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Supporting Information

SI Materials and Methods

S1. Detailed Information on the Selection of Study Species. We used a total of 93 herbaceous plant species from 15 different plant families. Half of these species (45 species) are native to Switzerland, and the other half (48 species) are alien to Switzerland. To avoid introduction of problematic invasive species to our study sites, we only used alien species that are commercially available as ornamental garden plants and that are not considered problematic invaders. We chose ornamental alien species because horticulture is the major introduction pathway for most invasive plant species. Obviously, exclusion of known invasive species limits the inferences that we can make about traits that allow species to cross the later barriers in the invasion process (barriers linked to reproduction and dispersal; ref. 1). Nevertheless, our study provides insight into traits that allow species to cross the first barriers (abiotic and biotic environmental barriers at the site of introduction).

To be able to correct for taxonomy, we wanted most families to be represented by both native and alien plant species. From the full list of seed-plant families that are native to Switzerland, we excluded monocots and carnivorous plant families, because the majority of invasive species in Europe is represented by other plant taxa (2). Because we focused on invasions in grasslands, we further excluded families mainly found in swampy or aquatic habitats as well as parasitic and woody families. This process resulted in a list of 55 plant families. For those, we searched in seed catalogs of commercial seed suppliers for confamilial native and alien species that were readily available in large quantities. We excluded species that are not winter hard and further restricted our selection to species only found in open habitats (i.e., we excluded species restricted to forests). To be able to generalize our results across life histories, we chose both perennial and nonperennial (annual and biennial) species. Our final set of study species thus consisted of 93 plant species and was, apart from the above-mentioned restrictions, selected randomly. We obtained seeds of the 93 study species from commercial seed suppliers (UFA Samen, Wyss Samen und Pflanzen, Samen-Steffen, B and T World Seeds, and Thompson & Morgan).

S2. Pseudo R^2 as a Goodness-of-Fit Measure. In generalized linear mixed-effects models (GLMMs), it is not possible to obtain an R^2 as a goodness-of-fit measure. We therefore calculated pseudo-R^2 values, based on the residual deviance of our final model and the one of a null model, using the formula in Zuur et al. (3). The use of pseudo-R^2 values as goodness-of-fit measure is not without controversy (4), and for mixed models the question of whether or not the null model should contain the random factors remains open. Therefore, we calculated pseudo-R^2 values using both types of null models.

