



## Alien vascular plants in Iceland: Diversity, spatial patterns, temporal trends, and the impact of climate change



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### ABSTRACT

The present study provides first comprehensive and up-to-date results on alien plant taxa in Iceland since 1967. We evidenced the presence of 336 alien vascular plant taxa, including 277 casuals and 59 naturalised taxa, two being invasive. The distribution of the alien flora exhibits a clear spatial pattern showing hotspots of occurrence and diversity within areas of major settlement centres. Altitude above sea level and temperature-related variables proved to be the most important factors shaping alien plant distribution in Iceland. Predictive modelling evidenced that arctic areas of Iceland and the Central Highlands are under serious risk of alien plant invasion due to climate change. The results provide crucial information for alien and invasive plant management and contribute data for meta-analyses of invasion processes worldwide.

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### Introduction

Only a small percent of alien plant taxa have a potential to become naturalised and invasive, but when they do, their impact on native flora and ecosystems may be immense and is usually irreversible (Hejda et al., 2009; Schwartz et al., 2006). This serious risk caused fast growth in research on alien plants worldwide, resulting in huge amounts of published data including national monographs and checklists (e.g. Pyšek et al., 2012; Tokarska-Guzik, 2005; Verloove, 2006; Zajáć et al., 1998). Research on alien taxa is crucial for understanding the dynamic changes of their geographical patterns; it allows to make a step towards the explanation of invasion patterns, and to assess their impact on ecosystems (Kühn et al., 2003, 2004; Lambdon et al., 2008; Lloret et al., 2004, 2005).

It was shown that the ongoing process of climate change will favour spread of alien species leading to new invasions and range expansion of already naturalised aliens (Thuiller et al., 2007). Recent studies suggested that climate change affects biodiversity most immediately through shifts in geographic range (Parmesan and Yohe, 2003). The fact that global temperature is increasing unevenly, with the highest rate of increase in northern latitudes (>50°N; Xu et al., 2013), poses the risk that within the next few

decades northern plant taxa, well adapted to cold environments will come under pressure and have to withdraw from their natural environments. In light of this, arctic and sub-arctic territories, such as Iceland, seem to be most vulnerable to range shifts caused by global warming. These areas, on the other hand, may soon become an excellent model to investigate the impact of climate change on plant invasions.

Knowledge on the alien flora of Iceland is still rather poorly represented in the scientific literature. In a review paper on alien plants in Europe Lambdon et al. (2008) listed just 80 alien plant taxa for Iceland, and reported all of them as having been naturalised. Another important source of information, DAISIE – European Invasive Alien Species Gateway (<http://www.europe-alien.org/>), lists 89 alien plant taxa from Iceland with 60% of records having the status set to “uncertain”. These examples show that knowledge on Icelandic alien flora is rather scarce and based on outdated research (e.g. Davíðsson, 1967). Present study is a comprehensive approach towards the problem of alien species in Iceland, being the first one that summarizes data on alien taxa from 1840 to 2012. We focussed on achieving the following aims:

1. To provide up-to-date information on vascular alien plant species in Iceland.
2. To define spatial patterns of alien plants in Iceland and to identify hotspots of alien plant diversity.
3. To define major environmental factors that have an impact on alien plant distribution in Iceland.

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**Table 1**

Variables used in the present study in maximum entropy modeling experiments.

Variable name	Description	Variation range in investigated area	Unit
Alt	Altitude above sea level	1–2006	m
Bio1	Annual mean temperature	−6.5 to 5.6	°C
Bio2	Mean diurnal temperature range ( $t_{\max} - t_{\min}$ , monthly averages)	3.8–6.5	°C
Bio3	Isothermality <sup>a</sup> ( $\text{bio1/bio7} \times 100$ )	29.3–40.6	–
Bio4	Temperature seasonality (coefficient of variation)	332.0–492.1	–
Bio5	Maximum temperature of the warmest period	3.8–14.6	°C
Bio6	Minimum temperature of the coldest period	−13.9 to 0.0	°C
Bio7	Temperature annual range	12.4–19.4	°C
Bio8	Mean temperature of the wettest quarter	−11.0 to 8.2	°C
Bio9	Mean temperature of the driest quarter	−2.3 to 9.2	°C
Bio10	Mean temperature of the warmest quarter	−0.3 to 10.5	°C
Bio11	Mean temperature of the coldest quarter	−11.0 to 2.2	°C
Bio12	Annual precipitation	581–2085	mm
Bio13	Precipitation of the wettest period	70–208	mm
Bio14	Precipitation of the driest period	25–142	mm
Bio15	Precipitation seasonality (coefficient of variation)	12.9–28.8	–
Bio16	Precipitation of the wettest quarter	190–587	mm
Bio17	Precipitation of the driest quarter	89–429	mm
Bio18	Precipitation of the warmest quarter	118–461	mm
Bio19	Precipitation of the coldest quarter	166–587	mm

<sup>a</sup> The variable called isothermality represents here temperature evenness over the course of year (e.g. areas with isothermality value of 100 represent sites where diurnal temperature range equals to the annual temperature range, whereas areas with isothermality value of 50 represent sites where diurnal temperature range is equal to half of the annual temperature range).

#### 4. To predict the impact of climate change on the alien flora in Iceland.

### Materials and methods

The present study is focused on alien plant species defined after Pyšek et al. (2004) as taxa whose presence in a given area is due to intentional or unintentional human involvement or which have arrived there without human involvement from an area in which they are alien. This large group of taxa is further subdivided into two categories: casual alien plants and naturalised alien plants. Definition of both groups follows strictly the distinction proposed by Pyšek et al. (2004). Within naturalised aliens we further recognize invasive alien plants, following the recent proposition of Pyšek et al. (2012). Classification of species as native vascular plants follows strictly Kristinsson (2008).

Data were obtained from the database of the Icelandic Institute of Natural History. We used 9286 records of occurrence including 2571 vouchered specimens (herbaria AMHN and ICEL) and 6715 field observations and literature data records. Doubtful identifications of vouchered collections were verified during the study.

All alien taxa recorded from Iceland between 1840 and 2012 were included in the checklist, that summarizes information concerning taxonomy, modes of introduction, time of residence, naturalisation status, geographic distribution and other relevant data. The checklist was prepared using Brahm's 7.0 (Department of Plant Sciences, University of Oxford, UK). Information on the area of geographic origin, mode of introduction and life form (Raunkiær, 1934) was gathered for each taxon and analyse quantitatively.

To estimate yearly accumulation of alien taxa, including a projected total number in 2050, we employed linear regression of cumulative numbers that started in the year 1890. Computations were made in Statistica 10 (Statsoft Inc., USA).

Occurrence data were converted into GIS layers using DIVA GIS 7.5 (Hijmans et al., 2012) downloaded from <http://www.diva-gis.org/download> to create distribution/diversity rasters. A square grid of 2000 m was employed. In order to create the raster, we employed the circular neighbourhood method as implemented in DIVA GIS (DIVA GIS 7.5) (Hijmans et al., 2012). This approach allowed us to overcome the problem common in all spatial research employing grids. Hitherto results of these analyses

have been heavily dependent on the definition of the raster size (resolution). It was shown that depending on cell size a higher resolution may be achieved, but may lead to loss of spatial patterns. The circular neighbourhood procedure repeats itself for each cell, and each observation contributes to the value of a number of different cells within the raster. This methodology allowed us to maintain a high degree of resolution without losing the pattern of diversity.

For each raster cell the value of Shannon diversity index (Magurran, 1988) was calculated according to the formula:

$$H' = - \sum \frac{n_i}{N} \ln \frac{n_i}{N},$$

where:  $n_i$  – number of individuals in the  $i$ th class,  $N$  – number of observations per raster cell.

As a result we obtained two raster layers containing information on distribution and diversity of (1) casual aliens and (2) naturalised aliens. These raster layers were projected into maps using DIVA GIS.

Current and future distribution of alien plant species in Iceland was inferred on the basis of presence data and environmental layers representing 19 ecogeographic variables and one topographic variable describing elevation above sea level over investigated area (Table 1).

Climatic data necessary to create GIS layers with ecogeographic variables were obtained from WORLDCLIM database – worldclim.org (Hijmans et al., 2005). The present data are interpolations of observed data, representative of 1950–2000. IPPC 3rd assessment data as future climate projections were used (downloaded from WORLDCLIM database). We employed data from three different models (CCCMA, HADCM3 and CSIRO) calculated for A2a emission scenario for the year 2050, calibrated and statistically downscaled. Data from the three models were subsequently combined and an average was taken into account as a basis of our analyses. Climatic data with 30" resolution were used throughout the study. Ecogeographic variables were created from input data (WORLDCLIM database) using DIVA GIS (30" resolution).

In order to define major environmental factors that shape the occurrence of alien species in Iceland and to predict future changes in their distribution we used a species distribution model based on presence data. The maximum entropy method (MaxEnt) for analysing presence-only records (Phillips et al., 2006) was used, as it has been shown to outperform other presence-only methods in

**Table 2**

Potential scenarios caused by the impact of climate change on alien plant taxa and their distinction on the basis of data analysis. Values in the table correspond to values of raster cells used in current analysis (binary raster of presence/absence created by means of predictive modelling using  $THR_{10}$  threshold values as indicated in [Table 3](#)). Value reclassifications within a raster were indicated by “→”.

Situation	Raster of future potential distribution (A)	Raster of current potential distribution (B)	Outcome (A-B)
Species retreat – no longer suitable under future conditions	0	1	-1
Area outside climatic niche – suitable neither under present nor under future climatic conditions	0	0	0
Low impact – suitable under both present and future conditions	3 (1 → 3)	1	2
High impact – potential occurrence under future conditions	3 (1 → 3)	0	3

estimating potential species distribution ([Elith et al., 2006](#); [Phillips et al., 2006](#)). Analyses were carried out using Maxent 3.3.3k downloaded from <http://www.cs.princeton.edu/~schapire/maxent/>.

The goodness of fit of each model was assessed by a ROC (receiver operating characteristics) analysis. We compared the AUC (area under the ROC curve) of each model for presences against a purely random distribution model. The significance of the AUC was tested by a cross-validation procedure involving 100 permutations. We used the following parameters for the analysis: default prevalence = 0.5, convergence threshold =  $10^{-5}$ , 10,000 training iterations of the optimization algorithm, regularization multiplier = 1.0, and the use of “auto” features. We used 25% of the presence points for model testing. 10 percentile training presence threshold was applied to generate output results.

The impact of climate change was investigated on the subset of 18 naturalised taxa. A smaller subset of taxa for modelling studies was used to ensure that a sufficient number of presence points will be used during modelling experiments. It has been shown that at least 50 unique occurrence records should be used in order to obtain sound modelling results ([Scheldeman and van Zonneveld, 2010](#)).

Binary (presence/absence) raster of potential distributions were generated using Maxent model for future climatic conditions. Values from the raster of present potential distributions were subtracted from data in the raster of future potential distributions. The resulting raster, being the outcome of predictive modelling have two values: (1) for presence and (0) for absence. If these values were used for further analysis there would be only two possible results of subtracting or adding: 0 or 1. To overcome this problem and to be able to visualize four possible situations caused by climate change ([Table 2](#)) we reclassified the raster of future potential distributions: values from raster of present potential distributions were subtracted from the data in raster of future potential distributions. In the next step we created a stack containing all the 18 investigated raster and calculated mean values for each raster cell. Cells with a mean value <0 were classified as areas of predominant retreat tendencies of species. When calculated mean was equal to 0, the area was classified as being outside the climatic niche. For mean values within the intervals (0, 1.5] and (1.5, 3] corresponding raster cells were classified as “low impact” and “high impact” areas, accordingly (cf. [Table 2](#) for definition of low and high impact areas).

To analyse variation range of each investigated ecogeographic variable (alt, bio1–bio19) we extracted data from climatic and topographic layers using occurrence coordinates. Frequency tables were prepared in Statistica 10 (Statsoft Inc., USA) and frequency distribution histograms were generated using Sigma Plot 9.0 (Systat Software Inc., USA).

## Results

There were 336 alien plant taxa recorded in Iceland between 1840 and 2012. According to the criteria proposed by [Pyšek et al. \(2004\)](#) 277 taxa (82.5% of the total alien flora) were classified as

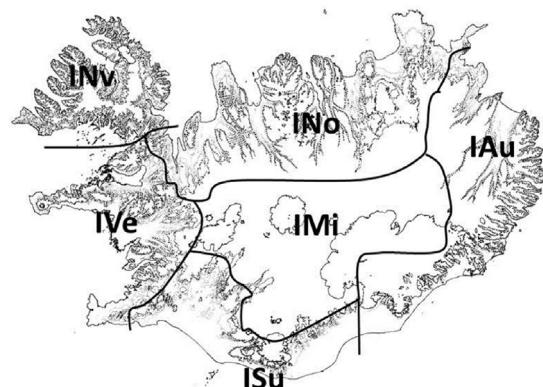
casual aliens whereas 59 taxa (17.5%) were classified as naturalised aliens (Appendix A). Adopting conservative criteria proposed by [Pyšek et al. \(2012\)](#) 2 taxa were classified as invasive: *Lupinus nootkatensis* Donn ex Sims and *Anthriscus sylvestris* (L.) Hoffm.

Alien vascular plants in Iceland belong to 49 families and 191 genera. There are 5 families accounting for more than 5% of the total alien flora: Asteraceae (46 taxa, 13.5% of the total alien flora), Poaceae (42, 12.5%), Brassicaceae (38, 11.3%), Rosaceae (21, 6.2%) and Fabaceae (17, 5.01%). 13 families account for more than 1% of the total alien flora each and 31 families account for less than 1%. 21 genera are among the most represented ones (more than 1% contribution): *Hordeum* and *Lepidium* (7 alien taxa, 2% contribution each); *Chenopodium*, *Pinus*, *Veronica* (6, 1.8%); *Centaurea*, *Silene*, *Trifolium*, *Geranium*, *Lamium*, *Mentha*, *Bromus*, *Rumex*, *Salix* (5, 1.5%); *Senecio*, *Brassica*, *Campanula*, *Galeopsis*, *Picea*, *Lolium* and *Galium* (4, 1.2%). The remaining genera have lower contributions. There are 13 genera with 3 alien taxa, 36 genera with 2 alien taxa and 121 genera with only one alien taxon.

