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Neophyte invasions in European grasslands

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Author Contributions:

MC and IA conceived the research idea. Co-authors from the EVA database contributed the data. IA prepared the data, performed statistical analyses, together with VK and JD compiled the final neophyte lists, with MV prepared the maps and led the writing. All co-authors helped with species status assignment and commented on the manuscript.

Author's Data Availability Statement:

The vegetation-plot data used in this study are stored in the European Vegetation Archive database (EVA; <http://euroveg.org/eva-database>) under the project number 56 â€” 2017-10-11. Maps can be downloaded from the Zenodo repository (link to be added).

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Neophyte invasions in European grasslands

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Abstract**Questions**

The human-related spread of alien plants has serious environmental and socioeconomic impacts, and therefore it is important to know which habitats are most threatened and why. We studied a wide range of European grasslands to assess: (i) how invasion levels differ across European countries; (ii) which habitat types are the most invaded; and (iii) which alien species are the most successful invaders.

Location

Europe

Methods

To address our questions, we selected 97,417 grassland vegetation plots from the European Vegetation Archive (EVA). We assigned a native or alien status to each of the 8,212 vascular plant species, considering only neophytes (alien species introduced after 1500 AD), which we further divided according to their origin. We compared the levels of invasions using relative frequency of neophytes in the species lists, relative neophyte richness and cover per plots, and percentages of invaded plots among regions and habitats.

Results

Only 536 species, representing 6.5% of all grassland vascular plant species, were classified as neophytes. Most neophytes in grasslands were present in very few plots, while only three species were recorded in more than 1% of all plots, namely *Onobrychis viciifolia*, *Erigeron annuus* and *E. canadensis*. We found a comparable total number of neophytes from Europe (n =251) and from outside Europe (n =249), with therophytes and hemicryptophytes being the most predominant life forms. We found no pronounced geographical patterns in the distribution of neophytes across European grasslands but differences among habitat types. The most invaded habitat types were sandy grasslands, while the least invaded were alpine and oromediterranean grasslands.

Conclusions

In general, natural or semi-natural European grassland habitats have relatively low levels of neophyte invasions compared to human-made habitats or alluvial forests, or grasslands on other continents. The most typical neophytes invading European grasslands are therophytes with broad ecological niches.

Keywords

alien, plant invasion, neophyte, invasion level, invasion success, Europe, European Vegetation Archive (EVA), continental scale, grassland, semi-natural vegetation, EUNIS habitat

101 Introduction

2
302 The human-related spread of alien plants is an important issue worldwide (van Kleunen *et al.*, 2015; Pyšek *et al.*, 2017)
4
303 as many alien plant invasions have serious environmental and socioeconomic impacts (Vilà *et al.*, 2011; Pyšek *et al.*,
6
104 2020). However, there appears to be significant differences in the levels of alien invasion among regions (Chytrý *et al.*,
8
305 2008b; Kalusová *et al.*, 2015) and among habitats (Chytrý *et al.*, 2008a; Pyšek *et al.*, 2012a; Kalusová *et al.*, 2014). To
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106 apply proper risk-assessment schemes and effective management, we need to identify the most vulnerable habitats
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107 and the factors responsible for their high levels of alien plant invasion.
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108 Europe is an important source of numerous neophytes (i.e. alien plants introduced to a region after 1500 AD) for other
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15
109 continents, but also receives many neophytes from elsewhere (Kalusová *et al.*, 2015; van Kleunen *et al.*, 2015; 2019).
16
17
110 The first overviews of alien plants across European countries were based on the data from national and regional floras
18
111 and additional plant distribution data (Weber *et al.*, 1997; Lambdon *et al.*, 2008). These efforts recently continued with
20
112 the assessment of naturalized neophytes at the global scale (van Kleunen *et al.*, 2015; 2019). However, the data based
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22
113 on regional floras do not necessarily reflect the frequency of neophyte species in different habitats. Therefore,
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114 vegetation researchers focused on fine-scale data related to habitat types to get a different point of view of the invasion
25
115 levels (see Pyšek and Chytrý, 2014, for a review). The first comparisons among regions based on vegetation-plot data
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27
116 showed that the same broadly defined habitats had comparable levels of neophyte invasions (Chytrý *et al.*, 2008b).
28
117 Despite different absolute invasion levels, the most and least invaded habitats were the same when comparing
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30
118 European and North American regions (Kalusová *et al.*, 2015), suggesting that habitat typologies are a key factor to
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32
119 understand plant invasions. Generally, the most invaded habitats seem to be human-made habitats (e.g. arable fields,
33
120 wastelands), while natural vegetation such as high-altitude grasslands or mires are less invaded (Chytrý *et al.*, 2008b;
35
121 Lambdon *et al.*, 2008). The recently compiled European Vegetation Archive (EVA; Chytrý *et al.*, 2016) enabled even
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37
122 deeper insights into the neophyte invasion patterns at the level of fine-scale habitats, already reported for European
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123 woodlands (Wagner *et al.*, 2017) and coastal dunes (Giulio *et al.*, 2020). However, neophyte invasions across grassland
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124 habitats have not been studied so far at the European extent.
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125 After forests, grasslands represent the second most widespread broad vegetation type in Europe, occurring across large
44
126 gradients of soil moisture and pH, nutrient availability and climate. Grassland habitats also bear the imprint of the past,
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46
127 not only glacial-interglacial cycles and postglacial migration, but also traditional management practices (Pärtel *et al.*,
47
128 2005; Feurdean *et al.*, 2018). All these factors shape current grassland vegetation and result in high variability of
49
129 vegetation types (Chytrý *et al.*, 2021).
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130 Previous comparisons of broadly defined habitat types showed that different levels of alien plant invasion could be
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131 explained by several factors, especially resource availability, propagule pressure and climate (Chytrý *et al.*, 2008a).
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132 Another important aspect affecting alien plant invasions are disturbances (Hobbs and Huenneke, 1992; Lozon and
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133 Maclsaax, 1997) and with them related fluctuations in resource availability (Davis *et al.*, 2000). While the highly invaded
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134 human-made habitats and alluvial forests are generally occurring in the most fertile parts of the countries and are
135 subjected to repeated introductions of neophytes, grasslands are likely to be less exposed to alien plant propagule
136 pressure (Botham *et al.*, 2009). The type, frequency and intensity of disturbance in grasslands differ from those typical
137 of human-made habitats or forests. Consequently, also the geographic patterns of neophyte invasions in grasslands
138 and forests differ considerably (Divíšek and Chytrý, 2018). Therefore, in addition to the recent assessment of neophyte
139 invasions across European woodlands (Wagner *et al.*, 2017), a reliable assessment of neophyte invasions across
140 European grasslands is also needed. To meet this aim, we used an up-to-date version of the largest European
141 vegetation-plot database (EVA; Chytrý *et al.*, 2016) to provide a synthetic overview of neophyte invasions in European
142 grassland vegetation, asking the following questions: (i) How do invasion levels change across European countries? (ii)
143 Which grassland types are the most invaded? (iii) Which alien species are the most successful invaders of European
144 grasslands?

146 **Methods**

147 *Region definitions*

148 Regions used in our study mostly correspond to countries, but some large islands or archipelagoes with distinct
149 biogeographic position were treated as separate regions (Balears, Corsica, Crete, Sardinia, and Sicily with Malta). We
150 also followed the region delimitation concept of the Euro+Med PlantBase (2006–2020), and divided European Russia
151 into seven regions (Russia North, Russia Northwest, Russia Kaliningrad, Russia Central, Russia South, Russia Caucasus
152 and Russia East). For the list of all 49 studied regions and the detailed number of plots per region, see Appendix S3.

154 *Dataset preparation and filtering*

155 We used 465,629 grassland vegetation plots provided by the European Vegetation Archive (EVA; Chytrý *et al.*, 2016).
156 The plots were classified to European Nature Information System grassland habitat types at the third level of the
157 classification hierarchy (hereafter EUNIS habitats or habitats) using the EUNIS-ESy expert system (Chytrý *et al.*, 2021)
158 in the JUICE software (Tichý, 2002). Apart from grasslands in a narrow sense (EUNIS group R), we also included coastal
159 grasslands of grey dunes, which belong to EUNIS group N (coastal habitats). An overview of contributing databases and
160 numbers of plots assigned to particular EUNIS habitat types is available in Appendices S1 and S2 in the Supplementary
161 Materials. We also merged these habitats to broader habitat types (habitat groups, see Appendix S2 for details on
162 merging), enabling us to detect more general patterns in analyses and comparisons at a coarser scale. Data from the
163 National Vegetation Database of Denmark could not be classified by the EUNIS-ESy expert system, because they lack
164 records of cover-abundances of species. Therefore, we calculated the Bray-Curtis dissimilarity index to find the most
165 similar plots from other countries with known classification and assigned the Danish plots to the same habitat groups

(all plots with similarity lower than 15%, i.e., Bray-Curtis dissimilarity > 0.85 , were excluded; in total 1,885 vegetation plots were assigned to habitat groups).

For our analyses, we filtered vegetation plots using the following criteria. First, we removed: (i) plots that could not be assigned to any EUNIS grassland habitat type at the third level of classification (transitional between different grassland habitat types); (ii) plots with a cover of woody species (trees or shrubs taller than 0.5 m) higher than 10%; (iii) plots dominated by *Pteridium aquilinum* (classified as R54 in EUNIS habitat); and (iv) plots from forest clearings (R57). Second, we excluded plots without geographic coordinates or with a location uncertainty ≥ 7000 m. Third, we selected only plots with a surface area ranging between 10 and 100 m² to limit the area effect (85% of the plots in original selection were of this size). However, for Nordic countries we retained plots between 1 and 100 m², since the small-size plots traditionally prevail there. We also kept plots with unknown size (based on the plot size histogram, we assumed most of the unknown sizes were within the range of 10–100 m²). Fourth, we kept only the vegetation plots sampled between 1970 and 2018 to lower the effect of vegetation changes across time. Fifth, to limit potential pseudo-replication due to spatial autocorrelations, we used geographical position and compositional similarity to define group of plots that need resampling (we selected all plots with similarity of 80% or more, i.e. ≤ 0.2 of Bray-Curtis dissimilarity index) sampled within a distance of less than 1 km). From each pair of plots with highest similarity, we randomly selected just one and if needed repeated the resampling. Sixth, to further reduce over-representation of some regions in the dataset, we calculated the density of plots belonging to each habitat type for each region. Subsequently, the corresponding density threshold defining outlier values (upper quartile + 1.5 \times interquartile range) was calculated for each habitat type. This threshold was used as a limit for the maximum number of plots to be retained for a particular habitat in a given region. The plots to fit this limit were randomly selected. After filtering, the final dataset included 97,417 plots.

Species status assignment

We considered only vascular plants in our study, including trees and shrubs. The nomenclature was unified to follow Euro+Med (2006–2020) PlantBase concept, or The Plant List (TPL, 2013) if the taxon was not included in Euro+Med. We assigned the native, alien or uncertain status to all the plant taxa with respect to the region where they were recorded. We included archaeophytes among native species, hence the alien plants in our study corresponded to neophytes only (i.e., alien species that arrived in the region after 1500 AD, see Pyšek and Jarošík, 2005). Archaeophytes were not treated separately as their lists are lacking or incomplete in many countries, and in many cases their status as archaeophyte or native in a given country or region is doubtful. If a species was considered native in at least one part of a region, we assigned its native status for that region. We assigned the native/alien status to species using the Euro+Med PlantBase (2006–2020), DAISIE (2009), the GLONAF database (van Kleunen *et al.*, 2019), national and regional species checklists and knowledge of local experts. All sources are listed in Appendix S4. Taxa for which we could not decide their status were excluded (mostly genus-level records). For a status assignment at the plot level, we

199 used intraspecific data, as sometimes one subspecies can be native while another subspecies is considered as neophyte.
200 For comparison between species lists of regions and habitats, we summarised the results at the species level
201 (considering the subspecies status assignment) to make our results comparable with recent studies of other European
202 habitats (e.g., Wagner *et al.*, 2017; Giulio *et al.*, 2020).

203 We further classified neophytes into groups according to their origin: A, neophyte species originating from outside of
204 Europe (Africa, America, Asia, Australia); E, species native to some parts of Europe but considered to be neophytes
205 elsewhere in Europe, C, other origins, i.e., neophytes or species with hybrid origin (see also Wagner *et al.*, 2017 for
206 details). We also classified all neophytes with respect to their prevailing life form: phanerophytes, chamaephytes,
207 hemicryptophytes, geophytes, therophytes, hydrophytes and woody lianas. For the list of sources used for this
208 assignment, see Appendix S5.

210 *Data analyses*

211 We assessed the levels of invasions using different metrics (see also Catford *et al.*, 2012; Wagner *et al.*, 2017; Giulio *et*
212 *al.*, 2020): (1) percentage of neophytes in the grassland species list, (2) frequency of neophytes across all occurrences
213 (sum of individual plot records) of all species in a given subset, (3) relative frequency of invaded plots (i.e., plots with
214 at least one neophyte present), (4) mean and median of relative species richness of neophytes per plot in a given subset
215 (relative species richness of neophytes refers to the number of neophytes/all species in the plot *100), (5) relative
216 neophyte cover per plot in a given subset (relative to total cover in the plot).

217 To compare the species lists of habitat groups with different numbers of plots, we selected only neophytes represented
218 in at least 0.5% and in at least 1% of the plots of that habitat group. Note that we selected such low levels of threshold
219 because most of the plots were free of neophytes. The differences in relative neophyte richness and relative neophyte
220 cover among habitat groups were tested using the Kruskal-Wallis multiple comparison test in the package *pgirmess*
221 (Giraudoux, 2013) in the R software (R Core Team, 2012). Total plant cover and neophyte cover were calculated as a
222 sum of individual plant covers considering their possible overlap (Fischer, 2015).

223 To track geographical patterns in the level of invasions, we assigned vegetation plots into the UTM grid cells spanning
224 50 km × 50 km. For each grid, we calculated the relative frequency of invaded plots, i.e., what percentage of plots
225 within a given grid cell have at least one neophyte present. We prepared separate maps with respect to habitat groups
226 and different origin categories of neophytes using the R packages 'raster' (Hijmans *et al.*, 2020), 'rgdal' (Bivand *et al.*,
227 2020), 'spatialEco' (Evans *et al.*, 2020) and 'berryFunctions' (Boessenkool, 2020). We mapped only grid cells containing
228 more than ten plots, in order to avoid interpreting random patterns. The data were processed using the R software
229 v.3.6.0 (R Core Team, 2019).

Results

Our final grassland dataset included in total 8,212 species, out of which only 536 were classified as neophytes (approximately 6.5% of all species) with almost the same number of neophytes originating from Europe (3.0%) and outside of Europe (3.1%). Most neophytes in grasslands were present in very few plots (median of 2 plots), while only three species, namely *Onobrychis viciifolia*, *Erigeron annuus* and *E. canadensis*, were recorded in more than 1% of all plots (Table 1). When comparing the relative frequency of species occurrences in plots, European neophytes correspond to 0.17% (4,259 of all 2,565,674 occurrences), while those from outside of Europe to 0.33% (8,473), which is different from percentages based on the grassland species list (see above, or Figure 1). The prevailing life forms of neophytes in our study were hemicryptophytes (32%) and therophytes (31%), followed by phanerophytes (21%) (Figure 2).

Most of the vegetation-plot records included only native species and archaeophytes, while invaded plots, i.e., plots with at least one neophyte, represented only 11.9% of all plots (7.1% of plots if only non-European neophytes were considered, Appendix S6). The proportion of invaded plots varied greatly among individual regions and habitat types. The means of relative neophyte species richness per plot also differed, although the medians were close or equal to zero, suggesting the prevalence of neophyte-free plots. Summary statistics can be found in Appendix S6 and S7 for regions and in Appendix S8 and S9 for habitat groups and EUNIS habitats. A list of neophytes recorded per regions is available in Appendix S10.

We did not reveal any distinct geographical pattern in the distribution of neophytes across Europe (see Figure 3 for overall pattern and other maps in Appendix S12 for separate habitat groups or neophytes according to their origin). Higher invasion levels can be seen in northern European countries, where this is mostly due to the higher number of European neophytes (see also Appendix S6). In addition, there is a slightly higher tendency for invaded plots to occur in coastal areas. When comparing only the relative frequency of non-European neophytes, the regions with the highest representation of neophytes relative to all species were Poland (3.9%), Netherlands (3.8%), Lithuania (3.5%), Denmark (3.0%) and Germany (3.0%), for more see Appendix S6.

Analyses at the third hierarchical level of EUNIS habitat classification show that sandy habitats (both inland and coastal) have the highest frequency of invaded plots across different types and geographical regions (on average around 20%, with a maximum of 31%). Comparable percentages of invaded plots were also found in lowland wet tall-herb grasslands, in both temperate and Mediterranean types. In contrast, high-altitude grasslands, especially alpine and oromediterranean, had the lowest percentages of invaded plots (Figure 4).

Comparison among the habitat groups revealed that most neophyte species (90% when considering only species recorded in at least five plots) occur in more than one habitat group, indicating their low degree of specialization (see Table 2 for the most frequent neophytes per habitat group). The highest numbers of neophyte species were recorded

in mesic, wet and dry grasslands, followed by sandy grasslands (Table 3). However, removing rare species with few occurrences (recorded in less than 0.5 or 1% of the plots from the respective habitat) from these counts lowers the number of neophyte species considerably (Figure 5a,c). After the exclusion of rare neophytes, sandy, wet and mesic habitats harboured the highest cumulative numbers of neophyte species, while the oromediterranean and alpine grasslands the lowest. A similar pattern can also be seen in the relative frequency of invaded plots per habitat group (Figure 5b,d). Note that in dry grasslands, the relative frequency of invaded plots reaches almost the same percentages as in mesic and wet grasslands, but the number of neophytes in dry grassland species list is much lower, suggesting their higher frequency in the plots. While rocky, dry and mesic habitat groups have a higher number of European neophytes than those of non-European origin, sandy, wet and saline habitats showed a reverse pattern. We revealed the highest prevalence of non-European neophytes in wet grasslands (Table 3). For mean relative neophyte richness and other summary statistics calculated across plots, see Table 4. Kruskal-Wallis multiple comparisons of both the mean relative neophyte richness and the mean relative neophyte cover per habitat groups confirmed the above described pattern (Table 4, Appendix S11).

Discussion

Geographical patterns

We found a relatively low proportion of neophyte species in European grasslands (only 6.5% of all species in the dataset). Such low levels of invasion are similar to values reported from European forests (Wagner *et al.*, 2017) and coastal vegetation (Giulio *et al.*, 2020), but they are in contrast to those reported from North-American habitats (Lonsdale 1999; Kalusová *et al.* 2015). The several times higher numbers of neophytes in North America, even when comparing similar grasslands (15% reported from prairies by Stohlgren *et al.*, 1999), support the view that Europe is donating more alien species than it is receiving in exchange (Seastedt & Pyšek, 2011; Stohlgren *et al.*, 2011; Hejda *et al.*, 2015), which holds also specifically for grasses (Monnet *et al.*, 2020).

We did not find any distinct geographical pattern, although there were higher percentages of invaded plots in northern Europe (mostly due to a higher abundance of neophytes of European origin there) and in coastal habitats. The neophytes of European origin were mostly from the Mediterranean, i.e. native to southern Europe from where they spread to suitable habitats in other regions. Depending on when they reached individual countries, the same species can be classified as either an archaeophyte or neophyte (Pyšek *et al.*, 2005). Moreover, plant ranges do not reflect only recent climate but also the landscape history, especially Pleistocene glaciations, as the possibilities of postglacial migration towards the north were limited (Normand *et al.*, 2011). A large number of otherwise frequent European species have probably been able to colonize northern countries only as a consequence of human-induced changes of habitats (Lambdon *et al.*, 2008). The shares of non-European and European neophytes were almost equal in terms of numbers of species occurring in grassland, but the latter group prevailed when considering the relative frequency of occurrences across the plots (accounting for 58.6% of all neophyte occurrences, most of them from North America). This is in agreement with greater representation of species from other continents reported by previous large-scale European studies (Wagner *et al.*, 2017; Giulio *et al.*, 2020). Such pattern results mostly from the fact that there are fewer regions in Europe where species of European origin can be recorded as neophytes, although alternative explanations can also be raised (see Wagner *et al.*, 2017).

We found the highest levels of invasion (relative number of neophytes in the species list) in Poland, the Netherlands, Lithuania, Denmark and Germany, where both European and non-European neophytes were present in relatively high numbers. We expect that in these countries, there was both the effect of glaciation and at the same time the presence of coastal habitats which are generally more invaded (Chytrý *et al.*, 2008b; Dawson *et al.* 2017; Giulio *et al.*, 2020). Another important factor supporting higher invasion levels can also be the recent changes in traditional management (e.g. Timmermann *et al.*, 2015). We note that natural factors such as grazing by wild herbivores also maintained a presence of grasslands in temperate Europe before agriculture and pastoralism or even before the arrival of *Homo sapiens* to the continent (Svenning, 2002; Feurdean *et al.*, 2018). However, nowadays many grasslands experience both

reduced wild grazing and reduced management, leading to secondary succession and vegetation changes that can support the success of neophytes (e.g. Swacha *et al.*, 2018).

Habitat comparison

We confirmed that grasslands generally have low levels of invasion, which is in contrast to highly invaded human-made habitats, alluvial forests and herb-dominated river fringes (Chytrý *et al.*, 2008b; Kalusová *et al.*, 2015). However, although the overall frequency of invaded plots was rather low (less than 12% of all plots), EUNIS habitat types varied from 0 to 31% invaded plots. The highest percentages of invaded plots were found in sandy habitats and in lowland tall-herb wet meadows, while grasslands at high altitudes were almost free of any neophytes. Such pattern is in accordance with conclusions of earlier studies that neophytes preferably invade habitats with sufficient resources, under milder climate and that they benefit from disturbances that suppress native species (Chytrý *et al.*, 2008a; Pyšek and Chytrý, 2014).

When comparing neophytes among habitat groups, we did not find any typical habitat specialists. Similarly, also Giulio *et al.* (2020) concluded that most (94%) of the neophytes found in their study of coastal dunes were generalists occurring also in other habitats. Chytrý *et al.* (2008b) revealed comparable habitat levels of invasions among regions, although the species lists of neophytes were different, suggesting that the habitat properties are more important than geographical position within Europe. Since sandy and wet grasslands differ in many habitat characteristics, we can also expect different strategies of neophytes invading them. Life-form comparison of neophytes revealed relatively high representation of two distinct groups in our grassland dataset species list, namely therophytes and hemicryptophytes (each group represented around 30%), which supports our expectation of different strategies. Wet grasslands mostly have high total cover, and gaps occur only rarely after disturbances; thus, competitive hemicryptophytes are more successful. In contrast, the unstable soil in sandy habitats does not allow the formation of closed stands, and many open gaps are available to support therophytes. The spread of these short-lived, ruderal species can be recently detected also in other vegetation types, such as dry grasslands. As present weather fluctuations and drought events are leading to decreased cover or even disappearance of some native species, new gaps emerge in the stands and therefore also opportunities for new species to successfully germinate (Fischer *et al.*, 2020).

Although canopy openness seems to be important, it does not ensure the success of the neophytes alone. We can expect that the rather open stands of alpine and oromediterranean habitats are so extreme and nutrient-poor that only species adapted to such conditions can grow there, which limits the number of suitable neophytes (Chytrý *et al.*, 2008b). Compared to lowlands, grasslands in higher altitudes historically experienced lower human impact and intensity of disturbances, thus suppressing or at least reducing success of neophytes (see also Medvecká *et al.*, 2014; Lembrechts *et al.*, 2016).

Successful neophytes

Neophytes themselves significantly differ in their ability to overcome abiotic and reproductive barriers and establish sustainable populations in new environments. Some species are able to invade only the same or similar habitat from which they originated and to which they are adapted. Therefore, the more habitats the species occupies in its native range, the higher are the chances that it will become a successful invader (Hejda et al., 2015; Kalusová et al., 2017), and the most successful species that reach the invasion stage extend their habitat niche in the invaded regions, compared to the region of origin (Hejda et al., 2009). The association with human-made habitats and disturbances in the native range also seems to support invasion success (Kalusová et al., 2017). This is in agreement with our findings that many neophytes in our grassland dataset were not habitat specialists but short-lived ruderal species, using opportunities of establishing in open gaps after disturbances. Divišek *et al.* (2018) suggested that while having similar traits as other species within the community enables naturalization in that particular habitat, a difference in at least some traits (such as plant height) allows the neophyte species to prevail in the community and become invasive. This points at another neophyte group - species growing in relatively productive sites, with intense competition for resources (e.g. *Solidago* spp., *Symphotrichum* spp.). Within our dataset, we found mostly neophytes with few occurrences only. Despite being rare in semi-natural grasslands, it is probable that many of these species are more abundant in more suitable, human-made habitats of the same regions. We also have to note that many neophytes are relatively new in Europe, and longer residence time is probably needed for them to become more widespread (Pyšek and Jarošík 2005).

The most frequent neophyte in our dataset was *Onobrychis viciifolia*, a perennial species native to southern and southeastern Europe and western Asia, from where it was intentionally introduced to the rest of Europe (but also to North America and Australia) as a forage crop (Mora-Ortiz and Smith, 2018). After the first introductions, it started to spread spontaneously to suitable habitats. The second most frequent species was *Erigeron canadensis*, an annual or overwintering species native to southern Canada and having a broad climatic tolerance. Although it is mostly found in human-made habitats (orchards, vineyards, roadsides, arable fields, ruderal sites), it has broad climatic tolerance and is adaptable to different environments. Thanks to very effective wind dispersal, it can quickly establish in open gaps after disturbance and start to grow rapidly (Weaver, 2001). It was reported as the most successful alien species also in European coastal dunes (Giulio *et al.*, 2020) and across Europe in general (Lambdon *et al.*, 2008). The third most frequent species was *Erigeron annuus*, an annual species with prevailing apomictic reproduction, native to North-American tall-grass prairies. This species also has effective wind dispersal and is widespread across Europe. Although it has been shown that its frequency declines towards higher altitudes, growth performance and seed production are comparable with lowland populations, and the reason for the decline is probably its greater winter mortality (Trtikova et al. 2011). In contrast to *Onobrychis*, the spread of which was directly supported by humans, both *Erigeron* species

377 seem to be so successful mostly due to high seed production and long-distance seed dispersal (Weaver, 2001) as high
378 propagule pressure is one of the key factors in neophyte invasions (Pyšek and Chytrý, 2014).

380 *Dataset limitations*

381 There are several possible limitations of our data. Firstly, EVA database (Chytrý *et al.*, 2016) comprises data originally
382 sampled for phytosociological surveys; therefore, we can expect that they largely originate from preferential sampling
383 (Michalcová *et al.*, 2011), as scientists studying natural and semi-natural vegetation often show tendency to avoid plots
384 with alien plants. Therefore, only when the neophyte is more abundant in the landscape, it is also recorded in the plots.
385 Secondly, when analyzing these data, we cannot easily track the changes in vegetation following the abandonment of
386 traditional management, although this seems to be an important factor. For example, if a grassland site is severely
387 disturbed and the management is no longer applied, the succession might lead towards ruderal sites dominated by
388 invasive neophytes (such as *Solidago gigantea*), which are no longer classified as grasslands and included in our dataset.
389 Finally, yet importantly, the data coverage across regions is unequal, and although we stratified the dataset to avoid
390 oversampling of some regions, there were regions less well represented in the data. We would also like to point at the
391 questionable status of some species, which can affect the overall patterns (but see Courchamp *et al.*, 2020). As most
392 problematic we see grasses, which were traditionally supported by humans and are hard to distinguish in archaeological
393 findings, such as *Lolium multiflorum*, *Festuca brevipila*, but most notably *Arrhenatherum elatius*. Although some
394 sources suggest neophyte status of *Arrhenatherum* (see for example Poschlod 2015), based on previous archaeological
395 findings we accepted it as an archaeophyte (see Pyšek *et al.*, 2012b). In the opposite case, it would be one of the most
396 successful neophyte across Europe.

398 **Conclusions**

399 We provided the first overview of neophyte invasion patterns in grassland vegetation across Europe based on the most
400 comprehensive dataset of vegetation plots existing to date. Although we found generally low invasion levels, there
401 were distinct differences between individual habitat types. While sandy habitats and lowland wet grasslands were the
402 most invaded, high-altitude grasslands were almost free of neophytes. A high proportion of neophytes invading
403 grasslands are therophytes with broad habitat niches.

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Data availability statement

The vegetation-plot data used in this study are stored in the European Vegetation Archive database (EVA; <http://euroveg.org/eva-database>) under the project number 56 – 2017-10-11. Maps can be downloaded from the Zenodo repository (link to be added).

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Supporting information

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579 categories.

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For Review Only

Table 1. A list of the most frequent neophyte species recorded in European grasslands assessed by **(a)** number of plots across all regions where the species is considered neophyte (from a total of 97,417 plots) and **(b)** number of regions where the species occurred as a neophyte (from a total of 49; for more details on regions, see Appendix S6, S7 and S10). E - species with origin within Europe (they are considered neophytes only in some European regions, and their occurrences in the regions with native status were not counted), A - non-European origin, C - other origin (anecophytes, hybrids).

