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Habitat invasions by alien plants: a quantitative comparison among Mediterranean, subcontinental and oceanic regions of Europe

Milan Chytrý[1]*, Lindsay C. Maskell[2], Joan Pino[3], Petr Pyšek[4], Montserrat Vilà[5], Xavier Font[6] and Simon M. Smart[2]

[1]*Department of Botany and Zoology, Masaryk University, Kotlárská 2, CZ-61137 Brno, Czech Republic;* [2]*Centre for Ecology and Hydrology, Lancaster Environment Centre, Library Avenue, Bailrigg LA1 4AP, UK;* [3]*Center for Ecological Research and Forestry Applications (CREAF), and Unit of Ecology, Department of Animal and Plant Biology and Ecology, Autonomous University of Barcelona, E-08193 Bellaterra, Spain;* [4]*Institute of Botany, Academy of Sciences of the Czech Republic, CZ-25243 Pruhonice, and Department of Ecology, Charles University, ViniÇná 7, CZ-12801 Praha, Czech Republic;* [5]*Biological Station Doñana (EBD-CSIC), Avda. María Luisa s/n Pabellón del Perú, E-41013 Sevilla, Spain; and* [6]*Department of Plant Biology, University of Barcelona, Avd. Diagonal 645, E-08028 Barcelona, Spain*

Summary

1. Although invasions by alien plants are major threats to the biodiversity of natural habitats, individual habitats vary considerably in their susceptibility to invasion. Therefore the risk assessment procedures, which are used increasingly by environmental managers to inform effective planning of invasive plant control, require reliable quantitative information on the extent to which different habitats are susceptible to invasion. It is also important to know whether the levels of invasion in different habitats are locally specific or consistent among regions with contrasting climate, flora and history of human impact.

2. We compiled a database of 52 480 vegetation plots from three regions of Europe: Catalonia (Mediterranean–submediterranean region), Czech Republic (subcontinental) and Great Britain (oceanic). We classified plant species into neophytes, archaeophytes and natives, and calculated the proportion of each group in 33 habitats described by the European Nature Information System (EUNIS) classification.

3. Of 545 alien species found in the plots, only eight occurred in all three regions. Despite this large difference in species composition, patterns of habitat invasions were highly consistent between regions. None or few aliens were found in environmentally extreme and nutrient-poor habitats, e.g. mires, heathlands and high-mountain grasslands. Many aliens were found in frequently disturbed habitats with fluctuating nutrient availability, e.g. in man-made habitats. Neophytes were also often found in coastal, littoral and riverine habitats.

4. Neophytes were found commonly in habitats also occupied by archaeophytes. Thus, the number of archaeophytes can be considered as a good predictor of the neophyte invasion risk. However, neophytes had stronger affinity to wet habitats and disturbed woody vegetation while archaeophytes tended to be more common in dry to mesic open habitats.

5. *Synthesis and applications.* The considerable inter-regional consistency of the habitat invasion patterns suggests that habitats can be used as a good predictor for the invasion risk assessment. This finding opens promising perspectives for the use of spatially explicit information on habitats, including scenarios of future land-use change, to identify the areas of highest risk of invasion.

Key-words: archaeophyte, Catalonia, Czech Republic, exotic species, Great Britain, invasibility, neophyte, non-native, vascular plants, vegetation plots

*Correspondence author. E-mail: chytry@sci.muni.cz

Introduction

Invasions by alien plant species is an environmental issue of global significance (Mack *et al*. 2000; Hulme 2006; Pyšek, Richardson & Jarošík 2006; Rejmánek *et al*. 2006; Richardson & Pyšek 2006). However, not all regions, biomes or habitats are invaded to the same extent. It has been demonstrated that temperate regions are invaded more frequently than the tropics (Lonsdale 1999; Rejmánek, Richardson & Pyšek 2005), New World more than the Old World (di Castri 1989; Lonsdale 1999), islands more than the mainlands (Lonsdale 1999; Daehler 2006) and landscapes rich in native species more than landscapes poor in native species (Kühn *et al*. 2003; Stohlgren *et al*. 2005). Within particular regions, the level of invasion usually varies strongly among habitats (Crawley 1987; Rejmánek 1989; Rejmánek, Richardson & Pyšek 2005), suggesting that some habitats are more susceptible to invasions than others. Quantitative comparisons of the level of invasion between habitats have been conducted in some regions (Stohlgren *et al*. 1999; Chytrý *et al*. 2005; Maskell *et al*. 2006; Vilà, Pino & Font 2007), but it is still unclear how far patterns from one region can be generalized or transferred to regions with other climates, historical and biogeographical features and different assemblages of alien plants.

Currently, considerable effort is devoted to modelling spatially explicit scenarios of future climate and land-use change (Sala *et al*. 2000; Settele *et al*. 2005; Rounsevell *et al*. 2006). The risk of invasions by alien species can be projected upon these scenarios, provided there is sufficiently detailed knowledge of the level of invasion typical of different habitats. However, this knowledge is available only for restricted regions. For the development of invasion risk scenarios for large areas such as Europe, it is therefore necessary to test whether the patterns of habitat invasion identified in smaller regions are valid in other regions, particularly in those with contrasting climate.

Earlier attempts to quantify the habitat-specific levels of plant invasion were based usually on the identification of species pools for particular habitats (Crawley 1987; Rejmánek, Richardson & Pyšek 2005; Walter *et al*. 2005). Using this approach, each species of the regional flora was assigned to one or more habitats, based on the expert knowledge of species' habitat preferences. Subsequently, habitats with more species were considered as more invaded or perhaps even more invasible (but see Lonsdale 1999; Chytrý *et al*. 2005). However, habitats with large regional pools of ecologically compatible invasive species may actually not be highly invaded at the local scale. Invasion-resistant habitats may locally contain few or no alien species despite a large pool of ecologically compatible alien species present in the wider region. In contrast, invasion-prone habitats may contain some aliens in most places even though the regional pool of ecologically compatible aliens can be limited.

Large databases of vegetation plots, amassed recently in some European countries (Hennekens & Schaminée 2001), enable comparative analyses of actual level of invasion of different habitats. First analyses based on such data have already appeared for the city of Berlin (Kowarik 1995; 43 habitat types), the Czech Republic (Chytrý *et al*. 2005; 32 habitat types), Great Britain (Maskell *et al*. 2006; eight habitat types) and Catalonia (Vilà, Pino & Font 2007; 32 habitat types). However, no comprehensive data sets of vegetation plots are available so far in most European countries, which prevents an analysis of the level of invasion across habitats in the whole of Europe.

Within the framework of an international project, ALARM (Assessing LArge-scale environmental Risks for biodiversity with tested Methods; Settele *et al*. 2005), we explored three comprehensive data sets of vegetation plots from three regions which represent contrasting climates typical of large parts of southern, central and western Europe: Catalonia (Mediterranean–submediterranean climate), Czech Republic (subcontinental) and Great Britain (oceanic), with the aim to identify (1) whether the composition of alien species found in individual habitats differs between the three regions and if so, to what extent; (2) which are the most common alien plant species; (3) which habitats are most and least invaded; (4) whether the between-habitat pattern in the proportion of alien species is consistent across the three regions; and (5) whether neophytes (post-1500 immigrants) tend to invade the same habitats as archaeophytes (pre-1500 immigrants).

Materials and methods

VEGETATION DATA

The data sets from Catalonia, Czech Republic and Great Britain contained a total of 52 480 vegetation plots (Table 1).

Catalonia is located in north-eastern Spain between the Pyrenees and the Mediterranean Sea. It is a region with predominantly Mediterranean–submediterranean climate, although some areas with oceanic and alpine climates occur in the north. The Catalonian data set included vegetation plots (relevés) stored in the FLORACAT database

Table 1. Selected characteristics of the studied regions and numbers of vegetation plots. Numbers of alien species are given with casual species excluded (sources: Bolòs *et al*. 1993; Preston, Pearman & Dines 2002; Pyšek, Sádlo & Mandák 2002; Pino *et al*. 2005)

	Catalonia	Czech Republic	Great Britain
Area (km^2)	32 106	78 865	229 979
Altitude (m a.s.l.)	0–3150	115–1602	0–1343
No. of native species in the region's flora	*c*. 2950	2 256	1 455[1]
No. of archaeophytes in the region's flora	–[2]	258	151
No. of neophytes in the region's flora	264	229	259
No. of plots used in the current study	15 650	20 468	16 362

[1]Including 46 species with doubtful status (native or alien).
[2]Archaeophytes are included among native species.

(Font & Ninot 1995), which were sampled originally for the purpose of phytosociological classification. Only plots assigned to units of phytosociological classification were used in this study. The plots differed in size from 1 m^2 to hundreds of m^2 (Table 2), as is typical for European phytosociological relevés (Chytrý & Otýpková 2003). Further details on the Catalonian data set are given in Vilà, Pino & Font (2007).

The Czech Republic is located in Central Europe and has a subcontinental climate. The Czech data set included vegetation plots sampled with the same aims and methods and using comparable plot sizes as in Catalonia. The source of the data was the Czech National Phytosociological Database (Chytrý & Rafajová 2003), from which a stratified random sample of vegetation plots was taken in order to reduce the effects of local oversampling of some habitats, especially urban areas (Knollová *et al.* 2005). Only plots recorded after 1970 were considered. For further details on the Czech data set see Chytrý *et al.* (2005).

Great Britain is located in a region with oceanic climate. Vegetation plots for the current study were taken from the Countryside Survey database, which includes data from three surveys of British habitats undertaken in 1978, 1990 and 1998 (Smart *et al.* 2003). Countryside Survey plots were located according to the stratified random sampling scheme (Firbank *et al.* 2003) and their size was 4, 10 or 200 m^2. For the purpose of the current analysis, plots from different sites and from all three surveys were selected at random. Although some plots were sampled repeatedly in individual surveys, each plot was selected only once for this analysis.

Alien species found in Czech and British vegetation plots were classified as either archaeophytes (arrived before AD 1500) or neophytes (arrived after AD 1500), based on Pyšek, Sádlo & Mandák (2002) and Preston, Pearman & Dines (2002). Both these national lists of alien species used comparable criteria for classifying species as archaeophyte or neophyte; however, in many cases it is difficult to prove whether a species is archaeophyte or native. As most European archaeophytes originate from southern Europe or the Near East (di Castri 1990), the distinction between archaeophytes and native species is particularly unclear in southern Europe. Therefore Catalonian species were classified only either as neophytes or non-neophytes, the latter containing native species and archaeophytes. The neophyte proportions reported for Catalonia in the present paper are slightly lower than alien proportions reported in Vilà, Pino & Font (2007) because we used a newer version of the FLORACAT database, in which some archaeophytes were removed from the alien species list. Planted crops recorded in arable land plots were excluded from the analysis. Species nomenclature follows Tutin *et al.* (1968–93).

HABITAT CLASSIFICATION

An important part of the current study was the development of a common platform of habitat classification for the three regions. Although the systems of vegetation classification in most European countries are based on the Braun–Blanquet approach (Westhoff & van der Maarel 1973), compatibility of standard vegetation classifications used in different countries is limited. In the current study, this problem was amplified further by a large geographical distance between the studied regions (implying large habitat differences) and different traditions of vegetation classification in the United Kingdom and continental Europe. Therefore, we used broadly delimited habitat types (hereafter called habitats) which reflected environmental features common to the three regions. We adopted the European Nature Information System (EUNIS) Habitats Classification, a standard classification of European habitats developed by the European Environment Agency (http://eunis.eea.europa.eu/habitats.jsp). From the version of this classification, available online from October 2005, we used habitats on hierarchical Level 2, but where these habitats were too heterogeneous with respect to the level of invasion we also used habitats on Level 3. In some cases we merged two or three habitats, because we were not able to assign many plots unequivocally to one of them. In total, we used 33 habitat classes, of which 14 were recorded in all the three regions (Appendix S1 in Supplementary material).

Catalonian and Czech plots were assigned to the EUNIS habitats based on their existing assignments to phytosociological syntaxa, using a syntaxa–EUNIS crosswalk (Rodwell *et al.* 2002; Appendix S2, Supplementary material). Assignment of the Catalonian and Czech plots to habitats differs slightly from the preliminary analyses of the same data sets (Chytrý *et al.* 2005; Vilà, Pino & Font 2007), because the previous analyses used an older version of the EUNIS classification and because some habitats had to be merged or interpreted in a slightly different way in order to achieve compatibility between the three national data sets. In the British data set, plots were assigned to the EUNIS habitats by allocating them to a British National Vegetation Classification community (Rodwell 1991–2000) and Broad Habitat category (www.ukbap.org.uk). These were then matched to EUNIS habitats (Appendix S3, Supplementary material). It is important to note that most vegetation plots included in this study represent homogeneous stands of vegetation rather than ecotonal sites, although the latter can be important habitats of some alien species.

DATA ANALYSIS

For the comparison of the proportion of alien species between habitats and regions, we computed descriptive statistics and univariate tests in the STATISTICA version 7.1 software (www.statsoft.com). In these analyses, we avoided comparing species numbers, because these were affected potentially by different plot sizes. We report mean species numbers per plot for a rough indication, but not for direct comparison, of species richness between habitats. Instead of absolute species numbers, we restricted our between-habitat comparisons to proportions, e.g. the number of aliens divided by the number of all species. The proportions can also be affected to some extent by plot size. For example, Stohlgren *et al.* (2006) reported that the proportion of alien to native species may decrease with increasing plot size. However, our preliminary analyses (e.g. Chytrý *et al.* 2005; Vilà, Pino & Font 2007) showed that the effect of plot size on proportions was negligible. To quantify relationships between archaeophytes and neophytes, we calculated correlation and regression analyses in which species numbers were used instead of proportions, assuming that an increase in plot size would cause the same relative increase in both groups of aliens and native species. Where appropriate, in statistical analyses, variables were square root-transformed after adding 0·5.