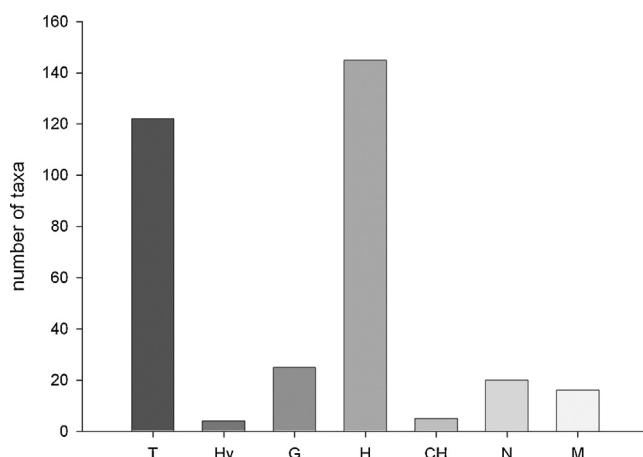
167 taxa (49.7%) have to be classified as deliberate introductions (146 – “deliberately introduced”, 21 – “most probably deliberately introduced”), whereas 169 taxa (50.3%) are considered as accidental introductions (136 – “accidentally introduced” and 33 – “most probably accidentally introduced”). Among the naturalised aliens 64.4% of the taxa are classified as deliberate introductions, whereas 78.1% of casuals fall into this category.

Hemicryptophytes and therophytes are among the most represented life forms, with 145 (43%) and 122 (36.2%) taxa assigned, respectively. We assigned 25 taxa to geophytes, 20 taxa to nano-phanerophytes and 16 taxa to mega-phanerophytes. Chamaephytes and hydrophytes are among the least represented plants, with only 5 and 4 taxa assigned, respectively ([Fig. 2](#)).

Taxa of European origin constitute the core (49.2%) of the Icelandic alien flora, while 30.3% of the investigated taxa are of Asian origin. North American taxa account for 8.9%, African taxa for



**Fig. 1.** Delimitation of major phytogeographical provinces within Iceland, based on Flora Nordica ([Karlsson, 2004](#)).



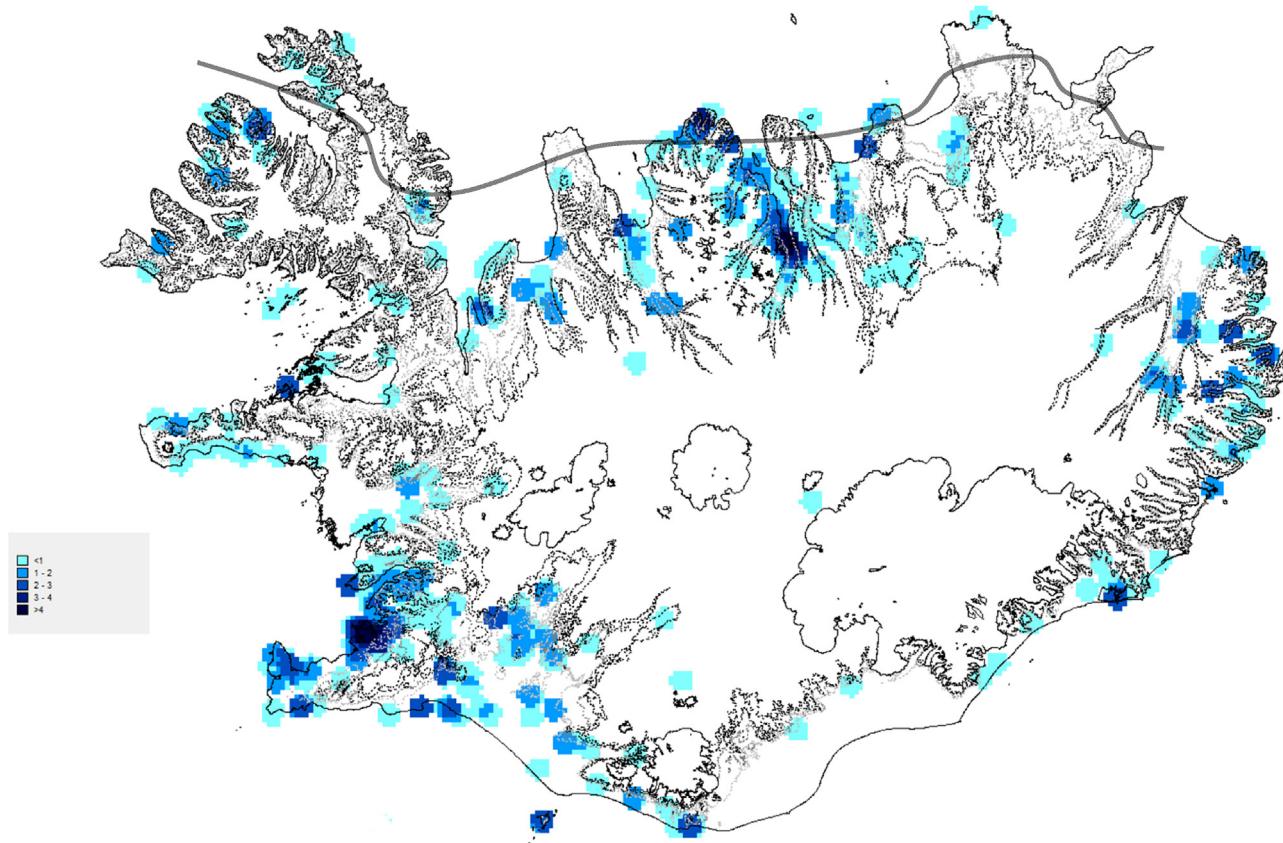
**Fig. 2.** Life forms of alien plant taxa in Iceland; T – therophytes, Hy – hydrophytes, G – geophytes, H – hemicryptophytes, CH – chamaephytes, N – nano-phanerophytes, M – mega-phanerophytes.

6.4% and 1 alien taxon (*Egeria densa*) is of Southern American origin (0.2%). Cultivated, cosmopolitan taxa as well as hybrids (including cultivars) account for 4.4% of the alien flora of Iceland.

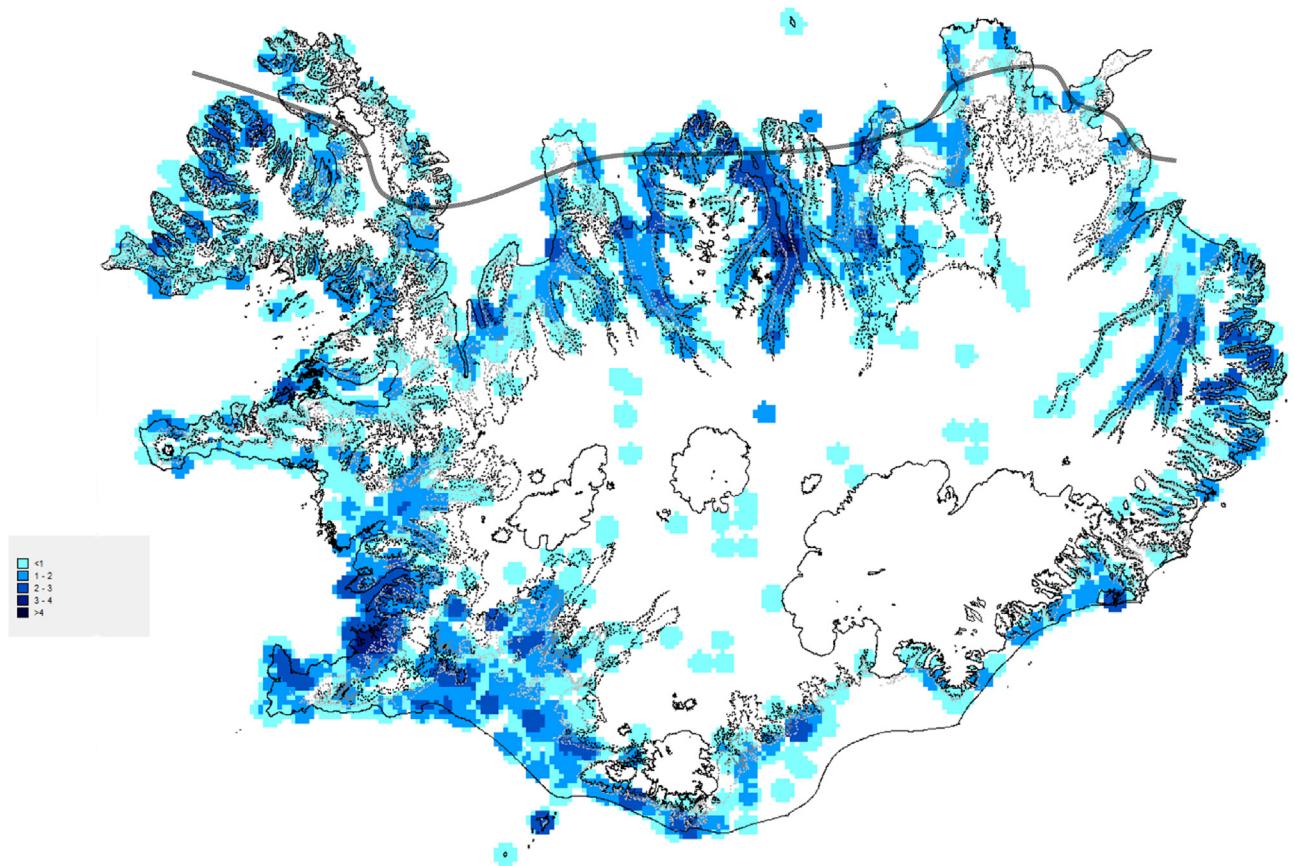
High values of the diversity index for casual aliens were obtained for areas located in the vicinity of major municipalities, Reykjavík (SW Iceland) and Akureyri (N Iceland). Casual species show a tendency to be distributed within lowland areas and were found only occasionally in regions of arctic character (Fig. 3). Distribution of naturalised taxa (Fig. 4) is more continuous, but clear hotspots of occurrence correspond to major

centres of settlement. The diversity of naturalised aliens follows roughly the same pattern, with highest values of the Shannon diversity index in Reykjavík area, Akureyri, and around other major municipalities. The distribution of naturalised aliens is confined mostly to inhabited lowland areas. The arctic regions generally show a low degree of colonisation by alien plants. By contrast, valleys of Icelandic fjords, and rivers, are rather highly colonised by alien plants (Figs. 3 and 4).

Maximum entropy modelling was performed on 18 taxa of naturalised aliens (Table 3). All models were significant. AUC values were very high and varied from 0.865 to 0.980, suggesting a good fit between the model and the data (Fielding and Bell, 1997). Variables with the highest predictive power were selected on the basis of permutation importance values (>10%). Altitude was the most important variable, having the highest importance in 6 models (Table 3) and having >10% importance in 50% of examined models. Maximum temperature of the warmest period (bio5) had the highest importance in 5 models (Table 3, >10% importance in 33% of examined models). Mean temperature of the warmest quarter (bio10) had the highest importance in 2 models (Table 3, >10% importance in 27% of examined models). Annual mean temperature (bio1) had the highest importance in 2 models (Table 3, >10% importance in 22% of examined models). Isothermality (bio3) had the highest importance in 2 models (Table 3, >10% importance in 16% of examined models). The examined alien taxa preferred locations with relatively low altitude above sea level (<100 m a.s.l., Fig. 5A), with a relatively high maximum temperature of the warmest period (>12 °C, Fig. 5F), highest mean temperatures of the warmest quarter (>10 °C, Fig. 5K) and with highest annual mean temperatures (>4 °C, Fig. 5B). Low isothermality values are also characteristic for the occurrence of alien plant taxa in Iceland (most of records from



**Fig. 3.** Distribution and diversity (Shannon diversity index – colour scale) of casual alien plants (277 taxa) in Iceland. Analysis was carried out in 2 km × 2 km grid cells, using circular neighbourhood method with neighbourhood diameter of 10 km. Solid line represents borderline of Arctic as defined by Elven et al. (2011).



**Fig. 4.** Distribution and diversity (Shannon diversity index – colour scale) of naturalised alien plants (59 taxa) in Iceland. Analysis was carried out in 2 km × 2 km grid cells, using circular neighbourhood method with neighbourhood diameter of 10 km. Solid line represents borderline of Arctic as defined by Elven et al. (2011).

areas with isothermality <36, Fig. 5D). Variables connected with precipitation did not show any significant predictive power.

We plotted the cumulative number of first taxa records against time (Fig. 6) to examine temporal trends in alien taxa immigration. This analysis shows a steady, linear increase of ca. 3 new alien taxa per year. It can be clearly seen that the real cumulative number of taxa departs a bit from values predicted by linear regression; however, no distinct decelerating trend is visible. We

used linear regression to predict the total number of alien taxa in 2050. Analyses showed that the model was statistically significant ( $R^2 = 0.968$ , adjusted  $R^2 = 0.967$ ,  $p = 0.0000$ ,  $\alpha = 0.05$ ) and that, based on this, the total cumulative number of 429 alien taxa might be predicted for the year 2050 (an increase by 26% when compared to 2012).

Finally, we analysed the impact of climate change on the distribution of alien plant taxa in 2050. Our models suggest that

**Table 3**

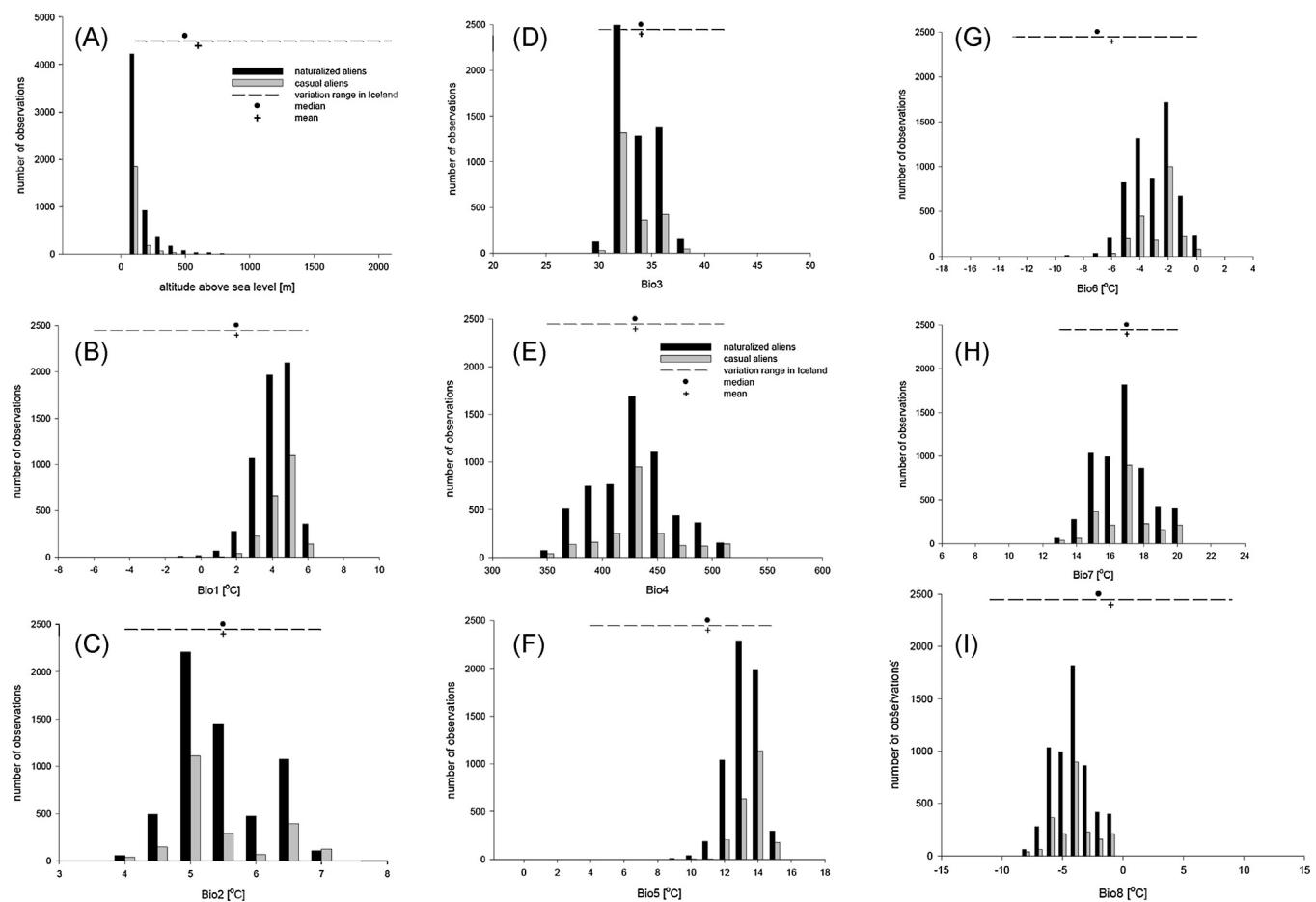
Results of predictive modelling (Maxent 3.3.3k) and most important parameters for each model:  $N$  – number of unique accessions used,  $THR_{10}$  – 10 percentile training presence threshold,  $AUC$  – the value of the area under receiver operating characteristic (ROC) curve, variables with highest predictive power (permutation importance > 10%) for each model were also given.