(a)				(b)		
Taxon	Origin	No. of plots	%	Taxon	Origin	No. of regions (max. 49)
<i>Onobrychis viciifolia</i>	E	1442	1.5	<i>Erigeron canadensis</i>	A	27
<i>Erigeron annuus</i> *	A	1312	1.3	<i>Medicago sativa</i> *	C	22
<i>Erigeron canadensis</i>	A	1188	1.2	<i>Oenothera biennis</i> agg.	A	20
<i>Trifolium hybridum</i> *	C	794	0.8	<i>Erigeron annuus</i> *	A	19
<i>Medicago sativa</i> *	C	743	0.8	<i>Matricaria discoidea</i>	A	19
<i>Solidago gigantea</i>	A	609	0.6	<i>Xanthium orientale</i> *	A	19
<i>Epilobium ciliatum</i> *	A	408	0.4	<i>Juncus tenuis</i>	A	18
<i>Matricaria discoidea</i>	A	348	0.4	<i>Bidens frondosus</i>	A	17
<i>Juncus tenuis</i>	A	323	0.3	<i>Onobrychis viciifolia</i>	E	17
<i>Impatiens glandulifera</i>	A	304	0.3	<i>Veronica persica</i>	A	17
<i>Oenothera biennis</i> agg.	A	244	0.3	<i>Robinia pseudoacacia</i>	A	16
<i>Solidago canadensis</i>	A	241	0.2	<i>Epilobium ciliatum</i> *	A	15
<i>Senecio leucanthemifolius</i> *	E	212	0.2	<i>Impatiens glandulifera</i>	A	15
<i>Impatiens parviflora</i>	A	210	0.2	<i>Solidago canadensis</i>	A	15
<i>Lolium multiflorum</i>	E	208	0.2	<i>Impatiens parviflora</i>	A	14
<i>Bidens frondosus</i>	A	199	0.2	<i>Solidago gigantea</i>	A	14
<i>Berteroa incana</i>	E	186	0.2	<i>Amaranthus retroflexus</i>	A	13
<i>Veronica persica</i>	A	178	0.2	<i>Galinsoga quadriradiata</i>	A	12
<i>Achillea ptarmica</i>	E	171	0.2	<i>Lolium multiflorum</i>	E	12
<i>Xanthium orientale</i> *	A	167	0.2	<i>Oxalis stricta</i>	A	12

*Taxon names marked by asterisk include the following subspecies: *Epilobium ciliatum* (subsp. *ciliatum*, subsp. *adenocaulon*), *Erigeron annuus* (subsp. *annuus*, subsp. *septentrionalis*), *Medicago sativa* (subsp. *sativa*, nothosubsp. *varia*), *Senecio leucanthemifolius* subsp. *vernalis*, *Trifolium hybridum* (subsp. *hybridum*, subsp. *elegans*), *Xanthium orientale* (subsp. *orientale*, subsp. *californicum*, subsp. *italicum*, subsp. *riparium*). *Oenothera biennis* agg. refers to a group of taxa which are difficult to determine and usually not distinguished.

Table 2. A list of the most frequent neophyte species per habitat group assessed by **(a)** number of plots across all regions where the species is considered to be a neophyte and **(b)** number of regions where the species is considered to be a neophyte. The group of oromediterranean habitats (recorded in six regions) is excluded here due to the absence of neophytes. All the neophyte species in the group of alpine habitats were recorded in one region only; therefore, they cannot be sorted by the number of regions in **(b)**. Origin 'A' refers to non-European origin, 'E' to European origin and 'C' to another origin (anecophytes, hybrids). For details on included intraspecific taxa see Table 1.

Habitat group (plots)	(a)			(b)			
	Taxon	Origin	No. of plots	%	Taxon	Origin	No. of regions (max)
Sandy (4359)	<i>Erigeron canadensis</i>	A	492	11.3	<i>Erigeron canadensis</i>	A	20 (38)
	<i>Oenothera biennis</i> agg.	A	148	3.4	<i>Oenothera biennis</i> agg.	A	10 (38)
	<i>Senecio leucanthemifolius</i>	E	113	2.6	<i>Xanthium orientale</i>	A	8 (38)
	<i>Xanthium orientale</i>	A	79	1.8	<i>Robinia pseudoacacia</i>	A	7 (38)
	<i>Berteroa incana</i>	E	71	1.6	<i>Ambrosia artemisiifolia</i>	A	6 (38)
Rocky (4671)	<i>Berteroa incana</i>	E	42	0.9	<i>Erigeron canadensis</i>	A	10 (33)
	<i>Erigeron canadensis</i>	A	36	0.8	<i>Onobrychis viciifolia</i>	E	7 (33)
	<i>Onobrychis viciifolia</i>	E	36	0.8	<i>Erigeron annuus</i>	A	5 (33)
	<i>Dianthus caryophyllus</i>	E	34	0.7	<i>Medicago sativa</i>	C	5 (33)
	<i>Oxalis dillenii</i>	A	20	0.4	<i>Oenothera biennis</i> agg.	A	4 (33)
Dry (25430)	<i>Onobrychis viciifolia</i>	E	1073	4.2	<i>Erigeron canadensis</i>	A	17 (43)
	<i>Erigeron annuus</i>	A	307	1.2	<i>Medicago sativa</i>	C	17 (43)
	<i>Medicago sativa</i>	C	272	1.1	<i>Erigeron annuus</i>	A	16 (43)
	<i>Erigeron canadensis</i>	A	158	0.6	<i>Onobrychis viciifolia</i>	E	16 (43)
	<i>Crassula lycopodioides</i>	A	119	0.5	<i>Robinia pseudoacacia</i>	A	12 (43)
Mesic (32740)	<i>Erigeron annuus</i>	A	819	2.5	<i>Erigeron canadensis</i>	A	22 (45)
	<i>Trifolium hybridum</i>	C	533	1.6	<i>Erigeron annuus</i>	A	18 (45)
	<i>Medicago sativa</i>	C	435	1.3	<i>Matricaria discoidea</i>	A	18 (45)
	<i>Erigeron canadensis</i>	A	366	1.1	<i>Medicago sativa</i>	C	18 (45)
	<i>Onobrychis viciifolia</i>	E	320	1.0	<i>Juncus tenuis</i>	A	16 (45)
Wet (22763)	<i>Solidago gigantea</i>	A	417	1.8	<i>Bidens frondosus</i>	A	16 (47)
	<i>Epilobium ciliatum</i>	A	324	1.4	<i>Erigeron annuus</i>	A	16 (47)
	<i>Impatiens glandulifera</i>	A	283	1.2	<i>Erigeron canadensis</i>	A	16 (47)
	<i>Trifolium hybridum</i>	C	254	1.1	<i>Epilobium ciliatum</i>	A	15 (47)
	<i>Bidens frondosus</i>	A	188	0.8	<i>Impatiens glandulifera</i>	A	15 (47)
Alpine (6086)	<i>Onobrychis viciifolia</i>	E	9	0.1			1 (26)
	<i>Amorpha fruticosa</i>	A	4	0.1			1 (26)
	<i>Alchemilla conjuncta</i>	E	3	0.0			1 (26)
	<i>Cota triumfettii</i>	E	2	0.0			1 (26)
	<i>Oenothera glazioviana</i>	A	2	0.0			1 (26)
Saline (988)	<i>Grindelia squarrosa</i>	A	17	1.7	<i>Erigeron canadensis</i>	A	6 (22)
	<i>Xanthium orientale</i>	A	17	1.7	<i>Symphotrichum squamatum</i>	A	3 (22)
	<i>Erigeron canadensis</i>	A	8	0.8	<i>Xanthium orientale</i>	A	3 (22)
	<i>Ambrosia artemisiifolia</i>	A	7	0.7	<i>Xanthium spinosum</i>	A	3 (22)
	<i>Symphotrichum squamatum</i>	A	4	0.4	<i>Cotula coronopifolia</i>	A	2 (22)

Table 3. Overview of the species-pool data and relative frequency of invaded plots (plots with the presence of at least one neophyte) for habitat groups. Oromedit. refers to oromediterranean habitat group.

	Sandy	Rocky	Dry	Oromedit.	Mesic	Wet	Alpine	Saline
Number of all species	2150	3354	6016	957	4014	3584	3180	846
Number of native species	2020	3293	5798	957	3736	3323	3167	828
Number of neophytes	130	61	218	0	278	261	13	18
Neophytes of non-European origin	80	24	89	0	115	158	6	13
Neophytes of European origin	46	33	111	0	141	85	7	2
Other (anecophytes, hybrids)	4	4	18	0	22	18	0	3
Relative frequency of all neophytes in the species list [%]	6.1	1.8	3.7	0	7.2	7.4	0.4	2.1
Relative frequency of non-European neophytes in the species list [%]	3.7	0.7	1.5	0	2.9	4.4	0.2	1.5
All plots	4359	4671	25430	380	32740	22763	6086	988
Plots with at least one neophyte present (invaded plots)	1122	263	2729	0	4413	2916	30	73
% of invaded plots	25.7	5.6	10.7	0	13.5	12.8	0.5	7.4
% of plots invaded by at least one non-European neophyte	21.8	2.3	3.9	0	7.5	10.2	0.2	6.4

Table 4. Summary statistics for habitat groups: mean, standard error of the mean (SEM) and median of species richness and relative abundance of neophyte species calculated across plots. Oromedit. refers to oromediterranean habitat group. Species richness refers to all species recorded in the plot. Neophytes include all neophyte species irrespective of their origin, while they are separated in the latter categories. Kruskal-Wallis test shows significant differences at the level of $p=0.01$.

		Sandy	Rocky	Dry	Oromedit.	Mesic	Wet	Alpine	Saline
Species richness	mean	15.8	26.1	31.6	19.5	28.4	21.8	21.5	9.5
	SEM	0.1	0.2	0.1	0.4	0.1	0.1	0.1	0.2
	median	15	25	30	18	27	20	20	9
Neophytes [%]	mean	2.2	0.3	0.4	0	0.7	1	0	0.8
	SEM	0.1	0	0	0	0	0	0	0.1
	median	0	0	0	0	0	0	0	0
Non-European origin [%]	mean	1.8	0.1	0.1	0	0.4	0.8	0	0.7
	SEM	0.1	0	0	0	0	0	0	0.1
	median	0	0	0	0	0	0	0	0
European origin [%]	mean	0.4	0.2	0.2	0	0.2	0.1	0	0.1
	SEM	0	0	0	0	0	0	0	0
	median	0	0	0	0	0	0	0	0
Other [%]	mean	0	0	0	0	0.1	0.1	0	0.1
	SEM	0	0	0	0	0	0	0	0
	median	0	0	0	0	0	0	0	0
Kruskal-Wallis comparison of relative neophyte richness		e	a	c	abc	d	d	b	acd
Kruskal-Wallis comparison of relative neophyte cover		e	a	c	abc	d	d	b	abcd

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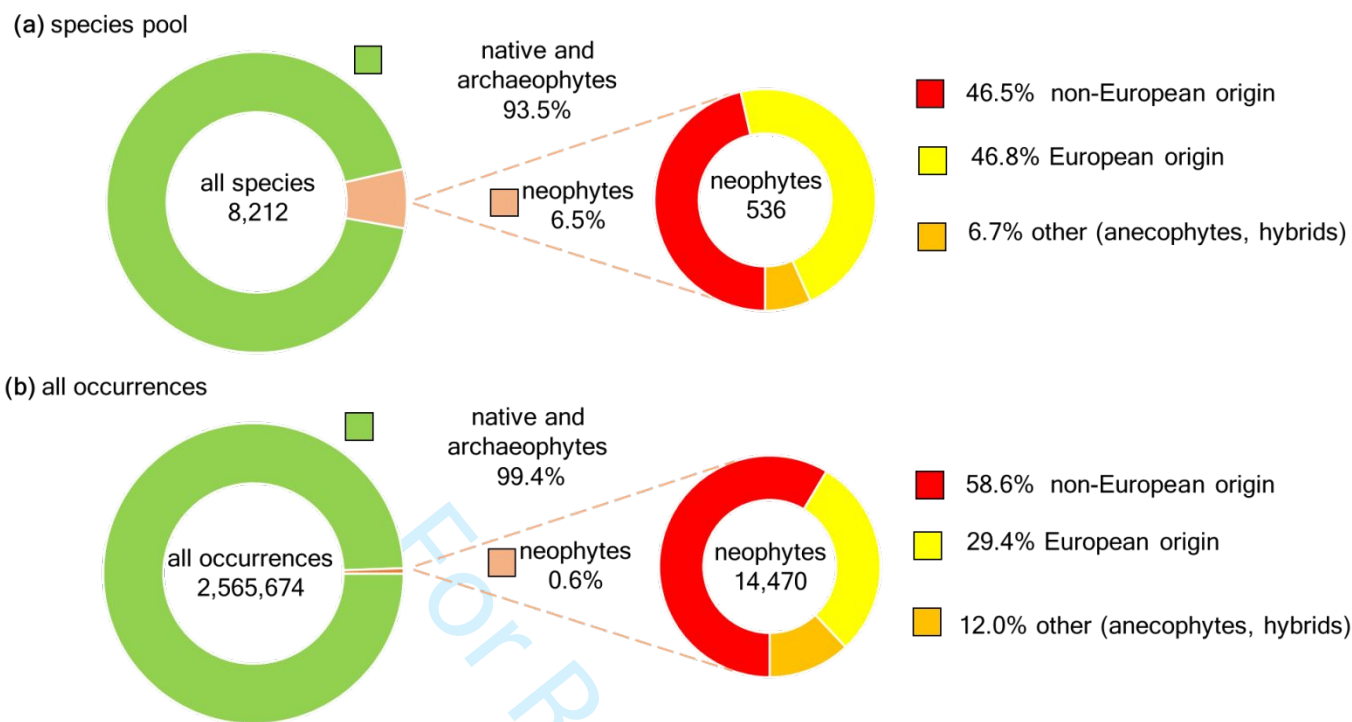


Figure 1. Absolute and relative numbers of native (including archaeophytes) and neophyte species in European grasslands. Representation in the grassland species list **(a)** considers native only those species that are in all countries included in the native category, while species of European origin considered as a neophyte in at least one country were included in the neophyte numbers. In total, 242 species had double status within Europe (approximately 2.9 %). Overview based on all occurrences **(b)** considers each record of plant species in a plot separately (see Appendix S10 for details).

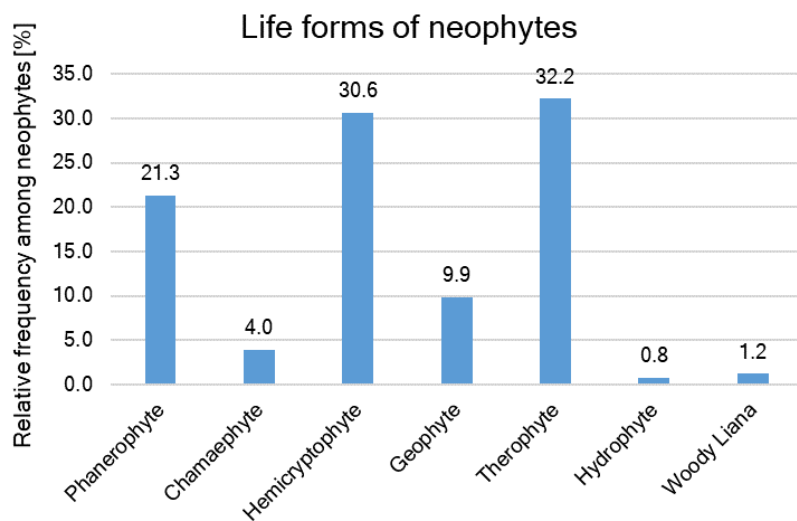


Figure 2. Life forms of neophytes in European grasslands.

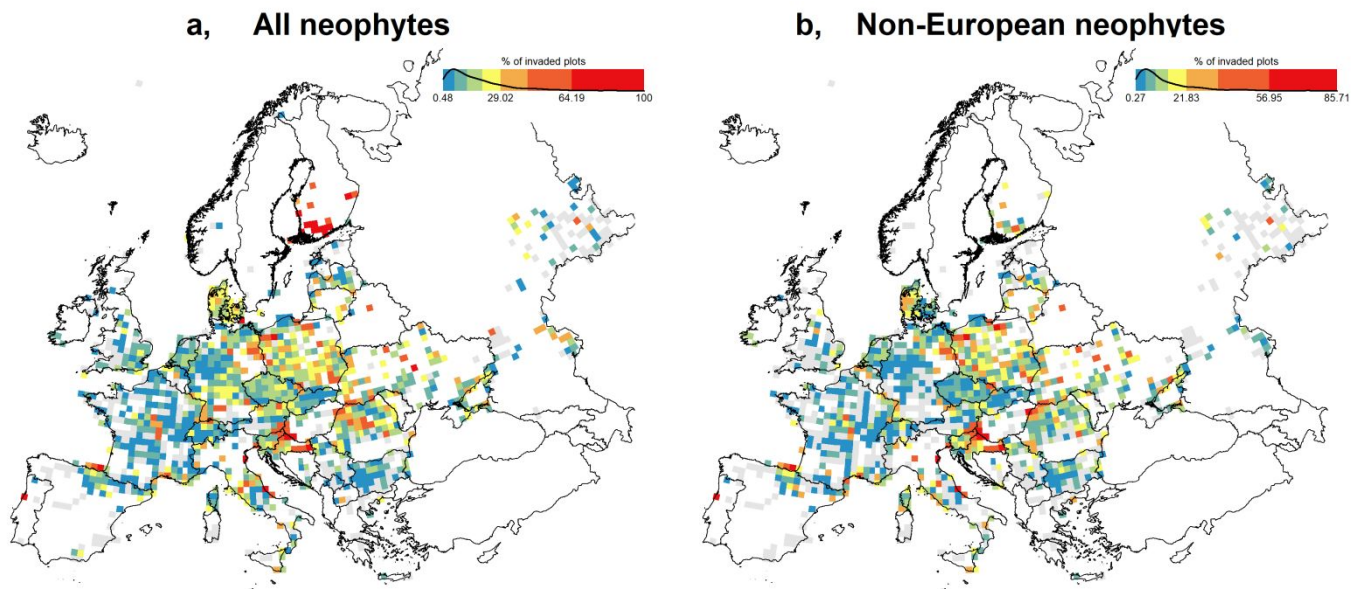
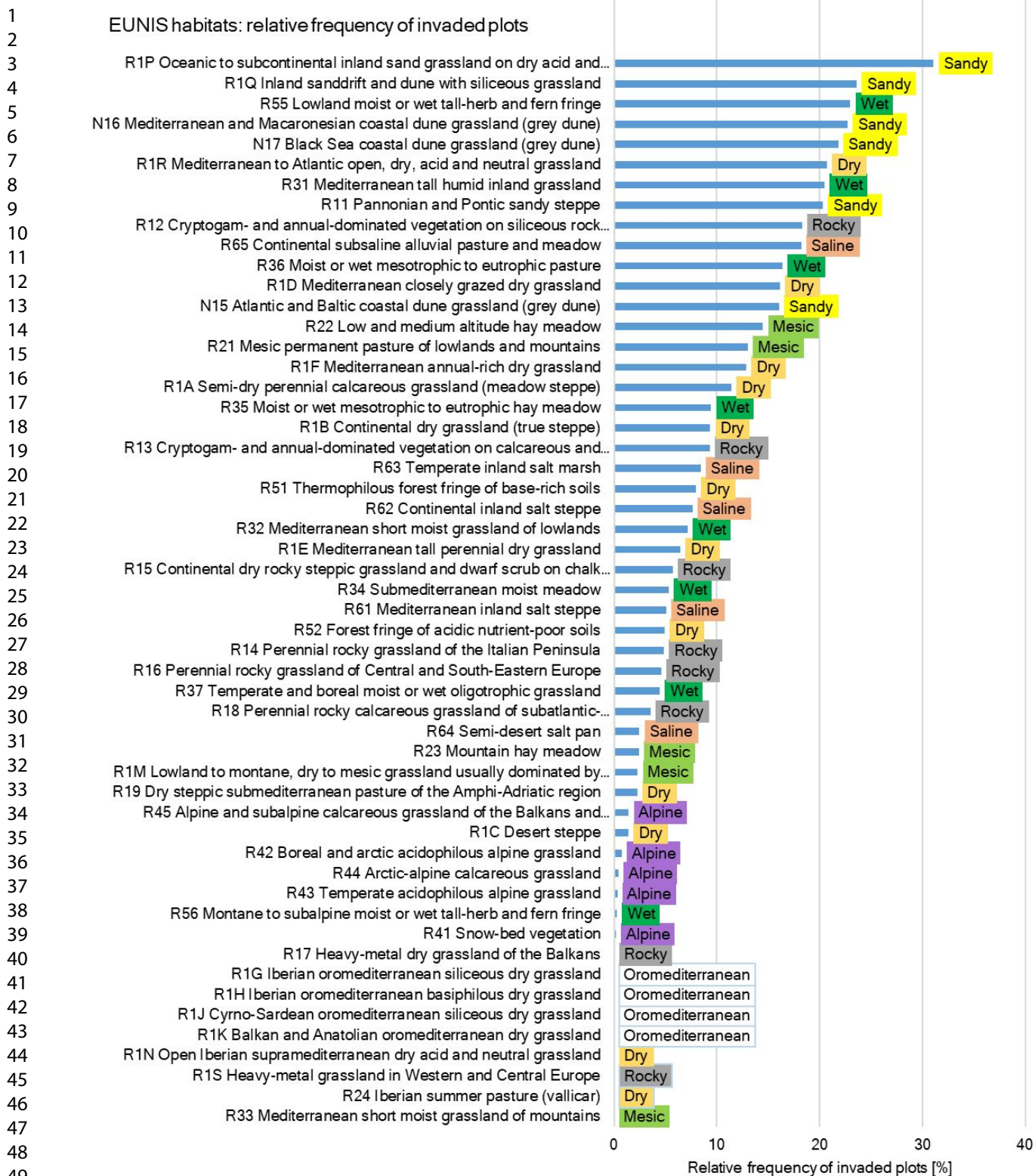


Figure 3. Relative frequency of invaded plots calculated per UTM 50 × 50 km grid cells. Colour-scale categories were defined to reflect the distribution of values (breaks calculated by k-means). Grey colour indicates cells with only not-invaded plots (0 %). Cells with less than ten plots are not mapped. Maps for habitat groups and neophyte origin categories are in Appendix S12.



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Figure 4. Relative frequency (%) of plots with neophytes in individual EUNIS habitats. Corresponding habitat groups are indicated by the labels to the right part of the bars. Note that last nine habitats (starting with R17) do not have any invaded plots and are sorted alphabetically by their EUNIS codes. For other statistics, see Appendix S8 and S9. Unclassified plots from Denmark are not included.

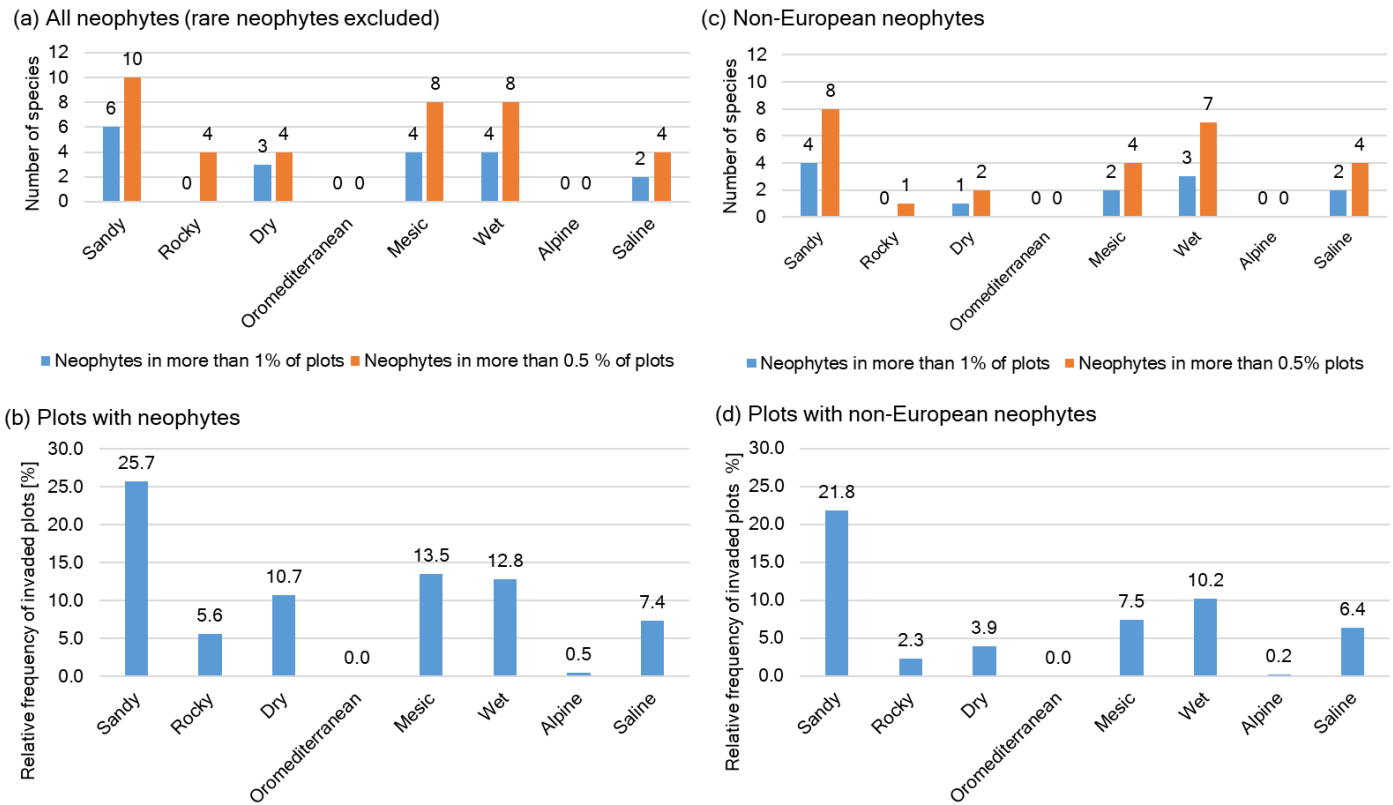


Figure 5. Overview of the species lists of neophytes by habitat groups. (a) Neophytes occurring in at least 0.5 or 1% of plots, respectively; (b) Relative frequency of plots invaded by neophytes; (c) Non-European neophytes occurring in at least 0.5 or 1% of plots; (d) Relative frequency of plots invaded by non-European neophytes.

1 **Supporting information to the paper**

1 Axmanová, I. *et al.*, Neophyte invasions in European grasslands. *Journal of Vegetation Science*.

3 **Appendix S1** Overview of contributing vegetation-plot databases.

5 **Appendix S2** Overview of the habitat types.

7 **Appendix S3** List of regions.

9 **Appendix S4** Literature used for status assessment.

11 **Appendix S5** References used for life-form assessment of neophytes.

13 **Appendix S6** Summary statistics for Europe and regions.

15 **Appendix S7** Summary statistics for Europe and regions calculated across plots.

17 **Appendix S8** Summary statistics for habitats.

19 **Appendix S9** Summary statistics for habitats calculated across plots.

21 **Appendix S10** List of neophytes recorded per region.

23 **Appendix S11** Comparison of relative neophyte species richness and neophyte cover among habitat groups.

25 **Appendix S12** Maps of the proportion of invaded plots in individual habitats relative to the neophyte origin categories.

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Supporting information to the paper

Axmanová, I. *et al.* Neophyte invasions in European grasslands. *Journal of Vegetation Science*.

Appendix S1. Overview of contributing vegetation-plot databases, number (n) and percentage (%) of plots used in the final dataset (N = 97,417). Databases are arranged according to the codes in the GIVD database.