1. Richardson, et al. (2000) Naturalization and invasion of alien plants: Concepts and definitions. *Divers Distrib* 6(2):93–107.
2. Lambdon PW, et al. (2008) Alien flora of Europe: Species diversity, temporal trends, geographical patterns and research needs. *Preslia* 80:101–149.
3. Zuur A, Ieno EN, Saveliev AA, Smith GM (2009) *Mixed Effects Models and Extensions in Ecology with R* (Springer, New York).
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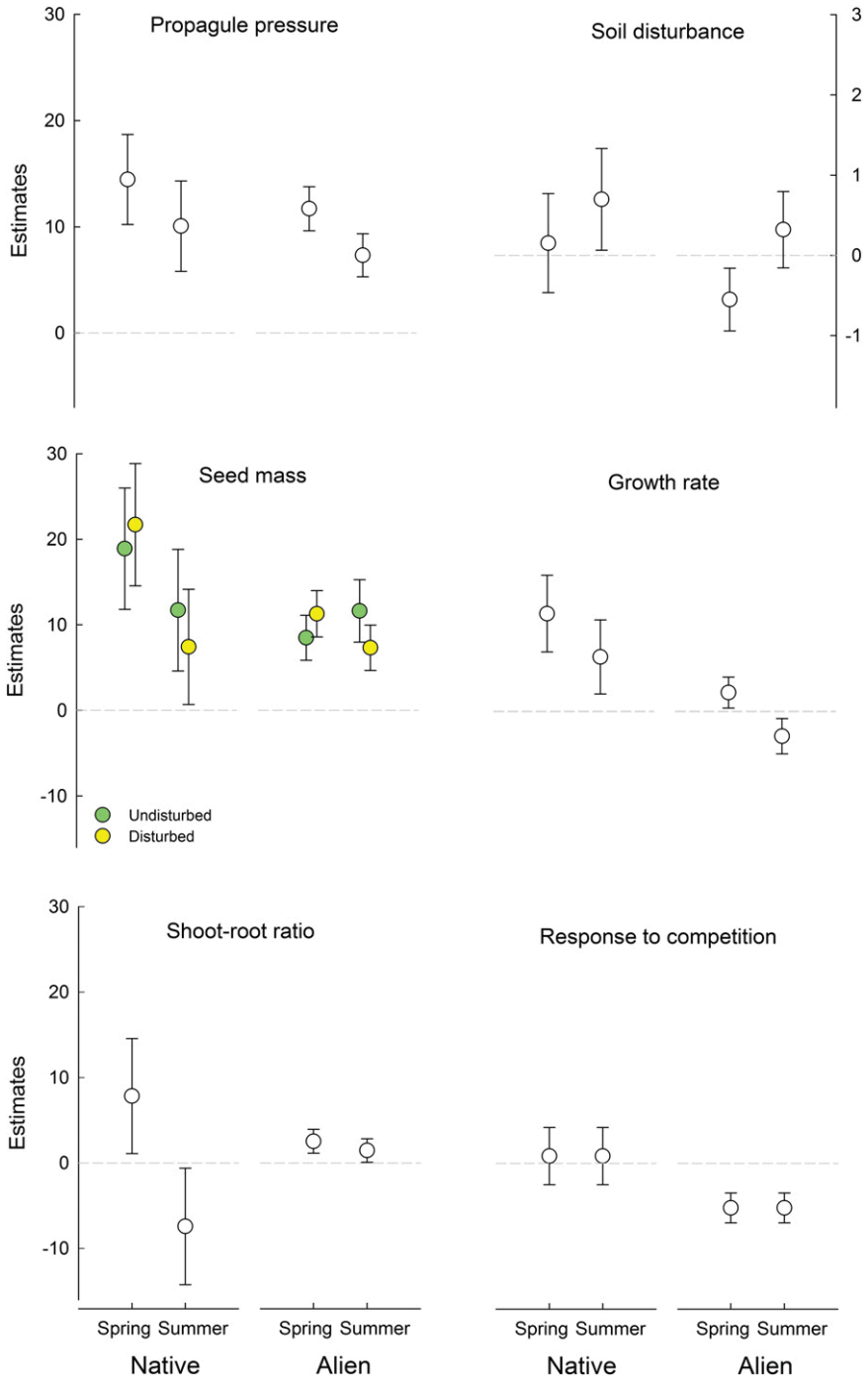

Fig. S1. Estimates ± SEM of the effects of species characteristics on establishment for the first two censuses only and separately for native and alien species. Estimates indicate how much the logit of the establishment probability increases when moving from one factor level to the other (e.g., from no soil disturbance to soil disturbance) or, in the case of covariables (e.g., seed mass), when increasing the covariable with one unit (i.e., with one SD). Effect of all plotted traits differed for native and alien species. Effects of several traits also changed between seasons or between disturbed and nondisturbed sites (significant interactions with status, season, or soil disturbance; see seed mass in Table S4).

Table S1. Number of established plant species and individual plants in the field for each of the six censuses, separately for native and alien plant species

	Native		Alien	
Time	No. of species	No. of plants	No. of species	No. of plants
First spring	16	20,906	34	11,159
First summer	24 (1)	1,151 (1)	24 (3)	3,465 (50)
Second spring	11	411	8	181
Second summer	16 (5)	466 (18)	3	16
Third spring	12 (3)	316 (32)	2	13
Third summer	12 (7)	246 (86)	2	5

The numbers of flowering species and flowering plants are given in parentheses. Of the 93 plant species (45 natives and 48 aliens) introduced into the 16 sites, 64 species (28 natives and 36 aliens) were found at least once during the 3 y of observation, and 12 of them (9 natives and 3 aliens) flowered.

