non-Iberian Cantabrian-Atlantic territories, and to the British and North Atlantic subprovinces.

The southern Atlantic character of Carici lusitanicae-Alnetum allows us to distinguish it from other associations within the alliance Alnion glutinosae. Apart from some floristic vicariances as seen in Table 2, species that are common in swampy woodlands in more northerly territories are absent from the Iberian Cantabro-Atlantic territory, or are restricted to peaty habitats in the Supratemperate belt. This is the case with species like *Ribes nigrum*, *Potentilla palustris* or *Equisetum sylvaticum*, all highly conspicuous for example in the association Osmundo-Salicetum atrocinereae in Ireland (Braun-Blanquet & Tüxen 1952). Other clear examples can be seen in a type of swampy woodland that is widely distributed in England and Wales, initially studied by Klötzli (1970) and later expanded conceptually by Wheeler (1980), who gave it the name Osmundo-Alnetum glutinosae Klötzli 1970. This woodland type [basically assimilated by Rodwell (1991) in his concept *Alnus glutinosae-Carex paniculata* woodland] constantly contains species like *Ribes nigrum*, *Peucedanum palustre*, *Calamagrostis canescens* and *Chrysosplenium alternifolium* that are very rarely present in the wild state in the Iberian Peninsula, and never present in Carici lusitanicae-Alnetum. Potentially confusable with this British woodland type is that proposed by Vanden Berghen (1971) on the basis of relevés from southwest France, and likewise denominated Osmundo-Alnetum glutinosae; however, the nomenclatural invalidity of this proposal was pointed out by Díaz & Fernández-Prieto (1994), who also note the floristic differences between this community and Carici lusitanicae-Alnetum.

4.3.1 Alluvial woodlands and swamp woodlands

Both alluvial and swampy woodlands can be categorized as edaphohygrophilous, i.e. azonal. As noted above, though, these are two clearly different habitats, principally differentiated by the marked summer drop in the water table in alluvial woodlands (see Section 4.2.2). We can distinguish three major types of alluvial woodland in the Iberian Peninsula:

a) Alluvial woodlands of Alnion incanae, distributed throughout most of the Iberian Eurosiberian Region, present along all the rivers feeding to the Bay of Biscay (Mar Cantábrico) (units 2a and 2b in Fig. 1). These are all rather short rivers (< 150 km in length) with flow relatively constant throughout the year. They are dominated by *Alnus glutinosa* and/or *Fraxinus excelsior*, and are characterized by the presence of numerous floristic elements from Fagetalia sylvaticae woodlands, with which it frequently enters into catenal contact.
b) Alluvial woodlands of Osmundo-Alnion extend throughout all the Iberian river systems feeding to the Atlantic, and correspond to a bigeographically Mediterranean territory, except those of the Galaico-Portuguese Sector (unit 2c, Fig. 1); these can be very long rivers (> 500 km) with very marked seasonal variation in flow. These riparian woodlands are dominated by *Alnus glutinosa* and/or *Fraxinus angustifolia* (with some exceptions in stands dominated by *Salix atrocinerea* or *Betula parvibracteata*), and have floristic composition more similar to that of Populetalia albae, including several Iberian endemics.
c) Alluvial woodlands of Populion albae occur in Mediterranean territories on meso-eutrophic soils with little or no waterlogging. The tree layer may contain any of various species, including *Ulmus minor*, *Populus alba*, *Populus nigra*, *Salix neotricha*, *Fraxinus angustifolia* and sometimes even *Quercus pyrenaica*; *Alnus glutinosa* is much less common.

Fluctuations in water level in Iberian riparian woodlands, associated with Mediterranean chorology and bioclimate, give rise to changes in floristic composition such that riparian alderwoods show transition from Alnion incanae to Osmundo-Alnion glutinosae. Analogously, summer drops in the level of the water table are seen in swampy habitats under Mediterranean (or Submediterranean Temperate) macrobioclimate, leading to floristic changes favourable for the species of alluvial woodlands, which may form mosaics with strictly swampy habitats, so that in phytosociological tables we may see unclear "mixtures" of Salici-Populetea and Alnetea glutinosae. For this reason, in Table 3 we have included the contents of the principal riparian woodlands of the alliance Osmundo-Alnion glutinosae (class Salici-Populetea, columns 1–9), contrasted with the principal communities of Alnetea glutinosae described from the Iberian Peninsula (columns 10–15), Algeria (columns 16 and 17) and Italy (columns 18–21). Examination of this table suggests the following:

1) A significant proportion of the plants characteristic of the various communities of Osmundo-Alnion are clearly absent from the Alnion glutinosae woodlands, notably a number of Iberian endemics [*Galium broterianum*, *Carex elata* subsp. *reuteriana* (= *C. broteriana*), *Clematis campaniflora*, *Salix salvifolia* and *Rhododendron ponticum* subsp. *baeticum*] and Ibero-Tingitanian endemics (*Thalictrum speciosissimum*).
2) Some species of Populetalia albae are more or less frequently present in these South European Alnion glutinosae woodlands, such as *Brachypodium sylvaticum*, *Fraxinus angustifolia* and *Arum italicum*. This tendency is particularly marked in swampy woodlands containing *Carex*

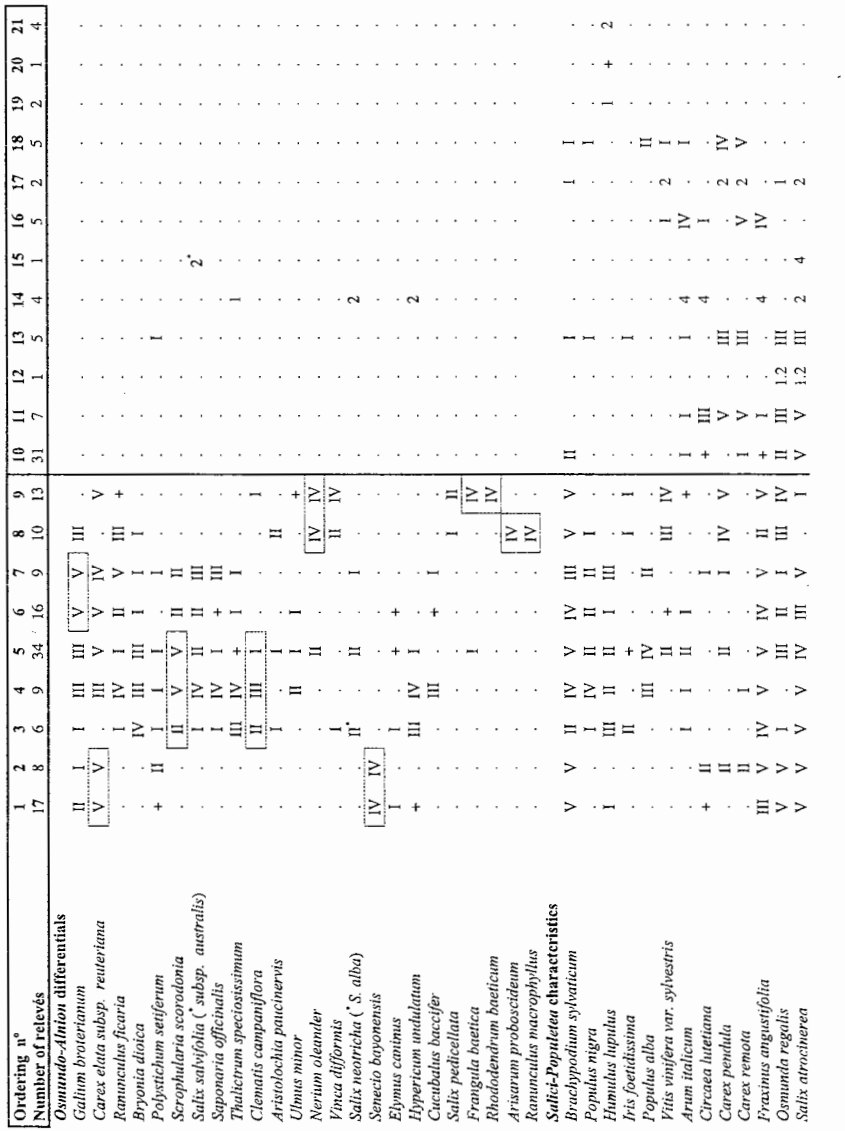
pendula and *Carex remota*, reaffirming the significance of the new syntaxon Carici lusitanicae-Alnetum subass. caricetosum pendulae.