	Species	$N$	$THR_{10}$	AUC	Variables with permutation importance >10%
1.	<i>Alopecurus pratensis</i>	558	0.326	0.889	Alt (29.3), bio13 (12.7)
2.	<i>Anthriscus sylvestris</i>	209	0.272	0.953	Bio10 (38), Bio15 (15.5)
3.	<i>Bromus inermis</i>	63	0.154	0.968	Bio5 (77.1)
4.	<i>Dactylis glomerata</i>	93	0.195	0.955	Alt (37.6)
5.	<i>Deschampsia cespitosa</i> subsp. <i>beringensis</i>	92	0.339	0.929	Alt (32.1), bio 11 (13.3)
6.	<i>Lamium album</i>	109	0.244	0.967	Bio3 (27.5), bio15 (19.8), alt (17.4), bio10 (13.7)
7.	<i>Lepidotheca suaveolens</i>	290	0.312	0.932	Alt (26.7), bio1 (22.2), bio10 (15.2)
8.	<i>Lupinus nootkatensis</i>	641	0.258	0.865	Bio5 (23.3), bio10 (17.2), bio1 (15.7), bio8 (10.2)
9.	<i>Myrrhis odorata</i>	71	0.246	0.959	Alt (83.0)
10.	<i>Phleum pratense</i>	413	0.255	0.878	Bio10 (25.9), alt (21.8), bio3 (13.6), bio9 (14.2)
11.	<i>Salix alaxensis</i>	107	0.255	0.969	Bio1 (44.5), bio9 (16.7)
12.	<i>Salix myrsinifolia</i> subsp. <i>borealis</i>	132	0.286	0.971	Bio5 (31.0)
13.	<i>Silene dioica</i>	54	0.291	0.953	Bio11 (29.3), alt (24.8), bio5 (14.8)
14.	<i>Stellaria graminea</i>	224	0.224	0.923	Bio15 (32.8), bio9 (11.5), bio2 (10.9)
15.	<i>Trifolium pratense</i>	98	0.210	0.963	Bio3 (28.2), bio5 (15.2),
16.	<i>Tussilago farfara</i>	86	0.110	0.980	Bio1 (75.4)
17.	<i>Urtica dioica</i>	51	0.254	0.953	Alt (56.1), bio11 (10.2)
18.	<i>Valeriana officinalis</i>	83	0.223	0.949	Bio5 (24.2), bio19 (18.6), bio13 (18.7)

only small areas of Iceland will remain outside of the climatic niche of investigated species (Fig. 7). Most of the area of the Central Highlands as well as vast areas in lowlands might be affected. Interestingly, the highest impact of climate change, enabling significant colonisation of alien plant taxa, is predicted for areas of the northern and north-eastern part of Iceland (including areas considered as part of the Arctic according to Elven et al., 2011). These results are supported by predictive modelling carried out for each investigated taxon separately (see Figs. 1C–18C available in electronic form – Appendix B). Our results show that under climate change, in 2050 the potential distribution of the invasive *Lupinus nootkatensis* might expand enormously into the Central Highlands (Fig. 8C, Appendix B). Distribution of the other species ranked as an invasive alien, *Anthriscus sylvestris*, seems to remain more or less stationary, with new suitable areas in arctic regions of NE Iceland as well as in some smaller areas in SE Iceland (Fig. 2C, Appendix B).

## Discussion

The flora of Iceland started to be explored from the middle of the 18th century, but it was not before the second half of the 19th century when first critical surveys were published by Babington (1871) and Grönlund (1881). The first work that meets scientific requirements was published by Stefánsson (1901). This work lists 44 alien taxa from Iceland. This number was updated in subsequent editions from 51 taxa in 1924 to 65 in 1948. Some issues concerning the alien flora of Iceland were also briefly discussed by Gröntved (1942). The first (and the only) work that addressed the question of alien flora of Iceland available for international scientific community was published by Davíðsson (1967). He summarized the knowledge on alien flora of Iceland available at that time, enumerating 183 alien taxa and treating 26 of them as naturalised. Some information on the alien flora can be found also in the work of Steindórsson (1967).



**Fig. 5.** (A–C) Distribution of values of topographic and climatic variables for points of occurrence of naturalised and casual alien plant species in Iceland. Dashed line shows variable range in Iceland, mean and median values for each variable are also given (calculated on the basis of the total data from GIS raster files). (A) Altitude above sea level [m], (B) bio1 – annual mean temperature [°C], (C) bio2 – mean diurnal temperature range [°C], (D–F) distribution of values of climatic variables for points of occurrence of naturalised and casual alien plant species in Iceland. Dashed line shows variable range in Iceland, mean and median values for each variable are also given (calculated on the basis of the total data from GIS raster files). (D) bio3 – isothermality, (E) bio4 – temperature seasonality, (F) bio5 – maximum temperature of the warmest period [°C], (G–I) distribution of values of climatic variables for points of occurrence of naturalised and casual alien plant species in Iceland. Dashed line shows variable range in Iceland, mean and median values for each variable are also given (calculated on the basis of the total data from GIS raster files). (G) bio6 – minimum temperature of the coldest period [°C], (H) bio7 – annual range of temperature [°C], (I) bio8 – mean temperature of the wettest quarter [°C], (J–L) distribution of values of climatic variables for points of occurrence of naturalised and casual alien plant species in Iceland. Dashed line shows variable range in Iceland, mean and median values for each variable are also given (calculated on the basis of the total data from GIS raster files). (J) bio9 – mean temperature of the driest quarter [°C], (K) bio10 – mean temperature of the warmest quarter [°C], (L) bio11 – mean temperature of the coldest quarter [°C], (M–O) distribution of values of climatic variables for points of occurrence of naturalised and casual alien plant species in Iceland. Dashed line shows variable range in Iceland, mean and median values for each variable are also given (calculated on the basis of the total data from GIS raster files). (M) bio12 – annual precipitation [mm], (N) bio13 – precipitation of the wettest period [mm], (O) bio14 – precipitation of the driest period [mm]. (P–S) Distribution of values of climatic variables for points of occurrence of naturalised and casual alien plant species in Iceland. Dashed line shows variable range in Iceland, mean and median values for each variable are also given (calculated on the basis of the total data from GIS raster files). (P) bio15 – precipitation seasonality, (Q) bio16 – precipitation of the wettest quarter [mm], (R) bio17 – precipitation of the driest quarter [mm]. (S and T) Distribution of values of climatic variables for points of occurrence of naturalised and casual alien plant species in Iceland. Dashed line shows variable range in Iceland, mean and median values for each variable are also given (calculated on the basis of the total data from GIS raster files). (S) bio18 – precipitation of the warmest quarter [mm], (T) bio19 – precipitation of the coldest quarter [mm].

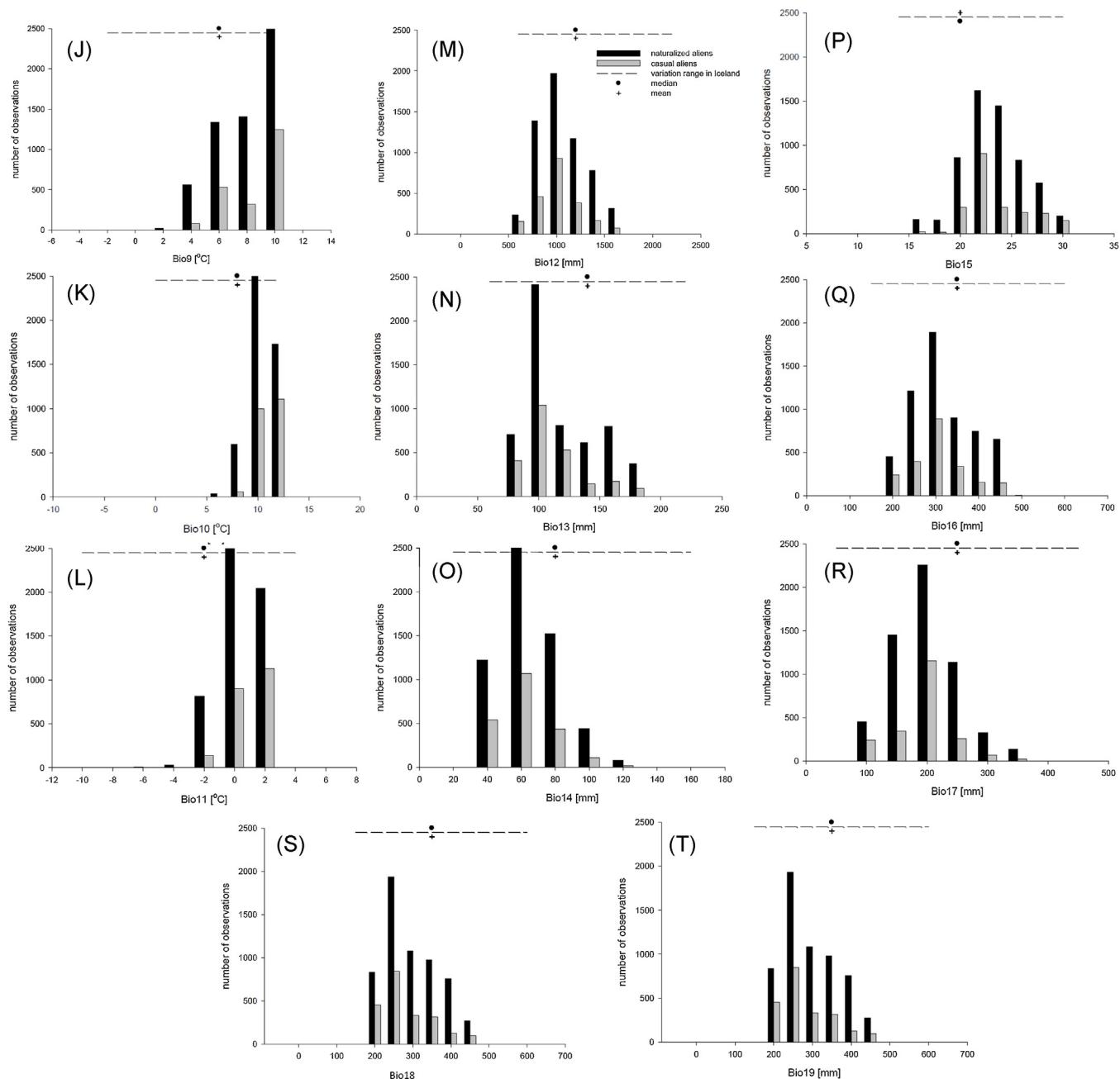


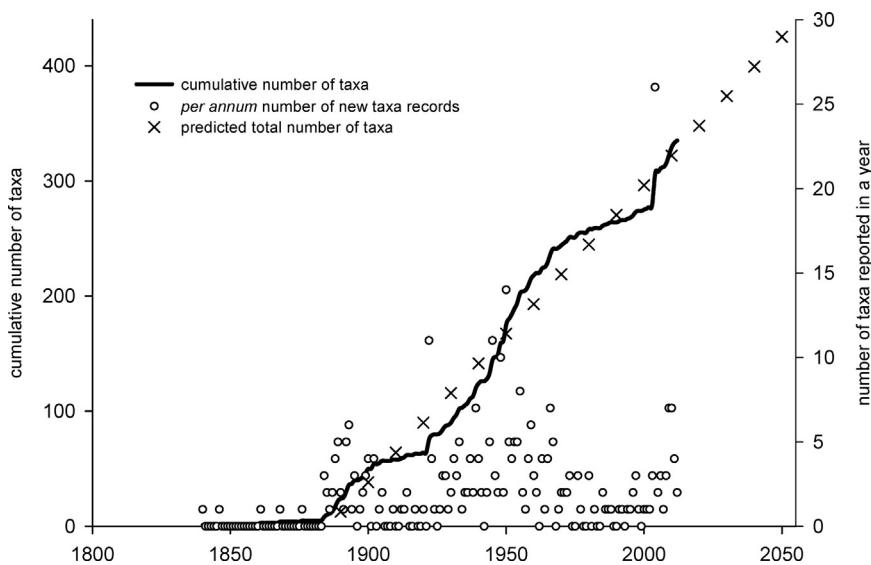
Fig. 5. (continued).

However, his treatment of the Icelandic alien flora is rather unclear and probably incomplete. Numerous papers describing new alien species were published almost throughout the whole 20th century (mainly in Icelandic). The checklist of vascular plants in Iceland (Kristinsson, 2008) contains the most recent data on alien plant taxa.

Here, we presented a checklist of alien flora of Iceland (see Appendix A), together with updated and reliable information on the diversity and distribution of these taxa. Major improvements have been done mainly in terms of establishment of the time of residence for numerous taxa and assigning alien plants to one of two major categories (naturalised and casual species, respectively) according to contemporary international standards. Casual alien plant taxa in Iceland were compiled here for the first time.

Importation of alien plant taxa to Iceland started only after the 9th century, when the settlement of Iceland begun (Schutzbach, 1985). Although Irish monks probably settled at the southern coast of Iceland perhaps 100 or 200 years before Nordic settlers arrived (Schutzbach, 1985), their impact on alien flora remains obscure. It is out of question that the natural environment of Iceland underwent a tremendous change after the settlement started including importation of alien taxa (Davíðsson, 1967).