Table S2. Estimates and SEs from a GLMM with the presence–absence of a species in a subplot as response variable, combined for all six censuses

Fixed effects	Estimate ± SEM	Likelihood ratio χ^2	*P* value
Soil disturbance	0.075 ± 0.360	0.044	0.834
Propagule pressure	2.713 ± 0.221	40.952	<0.0001
Standing biomass	−1.153 ± 0.273	15.175	<0.0001
Year	−2.745 ± 0.459	12.423	0.0004
Season	−1.205 ± 0.743	2.231	0.135
Status	2.544 ± 0.637	14.338	0.0002
Thousand seed mass	1.998 ± 0.316	32.189	<0.0001
Germination percentage greenhouse	0.062 ± 0.507	0.013	0.908
Relative growth rate	0.182 ± 0.272	0.422	0.516
Response to competition	−0.754 ± 0.258	7.470	0.006
Herbivore resistance	0.089 ± 0.237	0.130	0.718
Shoot–root ratio	0.298 ± 0.233	1.573	0.210
Response to shading	0.127 ± 0.275	0.212	0.645
Life history − perennial	0.290 ± 0.560	0.226	0.635
Year × season	—	—	—
Soil disturbance × propagule pressure	—	—	—
Soil disturbance × status	—	—	—
Soil disturbance × thousand seed mass	—	—	—
Soil disturbance × germination percentage greenhouse	−0.587 ± 0.305	3.694	0.055
Soil disturbance × relative growth rate	0.523 ± 0.203	6.558	0.010
Soil disturbance × response to competition	—	—	—
Soil disturbance × herbivore resistance	—	—	—
Soil disturbance × shoot–root ratio	—	—	—
Soil disturbance × response to shading	−0.148 ± 0.217	0.451	0.502
Soil disturbance × life history − perennial	1.604 ± 0.414	14.900	0.0001
Year × status	2.449 ± 0.387	51.770	<0.0001
Year × soil disturbance*	1.049 ± 0.295	13.790	0.0002
Year × propagule pressure	−0.658 ± 0.188	10.179	0.001
Year × standing biomass	−0.448 ± 0.257	3.419	0.064
Year × thousand seed mass	—	—	—
Year × germination percentage greenhouse	—	—	—
Year × relative growth rate	—	—	—
Year × response to competition	0.333 ± 0.158	4.485	0.034
Year × herbivore resistance	0.784 ± 0.177	24.252	<0.0001
Year × shoot–root ratio	—	—	—
Year × response to shading	−0.505 ± 0.140	13.110	0.0003
Year × life history − perennial	1.374 ± 0.485	10.070	0.002
Season × status	2.037 ± 0.376	29.082	<0.0001
Season × soil disturbance*	1.063 ± 0.314	11.334	0.0008
Season × propagule pressure	—	—	—
Season × standing biomass	—	—	—
Season × thousand seed mass	—	—	—
Season × germination percentage greenhouse	—	—	—
Season × relative growth rate	−0.991 ± 0.203	23.551	<0.0001
Season × response to competition	—	—	—
Season × herbivore resistance	0.814 ± 0.174	22.498	<0.0001
Season × shoot–root ratio	−0.553 ± 0.179	9.298	0.002
Season × response to shading	—	—	—
Season × life history − perennial	—	—	—
Year × soil disturbance × propagule pressure	—	—	—
Season × soil disturbance × propagule pressure	—	—	—
Year × season × soil disturbance	—	—	—
Year × season × propagule pressure	—	—	—
Year × season × standing biomass	—	—	—
Year × season × status	—	—	—
Year × season × thousand seed mass	—	—	—
Year × season × germination percentage greenhouse	—	—	—
Year × season × relative growth rate	—	—	—
Year × season × response to competition	—	—	—
Year × season × herbivore resistance	—	—	—
Year × season × shoot–root ratio	—	—	—
Year × season × response to shading	—	—	—

Table S2. Cont.