3) The absence of species of Querco-Fagetea is clearly indicative of swampy woodland. However, creepers and thorny shrubs of Rhamno-

Table 3. Comparison of West Iberian Mediterranean alluvial alderwoods (Osmundo-Alnion glutinosae, Salici-Populetea nigrae, columns 1–9) and South European (Iberian and Italian) and North African (Algerian) swampy alder and willow woods (Alnetea glutinosae, columns 10–21). Boxes indicate species we interpret as good territorial indicators of the different associations included in the table.

Table sources:

1. Senecio bayonensis-Alnetum glutinosae subass. alnetosum glutinosae. AMIGO et al. (1987), Table 1.
2. Senecio bayonensis-Alnetum glutinosae subass. fraxinetosum excelsioris. AMIGO et al. (1987), Table 1.
3. Scrophulario scorodoniae-Alnetum glutinosae. BRAUN-BLANQUET et al. (1956), Table 6, excluded relevés n° 815 and 613.
4. Scrophulario scorodoniae-Alnetum glutinosae. NAVARRO & VALLE-GUTIERREZ (1983), Table 14.
5. Scrophulario scorodoniae-Alnetum glutinosae. RIVAS-MARTÍNEZ et al. (1986), Tables 3, 4 and 5.
6. Galio broteriani-Alnetum glutinosae. RIVAS-MARTÍNEZ et al. (1986), Tables 1 and 2.
7. Galio broteriani-Alnetum glutinosae. NAVARRO et al. (1986), Table 1.
8. Arisaro proboscidei-Alnetum glutinosae. MARTÍNEZ-PARRAS & PEINADO (1987), Table 2.
9. Rhododendro baeticae- Alnetum glutinosae. RIVAS-MARTÍNEZ et al. (1986), Table 6.
10. Carici lusitanicae-Alnetum glutinosae subass. alnetosum glutinosae. AMIGO et al., present paper, Table 1, relevés 1–31.
11. Carici lusitanicae-Alnetum glutinosae subass. caricetosum pendulae. AMIGO et al., present paper, Table 1, relevés 32–38.
12. Carici lusitanicae-Alnetum glutinosae subass. alnetosum glutinosae. DÍAZ & F.-PRIETO (1994), solitary relevé.
13. Carici lusitanicae-Alnetum glutinosae subass. alnetosum + caricetosum pendulae. HERRERA (1995), Table 83, invts. 1–5.
14. Carici lusitanicae-Alnetum glutinosae subass. fraxinetosum angustifoliae. ESPIRITO SANTO et al. 2002, Table n° 1.
15. Carici lusitanicae-Salicetum atrocinereae. NETO et al. (1996), solitary relevé.
16. Rusco hypophylli-Alnetum glutinosae subass. alnetosum glutinosae. GÉHU et al. (1994), Table n° 1.
17. Rusco hypophylli-Alnetum glutinosae subass. caricetosum pendulae. GÉHU et al. (1994), Table n° 1.
18. Hydrocotylo-Alnetum glutinosae. GELLINI et al. (1986), Table 1.
19. Carici acutiformis-Alnetum glutinosae. PEDROTTI (1995), Table 22.
20. Salicetum cinereae. PEDROTTI (1995), Table 21.
21. Salicetum cinereae. VENANZONI & GIGANTE (2000), Table 34.