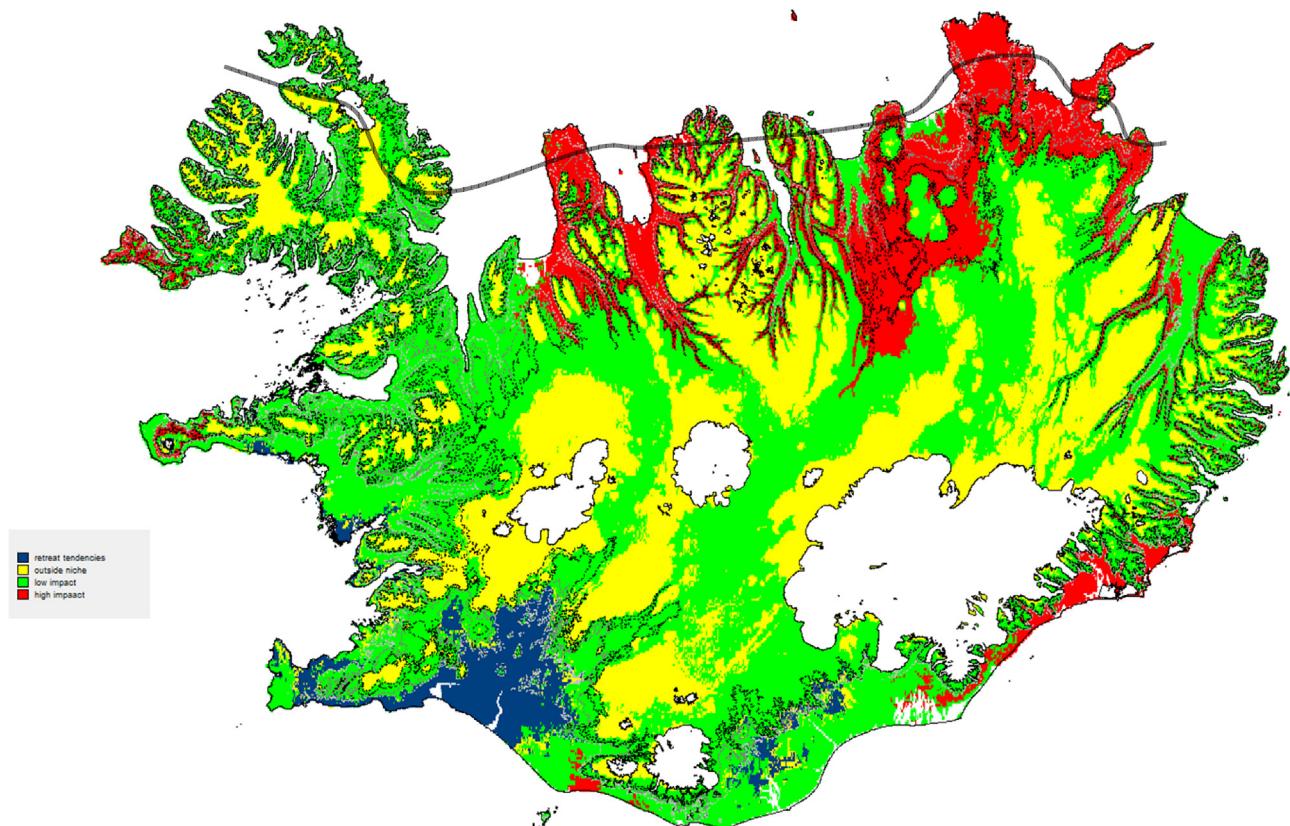
There is no sure evidence, which plants were brought to Iceland during the early stages of settlement. Some conjectures were made by Davíðsson (1967) and Steindórsson (1967), but detailed evidence-based analyses are still lacking. To overcome this problem, all plants that are native or become naturalised before 1750 were classified within one group in the latest edition of the Icelandic flora checklist (Kristinsson, 2008). The problem



**Fig. 6.** Dynamics and temporal trends in alien plant flora of Iceland (1840–2050). Cumulative number of taxa was calculated on the basis the number of per annum new taxa records (right axis). Prediction of yearly accumulation of alien plant taxa is based on linear regression that started in year 1890 ( $R^2 = 0.968$ , adjusted  $R^2 = 0.967$ ,  $p = 0.0000$ ,  $\alpha = 0.05$ ).

of “early aliens” (archaeophytes) remains one of the important, still open challenges for Icelandic botany. In our study we focused only on taxa that can doubtless be considered as neophytes.

The taxonomic composition of the Icelandic alien flora is similar to that of continental Europe, where Asteraceae, Poaceae, Fabaceae, Rosaceae and Brassicaceae were found to be the most diverse families (Lambdon et al., 2008). The only predominantly woody



**Fig. 7.** Prediction of the impact of climate change on the distribution of alien plant species in Iceland in 2050 (maximum entropy modelling). Analysis was carried out on 18 naturalised alien plant taxa (cf. Table 3). Blue colour marks areas that might be no longer suitable for many of the analysed taxa, yellow colour marks areas outside of the climatic niche, green colour marks areas of low impact of climate change, areas of possible range expansion are marked in red. Solid line represents borderline of Arctic as defined by Elven et al. (2011).

family members of which are reported to have been introduced for in Iceland and continental Europe is *Pinaceae* (Lambdon et al., 2008). Five genera found to be the most diverse ones are also included into the list of most represented genera in the alien flora of Europe (Lambdon et al., 2008).

Davíðsson (1967) hypothesized that due to geographic and economic isolation alien plants were introduced in Iceland rather infrequently until 1900. Our results indicate as well that new introductions were not frequent before 1890, when a clearly increasing trend started and continued until present (cf. Fig. 6). Similar trends were observed in many European countries (e.g. Pyšek et al., 2012; Tokarska-Guzik, 2005; Verloove, 2006). It is clear however, that the process of rapid accumulation of alien taxa started in Iceland about one century later than in other parts of Europe (Lambdon et al., 2008). This can primarily be explained by the isolation of the country in the past.

Our study evidences that the number of alien taxa in Iceland is increasing with a reasonably stable rate of three new taxa per year. Interestingly, in spite of geographical isolation this rate of accumulation is comparable to trends recorded in other European countries (e.g. Hulme et al., 2009; Pyšek et al., 2012). Accumulation of new alien taxa, however, seems to be less problematic than the presence of already naturalised aliens. It was shown that alien invasion is often characterized by a considerable time lag between the date of first introduction of a species and its naturalisation (Aikio et al., 2010; Pyšek et al., 1995). This in turn means that independently of strict biosecurity regulations preventing further introductions, future invasion problems will have their roots in past introductions. This problem was termed “invasion debt” (Essl et al., 2011) and it seems that it may pose a serious risk for the Icelandic flora, especially under climate change.

Harsh environmental conditions are a constraint on alien plant invasions (Shea and Chesson, 2002). This is particularly true in arctic and subarctic environments where low air and soil temperatures, large temperature variations and a short growing season are major challenges for plant growth (Callaghan et al., 2004; Chapin and Shaver, 1981; Chapin et al., 1975; Liška and Soldán, 2004). Our results suggest indeed that temperature-related variables have an impact on the distribution pattern of the examined naturalised plant taxa. We can confirm also that altitude can be considered an important factor shaping the distribution of alien species, as it was proved before by studies conducted on oceanic islands with a warm climate (Arevalo et al., 2005; Senan et al., 2012). The data from Iceland show that similar relationships between altitude and the occurrence of alien plant taxa exists also in high northern latitudes.

Alien plant taxa in Iceland exhibit a clear spatial pattern and are mostly confined to inhabited lowland areas that are distributed along the coast and major valleys. These areas host all major municipalities and smaller settlements, as well as most of the economic activity. A similar spatial pattern was found also in other oceanic islands (e.g. Senan et al., 2012). Our results seem to confirm also that human-mediated propagule pressure and disturbance are key factors that influence distribution of alien plant taxa and promote processes of naturalisation and invasion (Chown et al., 1998; Denslow et al., 2009; Kueffer et al., 2010; Rodgers and Parker, 2003; Taylor and Irwin, 2004; Trueman et al., 2010).

Prediction of species responses to future climate change is of fundamental importance for effective management of biodiversity (Hannah et al., 2002). It is possible to make such predictions using techniques of modelling of species distribution, based on the environmental conditions of sites of known occurrence (Phillips et al., 2006; Serra-Díaz et al., 2012). Predictive modelling was successfully employed in studies aiming to get insight into the geographic distributions during past climates (Hugall et al., 2002; Pauwels et al., 2012; Peterson et al., 2004) as well as to predict the impact of expected climate change on distribution patterns (Khanum et al.,

2013; Wilson et al., 2009). It was confirmed that niche models are especially well suited to application in the arctic and subarctic owing to the predominant role of abiotic factors in determining species distributions in these harsh environments (Chapin et al., 1996; Pearson et al., 2013).

Our results suggest that climate change might have a strong impact on the alien flora of Iceland. It seems that species being already classified as invasive will have a very strong potential to colonise new areas under the climate change scenario. Our results suggest that the suitable climatic niche for *Lupinus nootkatensis* will grow enormously until 2050 (Fig. 8C, Appendix B), what may result in colonisation of the vast areas of the central highlands by this species. Similarly, the climatic niche for *Anthriscus sylvestris* is predicted to grow significantly (but not as drastic as for the former species), leading to colonisation of areas where this invasive plant is absent under the present climate.

Predictions suggest that new invasive taxa can emerge from naturalised aliens, and *Salix alaxensis* may serve as a good example (Fig. 11C, Appendix B). This species (deliberately introduced in recent times) has a potential to spread rapidly in the northern part of the country as well as into the Central Highlands. Our results concerning woody species support recent predictive research on arctic vegetation, showing that areas suitable for establishment of woodlands will increase significantly in near future (Pearson et al., 2013).

It should be stressed that due to limited occurrence several potentially invasive taxa (e.g. *Heracleum spp.*) were not investigated during present study. As consequence, our predictions may even underestimate potential influence of climate change on the distribution of alien taxa in Iceland. This situation is still more serious when taking into account that at least half of the vegetated areas in the Arctic realm is predicted to shift to a different physiognomic class (Pearson et al., 2013) over next few decades. The resulting sudden change in distribution of native species will most probably open new areas for invasions.

Previous research showed that the Arctic alien plants are not considered to be a threat to native taxa and arctic ecosystems at present (Elven et al., 2011) and our results confirm these findings. Our predictions show clearly that this may change when these areas become severely impacted by climate change in forthcoming decades.

Present study has to be appreciated as only the first step in a detailed research on the alien flora of Iceland. There are major questions and problems that are still waiting to be solved. One of the most important of them is, to define a set of archeophytes and subsequently use this information to update the catalogue of native plant taxa in Iceland. Detailed studies are still needed to put the naturalisation and invasion processes into a spatio-temporal context. Close monitoring of the distribution of alien plants will provide information to respond promptly and adequately to climate-change-induced alterations in the distribution of alien flora and to monitor the invasion status of already naturalised taxa.

## Conclusions

Present study provides up-to-date information on alien vascular plant taxa in Iceland. The distribution of alien plant taxa in Iceland exhibits a clear spatial pattern, with hotspots of their occurrence and diversity confined to major areas of settlement. Our results seem to indicate that altitude and temperature-related variables are the most important factors governing the distribution of alien plant taxa in Iceland. Climate change might have a major influence on the flora of Iceland, promoting establishment of invasive plant populations in many areas. Areas considered as a part of the Arctic (following the treatment proposed by Elven et al., 2011) might be among the most affected ones by the spread of alien taxa as caused

by climate change. The data on the alien flora of Iceland may better enable respective management efforts, and they can contribute to meta-analyses of invasion processes worldwide.

## Acknowledgements

The present study is based on the data collected by numerous Icelandic botanists whose hard and systematic work should be greatly acknowledged.

## Appendix A. Checklist of alien vascular plants in Island (1840–2012)

**Mode of introduction:** D – taxon introduced deliberately (this includes taxa of horticultural or agricultural use as well as most if not all woody immigrants), A – taxon introduced accidentally,

D? – taxon introduced most probably deliberately, A? – taxon introduced most probably accidentally. **First record:** Data for the first record are usually taken from databased herbarium collections. In some rare cases, however, they are based on observations only. This usually refers to taxa that are not present in herbaria collections in Iceland but were listed on the basis of literature reports.

**Most recent record:** The data on the most recent record are based on both herbarium and observational data. **Naturalisation status:** Terminology according to Pyšek et al. (2004); the following categories were used: CAS – “casual alien plants”, NAT – “naturalised plants”, INV – invasive species, O – taxon known from observations or literature data (no vouchered collections present). **Distribution:** Phytogeographical provinces within Iceland see Fig. 1; Abbreviations: INv – North-West province, INo – North province, IVe – West province, ISu – South province, IAu – East province, IMi – Central Highlands.