Results

COMPARISON OF ALIEN SPECIES COMPOSITION AMONG REGIONS

The pooled data set from the three regions contained 545 alien species (301 neophytes, 228 archaeophytes and 16 species with different status in different regions; Table 3). There were 109 aliens in the Catalonian data set (all neophytes), 390 in the Czech data set (171 neophytes and 219 archaeophytes) and 189 in the British data set (107 neophytes and 82 archaeophytes). The remarkably higher number of aliens in the Czech

Table 2. Descriptive statistics for the vegetation plot size, number of species per plot and percentages of archaeophytes and neophytes relative to the number of all species in plots belonging to different EUNIS habitats. Dash = habitat does not occur in the region or data are not available; Cat = Catalonia, CZ = Czech Republic, GB = Great Britain

	Plot size (interquartile range, m^2)			No. of all species per plot (mean ± SD)			% of neophytes (mean ± SD)			% of archaeophytes (mean ± SD)	
EUNIS habitat	Cat	CZ	GB	Cat	CZ	GB	Cat	CZ	GB	CZ	GB
A2·5 & D6 & E6 Saline habitats	20–50	8–20	4–10	8·0 ± 4·1	16·7 ± 8·8	8·0 ± 4·3	2·2 ± 5·6	1·6 ± 3·4	0·7 ± 2·7	7·4 ± 10·6	1·5 ± 4·6
B1 & B2 Coastal sediments	12–50	–	4–10	10·7 ± 5·8	–	11·6 ± 7·1	3·3 ± 6·4	–	10·0 ± 18·9	–	3·3 ± 7·8
B3 Coastal rocks	20–100	–	4–10	12·0 ± 6·3	–	12·3 ± 6·0	0·7 ± 2·3	–	0·9 ± 4·9	–	0·5 ± 2·2
C1 Standing waters	1–4	10–25	–	11·8 ± 12·0	3·7 ± 2·3	–	0·9 ± 4·3	3·9 ± 12·5	–	0	–
C2 Running waters	4–20	6–20	–	8·6 ± 3·9	10·0 ± 7·3	–	0	1·0 ± 4·1	–	0·2 ± 1·3	–
C3 & D5 Sedge-reed beds	6–44	9–25	4–10	9·8 ± 5·7	10·0 ± 6·8	9·8 ± 6·2	7·1 ± 12·5	2·9 ± 7·2	4·4 ± 14·8	2·5 ± 5·9	1·3 ± 3·1
D1 Bogs	4–18	10–25	10–200	16·1 ± 6·6	9·8 ± 4·9	13·8 ± 7·3	0	0	0·2 ± 1·3	0·1 ± 0·4	0·0 ± 0·3
D2 Poor fens	10–20	10–25	4–10	17·0 ± 5·9	18·3 ± 10·7	14·7 ± 5·2	0	0·1 ± 0·9	0·4 ± 2·4	0·5 ± 1·3	0
D4 Base-rich fens	4–15	10–20	4–10	16·3 ± 5·2	23·8 ± 10·8	22·8 ± 9·4	0	0·2 ± 0·7	0·3 ± 1·0	1·4 ± 2·4	0
E1 Dry grasslands	5–35	14–25	10	29·2 ± 11·8	26·2 ± 12·7	16·6 ± 8·6	0·4 ± 1·4	0·7 ± 3·0	0·4 ± 1·9	6·0 ± 7·7	0·1 ± 1·1
E2 Mesic grasslands	18–50	16–25	10	27·2 ± 12·1	30·3 ± 11·0	18·0 ± 6·9	0·4 ± 1·3	0·7 ± 2·1	1·3 ± 3·2	5·3 ± 6·9	2·5 ± 5·2
E3 & E5·4 Wet grasslands	7–25	15–25	4–10	16·4 ± 7·6	27·0 ± 12·0	16·3 ± 7·0	2·6 ± 7·8	1·2 ± 4·2	1·1 ± 3·5	2·7 ± 5·7	1·0 ± 3·4
E4 Alpine grasslands	10–50	16–25	–	21·5 ± 10·3	13·7 ± 7·7	–	0	0·1 ± 1·1	–	0	–
E5·1 Ruderal vegetation	10–30	10–20	10	17·7 ± 9·4	15·7 ± 7·5	13·1 ± 5·8	5·3 ± 10·6	6·9 ± 8·6	4·5 ± 8·6	35·5 ± 18·8	6·7 ± 10·1
E5·2 Woodland fringes	10–30	10–25	–	24·8 ± 8·7	27·5 ± 9·5	–	0·0 ± 0·3	0·3 ± 1·0	–	4·1 ± 4·4	–
E5·3 Bracken	–	–	10	–	–	10·5 ± 5·4	–	–	0·8 ± 3·1	–	0·5 ± 2·4
E5·5 Subalpine tall forbs	15–75	16–25	4–10	23·0 ± 9·8	16·8 ± 9·1	21·1 ± 7·7	0	0·2 ± 1·7	0·6 ± 1·6	0·7 ± 4·9	0
F2 Subalpine scrub	49–100	100	–	20·6 ± 8·4	23·8 ± 12·7	–	0	0	–	0	–
F3 Temperate scrub	20–50	20–60	10	19·2 ± 10·1	22·3 ± 10·7	15·6 ± 7·2	0·5 ± 2·6	2·3 ± 5·7	1·9 ± 6·7	8·7 ± 10·5	2·3 ± 4·8
F4 Temperate heaths	20–100	10–25	10	23·3 ± 11·7	13·7 ± 7·2	10·8 ± 7·5	0	0·2 ± 1·3	0·3 ± 2·6	0·6 ± 1·8	0·0 ± 0·3
F5 Maquis	50–100	–	–	21·8 ± 8·6	–	–	0·2 ± 1·3	–	–	–	–
F6 Garrigue	25–50	–	–	26·3 ± 9·6	–	–	0·0 ± 0·7	–	–	–	–
F7 Mediterranean heaths	20–50	–	–	20·9 ± 7·4	–	–	0	–	–	–	–
F9 Wet scrub	25–80	38–100	–	18·9 ± 10·9	14·6 ± 7·8	–	3·1 ± 6·5	2·0 ± 4·2	–	1·4 ± 3·4	–
FA Hedgerows	–	–	10	–	–	6·7 ± 5·5	–	–	2·8 ± 8·3	–	1·7 ± 5·8
G1 & 4 Deciduous woodlands	75–100	150–400	4–10	27·7 ± 11·3	26·3 ± 12·8	14·9 ± 8·5	0·2 ± 1·7	1·0 ± 2·4	3·1 ± 7·9	0·7 ± 2·0	0·9 ± 4·3
G2 Evergreen woodlands	40–100	–	–	22·8 ± 10·3	–	–	0·1 ± 0·6	–	–	–	–
G3 Coniferous woodlands	100–150	25–50	10–200	24·8 ± 8·5	15·6 ± 10·5	9·9 ± 8·2	0	0·4 ± 1·6	24·8 ± 29·7	0·6 ± 2·8	0·3 ± 1·9
G5 Disturbed woodlands	10–30	25–50	–	21·1 ± 8·4	20·2 ± 9·6	–	0·2 ± 1·1	2·8 ± 4·8	–	4·2 ± 8·8	–
H2 Screes	10–60	9–24	–	13·0 ± 5·9	16·5 ± 8·3	–	0·7 ± 3·2	1·4 ± 3·3	–	10·7 ± 9·5	–
H3 Cliffs and walls	4–20	1–9	–	10·2 ± 5·3	8·0 ± 5·0	–	0·3 ± 2·4	7·0 ± 14·1	–	9·5 ± 17·2	–
H5·6 Trampled areas	5–20	4–15	–	15·7 ± 8·6	12·0 ± 6·5	–	6·2 ± 11·2	6·0 ± 7·2	–	21·8 ± 21·0	–
I1 Arable land	30–90	15–100	10–200	21·6 ± 9·0	26·2 ± 9·5	11·7 ± 7·9	7·3 ± 9·8	5·6 ± 5·2	14·3 ± 25·6	55·5 ± 13·5	16·2 ± 16·0

Table 3. Numbers of neophytes and archaeophytes recorded in all vegetation plots from individual regions, including those found in a single region only, in two regions only and in all the three regions. Sixteen species with different status (archaeophyte or neophyte) in different regions are included in both groups. CZ = Czech Republic, GB = Great Britain

	Neophytes	Archaeophytes
Total	317	244
Catalonia total	109	–
Czech Republic total	171	219
Great Britain total	107	82
Catalonia only	74	–
Czech Republic only	113	162
Great Britain only	67	25
Catalonia + CZ only	23	–
Catalonia + GB only	5	–
CZ + GB only	28	57
Catalonia + CZ + GB	7	–

data set was not due to more plots included in this data set: we conducted a few trials in which we deleted 4818 plots randomly from the Czech data set in order to make its size equal to the Catalonian (smallest) data set, but these trials led to a decrease in the total number of aliens by only 14–19 species.

Of 301 neophytes, only seven were recorded in vegetation plots in all three regions: *Calendula officinalis*, *Conyza canadensis*, *Helianthus tuberosus*, *Juncus tenuis*, *Chamomilla suaveolens*, *Phalaris canariensis* and *Solidago canadensis*. In addition, *Panicum miliaceum* also occurred in all three regions, but it is considered as an archaeophyte in the Czech Republic and neophyte in the other two regions. A further 56 neophytes were found in two regions. Species compositions of neophytes in Czech and British habitats were more similar to each other than to the species composition of neophytes in Catalonian habitats. Of 228 archaeophytes, 57 occurred in both the Czech Republic and Britain. In addition, 12 occurred in both regions with reversed status.

Although the region's lists of top aliens contain some species common to two regions, overall they are somewhat dissimilar (Tables 4 and 5; see also Appendix S4 in Supplementary material for the lists of the most common aliens in particular habitats). Interestingly, the British list of the most common neophytes (Table 4a) contains 40% woody plants. However, woody plants are absent from the corresponding Catalonian list, and represented by a single species, *Robinia pseudacacia*, in the Czech list.

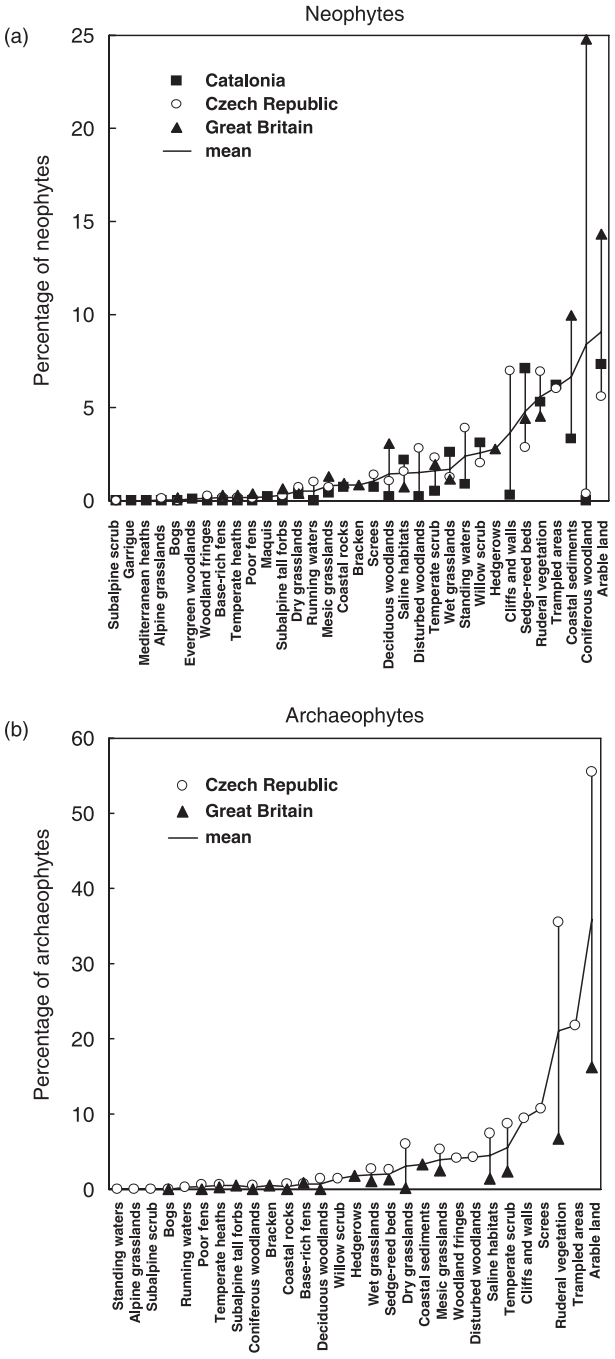

Fig. 1. Percentages of neophytes and archaeophytes occurring in vegetation plots in different EUNIS habitats in Catalonia, Czech Republic and Great Britain. Habitats are ranked by increasing mean percentages. Some habitats are only represented or documented in one or two countries. See Table 2 for EUNIS habitat codes and Appendix 1 for full habitat names.

PROPORTION OF ALIENS IN DIFFERENT HABITATS

Mean proportions of alien species per plot were compared among different habitats (Table 2). Generally, similar habitats were found with high or low alien proportions in different regions, which indicates that the patterns in the proportion of alien species are consistent even across regions with rather different alien floras (Fig. 1).

The habitats with the lowest proportions of neophytes (Table 2, Fig. 1a) are those on soils with constantly low nutrient availability. They include mires (bogs, poor fens, base-rich fens), some grasslands (alpine grasslands, woodland fringes), heathlands and scrub (subalpine scrub, temperate heaths) and evergreen Mediterranean vegetation (maquis, garrigue, Mediterranean heaths, evergreeen woodland).