GIVD database name	GIVD code	n	%	Custodian	Deputy custodian
Database of non-forest vegetation of the Southern Urals	00-RU-006	1702	1.7	Sergey Yamalov	Mariya Lebedeva
Nenets Tundra	AS-RU-005	9	<0.1	Igor Lavrinenko	
Nordic-Baltic Grassland Vegetation Database (NBGVGD)	EU-00-002	1392	1.4	Jürgen Dengler	Łukasz Kozub
Iberian and Macaronesian Vegetation Information System (SIVIM)	EU-00-004	1	<0.1	Xavier Font	
Iberian and Macaronesian Vegetation Information System (SIVIM) – Alpine grasslands	EU-00-004	274	0.3	Borja Jiménez-Alfaro	Xavier Font
Iberian and Macaronesian Vegetation Information System (SIVIM) – Catalonia	EU-00-004	55	0.1	Xavier Font	
Iberian and Macaronesian Vegetation Information System (SIVIM) – Grasslands	EU-00-004	1549	1.6	Maria Pilar Rodríguez-Rojo	Xavier Font
Vegetation-Plot Database of the University of the Basque Country (BIOVEG)	EU-00-011	2225	2.3	Idoia Biurrun	Itziar García-Mijangos
Balkan Dry Grasslands Database	EU-00-013	2577	2.6	Kiril Vassilev	Armin Macanović
Mediterranean Ammophiletea database	EU-00-016	455	0.5	Corrado Marcenò	Borja Jiménez-Alfaro
European Coastal Vegetation Database	EU-00-017	61	0.1	John Janssen	
The Nordic Vegetation Database	EU-00-018	806	0.8	Jonathan Lenoir	Jens-Christian Svenning
Balkan Vegetation Database	EU-00-019	1008	1.0	Kiril Vassilev	Hristo Pedashenko
European Mire Vegetation Database	EU-00-022	23	<0.1	Tomáš Peterka	Martin Jiroušek
High Mediterranean Mountains Database	EU-00-029	132	0.1	Gianpietro Giusso del Galdo	Corrado Marcenò
Masaryk University's Gap-Filling Database of European Vegetation	EU-00-031	1	<0.1	Milan Chytrý	Ilona Knollová
Vegetation Database of Albania	EU-AL-001	29	<0.1	Michele De Sanctis	Giuliano Fanelli
Austrian Vegetation Database	EU-AT-001	4739	4.9	Wolfgang Willner	
INBOVEG	EU-BE-002	117	0.1	Els De Bie	
Bulgarian Vegetation Database	EU-BG-001	615	0.6	Iva Apostolova	Desislava Sopotlieva
Monitoring Effectiveness of Habitat Conservation in Switzerland	EU-CH-011	1807	1.9	Ariel Bergamini	Steffen Boch

1	Czech National Phytosociological Database	EU-CZ-001	5324	5.5	Milan Chytrý	Ilona Knollová
2	VegMV	EU-DE-001	3806	3.9	Florian Jansen	Christian Berg
3	VegetWeb Germany 1	EU-DE-013	1848	1.9	Florian Jansen	Jörg Ewald
4	VegetWeb Germany 2 (Tüxen's archive)	EU-DE-013	31	<0.1	Friedemann Goral	Florian Jansen
5	German Vegetation Reference Database (GVRD)	EU-DE-014	5965	6.1	Ute Jandt	Helge Bruelheide
6	German Grassland Vegetation Database (GrassVeg.DE)	EU-DE-020	1646	1.7	Jürgen Dengler	Ricarda Pätsch
7	Database Schleswig-Holstein (Northern Germany)	EU-DE-040	332	0.3	Joachim Schrautzer	
8	National Vegetation Database of Denmark	EU-DK-002	1885	1.9	Jesper Erenskjold Moeslund	Rasmus Ejrnæs
9	Iberian and Macaronesian Vegetation Information System (SIVIM) – Wetlands	EU-ES-001	98	0.1	Aaron Pérez-Haase	Xavier Font
10	SOPHY	EU-FR-003	20404	20.9	Henry Brisse	Patrice de Ruffray
11	UK National Vegetation Classification Database	EU-GB-001	2016	2.1	John S. Rodwell	
12	KRITI	EU-GR-001	93	0.1	Erwin Bergmeier	
13	Hellenic Natura 2000 Vegetation Database (HelNatVeg)	EU-GR-005	126	0.1	Panayotis Dimopoulos	Ioannis Tsiripidis
14	Croatian Vegetation Database	EU-HR-002	513	0.5	Željko Škvorc	Daniel Krstonošić
15	CoenoDat Hungarian Phytosociological Database	EU-HU-003	236	0.2	János Csiky	Zoltán Botta-Dukát
16	Irish Vegetation Database	EU-IE-001	143	0.1	Úna FitzPatrick	Lynda Weekes
17	VegItaly	EU-IT-001	483	0.5	Roberto Venanzoni	Flavia Landucci
18	Vegetation database of Habitats in the Italian Alps - HabItAlp	EU-IT-010	292	0.3	Laura Casella	Pierangela Angelini
19	Vegetation Plot Database – Sapienza University of Rome	EU-IT-011	1572	1.6	Emiliano Agrillo	Fabio Attorre
20	VIOLA	EU-IT-019	416	0.4	Angela Stanisci	Maria Laura Carranza
21	Lithuanian vegetation Database	EU-LT-001	462	0.5	Valerius Rašomavičius	Domas Uogintas
22	Semi-natural Grassland Vegetation Database of Latvia	EU-LV-001	882	0.9	Solvita Rūsiņa	
23	Vegetation Database of the Republic of Macedonia	EU-MK-001	29	<0.1	Renata Čušterevska	
24	Dutch National Vegetation Database	EU-NL-001	1617	1.7	Stephan Hennekens	Joop Schaminée
25	Dutch Military Ranges Vegetation Database (DUMIRA)	EU-NL-003	71	0.1	Iris de Ronde	Rense Haveman
26	Polish Vegetation Database	EU-PL-001	10433	10.7	Zygmunt Kącki	Grzegorz Swacha
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1	Romanian Grassland Database	EU-RO-008	5118	5.3	Eszter Ruprecht	Kiril Vassilev
2	Vegetation Database Grassland Vegetation of Serbia	EU-RS-002	1545	1.6	Svetlana Aćić	Zora Dajić Stevanović
3	Database of Forest Vegetation in Republic of Serbia	EU-RS-003	34	<0.1	Mirjana Krstivojević Ćuk	
4	& Vegetation Database of Northern Part of Serbia (AP Vojvodina)	EU-RS-004				
5	Lower Volga Valley Phytosociological Database	EU-RU-002	684	0.7	Valentin Golub	Andrei Chuvashov
6	Vegetation Database of the Volga and the Ural Rivers Basins	EU-RU-003	299	0.3	Tatiana Lysenko	
7	Vegetation Database of Tatarstan	EU-RU-011	485	0.5	Vadim Prokhorov	
8	Vegetation Database of Slovenia	EU-SI-001	1256	1.3	Urban Šilc	Filip Kuzmič
9	Slovak Vegetation Database	EU-SK-001	3388	3.5	Milan Valachovič	Jozef Šibík
10	Ukrainian Grassland Database	EU-UA-001	2331	2.4	Anna Kuzemko	Yulia Vashenyak
11	Halophytic and coastal vegetation database of Ukraine	EU-UA-005	250	0.3	Tetiana Dziuba	Dmytro Dubyna
12	Vegetation Database of Ukraine and Adjacent Parts of Russia	EU-UA-006	1018	1.0	Viktor Onyshchenko	Vitaliy Kolomyichuk
13	Steppe Vegetation Rostov Region Database	-	567	0.6	Olga Demina	
14	Teberda - Caucasus Database	-	142	0.1	Vladimir Onipchenko	Alexei Egorov

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23 Supporting information to the paper

24 Axmanová, I. *et al.* Neophyte invasions in European grasslands. *Journal of Vegetation Science*.

25 **Appendix S2.** Overview of the classification of vegetation plots into habitat types according to the European Nature Information System (EUNIS) and their
 26 assignment into broad vegetation types. Habitat group combines vegetation types of similar ecology and vegetation characteristics. The total number of plots in
 27 the final dataset was 97,417. Asterisks indicate grassland plots from Denmark (National Vegetation Database of Denmark) that were not classified to EUNIS habitats
 28 but assigned into broad vegetation types based on their similarity in species composition (Bray-Curtis index) to plots from other countries (see Methods for details).

EUNIS code	EUNIS habitat	Habitat group	Plot number
N15	Atlantic and Baltic coastal dune grassland (grey dune)	Sandy	468
N16	Mediterranean and Macaronesian coastal dune grassland (grey dune)	Sandy	714
N17	Black Sea coastal dune grassland (grey dune)	Sandy	390
R11	Pannonian and Pontic sandy steppe	Sandy	192
R12	Cryptogam- and annual-dominated vegetation on siliceous rock outcrops	Rocky	235
R13	Cryptogam- and annual-dominated vegetation on calcareous and ultramafic rock outcrops	Rocky	687
R14	Perennial rocky grassland of the Italian Peninsula	Rocky	371
R15	Continental dry rocky steppic grassland and dwarf scrub on chalk outcrops	Rocky	123
R16	Perennial rocky grassland of Central and South-Eastern Europe	Rocky	1615
R17	Heavy-metal dry grassland of the Balkans	Rocky	21
R18	Perennial rocky calcareous grassland of subatlantic-submediterranean Europe	Rocky	1610
R19	Dry steppic submediterranean pasture of the Amphi-Adriatic region	Dry	223
R1A	Semi-dry perennial calcareous grassland (meadow steppe)	Dry	16100
R1B	Continental dry grassland (true steppe)	Dry	6176
R1C	Desert steppe	Dry	440
R1D	Mediterranean closely grazed dry grassland	Dry	149
R1E	Mediterranean tall perennial dry grassland	Dry	777
R1F	Mediterranean annual-rich dry grassland	Dry	70
R1G	Iberian oromediterranean siliceous dry grassland	Oromediterranean	65
R1H	Iberian oromediterranean basiphilous dry grassland	Oromediterranean	209
R1J	Cyrno-Sardean oromediterranean siliceous dry grassland	Oromediterranean	28
R1K	Balkan and Anatolian oromediterranean dry grassland	Oromediterranean	78
R1M	Lowland to montane, dry to mesic grassland usually dominated by <i>Nardus stricta</i>	Mesic	826
R1N	Open Iberian supramediterranean dry acid and neutral grassland	Dry	15
R1P	Oceanic to subcontinental inland sand grassland on dry acid and neutral soils	Sandy	1989
R1Q	Inland sanddrift and dune with siliceous grassland	Sandy	606

1	R1R	Mediterranean to Atlantic open, dry, acid and neutral grassland	Dry	561
2	R1S	Heavy-metal grassland in Western and Central Europe	Rocky	9
3	R21	Mesic permanent pasture of lowlands and mountains	Mesic	6542
4	R22	Low and medium altitude hay meadow	Mesic	22885
5	R23	Mountain hay meadow	Mesic	1400
6	R24	Iberian summer pasture (vallicar)	Dry	15
7	R31	Mediterranean tall humid inland grassland	Wet	313
8	R32	Mediterranean short moist grassland of lowlands	Wet	14
9	R33	Mediterranean short moist grassland of mountains	Mesic	147
10	R34	Submediterranean moist meadow	Wet	244
11	R35	Moist or wet mesotrophic to eutrophic hay meadow	Wet	9408
12	R36	Moist or wet mesotrophic to eutrophic pasture	Wet	3460
13	R37	Temperate and boreal moist or wet oligotrophic grassland	Wet	2946
14	R41	Snow-bed vegetation	Alpine	511
15	R42	Boreal and arctic acidophilous alpine grassland	Alpine	131
16	R43	Temperate acidophilous alpine grassland	Alpine	3157
17	R44	Arctic-alpine calcareous grassland	Alpine	1585
18	R45	Alpine and subalpine calcareous grassland of the Balkans and Apennines	Alpine	702
19	R51	Thermophilous forest fringe of base-rich soils	Dry	477
20	R52	Forest fringe of acidic nutrient-poor soils	Dry	305
21	R55	Lowland moist or wet tall-herb and fern fringe	Wet	4723
22	R56	Montane to subalpine moist or wet tall-herb and fern fringe	Wet	832
23	R61	Mediterranean inland salt steppe	Saline	79
24	R62	Continental inland salt steppe	Saline	460
25	R63	Temperate inland salt marsh	Saline	357
26	R64	Semi-desert salt pan	Saline	81
27	R65	Continental subsaline alluvial pasture and meadow	Saline	11
28	*	NA	Dry	122
29	*	NA	Mesic	940
30	*	NA	Wet	823

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30 Supporting information to the paper

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32 **Appendix S3.** List of regions. Regions marked by an asterisk have less than 100 plots; therefore, statistics for these regions are less representative. The European
33 part of the Russian Federation is divided into regions according to the Euro+Med PlantBase.

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Region	Number of plots	Region	Number of plots	Region	Number of plots
Albania*	29	Hungary	273	Russia (Kaliningrad)*	3
Austria	4767	Ireland	147	Russia (North)	19
Baleares*	7	Italy	2691	Russia (Northwest)	44
Belarus*	42	Kosovo	259	Russia (South)	1294
Belgium	137	Latvia	912	Romania	5153
Bosnia and Herzegovina	243	Lithuania	468	Sardinia	162
Bulgaria	3466	Luxembourg*	12	Serbia	1531
Corsica	268	Macedonia*	71	Sicily and Malta	224
Crete*	98	Moldova	201	Slovakia	3366
Croatia	537	Montenegro*	42	Slovenia	1267
Czech Republic	5215	Netherlands	1682	Spain	4361
Denmark	1885	Norway	348	Sweden	390
Estonia	955	Poland	10490	Switzerland	2376
Finland	430	Portugal	160	Ukraine	3276
France	19069	Russia (Central)*	42	United Kingdom	2019
Germany	13882	Russia (Caucasus)	289		
Greece	480	Russia (East)	2335		

Supporting information to the paper

Axmanová, I. *et al.* Neophyte invasions in European grasslands. *Journal of Vegetation Science*.

Appendix S4. List of literature sources used for status assessment.

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216 **Appendix S5.** References used for life-form assessment of neophytes. We used the Raunkiaer definitions (1934) to assign each neophyte plant to following
217 categories of phanerophytes, chamaephytes, hemicryptophytes, geophytes, therophytes, hydrophytes and woody lianas.

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Appendix S6. Overview of the species-pool data and relative frequency of invaded plots (plots with the presence of at least one neophyte) for Europe and individual countries. For Europe, we included into native category only species considered native in all regions, while species of European origin considered as a neophyte in at least one country were included in the neophyte numbers. Regions marked by an asterisk have less than 100 plots; therefore, statistics for these regions are less representative. The European part of the Russian Federation is divided into regions according to the Euro+Med PlantBase.

Region	Number of all species	Number of native species and archaeophytes	Number of neophytes	Non-European origin	European origin	Other (anecophytes, hybrids)	Relative frequency of neophytes in the species pool [%]	Relative frequency of non-European neophytes [%]	All plots	Plots with native taxa only (no neophytes)	Plots with at least one neophyte present (invaded plots)	% of invaded plots	% of plots invaded by non-European neophytes
EUROPE	8212	7676	536	249	251	36	6.5	3.0	97417	85871	11546	11.9	7.1
Albania*	247	244	3	2	1	0	1.2	0.8	29	26	3	10.3	6.9
Austria	1870	1806	64	29	27	8	3.4	1.6	4767	3877	890	18.7	9.8
Balears*	20	20	0	0	0	0	0.0	0.0	7	7	0	0.0	0.0
Belarus*	229	218	11	6	2	3	4.8	2.6	42	21	21	50.0	35.7
Belgium	372	355	17	9	7	1	4.6	2.4	137	106	31	22.6	19.7
Bosnia and Herzegovina	870	860	10	8	1	1	1.1	0.9	243	230	13	5.3	4.1
Bulgaria	2215	2194	21	17	1	3	0.9	0.8	3466	3368	98	2.8	2.6
Corsica	715	705	10	9	1	0	1.4	1.3	268	246	22	8.2	7.8
Crete*	639	628	11	10	0	1	1.7	1.6	98	92	6	6.1	5.1
Croatia	1061	1035	26	23	2	1	2.5	2.2	537	334	203	37.8	35.2
Czech Republic	1570	1489	81	44	30	7	5.2	2.8	5215	4492	723	13.9	7.4
Denmark	783	713	70	23	40	7	8.9	2.9	1885	1475	410	21.8	12.1
Estonia	377	371	6	0	5	1	1.6	0.0	955	943	12	1.3	0.0
Finland	433	413	20	3	16	1	4.6	0.7	430	159	271	63.0	11.4
France	3171	3050	121	86	26	9	3.8	2.7	19069	18028	1041	5.5	3.8
Germany	1568	1458	110	47	56	7	7.0	3.0	13882	12111	1771	12.8	5.6

1	Greece	1228	1222	6	6	0	0	0.5	0.5	480	466	14	2.9	2.9
2	Hungary	789	775	14	10	3	1	1.8	1.3	273	228	45	16.5	15.8
3	Ireland	344	338	6	4	2	0	1.7	1.2	147	135	12	8.2	6.1
4	Italy	2471	2421	50	44	6	0	2.0	1.8	2691	2312	379	14.1	8.2
5	Kosovo	622	621	1	0	0	1	0.2	0.0	259	257	2	0.8	0.0
6	Latvia	557	528	29	14	12	3	5.2	2.5	912	813	99	10.9	5.2
7	Lithuania	602	568	34	21	11	2	5.6	3.5	468	353	115	24.6	19.2
9	Luxembourg*	102	102	0	0	0	0	0.0	0.0	12	12	0	0.0	0.0
10	Macedonia*	590	589	1	0	1	0	0.2	0.0	71	66	5	7.0	0.0
11	Moldova	489	475	14	10	3	1	2.9	2.0	201	166	35	17.4	15.9
12	Montenegro*	283	283	0	0	0	0	0.0	0.0	42	42	0	0.0	0.0
13	Netherlands	686	641	45	26	14	5	6.6	3.8	1682	1504	178	10.6	8.1
15	Norway	342	338	4	0	4	0	1.2	0.0	348	341	7	2.0	0.0
16	Poland	1589	1471	118	62	47	9	7.4	3.9	10490	8646	1844	17.6	12.3
17	Portugal	506	500	6	6	0	0	1.2	1.2	160	127	33	20.6	20.6
18	Russia (Central)*	331	329	2	0	2	0	0.6	0.0	42	33	9	21.4	0.0
19	Russia (Caucasus)	762	752	10	8	2	0	1.3	1.0	289	276	13	4.5	4.2
20	Russia (East)	1271	1244	27	18	6	3	2.1	1.4	2335	2210	125	5.4	3.3
22	Russia (Kaliningrad)*	43	40	3	3	0	0	7.0	7.0	3	0	3	100.0	100.0
23	Russia (North)	118	118	0	0	0	0	0.0	0.0	19	19	0	0.0	0.0
24	Russia (Northwest)	165	163	2	1	1	0	1.2	0.6	44	41	3	6.8	2.3
25	Russia (South)	898	876	22	16	4	2	2.4	1.8	1294	1161	133	10.3	3.6
27	Romania	2125	2073	52	42	8	2	2.4	2.0	5153	4121	1032	20.0	9.4
28	Sardinia	475	466	9	8	0	1	1.9	1.7	162	152	10	6.2	5.6
29	Serbia	1416	1403	13	13	0	0	0.9	0.9	1531	1462	69	4.5	4.5
30	Sicily and Malta	660	648	12	11	1	0	1.8	1.7	224	197	27	12.1	11.6
31	Slovakia	1686	1637	49	25	20	4	2.9	1.5	3366	3096	270	8.0	3.7
32	Slovenia	1410	1374	36	30	3	3	2.6	2.1	1267	971	296	23.4	20.9
34	Spain	2747	2671	76	61	8	7	2.8	2.2	4361	4022	339	7.8	6.6
35	Sweden	401	391	10	1	8	1	2.5	0.2	390	368	22	5.6	0.3
36	Switzerland	1521	1482	39	22	15	2	2.6	1.4	2376	2129	247	10.4	4.6
37	Ukraine	1838	1767	71	42	22	7	3.9	2.3	3276	2713	563	17.2	11.8
38	Ukraine	1838	1767	71	42	22	7	3.9	2.3	3276	2713	563	17.2	11.8
39	United Kingdom	773	729	44	13	26	5	5.7	1.7	2019	1917	102	5.1	2.3

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Appendix S7. Summary statistics for Europe and individual regions: mean, standard error of the mean (SEM) and median of species richness and relative abundance of neophyte species calculated across plots. Species richness refers to all species recorded in the plot. Neophytes include all neophyte species irrespective of their origin, while in the latter categories they are separated. Regions marked by an asterisk have less than 100 plots; therefore, statistics for them are less representative.

Region	Species richness			Neophytes [%]			Non-European origin [%]			European origin [%]			Other origin [%]		
	mean	SEM	median	mean	SEM	median	mean	SEM	median	mean	SEM	median	mean	SEM	median
EUROPE	26.3	0.0	25.0	0.7	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0
Albania*	15.4	1.1	16.0	0.8	0.5	0.0	0.7	0.5	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Austria	34.0	0.2	34.0	0.8	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0
Balears*	5.1	0.4	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belarus*	19.0	1.3	19.0	3.9	0.8	1.2	2.7	0.7	0.0	0.8	0.4	0.0	0.4	0.3	0.0
Belgium	17.4	0.6	16.0	1.9	0.3	0.0	1.5	0.3	0.0	0.4	0.1	0.0	0.0	0.0	0.0
Bosnia and Herzegovina	25.0	0.8	23.0	0.4	0.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulgaria	28.5	0.2	28.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corsica	16.3	0.4	15.0	0.7	0.2	0.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crete*	21.4	1.2	18.0	0.9	0.6	0.0	0.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Croatia	31.3	0.5	32.0	2.0	0.2	0.0	1.8	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Czech Republic	27.6	0.2	26.0	0.8	0.0	0.0	0.5	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0
Denmark	28.3	0.2	27.0	0.9	0.0	0.0	0.5	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0
Estonia	24.4	0.3	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finland	26.2	0.6	23.0	3.8	0.2	3.8	0.4	0.1	0.0	2.9	0.1	2.8	0.6	0.1	0.0
France	25.1	0.1	24.0	0.3	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Germany	25.5	0.1	25.0	0.8	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0
Greece	19.2	0.5	17.0	0.3	0.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary	21.9	0.7	21.0	1.2	0.2	0.0	1.2	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Ireland	18.7	0.7	17.0	0.5	0.1	0.0	0.3	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Italy	23.8	0.2	22.0	1.1	0.1	0.0	0.9	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0

1	Kosovo	34.9	0.6	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Latvia	26.9	0.3	26.0	0.5	0.1	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0
3	Lithuania	21.2	0.4	20.0	1.9	0.2	0.0	1.4	0.2	0.0	0.4	0.1	0.0	0.0	0.0
4	Luxembourg*	30.6	1.7	31.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Macedonia*	39.5	2.4	33.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
6	Moldova	32.0	0.7	32.0	0.6	0.1	0.0	0.6	0.1	0.0	0.1	0.0	0.0	0.0	0.0
7	Montenegro*	37.0	1.3	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Netherlands	19.4	0.2	19.0	0.6	0.0	0.0	0.5	0.0	0.0	0.1	0.0	0.0	0.0	0.0
9	Norway	15.5	0.3	14.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
10	Poland	25.7	0.1	25.0	1.0	0.0	0.0	0.7	0.0	0.0	0.1	0.0	0.0	0.1	0.0
11	Portugal	16.9	0.5	16.5	1.6	0.3	0.0	1.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0
12	Russia (Central)*	28.5	2.5	28.5	0.5	0.2	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0
13	Russia (Caucasus)	19.5	0.6	18.0	0.4	0.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
14	Russia (East)	33.9	0.4	31.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
15	Russia (Kaliningrad)*	15.3	2.7	17.0	7.0	1.5	5.9	7.0	1.5	5.9	0.0	0.0	0.0	0.0	0.0
16	Russia (North)	13.2	1.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	Russia (Northwest)	21.9	1.1	21.0	0.3	0.2	0.0	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.0
18	Russia (South)	26.2	0.5	20.0	0.7	0.1	0.0	0.3	0.1	0.0	0.4	0.0	0.0	0.0	0.0
19	Romania	27.9	0.2	25.0	0.8	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.0	0.0	0.0
20	Sardinia	14.2	0.6	13.0	0.7	0.2	0.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0
21	Serbia	28.9	0.4	27.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	Sicily and Malta	22.9	0.6	23.0	1.1	0.2	0.0	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
23	Slovakia	30.6	0.2	30.0	0.4	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.1	0.0
24	Slovenia	31.9	0.4	30.0	1.4	0.1	0.0	1.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0
25	Spain	22.5	0.2	21.0	0.7	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	Sweden	18.1	0.4	18.0	0.3	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0
27	Switzerland	32.8	0.3	32.5	0.5	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
28	Ukraine	24.9	0.2	23.0	0.9	0.0	0.0	0.7	0.0	0.0	0.2	0.0	0.0	0.1	0.0
29	United Kingdom	17.1	0.2	16.0	0.4	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0

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Appendix S8. Overview of the species-pool data and relative frequency of invaded plots (plots with the presence of at least one neophyte) for habitat groups and EUNIS habitats. Note that number of all species refers to taxa at the species level. EUNIS habitats marked by an asterisk have less than 100 plots; therefore, statistics for these habitats are less representative. Non-classified plots from Denmark are not included in the EUNIS habitat statistics (in total 1885 plots).

Habitat	Number of all species	Number of native species	Number of neophytes	Non-European origin	European origin	Other (anecophytes, hybrids)	Relative frequency of all neophytes in the species pool [%]	Relative frequency of non-European neophytes [%]	All plots	Plots with only native taxa (no neophytes)	Plots with at least one neophyte present (invaded plots)	% of invaded plots	% of plots invaded by non-European neophytes
Habitat group													
Sandy	2150	2020	130	80	46	4	6.1	3.7	4359	3237	1122	25.7	21.8
Rocky	3354	3293	61	24	33	4	1.8	0.7	4671	4408	263	5.6	2.3
Dry	6016	5798	218	89	111	18	3.7	1.5	25430	22701	2729	10.7	3.9
Oromediterranean	957	957	0	0	0	0	0.0	0.0	380	380	0	0.0	0.0
Mesic	4014	3736	278	115	141	22	7.2	2.9	32740	28327	4413	13.5	7.5
Wet	3584	3323	261	158	85	18	7.4	4.4	22763	19847	2916	12.8	10.2
Alpine	3180	3167	13	6	7	0	0.4	0.2	6086	6056	30	0.5	0.2
Saline	846	828	18	13	2	3	2.1	1.5	988	915	73	7.4	6.4
EUNIS habitat													

1	R63	Temperate inland salt marsh	475	461	14	10	2	2	2.9	2.1	357	327	30	8.4	6.2
2	R64*	Semi-desert salt pan	121	119	2	2	0	0	1.7	1.7	81	79	2	2.5	2.5
3															
4	R65*	Continental subsaline alluvial pasture and meadow	53	50	3	2	1	0	5.7	3.8	11	9	2	18.2	18.2

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Appendix S9. Summary statistics for habitat groups and EUNIS habitats: mean, standard error of the mean (SEM) and median of species richness and relative abundance of neophyte species calculated across plots. Species richness refers to all species recorded in the plot, Neophytes include all neophyte species irrespective of their origin, while in latter categories they are separated. EUNIS habitats marked by an asterisk have less than 100 plots; therefore, statistics for them are less representative. Not-classified plots from Denmark are not included in the EUNIS habitat statistics (in total 1885 plots).

Habitat	Species richness mean	SEM	median	Neophytes [%] mean	SEM	median	Non-European origin [%] mean	SEM	median	European origin [%] mean	SEM	median	Other [%] mean	SEM	median
Habitat group															
Sandy	15.8	0.1	15.0	2.2	0.1	0.0	1.8	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Rocky	26.1	0.2	25.0	0.3	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Dry	31.6	0.1	30.0	0.4	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Oromediterranean	19.5	0.4	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesic	28.4	0.1	27.0	0.7	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0
Wet	21.8	0.1	20.0	1.0	0.0	0.0	0.8	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
Alpine	21.5	0.1	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saline	9.5	0.2	9.0	0.8	0.1	0.0	0.7	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0
EUNIS habitat															
N15	Atlantic and Baltic coastal dune grassland (grey dune)	11.6	0.3	11.0	1.6	0.2	0.0	1.3	0.2	0.0	0.4	0.1	0.0	0.0	0.0
N16	Mediterranean and Macaronesian coastal dune grassland (grey dune)	11.7	0.2	10.0	2.7	0.2	0.0	2.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0
N17	Black Sea coastal dune grassland (grey dune)	13.8	0.3	13.0	1.9	0.2	0.0	1.7	0.2	0.0	0.2	0.1	0.0	0.0	0.0
R11	Pannonian and Pontic sandy steppe	21.1	0.5	20.0	1.3	0.2	0.0	1.2	0.2	0.0	0.1	0.1	0.0	0.0	0.0
R12	Cryptogam- and annual-dominated vegetation on siliceous rock outcrops	19.3	0.6	17.0	1.1	0.2	0.0	0.5	0.1	0.0	0.6	0.1	0.0	0.0	0.0

1	R51	Thermophilous forest fringe of base-rich soils	26.9	0.5	25.0	0.3	0.1	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
2																	
3	R52	Forest fringe of acidic nutrient-poor soils	18.1	0.4	17.0	0.3	0.1	0.0	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
4																	
5	R55	Lowland moist or wet tall-herb and fern fringe	17.9	0.1	17.0	2.4	0.1	0.0	2.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0
6																	
7	R56	Montane to subalpine moist or wet tall-herb and fern fringe	21.9	0.3	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8																	
9	R61*	Mediterranean inland salt steppe	7.2	0.4	7.0	0.7	0.3	0.0	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10																	
11	R62	Continental inland salt steppe	9.5	0.2	8.0	0.8	0.1	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12																	
13	R63	Temperate inland salt marsh	10.7	0.3	10.0	0.8	0.2	0.0	0.6	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0
14																	
15	R64*	Semi-desert salt pan	6.5	0.4	5.0	0.6	0.5	0.0	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16																	
17	R65*	Continental subsaline alluvial pasture and meadow	9.7	0.9	9.0	3.6	2.5	0.0	2.4	1.6	0.0	1.1	1.1	0.0	0.0	0.0	0.0

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Appendix S10. List of neophyte species recorded in individual regions. Species are listed alphabetically and their frequency in regional subsets is shown under No. of plots in which the species was recorded. Subspecies were listed only if recorded in the vegetation plot and considered as neophytes for the given region. Russia refers to European part of Russia, which is in our study subdivided into seven regions. All the regions are delimited following the Euro+Med PlantBase. Note that some regions are considered separately due to their specific history or ecology (e.g. Crete). Regions with a low number of plots (less than 100) are marked by an asterisk. Origin 'A' refers to non-European origin, 'E' to European origin and 'C' to other origin (anecophytes, hybrids).