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
Family: Alliaceae <i>Allium schoenoprasum</i> L. ( <i>Graslaukur</i> )	D	1935	1998	Europe, Asia, North America	CAS	INo, ISu, IVe	
Family: Amaryllidaceae <i>Narcissus pseudonarcissus</i> L. ( <i>Tjarnasverðlilja</i> )	D?	2009	2009	Europe, Asia	CAS	IVe	
Family: Apiaceae <i>Aegopodium podagraria</i> L. ( <i>Geitakál</i> )	A?	1948	2011	Europe	NAT	IAu, INo, INv, ISu, IVe	Plant introduced probably around 1900 by Norwegian whalers in Asknes (Kristinsson, 2008). First confirmed records of presence came from 1948.
<i>Aethusa cynapium</i> L. ( <i>Villisteinselja</i> )	A	1966	1966	Europe	CAS	IVe	
<i>Anthriscus sylvestris</i> (L.) Hoffm. ( <i>Skógarkerfill</i> )	A?	1923	2012	Europe, Asia	NAT INV	IAu, INo, INv, ISu, IVe	The species is now considered to be invasive in Iceland. First records came from Northern Iceland (Akureyri) (Óskarsson, 1932). Its spread was evident as early as in 1940, when species was seen to spreading widely around army camps and gardens in Reykjavík and surroundings (Davíðsson, 1967).
<i>Daucus carota</i> L. ssp. <i>sativus</i> (Hoffm.) Arcang. ( <i>Gulrót</i> )	D	1965	1965	cultivated	CAS	INo	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Heracleum mantegazzianum</i> Sommier & Levier ( <i>Bjarnarkló</i> )	D	1997	2010	Asia	NAT	INo, INv, ISu, IVe	Potentially invasive species that might have already started to spread in several places in Iceland. Close monitoring and quick eradication would probably prevent further invasion. (see also notes for <i>H. persicum</i> )
<i>Heracleum persicum</i> Desf. ex Fisch., C.A.Mey. & Avé-Lall., ( <i>Tröllakló</i> )	D	2001	2009	Asia	NAT	INo	Potentially invasive species already established in Northern Iceland (might have started to spread locally). It seems that the species is only present in northern part of the country, while <i>H. mantegazzianum</i> is present mainly in the southern part.
<i>Heracleum sphondylium</i> L. ( <i>Húnakló</i> )	D?	2002	2002	Europe, Asia	CAS O	IVe	
<i>Levisticum officinale</i> W.D.J.Koch ( <i>Skessujurt</i> )	D	2004	2012	Europe, Asia	CAS	IVe	
<i>Meum athamanticum</i> Jacq. ( <i>Bjarnarrót</i> )	D	2008	2010	Europe	CAS	INo, ISu	
<i>Myrrhis odorata</i> Scop. ( <i>Spánarkerfill</i> )	D	1936	2012	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Torilis japonica</i> (Houtt.) DC. ( <i>Runnakerfill</i> )	A	1948	1950	Europe, Asia, North Africa	CAS	IVe	
Family: Asteraceae							
<i>Ambrosia artemisiifolia</i> L. ( <i>Ömbrujurt</i> )	A	1948	1948	North America	CAS	IVe	
<i>Anthemis arvensis</i> L. ( <i>Akurgasajurt</i> )	A	1894	1972	Eutope	CAS	IAu, INo, INv, ISu, IVe	
<i>Anthemis tinctoria</i> L. ( <i>Gullgæsajurt</i> )	A	1937	1953	Europe, Asia	CAS	IAu, INo, ISu	
<i>Artemisia vulgaris</i> L. ( <i>Malurt</i> )	A	1945	2005	Europe, Asia, North Africa	CAS	INo, IVe	
<i>Aster linosyris</i> (L.) Bernh. ( <i>Gullstjarna</i> )	D?	2008	2008	Europe	CAS O	IVe	
<i>Bellis perennis</i> L. ( <i>Fagurfífill</i> )	D?	1913	2010	Europe	CAS	IAu, INo, INv, ISu, IVe	
<i>Carduus crispus</i> L. ( <i>bistilbróðir</i> )	A	2009	2009	Europe	CAS	IVe	
<i>Centaurea cyanus</i> L. ( <i>Garðakornblóm</i> )	D	1887	1973	Europe, Asia	CAS	IAu, INo, ISu, IVe	
<i>Centaurea jacea</i> L. ( <i>Hnappakornblóm</i> )	A?	1934	2010	Europe, Asia, North Africa	CAS	ISu, IVe	
<i>Centaurea montana</i> L. ( <i>Fjallakornblóm</i> )	D	1893	2012	Europe	NAT	IAu, INo, ISu, IVe	
<i>Centaurea scabiosa</i> L. ( <i>Fagurkornblóm</i> )	A?	1948	1948	Europe	CAS	INv	
<i>Centaurea triumfettii</i> All. ( <i>Flauelskornblóm</i> )	D	1963	2008	Europe, Africa, West Asia	CAS	INo, IVe	
<i>Cicerbita alpina</i> (L.) Wallr. ( <i>Fjallablámi</i> )	D	2006	2011	Europe	NAT	INo	
<i>Cicerbita macrophylla</i> Wallr. ( <i>Kákásusblámi</i> )	D	2009	2009	Europe, Asia	CAS	IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Cirsium heterophyllum</i> (L.) Hill. ( <i>Purpurapistill</i> )	A?	1945	2011	North Europe (Scandinavia)	NAT	IAu, INo, ISu, IVe	
<i>Cirsium palustre</i> (L.) Scop. ( <i>Mýrapistill</i> )	A?	1950	1950	Europe, Asia	CAS	IAu	
<i>Crepis capillaris</i> (L.) Wallr. ( <i>Fálkaskegg</i> )	A	1927	1927	Europe	CAS	INo	
<i>Crepis tectorum</i> L. ( <i>Valsskegg</i> )	A	1987	1987	Europe, Asia	CAS	IVe	
<i> Doronicum columnae</i> Ten. ( <i>Gimbraffill</i> )	D	2011	2011	Europe	CAS	ISu	
<i>Doronicum orientale</i> Hoffm. ( <i>Hjartarfíll</i> )	D	2004	2004	Asia, Europe	CAS O	IVe	
<i>Doronicum pardalianches</i> L. ( <i>Bolafíll</i> )	D	2011	2011	Europe	CAS	INo	
<i>Echinops exaltatus</i> Schrad. ( <i>Broddþyrnikollur</i> )	D	1950	1950	Europe	CAS	INo	
<i>Erigeron speciosus</i> (Lindl.) DC., ( <i>Garðakobbi</i> )	D	2012	2012	North America	CAS	IVe	
<i>Filago vulgaris</i> Lam. ( <i>Knappmulla</i> )	A?	1924	1924	Europe	CAS O	INo	
<i>Helianthus annuus</i> L. ( <i>Sólfíll</i> )	A	1950	1950	cultivated	CAS	ISu	
<i>Hieracium pilosella</i> L. ( <i>Tágafíll</i> )	D?	2010	2010	Europe, Asia	CAS O	IVe	
<i>Lactuca serriola</i> L. ( <i>brynnisalat</i> )	A	1950	1950	Europe, North Africa, Asia	CAS O	IVe	
<i>Lapsana communis</i> L. ( <i>Héraffíll</i> )	A	1923	1973	Asia, Europe	CAS	IAu, INo, ISu, IVe	
<i>Lepidotheca suaveolens</i> (Pursh) Nutt. – Syn.: <i>Matricaria matricarioides</i> (Less.) Porter ( <i>Hlaðkolla</i> )	A	1902	2012	Europe, North America, Asia	NAT	IAu, IMi, INo, INv, ISu, IVe	
<i>Leucanthemum vulgare</i> Lam. ( <i>Freyjubrá</i> )	A	1931	2012	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Matricaria recutita</i> L. – Syn.: <i>Chamomilla recutita</i> (L.) (Kryddbrá)	A	1966	2008	Europe, Asia	CAS	INo, ISu, IVe	
<i>Mycelis muralis</i> (L.) Dumort. ( <i>Skógarsalat</i> )	A	1950	1950	Europe	CAS	IVe	
<i>Petasites hybridus</i> (L.) G.Gaertn. ( <i>Hrossafíll</i> )	A	1928	2011	Europe, Asia	CAS	INo, IVe	
<i>Pilosella aurantiaca</i> (L.) F.W. Schmidt & Schultz. ( <i>Roðaffíll</i> )	D	1955	2012	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Rudbeckia laciniata</i> L. ( <i>Sólhattur</i> )	A?	1955	1955	North America	CAS	IVe	
<i>Senecio duriæi</i> J.Gay – Syn.: <i>Senecio nebrodensis</i> L. ( <i>Meistarakrossgras</i> )	A	1960	1960	Europe	CAS O	INo	
<i>Senecio pseudoarnica</i> Less. ( <i>Stormþulur</i> )	D	2004	2011	North America	CAS	IAu, ISu, IVe	
<i>Senecio sylvaticus</i> L. ( <i>Trönuþulur</i> )	A	2005	2005	Europe, Asia	CAS	IVe	
<i>Senecio vernalis</i> Waldst. & Kit. – Syn.: <i>Senecio leucanthemifolius</i> Poir. ssp. <i>vernalis</i> (Waldst. & Kit.) ( <i>Vorpulur</i> )	A	1960	2004	Europe	CAS	INo	
<i>Sonchus arvensis</i> L. ( <i>Grísaffíll</i> )	A	1945	2010	Europe, Asia, North Africa	CAS	INo, ISu, IVe	
<i>Sonchus asper</i> (L.) Hill ( <i>Galtarfíll</i> )	A	1939	1965	Europe	CAS	IAu, INo, INv, ISu, IVe	
<i>Sonchus oleraceus</i> (L.) L. ( <i>Gyltuþíll</i> )	A	1948	1963	Asia, Europe	CAS	IAu, ISu, IVe	
<i>Tanacetum vulgare</i> L. ( <i>Regnfang</i> )	D	1931	2011	Europe, Asia	CAS	IAu, INo, IVe	
<i>Tragopogon pratensis</i> L. ( <i>Hafursskeggfíll</i> )	A	2004	2004	Europe, Asia	CAS O	IVe	
<i>Tripleurospermum inodorum</i> (L.) Sch.Bip. – Syn.: <i>Tripleurospermum perforatum</i> (Mérat) Wagenitz ( <i>Völvubrá</i> )	A	1961	2011	Europe, Asia, North Africa	CAS	IMi, INo, INv, ISu, IVe	
<i>Tussilago farfara</i> L. ( <i>Hóffíll</i> )	A	1933	2012	Europe, Asia	NAT	IAu, INo, INv, ISu, IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<b>Family: Betulaceae</b>							
<i>Alnus incana</i> (L.) Moench ssp. <i>kolaensis</i> (Orlova) Å. & D. Löve ( <i>Gráðlur</i> )	D	2009	2009	Europe	CAS	ISu	Kristinsson (2008) mentioned that the species was imported for use in forestry around 1900. It is still difficult to say if it is able to sustain self replacing populations and therefore was classified as casual alien
<i>Alnus viridis</i> (Chaix) DC. ssp. <i>sinuata</i> (Regel) Å. Löve & D. Löve, Syn.: <i>Alnus sinuata</i> (Regel) Rydb. ( <i>Sitkaðlur</i> )	D	1996	2005	North America, East Asia	NAT O	IAu, IMi, ISu, IVe	
<b>Family: Boraginaceae</b>							
<i>Anchusa arvensis</i> (L.) M. Bieb. ( <i>Uxajurt</i> )	A	1940	1956	Europe	CAS O	INo, IVe	
<i>Asperugo procumbens</i> L. ( <i>Klöajurt</i> )	D?	1929	2009	Europe	CAS	INo	
<i>Borago officinalis</i> L ( <i>Hjólkrona</i> )	A?	1954	1954	Europe	CAS	IVe	
<i>Cynoglossum officinale</i> L ( <i>Hundatunga</i> )	A?	1945	1945	Europe	CAS	INo	
<i>Echium vulgare</i> L. ( <i>Naðurkollur</i> )	A	1939	1964	Europe, Asia	CAS	ISu, IVe	
<i>Lappula marginata</i> (M. Bieb.) Gurke	A	1951	1956	Europe	CAS	IAu, INo	
<i>Lappula squarrosa</i> (Retz.) Dumont. – Syn.: <i>Lappula</i> <i>myosotis</i> Moench ( <i>Íguljurt</i> )	A	1888	1946	Europe, Asia	CAS	INo, ISu, IVe	
<i>Myosotis scorpioides</i> L. ( <i>Engjamunablóm</i> )	D	1929	2012	Europe	NAT	IAu, INo, ISu, IVe	Due to printing error listed as native in Kristinsson's checklist (2008)
<i>Myosotis sylvatica</i> Ehrh. ex Hoffm. ( <i>Skógmunablóm</i> )	D	1952	1988	Europe	CAS	INo	
<i>Symphytum asperum</i> Lepechin ( <i>Burstavalurt</i> )	A	1945	1945	Asia	CAS	ISu	
<i>Symphytum officinale</i> L. ( <i>Valurt</i> )	A?	1967	1967	Europe	CAS O	INo, ISu	
<b>Family: Brassicaceae</b>							
<i>Alliaria petiolata</i> (Bieb.) Cavara & Grande ( <i>Laakkarsí</i> )	A	1935	2010	Europe, Asia	CAS	INo, IVe	
<i>Armoracia rusticana</i> P. Gaertn. ( <i>Piparrót</i> )	D	1943	1960	Europe	CAS	INo, ISu, IVe	
<i>Barbarea stricta</i> Andrz. ex Besser ( <i>Hlíðableikja</i> )	A	1967	2011	Europe	NAR	INo, ISu, IVe	
<i>Barbarea vulgaris</i> R.Br. ( <i>Garðableikja</i> )	A	1922	2012	Europe, Asia	CAS	IAu, INo, ISu, IVe	
<i>Barbarea vulgaris</i> R.Br. var. <i>arcuata</i> (Opiz ex J. Presl & C. Presl) Fr. ( <i>Akurbleikja</i> )	A	1955	1963	Europe, Asia	CAS	INo	
<i>Berteroa incana</i> (L.) DC. ( <i>Hvítduðra</i> )	A	1959	1960	Europe	CAS O	Isu	
<i>Brassica napus</i> L. var. <i>napobrassica</i> (L.) Rchb. ( <i>Gulrófa</i> )	D	1899	2010	Europe	CAS	INo, IVe	
<i>Brassica oleracea</i> L. ( <i>Garðakál</i> )	D	1953	1966	Europe	CAS	INo, IVe	
<i>Brassica rapa</i> L. ( <i>Arfanæpa</i> )	D	1948	1974	Europe	CAS	IAu, INo, INv, ISu, IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Brassica rapa</i> L. ssp. <i>campestris</i> (L.) Clapham ( <i>Arfanæpa</i> )	D	1947	1973	Europe	CAS	IAu, INo, INv, ISu, IVe	
<i>Camelina microcarpa</i> Andrz. ex DC. ( <i>Hárðoðra</i> )	A	1889	1922	Europe	CAS	IAu, INo, INv, IVe	
<i>Camelina sativa</i> (L.) Crantz. ( <i>Akurðoðra</i> )	A	1922	1967	Europe	CAS	INo	
<i>Cardamine flexuosa</i> With. ( <i>Kjarrklukka</i> )	A?	1931	1931	Europe	CAS O	IAu	
<i>Conringia orientalis</i> (L.) Dumort. ( <i>Káljurt</i> )	A?	1889	1900	Europe, Asia	CAS	IAu, INo, IVe	
<i>Descurainia incana</i> (Bernh.) ex Fisch. & C.A.Mey.	A	1949	1949	North America	CAS	INo	
Dorn – Syn.: <i>Descurainia richardsonii</i> (Sweet) O.E.Schulz ( <i>Gráþejfjurt</i> )							
<i>Descurainia sophia</i> (L.) Webb ex Prantl ( <i>befjurt</i> )	A	1889	1998	Europe, Asia, North Africa	CAS	IAu, INo, IVe	
<i>Erucastrum gallicum</i> (Willd.) O.E.Schulz ( <i>Hundakál</i> )	A	1966	1976	Europe, Asia	CAS	IVe	
<i>Erysimum cheiranthoides</i> L. ( <i>Akurgyllir</i> )	A	1939	1974	Europe, Asia	CAS	INo, INv, ISu, IVe	
<i>Erysimum repandum</i> L., ( <i>Hafnagyllir</i> )	A	1893	1893	Europe, Asia	CAS	INo	
<i>Hesperis matronalis</i> L. ( <i>Næturffjóla</i> )	D	1956	2008	Europe, Asia	CAS	INo, ISu, IVe	
<i>Lepidium campestre</i> (L.) R.Br. ( <i>Akurperla</i> )	A	1922	1966	Europe	CAS	INo, ISu, IVe	
<i>Lepidium densiflorum</i> Schrad. – Syn.: <i>Lepidium neglectum</i> Thell. ( <i>þyrpiperla</i> )	A	1940	1951	North America	CAS	INo, IVe	
<i>Lepidium heterophyllum</i> Benth., ( <i>Hnoðperla</i> )	A	1892	1986	Europe	CAS	INo, IVe	
<i>Lepidium perfoliatum</i> L. ( <i>Sliðurperla</i> )	A	1893	1893	Europe, Asia	CAS	INo	
<i>Lepidium ruderale</i> L. ( <i>Haugperla</i> )	A	1950	1950	Asia, Europe	CAS	INo	
<i>Lepidium sativum</i> L. ( <i>Garðperla</i> )	A?	1922	1966	cultivated	CAS	INo, IVe	
<i>Lepidium virginicum</i> L. ( <i>Virginíuperla</i> )	A	1946	1946	North America	CAS	IVe	
<i>Malcolmia maritima</i> (L.) R.Br., ( <i>Martoppur</i> )	D	1991	1991	Europe	CAS	ISu	
<i>Nasturtium officinale</i> W.T. Aiton – Syn.: <i>Rorippa nasturtium-aquaticum</i> (L.) Hayek ( <i>Brunnperla</i> )	A	1958	2010	Europe, Asia	CAS	ISu	It seems that the species is close to being naturalised along Varmá river near Hveragerði in S Iceland.
<i>Pritzelago alpina</i> (L.) Kuntze ( <i>Snæbreiða</i> )	D	2010	2010	Europe	CAS	IVe	
<i>Raphanus raphanistrum</i> L. ( <i>Akurhreðka</i> )	A	1886	1968	Asia, Europe	CAS	IAu, INo, ISu, IVe	
<i>Raphanus sativus</i> L. ( <i>Ætihréðka</i> )	D	1955	1980	Asia	CAS	INo, IVe	
<i>Rorippa sylvestris</i> (L.) Besser ( <i>Flækjujurt</i> )	A	1927	1983	Europe, Asia	CAS	INo, INv, ISu, IVe	
<i>Sinapis alba</i> L. ( <i>Hvitur mustarður</i> )	A	1891	1978	Europe	CAS	INo, INv, ISu, IVe	
<i>Sinapis arvensis</i> L. ( <i>Arfamustarður</i> )	A	1892	1992	Europe	CAS	IAu, INo, INv, ISu, IVe	
<i>Sisymbrium altissimum</i> L. ( <i>Risadesurt</i> )	A	1895	1977	Europe	CAS	IAu, INo, ISu, IVe	
<i>Sisymbrium officinale</i> (L.) Scop. ( <i>Götudesurt</i> )	A	1959	1959	Europe	CAS	IVe	
<i>Thlaspi arvense</i> L. ( <i>Akursjóður</i> )	A	1892	2009	Europe	CAS	IAu, INo, INv, ISu, IVe	
Family: Campanulaceae							
<i>Campanula fragilis</i> Cirillo ( <i>Skrúðsklukka</i> )	D	1958	1958	Europe	CAS	INv	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Campanula glomerata</i> L. ( <i>Höfuðklukka</i> )	D	1973	2008	Europe, Asia	CAS O	IVe	
<i>Campanula latifolia</i> L. ( <i>Risaklukka</i> )	D	2004	2004	Asia, Europe	CAS O	IVe	
<i>Campanula patula</i> L. ( <i>Vallarklukka</i> )	A	1939	1939	Europe, Asia	CAS	INo	
Family: Cannabaceae							
<i>Cannabis sativa</i> L. ( <i>Hampjurt</i> )	A?	1966	1966	Asia	CAS	IVe	
Family: Caprifoliaceae							