Table 4. Twenty most common neophytes (a, measure of occurrence frequency in the landscape) and neophytes occurring in most habitats (b, measure of ecological range) in each region. Numbers are percentages. Percentages in (a) express the number of occurrences in the plots of each habitat relative to the total number of plots in that habitat, averaged across habitats. Percentages in (b) are the numbers of habitats in which the species was found in at least one plot, relative to the total number of habitats considered in this study for the particular region. Species included in the lists of two or three regions are in bold type

Catalonia		Czech Republic		Great Britain	
(a) Mean percentage occurrence in vegetation plots of different habitats					
Aster squamatus	2·3	*Impatiens parviflora*	3·8	*Picea sitchensis*	5·1
Xanthium strumarium ssp. *italicum*	1·7	***Veronica persica***	2·3	***Chamomilla suaveolens***	3·0
Amaranthus retroflexus	1·3	***Chamomilla suaveolens***	2·0	*Acer pseudoplatanus*	3·0
Conyza bonariensis	0·7	***Conyza canadensis***	1·7	***Veronica persica***	1·8
Amaranthus blitoides	0·6	***Epilobium adenocaulon***	1·5	*Brassica napus* ssp. *napus*	1·5
Sorghum halepense	0·6	*Trifolium hybridum*	1·4	*Lolium multiflorum*	0·9
Conyza canadensis	0·6	*Robinia pseudacacia*	0·9	*Pinus contorta*	0·7
Conyza sumatrensis (Retz.) E. Walker	0·5	***Amaranthus retroflexus***	0·9	***Impatiens glandulifera***	0·6
Cyperus eragrostis	0·5	*Agrostis gigantea*	0·8	*Picea abies*	0·4
Carpobrotus edulis	0·4	*Elodea canadensis*	0·7	***Epilobium adenocaulon***	0·4
Bidens frondosa	0·4	*Galinsoga ciliata*	0·6	*Epilobium brunnescens*	0·3
Sporobolus indicus	0·4	*Galinsoga parviflora*	0·6	*Cardaria draba*	0·3
Bromus willdenowii	0·4	***Bidens frondosa***	0·6	*Pinus nigra*	0·3
Amaranthus hybridus	0·4	***Impatiens glandulifera***	0·5	*Claytonia perfoliata*	0·2
Chenopodium ambrosioides	0·4	*Solidago canadensis*	0·4	*Aesculus hippocastanum*	0·2
Euphorbia prostrata	0·3	*Medicago sativa*	0·4	*Claytonia sibirica*	0·2
Artemisia verlotiorum	0·3	*Juncus tenuis*	0·4	*Pseudotsuga menziesii*	0·2
Xanthium spinosum	0·2	*Solanum tuberosum*	0·4	*Rhododendron ponticum*	0·2
Echinochloa colonum	0·2	*Oxalis europaea*	0·3	*Vicia faba*	0·2
Amaranthus albus	0·2	*Acorus calamus*	0·3	*Brassica rapa*	0·2
(b) Percentage of habitats in which the species was recorded					
Aster squamatus	45	***Epilobium adenocaulon***	72	*Acer pseudoplatanus*	74
Conyza canadensis	45	*Impatiens parviflora*	68	*Picea sitchensis*	68
Conyza bonariensis	35	*Agrostis gigantea*	52	*Brassica napus* ssp. *napus*	58
Conyza sumatrensis (Retz.) E. Walker	35	***Conyza canadensis***	52	*Lolium multiflorum*	58
Xanthium strumarium ssp. *italicum*	32	***Robinia pseudacacia***	48	***Veronica persica***	58
Amaranthus retroflexus	29	*Trifolium hybridum*	48	***Epilobium adenocaulon***	53
Artemisia verlotiorum	29	***Bidens frondosa***	44	*Impatiens glandulifera*	53
Sorghum halepense	29	*Erigeron annuus*	44	***Chamomilla suaveolens***	53
Amaranthus blitoides	26	*Juncus tenuis*	40	*Aesculus hippocastanum*	47
Chenopodium ambrosioides	26	*Medicago sativa*	40	*Picea abies*	47
Robinia pseudoacacia	26	*Solidago canadensis*	40	*Epilobium brunnescens*	42
Amaranthus hybridus	23	*Aster novi-belgii* group	36	*Senecio viscosus*	42
Cyperus eragrostis	23	*Cytisus scoparius*	36	*Brassica rapa*	37
Euphorbia nutans	23	*Lupinus polyphyllus*	36	*Claytonia perfoliata*	37
Euphorbia prostrata	23	***Chamomilla suaveolens***	36	*Claytonia sibirica*	37
Sporobolus indicus	23	*Oxalis fontana*	36	*Geranium pyrenaicum*	37
Bidens frondosa	19	*Acorus calamus*	32	*Cardaria draba*	37
Bromus willdenowii	19	*Galinsoga parviflora*	32	*Rhododendron ponticum*	37
Coronopus didymus	19	*Rumex thyrsiflorus*	32	*Veronica filiformis*	37
Datura stramonium	19	***Veronica persica***	32	*Castanea sativa*	32
Kochia scoparia	19			*Cotoneaster microphyllus*	32
Oenothera biennis	19			*Reynoutria japonica*	32
Paspalum dilatatum	19			*Mimulus guttatus*	32
				Veronica polita	32

The habitats with the greatest proportion of aliens belong to two groups, anthropogenic habitats (arable land, ruderal vegetation, trampled areas) and coastal, littoral and riverine habitats (coastal sediments, sedge-reed beds, wet scrub). Some habitats are among the most invaded in single regions only, e.g. coniferous woodland only in Britain and cliffs and walls only in the Czech Republic.

The pattern of habitat invasion by archaeophytes in the Czech Republic and Britain (Fig. 1b) is similar to the corresponding pattern for neophytes. The habitats with the highest and lowest proportions of aliens are generally the same for both neophytes and archaeophytes, although there are some exceptions (see the next section). Czech habitats contain on average higher proportion of archaeophytes than British habitats.

INVASIONS BY ARCHAEOPHYTES AND NEOPHYTES

If habitat mean values are compared, there is a strong positive correlation between the numbers of archaeophytes and

Table 5. Twenty most common archaeophytes and archaeophytes occurring in most habitats in the Czech Republic and Britain. See Table 4 for further explanation

Czech Republic		Great Britain	
(a) Mean percentage occurrence in vegetation plots of different habitats			
Arrhenatherum elatius	9·0	*Bromus sterilis*	3·9
Cirsium arvense	7·0	*Lamium album*	2·0
Matricaria perforata	5·4	***Capsella bursa-pastoris***	1·6
Polygonum aviculare group	5·4	*Avena fatua*	1·3
Fallopia convolvulus	4·6	***Lamium purpureum***	1·3
Convolvulus arvensis	4·4	*Geranium dissectum*	1·2
Capsella bursa-pastoris	4·1	*Viola arvensis*	1·0
Echium vulgare	3·1	*Artemisia vulgaris*	1·0
Mentha arvensis	3·0	***Fallopia convolvulus***	1·0
Lapsana communis	2·9	***Myosotis arvensis***	0·9
Myosotis arvensis	2·5	*Sisymbrium officinale*	0·8
Thlaspi arvense	2·3	*Alopecurus myosuroides*	0·6
Medicago lupulina	2·3	*Picris echioides*	0·6
Chelidonium majus	2·2	*Papaver rhoeas*	0·6
Lamium purpureum	2·1	*Aegopodium podagraria*	0·5
Veronica arvensis	1·9	*Silene latifolia*	0·5
Vicia hirsuta	1·8	*Conium maculatum*	0·5
Sonchus oleraceus	1·8	*Ballota nigra*	0·5
Anagallis arvensis	1·7	*Sinapis arvensis*	0·5
Atriplex patula	1·6	*Malva sylvestris*	0·5
(b) Percentage of habitats in which the species was recorded			
Arrhenatherum elatius	76	*Bromus sterilis*	68
Cirsium arvense	64	*Aegopodium podagraria*	63
Cirsium vulgare	60	***Ballota nigra***	63
Convolvulus arvensis	60	*Geranium dissectum*	63
Echium vulgare	60	*Agrostis gigantea*	58
Lapsana communis	60	*Artemisia vulgaris*	58
Linaria vulgaris	60	***Lamium album***	58
Medicago lupulina	60	***Myosotis arvensis***	58
Silene latifolia	60	*Picris echioides*	58
Tanacetum vulgare	60	*Avena fatua*	53
Lamium album	56	*Conium maculatum*	53
Mentha arvensis	56	*Lamium purpureum*	53
Fallopia convolvulus	52	***Silene latifolia***	53
Lactuca serriola	52	*Viola arvensis*	53
Myosotis arvensis	52	***Fallopia convolvulus***	47
Sonchus oleraceus	52	*Malva sylvestris*	47
Vicia hirsuta	52	*Alopecurus myosuroides*	42
Ballota nigra	48	***Capsella bursa-pastoris***	42
Capsella bursa-pastoris	48	*Fumaria officinalis*	42
Carduus acanthoides	48	*Chamomilla recutita*	42
Chelidoniumsat majus	48	*Sinapis arvensis*	42
Pastinaca sativa	48	*Sisymbrium* officinale	42
Matricaria perforata	48	*Smyrnium olusatrum*	42

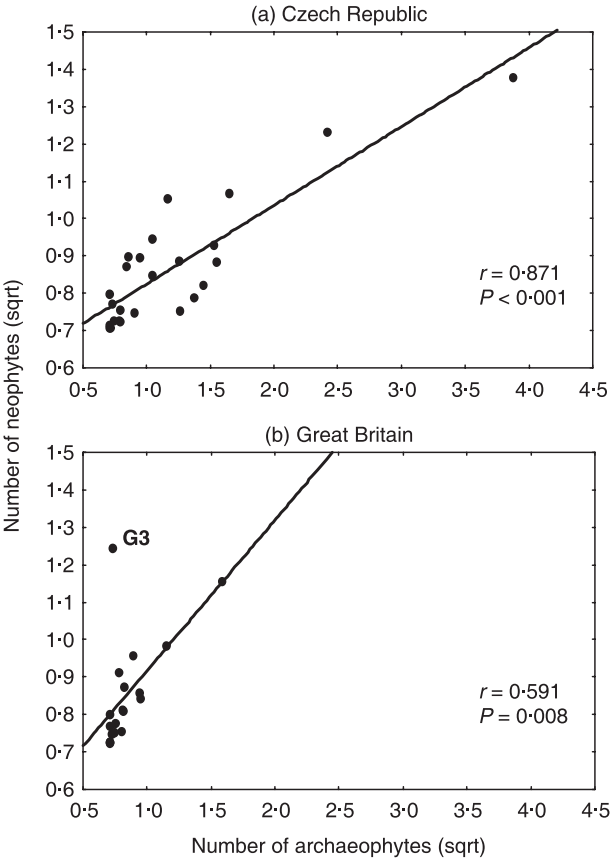

Fig. 2. Relationships between numbers of neophytes and archaeophytes in individual habitats in the Czech Republic and Great Britain. Each point represents habitat mean values. G3 = coniferous woodland.

neophytes in Czech and British habitats (Fig. 2). Positive relationships also prevail within individual habitats in separate analyses using individual plots of each habitat as data points (Table 6). For 16 Czech and 11 British habitats there are positive relationships and for nine Czech and eight British habitats the relationships are not significant. There is no negative relationship.

Apart from this general trend, it appears that some habitats tend to support a higher proportion of neophytes and others of archaeophytes (Table 6). Both in the Czech Republic and Britain proportion of neophytes to all aliens is high for woodlands and nutrient-rich wet habitats, while it is low for nutrient-poor habitats, dry and mesic grasslands, heathlands and scrub, and also for anthropogenic habitats.

Discussion

ALIEN SPECIES OF THE THREE REGIONS

In the Czech Republic the total numbers of both archaeophytes and neophytes found in all plots were the highest, while Catalonia and Britain did not differ greatly in the total numbers of neophytes (Table 3). This may reflect both the slightly different nature of the three data sets and real differences. The British data set did not involve urban habitats while these were contained in the other national data sets, so the total pool of aliens in the British data set may be underrepresented (Roy, Hill & Rothery 1999). The low number of archaeophytes in British compared to Czech habitats also reflects the differences in total pools of archaeophytes in the two countries. If casuals are excluded, the Czech flora contains 258 and the British flora 151 archaeophytes (Table 1). This pattern probably reflects the climatic match of archaeophytes in their secondary range. Most archaeophytes in central and western Europe originate from drier and warmer

Table 6. Within-habitat correlations between archaeophytes and neophytes (a) and ratios of the number of neophytes to the number of all aliens (archaeophytes + neophytes; b), in the Czech Republic and Britain. Dash = habitat does not occur in the region or data are not available. In (a), numbers are correlation coefficients between the number of archaeophytes and neophytes in vegetation plots of each habitat (***$P < 0{\cdot}001$, **$P < 0{\cdot}01$, *$P < 0{\cdot}05$, NS = not significant). 'No arch' and 'no neo' means that the habitat contains no archaeophytes or no neophytes, respectively. In (b) ratios for those habitats that contain on average less than 0·1% of neophytes or archaeophytes in vegetation plots are put into brackets, because such values may be unstable

	(a) Arch-neo correlations		(b) Ratio neophytes/all aliens	
EUNIS habitat	CZ	GB	CZ	GB
A2·5 & D6 & E6 Saline habitats	0·18*	NS	0·20	0·33
B1 & B2 Coastal sediments	–	0·25***	–	0·59
B3 Coastal rocks	–	NS	–	(0·53)
C1 Standing waters	no arch	–	1·00	–
C2 Running waters	NS	–	(0·75)	–
C3 & D5 Reedbeds	0·48***	NS	0·43	0·61
D1 Bogs	no neo	0·07*	(0)	(0·87)
D2 Poor fens	0·14**	no arch	0·16	(1·00)
D4 Rich fens	NS	no arch	0·16	(1·00)
E1 Dry grasslands	0·16***	0·08***	0·08	(0·73)
E2 Mesic grasslands	0·33***	0·23***	0·10	0·34
E3 & E5·4 Wet grasslands	0·22***	0·22***	0·27	0·50
E4 Alpine grasslands	no arch	–	(1·00)	–
E5·1 Ruderal vegetation	0·27***	0·21***	0·16	0·36
E5·2 Woodland fringes	NS	–	0·06	–
E5·3 Bracken	–	0·11*	–	0·60
E5·5 Subalpine tall forbs	NS	no arch	(0·33)	1·00
F2 Subalpine scrub	no aliens	–	no aliens	–
F3 Temperate scrub	0·31***	0·13***	0·17	0·38
F4 Temperate heaths	NS	NS	0·18	(0·86)
F9 Wet scrub	0·46***	–	0·57	–
FA Hedgerows	–	0·09***	–	0·48
G1 & 4 Deciduous woodlands	0·27***	0·09**	0·55	0·76
G3 Coniferous woodlands	0·28***	n.s.	0·35	0·97
G5 Disturbed woodlands	0·45***	–	0·41	–
H2 Screes	0·52***	–	0·13	–
H3 Cliffs and walls	0·36***	–	0·40	–
H5·6 Trampled areas	0·31***	–	0·22	–
I1 Arable land	0·15***	0·25***	0·09	0·29

areas of southern Europe and the Near East (di Castri 1990), which makes them better adapted to the subcontinental Czech climate than to the wet British climate. It is probable that the lower number of archaeophytes in British habitats does not result from the greater distance from their native range (thus a lower probability of immigration), because many archaeophytes arrived in both countries very soon after the beginning of Neolithic agriculture (Pyšek & Jarošík 2005).