Fixed effects	Estimate ± SEM	Likelihood ratio χ^2	*P* value
Year × season × life history − perennial	—	—	—
Soil disturbance × year × status	—	—	—
Soil disturbance × year × thousand seed mass	—	—	—
Soil disturbance × year × germination percentage greenhouse	—	—	—
Soil disturbance × year × relative growth rate	—	—	—
Soil disturbance × year × response to competition	—	—	—
Soil disturbance × year × herbivore resistance	—	—	—
Soil disturbance × year × shoot–root ratio	—	—	—
Soil disturbance × year × response to shading	−0.692 ± 0.259	7.595	0.006
Soil disturbance × year × life history − perennial	2.578 ± 1.368	6.683	0.009
Soil disturbance × season × status	—	—	—
Soil disturbance × season × thousand seed mass	—	—	—
Soil disturbance × season × germination percentage greenhouse	—	—	—
Soil disturbance × season × relative growth rate	—	—	—
Soil disturbance × season × response to competition	—	—	—
Soil disturbance × season × herbivore resistance	—	—	—
Soil disturbance × season × shoot–root ratio	—	—	—
Soil disturbance × season × response to shading	—	—	—
Soil disturbance × season × life history − perennial	—	—	—
Soil disturbance × year × season × propagule pressure	—	—	—
Soil disturbance × year × season × status	—	—	—
Soil disturbance × year × season × thousand seed mass	—	—	—
Soil disturbance × year × season × germination percentage greenhouse	—	—	—
Soil disturbance × year × season × relative growth rate	—	—	—
Soil disturbance × year × season × response to competition	—	—	—
Soil disturbance × year × season × herbivore resistance	—	—	—
Soil disturbance × year × season × shoot–root ratio	—	—	—
Soil disturbance × year × season × response to shading	—	—	—
Soil disturbance × year × season × life history − perennial	—	—	—
Random effects	Variance		
Site	0.237		
Family	0.020		
Family/species	2.149		
Subplot	1.453		
Time (categorical)	0.237		

To obtain estimates, we started with a full model including the factors listed below and reduced the fixed terms by stepwise deletion of nonsignificant terms and comparing the resulting model to the previous one using log likelihood-ratio tests. This process resulted in a minimal model containing only factors that were significant as main effects and/or in interactions with other factors. We kept all random factors in the model and present their variance. Estimates and significances of three-way interactions were derived by comparing the model without the factor of interest to the full model using log likelihood-ratio tests. To obtain estimates and significances of two-way interactions, we excluded all three-way interactions and compared this model with models missing the factors of interest. To obtain estimates and significances of main terms we excluded all higher-level interactions and compared this model with models missing the factors of interest.

*The estimates of soil disturbance × year and soil disturbance × season, which were measured at the field level, are based on models from which we excluded all soil disturbance × species traits interactions.

Table S3. Estimates and SEs from a linear mixed model using the log-transformed number of established plants per subplot as the response variable, for each of the six censuses separately

Fixed effects	First spring	First summer	Second spring	Second summer	Third spring	Third summer
Soil disturbance	−0.148 ± 0.289					
Propagule pressure (log)	1.448 ± 0.153***	1.057 ± 0.237***	1.034 ± 0.226***	1.050 ± 0.278**	1.192 ± 0.385*	
Standing biomass			−0.608 ± 0.237**			
Status − native			−5.199 ± 2.40**			
− soil disturbance	−0.358 ± 0.236		—	—	—	—
+ soil disturbance	0.275 ± 0.242**		—	—	—	—
Life history − perennial				—	—	—
− soil disturbance			—	—	—	—
+ soil disturbance			—	—	—	—
Thousand seed mass (log)	0.399 ± 0.102***	0.401 ± 0.156**	−1.024 ± 1.41			−1.222 ± 0.495**
− soil disturbance			—	—	—	—
+ soil disturbance			—	—	—	—
Germination percentage greenhouse						−2.954 ± 1.063
− soil disturbance			—	—	—	—
+ soil disturbance			—	—	—	—
Relative growth rate		0.234 ± 0.141(*)	−0.3407 ± 1.398**		−0.745 ± 0.278*	−2.540 ± 0.967**
− soil disturbance	−0.316 ± 0.129(*)		—	—	—	—
+ soil disturbance	−0.107 ± 0.138(*)		—	—	—	—
Response to competition			−0.309 ± 0.471		−0.316 ± 0.184(*)	−0.662 ± 0.238**
− soil disturbance			—	—	—	—
+ soil disturbance			—	—	—	—
Herbivore resistance		0.367 ± 0.129**	1.309 ± 0.777(*)			2.504 ± 1.228**
− soil disturbance			—	—	—	—
+ soil disturbance			—	—	—	—
Shoot–root ratio			−2.635 ± 1.353*			
− soil disturbance	−0.099 ± 0.11		—	—	—	—
+ soil disturbance	0.398 ± 0.125**		—	—	—	—
Response to shading		−0.36 ± 0.140**	0.761 ± 0.642		—	—
− soil disturbance			—	—	—	—
+ soil disturbance			—	—	—	—
Random effects	Variance					
Site	0.215	0.011	<0.0001	<0.0001	<0.0001	0.266
Family	0.823	0.911	<0.0001	<0.0001	<0.0001	<0.0001
Family/species	0.228	0.197	0.516	0.015	<0.0001	<0.0001