<i>Lonicera caerulea</i> L. ( <i>Blátóppur</i> )	D	2004	2004	Europe, Asia, North America	CAS	IVe	
<i>Sambucus racemosa</i> L. ssp. <i>pubens</i> ( <i>Dúnyllir</i> )	D	2010	2010	Europe, Asia, North America	CAS	IVe	
Family: Caryophyllaceae							
<i>Agrostemma githago</i> L. ( <i>Akurstjarna</i> )	A	1892	1976	Europe, Asia	CAS	INo, ISu, IVe	
<i>Cerastium biebersteinii</i> DC. ( <i>Rottueyra</i> )	D	2004	2004	Europe, cultivated Europe	CAS O	IVe	
<i>Cerastium tomentosum</i> L. ( <i>Völskueyra</i> )	D	2004	2004	Europe	CAS O	IVe	
<i>Dianthus deltoides</i> L. ( <i>Dvergadrottning</i> )	D	2010	2010	Europe, Asia	CAS	ISu	
<i>Silene dioica</i> (L.) Clairv ( <i>Dagstjarna</i> )	D	1922	2012	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Silene latifolia</i> Poir. ssp. <i>alba</i> (Miller) Greuter & Burdet ( <i>Aftanstjarna</i> )	D?	1922	2012	Europe, Asia, North Africa	CAS	Europe, Asia, North Africa	
<i>Silene noctiflora</i> L. ( <i>Rökkurstjarna</i> )	A	1951	1961	Europe, Asia	CAS	INo, IVe	
<i>Silene vulgaris</i> (Moench) Garcke, ( <i>Garðaholurt</i> )	A?	1889	2011	Europe	CAS	INo, ISu, IVe	
<i>Stellaria graminea</i> L. ( <i>Akurarfí</i> )	A	1861	2012	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Stellaria uliginosa</i> Murray – Syn.: <i>Stellaria alsine</i> Grimm ( <i>Bakkafarfi</i> )	A	1840	2008	Europe	NAT	IVe	First observation of this species in Iceland was made by Japetus Steenstrup in 1840. Other records come from 21st century. The status of this species seems to be still rather unclear.
<i>Vaccaria hispanica</i> (Mill.) Rausch. ( <i>Kúajurt</i> )	A	1948	1950	Europe, Asia	CAS	IVe	
Family: Chenopodiaceae							
<i>Atriplex littoralis</i> L. ( <i>banghrímblaðka</i> )	A	1985	1985	Europe	CAS	INo	
<i>Atriplex patula</i> L. ( <i>Akurhrímblaðka</i> )	A	1937	1997	Europe	CAS	INo	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Atriplex prostrata</i> Boucher ex DC.	A	2009	2010	Europe, Asia	CAS	IAu, INv	The species was not accepted as occurring in Iceland hitherto, although Elven et al. (2011) suggested that it might have been overlooked. The status of this species seems to be still rather unclear. According to Elven et al. (2011) it is common along Nordic shores, but in Iceland it was recorded only on two localities and always as part of the flora of human-made habitats. We classified <i>A. prostrata</i> as an alien; however, it is possible that its status will change in the future
<i>Chenopodium album</i> L. (Hélunjóli)	A	1884	2012	cosmopolitan	CAS	IAu, INo, INv, ISu, IVe	
<i>Chenopodium berlandieri</i> Moq. (Texasnjóli)	A	1950	1950	North America	CAS	INo	
<i>Chenopodium murale</i> L. (Netlunjóli)	A	1946	1946	Europe, Asia, North Africa	CAS	INo	
<i>Chenopodium opulifolium</i> Schrad. ex W.D.J.Koch & Ziz (Hærunjóli)	A	1951	1951	Europe, Africa	CAS O	INo	
<i>Chenopodium pratericola</i> Rydb. (Gæsanjóli)	A	1950	1951	North America	CAS	INo	
<i>Chenopodium suecicum</i> Murr. (Sviánjóli)	A	1963	1964	Europe, Asia	CAS	INo, ISu	
<i>Salsola kali</i> L. ssp. <i>tragus</i> (L.) – Syn.: <i>Salsola tragus</i> L. (þornurt)	A	1950	1950	Europe, Asia	CAS	INo	
<i>Suaeda maritima</i> (L.) Dumort ( <i>Salturt</i> )	A	1948	1950	Europe	CAS	IVe	
Family: Convolvulaceae							
<i>Calystegia sepium</i> (L.) R. Br. (Mariúvafklukka)	A	1971	1971	Europe	CAS	IVe	
<i>Convolvulus arvensis</i> L. (Akurvafklukka)	A	1947	1963	Europe, Asia	CAS	INo, IVe	
<i>Cuscuta campestris</i> Yunck.	A	1954	1954	North America	CAS O	IVe	
Family: Crassulaceae							
<i>Sedum album</i> L. (Ljósahnoðri)	D	1965	1965	Europe, North Africa	CAS	INo	
<i>Sedum maximum</i> (L.) Suter – Syn.: <i>Hylotelephium maximum</i> (L.) Holub. (Völvuhnoðri)	D?	2004	2004	Europe, Asia	CAS O	IVe	
<i>Sedum telephium</i> L. – Syn.: <i>Hylotelephium telephium</i> (L.) Ohba (Jónsmessuhnoðri)	D	2004	2004	Europe, Asia	CAS	IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<b>Family: Ericaceae</b> <i>Erica tetralix L. (Haustlyng)</i>	A	2003	2003	Europe	CAS O	ISu	Imported unintentionally with peat soil used in forestry
<b>Family: Euphorbiaceae</b> <i>Euphorbia cyparissias L. (Sedrusmjólk)</i>	D?	1994	1994	Europe	CAS	INo	
<b>Family: Fabaceae</b> <i>Astragalus alpinus L. (Seljahnúta)</i>	D	2005	2006	Europe, Asia	CAS O	IAu	
<i>Lotus corniculatus L. (Akurmaríuskór)</i>	A	1967	2009	Europe	CAS	IAu, ISu, IVe	The species is listed as established alien in Global Invasive Species Database ( <a href="http://www.issg.org">www.issg.org</a> ). We reject this classification on the basis of available data
<i>Lupinus nootkatensis</i> Donn ex Sims ( <i>Alaskalúpína</i> )	D	1967	2012	North America	NAT INV	IAu, IMi, INo, INv, ISu, IVe	Imported to Iceland from Alaska in 1945 ( <a href="#">Kristinsson, 2008</a> ). Currently classified as invasive and widely distributed. Threatens many native habitats including highland areas
<i>Lupinus polyphyllus</i> Lindl. ( <i>Garðalúpína</i> )	D	1954	2012	North America	CAS	IAu, INo, INv, IVe	
<i>Medicago lupulina</i> L. ( <i>Úlfasmári</i> )	A	1876	1965	Europe	CAS	ISu, IVe	
<i>Medicago sativa</i> L. ( <i>Refasmári</i> )	D?	1933	1961	cultivated	CAS	IAu, INo, IVe	
<i>Melilotus albus</i> Medik. ( <i>Mjallarsteinsmári</i> )	A	1884	1964	Europe, Asia, North Africa	CAS	INo, ISu, IVe	
<i>Melilotus officinalis</i> (L.) Pall. ( <i>Mánasteinsmári</i> )	A?	1889	1977	Europe, Asia	CAS	IAu, INo, INv, ISu, IVe	
<i>Pisum sativum</i> L. – Syn.: <i>Pisum arvense</i> L. ( <i>Garðertur</i> )	D	1885	2003	Europe	CAS	IAu, INo, ISu, IVe	
<i>Trifolium aureum</i> Pollich ( <i>Gullsmári</i> )	A?	1923	1923	Europe, Asia	CAS	INo	
<i>Trifolium dubium</i> Sibth. ( <i>Másasmári</i> )	A	1950	1958	Europe	CAS	IVe	
<i>Trifolium hybridum</i> L. ( <i>Túnsmári</i> )	D	1927	2012	Europe	NAT	IAu, INo, ISu, IVe	
<i>Trifolium medium</i> L. ( <i>Skógarstmári</i> )	A?	1970	2005	Europe	NAT	ISu, IVe	
<i>Trifolium pratense</i> L. ( <i>Rauðsmári</i> )	D	1898	2012	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Vicia hirsuta</i> (L.) Gray ( <i>Loðflækja</i> )	A	1893	1934	Europe, West Asia	CAS	INo, IVe	
<i>Vicia sativa</i> L. ( <i>Akurflækja</i> )	D	1885	1959	Asia, Europe, North Africa	CAS	IAu, INo, ISu, IVe	
<i>Vicia villosa</i> Roth ( <i>Dúnflækja</i> )	A?	1914	1914	Europe, Asia	CAS O	INo	
<b>Family: Fumariaceae</b> <i>Fumaria officinalis</i> L. ( <i>Reykjurt</i> )	A	1951	1951	Europe	CAS	IVe	
<b>Family: Geraniaceae</b> <i>Erodium cicutarium</i> (L.) L'Hér. ( <i>Hegranef</i> )	D	1902	2003	Europe	CAS	ISu, IVe	
<i>Geranium magnificum</i> Hyl. ( <i>Kóngablágresi</i> )	D	2004	2004	cultivated	CAS	IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Geranium molle</i> L. ( <i>Loðblágresi</i> )	A?	1939	1939	Europe, Asia, North Africa	CAS	INo	
<i>Geranium pratense</i> L. ( <i>Garðablágresi</i> )	D	1944	2011	Europe, Asia	CAS	INo, IVe	
<i>Geranium pusillum</i> L. ( <i>Dvergblágresi</i> )	A	1923	1950	Europe, Asia, North Africa	CAS	INo, IVe	
<i>Geranium robertianum</i> L. ( <i>Rauðgresi</i> )	A	1950	1950	Europe, Asia, North Africa	CAS	IVe	
Family: Grossulariaceae							
<i>Ribes nigrum</i> L. ( <i>Sólberjarífs</i> )	D	1967	2004	Europe, Asia	CAS O	IAu, IVe	
<i>Ribes pallidum</i> Otto & A.Dietr. ( <i>Rífsberjarunni</i> )	D	1952	2011	cultivated	NAT	IAu, INo, ISu, IVe	
<i>Ribes uva-crispa</i> L. ( <i>Stikilsberjarunni</i> )	D	2004	2004	Europe, Asia, North Africa, cultivated	CAS O	IVe	
Family: Hydrocharitaceae							
<i>Egeria densa</i> Planch. ( <i>Kransarfi</i> )	D?	2007	2007	South America	NAT	ISu	This Brasilian freshwater species was found in Iceland in January 2004 (Þórðarson, 2010) and currently occurs only in one region close to Opnur pond and in the outlet brook in S Iceland. There is no doubt, that the species maintains a self-replacing population for over a decade, as it had already formed dense stands at the time of its discovery in 2004. It can be assumed that the species was introduced to the pond from aquarium culture before 2001 (Þórðarson, 2010). The pond is constantly supplied with water from hot springs resulting in a median water temperature in the pond > 15°C all over the year
Family: Hypericaceae							
<i>Hypericum maculatum</i> Crantz ( <i>Flekkjagullrunni</i> )	A	1977	2003	Europe, West Asia	CAS	IAu	
<i>Hypericum perforatum</i> L. ( <i>Doppugullrunni</i> )	A	2009	2010	Europe, Asia, North Africa	CAS	ISu	
Family: Iridaceae							
<i>Iris pseudacorus</i> L. ( <i>Tjarnasverðlilja</i> )	D?	1982	2006	Europe, Asia, North Africa	CAS	INo, IVe	
Family: Lamiaceae							
<i>Dracocephalum sibiricum</i> (L.) L. – Syn.: <i>Nepeta</i> <i>sibirica</i> L. ( <i>Högnanípa</i> )	A?	1943	1943	Asia	CAS	IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Galeopsis bifida</i> Boenn. ( <i>Skoruhjálmgras</i> )	A	1941	1980	Europe, Asia	CAS	ISu, IVe	
<i>Galeopsis ladanum</i> L. ( <i>Engjahjálmgras</i> )	A	1928	1937	Europe, Asia	CAS	ISu, IVe	
<i>Galeopsis speciosa</i> Mill. ( <i>Gullhjálmgras</i> )	A	1914	1967	Europe	CAS	ISu, IVe	
<i>Galeopsis tetrahit</i> L. ( <i>Garðahjálmgras</i> )	A	1846	2010	Europe	NAT	IAu, INo, ISu, IVe	
<i>Lamium album</i> L. ( <i>Ljósatvítönn</i> )	D	1933	2011	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Lamium amplexicaule</i> L. ( <i>Varpatvítönn</i> )	A?	1893	2008	Europe	NAT	IAu, INo, ISu, IVe	
<i>Lamium confertum</i> Fr. ( <i>Garðatvítönn</i> )	A	1890	2008	Europe	CAS	INo, INv, ISu, IVe	
<i>Lamium hybridum</i> Vill. ( <i>Flipatvítönn</i> )	A	1912	1991	Europe	CAS	INv, ISu, IVe	
<i>Lamium purpureum</i> L. ( <i>Akurtvítönn</i> )	A	1876	1996	Europe	NAT	IAu, INo, INv, ISu, IVe	
<i>Mentha aquatica</i> L. ( <i>Vatnamynta</i> )	D	1938	2006	Europe	NAT	INv	
<i>Mentha arvensis</i> L. ( <i>Akurmynta</i> )	D?	1946	1953	Europe, Asia, North America	CAS O	IVe	
<i>Mentha gentilis</i> L. – Syn.: <i>Mentha gracilis</i> Sole ( <i>Engjamynta</i> )	D	1953	1953	Europe	CAS O	IVe	
<i>Mentha longifolia</i> (L.) Huds. ( <i>Grámynta</i> )	A	2006	2006	Europe, Asia	CAS O	IVe	
<i>Mentha spicata</i> L. ( <i>Garðmynta</i> )	D?	1953	1960	Europe, Asia	CAS	ISu, IVe	
<i>Stachys macrantha</i> (K.Koch) Stearn ( <i>Álfakollur</i> )	D	1940	2009	Asia	CAS	IVe	
Family: Liliaceae <i>Lilium bulbiferum</i> L. ( <i>Eldlilja</i> )	D	2004	2004	Europe	CAS O	IVe	
Family: Limnanthaceae <i>Limnanthes douglasii</i> R.Br. ( <i>Eggjablóm</i> )	D	1954	1954	North America	CAS	IVe	
Family: Linaceae <i>Linum usitatissimum</i> L. ( <i>Spunalín</i> )	D	1895	2006	Asia (cultivated)	CAS	INo, ISu, IVe	
Family: Malvaceae <i>Malva pusilla</i> Sm. ( <i>Hænsnarós</i> )	A	1950	1951	Europe, Asia	CAS	IVe	
<i>Malva verticillata</i> L. ( <i>Kransstokkrós</i> )	A?	1950	1950	Asia	CAS O	ISu	
Family: Nymphaeaceae <i>Nuphar pumila</i> (Timm) DC. ( <i>Dvergvatnalilja</i> )	D	1992	1992	Asia	CAS	INo	Cultivated in the Botanic Garden, brought intentionally out into nature where it persists.
Family: Onagraceae <i>Epilobium ciliatum</i> Raf. Med. ( <i>Kirtildúnurt</i> )	A	1964	2010	North America, East Asia	NAT	IAu, INo, ISu, IVe	Present in Iceland probably from 1955 (Davíðsson, 1967), but first confirmed records are from 1964. Two subspecies were recorded in Iceland: subsp. <i>ciliatum</i> ( <i>Vætudúnurt</i> ) and subsp. <i>glandulosum</i> ( <i>Kirtildúnurt</i> ).
<i>Epilobium montanum</i> L. ( <i>Runnadúnurt</i> )	A	1967	1980	Europe, Asia	CAS	IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<b>Family: Oxalidaceae</b>							
<i>Oxalis corniculata</i> L.( <i>Hornsmæra</i> )	A	1959	1999	cosmopolitan	CAS	ISu	
<b>Family: Papaveraceae</b>							
<i>Meconopsis cambrica</i> Vig. ( <i>Gulsól</i> )	D	2009	2010	Europe	CAS	IVe	
<i>Papaver croceum</i> Ledeb. ( <i>Garðasól</i> )	D	1957	2012	Asia	NAT	IAu, INo, INv, ISu, IVe	
<i>Papaver somniferum</i> L. ( <i>Svefn sól</i> )	A	1933	1950	Cultivated			
				CAS		INo, IVe	
<b>Family: Pinaceae</b> For taxa of this family we report the first and last record (as present in database). In most cases, however, year of first introduction (deliberate in all cases) was not covered by relevant herbarium specimens or field observation. This important information is given in notes for each taxon separately.							
<i>Abies lasiocarpa</i> (Hooker) Nutt. ( <i>Fjallapínur</i> )	D	1994	2006	North America	CAS	IAu	Imported for cultivation in forestry in the early 20th century (Kristinsson, 2008).
<i>Larix sibirica</i> Ledeb. ( <i>Síberíulerki</i> )	D	1966	2011	Asia	NAT O	IAu, INo, ISu	Imported for cultivation in forestry in 1922 (Kristinsson, 2008).
<i>Picea abies</i> (L.) H.Karsten ( <i>Rauðgreni</i> )	D	1977	1997	Europe	CAS O	IAu, IVe	Imported for cultivation in forestry in 1902 (Kristinsson, 2008).
<i>Picea engelmannii</i> Parry ex Engelm. ( <i>Blágreni</i> )	D	1983	1983	North America	CAS O	IAu	Imported for cultivation in forestry ca. 1920 (Kristinsson, 2008).
<i>Picea glauca</i> (Moench) Voss ( <i>Hvítgreni</i> )	D	2007	2007	North America	CAS	IAu	
<i>Picea sitchensis</i> (Bong.) Carrére ( <i>Sítkagreni</i> )	D	1970	2011	North America	NAT O	INv, ISu, IVe	
<i>Pinus aristata</i> Engelm. ( <i>Broddfura</i> )	D	1977	1977	North America	CAS O	IAu	Imported for cultivation in forestry ca. 1905 (Kristinsson, 2008).
<i>Pinus cembra</i> L. ( <i>Lindifura</i> )	D	1978	1978	Europe	CAS O	IAu	Imported for cultivation in forestry ca. 1900 (Kristinsson, 2008).
<i>Pinus contorta</i> Douglas ex Loudon ( <i>Stafafura</i> )	D	1976	2012	North America	NAT O	IAu, INo, INv, ISu, IVe	First known record of importation from 1930, but started to be grown on a bigger scale after 1960 (Kristinsson, 2008).
<i>Pinus mugo</i> Turra ( <i>Fjalla fura</i> )	D	1960	1960	Europe	CAS O	ISu	Imported for cultivation in forestry ca. 1920 (Kristinsson, 2008).
<i>Pinus sylvestris</i> L. ( <i>Skógarfura</i> )	D	2003	2012	Europe, Asia	CAS O	INo, ISu	Widely used in forestry from 1959 (Kristinsson, 2008).