Ordering n°	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Frangula alnus	IV	IV	IV	II	I	III	.	.	.	II	II	.	.	3	+	.	.	.	2	+	1
Solanum dulcamara	I	I	III	IV	I	+	IV	.	.	IV	IV	+.1	I	4	.	.	2	III	2	+	2
Athyrium filix-foemina	V	V	III	V	IV	IV	IV	.	III	IV	V	1.2	IV	1	.	.	2	.	.	.	.
Alnus glutinosa	V	V	V	V	V	V	V	V	V	V	V	4.4	V	4	.	V	2	V	2	.	.
Querco-Fagetea + Rhamno-Prunetea																					
Holcus mollis	+	I	.	II	IV	III	II	.	IV	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera hispanica	.	.	.	III	V	V	IV	II	IV	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia amygdaloides	II	II	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aquilegia vulgaris s.l.	+	I	.	II	.	III	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Primula acaulis	.	.	I	III	II	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dryopteris filix-mas	.	.	.	.	III	IV	IV	II	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula sylvatica subsp. henriquesii	III	II	.	.	+	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia dulcis	II	IV	I	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Stellaria holostea	.	.	III	III	.	.	II	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Melica uniflora	.	.	.	.	II	II	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula forsteri	.	.	.	.	II	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Blechnum spicant	IV	II	.	I	I	1	II	.	.	II	.	.	.	.	.	.	.	.	.	.	.
Viola riviniana	III	II	II	IV	IV	V	IV	.	.	+	II	.	.	.	.	.	.	.	.	.	.
Poa nemoralis	II	.	.	II	II	IV	III	.	.	.	.	1.1	.	.	.	.	.	.	.	.	.
Corylus avellana	I	II	I	.	I	II	II	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.
Teucrium scorodonia	II	.	II	II	V	V	III	.	.	.	.	.	I	.	.	.	.	.	.	.	.
Betula pubescens subsp. celtiberica	II	I	.	.	.	II	II	.	.	II	.	.	I	.	.	.	.	.	.	.	.
Dryopteris affinis (* *incl. D. borreri*)	III	III	III*	.	+*	+*	.	.	.	I	.	+.2	II	.	.	.	.	.	.	.	.
Ajuga reptans	I	IV	.	.	.	.	.	.	.	I	II	+.1	I	.	.	.	.	.	.	.	.
Lonicera periclymenum	III	II	II	.	.	.	.	.	.	IV	III	+.2	III	4	.	.	.	.	.	.	.
Rubus ulmifolius	.	.	I	II	V	V	IV	III	V	.	.	.	IV	4	.	V	2	V	.	.	.
Crataegus monogyna (* *brevispina*)	II	II	III	.	III	IV	II	II	IV*	I	.	.	III	.	.	.	.	IV	.	.	1
Hedera helix	V	IV	II	II	V	III	IV	III	V	IV	V	1.2	IV	4	.	IV	2	III	1	.	1
Tamus communis	+	.	II	.	V	III	II	I	V	II	I	+.1	IV	2	.	I	2	.	.	.	.
Sambucus nigra	I	.	I	IV	II	III	IV	.	.	+	II	.	II	.	.	.	.	I	1	.	.
Rubus sp.	IV	V	V	.	.	V	.	.	.	IV	V	+.2	.	.	.	.	.	.	.	.	1
Cornus sanguinea	.	.	I	.	+	I	I	.	.	.	.	.	II	.	.	.	.	.	2	+	.
Prunus spinosa	.	.	I	III	.	.	.	.	.	+	I	.	II	.	.	.	.	.	.	.	1
Viburnum opulus	.	I	.	.	+	+	I	.	.	.	.	.	.	.	.	.	.	.	2	.	3
***Alnetea* characteristics + differentials**																					
Iris pseudacorus	+	I	.	.	.	.	.	.	.	III	IV	.	I	3	+	V	2	I	2	+	3
Galium palustre	.	.	.	.	.	.	.	.	.	IV	III	1.2	IV	1	.	.	.	V	.	+	.
Mentha aquatica	+	I	.	.	.	.	.	.	.	II	IV	1.2	II	2	.	.	.	V	.	.	.
Thelypteris palustris	.	.	.	.	.	.	.	.	.	+	.	.	II	1	I	.	.	V	1	.	.
Hydrocotyle vulgaris	.	.	.	.	.	.	.	.	.	II	.	.	I	1	+	.	.	V	.	.	.
Apium nodiflorum	.	.	.	.	.	.	.	I	.	+	III	+.1	I	.	.	II	1	.	.	.	.