The analysis of alien species composition in vegetation plots revealed a considerable dissimilarity between the Mediterranean–submediterranean, subcontinental and oceanic regions of Europe. Generally, compositions of alien floras are more similar among different habitats of the same region than between the same habitats of different regions. A similar pattern was found by Weber (1997) in his analysis of alien plant occurrence in European countries and by Lloret *et al*. (2004), who found more than 400 aliens on eight large Mediterranean islands, but only four of them were present on all islands.

This is important for the interpretation of the habitat invasion patterns. As the alien floras found in vegetation plots of the same habitats differ strongly between regions, patterns of habitat invasions in each region seem to be determined mainly by properties of the habitats rather than the identity of particular alien species.

LEVEL OF INVASION IN DIFFERENT HABITATS

Between-habitat patterns in the proportion of aliens are very similar among the Mediterranean–submediterranean, subcontinental and oceanic regions. Generally, similar habitats have high or low proportions in each of these regions. For neophytes, there are two exceptions which result from artefacts in the data (Fig. 1a). Firstly, coniferous woodland has a very high proportion of neophytes in Britain but a low proportion in the other regions. This is due to most British coniferous woodlands being plantations of alien conifers, whereas natural coniferous woodlands are poor in aliens (Crawley 1987). Secondly, the higher proportion of aliens on cliffs and walls in the Czech Republic is due to many Czech plots being sampled on urban walls.

Our study suggests that the habitat-specific proportions of alien species between the contrasting climatic regions are consistent for neophytes and archaeophytes. The habitats with the lowest proportion of aliens in all regions include bogs and mires, alpine–subalpine grasslands and different kinds of nutrient-poor heathlands (i.e. alpine, temperate and Mediterranean). In contrast, the highest proportions were in man-made and coastal habitats. Neophytes are also found in high proportions in fresh-water and littoral habitats while this is also true of archaeophytes on screes. Similar patterns have also been confirmed by the analyses of habitat-specific species pools of aliens in other parts of Europe, e.g. Austria (Walter *et al*. 2005) or Berlin (Kowarik 1995).

The relative constancy of the habitat invasion patterns across regions, occurring in spite of the large differences in species composition, suggests the existence of general mechanisms that make a habitat either resistant or susceptible to invasion. Common attributes of habitats with a low proportion of aliens include environmentally stressful conditions (e.g. low temperature or pronounced drought), low nutrient availability and infrequent disturbance. In contrast, habitats with higher proportions of aliens are usually developed on nutrient-rich soil and experience frequent disturbances, both anthropogenic and natural (e.g. coastal sediments or riverine vegetation). In addition, all the habitats with high proportions of aliens experience short periods of strongly increased nutrient availability, e.g. fertilization on arable land, deposition of nutrient-rich mud from flood waters or disturbance of resident vegetation, which causes lower nutrient uptake. These observations are consistent with the theory of fluctuating resource availability (Davis, Grime & Thompson 2000), which suggests that occurrence of rapid pulses in resource availability is the key process determining habitat invasibility by enabling new species to establish in the community (see also Shea & Chesson 2002).

ARCHAEOPHYTES AND NEOPHYTES

Generally, habitats with more archaeophytes also have more neophytes (Fig. 2) and the same is true when individual sites are compared within particular habitats (Table 6). This observation made on Czech and British vegetation plots corresponds to the observation made by Deutschewitz *et al*. (2003) in larger sampling units – grid cells of 32 km^2 in Germany. The evidence of this positive relationship on different spatial scales is important for risk assessment of habitat invasions, because it predicts that the habitats and areas currently highly invaded by archaeophytes hold a higher risk of future invasions by new neophytes. This is also interesting from the theoretical point of view because it suggests that, through time, basically the same mechanisms can be responsible for higher susceptibility of habitats to invasion, in spite of different taxa, origin, residence time and invasion event characteristics.

However, apart from this general trend and from the fact that nearly all habitats contain a larger proportion of archaeophytes than neophytes, some habitats tend to host more archaeophytes and less neophytes than others and vice versa (Table 6; see also the deviations of data points from the regression lines in Fig. 2). Neophytes show a higher affinity to wet habitats and woodlands, while archaeophytes to open vegetation at dry or mesic sites. This general trend, valid across a broad range of different habitats in two contrasting climatic regions, is consistent with previous Central European studies which compared habitat affinities of these two groups of aliens within a single broad habitat such as arable land (Pyšek *et al*. 2005) or across a landscape (Deutschewitz *et al*. 2003). The most probable explanation is the habitat compatibility of aliens in their primary and secondary range. Most archaeophytes of temperate Europe originate from southern Europe and the Near East, i.e. rather dry areas with a high representation of dry treeless vegetation. In contrast, most neophytes originate from wetter areas with deciduous broad-leaved woodlands of North America or Eastern Asia. Thus, each of these two groups of aliens matches the prevailing habitat conditions in their native range.

TOWARDS A RISK ASSESSMENT OF PLANT INVASIONS

We demonstrated that similar patterns of habitat invasion emerge in different regions of Europe, which have contrasting climate and considerably different composition of alien floras. Independently of the available pool of potential invaders, habitats with high proportions of aliens are frequently disturbed with intermittent increases of nutrient availability, while those with low proportions are infrequently disturbed habitats with constantly low nutrient availability, many of them occurring in harsh climatic conditions. Moreover, recently spreading aliens are generally present in the same habitats that have been invaded by historically earlier aliens, although there are some deviations reflecting habitat compatibility of different species in their native and secondary range.

These robust patterns make habitats a promising predictor of biological invasions at the regional level. For planning effective monitoring and management of alien plants, nature conservationists and land managers use risk assessment tools (Daehler *et al*. 2004; Maguire 2004), which are so far based mainly on traits of the potentially invasive species. Our study demonstrates that the quality of risk assessment can benefit greatly from incorporating the information on the identity of receptor habitats. Many maps of habitat distribution are currently available in Europe and such maps can help identify areas with high invasion risk. Furthermore, in order to estimate major trends in the future spread of alien plants, the habitat-specific proportions of aliens could be projected onto spatially explicit scenarios of future land-use changes (Rounsevell *et al*. 2006). Due to consistent patterns of habitat invasion between different climatic regions, such scenarios may have a broad potential for extrapolation to wider areas of Europe.

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Supplementary material

The following supplementary material is available for this article.

Appendix S1. Overview of the EUNIS habitats used.

Appendix S2. Crosswalk phytosociological syntaxa–EUNIS.

Appendix S3. Crosswalk British NVC communities–EUNIS.

Appendix S4. List of most common alien species in Catalonian, Czech and British habitats.

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Supplementary material to the paper
Chytrý, M., Maskell, L.C., Pino, J., Pyšek, P., Vilà, M., Font, X. & Smart, S.M.
Habitat invasions by alien plants: a quantitative comparison among Mediterranean, subcontinental and oceanic regions of Europe

Appendix S1. Overview of the EUNIS habitats used in this study with their full names and numbers of plots available from individual regions.

EUNIS habitat	No. of plots			
	Catalonia	CZ	GB	Total
A2.5&D6&E6 Coastal saltmarshes and saline reedbeds (A2.5), Inland saline and brackish marshes and reedbeds (D6), Inland salt steppes (E6)	670	183	101	954
B1&B2 Coastal dunes and sandy shores (B1), Coastal shingle (B2)	287	0	250	537
B3 Rock cliffs, ledges and shores, including the supralittoral	171	0	132	303
C1 Surface standing waters	136	1028	0	1164
C2 Surface running waters	101	254	0	355
C3&D5 Littoral zone of inland surface waterbodies (C3), Sedge and reedbeds, normally without free-standing water (D5)	432	2891	64	3387
D1 Raised and blanket bogs	153	75	1338	1566
D2 Valley mires, poor fens and transition mires	229	375	36	640
D4 Base-rich fens and calcareous spring mires	46	49	55	150
E1 Dry grasslands	2653	2508	1900	7061
E2 Mesic grasslands	396	1698	2887	4981
E3&E5.4 Seasonally wet and wet grasslands (E3), Moist or wet tall-herb and fern fringes and meadows (E5.4)	431	3152	1201	4784
E4 Alpine and subalpine grasslands	1344	94	0	1438
E5.1 Anthropogenic herb stands	983	1023	1434	3440
E5.2 Thermophile woodland fringes	139	369	0	508
E5.3 *Pteridium aquilinum* fields	0	0	335	335
E5.5 Subalpine moist or wet tall-herb and fern stands	123	218	7	348
F2 Arctic, alpine and subalpine scrub	369	24	0	393
F3 Temperate and mediterranean-montane scrub	422	102	745	1269
F4 Temperate shrub heathland	119	228	668	1015
F5 Maquis, arborescent matorral and thermo-Mediterranean brushes	469	0	0	469
F6 Garrigue	778	0	0	778
F7 Spiny Mediterranean heaths (phrygana, hedgehog-heaths and related coastal cliff vegetation)	141	0	0	141
F9 Riverine and fen scrubs	124	68	0	192
FA Hedgerows	0	0	3162	3162
G1&4 Broadleaved deciduous woodland (G1), Mixed deciduous and coniferous woodland (G4)	1413	2542	882	4837
G2 Broadleaved evergreen woodland	1005	0	0	1005
G3 Coniferous woodland	241	592	176	1009
G5 Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice	148	491	0	639
H2 Screes	436	50	0	486
H3 Inland cliffs, rock pavements and outcrops	831	236	0	1067
H5.6 Trampled areas	354	777	0	1131
I1 Arable land and market gardens	506	1441	989	2936
Total	15650	20468	16362	52480

Appendix S2. A list of phytosociological syntaxa (mostly alliances) assigned to individual EUNIS habitats in the Catalonian and Czech data set. Abbreviations Cat and CZ indicate that the syntaxon occurs in Catalonia or the Czech Republic, respectively.

A2.5&D6&E6 Saline habitats
- *Arthrocnemion fruticosi* – Cat
- *Cypero-Spergularion salinae* – CZ
- *Juncion maritimi* – Cat
- *Limoniastrion monopetali* – Cat
- *Limonion galloprovincialis* – Cat
- *Loto-Trifolienion* – CZ
- *Plantaginion crassifoliae* – Cat
- *Puccinellion limosae* – CZ
- *Scirpion maritimi* – CZ
- *Scorzonero-Juncion gerardii* – CZ
- *Suaedion braun-blanquetii* – Cat
- *Suaedion brevifoliae* – Cat
- *Thero-Salicornion* – Cat, CZ
- *Thero-Suaedion* – Cat, CZ

B1&B2 Coastal sediments
- *Alkanno-Malcolmion* – Cat
- *Ammophilion arundinaceae* – Cat
- *Crucianellion maritimae* – Cat
- *Saginion maritimae* – Cat

B3 Coastal rocks
- *Crithmo-Limonion* – Cat
- *Medicagini-Lavaterion arboreae* – Cat

C1 Standing waters
- *Isoetion* – Cat, CZ
- *Lemnion minoris* – Cat, CZ
- *Utricularion vulgaris* – CZ
- *Hydrocharition* – CZ
- *Nymphaeion albae* – CZ
- *Potamion pectinatae* – Cat
- *Potamogetonion eurosibiricum* – Cat
- *Magnopotamion* – CZ
- *Parvopotamion* – CZ
- *Batrachion aquatilis* – CZ
- *Ruppion maritimae* – Cat
- *Sphagno-Utricularion* – CZ

C2 Running waters
- *Callitricho-Batrachion* – Cat
- *Batrachion fluitantis* – CZ
- *Cardamino-Montion* – Cat, CZ
- *Cratoneurion commutati* – Cat
- *Cardaminion amarae* – CZ
- *Swertio-Anisothecion* squarrosi – CZ
- *Lycopodo-Cratoneurion commutati* – CZ

C3&D5 Sedge-reed beds
- *Bidention tripartitae* – Cat, CZ
- *Glycerio-Sparganion* – Cat, CZ
- *Littorellion uniflorae* – Cat, CZ
- *Magnocaricion elatae* – Cat, CZ
- *Caricion rostratae* – CZ
- *Caricion gracilis* – CZ
- *Phragmition australis* – Cat, CZ
- *Oenanthion aquaticae* – CZ
- *Phalaridion arundinaceae* – CZ
- *Carici-Rumicion hydrolapathi* – CZ
- *Nanocyperion flavescentis* – Cat, CZ
- *Eleocharition ovatae* – CZ
- *Radiolion linoidis* – CZ

D1 Bogs
- *Oxycocco-Ericion tetralicis* – Cat, CZ
- *Oxycocco-Empetrion hermaphroditi* – CZ
- *Sphagnion medii* – CZ

D2 Poor fens
- *Caricion nigrae* – Cat, CZ
- *Caricion lasiocarpate* – CZ
- *Caricion demissae* – CZ
- *Drepanocladion exannulati* – CZ
- *Sphagno-Tomenthypnion* – CZ
- *Eriophorion gracilis* – CZ
- *Rhynchosporion albae* – CZ
- *Sphagno-Caricion canescentis* – CZ
- *Leuko-Scheuchzerion* – CZ

D4 Base-rich fens
- *Caricion davallianae* – Cat, CZ

E1 Dry grasslands
- *Aegilopion* – Cat
- *Agropyro-Lygeion* – Cat
- *Alysso-Festucion pallentis* – CZ
- *Alysso-Sedion* – Cat, CZ
- *Aphyllanthion* – Cat
- *Arabidopsion thalianae* – CZ
- *Asplenio serpentini-Armerion* – CZ
- *Brachypodion phoenicoidis* – Cat
- *Corynephorion canescentis* – Cat, CZ
- *Festucion valesiacae* – CZ
- *Helianthemion guttati* – Cat
- *Helianthemo-Festucion pallentis* – CZ
- *Hyperico-Scleranthion* – CZ
- *Koelerion glaucae* – CZ
- *Koelerio-Phleion phleoidis* – CZ
- *Mesobromion erecti* – Cat, CZ
- *Ononidion striatae* – Cat
- *Phlomidio-Brachypodion retusi* – Cat
- *Plantagini-Festucion* – CZ
- *Saturejo-Hyparrhenion hirtae* – Cat
- *Sedo-Scleranthion* – Cat
- *Seslerio-Festucion pallentis* – CZ
- *Stipion capensis* – Cat
- *Taeniathero-Aegilopion geniculatae* – Cat
- *Thero-Airion* – Cat, CZ
- *Thero-Brachypodion* – Cat
- *Tuberarion guttatae* – Cat