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Pinus uncinata</i> Ramond ex DC. ( <i>Bergfura</i> ) Family: Plantaginaceae	D	2006	2006	Europe	CAS	ISu	
<i>Plantago arenaria</i> Waldst. & Kit. ( <i>Sandtunga</i> ) Family: Poaceae	A	1958	1959	Europe, Asia, North Africa	CAS	IVe	
<i>Agrostis gigantea</i> Roth ( <i>Stórlíngresi</i> )	A?	1930	1937	Europe	CAS	INo, IVe	
<i>Alopecurus myosuroides</i> Huds. ( <i>Akurlíðagras</i> )	A	1972	1982	Europe	CAS	IVe	
<i>Alopecurus pratensis</i> L. ( <i>Háliðagras</i> )	D	1902	2012	Europe, Asia	NAT	IAu, IMi, INo, INv, ISu, IVe	Probably introduced for agricultural reasons at the end of 19th century (Kristinsson, 2008), first confirmed records from 1902.
<i>Apera spica-venti</i> (L.) P.Beauv. ( <i>Akurvindgresi</i> )	A	1976	1977	Europe	CAS	IVe	
<i>Avena fatua</i> L. ( <i>Flughafrar</i> )	A	1966	1966	Europe, Asia	CAS	IVe	
<i>Avena sativa</i> L. ( <i>Hafrar</i> )	D	1876	2009	cultivated	CAS	IAu, INo, INv, ISu, IVe	
<i>Avenula pubescens</i> (Hudson) Dumort. – Syn.: <i>Helictotrichon pubescens</i> (Huds.) Schult. & Schult.f. ( <i>Dúnhafri</i> )	A	1937	2012	Europe, Asia	NAT	INo, ISu, IVe	
<i>Briza media</i> L. ( <i>Hjartapuntur</i> )	A?	1997	1997	Europe, Asia	NAT	IVe	Very rare alien species in Iceland, growing only within a small area close to Grafarvogur (Reykjavík). Dating of its arrival is probably much older than 1997 but still very uncertain.
<i>Bromus arvensis</i> L. ( <i>Akurfax</i> )	A	1905	2007	Europe, Asia	CAS	IAu, INo, INv, ISu, IVe	
<i>Bromus hordeaceus</i> L. ( <i>Mjúkfax</i> )	D	1904	2004	Europe, Asia	CAS	INo, ISu, IVe	
<i>Bromus inermis</i> Leyss. – Syn.: <i>Bromopsis inermis</i> (Leyss.) Holub ( <i>Sandfax</i> )	D	1944	2012	Europe, Asia	NAT	IAu, INo, INv, ISu, IVe	
<i>Bromus secalinus</i> L. ( <i>Rúgfax</i> )	A	1884	1981	Europe, Asia	CAS	INo, ISu, IVe	
<i>Bromus tectorum</i> L. – Syn.: <i>Anisantha tectorum</i> (L.) Nev. ( <i>þakfax</i> )	A	1895	2004	Europe, Asia, North Africa	CAS	INo, IVe	
<i>Calamagrostis purpurea</i> Trin. – Syn.: <i>Calamagrostis phragmitoides</i> Hartm. ( <i>Purpurahálmgresi</i> )	D?	2000	2000	Europe, Asia, North America	CAS	IAu	
<i>Calamagrostis epigeios</i> (L.) Roth ( <i>Melahálmgresi</i> )	D	1980	2003	Europe, Asia	CAS	IVe	
<i>Cynosurus cristatus</i> L. ( <i>Kambgras</i> )	A	1922	1922	Europe, Asia	CAS	INo	
<i>Dactylis glomerata</i> L. ( <i>Axhnoðapuntur</i> )	D	1920	2010	Europe, Asia, North Africa	NAT	IAu, INo, INv, ISu, IVe	
<i>Deschampsia cespitosa</i> (L.) Beauv. ssp. <i>beringensis</i> (Hultén) W.E. Lawr. – Syn.: <i>Deschampsia beringensis</i> Hultén ( <i>Beringspuntur</i> )	D	1986	2012	North America, East Asia (Kamchatka)	NAT	IAu, IMi, INo, INv, ISu, IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Digitaria ischaemum</i> (Schreb.) Muhl. ( <i>Fingurax</i> )	A	1969	2010	Europe, Asia	CAS	ISu, IVe	
<i>Elymus smithii</i> (Rydb.) Gould ( <i>Herpuntur</i> )	A	1945	1982	North America	CAS	IVe	
<i>Festuca arundinacea</i> Schreb. – Syn.: <i>Schedonorus arundinaceus</i> (Schreb.) Dumort. ( <i>Tágavingull</i> )	A?	1937	1937	Europe	CAS O	IVe	
<i>Festuca ovina</i> L. ( <i>Sauðvingull</i> )	D	1930	1980	Asia, Europe	CAS	INo, ISu	
<i>Hordeum brachyantherum</i> Nevski ( <i>Engjabyggi</i> )	D	2011	2011	North America, Asia	NAT	ISu, IVe	
<i>Hordeum bulbosum</i> L. – Syn.: <i>Hordeum nodosum</i> L. ( <i>Hnúðbygg</i> )	A?	1961	1961	Europe	CAS O	ISu	
<i>Hordeum distichon</i> L. ( <i>Tvíraða bygg</i> )	D?	1914	1976	cultivated	CAS	IAu, ISu, IVe	
<i>Hordeum jubatum</i> L. ( <i>Sílkibygg</i> )	D	1952	2005	North America	CAS	IAu, INo, IVe	
<i>Hordeum marinum</i> Huds. ( <i>Mararbygg</i> )	A	1973	1973	Europe, North Africa	CAS	IVe	
<i>Hordeum marinum</i> Huds. ssp. <i>gussoneanum</i> (Parl.) Thell. – Syn.: <i>Hordeum hystrrix</i> Roth	A	1961	2011	Europe, Asia, North America	CAS	ISu, IVe	
<i>Hordeum vulgare</i> L. – Syn.: <i>Hordeum vulgare</i> L. ssp. <i>polystichum</i> Schinz & Keller ( <i>Bygg</i> )	D	1889	2010	cultivated	CAS	IAu, INo, INv, ISu, IVe	
<i>Leymus mollis</i> (Trin.) Pilg. – Syn.: <i>Leymus mollis</i> (Trin.) H. Hara ( <i>Dúnmelur</i> )	D	2010	2010	North America	CAS	IVe	Very rare and found just in one locality. However, it is possible that the species will soon become naturalised.
<i>Lolium multiflorum</i> Lam. ( <i>Ítalskt rýgresi</i> )	D	1922	2003	Europe	CAS	INo, IVe	
<i>Lolium perenne</i> L. ( <i>Vallarrýgresi</i> )	D	1909	2010	Europe, Asia, North Africa	CAS	IAu, IMi, INo, INv, ISu, IVe	
<i>Lolium remotum</i> Schrank ( <i>Eiturrýgresi</i> )	A	1953	1953	Europe	CAS	ISu	
<i>Lolium temulentum</i> L. ( <i>Akurrýgresi</i> )	A	1966	1966	Europe	CAS	IVe	
<i>Phalaris arundinacea</i> L. – Syn.: <i>Phalaroides arundinacea</i> (L.) Rauschert ( <i>Strandreyr</i> )	A	1898	2009	Europe, Asia, North America	CAS	IAu, INo, ISu, IVe	
<i>Phalaris arundinacea</i> L. var. <i>picta</i> L. ( <i>Randagras</i> )	D	1972	2012	cultivated	CAS	IAu, INo, IVe	
<i>Phalaris canariensis</i> L. ( <i>Kanarígras</i> )	A	1887	2012	Europe	NAT	INo, IVe	
<i>Phleum pratense</i> L. ( <i>Vallarfoxgras</i> )	D	1887	2012	Europe	NAT	IAu, IMi, INo, INv, ISu, IVe	
<i>Phragmites australis</i> (Cav.) Trin. ex Steud. ( <i>bakreyr</i> )	D	1995	1999	cosmopolitan	CAS	INo	
<i>Secale cereale</i> L. ( <i>Rúgur</i> )	D	1888	1967	cultivated	CAS	IAu, INo, IVe	
<i>Triticum aestivum</i> L. ( <i>Hveiti</i> )	D	1931	2010	cultivated	CAS	Au, INo, INv, ISu, IVe	
<i>Triticum compactum</i> Host ( <i>Dverghveiti</i> )	D?	2010	2010	cultivated	CAS	INv	
Family: Polemoniaceae							
<i>Polemonium caeruleum</i> L. ( <i>Jakobsstigi</i> )	A	1928	2012	Europe, Asia	CAS	IAu, INo, INv, IVe	
Family: Polygonaceae							
<i>Aconogonon alpinum</i> (All.) Schur ( <i>Snaesúra</i> )	D	2004	2004	Asia	CAS O	IVe	
<i>Fagopyrum esculentum</i> Moench ( <i>Bókhveiti</i> )	A?	1944	2010	cultivated	CAS	IAu, INo, INv, ISu, IVe	
<i>Fagopyrum tataricum</i> (L.) Gaertn. ( <i>Tatarabókhveiti</i> )	A	1945	1945	Asia	CAS O	IVe	
<i>Fallopia convolvulus</i> (L.) Å.Löve ( <i>Vafsvára</i> )	A	1888	1997	Europe, Asia, North Africa	NAT	IAu, INo, INv, ISu, IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Fallopia sachalinensis</i> (F.Schmidt) Ronse Decr. ( <i>Risasúra</i> )	D?	1949	1966	Asia	CAS	IAu	
<i>Persicaria bistorta</i> (L.) Samp. – Syn.: <i>Bistorta officinalis</i> Delarbre ( <i>Slöngusúra</i> )	A?	1956	1963	Europe, Asia	CAS O	INo	
<i>Persicaria lapathifolia</i> (L.) Delarbre – Syn.: <i>Persicaria lapathifolia</i> (L.) Gray; <i>Persicaria lapathifolia</i> (L.) Gray ssp. <i>pallida</i> (With.) Knutsson ( <i>Lóblaðka</i> )	A	1888	1976	Europe, Asia, North Africa, North America	CAS	INo, ISu, IVe	
<i>Rheum rhabarbarum</i> L. – Syn.: <i>Rheum undulatum</i> L. ( <i>Rabbarbari</i> )	D	1912	1912	cultivated	CAS	IMi, INo, INv, ISu, IVe	
<i>Rumex crispus</i> L. ( <i>Hrukkunjóli</i> )	A	1945	1967	Europe, Asia, North Africa	CAS	INo, INv, ISu, IVe	
<i>Rumex obtusifolius</i> L. ssp. <i>sylvestris</i> (Wallr.) Celak. ( <i>Borgarnjóli</i> )	A	1955	2006	Europe	CAS	INo, INv, IVe	
<i>Rumex stenophyllus</i> Ledeb. ( <i>Akurnjóli</i> )	A	1951	1961	Europe, Asia	CAS O	INo	
<i>Rumex thrysiflorus</i> Fingerh. ( <i>Skúfasúra</i> )	A	2003	2003	Europe, Asia	CAS	IAu	
<i>Rumex triangulivalvis</i> (Danser) Rech. f. ( <i>Bugðunjóli</i> )	A	1952	1953	North America	CAS	INo	
Family: Portulacaceae							
<i>Claytonia sibirica</i> L. ( <i>Rósagrýta</i> )	D	2004	2004	Asia, North America	CAS O	IAu	
Family: Primulaceae							
<i>Anagallis arvensis</i> L. ( <i>Nónblóm</i> )	A	1960	1960	Europe, Asia, North Africa	CAS O	IVe	
<i>Lysimachia punctata</i> L. ( <i>Úttagi</i> )	D	1996	2012	Europe, Asia	CAS	IAu, ISu, IVe	
Family: Ranunculaceae							
<i>Aconitum cammarum</i> L. – Syn.: <i>Aconitum stoerkianum</i> Reichenb. ( <i>Fagurhjálmur</i> )	D	2004	2004	Europe	CAS O	IVe	
<i>Aconitum napellus</i> L. ssp. <i>lusitanicum</i> Rouy ( <i>Venusvagn</i> )	D	1976	2008	Europe	CAS	IAu, ISu, IVe	
<i>Anemone nemorosa</i> L. ( <i>Skógarsóley</i> )	D	1988	2005	Europe	NAT	INo	
<i>Ranunculus aconitifolius</i> L. ( <i>Silfursóley</i> )	D	2004	2004	Europe	CAS O	IVe	
<i>Ranunculus acris</i> L. ( <i>Brennisóley</i> )	A?	1897	1962	Europe	NAT	IAu, INo	Recent studies showed that almost all accessions treated previously as <i>R. acris</i> belong to <i>R. subborealis</i> Tzvelev. We treat <i>R. acris</i> as an alien; however, the status of this taxon should be further evaluated in the future.
<i>Trollius europaeus</i> L. ( <i>Gullhnappur</i> )	D	2011	2011	Europe	CAS	ISu	
Family: Rosaceae							
<i>Alchemilla mollis</i> (Buser) Rothm. ( <i>Garðamaríustakkur</i> )	D	1965	2012	Europe	NAT	IAu, INo, INv, ISu, IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Filipendula camtschatica</i> (Pall.) Maxim. ( <i>Risamjaðjurt</i> )	D	1980	2004	Asia	CAS	INo, IVe	
<i>Geum heldreichii</i> hort. ex N.Taylor ( <i>Skrúðdalaffill</i> )	D	2004	2004	cultivated	CAS O	IVe	
<i>Geum macrophyllum</i> Willd. ( <i>Skógdalaffill</i> )	A?	1985	2004	North America	CAS	INo, IVe	
<i>Geum sudeticum</i> Tausch ( <i>Blikdalaffill</i> )	D	2004	2004	Europe	CAS	IVe	
<i>Malus domestica</i> Baumg. ( <i>Eplatré</i> )	D	1953	1953	cultivated	CAS O	IVe	
<i>Padus avium</i> Mill. – Syn.: <i>Prunus padus</i> L. ( <i>Heggur</i> )	D	1955	1955	Europe, Asia	CAS	INo	
<i>Potentilla erecta</i> (L.) Raeusch. ( <i>Engjamura</i> )	A	1955	2005	Europe	NAT	INv, ISu	
<i>Potentilla fruticosa</i> L. ( <i>Runnamura</i> )	D	1997	2004	Europe, Asia, North America	CAS O	IVe	
<i>Potentilla norvegica</i> L. ( <i>Noregsmura</i> )	A	1917	1982	Europe, Asia	CAS	IAu, INo, IVe	
<i>Rosa majalis</i> Herrmann ( <i>Kanelrós</i> )	D	2008	2008	Europe, Asia	CAS	IVe	
<i>Rosa rugosa</i> Thunb. ( <i>Ígulrós</i> )	D	1944	2010	Asia	CAS	IAu, ISu	
<i>Rubus idaeus</i> L. ( <i>Hindber</i> )	D	1936	2005	Europe, Asia	CAS	IAu, INv, IVe	
<i>Rubus spectabilis</i> Pursh ( <i>Laxaber</i> )	D?	2004	2004	North America	CAS O	IVe	
<i>Sanguisorba alpina</i> Bunge ( <i>Höskollur</i> )	D	1922	2012	Asia	NAT	IAu, INo, INv, ISu, IVe	
<i>Sanguisorba canadensis</i> L. ( <i>Kanadakollur</i> )	D	2004	2004	North America	CAS O	IVe	
<i>Sorbaria sorbifolia</i> (L.) A.Braun ( <i>Reyniblaðka</i> )	D	1959	2004	Asia	CAS	IAu, IVe	
<i>Sorbus mougeotii</i> Soy. – Will. & Godr. ( <i>Alpareynir</i> )	D	2004	2004	Europe	CAS O	IVe	
<i>Spiraea billardii</i> Hort ex K. Koch ( <i>Úlfakvistur</i> )	D	2004	2004	cultivated	CAS O	IVe	
<i>Spiraea salicifolia</i> L. ( <i>Vfölkvistur</i> )	D	2004	2004	cultivated	CAS	IVe	
Family: Rubiaceae							
<i>Asperula orientalis</i> Boiss. & Hohen. ( <i>Heiðsnæra</i> )	D	1926	1946	Asia	CAS O	IVe	
<i>Galium aparine</i> L. ( <i>Krókamaðra</i> )	A	1889	1968	Europe	CAS	IAu, INo, INv, ISu, IVe	
<i>Galium mollugo</i> L. ssp. <i>erectum</i> Syme ( <i>Ljósamaðra</i> )	A	1948	2012	Europe	CAS	IAu, INo, IVe	
<i>Galium mollugo</i> L. ssp. <i>mollugo</i> ( <i>Mjúkamaðra</i> )	A	1939	1968	Europe	CAS	INo, IVe	
<i>Galium odoratum</i> (L.) Scop. ( <i>Ilmmaðra</i> )	D?	1966	1966	Europe	CAS O	INo	
<i>Sherardia arvensis</i> L. ( <i>Blámaðra</i> )	A	1963	1978	Europe, North Africa	CAS	ISu, IVe	
Family: Salicaceae							
<i>Populus trichocarpa</i> Torr. & A. Gray ( <i>Alaskaösp</i> )	D	1969	2011	North America	NAT	IAu, INo, ISu, IVe	
<i>Salix alaxensis</i> (Andersson) Coville ( <i>Alaskavíðir</i> )	D	1998	2012	North America	NAT	IAu, INo, ISu, IVe	
<i>Salix caprea</i> L. ( <i>Selja</i> )	D	1948	2011	Europe, Asia	NAT	IAu, IVe	
<i>Salix myrsinifolia</i> Salisb. ssp. <i>borealis</i> (Fr.) Hyl. ( <i>Viðja</i> )	D	1950	2012	Europe, Asia	NAT	IAu, INo, INv, ISu, IVe	
<i>Salix pentandra</i> L. ( <i>Gljávíðir</i> )	D	1941	2010	Europe, Asia	CAS	INo, ISu, IVe	
<i>Salix viminalis</i> L. ( <i>Körfuvíðir</i> )	D	2012	2012	Europe, Asia	CAS	IAu	
Family: Saxifragaceae							
<i>Saxifraga arendsii</i> Engl. ( <i>Roðasteinbrjótur</i> )	D	2010	2010	cultivated	CAS O	INo	
<i>Saxifraga granulata</i> L. ( <i>Kornsteinbrjótur</i> )	A?	1933	1972	Europe	NAT	IVe	
<i>Saxifraga umbrosa</i> L. ( <i>Skuggasteinbrjótur</i> )	D	1955	2010	Europe	CAS	INo, IVe	
Family: Scrophulariaceae							
<i>Digitalis purpurea</i> L. ( <i>Fingurbjargarblóm</i> )	D	1945	2010	Europe	CAS	ISu, IVe	