Ordering n°	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Valeriana dioica	.	.	.	.	.	.	.	.	.	II	.	.	I	.	.	.	.	.	2	1.2	1
Sparganium erectum	.	.	.	.	.	.	.	.	.	I	.	1.2	I	1	.	.	1	.	.	.	.
Ranunculus flammula	.	.	.	.	.	.	.	.	.	II	.	+.1	.	2	.	.	.	I	.	.	.
Polygonum hydropiper	.	.	.	.	.	.	.	.	.	+	III	.	1	.	.	IV	1	.	.	.	.
Carex pseudocyperus	.	.	.	.	.	.	.	.	.	1	I	.	I	.	1	.	.	.	.	.	.
Cardamine pratensis	.	.	.	.	.	.	.	.	.	II	II	.	II	.	.	.	.	.	.	.	.
Caltha palustris	.	.	.	.	.	.	.	.	.	II	.	.	.	1	.	.	.	.	2	+	.
Scutellaria galericulata	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	III	2	+	.
Carex elata subsp. elata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	2	+.2	1
Carex acutiformis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1.2	2
Salix cinerea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5.5	4
Scutellaria minor	.	.	.	.	.	.	.	.	.	III	1	1.1	.	.	.	.	.	.	.	.	.
Dryopteris carthusiana	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.
Scirpus fluitans	.	.	.	.	.	.	.	.	.	+	I	2.3	.	.	.	.	.	.	.	.	.
Lychnis flos-cuculi	.	.	.	.	.	.	.	.	.	+	I	+.1	.	.	.	.	.	.	.	.	.
Senecio aquaticus	.	.	.	.	.	.	.	.	.	+	II	.	I	.	.	.	.	.	.	.	.
Phragmites australis	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	+	.
Carex riparia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Scirpus sylvaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Periploca graeca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.
Fraxinus oxycarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.
Cladium mariscus	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	.	.	.	.	.	.
Myrica gale	+	I	.	.	.	.	.	.	.	+	.	.	.	.	3	.	.	.	.	.	.
Allium triquetrum	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	2	.	.	.	.
Ruscus hypophyllus	.	.	.	.	.	.	.	I	IV	.	.	.	.	.	.	.	1	.	.	.	.
Carex laevigata	.	.	.	.	.	.	.	I	.	II	.	1.2	I	.	.	.	.	.	.	.	.
Filipendula ulmaria	I	II	.	.	.	+	.	.	.	II	II	.	III	.	.	.	.	.	2	2.2	.
Juncus effusus	.	.	.	.	.	+	.	II	.	III	III	+.2	I	2	+	.	.	V	.	.	.
Angelica sylvestris	II	III	.	.	I	I	.	.	.	II	IV	+.1	II	2	.	.	.	.	.	+	.
Lycopus europaeus	I	III	.	II	.	.	.	.	.	III	IV	1.2	II	3	+	.	1	IV	.	.	.
Calystegia sepium	+	IV	III	.	.	.	.	.	.	I	III	.	.	3	.	I	1	II	1	+	.
Peucedanum lancifolium	I	I	.	II	.	.	.	.	.	III	I	1.2	.	2	.	.	.	.	.	.	.
Cirsium palustre	.	I	III	III	.	II	.	.	.	III	I	1.1	.	2	.	.	.	.	.	.	.
Carex paniculata subsp. lusitanica	.	.	1	II	II	+	.	.	.	III	I	3.4	II	4	1	.	.	.	.	.	.
Lythrum salicaria	II	V	III	.	+	.	II	II	I	III	IV	+.2	II	3	+	.	.	III	.	.	.
Lysimachia vulgaris	.	I	I	I	II	I	.	.	.	+	.	.	.	4	.	.	.	I	2	1.1	2
Urtica dioica	.	.	III	IV	I	.	II	.	.	+	I	.	1	.	.	.	.	IV	1	.	.
Deschampsia cespitosa s.l.	II	III	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	.	.	1.2	.
Scrophularia balbisii	II	II	.	V	+	.	.	.	.	II	.	.	.	1	.	.	2	.	.	.	.

Prunetea fringe communities, which are common in Osmundo-Alnion communities, appear rather often within the swampy woodlands of Alnion glutinosae (*Lonicera periclymenum*, *Tamus communis*, *Crataegus monogyna*, *Cornus sanguinea*, etc.).

4) The good differential species for the Alnetea glutinosae woodland (which have very few characteristic species) are species also found in Magnocarici-Phragmitetea or Molinietalia caeruleae: *Iris pseudacorus*, *Galium palustre*, *Mentha aquatica*, *Valeriana dioica*, and *Sparganium erectum*. In contrast, the shade-adapted nitrophilous species of Galio-Urticetea (*Angelica sylvestris*, *Calystegia sepium*, *Urtica dioica*, *Lysimachia vulgaris*, etc.) are shared by alluvial woodlands, and thus their presence in swampy woodlands does not aid discrimination between Salici-Populetea and Alnetea glutinosae.