Xerobromion erecti – Cat

E2 Mesic grasslands

Agrostion stoloniferae – Cat
Arrhenatherion elatioris – Cat, CZ
Cynosurion cristati – Cat, CZ
Deschampsion mediae – Cat
Nardo-Agrostion tenuis – CZ
Nardo-Juncion squarrosi – CZ
Polygono-Trisetion – CZ
Violion caninae – CZ
Violion cornutae – Cat

E3&E5.4 Wet grasslands

Aegopodion podagrariae – Cat, CZ
Alopecurion pratensis – CZ
Calthion palustris – Cat, CZ
Cnidion – CZ
Filipendulenion – CZ
Imperato-Erianthion – Cat
Juncion acutiflori – Cat
Lythrion tribracteati – Cat
Molinio-Holoschoenion vulgaris – Cat
Molinion coeruleae – Cat, CZ
Paspalo-Polypogonion – Cat
Petasition officinalis – CZ
Senecion fluviatilis – CZ
Veronico-Lysimachion – CZ

E4 Alpine grasslands

Arabidion coeruleae – Cat
Elynion medioeuropaeum – Cat
Festucion eskiae – Cat
Festucion gautieri – Cat
Festucion scopariae – Cat
Festucion supinae – Cat
Juncion trifidi – CZ
Laserpitio-Ranunculion thorae – Cat
Nardion strictae – Cat, CZ
Nardo-Caricion rigidae – CZ
Primulion intricatae – Cat
Salicion herbaceae – Cat, CZ

E5.1 Ruderal vegetation

Arction – Cat, CZ
Bromo-Hordeion – CZ
Bromo-Oryzopsion miliaceae – Cat
Carrichtero-Amberboion – Cat
Chenopodion glauci – CZ
Chenopodion muralis – Cat
Convolvulion sepium – Cat
Convolvulo-Agropyrion – CZ
Dauco-Melilotion – Cat, CZ
Eragrostion – CZ
Euphorbion peplis – Cat
Galio-Alliarion – Cat, CZ
Glaucio-Cakilion – Cat
Hordeion leporini – Cat
Malvion neglectae – CZ
Onopordion acanthii – Cat, CZ
Onopordion arabici – Cat
Rumicion alpini – Cat, CZ
Salsolion ruthenicae – CZ
Salsolo-Peganion – Cat
Silybo-Urticion – Cat
Sisymbrion officinalis – Cat, CZ

E5.2 Woodland fringes

Geranion sanguinei – Cat, CZ
Trifolion medii – Cat, CZ

E5.5 Subalpine tall forbs

Adenostylion alliariae – Cat, CZ
Calamagrostion arundinaceae – Cat, CZ
Calamagrostion villosae – CZ
Dryopterido-Athyrion – CZ
Poo chaixii-Deschampsion – CZ

F2 Subalpine scrub

Juniperion nanae – Cat
Loiseleurio-Vaccinion – Cat
Pinion mugo – CZ
Rhododendro-Vaccinion – Cat
Salicion silesiacae – CZ

F3 Temperate scrub

Berberidion vulgaris – Cat, CZ
Genistion purgantis – Cat
Prunion spinosae – CZ
Pruno-Rubion ulmifolii – Cat
Rubion subatlanticum – Cat
Sarothamnion scoparii – Cat
Ulici-Ericion ciliaris – Cat

F4 Temperate heaths

Calluno-Genistion – Cat
Euphorbio-Callunion – CZ
Genistion pilosae – CZ
Vaccinion – CZ

F5 Maquis

Cistion laurifolii – Cat
Cistion mediomediterraneum – Cat
Oleo-Ceratonion – Cat

F6 Garrigue

Gypsophilion – Cat
Lepidion subulati – Cat
Rosmarino-Ericion – Cat
Thymo-Siderition leucanthae – Cat
Thymo-Teucrion verticillati – Cat

F7 Mediterranean heaths

Genistion lobelii – Cat

F9 Wet scrub

Rubo ulmifolii-Nerion oleandri – Cat
Salicion cinereae – CZ
Salicion eleagno-daphnoidis – CZ
Salicion pentandrae – Cat
Salicion triandrae – CZ
Salicion triandro-fragilis – Cat
Tamaricion africanae – Cat

G1&G4 Deciduous woodlands
- *Alnion glutinosae* – CZ
- *Alnion incanae* – CZ
- *Alno-Padion* – Cat
- *Alno-Ulmion* – Cat
- *Betulion pubescentis* – CZ
- *Carpinion* – CZ
- *Fagion sylvaticae* – Cat, CZ
- *Fraxino-Carpinion* – Cat
- *Genisto germanicae-Quercion* – CZ
- *Luzulo-Fagion* – CZ
- *Populion albae* – Cat
- *Quercion pubescenti-petraeae* – Cat, CZ
- *Quercion robori-petraeae* – Cat
- *Salicion albae* – CZ
- *Tilio-Acerion* – Cat, CZ

G2 Evergreen woodlands
- *Quercion ilicis* – Cat

G3 Coniferous woodlands
- *Abieti-Piceion* – Cat
- *Athyrio-Piceion* – CZ
- *Deschampsio-Pinion* – Cat
- *Dicrano-Pinion* – CZ
- *Erico-Pinion* – CZ
- *Eriophoro vaginati-Pinetum mugo* – CZ
- *Piceion excelsae* – CZ
- *Pino rotundatae-Sphagnetum* – CZ

G5 Disturbed woodlands
- *Atropion belladonnae* – Cat, CZ
- *Bromo ramosi-Eupatorion cannabini* – Cat
- *Epilobion angustifolii* – Cat, CZ
- *Sambuco-Salicion capreae* – Cat, CZ

H2 Screes
- *Androsacion alpinae* – Cat, CZ
- *Andryalo-Glaucion* – Cat
- *Galeopsion* – Cat
- *Glaucion flavi* – Cat
- *Iberidion spathulatae* – Cat
- *Pimpinello-Gouffeion* – Cat
- *Scrophularion sciaphilae* – Cat
- *Senecion leucophylli* – Cat
- *Stipion calamagrostis* – Cat, CZ

H3 Cliffs
- *Adiantion* – Cat
- *Agrostion alpinae* – CZ
- *Androsacion vandellii* – Cat, CZ
- *Anomodontion europaeum* – Cat
- *Antirrhinion asarinae* – Cat
- *Asplenion petrarchae* – Cat
- *Asplenion serpentini* – CZ
- *Bartramio-Polypodion australis* – Cat
- *Centrantho-Parietarion* – CZ
- *Cystopteridion* – Cat, CZ
- *Homalothecio-Polypodion serrulati* – Cat
- *Hypno-Polypodion vulgaris* – Cat
- *Parietario-Centranthion rubri* – Cat
- *Phagnalo-Cheilanthion fragrantis* – Cat
- *Potentillion caulescentis* – CZ
- *Saxifragion mediae* – Cat

H5.6 Trampled areas
- *Agropyro-Rumicion crispi* – Cat, CZ
- *Echio-Galactition* – Cat
- *Polygonion avicularis* – Cat, CZ
- *Trifolio-Cynodontion* – Cat

I1 Arable land
- *Aphanion* – CZ
- *Caucalidion platycarpae* – Cat, CZ
- *Diplotaxion erucoidis* – Cat
- *Fumario-Euphorbion* – CZ
- *Panico-Setarion* – Cat, CZ
- *Polygono-Chenopodion polyspermi* – Cat
- *Scleranthion annui* – Cat, CZ
- *Secalion mediterraneum* – Cat
- *Sherardion* – CZ
- *Spergulo-Oxalidion* – CZ

Appendix S3. A list of communities of the British National Vegetation Classification (NVC; Rodwell 1991–2000) assigned to individual EUNIS habitats.

A2.5&D6&E6 Saline habitats
MG12 *Festuca arundin*acea grassland
S4d *Phragmites australis* swamp and reedbeds
S20 *Scirpus lacustris* ssp. *tabernaemontani* swamp
S21 *Scirpus maritimus* swamp
All NVC Salt marsh communities

B1&B2 Coastal sediments
SD1 *Rumex crispus-Glaucium flavum* shingle community
SD2 *Honkenya peploides-Cakile maritima* strandline community
SD3 *Matricaria maritima-Galium aparine* strandline community
SD4 *Elymus farctus* foredune
SD5 *Leymus arenarius* mobile dune community
SD6 *Ammophila arenaria* mobile dune community
SD7 *Ammophila arenaria-Arrhenatherum elatius* dune grassland
SD8 *Festuca rubra-Galium verum* grassland
SD9 *Ammophila arenaria-Arrhenatherum elatius* dune grassland
SD10 *Carex arenaria* dune community
SD11 *Carex arenaria-Cornicularia aculeata* dune community
SD12 *Carex arenaria-Festuca ovina-Agrostis capillaris* dune grassland
SD13 *Sagina nodosa*

B3 Coastal rocks
All NVC maritime cliff communities

C3&D5 Sedge-reed beds
S1 *Carex elata* swamp
S2 *Cladium mariscus* swamp
S3 *Carex paniculata* swamp
S4a-c *Phragmites australis* swamp and reedbed
S5 *Glyceria maxima* swamp
S9 *Carex rostrata* swamp
S11 *Carex vesicaria* swamp
S17 *Carex pseuudocyperus* swamp
S18 *Carex obtrubae* swamp
S24 *Phragmites australis-Peucedanum palustre* tall herb fen
S25 *Phragmites australis-Eupatorium cannabinum* tall herb fen
S26 *Phragmites australis-Urtica dioica* tall herb fen
S10 *Equisetum fluviatile* swamp
S12 *Typha latifolia* swamp
S13 *Typha angustifolia* swamp
S15 *Acorus calamus* swamp
S19 *Eleocharis palustris* swamp
S28 *Phalaris arundinacea* tall herb fen

D1 Bogs
M1 *Sphagnum auriculatum* bog pool community
M2 *Sphagnum cuspidatum/recurvum* bog pool community
M3 *Eriophorum angustifolium* bog pool community
M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket mire
M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire
M19 *Calluna vulgaris-Eriophorum vaginatum* blanket and raised mire

M20 *Eriophorum vaginatum* blanket and raised mire
M21 *Narthecium ossifragum-Sphagnum papillosum* valley mire
M15 *Scirpus cespitosus-Erica tetralix* wet heath
M16 *Erica tetralix-Sphagnum compactum* wet heath
M25 *Molinia caerulea-Potentilla erecta* raised mire

D2 Poor fens
M14 *Schoenus nigricans-Narthecium ossifragum* mire
M21 *Narthecium ossifragum-Sphagnum papillosum* valley mire
M29 *Hypericum elodes-Potamogeton polygonifolius* soakaway
M30 Related vegetation of seasonally-inundated habitats
M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire
M4 *Carex rostrata-Shagnum recurvum* mire

D4 Base-rich fens
M10 *Carex dioica-Pinguicula vulgaris* mire
M11 *Carex demissa-Saxifraga aizoides* mire
M13 *Schoenus nigricans-Juncus subnodulosus* mire
M22 *Juncus subnodulosus-Cirsium palustre* fen meadow
M24 *Molinia caerulea-Cirsium dissectum* fen meadow
M26 *Molinia caerulea-Crepis paludosa* mire
M12 *Carex saxatilis* mire
M9 *Carex rostrata-Calliergon cuspidatum/giganteum* mire
S27 *Carex rostrata-Potentilla palustris* tall herb fen
S6 *Carex riparia* swamp

E1 Dry grasslands
All Calcareous grassland communities
U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland
U2 *Deschampsia flexuosa* grassland
U3 *Agrostis curtisii* grassland
U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland
U5 *Nardus stricta-Galium saxatile* grassland
U6 *Juncus squarrosus-Festuca ovina* grassland
U7 *Nardus stricta-Carex bigelowii* grass-heath
U13 *Deschampsia cespitosa-Galium saxatile* grassland
MG3 *Anthoxanthum odoratum-Geranium sylvaticum* grassland
MG12 *Festuca arundinacea* grassland

E2 Mesic grasslands
MG1 *Arrhenatherum elatius* grassland
MG5 *Cynosurus cristatus-Centaurea nigra* grassland
MG6 *Lolium perenne-Cynosurus cristatus* grassland
MG7 *Lolium perenne* leys and related grasslands
OV12 *Poa annua-Myosotis arvensis* community

E3&E5.4 Wet grasslands
M23 *Juncus effusus/acutiflorus-Galium palustre* wet meadow
M25 *Molinia caerulea-Potentilla erecta* mire
M27 *Filipendula ulmaria-Angelica sylvestris* mire
M28 *Iris pseudacorus-Filipendula ulmaria* mire
MG10 *Holcus lanatus-Juncus effusus* rush pasture
MG11 *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland
MG13 *Agrostis stolonifera-Alopecurus geniculatus* grassland
MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland

MG8 *Cynosurus cristatus-Caltha palustris* grassland
MG9 *Holcus lanatus-Deschampsia cespitosa* grassland
OV28 *Agrostis stolonifera-Ranunculus repens* community
S22 *Glyceria fluitans* water-margin vegetation

E5.1 Ruderal vegetation
OV17 *Reseda lutea-Polygonum aviculare* community
OV18 *Polygonum aviculare-Chamomilla suaveolens* community
OV19 *Poa annua-Matricaria perforata* community
OV20 *Poa annua-Sagina procumbens* community
OV21 *Poa annua-Plantago major* community
OV22 *Poa annua-Taraxacum officinale* community
OV23 *Lolium perenne-Dactylis glomerata*
OV24 *Urtica dioica-Galium aparine* community
OV25 *Urtica dioica-Cirsium arvense* community
OV26 *Epilobium hirsutum* community
OV27 *Epilobium angustifolium* community
OV33 *Polygonum lapathifolium-Poa annua* community
OV37 *Festuca ovina-Minuartia verna* community