Because of low numbers of observations in the censuses of the second spring, second summer, third spring and third summer, the models did not converge, and we had to exclude all interaction terms with soil disturbance, and, except for the census second spring, as well the factor life history and hypocotyl elongation in response to shading to achieve convergence (indicated by −). We kept random factors in the model and present their variance. If there was a significant interaction between a species characteristic and disturbance, we present separate estimates for the species characteristic in undisturbed and disturbed sites. Significance level of the estimates for a species characteristic in the absence of disturbance refers to whether the estimate differed from zero. Significance level of the estimates for a species characteristic in the presence of disturbance refers to whether the estimate differed from the one in the absence of disturbance. Significance levels: (*)$P < 0.1$; *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Table S4. Estimates and SEs from a GLMM with the presence–absence of a species in a subplot as response variable, combined for the first two censuses only

Fixed effects	Estimates ± SEM	Likelihood ratio χ^2	*P* value
Soil disturbance	−0.09 ± 0.334	0.077	0.781
Propagule pressure	2.433 ± 0.205	37.463	<0.0001
Standing biomass	−0.95 ± 0.245	12.548	0.0004
Season	−2.45 ± 0.182	10.032	0.002
Status	1.702 ± 0.536	9.414	0.002
Thousand seed mass	1.844 ± 0.277	33.109	<0.0001
Germination percentage greenhouse	0.142 ± 0.446	0.092	0.762
Relative growth rate	0.035 ± 0.237	0.021	0.885
Response to competition	−0.64 ± 0.228	35.397	<0.0001
Herbivore resistance	0.084 ± 0.207	143.729	<0.0001
Shoot–root ratio	0.205 ± 0.204	0.974	0.324
Response to shading	0.169 ± 0.239	76.984	<0.0001
Life history – perennial	—	—	—
Soil disturbance × propagule pressure	—	—	—
Soil disturbance × standing biomass	0.277 ± 0.721	0.164	0.685
Soil disturbance × status	0.533 ± 0.498	1.120	0.290
Soil disturbance × thousand seed mass	−0.01 ± 0.283	0.001	0.981
Soil disturbance × germination percentage greenhouse	−0.13 ± 0.390	0.108	0.742
Soil disturbance × relative growth rate	—	—	—
Soil disturbance × response to competition	—	—	—
Soil disturbance × herbivore resistance	—	—	—
Soil disturbance × shoot–root ratio	—	—	—
Soil disturbance × response to shading	—	—	—
Soil disturbance × life history – perennial	—	—	—
Status × propagule pressure	0.572 ± 0.363	2.953	0.086
Status × standing biomass	—	—	—
Status × thousand seed mass	1.096 ± 0.903	1.428	0.232
Status × germination percentage greenhouse	—	—	—
Status × relative growth rate	1.851 ± 0.670	7.104	0.008
Status × response to competition	1.398 ± 0.579	5.452	0.020
Status × herbivore resistance	—	—	—
Status × shoot–root ratio	0.412 ± 0.946	0.188	0.665
Status × response to shading	—	—	—
Status × life history – perennial	—	—	—
Season × soil disturbance*	0.735 ± 0.363	4.014	0.045
Season × propagule pressure	0.060 ± 0.325	0.037	0.847
Season × standing biomass	−0.190 ± 0.337	0.315	0.574
Season × status	1.295 ± 0.562	5.369	0.020
Season × thousand seed mass	0.038 ± 0.309	0.016	0.901
Season × germination percentage greenhouse	−0.16 ± 0.412	0.141	0.707
Season × relative growth rate	−0.84 ± 0.225	11.391	0.0002
Season × response to competition	—	—	—
Season × herbivore resistance	0.855 ± 0.205	11.831	<0.0001
Season × shoot–root ratio	−0.44 ± 0.188	5.482	0.019
Season × response to shading	—	—	—
Season × life history – perennial	—	—	—
Soil disturbance × season × propagule pressure	—	—	—
Soil disturbance × season × standing biomass	32.22 ± 11.18	10.660	0.001
Soil disturbance × season × status	−8.675 ± 4.476	34.630	<0.0001
Soil disturbance × season × thousand seed mass	−7.104 ± 3.610	111.180	<0.0001
Soil disturbance × season × germination percentage greenhouse	−11.13 ± 4.127	110.590	<0.0001
Soil disturbance × season × relative growth rate	—	—	—
Soil disturbance × season × response to competition	—	—	—
Soil disturbance × season × herbivore resistance	—	—	—
Soil disturbance × season × shoot–root ratio	—	—	—
Soil disturbance × season × response to shading	—	—	—
Soil disturbance × season × life history – perennial	—	—	—
Status × season × standing biomass	—	—	—
Status × season × thousand seed mass	−10.327 ± 4.349	120.200	<0.0001
Status × season × germination percentage greenhouse	—	—	—
Status × season × relative growth rate	—	—	—
Status × season × response to competition	—	—	—