**Appendix A. (continued)**

Species name (incl. important synonyms and vernacular name)	Mode of introduction	First record	Most recent record	Origin of the species	Status of naturalisation	Distribution*)	Notes
<i>Linaria repens</i> (L.) Mill. ( <i>Randagin</i> )	D	1980	2010	Europe	CAS	IVe	
<i>Linaria vulgaris</i> Mill. ( <i>Gullgin</i> )	D	1958	2011	Europe, Asia	CAS	IAu, IVe	Close to be naturalised in E Iceland.
<i>Mimulus luteus</i> L. ( <i>Apablóm</i> )	D	1973	2012	North America	NAT	IAu, INo, INv, ISu, IVe	
<i>Pseudodolysimachion longifolium</i> (L.) Opiz – Syn.: <i>Veronica longifolia</i> L.	D	2004	2004	Europe, Asia	CAS	IVe	
<i>Rhinanthus angustifolius</i> C.C.Gmel. ( <i>Meyjarsjóður</i> )	A	1932	1932	Europe, Asia	CAS	INo, INv, IVe	
<i>Veronica agrestis</i> L. ( <i>Akurdepla</i> )	A	1963	1963	Europe	CAS	IVe	
<i>Veronica arvensis</i> L. ( <i>Reykjadepla</i> )	A	1932	2009	Europe, North Africa	CAS	INo, IVe	
<i>Veronica chamaedrys</i> L. ( <i>Völudepla</i> )	D?	1922	2012	Europe, Asia	NAT	IAu, INo, INv, ISu, IVe	
<i>Veronica gentianoides</i> Vahl ( <i>Kósakkadepla</i> )	D	2003	2003	Asia	CAS	INo	
<i>Veronica hederifolia</i> L. ( <i>Bergfléttudepla</i> )	D	1959	1959	Europe	CAS O	IVe	
<i>Veronica persica</i> Poiret ( <i>Varmadepla</i> )	A	1938	2008	Europe, Asia	NAT	INo, ISu, IVe	
Family: Solanaceae							
<i>Solanum lycopersicum</i> Lam. ( <i>Tómatur</i> )	D	1954	1954	cultivated	CAS	INo	
<i>Solanum nigrum</i> L. ( <i>Húmskuggi</i> )	A	1950	1966	Europe, Asia, North Africa	CAS	ISu, IVe	
Family: Urticaceae							
<i>Urtica dioica</i> L. ( <i>Brennineta</i> )	D	1890	2012	Europe, Asia, North America	NAT	IAu, INo, INv, ISu, IVe	Grown in gardens probably long before 1890 (Kristinsson, 2008), but exact dating not available.
Family: Valerianaceae							
<i>Valeriana officinalis</i> L. – Syn.: <i>Valeriana officinalis</i> L. ssp. <i>officinalis</i> ( <i>Garðabréða</i> )	D	1892	2011	Europe, Asia	NAT	IAu, INo, INv, ISu, IVe	Some of the records of <i>V. officinalis</i> (especially field observations) are doubtful, because of the close similarity of this species to the native <i>V. sambucifolia</i> . Nonetheless the presence of <i>V. officinalis</i> in Iceland and its status is confirmed and sure.
Family: Violaceae							
<i>Viola arvensis</i> Murray ( <i>Arfaffjóla</i> )	A	1939	2009	Europe	CAS	IAu, INv, IVe	

**Appendix B. Supplementary data**

Supplementary material related to this article [Point maps of distribution and results of predictive modeling (maximum entropy approach) for 18 naturalised alien plant taxa in Iceland] can be found, in the online version, at <http://dx.doi.org/10.1016/j.flora.2013.09.009>.

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