E5.3 Bracken
U20 *Pteridium aquilinum-Galium saxatile* community
W25 *Pteridium aquilinum-Rubus fruticosus* underscrub

E5.5 Subalpine tall forbs
U16 *Luzula sylvatica-Vaccinium myrtillus* tall herb community
U17 *Luzula sylvatica-Geum rivale* tall herb community
M2 *Sphagnum cuspidatum/recurvum* bog pool community

F3 Temperate scrub
W19 *Juniperus communis-Oxalis acetosella* woodland
W20 *Salix lapponum-Luzula sylvatica* scrub
W21 *Crataegus monogyna-Hedera helix* scrub
W22 *Prunus spinosa-Rubus fruticosus* scrub
W23 *Ulex europaeus-Rubus fruticosus* scrub
W24 *Rubus fruticosus-Holcus lanatus* underscrub
W25 *Pteridium aquilinum-Rubus fruticosus* underscrub

F4 Temperate heaths
All Heathland communities in the NVC

FA Hedgerows
All hedgerow plots

G1&G4 Broadleaved woodland
Most woodland communities in the NVC (except W13, W18, W19-W25 above)
W1 *Salix cinerea-Galium palustre* woodland
W2 *Salix cinerea-Betula pubescens-Phragmites australis* woodland
W3 *Salix pentandra-Carex rostrata* woodland
W4 *Betula pubescens-Molinia caerulea* woodland
W5 *Alnus glutinosa-Carex paniculata* woodland
W6 *Alnus glutinosa-Urtica dioica* woodland
W7 *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland
W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland
W9 *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland

W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland
W11 *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland
W12 *Fagus sylvatica-Mercurialis perennis* woodland
W14 *Fagus sylvatica-Rubus fruticosus* woodland
W15 *Fagus sylvatica-Deschampsia flexuosa* woodland
W16 *Quercus* spp.*-Betula* spp.*-Deschampsia flexuosa* woodland
W17 *Quercus petraea-Betula pubescens-Dicranum majus* woodland

G3 Coniferous woodland
Quadrats where coniferous species cover >5%. Also used
W18 *Pinus sylvestris-Hylocomium splendens* community
W13 *Taxus baccata* woodland

I1 Arable land
This classification resulted from ordination of plots and grouping into 8 categories (aggregate classes). It has been applied to all Countryside Survey plots. Also used
OV7 *Veronica persica-Veronica polita* community

Appendix S4. Most common alien species in individual habitats of Catalonia, Czech Republic and Great Britain and their percentage frequency in each habitats. Only species recorded in more than 1% of plots are listed. For those habitats which contain some alien species but none of them occurs with frequency > 1%, the most frequent species is listed with percentage frequency in brackets. Species nomenclature follows Flora Europaea (Tutin et al. 1968–1993)

Catalonia – neophytes

A2.5&D6&E6 Saline habitats: *Aster squamatus* 11.2, *Xanthium strumarium* subsp. *italicum* 4.5, *Cuscuta campestris* 1.2
B1&B2 Coastal dunes: *Xanthium strumarium* subsp. *italicum* 18.1, *Carpobrotus edulis* 3.8, *Aster squamatus* 2.4, *Cuscuta campestris* 2.1, *Conyza canadensis* 1.4, *Amaranthus blitoides* 1.0
B3 Coastal rocks: *Carpobrotus edulis* 7.6
C1 Standing waters: *Sporobolus indicus* 2.9, *Azolla filiculoides* 2.2
C2 Running waters: –
C3&D5 Sedge-reed beds: *Xanthium strumarium* subsp. *italicum* 17.6, *Aster squamatus* 16.2, *Bidens frondosa* 10.9, *Cyperus eragrostis* 9.3, *Chenopodium ambrosioides* 5.1, *Conyza canadensis* 3.9, *Amaranthus retroflexus* 2.8, *Aster pilosus* 1.4, *Panicum capillare* 1.4, *Veronica peregrina* 1.4, *Cuscuta campestris* 1.2, *Conyza sumatrensis* (Retz.) E. Walker 1.2, *Oenothera biennis* 1.2, *Amaranthus hybridus* 1.2, *Datura stramonium* 1.2
D1 Bogs, D2 Poor fens, D4 Base-rich fens: -
E1 Dry grasslands: *Crepis sancta* (0.6), *Iris germanica* (0.6)
E2 Mesic grasslands: *Aster squamatus* 1.3, *Sporobolus indicus* 1.0
E3&E5.4 Wet grasslands: *Aster squamatus* 7.4, *Xanthium strumarium* subsp. *italicum* 3.2, *Amaranthus retroflexus* 1.9, *Chamomilla suaveolens* 1.9, *Conyza canadensis* 1.4
E4 Alpine grasslands: –
E5.1 Ruderal vegetation: *Amaranthus retroflexus* 7.4, *Conyza bonariensis* 7.4, *Aster squamatus* 7.1, *Xanthium spinosum* 4.4, *Amaranthus blitoides* 3.9, *Conyza canadensis* 3.5, *Chenopodium ambrosioides* 3.2, *Amaranthus muricatus* 2.8, *Conyza sumatrensis* 2.7, *Artemisia verlotiorum* 2.7, *Bassia scoparia* 2.6, *Bromus willdenowii* 2.0, *Aster pilosus* 2.0, *Xanthium strumarium* subsp. *italicum* 1.6, *Amaranthus deflexus* 1.6, *Solidago canadensis* 1.5, *Helianthus tuberosus* 1.4, *Oenothera biennis* 1.4, *Lycopersicon esculentum* 1.2, *Sorghum halepense* 1.0
E5.2 Woodland fringes, E5.5 Subalpine tall forbs, F2 Subalpine scrub: –
F3 Temperate scrub: *Conyza bonariensis* (0.7), *Robinia pseudacacia* (0.7)
F4 Temperate heaths: –
F5 Maquis: *Carpobrotus edulis* (0.9)
F6 Garrigue: *Lathyrus tingitanus* (0.4)
F7 Mediterranean heaths: –
F9 Wetland shrubs: *Aster squamatus* 4.8, *Xanthium strumarium* subsp. *italicum* 4.0, *Cyperus eragrostis* 3.2, *Robinia pseudoacacia* 2.4, *Boussingaultia cordifolia* 2.4, *Conyza sumatrensis* (Retz.) E. Walker 2.4, *Oenothera biennis* 2.4, *Phytolacca americana* 2.4, *Artemisia verlotiorum* 1.6, *Platanus acerifolia* 1.6, *Aster pilosus* 1.6, *Amaranthus retroflexus* 1.6, *Amaranthus blitoides* 1.6, *Helianthus tuberosus* 1.6, *Buddleja davidii* 1.6
G1&G4 Deciduous woodlands: *Robinia pseudacacia* 1.1
G2 Evergreen woodlands: *Robinia pseudoacacia* (0.2), *Opuntia ficus-barbarica* A. Berger (0.2), *Einadia nutans* (R. Br.) A.J. Scott (0.2)
G3 Coniferous woodlands: –
G5 Disturbed woodlands: *Buddleja davidii* 1.4
H2 Screes: *Aster squamatus* 1.6, *Euphorbia prostrata* 1.4
H3 Cliffs: *Cheiranthus cheiri* (0.4)
H5.6 Trampled areas: *Aster squamatus* 15.8, *Sporobolus indicus* 7.1, *Crepis bursifolia* 4.0, *Conyza bonariensis* 3.4, *Xanthium strumarium* subsp. *italicum* 3.1, *Paspalum dilatatum* 3.1, *Eleusine tristachya* 3.1, *Conyza sumatrensis* (Retz.) E. Walker 2.8, *Euphorbia prostrata* 2.8, *Amaranthus retroflexus* 2.8, *Crepis sancta* 2.8, *Euphorbia serpens* HBK. 2.3, *Bromus willdenowii* 1.7,

Amaranthus deflexus 1.7, *Cyperus eragrostis* 1.4, *Chenopodium ambrosioides* 1.1, *Pennisetum villosum* 1.1, *Echinochloa colonum* 1.1, *Juncus tenuis* 1.1

I1 Arable land: *Amaranthus retroflexus* 24.1, *Sorghum halepense* 15.6, *Amaranthus blitoides* 10.0, *Amaranthus hybridus* 8.5, *Conyza bonariensis* 7.3, *Bromus willdenowii* 7.1, *Echinochloa colonum* 6.1, *Amaranthus albus* 5.7, *Conyza sumatrensis* (Retz.) E. Walker 4.5, *Euphorbia prostrata* 4.1, *Conyza canadensis* 3.7, *Aster squamatus* 3.2, *Solanum tuberosum* 2.8, *Crepis sancta* 2.2, *Euphorbia nutans* 2.0, *Artemisia verlotiorum* 1.8, *Panicum capillare* 1.6, *Xanthium spinosum* 1.6, *Abutilon theophrasti* 1.6, *Xanthium strumarium* subsp. *italicum* 1.4, *Paspalum dilatatum* 1.0

Czech Republic – neophytes

A2.5&D6&E6 Saline habitats: *Trifolium hybridum* 8.7, *Agrostis gigantea* 7.7, *Bidens frondosa* 1.6, *Chamomilla suaveolens* 1.1, *Epilobium adenocaulon* 1.1, *Conyza canadensis* 1.1, *Acorus calamus* 1.1, *Aster novi-belgii* s.lat. 1.1

C1 Standing waters: *Elodea canadensis* 13.0

C2 Running waters: *Impatiens parviflora* 5.5, *Elodea canadensis* 2.0, *Epilobium adenocaulon* 1.6

C3&D5 Sedge-reed beds: *Bidens frondosa* 7.2, *Epilobium adenocaulon* 6.3, *Trifolium hybridum* 4.2, *Acorus calamus* 3.6, *Elodea canadensis* 1.3

D1 Bogs: –

D2 Poor fens: *Epilobium adenocaulon* 1.3

D4 Base-rich fens: *Sisyrinchium angustifolium* 4.1, *Trifolium hybridum* 2.0

E1 Dry grasslands: *Conyza canadensis* 2.3, *Agrostis gigantea* 1.8

E2 Mesic grasslands: *Trifolium hybridum* 4.8, *Rumex thyrsiflorus* 2.2, *Medicago sativa* 1.8, *Solidago canadensis* 1.2

E3 Wet grasslands: *Trifolium hybridum* 5.8, *Epilobium adenocaulon* 4.1, *Impatiens glandulifera* 2.5, *Impatiens parviflora* 1.6

E4 Alpine grasslands: *Juncus tenuis* 1.1

E5.1 Ruderal vegetation: *Conyza canadensis* 17.1, *Amaranthus retroflexus* 8.9, *Impatiens parviflora* 6.4, *Sisymbrium loeselii* 6.4, *Chamomilla suaveolens* 5.8, *Solidago canadensis* 4.4, *Galinsoga parviflora* 4.2, *Sisymbrium altissimum* 4.2, *Epilobium adenocaulon* 3.2, *Helianthus tuberosus* 2.8, *Oenothera* sp. 2.7, *Trifolium hybridum* 2.5, *Galinsoga ciliata* 2.2, *Erigeron annuus* s.lat. 2.2, *Echinops sphaerocephalus* 2.0, *Solidago gigantea* 1.9, *Medicago sativa* 1.9, *Robinia pseudacacia* 1.9, *Agrostis gigantea* 1.7, *Veronica persica* 1.6, *Amaranthus powellii* 1.5, *Bidens frondosa* 1.3

E5.2 Woodland fringes: *Impatiens parviflora* 1.6

E5.5 Subalpine tall forbs: *Epilobium adenocaulon* (0.9), *Impatiens parviflora* (0.9)

F2 Subalpine scrub: –

F3 Temperate scrub: *Impatiens parviflora* 8.8, *Robinia pseudacacia* 4.9, *Cytisus scoparius* 4.9, *Lycium barbarum* 3.9, *Ailanthus altissima* 2.0

F4 Temperate heaths: *Robinia pseudacacia* (0.4), *Cytisus scoparius* (0.4), *Epilobium adenocaulon* (0.4), *Digitalis purpurea* (0.4), *Trifolium hybridum* (0.4), *Pinus strobus* (0.4)

F9 Wet scrub: *Impatiens parviflora* 11.8, *Impatiens glandulifera* 5.9, *Solidago canadensis* 2.9, *Bidens frondosa* 2.9, *Acorus calamus* 2.9, *Epilobium adenocaulon* 1.5, *Ribes rubrum* 1.5, *Echinocystis lobata* 1.5

G1&G4 Deciduous woodlands: *Impatiens parviflora* 15.1, *Robinia pseudacacia* 1.8, *Ribes rubrum* 1.0

G3 Coniferous woodlands: *Impatiens parviflora* 2.9

G5 Disturbed woodlands: *Impatiens parviflora* 19.1, *Epilobium adenocaulon* 10.2, *Conyza canadensis* 5.1, *Digitalis purpurea* 4.3, *Robinia pseudacacia* 2.0, *Quercus rubra* 1.4, *Impatiens glandulifera* 1.4, *Cytisus scoparius* 1.2, *Solidago canadensis* 1.2, *Juncus tenuis* 1.2, *Symphoricarpos albus* 1.0, *Erigeron annuus* s.lat. 1.0

H2 Screes: *Impatiens parviflora* 10.0, *Robinia pseudacacia* 10.0, *Conyza canadensis* 2.0, *Aesculus hippocastanum* 2.0, *Epilobium dodonaei* 2.0, *Caragana arborescens* 2.0

H3 Cliffs: *Impatiens parviflora* 7.2, *Pseudofumaria lutea* 6.8, *Antirrhinum majus* 5.1, *Conyza canadensis* 4.2, *Epilobium adenocaulon* 3.4, *Solidago canadensis* 1.3, *Erigeron annuus* s.lat. 1.3, *Oxalis europaea* 1.3, *Helianthus annuus* 1.3