Table S4. Cont.

Fixed effects	Estimates ± SEM	Likelihood ratio χ^2	*P* value
Status × season × herbivore resistance	—	—	—
Status × season × shoot–root ratio	−14.172 ± 5.349	117.840	<0.0001
Status × season × response to shading	—	—	—
Status × season × life history − perennial	—	—	—
Soil disturbance × status × propagule pressure	—	—	—
Soil disturbance × status × standing biomass	—	—	—
Soil disturbance × status × thousand seed mass	—	—	—
Soil disturbance × status × germination percentage greenhouse	—	—	—
Soil disturbance × status × relative growth rate	—	—	—
Soil disturbance × status × response to competition	—	—	—
Soil disturbance × status × herbivore resistance	—	—	—
Soil disturbance × status × shoot–root ratio	—	—	—
Soil disturbance × status × response to shading	—	—	—
Soil disturbance × status × life history − perennial	—	—	—
Status × season × soil disturbance × propagule pressure	—	—	—
Status × season × soil disturbance × standing biomass	—	—	—
Status × season × soil disturbance × thousand seed mass	—	—	—
Status × season × soil disturbance × germination percentage greenhouse	—	—	—
Status × season × soil disturbance × relative growth rate	—	—	—
Status × season × soil disturbance × response to competition	—	—	—
Status v season × soil disturbance × herbivore resistance	—	—	—
Status × season × soil disturbance × shoot–root ratio	—	—	—
Status × season × soil disturbance × response to shading	—	—	—
Status × season × soil disturbance × life history − perennial	—	—	—
Random effects	Variance		
Site	4.223		
Family	0.003		
Family/species	0.306		
Subplot	0.023		
Time (categorical)	<0.0001		

To obtain estimates, we started with a full model including the factors listed below and reduced the fixed terms by stepwise deletion of nonsignificant terms and comparing the resulting model to the previous one using log likelihood-ratio tests. This process resulted in a minimal model containing only factors that were significant as main effects and/or in interactions with other factors. We kept all random factors in the model and present their variance. Estimates and significances of three-way interactions were derived by comparing the model without the factor of interest to the full model using log likelihood-ratio tests. To obtain estimates and significances of two-way interactions, we excluded all three-way interactions and compared this model with models missing the factors of interest. To obtain estimates and significances of main terms we excluded all higher levels interactions and compared this model with models missing the factors of interest.