Region	Taxon	Origin	No. of plots	% of plots	Subsp.
Albania	* <i>Amorpha fruticosa</i>	A	1	3.45	
Albania	* <i>Onobrychis viciifolia</i>	E	1	3.45	
Albania	* <i>Symphyotrichum squamatum</i>	A	2	6.90	
Austria	<i>Acer negundo</i>	A	10	0.21	
Austria	<i>Aesculus hippocastanum</i>	E	1	0.02	
Austria	<i>Ailanthus altissima</i>	A	5	0.10	
Austria	<i>Amaranthus retroflexus</i>	A	5	0.10	
Austria	<i>Anthriscus cerefolium</i>	C	2	0.04	
Austria	<i>Armoracia rusticana</i>	E	3	0.06	
Austria	<i>Bidens frondosus</i>	A	2	0.04	
Austria	<i>Brassica napus</i>	C	1	0.02	
Austria	<i>Bunias orientalis</i>	E	1	0.02	
Austria	<i>Calendula officinalis</i>	C	1	0.02	
Austria	<i>Campanula rhomboidalis</i>	E	1	0.02	
Austria	<i>Castanea sativa</i>	E	5	0.10	
Austria	<i>Conringia orientalis</i>	E	1	0.02	
Austria	<i>Echium italicum</i>	E	1	0.02	
Austria	<i>Epilobium ciliatum</i>	A	10	0.21	
Austria	<i>Erigeron annuus</i>	A	242	5.08	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
Austria	<i>Erigeron canadensis</i>	A	27	0.57	
Austria	<i>Fumaria capreolata</i>	E	1	0.02	
Austria	<i>Galinsoga quadriradiata</i>	A	2	0.04	
Austria	<i>Galium verrucosum</i>	E	1	0.02	
Austria	<i>Geranium pyrenaicum</i>	E	27	0.57	
Austria	<i>Glebionis segetum</i>	E	1	0.02	
Austria	<i>Hemerocallis lilioasphodelus</i>	E	6	0.13	

1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Austria	<i>Chenopodium hircinum</i>	A	1	0.02	
4	Austria	<i>Iberis pinnata</i>	E	4	0.08	
5	Austria	<i>Impatiens glandulifera</i>	A	35	0.73	
6	Austria	<i>Impatiens parviflora</i>	A	25	0.52	
7	Austria	<i>Juncus tenuis</i>	A	7	0.15	
8	Austria	<i>Ligularia dentata</i>	A	1	0.02	
9	Austria	<i>Lolium multiflorum</i>	E	21	0.44	
10	Austria	<i>Lycium barbarum</i>	A	1	0.02	
11	Austria	<i>Lycopersicon esculentum</i>	A	5	0.10	
12	Austria	<i>Mahonia aquifolium</i>	A	1	0.02	
13	Austria	<i>Malva moschata</i>	E	6	0.13	
14	Austria	<i>Matricaria discoidea</i>	A	1	0.02	
15	Austria	<i>Medicago sativa</i>	C	142	2.98	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>
16	Austria	<i>Melilotus indicus</i>	E	1	0.02	
17	Austria	<i>Narcissus poeticus</i>	E	41	0.86	subsp. <i>poeticus</i> , subsp. <i>radiiflorus</i>
18	Austria	<i>Nepeta cataria</i>	E	1	0.02	
19	Austria	<i>Oenothera biennis</i>	A	1	0.02	
20	Austria	<i>Onobrychis viciifolia</i>	E	243	5.10	
21	Austria	<i>Oxalis stricta</i>	A	16	0.34	
22	Austria	<i>Physalis alkekengi</i>	C	2	0.04	
23	Austria	<i>Populus x canadensis</i>	C	1	0.02	
24	Austria	<i>Prunus cerasifera</i>	E	1	0.02	
25	Austria	<i>Prunus cerasus</i>	A	2	0.04	
26	Austria	<i>Prunus domestica</i>	C	13	0.27	
27	Austria	<i>Robinia pseudoacacia</i>	A	10	0.21	
28	Austria	<i>Rudbeckia laciniata</i>	A	4	0.08	
29	Austria	<i>Rumex cristatus</i>	E	3	0.06	
30	Austria	<i>Sedum spurium</i>	E	1	0.02	
31	Austria	<i>Senecio leucanthemifolius</i>	E	1	0.02	
32	Austria	<i>Sinapis alba</i>	E	1	0.02	
33	Austria	<i>Sisymbrium altissimum</i>	E	1	0.02	
34	Austria	<i>Solidago canadensis</i>	A	15	0.31	
35	Austria	<i>Solidago gigantea</i>	A	145	3.04	
36	Austria	<i>Symphotrichum lanceolatum</i>	A	7	0.15	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Austria	<i>Symphytotrichum novi-belgii</i>	A	3	0.06	
4	Austria	<i>Symphytotrichum salignum</i>	A	1	0.02	
5	Austria	<i>Syringa vulgaris</i>	E	5	0.10	
6	Austria	<i>Veronica filiformis</i>	E	1	0.02	
7	Austria	<i>Veronica peregrina</i>	A	1	0.02	
8	Austria	<i>Veronica persica</i>	A	9	0.19	
9						
10	Baleares	* NA				
11	Belarus	* <i>Bidens frondosus</i>	A	5	11.90	
12	Belarus	* <i>Calystegia silvatica</i>	E	3	7.14	
13	Belarus	* <i>Echinochloa crus-galli</i>	C	1	2.38	
14	Belarus	* <i>Epilobium ciliatum</i>	A	3	7.14	subsp. <i>adenocaulon</i>
15	Belarus	* <i>Erigeron canadensis</i>	A	8	19.05	
16	Belarus	* <i>Juncus tenuis</i>	A	1	2.38	
17	Belarus	* <i>Mimulus guttatus</i>	A	2	4.76	
18	Belarus	* <i>Oenothera biennis</i>	A	1	2.38	
19	Belarus	* <i>Rumex stenophyllus</i>	E	1	2.38	
20	Belarus	* <i>Trifolium hybridum</i>	C	1	2.38	
21						
22	Belgium	<i>Berteroa incana</i>	E	1	0.73	
23	Belgium	<i>Callistephus chinensis</i>	A	2	1.46	
24	Belgium	<i>Castanea sativa</i>	E	5	3.65	
25	Belgium	<i>Epilobium ciliatum</i>	A	9	6.57	
26	Belgium	<i>Erigeron canadensis</i>	A	6	4.38	
27	Belgium	<i>Juglans regia</i>	E	1	0.73	
28	Belgium	<i>Juncus tenuis</i>	A	5	3.65	
29	Belgium	<i>Lathyrus latifolius</i>	E	1	0.73	
30	Belgium	<i>Melilotus albus</i>	E	1	0.73	
31	Belgium	<i>Oenothera parviflora</i>	A	1	0.73	
32	Belgium	<i>Oxalis stricta</i>	A	1	0.73	
33	Belgium	<i>Parthenocissus inserta</i>	A	1	0.73	
34	Belgium	<i>Picea abies</i>	E	1	0.73	
35	Belgium	<i>Populus alba</i>	E	1	0.73	
36	Belgium	<i>Populus x canadensis</i>	C	1	0.73	
37	Belgium	<i>Prunus serotina</i>	A	5	3.65	
38	Belgium	<i>Quercus rubra</i>	A	2	1.46	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	Bosnia and Herzegovina	<i>Amaranthus retroflexus</i>	A	1	0.41	
4	Bosnia and Herzegovina	<i>Ambrosia artemisiifolia</i>	A	2	0.82	
5	Bosnia and Herzegovina	<i>Bolboschoenus fluviatilis</i>	A	1	0.41	
6	Bosnia and Herzegovina	<i>Centaurea cariensis</i>	E	1	0.41	
7	Bosnia and Herzegovina	<i>Erigeron annuus</i>	A	7	2.88	
8	Bosnia and Herzegovina	<i>Impatiens glandulifera</i>	A	1	0.41	
9	Bosnia and Herzegovina	<i>Medicago sativa</i>	C	2	0.82	
10	Bosnia and Herzegovina	<i>Papaver orientale</i>	A	1	0.41	
11	Bosnia and Herzegovina	<i>Veronica persica</i>	A	1	0.41	
12	Bosnia and Herzegovina	<i>Xanthium orientale</i>	A	2	0.82	
13						
14						
15	Bulgaria	<i>Ailanthus altissima</i>	A	1	0.03	
16	Bulgaria	<i>Amaranthus retroflexus</i>	A	2	0.06	
17	Bulgaria	<i>Amorpha fruticosa</i>	A	3	0.09	
18	Bulgaria	<i>Brassica napus</i>	C	1	0.03	
19	Bulgaria	<i>Cuscuta campestris</i>	A	1	0.03	
20	Bulgaria	<i>Elaeagnus angustifolia</i>	A	1	0.03	
21	Bulgaria	<i>Erigeron annuus</i>	A	43	1.24	
22	Bulgaria	<i>Erigeron canadensis</i>	A	18	0.52	
23	Bulgaria	<i>Gleditsia triacanthos</i>	A	1	0.03	
24	Bulgaria	<i>Juncus tenuis</i>	A	4	0.12	
25	Bulgaria	<i>Lavandula angustifolia</i>	E	1	0.03	
26	Bulgaria	<i>Medicago sativa</i>	C	7	0.20	subsp. <i>sativa</i>
27	Bulgaria	<i>Quercus rubra</i>	A	2	0.06	
28	Bulgaria	<i>Reynoutria x bohemica</i>	A	1	0.03	
29	Bulgaria	<i>Robinia pseudoacacia</i>	A	1	0.03	
30	Bulgaria	<i>Setaria italica</i>	A	2	0.06	
31	Bulgaria	<i>Solidago canadensis</i>	A	1	0.03	
32	Bulgaria	<i>Trigonella caerulea</i>	A	2	0.06	
33	Bulgaria	<i>Xanthium orientale</i>	A	5	0.14	subsp. <i>italicum</i> , subsp. <i>riparium</i>
34	Bulgaria	<i>Xanthium spinosum</i>	A	2	0.06	
35						
36	Corsica	<i>Carpobrotus edulis</i>	A	1	0.37	
37	Corsica	<i>Cotula coronopifolia</i>	A	6	2.24	
38	Corsica	<i>Crassula lycopodioides</i>	A	4	1.49	
39	Corsica	<i>Cyperus eragrostis</i>	A	1	0.37	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Corsica	<i>Erigeron bonariensis</i>	A	1	0.37	
4	Corsica	<i>Erigeron sumatrensis</i>	A	1	0.37	
5	Corsica	<i>Paspalum distichum</i>	A	4	1.49	
6	Corsica	<i>Pinus pinea</i>	E	1	0.37	
7	Corsica	<i>Symphytotrichum squamatum</i>	A	6	2.24	
8	Corsica	<i>Xanthium orientale</i>	A	2	0.75	
9						
10	Crete	* <i>Ageratina adenophora</i>	A	1	1.02	
11	Crete	* <i>Avena sativa</i>	C	1	1.02	
12	Crete	* <i>Digitaria ciliaris</i>	A	1	1.02	
13	Crete	* <i>Eleusine indica</i>	A	1	1.02	
14	Crete	* <i>Lycopersicon esculentum</i>	A	1	1.02	
15	Crete	* <i>Oxalis pes-caprae</i>	A	2	2.04	
16	Crete	* <i>Panicum dichotomiflorum</i>	A	1	1.02	
17	Crete	* <i>Paspalum distichum</i>	A	1	1.02	
18	Crete	* <i>Ricinus communis</i>	A	1	1.02	
19	Crete	* <i>Symphytotrichum squamatum</i>	A	1	1.02	
20	Crete	* <i>Xanthium orientale</i>	A	1	1.02	
21						
22	Croatia	<i>Amaranthus retroflexus</i>	A	2	0.37	
23	Croatia	<i>Ambrosia artemisiifolia</i>	A	15	2.79	
24	Croatia	<i>Amorpha fruticosa</i>	A	3	0.56	
25	Croatia	<i>Asclepias syriaca</i>	A	1	0.19	
26	Croatia	<i>Bidens frondosus</i>	A	1	0.19	
27	Croatia	<i>Carex vulpinoidea</i>	A	1	0.19	
28	Croatia	<i>Echinocystis lobata</i>	A	9	1.68	
29	Croatia	<i>Erigeron annuus</i>	A	145	27.00	
30	Croatia	<i>Erigeron canadensis</i>	A	11	2.05	
31	Croatia	<i>Galinsoga parviflora</i>	A	2	0.37	
32	Croatia	<i>Helianthus tuberosus</i>	A	1	0.19	
33	Croatia	<i>Impatiens glandulifera</i>	A	6	1.12	
34	Croatia	<i>Matricaria discoidea</i>	A	5	0.93	
35	Croatia	<i>Medicago sativa</i>	C	25	4.66	
36	Croatia	<i>Oenothera biennis</i>	A	1	0.19	
37	Croatia	<i>Oxalis dillenii</i>	A	1	0.19	
38	Croatia	<i>Oxalis stricta</i>	A	2	0.37	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Croatia	<i>Panicum capillare</i>	A	1	0.19	
4	Croatia	<i>Potentilla intermedia</i>	E	1	0.19	
5	Croatia	<i>Rudbeckia laciniata</i>	A	3	0.56	
6	Croatia	<i>Solidago canadensis</i>	A	5	0.93	
7	Croatia	<i>Solidago gigantea</i>	A	11	2.05	
8	Croatia	<i>Sorghum halepense</i>	A	2	0.37	
9	Croatia	<i>Stachys byzantina</i>	E	1	0.19	
10	Croatia	<i>Veronica persica</i>	A	2	0.37	
11	Croatia	<i>Xanthium spinosum</i>	A	7	1.30	
12	Croatia	<i>Xanthium spinosum</i>	A	7	1.30	
13	Croatia	<i>Xanthium spinosum</i>	A	7	1.30	
14	Czech Republic	<i>Acer negundo</i>	A	2	0.04	
15	Czech Republic	<i>Acorus calamus</i>	A	1	0.02	
16	Czech Republic	<i>Aesculus hippocastanum</i>	E	1	0.02	
17	Czech Republic	<i>Amaranthus powellii</i>	A	1	0.02	
18	Czech Republic	<i>Amaranthus retroflexus</i>	A	4	0.08	
19	Czech Republic	<i>Amorpha fruticosa</i>	A	1	0.02	
20	Czech Republic	<i>Anaphalis margaritacea</i>	A	2	0.04	
21	Czech Republic	<i>Asparagus officinalis</i>	E	32	0.61	
22	Czech Republic	<i>Bidens connatus</i>	A	1	0.02	
23	Czech Republic	<i>Bidens frondosus</i>	A	35	0.67	
24	Czech Republic	<i>Brachypodium rupestre</i>	E	1	0.02	
25	Czech Republic	<i>Brachypodium rupestre</i>	E	1	0.02	
26	Czech Republic	<i>Bunias orientalis</i>	E	1	0.02	
27	Czech Republic	<i>Campanula rapunculus</i>	E	1	0.02	
28	Czech Republic	<i>Campanula rapunculus</i>	E	1	0.02	
29	Czech Republic	<i>Centaurea nigra</i>	E	1	0.02	
30	Czech Republic	<i>Cytisus scoparius</i>	E	9	0.17	
31	Czech Republic	<i>Datura stramonium</i>	A	1	0.02	
32	Czech Republic	<i>Datura stramonium</i>	A	1	0.02	
33	Czech Republic	<i>Digitalis purpurea</i>	E	1	0.02	
34	Czech Republic	<i>Dipsacus strigosus</i>	E	1	0.02	
35	Czech Republic	<i>Echinocystis lobata</i>	A	4	0.08	
36	Czech Republic	<i>Echinops sphaerocephalus</i>	E	19	0.36	
37	Czech Republic	<i>Echinops sphaerocephalus</i>	E	19	0.36	
38	Czech Republic	<i>Epilobium ciliatum</i>	A	91	1.74	
39	Czech Republic	<i>Erigeron annuus</i>	A	20	0.38	
40	Czech Republic	<i>Erigeron canadensis</i>	A	40	0.77	
41	Czech Republic	<i>Galinsoga parviflora</i>	A	1	0.02	
42	Czech Republic	<i>Galinsoga quadriradiata</i>	A	8	0.15	
43	Czech Republic	<i>Galinsoga quadriradiata</i>	A	8	0.15	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Czech Republic	<i>Geranium pyrenaicum</i>	E	2	0.04	
4	Czech Republic	<i>Helianthus tuberosus</i>	A	8	0.15	
5	Czech Republic	<i>Heracleum mantegazzianum</i>	E	2	0.04	
6	Czech Republic	<i>Hesperis matronalis</i>	E	2	0.04	
7	Czech Republic	<i>Chenopodium strictum</i>	E	2	0.04	
8	Czech Republic	<i>Impatiens glandulifera</i>	A	62	1.19	
9	Czech Republic	<i>Impatiens parviflora</i>	A	70	1.34	
10	Czech Republic	<i>Iris x germanica</i>	C	2	0.04	
11	Czech Republic	<i>Juncus tenuis</i>	A	10	0.19	
12	Czech Republic	<i>Lamium galeobdolon</i>	C	2	0.04	subsp. <i>argentatum</i>
13	Czech Republic	<i>Lathyrus hirsutus</i>	E	1	0.02	
14	Czech Republic	<i>Lolium multiflorum</i>	E	12	0.23	
15	Czech Republic	<i>Lolium x hybridum</i>	C	1	0.02	
16	Czech Republic	<i>Lupinus polyphyllus</i>	A	10	0.19	
17	Czech Republic	<i>Lycium chinense</i>	A	1	0.02	
18	Czech Republic	<i>Lycopersicon esculentum</i>	A	4	0.08	
19	Czech Republic	<i>Mahonia aquifolium</i>	A	1	0.02	
20	Czech Republic	<i>Matricaria discoidea</i>	A	41	0.79	
21	Czech Republic	<i>Medicago sativa</i>	C	47	0.90	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>
22	Czech Republic	<i>Mimulus guttatus</i>	A	6	0.12	
23	Czech Republic	<i>Oenothera biennis</i>	A	10	0.19	
24	Czech Republic	<i>Onobrychis viciifolia</i>	E	53	1.02	
25	Czech Republic	<i>Opuntia</i>	A	1	0.02	
26	Czech Republic	<i>Oxalis dillenii</i>	A	1	0.02	
27	Czech Republic	<i>Oxalis stricta</i>	A	5	0.10	
28	Czech Republic	<i>Peucedanum austriacum</i>	E	1	0.02	
29	Czech Republic	<i>Peucedanum ostruthium</i>	E	10	0.19	
30	Czech Republic	<i>Picea pungens</i>	A	4	0.08	
31	Czech Republic	<i>Pinus nigra</i>	E	6	0.12	
32	Czech Republic	<i>Populus x canadensis</i>	C	1	0.02	
33	Czech Republic	<i>Prunus armeniaca</i>	A	1	0.02	
34	Czech Republic	<i>Reynoutria</i>	A	3	0.06	
35	Czech Republic	<i>Reynoutria japonica</i>	A	7	0.13	
36	Czech Republic	<i>Reynoutria sachalinensis</i>	A	1	0.02	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	Czech Republic	<i>Reynoutria x bohemica</i>	A	2	0.04	
4	Czech Republic	<i>Robinia pseudoacacia</i>	A	13	0.25	
5	Czech Republic	<i>Rudbeckia laciniata</i>	A	1	0.02	
6	Czech Republic	<i>Rumex thyrsoiflorus</i>	E	41	0.79	
7	Czech Republic	<i>Sedum spurium</i>	E	1	0.02	
8	Czech Republic	<i>Senecio leucanthemifolius</i>	E	1	0.02	
9	Czech Republic	<i>Silene flos-jovis</i>	E	1	0.02	
10	Czech Republic	<i>Sisymbrium altissimum</i>	E	3	0.06	
11	Czech Republic	<i>Sisymbrium loeselii</i>	E	3	0.06	
12	Czech Republic	<i>Sisymbrium strictissimum</i>	E	1	0.02	
13	Czech Republic	<i>Solanum tuberosum</i>	A	1	0.02	
14	Czech Republic	<i>Solidago canadensis</i>	A	23	0.44	
15	Czech Republic	<i>Solidago gigantea</i>	A	7	0.13	
16	Czech Republic	<i>Symphyotrichum lanceolatum</i>	A	7	0.13	
17	Czech Republic	<i>Symphyotrichum novi-belgii</i>	A	5	0.10	
18	Czech Republic	<i>Syringa vulgaris</i>	E	3	0.06	
19	Czech Republic	<i>Trifolium hybridum</i>	C	123	2.36	subsp. <i>hybridum</i>
20	Czech Republic	<i>Veronica filiformis</i>	E	2	0.04	
21	Czech Republic	<i>Veronica persica</i>	A	14	0.27	
22	Czech Republic	<i>Viola suavis</i>	E	1	0.02	
23	Czech Republic	<i>Xanthium orientale</i>	A	1	0.02	
24	Denmark	<i>Abies alba</i>	E	2	0.11	
25	Denmark	<i>Acorus calamus</i>	A	2	0.11	
26	Denmark	<i>Amelanchier spicata</i>	A	1	0.05	
27	Denmark	<i>Berberis thunbergii</i>	A	1	0.05	
28	Denmark	<i>Berberis vulgaris</i>	E	7	0.37	
29	Denmark	<i>Brassica napus</i>	C	2	0.11	
30	Denmark	<i>Bromopsis inermis</i>	E	1	0.05	
31	Denmark	<i>Centaurea nigra</i>	E	5	0.27	
32	Denmark	<i>Cerastium tomentosum</i>	E	1	0.05	
33	Denmark	<i>Clematis vitalba</i>	E	1	0.05	
34	Denmark	<i>Cotoneaster horizontalis</i>	A	3	0.16	
35	Denmark	<i>Dactylis glomerata</i>	E	2	0.11	
36	Denmark	<i>Digitalis purpurea</i>	E	1	0.05	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Denmark	<i>Epilobium ciliatum</i>	A	146	7.75	subsp. <i>adenocaulon</i> , subsp. <i>ciliatum</i> , subsp. <i>glandulosum</i>
4	Denmark	<i>Epilobium komarovianum</i>	A	3	0.16	
5	Denmark	<i>Erigeron canadensis</i>	A	4	0.21	
6	Denmark	<i>Falcaria vulgaris</i>	E	1	0.05	
7	Denmark	<i>Heracleum mantegazzianum</i>	E	15	0.80	
8	Denmark	<i>Heracleum sphondylium</i>	E	3	0.16	
9	Denmark	<i>Impatiens parviflora</i>	A	3	0.16	
10	Denmark	<i>Lathyrus sativus</i>	C	1	0.05	
11	Denmark	<i>Linum austriacum</i>	E	18	0.95	
12	Denmark	<i>Lolium multiflorum</i>	E	1	0.05	
13	Denmark	<i>Lupinus polyphyllus</i>	A	1	0.05	
14	Denmark	<i>Lycium barbarum</i>	A	1	0.05	
15	Denmark	<i>Lysimachia punctata</i>	E	2	0.11	
16	Denmark	<i>Malus toringo</i>	A	2	0.11	
17	Denmark	<i>Malva moschata</i>	E	2	0.11	
18	Denmark	<i>Matricaria discoidea</i>	A	3	0.16	
19	Denmark	<i>Medicago sativa</i>	C	7	0.37	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>
20	Denmark	<i>Mimulus guttatus</i>	A	2	0.11	
21	Denmark	<i>Onobrychis viciifolia</i>	E	3	0.16	
22	Denmark	<i>Petasites hybridus</i>	E	1	0.05	
23	Denmark	<i>Picea abies</i>	E	19	1.01	
24	Denmark	<i>Picea glauca</i>	A	7	0.37	
25	Denmark	<i>Picea sitchensis</i>	A	7	0.37	
26	Denmark	<i>Pilosella aurantiaca</i>	E	1	0.05	
27	Denmark	<i>Pinus contorta</i>	A	1	0.05	
28	Denmark	<i>Pinus mugo</i>	E	7	0.37	
29	Denmark	<i>Pinus nigra</i>	E	2	0.11	
30	Denmark	<i>Populus alba</i>	E	1	0.05	
31	Denmark	<i>Populus x canescens</i>	E	1	0.05	
32	Denmark	<i>Potentilla recta</i>	E	2	0.11	
33	Denmark	<i>Prunus cerasifera</i>	E	60	3.18	
34	Denmark	<i>Prunus serotina</i>	A	14	0.74	
35	Denmark	<i>Reseda lutea</i>	E	4	0.21	
36	Denmark	<i>Reynoutria japonica</i>	A	1	0.05	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	Denmark	<i>Ribes uva-crispa</i>	E	6	0.32	
4	Denmark	<i>Rosa rugosa</i>	A	27	1.43	
5	Denmark	<i>Rubus laciniatus</i>	C	1	0.05	
6	Denmark	<i>Rubus ulmifolius</i>	E	1	0.05	
7	Denmark	<i>Rudbeckia</i>	A	1	0.05	
8	Denmark	<i>Salix alba</i>	E	1	0.05	
9	Denmark	<i>Salix viminalis</i>	E	3	0.16	
10	Denmark	<i>Salix x fragilis</i>	E	2	0.11	
11	Denmark	<i>Salix x smithiana</i>	E	1	0.05	
12	Denmark	<i>Sanguisorba minor</i>	E	15	0.80	
13	Denmark	<i>Saponaria officinalis</i>	E	1	0.05	
14	Denmark	<i>Senecio leucanthemifolius</i>	E	4	0.21	
15	Denmark	<i>Solidago gigantea</i>	A	3	0.16	
16	Denmark	<i>Sorbus aria</i>	E	1	0.05	
17	Denmark	<i>Symphoricarpos albus</i>	A	2	0.11	
18	Denmark	<i>Symphytum x uplandicum</i>	C	4	0.21	
19	Denmark	<i>Syringa vulgaris</i>	E	2	0.11	
20	Denmark	<i>Trifolium hybridum</i>	C	4	0.21	
21	Denmark	<i>Veronica longifolia</i>	E	1	0.05	
22	Denmark	<i>Vicia sativa</i>	E	12	0.64	
23	Denmark	<i>Vicia villosa</i>	E	1	0.05	
24	Denmark	<i>Zea mays</i>	A	1	0.05	
25	Estonia	<i>Aquilegia vulgaris</i>	E	2	0.21	
26	Estonia	<i>Lolium multiflorum</i>	E	2	0.21	
27	Estonia	<i>Lolium perenne</i>	E	1	0.10	
28	Estonia	<i>Lotus maritimus</i>	E	2	0.21	
29	Estonia	<i>Medicago sativa</i>	C	3	0.31	
30	Estonia	<i>Trifolium alpestre</i>	E	2	0.21	
31	Finland	<i>Achillea ptarmica</i>	E	170	39.53	
32	Finland	<i>Cota triumfettii</i>	E	2	0.47	
33	Finland	<i>Epilobium ciliatum</i>	A	30	6.98	
34	Finland	<i>Fragaria moschata</i>	E	3	0.70	
35	Finland	<i>Galium album</i>	E	100	23.26	subsp. <i>album</i>
36	Finland	<i>Galium x pomeranicum</i>	E	5	1.16	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Finland	<i>Holcus mollis</i>	E	2	0.47	
4	Finland	<i>Chaerophyllum prescottii</i>	E	8	1.86	
5	Finland	<i>Lolium multiflorum</i>	E	2	0.47	
6	Finland	<i>Lolium perenne</i>	E	15	3.49	
7	Finland	<i>Lupinus polyphyllus</i>	A	1	0.23	
8	Finland	<i>Matricaria discoidea</i>	A	19	4.42	
9	Finland	<i>Noccaea brachypetala</i>	E	3	0.70	
10	Finland	<i>Noccaea caerulea</i>	E	4	0.93	
11	Finland	<i>Odontites vernus</i>	E	2	0.47	
12	Finland	<i>Potentilla intermedia</i>	E	2	0.47	
13	Finland	<i>Potentilla thuringiaca</i>	E	1	0.23	
14	Finland	<i>Sambucus racemosa</i>	E	1	0.23	
15	Finland	<i>Trifolium hybridum</i>	C	74	17.21	
16	Finland	<i>Veronica agrestis</i>	E	1	0.23	
17	France	<i>Acacia dealbata</i>	A	3	0.02	
18	France	<i>Acer negundo</i>	A	5	0.03	
19	France	<i>Allium ascalonicum</i>	A	3	0.02	
20	France	<i>Amaranthus albus</i>	A	1	0.01	
21	France	<i>Amaranthus blitoides</i>	A	1	0.01	
22	France	<i>Amaranthus deflexus</i>	A	1	0.01	
23	France	<i>Amaranthus emarginatus</i>	A	1	0.01	
24	France	<i>Amaranthus hybridus</i>	A	3	0.02	
25	France	<i>Ambrosia artemisiifolia</i>	A	9	0.05	
26	France	<i>Angelica archangelica</i>	E	4	0.02	
27	France	<i>Armoracia rusticana</i>	E	1	0.01	
28	France	<i>Artemisia biennis</i>	A	1	0.01	
29	France	<i>Artemisia verlotiorum</i>	A	1	0.01	
30	France	<i>Arundo donax</i>	A	4	0.02	
31	France	<i>Asclepias syriaca</i>	A	1	0.01	
32	France	<i>Atriplex tatarica</i>	E	1	0.01	
33	France	<i>Avena sativa</i>	C	1	0.01	
34	France	<i>Avena strigosa</i>	E	1	0.01	
35	France	<i>Baccharis halimifolia</i>	A	6	0.03	
36	France	<i>Berteroa incana</i>	E	98	0.51	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	France	<i>Bidens connatus</i>	A	1	0.01	
4	France	<i>Bidens frondosus</i>	A	31	0.16	
5	France	<i>Brassica elongata</i>	E	1	0.01	
6	France	<i>Brassica napus</i>	C	2	0.01	
7						
8	France	<i>Bromus brachystachys</i>	E	2	0.01	
9	France	<i>Buddleja davidii</i>	A	3	0.02	
10	France	<i>Carduus tenuiflorus</i>	E	17	0.09	
11	France	<i>Cedrus atlantica</i>	A	4	0.02	
12	France	<i>Collomia grandiflora</i>	A	7	0.04	
13	France	<i>Cotula coronopifolia</i>	A	9	0.05	
14						
15	France	<i>Crassula lycopodioides</i>	A	145	0.76	
16	France	<i>Crataegus germanica</i>	E	2	0.01	
17	France	<i>Crepis sancta</i>	E	36	0.19	
18	France	<i>Cuscuta campestris</i>	A	1	0.01	
19	France	<i>Cuscuta suaveolens</i>	A	6	0.03	
20	France	<i>Cymbalaria muralis</i>	E	2	0.01	
21						
22	France	<i>Cyperus eragrostis</i>	A	7	0.04	
23	France	<i>Dianthus caryophyllus</i>	E	56	0.29	
24	France	<i>Dysphania ambrosioides</i>	A	8	0.04	
25						
26	France	<i>Elaeagnus angustifolia</i>	A	1	0.01	
27	France	<i>Elodea canadensis</i>	A	1	0.01	
28	France	<i>Epilobium ciliatum</i>	A	1	0.01	
29	France	<i>Erigeron annuus</i>	A	53	0.28	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
30	France	<i>Erigeron canadensis</i>	A	108	0.57	
31	France	<i>Erigeron sumatrensis</i>	A	5	0.03	
32	France	<i>Erysimum cheiri</i>	E	2	0.01	
33	France	<i>Euthamia graminifolia</i>	A	1	0.01	
34	France	<i>Fragaria ananassa</i>	C	1	0.01	
35	France	<i>Freesia refracta</i>	A	2	0.01	
36	France	<i>Galega officinalis</i>	E	13	0.07	
37	France	<i>Galinsoga parviflora</i>	A	2	0.01	
38	France	<i>Galinsoga quadriradiata</i>	A	3	0.02	
39	France	<i>Helianthus tuberosus</i>	A	4	0.02	
40	France	<i>Impatiens balfourii</i>	A	2	0.01	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	France	<i>Impatiens glandulifera</i>	A	41	0.22	
4	France	<i>Impatiens parviflora</i>	A	5	0.03	
5	France	<i>Inula helenium</i>	E	8	0.04	
6	France	<i>Juglans regia</i>	E	38	0.20	
7	France	<i>Juncus tenuis</i>	A	46	0.24	
8	France	<i>Lathyrus hirsutus</i>	E	25	0.13	
9	France	<i>Lathyrus sativus</i>	C	2	0.01	
10	France	<i>Lepidium didymum</i>	A	1	0.01	
11	France	<i>Lepidium virginicum</i>	A	12	0.06	
12	France	<i>Lindernia dubia</i>	A	1	0.01	
13	France	<i>Lonicera japonica</i>	A	1	0.01	
14	France	<i>Ludwigia grandiflora</i>	A	2	0.01	
15	France	<i>Lupinus luteus</i>	E	1	0.01	
16	France	<i>Lycopersicon esculentum</i>	A	2	0.01	
17	France	<i>Lysimachia punctata</i>	E	1	0.01	
18	France	<i>Matricaria discoidea</i>	A	28	0.15	
19	France	<i>Medicago sativa</i>	C	15	0.08	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>
20	France	<i>Oenothera biennis</i>	A	27	0.14	
21	France	<i>Oenothera longiflora</i>	A	1	0.01	
22	France	<i>Oenothera parviflora</i>	A	2	0.01	
23	France	<i>Oenothera suaveolens</i>	A	2	0.01	
24	France	<i>Oxalis dillenii</i>	A	41	0.22	
25	France	<i>Oxalis pes-caprae</i>	A	1	0.01	
26	France	<i>Oxalis stricta</i>	A	11	0.06	
27	France	<i>Panicum capillare</i>	A	9	0.05	
28	France	<i>Paspalum dilatatum</i>	A	3	0.02	
29	France	<i>Paspalum distichum</i>	A	6	0.03	
30	France	<i>Paspalum vaginatum</i>	A	2	0.01	
31	France	<i>Phaseolus vulgaris</i>	A	1	0.01	
32	France	<i>Populus x canadensis</i>	C	2	0.01	
33	France	<i>Potentilla indica</i>	A	1	0.01	
34	France	<i>Prunus cerasifera</i>	E	1	0.01	
35	France	<i>Prunus cerasus</i>	A	4	0.02	
36	France	<i>Prunus domestica</i>	C	1	0.01	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	France	<i>Prunus dulcis</i>	C	3	0.02	
4	France	<i>Prunus serotina</i>	A	7	0.04	
5	France	<i>Pseudotsuga menziesii</i>	A	6	0.03	
6	France	<i>Quercus rubra</i>	A	5	0.03	
7	France	<i>Reynoutria japonica</i>	A	8	0.04	
8	France	<i>Ricinus communis</i>	A	1	0.01	
9	France	<i>Robinia pseudoacacia</i>	A	30	0.16	
10	France	<i>Rorippa austriaca</i>	E	1	0.01	
11	France	<i>Rubus spectabilis</i>	A	16	0.08	
12	France	<i>Rudbeckia laciniata</i>	A	4	0.02	
13	France	<i>Rumex patientia</i>	E	2	0.01	
14	France	<i>Rumex thysiflorus</i>	E	76	0.40	
15	France	<i>Ruta graveolens</i>	E	3	0.02	
16	France	<i>Sisyrinchium angustifolium</i>	A	1	0.01	
17	France	<i>Sisyrinchium montanum</i>	A	1	0.01	
18	France	<i>Solanum gracile</i>	A	1	0.01	
19	France	<i>Solidago canadensis</i>	A	18	0.09	
20	France	<i>Solidago gigantea</i>	A	70	0.37	
21	France	<i>Sorghum halepense</i>	A	1	0.01	
22	France	<i>Spartina x townsendii</i>	C	2	0.01	
23	France	<i>Sporobolus indicus</i>	A	1	0.01	
24	France	<i>Symphyotrichum lanceolatum</i>	A	7	0.04	
25	France	<i>Symphyotrichum novi-belgii</i>	A	1	0.01	
26	France	<i>Symphyotrichum parviflorum</i>	A	1	0.01	
27	France	<i>Symphyotrichum salignum</i>	A	3	0.02	
28	France	<i>Symphyotrichum squamatum</i>	A	2	0.01	
29	France	<i>Tanacetum coccineum</i>	E	1	0.01	
30	France	<i>Veronica filiformis</i>	E	2	0.01	
31	France	<i>Veronica peregrina</i>	A	3	0.02	
32	France	<i>Veronica persica</i>	A	32	0.17	
33	France	<i>Xanthium orientale</i>	A	2	0.01	
34	France	<i>Zinnia elegans</i>	A	1	0.01	
35	Germany	<i>Acorus calamus</i>	A	22	0.16	
36	Germany	<i>Aesculus hippocastanum</i>	E	1	0.01	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	Germany	<i>Agrostis castellana</i>	E	1	0.01	
4	Germany	<i>Alchemilla mollis</i>	E	20	0.14	
5	Germany	<i>Amaranthus retroflexus</i>	A	2	0.01	
6	Germany	<i>Ambrosia artemisiifolia</i>	A	3	0.02	
7	Germany	<i>Anthoxanthum aristatum</i>	E	18	0.13	
8	Germany	<i>Armoracia rusticana</i>	E	4	0.03	
9	Germany	<i>Atriplex hortensis</i>	E	1	0.01	
10	Germany	<i>Bassia scoparia</i>	E	1	0.01	
11	Germany	<i>Berteroa incana</i>	E	86	0.62	
12	Germany	<i>Bidens frondosus</i>	A	14	0.10	
13	Germany	<i>Brassica napus</i>	C	3	0.02	
14	Germany	<i>Bunias orientalis</i>	E	12	0.09	
15	Germany	<i>Calystegia silvatica</i>	E	1	0.01	
16	Germany	<i>Caragana arborescens</i>	A	1	0.01	
17	Germany	<i>Centaurea nigrescens</i>	E	6	0.04	subsp. <i>nigrescens</i>
18	Germany	<i>Cerastium tomentosum</i>	E	13	0.09	
19	Germany	<i>Corispermum intermedium</i>	E	9	0.06	
20	Germany	<i>Cotinus coggygria</i>	E	1	0.01	
21	Germany	<i>Cotula coronopifolia</i>	A	1	0.01	
22	Germany	<i>Crepis nicaeensis</i>	E	1	0.01	
23	Germany	<i>Cynodon dactylon</i>	E	6	0.04	
24	Germany	<i>Dactylis glomerata</i>	E	1	0.01	
25	Germany	<i>Diplotaxis tenuifolia</i>	E	7	0.05	
26	Germany	<i>Echinops sphaerocephalus</i>	E	16	0.12	
27	Germany	<i>Elaeagnus commutata</i>	A	1	0.01	
28	Germany	<i>Epilobium ciliatum</i>	A	72	0.52	
29	Germany	<i>Eragrostis minor</i>	E	1	0.01	
30	Germany	<i>Erigeron annuus</i>	A	19	0.14	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
31	Germany	<i>Erigeron canadensis</i>	A	325	2.34	
32	Germany	<i>Fritillaria meleagris</i>	E	25	0.18	
33	Germany	<i>Galinsoga parviflora</i>	A	10	0.07	
34	Germany	<i>Galinsoga quadriradiata</i>	A	5	0.04	
35	Germany	<i>Geranium purpureum</i>	E	1	0.01	
36	Germany	<i>Geranium pyrenaicum</i>	E	10	0.07	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Germany	<i>Helianthus annuus</i>	A	2	0.01	
4	Germany	<i>Helianthus tuberosus</i>	A	1	0.01	
5	Germany	<i>Helminthotheca echioides</i>	E	1	0.01	
6	Germany	<i>Heracleum mantegazzianum</i>	E	1	0.01	
7	Germany	<i>Hesperis matronalis</i>	E	5	0.04	
8	Germany	<i>Chenopodium strictum</i>	E	1	0.01	
9	Germany	<i>Impatiens glandulifera</i>	A	72	0.52	
10	Germany	<i>Impatiens parviflora</i>	A	13	0.09	
11	Germany	<i>Juncus tenuis</i>	A	51	0.37	
12	Germany	<i>Laburnum anagyroides</i>	E	1	0.01	
13	Germany	<i>Lactuca tatarica</i>	E	1	0.01	
14	Germany	<i>Lepidium densiflorum</i>	A	1	0.01	
15	Germany	<i>Lepidium draba</i>	E	4	0.03	
16	Germany	<i>Lepidium heterophyllum</i>	E	1	0.01	
17	Germany	<i>Linum austriacum</i>	E	17	0.12	
18	Germany	<i>Lolium multiflorum</i>	E	136	0.98	
19	Germany	<i>Lupinus polyphyllus</i>	A	16	0.12	
20	Germany	<i>Lycium barbarum</i>	A	1	0.01	
21	Germany	<i>Matricaria discoidea</i>	A	31	0.22	
22	Germany	<i>Medicago sativa</i>	C	216	1.56	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>
23	Germany	<i>Mentha x piperita</i>	C	1	0.01	
24	Germany	<i>Mimulus guttatus</i>	A	2	0.01	
25	Germany	<i>Narcissus poeticus</i>	E	4	0.03	subsp. <i>poeticus</i> , subsp. <i>radiiflorus</i>
26	Germany	<i>Oenothera</i> sp.	A	27	0.19	
27	Germany	<i>Oenothera biennis</i>	A	31	0.22	
28	Germany	<i>Onobrychis viciifolia</i>	E	177	1.28	
29	Germany	<i>Ornithogalum nutans</i>	E	1	0.01	
30	Germany	<i>Ornithopus sativus</i>	E	5	0.04	
31	Germany	<i>Oxalis stricta</i>	A	1	0.01	
32	Germany	<i>Pinus nigra</i>	E	4	0.03	
33	Germany	<i>Populus balsamifera</i>	A	1	0.01	
34	Germany	<i>Populus trichocarpa</i>	A	1	0.01	
35	Germany	<i>Populus x canadensis</i>	C	6	0.04	
36	Germany	<i>Prunus cerasus</i>	A	7	0.05	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
1						
2						
3	Germany	<i>Prunus domestica</i>	C	22	0.16	
4	Germany	<i>Prunus serotina</i>	A	7	0.05	
5	Germany	<i>Pseudotsuga menziesii</i>	A	1	0.01	
6	Germany	<i>Quercus rubra</i>	A	3	0.02	
7	Germany	<i>Reynoutria sachalinensis</i>	A	1	0.01	
8	Germany	<i>Robinia pseudoacacia</i>	A	12	0.09	
9	Germany	<i>Rosa rugosa</i>	A	1	0.01	
10	Germany	<i>Rubus armeniacus</i>	E	2	0.01	
11	Germany	<i>Rudbeckia laciniata</i>	A	1	0.01	
12	Germany	<i>Rumex triangulivalvis</i>	A	1	0.01	
13	Germany	<i>Salix integra</i>	A	5	0.04	
14	Germany	<i>Salsola tragus</i>	E	7	0.05	
15	Germany	<i>Salvia officinalis</i>	E	1	0.01	
16	Germany	<i>Sanguisorba minor</i>	E	9	0.06	
17	Germany	<i>Sedum spurium</i>	E	3	0.02	
18	Germany	<i>Senecio leucanthemifolius</i>	E	142	1.02	
19	Germany	<i>Sisymbrium altissimum</i>	E	1	0.01	
20	Germany	<i>Sisymbrium loeselii</i>	E	8	0.06	
21	Germany	<i>Solanum tuberosum</i>	A	1	0.01	
22	Germany	<i>Solidago canadensis</i>	A	36	0.26	
23	Germany	<i>Solidago gigantea</i>	A	51	0.37	
24	Germany	<i>Symphyotrichum lanceolatum</i>	A	2	0.01	
25	Germany	<i>Symphyotrichum novi-belgii</i>	A	10	0.07	
26	Germany	<i>Symphyotrichum parviflorum</i>	A	1	0.01	
27	Germany	<i>Symphyotrichum salignum</i>	A	2	0.01	
28	Germany	<i>Symphytum asperum</i>	E	1	0.01	
29	Germany	<i>Syringa vulgaris</i>	E	2	0.01	
30	Germany	<i>Telekia speciosa</i>	E	19	0.14	
31	Germany	<i>Thymus pulegioides</i>	E	40	0.29	
32	Germany	<i>Trifolium hybridum</i>	C	131	0.94	subsp. <i>hybridum</i>
33	Germany	<i>Trifolium resupinatum</i>	E	1	0.01	
34	Germany	<i>Ulex europaeus</i>	E	1	0.01	
35	Germany	<i>Veronica filiformis</i>	E	3	0.02	
36	Germany	<i>Veronica persica</i>	A	16	0.12	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	Germany	<i>Vicia grandiflora</i>	E	1	0.01	
4	Germany	<i>Vicia pannonica</i>	E	2	0.01	subsp. <i>pannonica</i>
5	Germany	<i>Vicia villosa</i>	E	41	0.30	subsp. <i>villosa</i>
6	Germany	<i>Xanthium orientale</i>	A	4	0.03	
7	Germany	<i>Zea mays</i>	A	1	0.01	
8						
9	Greece	<i>Cenchrus spinifex</i>	A	1	0.21	
10	Greece	<i>Cyperus sharonensis</i>	A	2	0.42	
11	Greece	<i>Digitaria ciliaris</i>	A	1	0.21	
12	Greece	<i>Linum numidicum</i>	A	1	0.21	
13	Greece	<i>Oenothera drummondii</i>	A	6	1.25	
14	Greece	<i>Xanthium spinosum</i>	A	4	0.83	
15						
16	Hungary	<i>Ambrosia artemisiifolia</i>	A	18	6.59	
17	Hungary	<i>Asclepias syriaca</i>	A	1	0.37	
18	Hungary	<i>Bidens frondosus</i>	A	1	0.37	
19	Hungary	<i>Erigeron annuus</i>	A	4	1.47	
20	Hungary	<i>Erigeron canadensis</i>	A	15	5.49	
21	Hungary	<i>Fagopyrum esculentum</i>	C	1	0.37	
22	Hungary	<i>Hemerocallis lilioasphodelus</i>	E	2	0.73	
23	Hungary	<i>Melissa officinalis</i>	E	1	0.37	
24	Hungary	<i>Oenothera biennis</i>	A	2	0.73	
25	Hungary	<i>Onobrychis viciifolia</i>	E	1	0.37	
26	Hungary	<i>Robinia pseudoacacia</i>	A	1	0.37	
27	Hungary	<i>Solidago canadensis</i>	A	1	0.37	
28	Hungary	<i>Solidago gigantea</i>	A	14	5.13	
29	Hungary	<i>Xanthium</i> sp.	A	1	0.37	
30						
31	Ireland	<i>Crepis vesicaria</i>	E	2	1.36	
32	Ireland	<i>Epilobium brunnescens</i>	A	5	3.40	
33	Ireland	<i>Lepidium didymum</i>	A	2	1.36	
34	Ireland	<i>Matricaria discoidea</i>	A	3	2.04	
35	Ireland	<i>Rhododendron ponticum</i>	E	1	0.68	
36	Ireland	<i>Veronica persica</i>	A	2	1.36	
37						
38	Italy	<i>Agave americana</i>	A	1	0.04	
39	Italy	<i>Ailanthus altissima</i>	A	2	0.07	
40	Italy	<i>Ambrosia psilostachya</i>	A	18	0.67	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Italy	<i>Ambrosia tenuifolia</i>	A	1	0.04	
4	Italy	<i>Amorpha</i> sp.	A	4	0.15	
5	Italy	<i>Amorpha fruticosa</i>	A	10	0.37	
6	Italy	<i>Artemisia verlotiorum</i>	A	9	0.33	
7	Italy	<i>Bidens frondosus</i>	A	12	0.45	
8	Italy	<i>Carpobrotus acinaciformis</i>	A	2	0.07	
9	Italy	<i>Carpobrotus edulis</i>	A	2	0.07	
10	Italy	<i>Cenchrus spinifex</i>	A	12	0.45	
11	Italy	<i>Ceratochloa cathartica</i>	A	1	0.04	
12	Italy	<i>Crepis sancta</i>	E	30	1.11	
13	Italy	<i>Cuscuta campestris</i>	A	1	0.04	
14	Italy	<i>Cycloloma atriplicifolium</i>	A	1	0.04	
15	Italy	<i>Dactyloctenium aegyptium</i>	A	1	0.04	
16	Italy	<i>Dipsacus laciniatus</i>	E	1	0.04	
17	Italy	<i>Dysphania ambrosioides</i>	A	3	0.11	
18	Italy	<i>Elaeagnus angustifolia</i>	A	2	0.07	
19	Italy	<i>Erigeron annuus</i>	A	9	0.33	
20	Italy	<i>Erigeron bonariensis</i>	A	9	0.33	
21	Italy	<i>Erigeron canadensis</i>	A	27	1.00	
22	Italy	<i>Erigeron sumatrensis</i>	A	5	0.19	
23	Italy	<i>Galinsoga parviflora</i>	A	1	0.04	
24	Italy	<i>Helianthus tuberosus</i>	A	3	0.11	
25	Italy	<i>Impatiens parviflora</i>	A	2	0.07	
26	Italy	<i>Juncus tenuis</i>	A	2	0.07	
27	Italy	<i>Matricaria discoidea</i>	A	3	0.11	
28	Italy	<i>Oenothera biennis</i>	A	40	1.49	
29	Italy	<i>Oenothera glazioviana</i>	A	2	0.07	
30	Italy	<i>Oenothera parviflora</i>	A	1	0.04	
31	Italy	<i>Oenothera suaveolens</i>	A	2	0.07	
32	Italy	<i>Onobrychis viciifolia</i>	E	129	4.79	
33	Italy	<i>Oxalis dillenii</i>	A	1	0.04	
34	Italy	<i>Oxalis pes-caprae</i>	A	1	0.04	
35	Italy	<i>Oxalis stricta</i>	A	1	0.04	
36	Italy	<i>Paspalum distichum</i>	A	20	0.74	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
3	Italy	<i>Phalaris canariensis</i>	E	2	0.07	
4	Italy	<i>Phytolacca americana</i>	A	1	0.04	
5	Italy	<i>Potentilla norvegica</i>	E	2	0.07	
6	Italy	<i>Reynoutria japonica</i>	A	1	0.04	
8	Italy	<i>Robinia pseudoacacia</i>	A	2	0.07	
9	Italy	<i>Senecio inaequidens</i>	A	1	0.04	
10	Italy	<i>Solidago gigantea</i>	A	5	0.19	
11	Italy	<i>Sporobolus virginicus</i>	A	23	0.85	
12	Italy	<i>Symphyotrichum squamatum</i>	A	9	0.33	
14	Italy	<i>Trachelium caeruleum</i>	E	2	0.07	
15	Italy	<i>Veronica persica</i>	A	11	0.41	
16	Italy	<i>Xanthium orientale</i>	A	52	1.93	
17	Italy	<i>Yucca gloriosa</i>	A	2	0.07	
18	Kosovo	<i>Medicago sativa</i>	C	2	0.77	
20	Latvia	<i>Armoracia rusticana</i>	E	1	0.11	
21	Latvia	<i>Asparagus officinalis</i>	E	1	0.11	
22	Latvia	<i>Centaurea calcitrapa</i>	E	1	0.11	
23	Latvia	<i>Epilobium ciliatum</i>	A	1	0.11	
24	Latvia	<i>Erigeron annuus</i>	A	7	0.77	
25	Latvia	<i>Erigeron canadensis</i>	A	15	1.64	
27	Latvia	<i>Fagopyrum esculentum</i>	C	1	0.11	
28	Latvia	<i>Galinsoga quadriradiata</i>	A	1	0.11	
29	Latvia	<i>Glycine max</i>	A	1	0.11	
30	Latvia	<i>Heracleum pubescens</i>	E	1	0.11	
31	Latvia	<i>Impatiens glandulifera</i>	A	2	0.22	
32	Latvia	<i>Impatiens parviflora</i>	A	1	0.11	
34	Latvia	<i>Juncus tenuis</i>	A	1	0.11	
35	Latvia	<i>Lupinus polyphyllus</i>	A	4	0.44	
36	Latvia	<i>Malva sylvestris</i>	E	2	0.22	
37	Latvia	<i>Medicago sativa</i>	C	29	3.18	
38	Latvia	<i>Oenothera biennis</i>	A	14	1.54	
39	Latvia	<i>Oenothera rubricaulis</i>	A	1	0.11	
40	Latvia	<i>Pilosella aurantiaca</i>	E	1	0.11	
41	Latvia	<i>Plantago arenaria</i>	E	1	0.11	