Table 3 certainly allows us to extract floristic criteria for the identification of Alnetea glutinosae woodlands in southern Europe. Various associations within this class have been described from Italy (PEDROTTI & GAFTA 1996), and in all of them the differential floristic criteria outlined above are applicable: species of Magnocarici-Phragmitetea like *Carex acutiformis*, *Carex elata* subsp. *elata*, *Scirpus sylvaticus*, together with species of Molinietalia caeruleae, but also including Iberian vicariants (e.g. *Fraxinus oxycarpa* instead of *F. angustifolia*, *Salix cinerea* instead of *S. atrocinerea*).

The most chorologically extreme Alnetea woodlands of this type, those studied by GÉHU et al. (1994) in Algeria, show low floristic richness, as expected, but are nevertheless still recognizably swamp alderwoods. We have not taken into account the community denominated by these authors as Rusco hypophylli-Salicetum atrocinereae, since it is based on a single relevé with highly impoverished floristic composition. Moreover, the problem to distinguish between swampy or alluvial alder woodlands in that extremal distribution territory can be evaluated by the fact that a previous phytosociological study, dealing with alderwoods at the same area [El Kala wetland shore (BENSETTITI 1992)], concluded that it would be interpreted as Carici pendulae-Alnetum glutinosae Br.-Bl. 1967, i.e. Alnion incanae; in our opinion this later author gathered several bad delimited relevés at the same table.

On the other hand, the interpretation followed here of the Osmundo-Alnion alluvial woodlands is justified as an Iberian alliance, or at most an Iberian-Tingitanian alliance. Riparian alderwoods from more eastern territories along North Africa have been assigned to Osmundo-Alnion as well (i.e. Scrophulario tenuipedis-Alnetum glutinosae in MEDDOUR & LARIBI, 1999) but including a very important North African floristic collective, completely absent in european alderwoods, which marks interesting differences with Iberian ripisilves and could justify in our opinion a stronger syntaxonomic differentiation (suballiance) if more data were available. Our basically Iberian conception of Osmundo-Alnion excludes the riparian alderwoods of Corsica, which were interpreted by DIERSCHKE (1975) as a suballiance Hyperico hircini-Alnion glutinosae (sic) within Osmundo-Alnion.

5 Conservation

The Alnetea glutinosae swamp woodlands are not expressly identified in Directive 92/43/EEC of the Habitat Directive, although they can be considered to form part of category 91E0 "Alluvial *Alnus glutinosa* and *Fraxinus excelsior* woodlands" (see EUROPEAN COMMISSION, 1999), if we accept a rather broad definition of this habitat.

Currently we do not have any data on the area possibly occupied in Galicia by Carici lusitanicae-Alnetum glutinosae alderwood. However, we do have an estimate for riparian alderwood, based on a 1996 cartographic analysis (author's unpublished data), indicating a total of about 1055 km of river length with reasonably well-conserved alderwood, whether of Alnion incanae or Osmundo-Alnion. This figure is relatively small given the estimated 30,000 km of total river length in Galicia (see RÍO-BARJA & RODRÍGUEZ-LESTEGÁS 1996). Bearing in mind the characteristic river-side width of these communities, and assuming that in all cases alderwood occurs on both banks, we can very approximately estimate a total area of perhaps about 1500–2000 hectares of riparian alderwood.

In contrast, our estimates for swamp alderwoods are rather less optimistic: certainly no more than about 5 % of the total area occupied by riparian alderwoods. In addition, the traditionally negative attitudes towards this habitat (unproductive, difficult to exploit, "unhealthy"), as towards wetlands in general, has not favoured its survival: considering Spain as a whole, "it is calculated that the current wetland area is about 114,100 ha, which according to diverse estimates represents 30–40 % of the area existing 50 years ago" (DGOH 1998).

We hope that the increasing sensitivity of the corresponding administrations to these clearly threatened habitats will encourage their detailed cataloguing and mapping, in parallel with effective practical measures for the protection of the few examples of Carici lusitanicae-Alnetum glutinosae that have survived in Galicia to the 21st century.

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