*The estimates of soil disturbance × season, which were measured at the field level, are based on models from which we excluded all soil disturbance × species traits interactions.

Table S5. List of the 93 plant species used in the study and overview of the species present in each of the five experiments

Family	Species name	Life history	Status	Field	Seed mass and germination percentage	Response to shading	Shoot–root ratio and relative growth rate	Response to competition	Herbivore resistance
Asteraceae	*Achillea filipendulina*	p	A	+	+	+	+	+	+
	Calendula officinalis	np	A	+	+	+	+	+	+
	Helianthus annuus	np	A	+	+	+	+	+	+
	Senecio bicolor	p	A	+	+	+	+	+	+
	Zinnia angustifolia	np	A	+	+	+	+	+	+
	Chrysanthemum carinatum	np	A	+	+				+
	Aster bellidiastrum	p	N	+	+		+		
	Cichorium intybus	p	N	+	+	+	+	+	+
	Erigeron acer	p	N	+	+		+		
	Leucanthemum vulgare	p	N	+	+	+	+	+	+
	Senecio ovatus	p	N	+	+	+	+		
Boraginaceae	*Anchusa capensis*	p	A	+	+	+	+	+	+
	Cynoglossum amabile	p	A	+	+	+	+	+	+
	Anchusa arvensis	p	N	+	+	+	+	+	
	Anchusa officinalis	p	N	+	+			+	+
	Borago officinalis	np	N	+	+		+	+	
	Cynoglossum officinalis	p	N	+	+		+	+	+
	Echium vulgare	p	N	+	+	+	+	+	+
Brassicaceae	*Alyssum saxatile*	p	A	+	+	+	+		+
	Arabis caucasia	p	A	+	+	+	+	+	+
	Bunias orientalis	p	A	+	+			+	
	Iberis sempervirens	p	A	+	+	+	+	+	+
	Lobularia maritima	p	A	+	+	+	+	+	+
	Alyssum alyssoides	p	N	+	+				
	Arabis hirsuta	p	N	+	+		+		
	Cardamine pratensis	p	N	+	+				
	Iberis amara	p	N	+	+				
Campanulaceae	*Campanula pyramidalis*	p	A	+	+	+	+	+	+
	Lobelia erinus	np	A	+	+	+	+	+	+
	Platycodon grandiflorus	p	A	+	+	+	+	+	+
	Symphyandra armena	p	A	+	+		+	+	+
	Campanula barbata	p	N	+	+				
	Campanula rapunculus	p	N	+	+				+
	Campanula rotundifolia	p	N	+	+		+		+
	Legousia speculum-veneris	p	N	+	+				+
	Phyteuma orbiculare	p	N	+	+				
Caryophyllaceae	*Dianthus caryophyllus*	p	A	+	+	+	+	+	+
	Gypsophila elegans	np	A	+	+	+	+	+	+
	Lychnis chalcedonica	p	A	+	+	+	+	+	+
	Silene coeli-rosa	np	A	+	+	+	+	+	+
	Dianthus armeria	p	N	+	+	+	+	+	+
	Lychnis flos-cuculi	p	N	+	+		+		
	Saponaria officinalis	p	N	+	+				
Convolvulaceae	*Convolvulos tricolor*	p	A	+	+	+	+	+	+
	Ipomoea tricolor	np	A	+	+	+	+	+	+
	Calystegia sepium	p	N	+	+			+	
	Convolvulus arvensis	p	N	+	+	+	+	+	+
Dipsacaceae	*Knautia arvensis*	p	N	+	+		+	+	+
	Scabiosa columbaria	p	N	+	+		+		
Fabaceae	*Lathyrus odoratus*	np	A	+	+	+	+	+	+
	Lupinus hartwegii	np	A	+	+	+	+	+	+
	Phaseolus coccineus	np	A	+	+	+	+	+	
	Medicago lupulina	np	N	+	+				
Lamiaceae	*Salvia argentea*	p	A	+	+	+	+	+	+
	Salvia farinacea	p	A	+	+	+	+	+	+
	Salvia lyrata	p	A	+	+	+	+	+	+
	Thymus × *citriodorus*	p	A	+	+	+	+	+	+
	Ajuga reptans	p	N	+	+		+		
	Galeopsis angustifolia	np	N	+	+				
	Salvia glutinosa	p	N	+	+				

Table S5. Cont.