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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
3	Latvia	<i>Potentilla inclinata</i>	E	9	0.99	
4	Latvia	<i>Prunus avium</i>	E	1	0.11	
5	Latvia	<i>Rumex confertus</i>	E	7	0.77	
6	Latvia	<i>Saponaria officinalis</i>	E	4	0.44	
7	Latvia	<i>Senecio leucanthemifolius</i>	E	6	0.66	
8	Latvia	<i>Solidago canadensis</i>	A	6	0.66	
9	Latvia	<i>Symphoricarpos albus</i>	A	1	0.11	
10	Latvia	<i>Symphyotrichum salignum</i>	A	1	0.11	
11	Latvia	<i>Symphyotrichum salignum</i>	A	1	0.11	
12	Lithuania	<i>Acer negundo</i>	A	1	0.21	
13	Lithuania	<i>Acorus calamus</i>	A	3	0.64	
14	Lithuania	<i>Agropyron dasyanthum</i>	E	5	1.07	
15	Lithuania	<i>Epilobium ciliatum</i>	A	1	0.21	
16	Lithuania	<i>Erigeron annuus</i>	A	9	1.92	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
17	Lithuania	<i>Erigeron canadensis</i>	A	27	5.77	
18	Lithuania	<i>Galinsoga quadriradiata</i>	A	2	0.43	
19	Lithuania	<i>Glyceria striata</i>	A	1	0.21	
20	Lithuania	<i>Helianthus tuberosus</i>	A	1	0.21	
21	Lithuania	<i>Heliotropium arborescens</i>	A	1	0.21	
22	Lithuania	<i>Heracleum pubescens</i>	E	3	0.64	
23	Lithuania	<i>Hippophae rhamnoides</i>	E	1	0.21	
24	Lithuania	<i>Hordeum jubatum</i>	A	2	0.43	
25	Lithuania	<i>Impatiens glandulifera</i>	A	1	0.21	
26	Lithuania	<i>Juncus tenuis</i>	A	2	0.43	
27	Lithuania	<i>Lactuca serriola</i>	E	1	0.21	
28	Lithuania	<i>Lupinus polyphyllus</i>	A	8	1.71	
29	Lithuania	<i>Matricaria discoidea</i>	A	22	4.70	
30	Lithuania	<i>Medicago sativa</i>	C	1	0.21	
31	Lithuania	<i>Mimulus guttatus</i>	A	1	0.21	
32	Lithuania	<i>Oenothera ammophila</i>	A	1	0.21	
33	Lithuania	<i>Oenothera biennis</i>	A	14	2.99	
34	Lithuania	<i>Oenothera rubricaulis</i>	A	7	1.50	
35	Lithuania	<i>Onobrychis viciifolia</i>	E	4	0.85	
36	Lithuania	<i>Parthenocissus quinquefolia</i>	A	1	0.21	
37	Lithuania	<i>Petasites hybridus</i>	E	7	1.50	

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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
1	Lithuania	<i>Rosa rugosa</i>	A	3	0.64	
2	Lithuania	<i>Rudbeckia</i> sp.	A	1	0.21	
3	Lithuania	<i>Salix euxina</i>	E	1	0.21	
4	Lithuania	<i>Saponaria officinalis</i>	E	7	1.50	
5	Lithuania	<i>Sedum album</i>	E	1	0.21	
6	Lithuania	<i>Sedum rupestre</i>	E	1	0.21	
7	Lithuania	<i>Senecio leucanthemifolius</i>	E	3	0.64	
8	Luxembourg	* NA				
9	Macedonia	* <i>Pistacia terebinthus</i>	E	5	7.04	
10	Moldavia	<i>Acer negundo</i>	A	7	3.48	
11	Moldavia	<i>Ailanthus altissima</i>	A	10	4.98	
12	Moldavia	<i>Ambrosia artemisiifolia</i>	A	10	4.98	
13	Moldavia	<i>Cuscuta campestris</i>	A	1	0.50	
14	Moldavia	<i>Elaeagnus angustifolia</i>	A	1	0.50	
15	Moldavia	<i>Erigeron annuus</i>	A	4	1.99	
16	Moldavia	<i>Erigeron canadensis</i>	A	1	0.50	
17	Moldavia	<i>Impatiens parviflora</i>	A	1	0.50	
18	Moldavia	<i>Lepidium draba</i>	E	1	0.50	
19	Moldavia	<i>Oenothera parviflora</i>	A	1	0.50	
20	Moldavia	<i>Onobrychis viciifolia</i>	E	3	1.49	
21	Moldavia	<i>Prunus cerasifera</i>	E	1	0.50	
22	Moldavia	<i>Robinia pseudoacacia</i>	A	1	0.50	
23	Montenegro	* NA				
24	Netherlands	<i>Acorus calamus</i>	A	15	0.89	
25	Netherlands	<i>Amelanchier lamarckii</i>	A	3	0.18	
26	Netherlands	<i>Aronia x prunifolia</i>	A	1	0.06	
27	Netherlands	<i>Azolla filiculoides</i>	A	1	0.06	
28	Netherlands	<i>Berteroa incana</i>	E	1	0.06	
29	Netherlands	<i>Bidens frondosus</i>	A	3	0.18	
30	Netherlands	<i>Brassica napus</i>	C	1	0.06	
31	Netherlands	<i>Claytonia perfoliata</i>	A	1	0.06	
32	Netherlands	<i>Cyanus segetum</i>	C	1	0.06	
33	Netherlands	<i>Cynodon dactylon</i>	E	4	0.24	
34	Netherlands	<i>Echinochloa crus-galli</i>	C	1	0.06	