H5.6 Trampled areas: *Chamomilla suaveolens* 27.9, *Conyza canadensis* 7.5, *Juncus tenuis* 5.9, *Epilobium adenocaulon* 3.1, *Trifolium hybridum* 2.6, *Amaranthus retroflexus* 2.1, *Agrostis gigantea* 1.5, *Galinsoga parviflora* 1.4, *Bidens frondosa* 1.3, *Galinsoga ciliata* 1.2, *Medicago sativa* 1.2, *Impatiens parviflora* 1.0, *Veronica persica* 1.0

I1 Arable land: *Veronica persica* 55.0, *Chamomilla suaveolens* 14.9, *Amaranthus retroflexus* 10.8, *Galinsoga ciliata* 10.6, *Galinsoga parviflora* 10.5, *Solanum tuberosum* 7.6, *Oxalis europaea* 6.1, *Conyza canadensis* 3.7, *Amaranthus powellii* 2.8, *Medicago sativa* 2.4, *Lolium multiflorum* 2.2, *Agrostis gigantea* 1.7, *Amaranthus hybridus* 1.7, *Trifolium hybridum* 1.5

Czech Republic – archaeophytes

A2.5&D6&E6 Saline habitats: *Cirsium arvense* 15.8, *Polygonum aviculare* group 14.2, *Matricaria perforata* 13.1, *Chenopodium glaucum* 10.9, *Mentha arvensis* 6.0, *Sonchus asper* 6.0, *Medicago lupulina* 4.4, *Sonchus arvensis* 4.4, *Pastinaca sativa* 4.4, *Echinochloa crus-galli* 2.7, *Cichorium intybus* 2.7, *Arrhenatherum elatius* 2.2, *Atriplex tatarica* 2.2, *Lactuca serriola* 1.6, *Anagallis arvensis* 1.6, *Thlaspi arvense* 1.6, *Verbena officinalis* 1.6, *Chenopodium polyspermum* 1.1, *Sonchus oleraceus* 1.1, *Arctium tomentosum* 1.1, *Veronica arvensis* 1.1, *Melilotus officinalis* 1.1

C1 Standing waters: –

C2 Running waters: *Mentha arvensis* 1.6, *Lapsana communis* 1.2

C3&D5 Sedge-reed beds: *Matricaria perforata* 7.0, *Cirsium arvense* 6.3, *Echinochloa crus-galli* 4.9, *Mentha arvensis* 3.0, *Polygonum aviculare* group 1.9, *Chenopodium polyspermum* 1.8, *Chenopodium ficifolium* 1.2, *Tanacetum vulgare* 1.0

D1 Bogs: *Mentha arvensis* 1.3

D2 Poor fens: *Mentha arvensis* 11.0

D3 Base-rich fens: *Mentha arvensis* 21.0, *Arrhenatherum elatius* 4.1, *Medicago lupulina* 2.0, *Vicia sativa* 2.0, *Mentha verticillata* s.lat. 2.0

E1 Dry grasslands: *Arrhenatherum elatius* 27.2, *Echium vulgare* 18.7, *Convolvulus arvensis* 12.5, *Medicago lupulina* 6.4, *Vicia hirsuta* 5.7, *Melampyrum arvense* 3.9, *Veronica arvensis* 3.4, *Berteroa incana* 2.6, *Fallopia convolvulus* 2.3, *Artemisia absinthium* 2.1, *Reseda lutea* 1.9, *Linaria vulgaris* 1.8, *Silene latifolia* 1.8, *Vicia angustifolia* 1.8, *Cirsium arvense* 1.7, *Carduus acanthoides* 1.7, *Geranium columbinum* 1.7, *Melilotus officinalis* 1.6, *Bromus tectorum* 1.6, *Lathyrus tuberosus* 1.5, *Myosotis arvensis* 1.5, *Erodium cicutarium* 1.5, *Cynodon dactylon* 1.3, *Bromus hordeaceus* 1.3, *Descurainia sophia* 1.3, *Crepis biennis* 1.2, *Galeopsis ladanum* 1.2, *Cardaria draba* 1.2, *Capsella bursa-pastoris* 1.1, *Pastinaca sativa* 1.1, *Cichorium intybus* 1.1, *Polygonum aviculare* group 1.0

E2 Mesic grasslands: *Arrhenatherum elatius* 48.6, *Crepis biennis* 16.2, *Cirsium arvense* 10.8, *Pastinaca sativa* 8.2, *Convolvulus arvensis* 8.1, *Medicago lupulina* 7.7, *Veronica arvensis* 7.0, *Bromus hordeaceus* 4.9, *Myosotis arvensis* 4.7, *Vicia hirsuta* 4.1, *Tanacetum vulgare* 3.1, *Capsella bursa-pastoris* 2.4, *Mentha arvensis* 1.9, *Linaria vulgaris* 1.9, *Cichorium intybus* 1.8, *Lamium album* 1.8, *Silene latifolia* 1.6, *Cirsium vulgare* 1.6, *Vicia sativa* 1.6, *Matricaria perforata* 1.5, *Polygonum aviculare* group 1.3, *Lathyrus tuberosus* 1.2

E3 Wet grasslands: *Cirsium arvense* 9.6, *Arrhenatherum elatius* 8.9, *Mentha arvensis* 8.1, *Mentha verticillata* s.lat. 6.5, *Carduus crispus* 2.1, *Lamium album* 2.0, *Veronica arvensis* 1.7, *Convolvulus arvensis* 1.6, *Crepis biennis* 1.5, *Bromus hordeaceus* 1.5, *Tanacetum vulgare* 1.4, *Pastinaca sativa* 1.1, *Chelidonium majus* 1.1

E4 Alpine grasslands: –

E5.1 Ruderal vegetation: *Matricaria perforata* 30.2, *Cirsium arvense* 24.0, *Arrhenatherum elatius* 19.8, *Ballota nigra* 19.5, *Convolvulus arvensis* 18.6, *Polygonum aviculare* group 17.2, *Lactuca serriola* 16.5, *Atriplex patula* 14.8, *Lamium album* 14.4, *Tanacetum vulgare* 13.4, *Chelidonium majus* 12.5, *Capsella bursa-pastoris* 12.5, *Atriplex nitens* 12.4, *Sonchus oleraceus* 10.8, *Arctium tomentosum* 10.6, *Medicago lupulina* 10.5, *Silene latifolia* 10.4, *Carduus acanthoides* 10.3, *Melilotus alba* 9.3, *Echium vulgare* 8.0, *Fallopia convolvulus* 7.4, *Pastinaca sativa* 7.1, *Lapsana communis* 6.9, *Cirsium vulgare* 6.9, *Descurainia sophia* 6.7, *Melilotus officinalis* 6.5, *Bromus tectorum* 6.3, *Arctium lappa* 5.8, *Malva neglecta* 5.8, *Bromus sterilis* 5.8, *Echinochloa crus-galli* 5.8, *Sisymbrium officinale* 5.8, *Arctium minus* 5.2, *Linaria vulgaris* 5.1, *Chenopodium glaucum*

4.7, *Cichorium intybus* 4.6, *Geranium pusillum* 4.6, *Thlaspi arvense* 4.5, *Crepis biennis* 4.4, *Chenopodium bonus-henricus* 4.1, *Chenopodium polyspermum* 3.9, *Atriplex oblongifolia* 3.7, *Reseda lutea* 3.6, *Chenopodium ficifolium* 3.6, *Sonchus asper* 3.2, *Apera spica-venti* 3.0, *Carduus crispus* 2.9, *Lepidium ruderale* 2.7, *Senecio vulgaris* 2.6, *Setaria viridis* 2.5, *Papaver rhoeas* 2.4, *Artemisia absinthium* 2.4, *Sinapis arvensis* 2.3, *Solanum nigrum* 2.3, *Crepis foetida* ssp. *rhoeadifolia* 2.3, *Urtica urens* 2.2, *Berteroa incana* 2.2, *Cardaria draba* 2.2, *Atriplex tatarica* 2.2, *Hordeum murinum* 2.2, *Lamium purpureum* 2.1, *Chaenorrhinum minus* 2.1, *Armoracia rusticana* 2.0, *Leonurus cardiaca* 2.0, *Viola odorata* 2.0, *Onopordum acanthium* 2.0, *Saponaria officinalis* 1.9, *Aethusa cynapium* 1.9, *Digitaria sanguinalis* 1.9, *Bromus hordeaceus* 1.8, *Sonchus arvensis* 1.7, *Mercurialis annua* 1.7, *Anagallis arvensis* 1.6, *Conium maculatum* 1.5, *Erodium cicutarium* 1.5, *Anthemis cotula* 1.5, *Myosotis arvensis* 1.4, *Erysimum cheiranthoides* 1.4, *Setaria pumila* 1.4, *Chenopodium botrys* 1.4, *Lathyrus tuberosus* 1.3, *Euphorbia helioscopia* 1.3, *Euphorbia peplus* 1.3, *Veronica arvensis* 1.2, *Raphanus raphanistrum* 1.2, *Fumaria officinalis* 1.2, *Bromus japonicus* 1.2, *Avena fatua* 1.1, *Eragrostis minor* 1.1

E5.2 Woodland fringes: *Arrhenatherum elatius* 41.5, *Echium vulgare* 8.1, *Convolvulus arvensis* 6.8, *Vicia hirsuta* 5.1, *Melampyrum arvense* 4.3, *Cirsium arvense* 3.5, *Fallopia convolvulus* 3.3, *Artemisia absinthium* 3.3, *Galeopsis ladanum* 3.3, *Medicago lupulina* 3.0, *Linaria vulgaris* 3.0, *Lapsana communis* 3.0, *Prunus domestica* 1.9, *Tanacetum vulgare* 1.6, *Melilotus officinalis* 1.6, *Crepis biennis* 1.6, *Carduus acanthoides* 1.1, *Pastinaca sativa* 1.1, *Geranium columbinum* 1.1

E5.5 Subalpine tall forbs: *Cirsium arvense* 1.8

F2 Subalpine scrub: –

F3 Temperate scrub: *Arrhenatherum elatius* 25.5, *Fallopia convolvulus* 8.8, *Silene latifolia* 8.8, *Chelidonium majus* 8.8, *Echium vulgare* 7.8, *Cirsium arvense* 6.9, *Ballota nigra* 6.9, *Convolvulus arvensis* 5.9, *Vicia hirsuta* 4.9, *Carduus acanthoides* 4.9, *Bromus sterilis* 4.9, *Bryonia alba* 4.9, *Medicago lupulina* 3.9, *Viola odorata* 3.9, *Berteroa incana* 3.9, *Lapsana communis* 2.9, *Lamium album* 2.9, *Prunus cerasus x fruticosa* 2.9, *Reseda lutea* 2.9, *Galium spurium* 2.9, *Pyrus communis* 2.9, *Lactuca serriola* 2.9, *Carduus crispus* 2.9, *Cirsium vulgare* 2.0, *Melampyrum arvense* 2.0, *Artemisia absinthium* 2.0, *Pastinaca sativa* 2.0, *Fumaria vaillantii* 2.0, *Bromus tectorum* 2.0, *Lathyrus tuberosus* 2.0, *Lepidium campestre* 2.0, *Atriplex nitens* 2.0, *Sonchus oleraceus* 2.0, *Descurainia sophia* 2.0, *Asperugo procumbens* 2.0, *Prunus cerasus* 2.0, *Geranium molle* 2.0

F4 Temperate heaths: *Arrhenatherum elatius* 6.1, *Echium vulgare* 2.6

F9 Wet scrub: *Cirsium arvense* 5.9, *Lamium album* 4.4, *Arrhenatherum elatius* 1.5, *Silene latifolia* 1.5, *Convolvulus arvensis* 1.5, *Carduus crispus* 1.5, *Crepis biennis* 1.5, *Solanum nigrum* 1.5, *Armoracia rusticana* 1.5, *Bromus hordeaceus* 1.5, *Nepeta cataria* 1.5

G1&G4 Deciduous woodlands: *Chelidonium majus* 3.6, *Lapsana communis* 3.1, *Arrhenatherum elatius* 2.1, *Fallopia convolvulus* 1.1, *Prunus cerasus* 1.0

G3 Coniferous woodlands: *Arrhenatherum elatius* 2.9, *Chelidonium majus* 1.5, *Linaria vulgaris* 1.4, *Medicago lupulina* 1.0

G5 Disturbed woodlands: *Cirsium arvense* 15.1, *Arrhenatherum elatius* 5.7, *Cirsium vulgare* 5.3, *Chelidonium majus* 4.5, *Fallopia convolvulus* 3.9, *Ballota nigra* 3.7, *Lapsana communis* 3.5, *Linaria vulgaris* 3.1, *Lactuca serriola* 2.2, *Sonchus oleraceus* 1.8, *Convolvulus arvensis* 1.6, *Tanacetum vulgare* 1.6, *Vicia hirsuta* 1.4, *Senecio vulgaris* 1.4, *Silene latifolia* 1.2, *Lamium album* 1.2, *Bromus sterilis* 1.2, *Polygonum aviculare* group 1.2, *Matricaria perforata* 1.0, *Carduus crispus* 1.0

H2 Screes: *Echium vulgare* 26.0, *Arrhenatherum elatius* 24.0, *Fallopia convolvulus* 24.0, *Chaenorrhinum minus* 22.0, *Galeopsis ladanum* 14.0, *Lapsana communis* 12.0, *Reseda lutea* 8.0, *Artemisia absinthium* 8.0, *Chelidonium majus* 6.0, *Convolvulus arvensis* 6.0, *Tragopogon dubius* 4.0, *Diplotaxis muralis* 4.0, *Cirsium vulgare* 2.0, *Linaria vulgaris* 2.0, *Sonchus oleraceus* 2.0, *Tanacetum vulgare* 2.0, *Vicia hirsuta* 2.0, *Sonchus asper* 2.0, *Arctium lappa* 2.0, *Setaria viridis* 2.0, *Lepidium campestre* 2.0, *Fumaria vaillantii* 2.0, *Geranium columbinum* 2.0, *Crepis foetida* ssp. *rhoeadifolia* 2.0, *Erodium cicutarium* 2.0, *Lappula squarrosa* 2.0, *Euphorbia exigua* 2.0, *Parietaria officinalis* 2.0

H3 Cliffs: *Chelidonium majus* 15.7, *Cymbalaria muralis* 8.5, *Sonchus oleraceus* 4.2, *Lamium album* 3.4, *Ballota nigra* 2.5, *Arrhenatherum elatius* 2.1, *Tanacetum parthenium* 2.1, *Lamium purpureum* 1.7, *Mercurialis annua* 1.7, *Echium vulgare* 1.3, *Convolvulus arvensis* 1.3