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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Netherlands	<i>Elodea canadensis</i>	A	2	0.12	
4	Netherlands	<i>Elodea nuttallii</i>	A	3	0.18	
5	Netherlands	<i>Epilobium ciliatum</i>	A	8	0.48	
6	Netherlands	<i>Erigeron canadensis</i>	A	26	1.55	
7	Netherlands	<i>Galinsoga quadriradiata</i>	A	1	0.06	
8	Netherlands	<i>Geranium pyrenaicum</i>	E	1	0.06	
9	Netherlands	<i>Heracleum mantegazzianum</i>	E	1	0.06	
10	Netherlands	<i>Impatiens glandulifera</i>	A	3	0.18	
11	Netherlands	<i>Juncus tenuis</i>	A	4	0.24	
12	Netherlands	<i>Larix kaempferi</i>	A	1	0.06	
13	Netherlands	<i>Lepidium didymum</i>	A	1	0.06	
14	Netherlands	<i>Lepidium draba</i>	E	2	0.12	
15	Netherlands	<i>Lolium multiflorum</i>	E	2	0.12	
16	Netherlands	<i>Lycium chinense</i>	A	1	0.06	
17	Netherlands	<i>Matricaria discoidea</i>	A	37	2.20	
18	Netherlands	<i>Medicago sativa</i>	C	7	0.42	
19	Netherlands	<i>Oenothera</i> sp.	A	1	0.06	
20	Netherlands	<i>Oenothera biennis</i>	A	2	0.12	
21	Netherlands	<i>Oxalis stricta</i>	A	1	0.06	
22	Netherlands	<i>Picea abies</i>	E	1	0.06	
23	Netherlands	<i>Pilosella aurantiaca</i>	E	1	0.06	
24	Netherlands	<i>Pilosella caespitosa</i>	E	1	0.06	
25	Netherlands	<i>Pinus nigra</i>	E	1	0.06	
26	Netherlands	<i>Plantago arenaria</i>	E	1	0.06	
27	Netherlands	<i>Populus alba</i>	E	1	0.06	
28	Netherlands	<i>Prunus serotina</i>	A	17	1.01	
29	Netherlands	<i>Quercus rubra</i>	A	3	0.18	
30	Netherlands	<i>Rumex thyrsiflorus</i>	E	23	1.37	
31	Netherlands	<i>Senecio inaequidens</i>	A	5	0.30	
32	Netherlands	<i>Solanum tuberosum</i>	A	1	0.06	
33	Netherlands	<i>Solidago gigantea</i>	A	5	0.30	
34	Netherlands	<i>Veronica filiformis</i>	E	1	0.06	
35	Netherlands	<i>Veronica persica</i>	A	3	0.18	
36	Netherlands	<i>x Festulolium loliaceum</i>	C	1	0.06	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
1	Norway	<i>Achillea ptarmica</i>	E	1	0.29	
2	Norway	<i>Noccaea caerulea</i>	E	1	0.29	
3	Norway	<i>Potentilla anglica</i>	E	1	0.29	
4	Norway	<i>Potentilla reptans</i>	E	4	1.15	
5	Poland	<i>Acer negundo</i>	A	3	0.03	
6	Poland	<i>Acer saccharinum</i>	A	2	0.02	
7	Poland	<i>Acorus calamus</i>	A	14	0.13	
8	Poland	<i>Aesculus hippocastanum</i>	E	4	0.04	
9	Poland	<i>Amaranthus retroflexus</i>	A	4	0.04	
10	Poland	<i>Anthemis ruthenica</i>	E	1	0.01	
11	Poland	<i>Anthoxanthum aristatum</i>	E	11	0.10	
12	Poland	<i>Artemisia austriaca</i>	E	2	0.02	
13	Poland	<i>Asclepias syriaca</i>	A	1	0.01	
14	Poland	<i>Atriplex tatarica</i>	E	5	0.05	
15	Poland	<i>Beckmannia eruciformis</i>	E	10	0.10	
16	Poland	<i>Berberis verruculosa</i>	A	1	0.01	
17	Poland	<i>Bidens connatus</i>	A	3	0.03	
18	Poland	<i>Bidens frondosus</i>	A	70	0.67	
19	Poland	<i>Brassica elongata</i>	E	1	0.01	
20	Poland	<i>Brassica napus</i>	C	2	0.02	
21	Poland	<i>Brassica rapa</i>	E	1	0.01	
22	Poland	<i>Bunias orientalis</i>	E	1	0.01	
23	Poland	<i>Celastrus orbiculatus</i>	A	1	0.01	
24	Poland	<i>Corispermum hyssopifolium</i>	E	1	0.01	
25	Poland	<i>Corispermum intermedium</i>	E	2	0.02	
26	Poland	<i>Cornus sericea</i>	A	2	0.02	
27	Poland	<i>Cymbalaria muralis</i>	E	1	0.01	
28	Poland	<i>Diplotaxis muralis</i>	E	1	0.01	
29	Poland	<i>Echinocystis lobata</i>	A	12	0.11	
30	Poland	<i>Echinops sphaerocephalus</i>	E	5	0.05	
31	Poland	<i>Epilobium ciliatum</i>	A	26	0.25	subsp. <i>adenocaulon</i> , subsp. <i>ciliatum</i>
32	Poland	<i>Eragrostis minor</i>	E	1	0.01	
33	Poland	<i>Erigeron annuus</i>	A	109	1.04	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
34	Poland	<i>Erigeron canadensis</i>	A	291	2.77	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Poland	<i>Euonymus fortunei</i>	A	1	0.01	
4	Poland	<i>Euthamia graminifolia</i>	A	7	0.07	
5	Poland	<i>Forsythia suspensa</i>	A	1	0.01	
6	Poland	<i>Fragaria ananassa</i>	C	1	0.01	
7	Poland	<i>Fraxinus pennsylvanica</i>	A	4	0.04	
8	Poland	<i>Galinsoga parviflora</i>	A	18	0.17	
9	Poland	<i>Galinsoga quadriradiata</i>	A	2	0.02	
10	Poland	<i>Galium parisiense</i>	E	1	0.01	
11	Poland	<i>Geranium pyrenaicum</i>	E	1	0.01	
12	Poland	<i>Glyceria striata</i>	A	2	0.02	
13	Poland	<i>Helianthus tuberosus</i>	A	3	0.03	
14	Poland	<i>Heracleum mantegazzianum</i>	E	13	0.12	
15	Poland	<i>Heracleum pubescens</i>	E	22	0.21	
16	Poland	<i>Chenopodium strictum</i>	E	4	0.04	
17	Poland	<i>Impatiens capensis</i>	A	2	0.02	
18	Poland	<i>Impatiens glandulifera</i>	A	46	0.44	
19	Poland	<i>Impatiens parviflora</i>	A	75	0.71	
20	Poland	<i>Inula helenium</i>	E	1	0.01	
21	Poland	<i>Juglans cinerea</i>	A	1	0.01	
22	Poland	<i>Juncus tenuis</i>	A	66	0.63	
23	Poland	<i>Lathyrus sativus</i>	C	1	0.01	
24	Poland	<i>Lepidium virginicum</i>	A	1	0.01	
25	Poland	<i>Linaria spartea</i>	E	2	0.02	
26	Poland	<i>Linum austriacum</i>	E	1	0.01	
27	Poland	<i>Lolium multiflorum</i>	E	22	0.21	
28	Poland	<i>Lupinus luteus</i>	E	5	0.05	
29	Poland	<i>Lupinus polyphyllus</i>	A	79	0.75	
30	Poland	<i>Lycium barbatum</i>	A	1	0.01	
31	Poland	<i>Lycopersicon esculentum</i>	A	1	0.01	
32	Poland	<i>Malva moschata</i>	E	4	0.04	
33	Poland	<i>Matricaria discoidea</i>	A	68	0.65	
34	Poland	<i>Medicago sativa</i>	C	66	0.63	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>
35	Poland	<i>Mentha spicata</i>	C	1	0.01	
36	Poland	<i>Mimulus guttatus</i>	A	6	0.06	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Poland	<i>Narcissus poeticus</i>	E	1	0.01	
4	Poland	<i>Oenothera</i> sp.	A	1	0.01	
5	Poland	<i>Oenothera ammophila</i>	A	1	0.01	
6	Poland	<i>Oenothera biennis</i>	A	62	0.59	
7	Poland	<i>Oenothera parviflora</i>	A	1	0.01	
8	Poland	<i>Oenothera rubricaulis</i>	A	38	0.36	
9	Poland	<i>Onobrychis viciifolia</i>	E	53	0.51	
10	Poland	<i>Ornithopus sativus</i>	E	1	0.01	
11	Poland	<i>Oxalis fontana</i>	A	26	0.25	
12	Poland	<i>Oxalis stricta</i>	A	18	0.17	
13	Poland	<i>Papaver somniferum</i>	E	2	0.02	
14	Poland	<i>Phalaris paradoxa</i>	E	1	0.01	
15	Poland	<i>Picea pungens</i>	A	1	0.01	
16	Poland	<i>Pinguicula grandiflora</i>	E	2	0.02	
17	Poland	<i>Pinus banksiana</i>	A	1	0.01	
18	Poland	<i>Populus x canadensis</i>	C	1	0.01	
19	Poland	<i>Potentilla intermedia</i>	E	1	0.01	
20	Poland	<i>Prunus cerasifera</i>	E	1	0.01	
21	Poland	<i>Prunus cerasus</i>	A	11	0.10	
22	Poland	<i>Prunus serotina</i>	A	31	0.30	
23	Poland	<i>Pseudotsuga menziesii</i>	A	1	0.01	
24	Poland	<i>Quercus rubra</i>	A	11	0.10	
25	Poland	<i>Reynoutria japonica</i>	A	2	0.02	
26	Poland	<i>Rhus typhina</i>	A	1	0.01	
27	Poland	<i>Robinia pseudoacacia</i>	A	11	0.10	
28	Poland	<i>Rosa glauca</i>	E	2	0.02	
29	Poland	<i>Rosa rugosa</i>	A	3	0.03	
30	Poland	<i>Rubia tinctorium</i>	E	2	0.02	
31	Poland	<i>Rudbeckia laciniata</i>	A	8	0.08	
32	Poland	<i>Rumex confertus</i>	E	20	0.19	
33	Poland	<i>Salix daphnoides</i>	E	1	0.01	
34	Poland	<i>Senecio leucanthemifolius</i>	E	55	0.52	
35	Poland	<i>Silene flos-jovis</i>	E	5	0.05	
36	Poland	<i>Sisymbrium loeselii</i>	E	8	0.08	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Poland	<i>Solidago canadensis</i>	A	112	1.07	
4	Poland	<i>Solidago gigantea</i>	A	226	2.15	
5	Poland	<i>Spiraea japonica</i>	A	1	0.01	
6	Poland	<i>Spiraea tomentosa</i>	A	1	0.01	
7	Poland	<i>Symphoricarpos albus</i>	A	1	0.01	
8	Poland	<i>Symphyotrichum lanceolatum</i>	A	8	0.08	
9	Poland	<i>Symphyotrichum salignum</i>	A	2	0.02	
10	Poland	<i>Syringa vulgaris</i>	E	5	0.05	
11	Poland	<i>Tanacetum parthenium</i>	E	2	0.02	
12	Poland	<i>Thladiantha dubia</i>	A	5	0.05	
13	Poland	<i>Trifolium hybridum</i>	C	340	3.24	subsp. <i>elegans</i> , subsp. <i>hybridum</i>
14	Poland	<i>Trifolium incarnatum</i>	E	1	0.01	
15	Poland	<i>Veronica filiformis</i>	E	2	0.02	
16	Poland	<i>Veronica persica</i>	A	12	0.11	
17	Poland	<i>Vicia grandiflora</i>	E	13	0.12	
18	Poland	<i>Vicia pannonica</i>	E	1	0.01	
19	Poland	<i>x Festulolium loliaceum</i>	C	1	0.01	
20	Poland	<i>Xanthium</i> sp.	A	2	0.02	
21	Poland	<i>Xanthium orientale</i>	A	12	0.11	
22	Portugal	<i>Arctotheca calendula</i>	A	2	1.25	
23	Portugal	<i>Carpobrotus edulis</i>	A	30	18.75	
24	Portugal	<i>Hydrocotyle bonariensis</i>	A	5	3.13	
25	Portugal	<i>Oxalis debilis</i>	A	1	0.63	
26	Portugal	<i>Paspalum dilatatum</i>	A	1	0.63	
27	Portugal	<i>Paspalum distichum</i>	A	2	1.25	
28	Russia (Central)	* <i>Lepidium draba</i>	E	1	2.38	
29	Russia (Central)	* <i>Marrubium peregrinum</i>	E	8	19.05	
30	Russia (Caucasus)	<i>Ailanthus altissima</i>	A	1	0.35	
31	Russia (Caucasus)	<i>Ambrosia artemisiifolia</i>	A	3	1.04	
32	Russia (Caucasus)	<i>Amorpha fruticosa</i>	A	2	0.69	
33	Russia (Caucasus)	<i>Diplotaxis tenuifolia</i>	E	1	0.35	
34	Russia (Caucasus)	<i>Erigeron canadensis</i>	A	1	0.35	
35	Russia (Caucasus)	<i>Populus carolinensis</i>	A	1	0.35	
36	Russia (Caucasus)	<i>Spartium junceum</i>	E	1	0.35	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Russia (Caucasus)	<i>Veronica peregrina</i>	A	1	0.35	
4	Russia (Caucasus)	<i>Xanthium orientale</i>	A	3	1.04	
5	Russia (Caucasus)	<i>Xanthium pungens</i>	A	2	0.69	
6	Russia (East)	<i>Acer negundo</i>	A	8	0.34	
7	Russia (East)	<i>Aconitum nemorum</i>	A	2	0.09	
8	Russia (East)	<i>Caragana arborescens</i>	A	1	0.04	
9	Russia (East)	<i>Echinocystis lobata</i>	A	1	0.04	
10	Russia (East)	<i>Erigeron canadensis</i>	A	25	1.07	
11	Russia (East)	<i>Grindelia squarrosa</i>	A	2	0.09	
12	Russia (East)	<i>Helianthus annuus</i>	A	2	0.09	
13	Russia (East)	<i>Heracleum pubescens</i>	E	4	0.17	
14	Russia (East)	<i>Leontodon biscutellifolius</i>	E	1	0.04	
15	Russia (East)	<i>Lepidium densiflorum</i>	A	1	0.04	
16	Russia (East)	<i>Lupinus polyphyllus</i>	A	9	0.39	
17	Russia (East)	<i>Matricaria discoidea</i>	A	7	0.30	
18	Russia (East)	<i>Medicago sativa</i>	C	35	1.50	
19	Russia (East)	<i>Myosotis alpestris</i>	E	1	0.04	
20	Russia (East)	<i>Oenothera biennis</i>	A	3	0.13	
21	Russia (East)	<i>Onobrychis viciifolia</i>	E	3	0.13	
22	Russia (East)	<i>Parthenocissus quinquefolia</i>	A	1	0.04	
23	Russia (East)	<i>Physocarpus opulifolius</i>	A	1	0.04	
24	Russia (East)	<i>Potentilla grisea</i>	A	8	0.34	
25	Russia (East)	<i>Prunus cerasus</i>	A	3	0.13	
26	Russia (East)	<i>Sambucus racemosa</i>	E	5	0.21	
27	Russia (East)	<i>Symphotrichum salignum</i>	A	1	0.04	
28	Russia (East)	<i>Trifolium pratense</i>	C	2	0.09	
29	Russia (East)	<i>Ulmus pumila</i>	A	1	0.04	
30	Russia (East)	<i>Verbascum phlomoides</i>	E	3	0.13	
31	Russia (East)	<i>Xanthium orientale</i>	A	6	0.26	
32	Russia (Kaliningrad)	* <i>Epilobium ciliatum</i>	A	1	33.33	
33	Russia (Kaliningrad)	* <i>Lupinus polyphyllus</i>	A	1	33.33	
34	Russia (Kaliningrad)	* <i>Rosa rugosa</i>	A	1	33.33	
35	Russia (North)	* NA				
36	Russia (NorthWest)	<i>Rosa rugosa</i>	A	1	2.27	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Russia (NorthWest)	<i>Schedonorus arundinaceus</i>	E	2	4.55	
4	Russia (South)	<i>Acorus calamus</i>	A	1	0.08	
5	Russia (South)	<i>Amaranthus albus</i>	A	6	0.46	
6	Russia (South)	<i>Amaranthus retroflexus</i>	A	5	0.39	
7	Russia (South)	<i>Ambrosia artemisiifolia</i>	A	6	0.46	
8	Russia (South)	<i>Amorpha fruticosa</i>	A	2	0.15	
9	Russia (South)	<i>Bidens frondosus</i>	A	2	0.15	
10	Russia (South)	<i>Bidens x garumnae</i>	C	2	0.15	
11	Russia (South)	<i>Cuscuta campestris</i>	A	2	0.15	
12	Russia (South)	<i>Diplotaxis tenuifolia</i>	E	1	0.08	
13	Russia (South)	<i>Elaeagnus angustifolia</i>	A	1	0.08	
14	Russia (South)	<i>Erigeron canadensis</i>	A	5	0.39	
15	Russia (South)	<i>Fraxinus pennsylvanica</i>	A	4	0.31	
16	Russia (South)	<i>Helianthus lenticularis</i>	A	3	0.23	
17	Russia (South)	<i>Lepidium densiflorum</i>	A	1	0.08	
18	Russia (South)	<i>Medicago sativa</i>	C	3	0.23	
19	Russia (South)	<i>Oenothera biennis</i>	A	2	0.15	
20	Russia (South)	<i>Onobrychis viciifolia</i>	E	1	0.08	
21	Russia (South)	<i>Prunus armeniaca</i>	A	1	0.08	
22	Russia (South)	<i>Sisymbrium orientale</i>	E	1	0.08	
23	Russia (South)	<i>Xanthium orientale</i>	A	13	1.00	subsp. <i>californicum</i> , subsp. <i>riparium</i>
24	Russia (South)	<i>Xanthium spinosum</i>	A	2	0.15	
25	Russia (South)	<i>Xanthium strumarium</i>	E	90	6.96	
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27	Romania	<i>Alcea rosea</i>	C	1	0.02	
28	Romania	<i>Alchemilla conjuncta</i>	E	3	0.06	
29	Romania	<i>Amaranthus albus</i>	A	3	0.06	
30	Romania	<i>Amaranthus hybridus</i>	A	1	0.02	
31	Romania	<i>Amaranthus retroflexus</i>	A	7	0.14	
32	Romania	<i>Ambrosia artemisiifolia</i>	A	7	0.14	
33	Romania	<i>Amorpha fruticosa</i>	A	5	0.10	
34	Romania	<i>Aristolochia macrophylla</i>	A	1	0.02	
35	Romania	<i>Bidens frondosus</i>	A	5	0.10	
36	Romania	<i>Bidens vulgatus</i>	A	1	0.02	
37	Romania	<i>Cuscuta campestris</i>	A	8	0.16	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Romania	<i>Echinocystis lobata</i>	A	9	0.17	
4	Romania	<i>Elaeagnus angustifolia</i>	A	6	0.12	
5	Romania	<i>Erigeron annuus</i>	A	244	4.74	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
6	Romania	<i>Erigeron canadensis</i>	A	66	1.28	
7	Romania	<i>Erucastrum nasturtiifolium</i>	E	7	0.14	
8	Romania	<i>Fraxinus pennsylvanica</i>	A	3	0.06	
9	Romania	<i>Galinsoga parviflora</i>	A	2	0.04	
10	Romania	<i>Gleditsia triacanthos</i>	A	1	0.02	
11	Romania	<i>Helianthus tuberosus</i>	A	6	0.12	
12	Romania	<i>Impatiens glandulifera</i>	A	2	0.04	
13	Romania	<i>Impatiens parviflora</i>	A	1	0.02	
14	Romania	<i>Inula helenium</i>	E	48	0.93	
15	Romania	<i>Iva xanthiifolia</i>	A	1	0.02	
16	Romania	<i>Juncus tenuis</i>	A	71	1.38	
17	Romania	<i>Lepidium densiflorum</i>	A	2	0.04	
18	Romania	<i>Lepidium virginicum</i>	A	1	0.02	
19	Romania	<i>Matricaria discoidea</i>	A	15	0.29	
20	Romania	<i>Medicago sativa</i>	C	40	0.78	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>
21	Romania	<i>Morus alba</i>	A	1	0.02	
22	Romania	<i>Oenothera biennis</i>	A	3	0.06	
23	Romania	<i>Onobrychis viciifolia</i>	E	548	10.63	
24	Romania	<i>Oxalis dillenii</i>	A	2	0.04	
25	Romania	<i>Panicum capillare</i>	A	1	0.02	
26	Romania	<i>Prunus cerasifera</i>	E	1	0.02	
27	Romania	<i>Prunus serotina</i>	A	1	0.02	
28	Romania	<i>Reynoutria japonica</i>	A	1	0.02	
29	Romania	<i>Reynoutria x bohemica</i>	A	1	0.02	
30	Romania	<i>Robinia pseudoacacia</i>	A	30	0.58	
31	Romania	<i>Rudbeckia laciniata</i>	A	2	0.04	
32	Romania	<i>Ruta graveolens</i>	E	2	0.04	
33	Romania	<i>Sisyrinchium bermudiana</i>	A	2	0.04	
34	Romania	<i>Sisyrinchium montanum</i>	A	1	0.02	
35	Romania	<i>Solidago canadensis</i>	A	3	0.06	
36	Romania	<i>Solidago gigantea</i>	A	2	0.04	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
1	Romania	<i>Sorghum halepense</i>	A	1	0.02	
2	Romania	<i>Symphyotrichum lanceolatum</i>	A	1	0.02	
3	Romania	<i>Tanacetum parthenium</i>	E	1	0.02	
4	Romania	<i>Veronica persica</i>	A	1	0.02	
5	Romania	<i>Vicia articulata</i>	E	2	0.04	
6	Romania	<i>Xanthium orientale</i>	A	16	0.31	subsp. <i>italicum</i> , subsp. <i>riparium</i>
7	Romania	<i>Xanthium spinosum</i>	A	19	0.37	
8	Sardinia	<i>Carpobrotus acinaciformis</i>	A	2	1.23	
9	Sardinia	<i>Carpobrotus edulis</i>	A	1	0.62	
10	Sardinia	<i>Opuntia ficus-indica</i>	A	1	0.62	
11	Sardinia	<i>Oxalis pes-caprae</i>	A	2	1.23	
12	Sardinia	<i>Paspalum distichum</i>	A	2	1.23	
13	Sardinia	<i>Pisum sativum</i>	C	1	0.62	
14	Sardinia	<i>Sporobolus virginicus</i>	A	1	0.62	
15	Sardinia	<i>Symphyotrichum squamatum</i>	A	1	0.62	
16	Sardinia	<i>Zantedeschia aethiopica</i>	A	1	0.62	
17	Serbia	<i>Amorpha fruticosa</i>	A	4	0.26	
18	Serbia	<i>Asclepias syriaca</i>	A	2	0.13	
19	Serbia	<i>Erigeron annuus</i>	A	27	1.76	
20	Serbia	<i>Erigeron canadensis</i>	A	23	1.50	
21	Serbia	<i>Galinsoga parviflora</i>	A	1	0.07	
22	Serbia	<i>Lycium barbarum</i>	A	3	0.20	
23	Serbia	<i>Panicum capillare</i>	A	1	0.07	
24	Serbia	<i>Robinia pseudoacacia</i>	A	4	0.26	
25	Serbia	<i>Sisyrinchium bermudiana</i>	A	2	0.13	
26	Serbia	<i>Sisyrinchium montanum</i>	A	3	0.20	
27	Serbia	<i>Veronica peregrina</i>	A	1	0.07	
28	Serbia	<i>Xanthium orientale</i>	A	1	0.07	
29	Serbia	<i>Xanthium spinosum</i>	A	1	0.07	
30	Sicily and Malta	<i>Arundo donax</i>	A	1	0.45	
31	Sicily and Malta	<i>Boerhavia repens</i>	A	1	0.45	
32	Sicily and Malta	<i>Cenchrus setaceus</i>	A	4	1.79	
33	Sicily and Malta	<i>Convolvulus sabatius</i>	E	1	0.45	
34	Sicily and Malta	<i>Dactyloctenium aegyptium</i>	A	1	0.45	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
3	Sicily and Malta	<i>Erigeron canadensis</i>	A	3	1.34	
4	Sicily and Malta	<i>Megathyrus maximus</i>	A	4	1.79	
5	Sicily and Malta	<i>Opuntia ficus-indica</i>	A	2	0.89	
6	Sicily and Malta	<i>Oxalis pes-caprae</i>	A	9	4.02	
7	Sicily and Malta	<i>Saccharum spontaneum</i>	A	6	2.68	
8	Sicily and Malta	<i>Symphyotrichum squamatum</i>	A	2	0.89	
9	Sicily and Malta	<i>Xanthium orientale</i>	A	6	2.68	
11	Slovakia	<i>Acorus calamus</i>	A	1	0.03	
12	Slovakia	<i>Achillea macrophylla</i>	E	1	0.03	
13	Slovakia	<i>Amaranthus retroflexus</i>	A	2	0.06	
14	Slovakia	<i>Anthriscus cerefolium</i>	C	1	0.03	
15	Slovakia	<i>Bidens frondosus</i>	A	6	0.18	
16	Slovakia	<i>Bunias orientalis</i>	E	2	0.06	
17	Slovakia	<i>Datura stramonium</i>	A	1	0.03	
18	Slovakia	<i>Echinops sphaerocephalus</i>	E	1	0.03	
19	Slovakia	<i>Epilobium ciliatum</i>	A	6	0.18	
20	Slovakia	<i>Erechtites hieraciifolius</i>	A	1	0.03	
21	Slovakia	<i>Erigeron annuus</i>	A	18	0.53	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
22	Slovakia	<i>Erigeron canadensis</i>	A	12	0.36	
23	Slovakia	<i>Erucastrum gallicum</i>	E	1	0.03	
24	Slovakia	<i>Galinsoga parviflora</i>	A	3	0.09	
25	Slovakia	<i>Galinsoga quadriradiata</i>	A	3	0.09	
26	Slovakia	<i>Galium verrucosum</i>	E	1	0.03	
27	Slovakia	<i>Geranium pyrenaicum</i>	E	1	0.03	
28	Slovakia	<i>Heracleum mantegazzianum</i>	E	1	0.03	
29	Slovakia	<i>Hordeum marinum</i>	E	3	0.09	
30	Slovakia	<i>Chenopodium strictum</i>	E	3	0.09	
31	Slovakia	<i>Impatiens glandulifera</i>	A	3	0.09	
32	Slovakia	<i>Impatiens parviflora</i>	A	8	0.24	
33	Slovakia	<i>Juncus tenuis</i>	A	17	0.51	
34	Slovakia	<i>Lolium multiflorum</i>	E	3	0.09	
35	Slovakia	<i>Malva moschata</i>	E	3	0.09	
36	Slovakia	<i>Matricaria discoidea</i>	A	47	1.40	
37	Slovakia	<i>Medicago sativa</i>	C	35	1.04	subsp. <i>sativa</i> , nothosubsp. <i>varia</i>