H5.6 Trampled areas: *Polygonum aviculare* group 48.4, *Capsella bursa-pastoris* 18.1, *Matricaria perforata* 15.1, *Lepidium ruderale* 11.1, *Cirsium arvense* 9.3, *Sclerochloa dura* 8.4, *Medicago lupulina* 6.8, *Bromus hordeaceus* 4.8, *Sonchus oleraceus* 4.8, *Convolvulus arvensis* 4.2, *Pastinaca sativa* 4.2, *Coronopus squamatus* 4.0, *Echinochloa crus-galli* 3.3, *Mentha arvensis* 3.3, *Tanacetum vulgare* 3.1, *Lamium album* 2.8, *Arrhenatherum elatius* 2.8, *Cichorium intybus* 2.8,.3, *Sisymbrium officinale* 2.8, *Arctium tomentosum* 2.4, *Malva neglecta* 2.4, *Geranium pusillum* 2.4, *Veronica arvensis* 2.3, *Eragrostis minor* 2.3, *Chenopodium glaucum* 2.2, *Atriplex patula* 2.1, *Anthemis cotula* 2.1, *Lactuca serriola* 1.8, *Bromus tectorum* 1.8, *Ballota nigra* 1.7, *Descurainia sophia* 1.7, *Scleranthus annuus* 1.4, *Crepis biennis* 1.4, *Melilotus alba* 1.3, *Cirsium vulgare* 1.2, *Linaria vulgaris* 1.2, *Setaria viridis* 1.2, *Hordeum murinum* 1.0, *Chenopodium bonus-henricus* 1.0, *Cardaria draba* 1.0, *Digitaria ischaemum* 1.0

I1 Arable land: *Capsella bursa-pastoris* 65.6, *Matricaria perforata* 64.8, *Fallopia convolvulus* 62.2, *Cirsium arvense* 61.6, *Myosotis arvensis* 52.5, *Polygonum aviculare* group 51.1, *Thlaspi arvense* 50.9, *Lamium purpureum* 44.6, *Convolvulus arvensis* 41.1, *Lapsana communis* 39.2, *Anagallis arvensis* 38.3, *Euphorbia helioscopia* 31.0, *Veronica arvensis* 30.5, *Papaver rhoeas* 28.5, *Lamium amplexicaule* 26.1, *Vicia angustifolia* 22.3, *Sinapis arvensis* 22.1, *Raphanus raphanistrum* 21.9, *Sonchus arvensis* 21.7, *Geranium pusillum* 21.6, *Avena fatua* 21.0, *Apera spica-venti* 20.8, *Vicia hirsuta* 20.7, *Scleranthus annuus* 20.5, *Atriplex patula* 20.5, *Silene noctiflora* 20.5, *Sonchus asper* 20.1, *Veronica polita* 19.2, *Anthemis arvensis* 19.0, *Centaurea cyanus* 19.0, *Consolida regalis* 18.5, *Sonchus oleraceus* 17.3, *Mentha arvensis* 17.3, *Aethusa cynapium* 16.9, *Geranium dissectum* 15.9, *Spergula arvensis* 15.6, *Erodium cicutarium* 14.6, *Echinochloa crus-galli* 13.9, *Descurainia sophia* 13.4, *Neslia paniculata* 13.2, *Chenopodium polyspermum* 12.3, *Fumaria officinalis* 12.3, *Medicago lupulina* 12.1, *Lathyrus tuberosus* 11.4, *Euphorbia exigua* 11.0, *Sherardia arvensis* 10.3, *Galium spurium* 9.9, *Erysimum cheiranthoides* 9.6, *Buglossoides arvensis* 8.5, *Lactuca serriola* 8.5, *Valerianella dentata* 7.4, *Anchusa arvensis* 6.8, *Senecio vulgaris* 6.5, *Silene latifolia* 6.5, *Adonis aestivalis* 6.1, *Setaria viridis* 5.8, *Ranunculus arvensis* 5.8, *Veronica triphyllos* 5.5, *Linaria vulgaris* 5.3, *Papaver argemone* 5.1, *Setaria pumila* 4.8, *Vicia sativa* 4.7, *Stachys annua* 4.6, *Anthemis austriaca* 4.3, *Chaenorrhinum minus* 3.9, *Kickxia spuria* 3.5, *Malva neglecta* 3.4, *Solanum nigrum* 3.4, *Fumaria vaillantii* 3.4, *Arctium tomentosum* 3.1, *Anagallis foemina* 3.1, *Carduus acanthoides* 2.9, *Papaver dubium* 2.8, *Pastinaca sativa* 2.8, *Crepis biennis* 2.7, *Cardaria draba* 2.7, *Veronica triloba* 2.6, *Caucalis platycarpos* 2.4, *Euphorbia falcata* 2.3, *Vicia villosa* 2.3, *Tanacetum vulgare* 2.2, *Mercurialis annua* 2.2, *Veronica agrestis* 2.1, *Bromus sterilis* 1.9, *Euphorbia peplus* 1.9, *Chenopodium ficifolium* 1.9, *Fumaria rostellata* 1.9, *Arrhenatherum elatius* 1.8, *Prunus domestica* 1.8, *Echium vulgare* 1.7, *Conringia orientalis* 1.7, *Cirsium vulgare* 1.5, *Cichorium intybus* 1.5, *Reseda lutea* 1.5, *Veronica opaca* 1.5, *Kickxia elatine* 1.5, *Galeopsis ladanum* 1.4, *Atriplex nitens* 1.2, *Anethum graveolens* 1.0, *Camelina microcarpa* 1.0

Great Britain – neophytes

A2.5&D6&E6 Saline habitats: *Acer pseudoplatanus* 1.0, *Brassica napus* subsp. *napus* 1.0, *Geranium pyrenaicum* 1.0, *Juncus tenuis* 1.0, *Chamomilla suaveolens* 1.0

B1&B2 Coastal dunes: *Brassica napus* subsp. *napus* 8.0, *Veronica persica* 1.6, *Vicia faba* 1.6, *Acer pseudoplatanus* 1.2

B3 Coastal rocks: *Brassica napus* subsp. *napus* 0.8, *Acer pseudoplatanus* 0.8, *Cardaria draba* 0.8, *Picea sitchensis* 0.8, *Claytonia perfoliata* 0.8, *Epilobium adenocaulon* 0.8

C3&D5 Sedge-reed beds: *Impatiens glandulifera* 4.7, *Cardaria draba* 3.1, *Brassica napus* subsp. *napus* 1.6, *Epilobium adenocaulon* 1.6, *Chamomilla suaveolens* 1.6, *Aesculus hippocastanum* 1.6, *Cirsium oleraceum* 1.6, *Claytonia sibirica* 1.6, *Hesperis matronalis* 1.6, *Impatiens capensis* 1.6, *Ligustrum ovalifolium* 1.6

D1 Bogs: *Picea sitchensis* 1.4

D2 Poor fens: *Pinus contorta* 2.8

D4 Base-rich fens: *Epilobium brunnescens* 3.6, *Picea sitchensis* 1.8, *Claytonia perfoliata* 1.8, *Impatiens glandulifera* 1.8

E1 Dry grasslands: *Picea sitchensis* 1.7

E2 Mesic grasslands: *Chamomilla suaveolens* 6.0, *Lolium multiflorum* 2.6, *Acer pseudoplatanus* 1.6, *Veronica persica* 1.6, *Brassica napus* subsp. *napus* 1.1
E3&E5.4 Wet grasslands: *Chamomilla suaveolens* 3.5, *Acer pseudoplatanus* 1.2, *Lolium multiflorum* 1.1, *Mimulus guttatus* 1.1
E5.1 Ruderal vegetation: *Chamomilla suaveolens* 14.7, *Veronica persica* 3.7, *Brassica napus* subsp. *napus* 3.6, *Lolium multiflorum* 3.1, *Acer pseudoplatanus* 2.0
E5.3 Bracken: *Acer pseudoplatanus* 5.1, *Picea sitchensis* 1.8
E5.5 Subalpine tall forbs: *Picea sitchensis* 14
F3 Temperate scrub: *Acer pseudoplatanus* 8.9, *Chamomilla suaveolens* 1.6, *Impatiens glandulifera* 1.1, *Epilobium adenocaulon* 1.1
F4 Temperate heaths: *Picea sitchensis* 1.4
FA Hedgerows: *Acer pseudoplatanus* 9.7
G1&G4 Deciduous woodland: *Acer pseudoplatanus* 17.8, *Picea sitchensis* 3.4, *Impatiens glandulifera* 1.4, *Castanea sativa* 1.2, *Epilobium adenocaulon* 1.1, *Rhododendron ponticum* 1.1, *Picea abies* 1.0
G3 Coniferous woodland: *Picea sitchensis* 68.8, *Pinus contorta* 9.7, *Acer pseudoplatanus* 6.3, *Picea abies* 6.3, *Pinus nigra* 4.5, *Pseudotsuga menziesii* 2.8, *Tsuga heterophylla* 2.3, *Rhododendron ponticum* 1.1, *Chamaecyparis lawsoniana* 1.1
I1 Arable land: *Chamomilla suaveolens* 27.4, *Veronica persica* 25.5, *Brassica napus* subsp. *napus* 10.5, *Lolium multiflorum* 6.0, *Brassica rapa* 2.1, *Vicia faba* 1.1

Great Britain – archaeophytes

A2.5&D6&E6 Saline habitats: *Artemisia vulgaris* 3.0, *Chenopodium bonus-henricus* 3.0, *Lamium album* 2.0, *Picris echioides* 2.0
B1&B2 Coastal dunes: *Bromus sterilis* 5.6, *Avena fatua* 2.8, *Artemisia vulgaris* 2.0, *Picris echioides* 1.6, *Alopecurus myosuroides* 1.6, *Fallopia convolvulus* 1.6, *Conium maculatum* 1.2, *Myosotis arvensis* 1.2, *Silene latifolia* 1.2, *Urtica urens* 1.2
B3 Coastal rocks: *Geranium dissectum* 1.5
C3&D5 Sedge-reed beds: *Lamium album* 6.3, *Ballota nigra* 3.1, *Bromus sterilis* 1.6, *Conium maculatum* 1.6, *Picris echioides* 1.6, *Silene latifolia* 1.6, *Agrostis gigantea* 1.6
D1 Bogs: *Agrostis gigantea* 0.1, *Fallopia convolvulus* 0.1, *Picris echioides* 0.1
D2 Poor fens, D4 Base-rich fens: –
E1 Dry grasslands: *Agrostis gigantea* 0.2, *Picris echioides* 0.2, *Lamium purpureum* 0.2
E2 Mesic grasslands: *Bromus sterilis* 10.5, *Lamium album* 4.7, *Geranium dissectum* 4.2, *Myosotis arvensis* 1.9, *Avena fatua* 1.8, *Artemisia vulgaris* 1.6, *Aegopodium podagraria* 1.5, *Conium maculatum* 1.3, *Capsella bursa-pastoris* 1.2
E3&E5.4 Wet grasslands: *Geranium dissectum* 1.9, *Lamium album* 1.2, *Aegopodium podagraria* 1.2
E5.1 Ruderal vegetation: *Bromus sterilis* 20.5, *Lamium album* 7.9, *Geranium dissectum* 4.7, *Capsella bursa-pastoris* 4.6, *Sisymbrium officinale* 4.3, *Artemisia vulgaris* 3.7, *Avena fatua* 3.5, *Lamium purpureum* 3.0, *Malva sylvestris* 2.8, *Hordeum murinum* 2.4, *Myosotis arvensis* 2.3, *Conium maculatum* 2.3, *Papaver rhoeas* 2.3, *Viola arvensis* 2.1, *Picris echioides* 1.8, *Aegopodium podagraria* 1.7, *Alopecurus myosuroides* 1.7, *Silene latifolia* 1.6, *Ballota nigra* 1.5, *Sinapis arvensis* 1.5, *Agrostis gigantea* 1.2, *Matricaria recutita* 1.1
E5.3 Bracken: *Bromus sterilis* (0.9), *Aegopodium podagraria* (0.9)
E5.5 Subalpine tall forbs: –
F3 Temperate scrub: *Bromus sterilis* 12.1, *Lamium album* 6.8, *Avena fatua* 2.0, *Myosotis arvensis* 1.6, *Aegopodium podagraria* 1.5, *Geranium dissectum* 1.3, *Lamium purpureum* 1.1
F4 Temperate heaths: *Aegopodium podagraria* 0.1, *Geranium dissectum* 0.1, *Fumaria officinalis* 0.1
FA Hedgerows: *Bromus sterilis* 4.9, *Lamium album* 2.0, *Prunus domestica* 1.1
G1&G4 Deciduous woodland: *Bromus sterilis* 1.9, *Aegopodium podagraria* 1.2, *Myosotis arvensis* 1.0
G3 Coniferous woodland: *Bromus sterilis* 0.6, *Aegopodium podagraria* 0.6, *Galium tricornutum* 0.6, *Onopordum acanthium* 0.6
I1 Arable land: *Capsella bursa-pastoris* 21.9, *Lamium purpureum* 15.9, *Fallopia convolvulus* 14.9, *Viola arvensis* 14.7, *Bromus sterilis* 13.4, *Avena fatua* 13.1, *Sisymbrium officinale* 7.9, *Myosotis*

arvensis 7.6, *Papaver rhoeas* 7.6, *Geranium dissectum* 7.0, *Alopecurus myosuroides* 7.0, *Sinapis arvensis* 6.9, *Artemisia vulgaris* 6.2, *Lamium album* 5.0, *Urtica urens* 4.8, *Fumaria officinalis* 4.8, *Euphorbia helioscopia* 4.3, *Malva sylvestris* 3.2, *Silene latifolia* 3.0, *Coronopus squamatus* 2.7, *Picris echioides* 2.3, *Matricaria recutita* 2.2, *Anchusa arvensis* 1.7, *Agrostis gigantea* 1.6, *Hordeum murinum* 1.6, *Thlaspi arvense* 1.3, *Conium maculatum* 1.2, *Lamium amplexicaule* 1.0