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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
1						
2						
3	Slovakia	<i>Oenothera biennis</i>	A	1	0.03	
4	Slovakia	<i>Oenothera villosa</i>	A	2	0.06	
5	Slovakia	<i>Onobrychis viciifolia</i>	E	35	1.04	
6	Slovakia	<i>Oxalis stricta</i>	A	2	0.06	
7	Slovakia	<i>Pinus nigra</i>	E	5	0.15	
8	Slovakia	<i>Robinia pseudoacacia</i>	A	10	0.30	
9	Slovakia	<i>Rumex patientia</i>	E	1	0.03	
10	Slovakia	<i>Rumex thyrsoiflorus</i>	E	8	0.24	
11	Slovakia	<i>Sedum rupestre</i>	E	1	0.03	
12	Slovakia	<i>Sisymbrium austriacum</i>	E	1	0.03	
13	Slovakia	<i>Solidago canadensis</i>	A	3	0.09	
14	Slovakia	<i>Solidago gigantea</i>	A	3	0.09	
15	Slovakia	<i>Symphyotrichum lanceolatum</i>	A	1	0.03	
16	Slovakia	<i>Symphyotrichum novi-belgii</i>	A	4	0.12	
17	Slovakia	<i>Syringa vulgaris</i>	E	1	0.03	
18	Slovakia	<i>Trifolium hybridum</i>	C	46	1.37	
19	Slovakia	<i>Veronica filiformis</i>	E	1	0.03	
20	Slovakia	<i>Veronica peregrina</i>	A	2	0.06	
21	Slovakia	<i>Veronica persica</i>	A	3	0.09	
22	Slovakia	<i>Viola suavis</i>	E	1	0.03	
23	Slovakia	<i>Xanthium orientale</i>	A	1	0.03	
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25	Slovakia					
26	Slovakia					
27	Slovakia					
28	Slovenia	<i>Ailanthus altissima</i>	A	1	0.08	
29	Slovenia	<i>Amaranthus cruentus</i>	A	2	0.16	
30	Slovenia	<i>Amaranthus retroflexus</i>	A	1	0.08	
31	Slovenia	<i>Ambrosia artemisiifolia</i>	A	6	0.47	
32	Slovenia	<i>Bidens frondosus</i>	A	1	0.08	
33	Slovenia	<i>Echinocystis lobata</i>	A	18	1.42	
34	Slovenia	<i>Erechtites hieraciifolius</i>	A	1	0.08	
35	Slovenia	<i>Erigeron annuus</i>	A	167	13.18	subsp. <i>annuus</i> , subsp. <i>septentrionalis</i>
36	Slovenia	<i>Erigeron canadensis</i>	A	27	2.13	
37	Slovenia	<i>Galinsoga parviflora</i>	A	9	0.71	
38	Slovenia	<i>Galinsoga quadriradiata</i>	A	4	0.32	
39	Slovenia	<i>Geum aleppicum</i>	E	4	0.32	
40	Slovenia	<i>Helianthus tuberosus</i>	A	4	0.32	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	Slovenia	<i>Impatiens glandulifera</i>	A	11	0.87	
4	Slovenia	<i>Impatiens parviflora</i>	A	3	0.24	
5	Slovenia	<i>Juncus tenuis</i>	A	6	0.47	
6	Slovenia	<i>Lupinus polyphyllus</i>	A	2	0.16	
7	Slovenia	<i>Lycopersicon esculentum</i>	A	4	0.32	
8	Slovenia	<i>Matricaria discoidea</i>	A	6	0.47	
9	Slovenia	<i>Medicago sativa</i>	C	41	3.24	
10	Slovenia	<i>Oenothera biennis</i>	A	2	0.16	
11	Slovenia	<i>Oxalis stricta</i>	A	10	0.79	
12	Slovenia	<i>Panicum dichotomiflorum</i>	A	1	0.08	
13	Slovenia	<i>Reynoutria japonica</i>	A	2	0.16	
14	Slovenia	<i>Robinia pseudoacacia</i>	A	3	0.24	
15	Slovenia	<i>Rudbeckia laciniata</i>	A	12	0.95	
16	Slovenia	<i>Scirpus georgianus</i>	A	2	0.16	
17	Slovenia	<i>Sedum spurium</i>	E	1	0.08	
18	Slovenia	<i>Solidago canadensis</i>	A	11	0.87	
19	Slovenia	<i>Solidago gigantea</i>	A	47	3.71	
20	Slovenia	<i>Tagetes erecta</i>	A	1	0.08	
21	Slovenia	<i>Veronica persica</i>	A	12	0.95	
22	Slovenia	<i>Viola cornuta</i>	E	4	0.32	
23	Slovenia	<i>x Festulolium</i> sp.	C	1	0.08	
24	Slovenia	<i>Xanthium orientale</i>	A	2	0.16	
25	Spain	<i>Aesculus hippocastanum</i>	E	1	0.02	
26	Spain	<i>Amaranthus albus</i>	A	1	0.02	
27	Spain	<i>Amaranthus bouchonii</i>	A	1	0.02	
28	Spain	<i>Amaranthus hybridus</i>	A	1	0.02	
29	Spain	<i>Amaranthus retroflexus</i>	A	1	0.02	
30	Spain	<i>Artemisia verlotiorum</i>	A	2	0.05	
31	Spain	<i>Arundo donax</i>	A	3	0.07	
32	Spain	<i>Avena sativa</i>	C	3	0.07	
33	Spain	<i>Baccharis halimifolia</i>	A	1	0.02	
34	Spain	<i>Bidens aureus</i>	A	6	0.14	
35	Spain	<i>Bidens frondosus</i>	A	6	0.14	
36	Spain	<i>Bromopsis inermis</i>	E	1	0.02	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Spain	<i>Buddleja davidii</i>	A	3	0.07	
4	Spain	<i>Carpobrotus edulis</i>	A	4	0.09	
5	Spain	<i>Ceratochloa cathartica</i>	A	4	0.09	
6	Spain	<i>Cortaderia selloana</i>	A	10	0.23	
7	Spain	<i>Crocasmia x crocosmiiflora</i>	C	2	0.05	
8	Spain	<i>Cuscuta campestris</i>	A	5	0.11	
9	Spain	<i>Cyperus eragrostis</i>	A	66	1.51	
10	Spain	<i>Delairea odorata</i>	A	1	0.02	
11	Spain	<i>Dysphania ambrosioides</i>	A	2	0.05	
12	Spain	<i>Eleocharis bonariensis</i>	A	1	0.02	
13	Spain	<i>Erigeron bonariensis</i>	A	4	0.09	
14	Spain	<i>Erigeron canadensis</i>	A	33	0.76	
15	Spain	<i>Erigeron floribundus</i>	A	19	0.44	
16	Spain	<i>Galega officinalis</i>	E	1	0.02	
17	Spain	<i>Galinsoga quadriradiata</i>	A	1	0.02	
18	Spain	<i>Gnaphalium coarctatum</i>	A	4	0.09	
19	Spain	<i>Helianthus x laetiflorus</i>	C	4	0.09	
20	Spain	<i>Hydrangea macrophylla</i>	A	1	0.02	
21	Spain	<i>Hypericum hircinum</i>	E	1	0.02	
22	Spain	<i>Impatiens balfourii</i>	A	5	0.11	
23	Spain	<i>Ipomoea indica</i>	A	1	0.02	
24	Spain	<i>Iris x germanica</i>	C	2	0.05	
25	Spain	<i>Juncus tenuis</i>	A	4	0.09	
26	Spain	<i>Lepidium didymum</i>	A	1	0.02	
27	Spain	<i>Lycopersicon esculentum</i>	A	1	0.02	
28	Spain	<i>Malcolmia maritima</i>	E	1	0.02	
29	Spain	<i>Melissa officinalis</i>	E	5	0.11	
30	Spain	<i>Mentha spicata</i>	C	7	0.16	
31	Spain	<i>Mentha x piperita</i>	C	1	0.02	
32	Spain	<i>Mirabilis jalapa</i>	A	1	0.02	
33	Spain	<i>Oenothera biennis</i>	A	9	0.21	
34	Spain	<i>Oenothera fallax</i>	A	5	0.11	
35	Spain	<i>Oenothera glazioviana</i>	A	1	0.02	
36	Spain	<i>Oenothera rosea</i>	A	7	0.16	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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3	Spain	<i>Oenothera suaveolens</i>	A	4	0.09	
4	Spain	<i>Onobrychis viciifolia</i>	E	26	0.60	
5	Spain	<i>Oxalis latifolia</i>	A	4	0.09	
6	Spain	<i>Panicum capillare</i>	A	3	0.07	
7	Spain	<i>Parthenocissus inserta</i>	A	1	0.02	
8	Spain	<i>Paspalum dilatatum</i>	A	59	1.35	
9	Spain	<i>Paspalum distichum</i>	A	53	1.22	
10	Spain	<i>Paspalum vaginatum</i>	A	8	0.18	
11	Spain	<i>Persicaria pensylvanica</i>	A	1	0.02	
12	Spain	<i>Pinus radiata</i>	A	1	0.02	
13	Spain	<i>Pinus strobus</i>	A	5	0.11	
14	Spain	<i>Populus x canadensis</i>	C	1	0.02	
15	Spain	<i>Prunus x fruticans</i>	E	1	0.02	
16	Spain	<i>Reynoutria japonica</i>	A	1	0.02	
17	Spain	<i>Robinia pseudoacacia</i>	A	3	0.07	
18	Spain	<i>Selaginella kraussiana</i>	A	1	0.02	
19	Spain	<i>Solanum chenopodioides</i>	A	4	0.09	
20	Spain	<i>Solanum tuberosum</i>	A	1	0.02	
21	Spain	<i>Sorghum halepense</i>	A	2	0.05	
22	Spain	<i>Sporobolus indicus</i>	A	13	0.30	
23	Spain	<i>Stenotaphrum secundatum</i>	A	9	0.21	
24	Spain	<i>Symphyotrichum squamatum</i>	A	67	1.54	
25	Spain	<i>Tradescantia fluminensis</i>	A	2	0.05	
26	Spain	<i>Tropaeolum majus</i>	A	1	0.02	
27	Spain	<i>Verbena bonariensis</i>	A	1	0.02	
28	Spain	<i>Veronica persica</i>	A	9	0.21	
29	Spain	<i>Xanthium orientale</i>	A	4	0.09	subsp. <i>orientale</i> , subsp. <i>italicum</i>
30	Spain	<i>Xanthium spinosum</i>	A	2	0.05	
31	Spain	<i>Yucca gloriosa</i>	A	1	0.02	
32	Spain	<i>Zantedeschia aethiopica</i>	A	3	0.07	
33	Spain					
34	Sweden	<i>Berberis vulgaris</i>	E	1	0.26	
35	Sweden	<i>Bromopsis erecta</i>	E	2	0.51	
36	Sweden	<i>Cota tinctoria</i>	E	3	0.77	
37	Sweden	<i>Cynoglossum officinale</i>	E	2	0.51	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
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2						
3	Sweden	<i>Festuca filiformis</i>	E	1	0.26	
4	Sweden	<i>Galium album</i>	E	5	1.28	subsp. <i>album</i>
5	Sweden	<i>Matricaria discoidea</i>	A	1	0.26	
6	Sweden	<i>Medicago sativa</i>	C	3	0.77	
7	Sweden	<i>Noccaea perfoliata</i>	E	3	0.77	
8	Sweden	<i>Sanguisorba minor</i>	E	1	0.26	
9						
10	Switzerland	<i>Bidens frondosus</i>	A	2	0.08	
11	Switzerland	<i>Bromopsis inermis</i>	E	7	0.29	
12	Switzerland	<i>Ceratochloa carinata</i>	A	1	0.04	
13	Switzerland	<i>Crepis nicaeensis</i>	E	1	0.04	
14	Switzerland	<i>Dipsacus sativus</i>	C	2	0.08	
15	Switzerland	<i>Erigeron annuus</i>	A	35	1.47	
16	Switzerland	<i>Erigeron canadensis</i>	A	3	0.13	
17	Switzerland	<i>Euphorbia lathyris</i>	E	1	0.04	
18	Switzerland	<i>Gaultheria procumbens</i>	A	1	0.04	
19	Switzerland	<i>Helianthus tuberosus</i>	A	1	0.04	
20	Switzerland	<i>Helminthotheca echioides</i>	E	1	0.04	
21	Switzerland	<i>Hesperis matronalis</i>	E	1	0.04	
22	Switzerland	<i>Impatiens glandulifera</i>	A	10	0.42	
23	Switzerland	<i>Impatiens parviflora</i>	A	2	0.08	
24	Switzerland	<i>Juncus tenuis</i>	A	5	0.21	
25	Switzerland	<i>Lolium multiflorum</i>	E	5	0.21	
26	Switzerland	<i>Lonicera japonica</i>	A	1	0.04	
27	Switzerland	<i>Matricaria discoidea</i>	A	1	0.04	
28	Switzerland	<i>Oenothera biennis</i>	A	1	0.04	
29	Switzerland	<i>Oenothera parviflora</i>	A	1	0.04	
30	Switzerland	<i>Onobrychis viciifolia</i>	E	109	4.59	
31	Switzerland	<i>Opuntia humifusa</i>	A	1	0.04	
32	Switzerland	<i>Ornithogalum nutans</i>	E	1	0.04	
33	Switzerland	<i>Panicum capillare</i>	A	4	0.17	
34	Switzerland	<i>Potentilla indica</i>	A	1	0.04	
35	Switzerland	<i>Robinia pseudoacacia</i>	A	4	0.17	
36	Switzerland	<i>Rubus armeniacus</i>	E	3	0.13	
37	Switzerland	<i>Salix repens</i>	E	2	0.08	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
3	Switzerland	<i>Schedonorus arundinaceus</i>	E	1	0.04	
4	Switzerland	<i>Solidago canadensis</i>	A	3	0.13	
5	Switzerland	<i>Solidago gigantea</i>	A	20	0.84	
6	Switzerland	<i>Symphotrichum lanceolatum</i>	A	2	0.08	
7	Switzerland	<i>Trifolium hybridum</i>	C	1	0.04	
8	Switzerland	<i>Veronica filiformis</i>	E	16	0.67	
9	Switzerland	<i>Veronica peregrina</i>	A	1	0.04	
10	Switzerland	<i>Veronica persica</i>	A	32	1.35	
11	Switzerland	<i>Vicia lutea</i>	E	5	0.21	
12	Switzerland	<i>Vicia sativa</i>	E	1	0.04	
13	Switzerland	<i>Vicia villosa</i>	E	8	0.34	subsp. <i>varia</i> , subsp. <i>villosa</i>
14	Ukraine	<i>Acer negundo</i>	A	8	0.24	
15	Ukraine	<i>Acorus calamus</i>	A	5	0.15	
16	Ukraine	<i>Ailanthus altissima</i>	A	3	0.09	
17	Ukraine	<i>Allium ascalonicum</i>	A	4	0.12	
18	Ukraine	<i>Amaranthus albus</i>	A	3	0.09	
19	Ukraine	<i>Amaranthus retroflexus</i>	A	1	0.03	
20	Ukraine	<i>Ambrosia artemisiifolia</i>	A	21	0.64	
21	Ukraine	<i>Anchusa stylosa</i>	E	9	0.27	
22	Ukraine	<i>Anthemis odontostephana</i>	A	1	0.03	
23	Ukraine	<i>Anthericum liliago</i>	E	2	0.06	
24	Ukraine	<i>Artemisia annua</i>	E	1	0.03	
25	Ukraine	<i>Asclepias syriaca</i>	A	2	0.06	
26	Ukraine	<i>Bidens frondosus</i>	A	3	0.09	
27	Ukraine	<i>Cannabis sativa</i>	E	1	0.03	
28	Ukraine	<i>Carthamus lanatus</i>	E	2	0.06	
29	Ukraine	<i>Cirsium ciliatum</i>	E	1	0.03	
30	Ukraine	<i>Cuscuta campestris</i>	A	7	0.21	
31	Ukraine	<i>Cuscuta epilinum</i>	C	1	0.03	
32	Ukraine	<i>Dasypyrum villosum</i>	E	2	0.06	
33	Ukraine	<i>Echinocystis lobata</i>	A	1	0.03	
34	Ukraine	<i>Elaeagnus angustifolia</i>	A	18	0.55	
35	Ukraine	<i>Erigeron annuus</i>	A	150	4.58	
36	Ukraine	<i>Erigeron canadensis</i>	A	41	1.25	

	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
1						
2						
3	Ukraine	<i>Fraxinus pennsylvanica</i>	A	1	0.03	
4	Ukraine	<i>Galinsoga quadriradiata</i>	A	1	0.03	
5	Ukraine	<i>Grindelia squarrosa</i>	A	42	1.28	
6	Ukraine	<i>Helianthus annuus</i>	A	1	0.03	
7						
8	Ukraine	<i>Heracleum mantegazzianum</i>	E	5	0.15	
9	Ukraine	<i>Hyssopus officinalis</i>	E	1	0.03	
10	Ukraine	<i>Impatiens parviflora</i>	A	1	0.03	
11	Ukraine	<i>Iva xanthiifolia</i>	A	2	0.06	
12	Ukraine	<i>Juncus tenuis</i>	A	21	0.64	
13						
14	Ukraine	<i>Lathyrus sativus</i>	C	1	0.03	
15	Ukraine	<i>Lepidium densiflorum</i>	A	3	0.09	
16	Ukraine	<i>Lolium multiflorum</i>	E	1	0.03	
17	Ukraine	<i>Lupinus polyphyllus</i>	A	3	0.09	
18	Ukraine	<i>Lycium barbarum</i>	A	3	0.09	
19						
20	Ukraine	<i>Medicago sativa</i>	C	16	0.49	
21	Ukraine	<i>Myagrum perfoliatum</i>	E	1	0.03	
22	Ukraine	<i>Oenothera biennis</i>	A	18	0.55	
23	Ukraine	<i>Oenothera rubricaulis</i>	A	14	0.43	
24	Ukraine	<i>Onobrychis viciifolia</i>	E	53	1.62	
25						
26	Ukraine	<i>Oxalis fontana</i>	A	5	0.15	
27	Ukraine	<i>Oxalis stricta</i>	A	2	0.06	
28	Ukraine	<i>Papaver somniferum</i>	E	1	0.03	
29	Ukraine	<i>Parthenocissus inserta</i>	A	1	0.03	
30	Ukraine	<i>Petrorhagia saxifraga</i>	E	1	0.03	
31						
32	Ukraine	<i>Plagiorhegma dubium</i>	A	2	0.06	
33	Ukraine	<i>Potentilla indica</i>	A	1	0.03	
34	Ukraine	<i>Prunus armeniaca</i>	A	3	0.09	
35	Ukraine	<i>Prunus cerasifera</i>	E	1	0.03	
36	Ukraine	<i>Prunus domestica</i>	C	2	0.06	
37						
38	Ukraine	<i>Quercus rubra</i>	A	2	0.06	
39	Ukraine	<i>Raphanus sativus</i>	C	1	0.03	
40	Ukraine	<i>Rapistrum rugosum</i>	E	3	0.09	
41	Ukraine	<i>Rhus typhina</i>	A	1	0.03	
42	Ukraine	<i>Robinia pseudoacacia</i>	A	3	0.09	
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1	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
2						
3	Ukraine	<i>Saponaria officinalis</i>	E	4	0.12	
4	Ukraine	<i>Sisymbrium altissimum</i>	E	12	0.37	
5	Ukraine	<i>Sisyrinchium septentrionale</i>	A	13	0.40	
6	Ukraine	<i>Solidago canadensis</i>	A	3	0.09	
7	Ukraine	<i>Syringa vulgaris</i>	E	1	0.03	
8	Ukraine	<i>Tanacetum macrophyllum</i>	E	2	0.06	
9	Ukraine	<i>Tribulus terrestris</i>	E	14	0.43	
10	Ukraine	<i>Trifolium hybridum</i>	C	73	2.23	subsp. <i>hybridum</i>
11	Ukraine	<i>Ulmus pumila</i>	A	1	0.03	
12	Ukraine	<i>Veronica peregrina</i>	A	1	0.03	
13	Ukraine	<i>Veronica persica</i>	A	5	0.15	
14	Ukraine	<i>Xanthium orientale</i>	A	34	1.04	subsp. <i>italicum</i> , subsp. <i>riparium</i>
15	Ukraine	<i>Xanthium strumarium</i>	E	3	0.09	subsp. <i>sibiricum</i>
16	United Kingdom	<i>Acer pseudoplatanus</i>	E	9	0.45	
17	United Kingdom	<i>Alchemilla conjuncta</i>	E	1	0.05	
18	United Kingdom	<i>Armoracia rusticana</i>	E	1	0.05	
19	United Kingdom	<i>Brassica napus</i>	C	1	0.05	
20	United Kingdom	<i>Briza maxima</i>	E	2	0.10	
21	United Kingdom	<i>Bromus hordeaceus</i>	E	13	0.64	
22	United Kingdom	<i>Bromus lepidus</i>	E	1	0.05	
23	United Kingdom	<i>Centaurea aspera</i>	E	2	0.10	
24	United Kingdom	<i>Centaurea calcitrapa</i>	E	1	0.05	
25	United Kingdom	<i>Claytonia perfoliata</i>	A	1	0.05	
26	United Kingdom	<i>Claytonia sibirica</i>	A	1	0.05	
27	United Kingdom	<i>Consolida ajacis</i>	E	1	0.05	
28	United Kingdom	<i>Cotoneaster microphyllum</i>	A	2	0.10	
29	United Kingdom	<i>Crepis vesicaria</i>	E	4	0.20	
30	United Kingdom	<i>Cymbalaria muralis</i>	E	1	0.05	
31	United Kingdom	<i>Epilobium ciliatum</i>	A	3	0.15	
32	United Kingdom	<i>Erica scoparia</i>	E	1	0.05	
33	United Kingdom	<i>Fragaria ananassa</i>	C	1	0.05	
34	United Kingdom	<i>Hesperis matronalis</i>	E	2	0.10	
35	United Kingdom	<i>Impatiens capensis</i>	A	1	0.05	
36	United Kingdom	<i>Impatiens glandulifera</i>	A	9	0.45	
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	Region	Taxon	Origin	No. of plots	% of plots	Subsp.
1	United Kingdom	<i>Lagurus ovatus</i>	E	1	0.05	
2	United Kingdom	<i>Lathyrus latifolius</i>	E	4	0.20	
3	United Kingdom	<i>Lolium multiflorum</i>	E	1	0.05	
4	United Kingdom	<i>Matricaria discoidea</i>	A	10	0.50	
5	United Kingdom	<i>Medicago sativa</i>	C	1	0.05	
6	United Kingdom	<i>Melilotus officinalis</i>	E	4	0.20	
7	United Kingdom	<i>Mimulus guttatus</i>	A	4	0.20	
8	United Kingdom	<i>Muscari neglectum</i>	E	1	0.05	
9	United Kingdom	<i>Myrrhis odorata</i>	E	2	0.10	
10	United Kingdom	<i>Oenothera stricta</i>	A	1	0.05	
11	United Kingdom	<i>Pentaglottis sempervirens</i>	E	1	0.05	
12	United Kingdom	<i>Pinus nigra</i>	E	1	0.05	
13	United Kingdom	<i>Potentilla recta</i>	E	1	0.05	
14	United Kingdom	<i>Reynoutria japonica</i>	A	1	0.05	
15	United Kingdom	<i>Ribes nigrum</i>	E	1	0.05	
16	United Kingdom	<i>Senecio squalidus</i>	E	2	0.10	
17	United Kingdom	<i>Sinapis alba</i>	E	1	0.05	
18	United Kingdom	<i>Solidago canadensis</i>	A	1	0.05	
19	United Kingdom	<i>Symphoricarpos albus</i>	A	1	0.05	
20	United Kingdom	<i>Trifolium hybridum</i>	C	1	0.05	
21	United Kingdom	<i>Veronica persica</i>	A	14	0.69	
22	United Kingdom	<i>Veronica praecox</i>	E	1	0.05	
23	United Kingdom	<i>x Festulolium loliaceum</i>	C	6	0.30	

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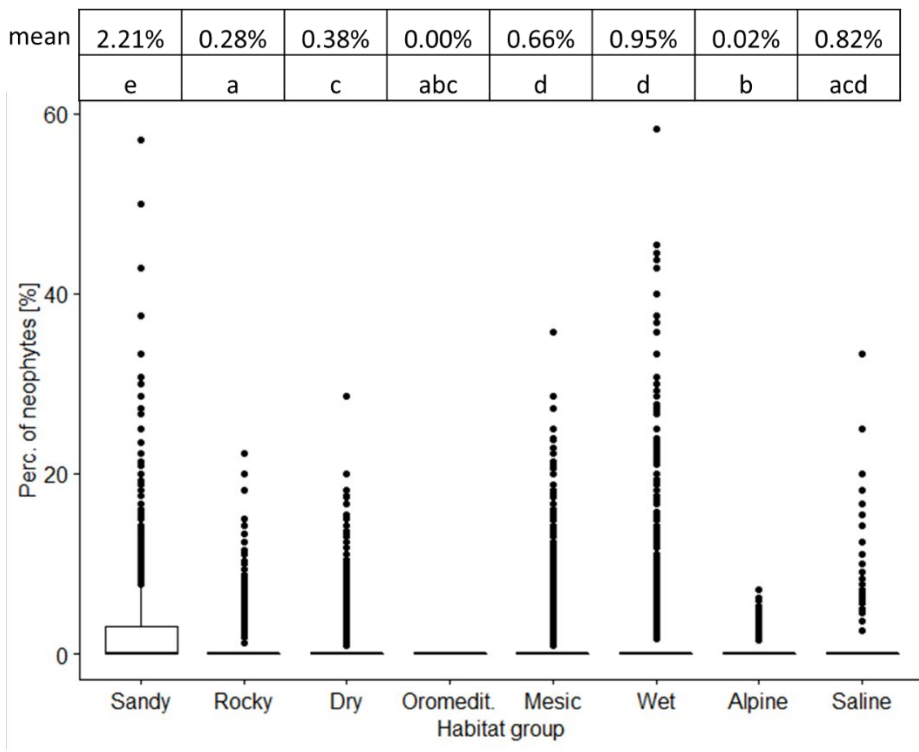
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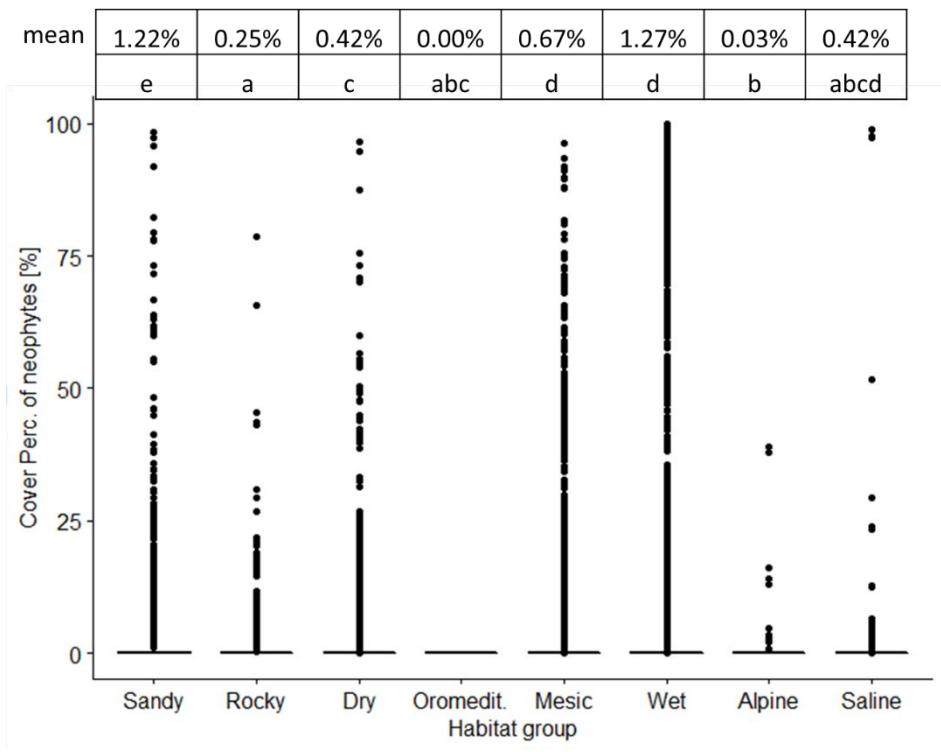
289 Supporting information to the paper
 290 Axmanová, I. *et al.* Neophyte invasions in European grasslands. *Journal of Vegetation Science*.

291 **Appendix S11.** Comparison of relative neophyte species richness and relative neophyte cover per habitat group. The differences were tested using the Kruskal-
 292 Wallis multiple comparison test. All differences were significant at the p value 0.01.

294 a, Relative neophyte richness [%]



b, Relative neophyte cover [%]



297 Supporting information to the paper

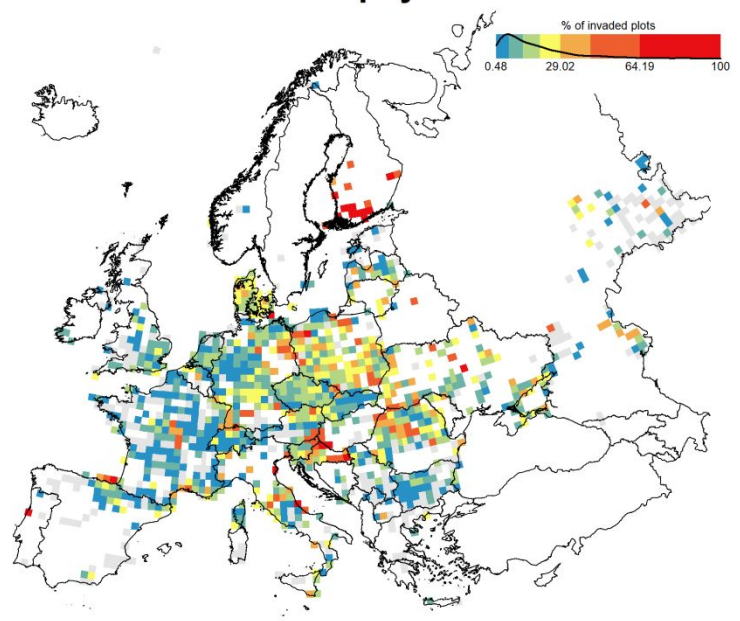
298 Axmanová, I. *et al.* Neophyte invasions in European grasslands. *Journal of Vegetation Science*.

299 **Appendix S12.** Relative frequency of invaded plots in the whole dataset and individual habitat groups with respect to neophyte origin categories calculated per
300 UTM 50 × 50 km grid cells. Cells with less than 10 plots are not mapped. Colour scale categories were defined to reflect the distribution of values using the k-means
301 breaks (note different scaling in different maps). Grey colour indicates cells with only not-invaded plots. Oromediterranean habitat group had no invaded plots
302 and therefore it is not shown here.

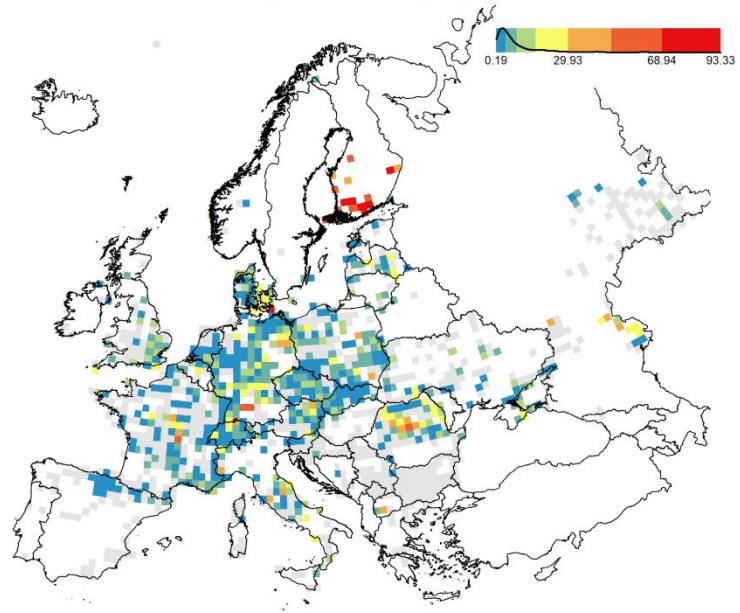
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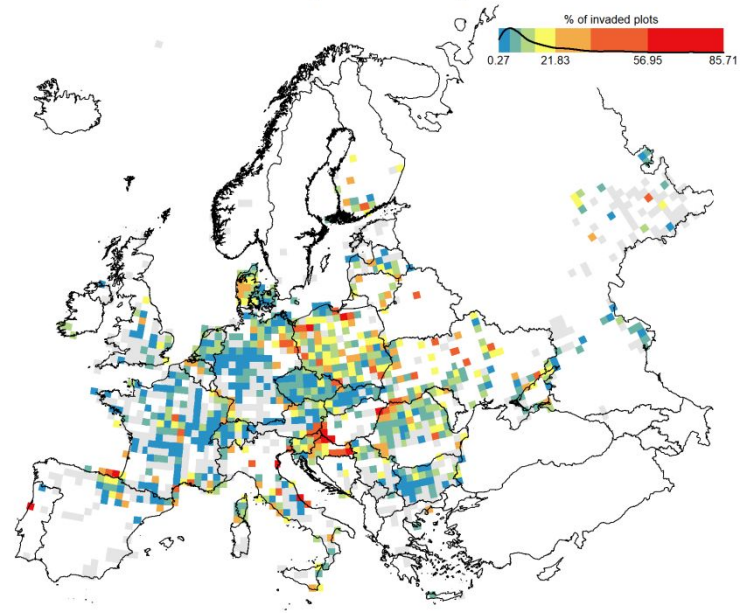
All neophytes



European neophytes

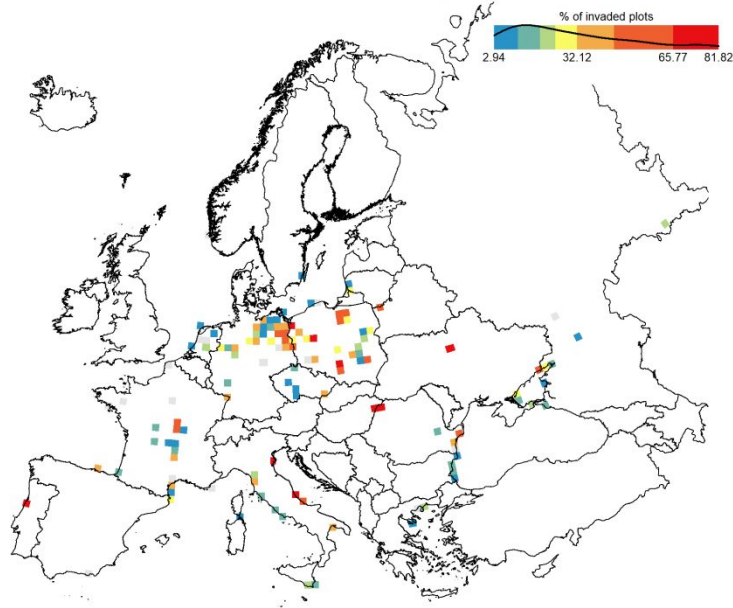


Non-European neophytes

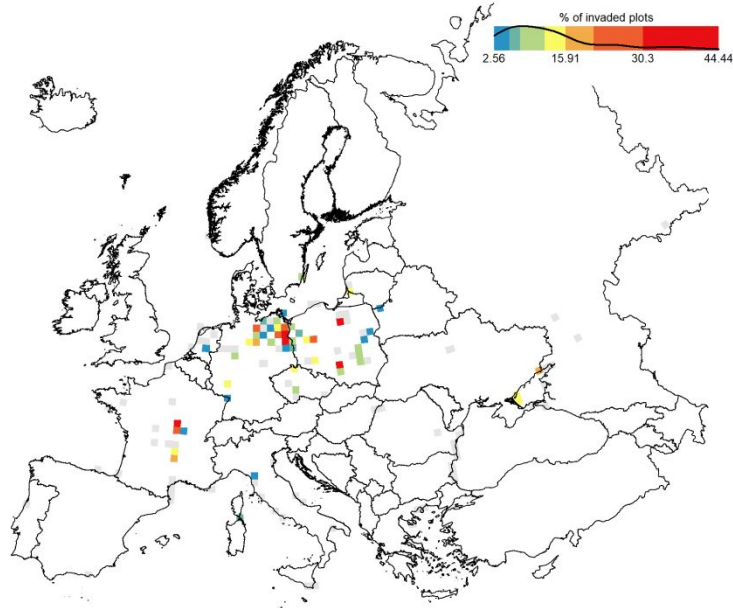


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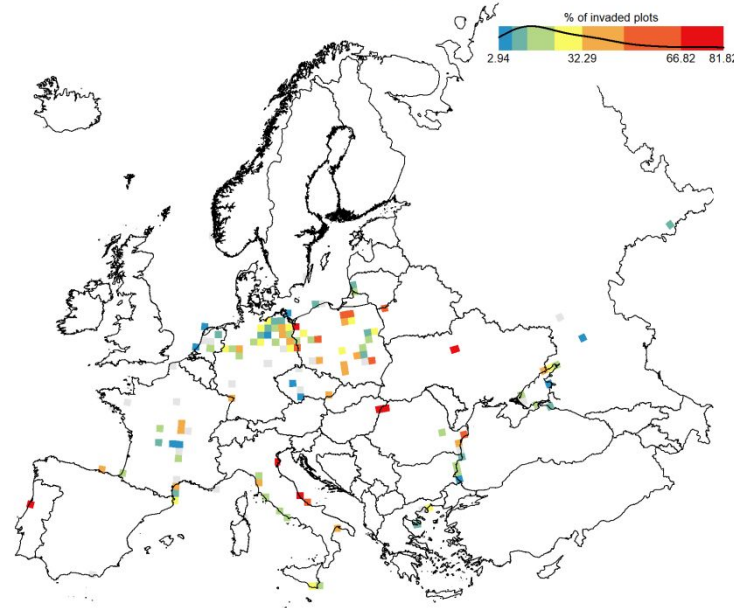
SANDY All neophytes



SANDY European neophytes



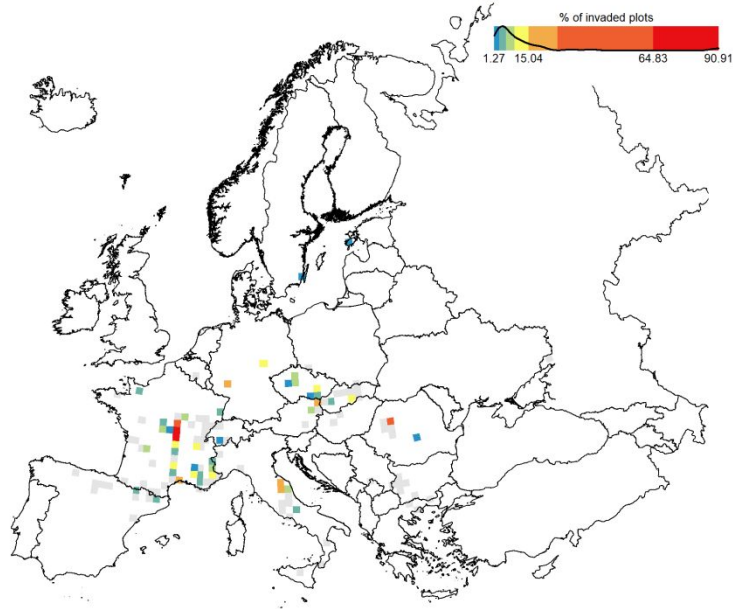
SANDY Non-European neophytes



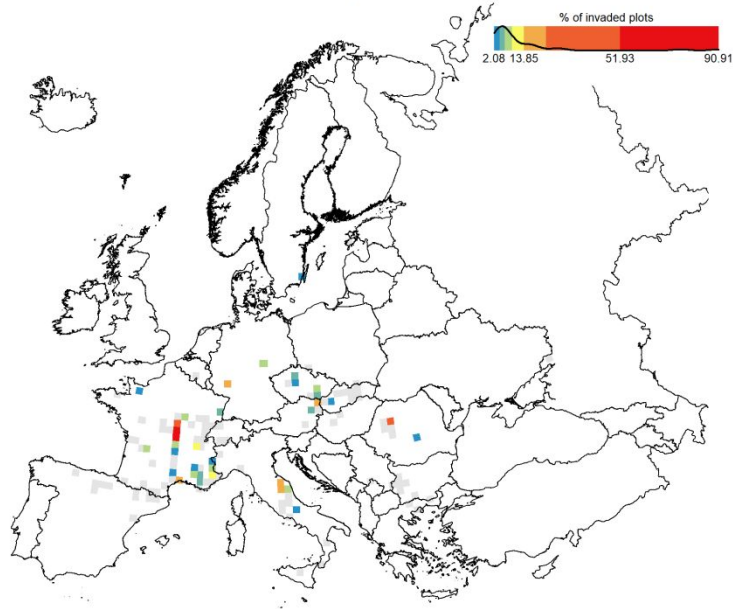
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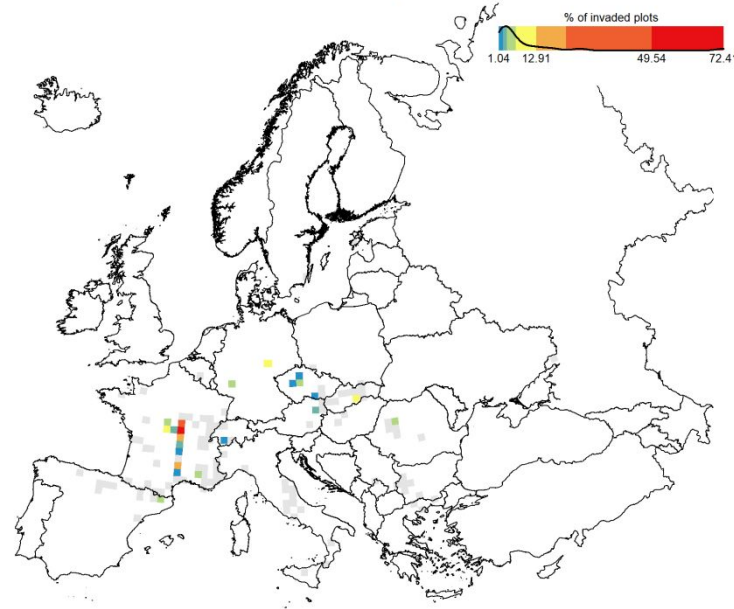
ROCKY All neophytes



ROCKY European neophytes



ROCKY Non-European neophytes

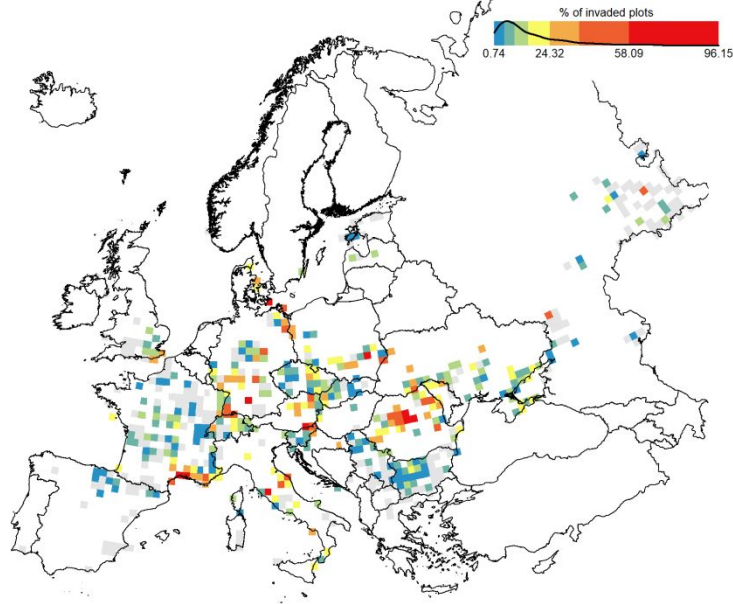


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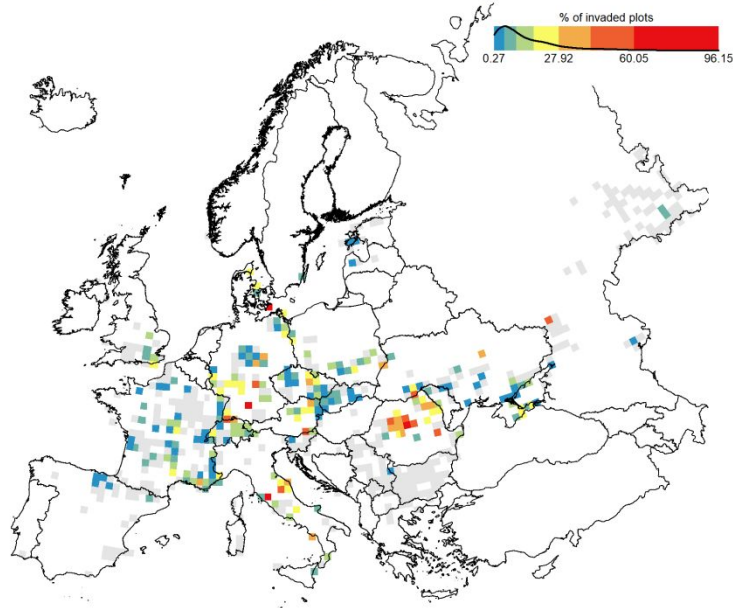
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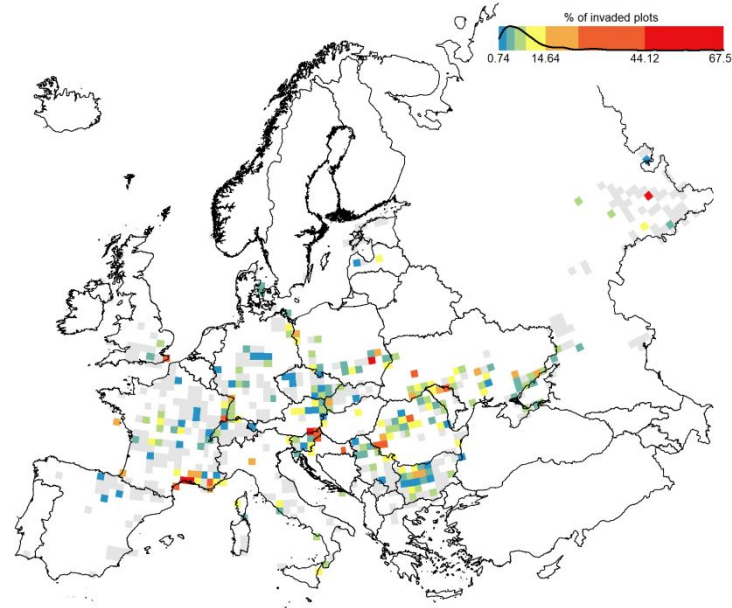
DRY All neophytes



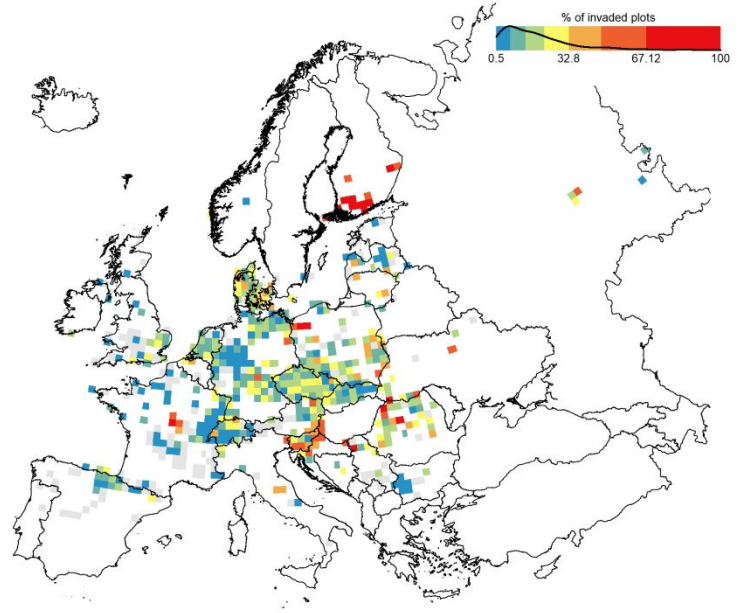
DRY European neophytes



DRY Non-European neophytes



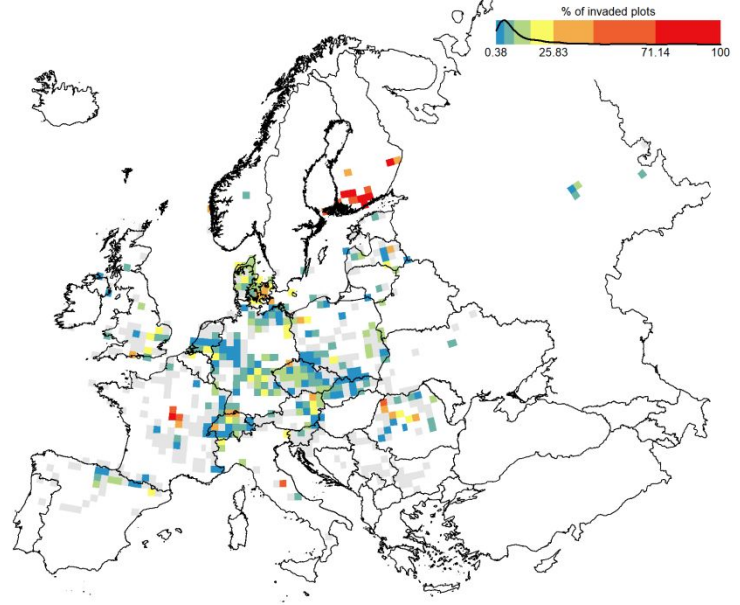
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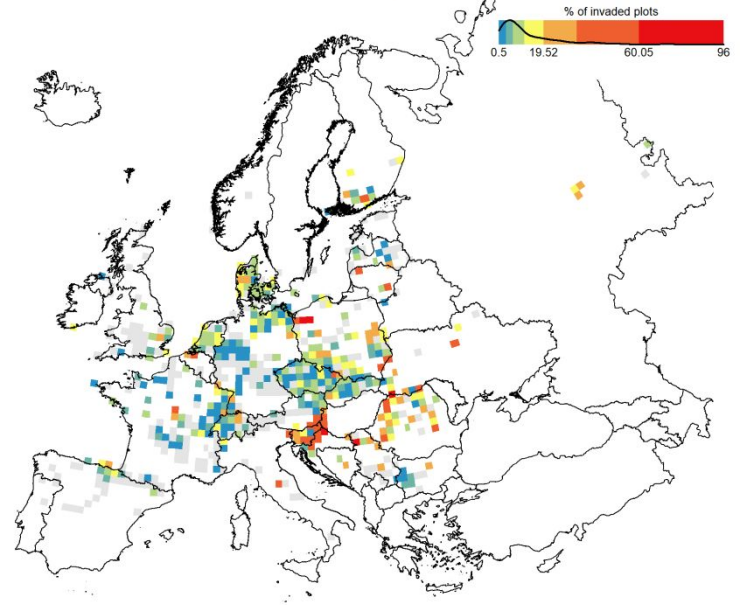
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MESIC European neophytes

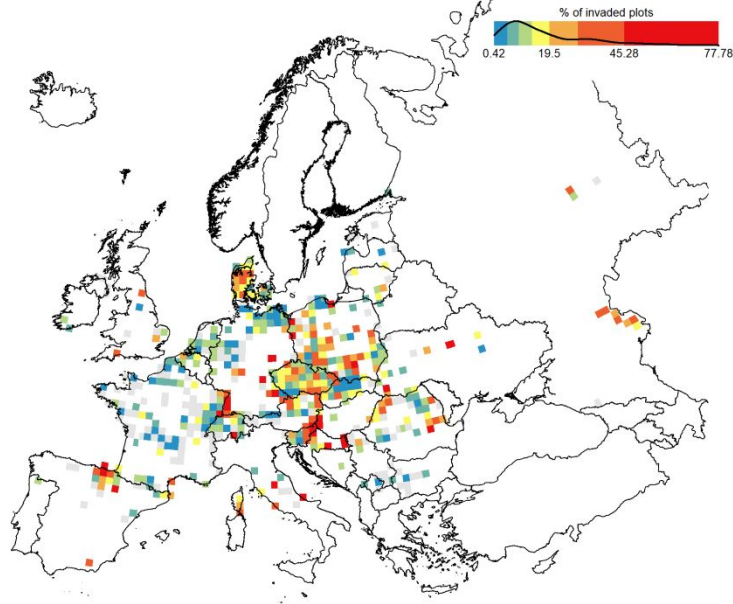


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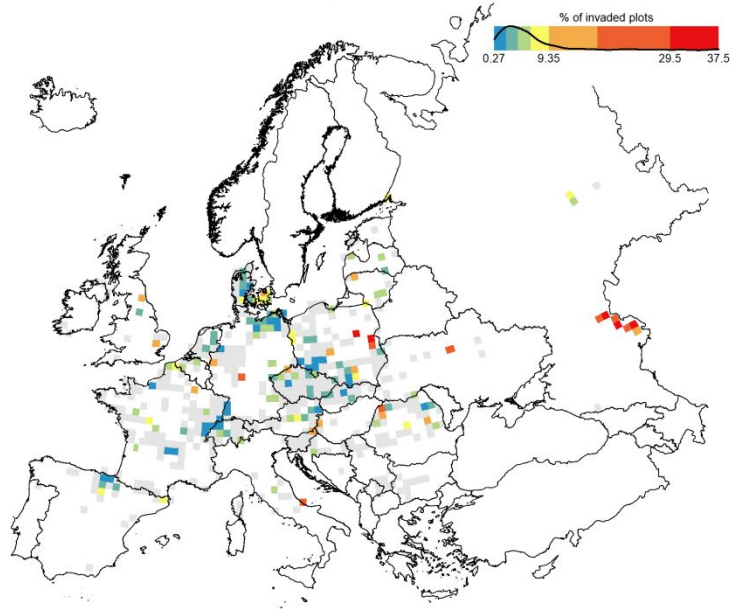


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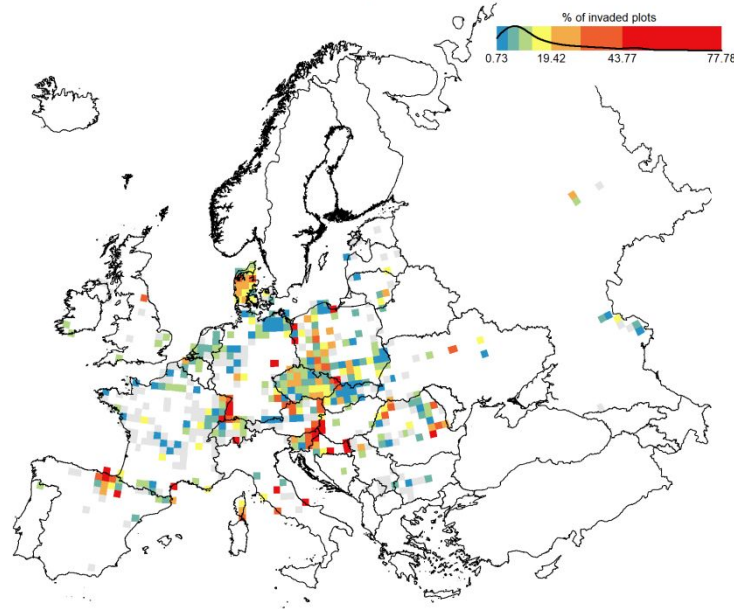
WET All neophytes



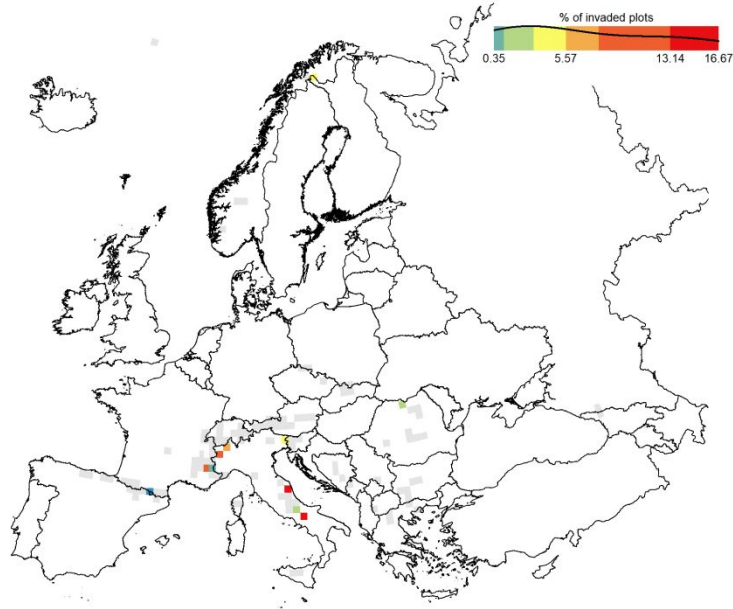
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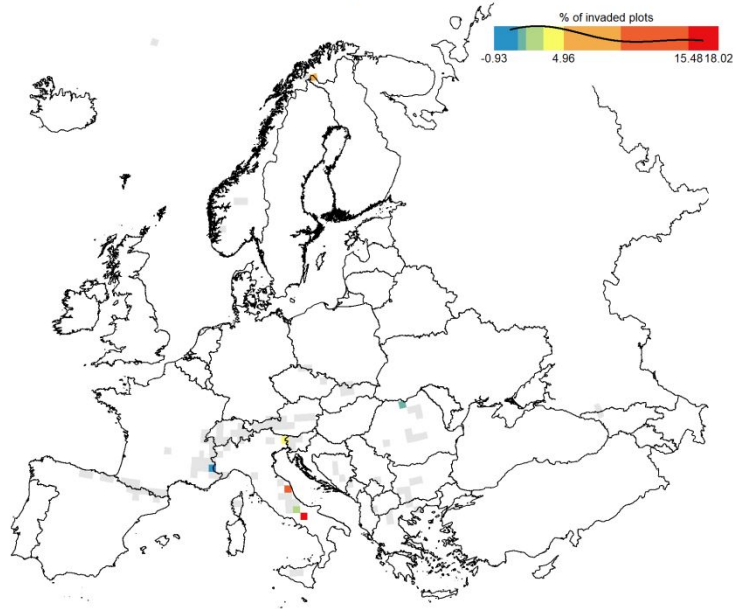
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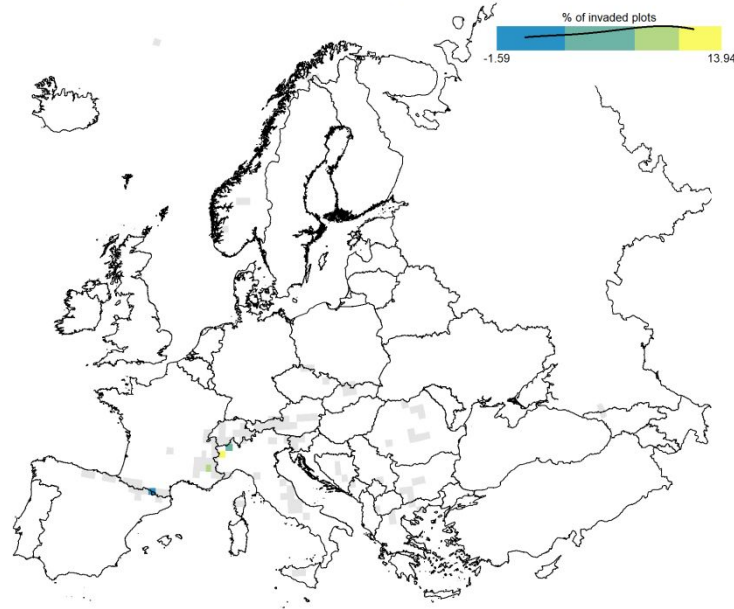
ALPINE All neophytes



ALPINE European neophytes



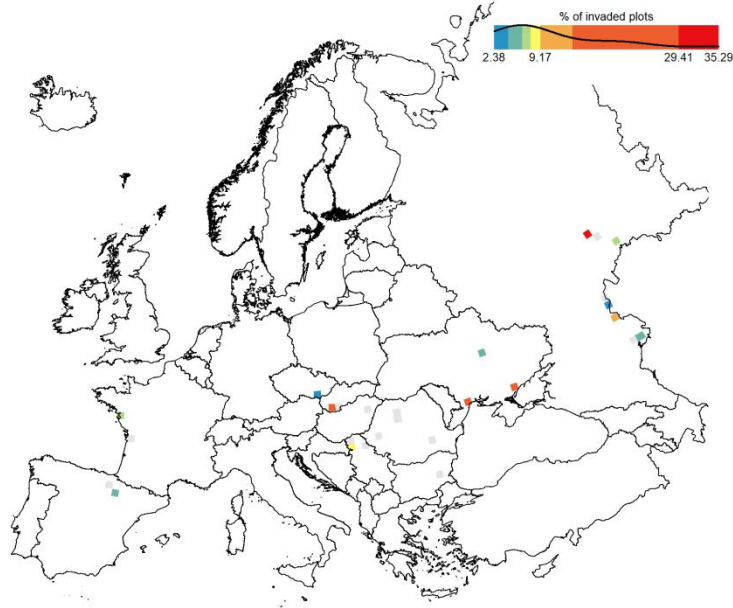
ALPINE Non-European neophytes



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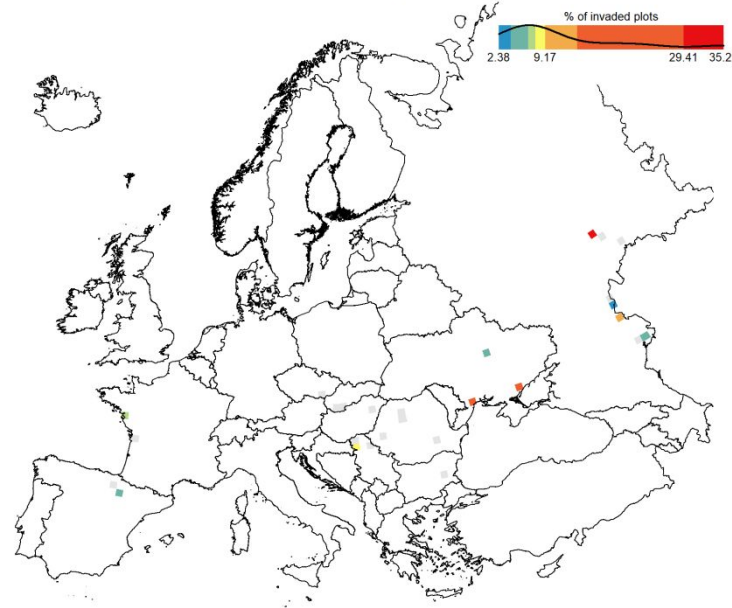
SALINE All neophytes



SALINE European neophytes



SALINE Non-European neophytes



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