Family	Species name	Life history	Status	Field	Seed mass and germination percentage	Response to shading	Shoot–root ratio and relative growth rate	Response to competition	Herbivore resistance
	Thymus pulegioides	p	N	+	+	+	+	+	
Malvaceae	*Althaea rosea*	p	A	+	+	+	+	+	+
	Anoda cristata	np	A	+	+	+	+	+	+
	Hibiscus trionum	np	A	+	+	+	+	+	
	Lavatera trimestris	np	A	+	+	+	+	+	+
	Malva alcea	p	N	+	+	+	+	+	+
	Malva moschata	p	N	+	+	+	+	+	+
	Malva neglecta	p	N	+	+	+	+	+	+
Onagraceae	*Clarkia amoena*	np	A	+	+	+	+	+	+
	Oenothera glazioviana	p	A	+	+	+	+	+	+
	Oenothera macrocarpa	p	A	+	+	+	+	+	+
	Circaea lutetiana	p	N	+	+				
	Epilobium dodonai	p	N	+	+				
Papaveraceae	*Eschscholtzia californica*	p	A	+	+	+	+		
	Meconopsis betonicifolia	p	A	+	+				
	Meconopsis cambrica	p	A	+	+				
	Papaver communatum	np	A	+	+		+	+	+
	Papaver orientale	p	A	+	+			+	+
	Chelidonium majus	p	N	+	+				
	Papaver dubium	np	N	+	+			+	+
	Papaver rhoeas	np	N	+	+	+		+	+
Polemoniaceae	*Phlox drummondii*	np	A	+	+	+	+	+	+
	Polemonium caeruleum	p	N	+	+	+	+	+	+
Ranunculaceae	*Aquilegia viridiflora*	p	A	+	+	+	+	+	+
	Clematis mandshurica	p	A	+	+		+	+	
	Aquilegia vulgaris	p	N	+	+	+	+		
	Clematis vitalba	p	N	+	+				
	Nigella arvensis	np	N	+	+	+	+	+	+
Solanaceae	*Datura stramonium*	np	A	+	+			+	
	Nicotiana sylvestris	np	A	+	+	+	+	+	+
	Physalis peruviana	p	A	+	+	+	+	+	+
	Solanum nigrum	np	N	+	+	+	+		
	Solanum dulcamara	p	N	+	+				

Because of differences in germination, we could not assess each trait for all 93 plant species. We had complete data for 45 species. np, nonperennial (annual or biannual); p, perennial; A, alien species; N, native species.

Table S6. Characteristics of the experimental grassland sites

Site name	Latitude	Longitude	Propagule pressure	Soil disturbance	Species richness	Productivity, g/m^2	Mean Ellenberg indicator value to nutrients
Kräiligen	N47° 08′ 30″	E7° 31′ 20″	1	No	22	392.8	5.9
Worblaufen	N46° 59′ 33.86″	E7° 28′ 43.73″	1	No	24	362.8	5.9
Albligen	N46° 51′ 16.58″	E7° 19′ 14.28″	1	Yes	17	775.0	6.6
Bützberg	N47° 12′ 19″	E7° 43′ 24.41″	1	Yes	26	264.6	6.6
Bützberg	N47° 12′ 44.15″	E7° 45′ 33.31″	5	No	21	556.6	6.1
Rüderswil	N46° 59′ 02.51″	E7° 42′ 59.73″	5	No	32	384.5	5.5
Büren a. d. Aare	N47° 08′ 35″	E7° 23′ 22″	5	Yes	16	648.7	6.3
Heimiswil	N47° 03′ 58″	E7° 39′ 58″	5	Yes	30	404.4	6.7
Mülchi	N47° 06′ 03″	E7° 28′ 13″	50	No	29	369.8	6.4
Signau	N46° 56′ 28″	E7° 45′ 35″	50	No	43	357.3	6.1
Hindelbank	N47° 02′ 25″	E7° 33′ 25″	50	Yes	34	568.6	6.7
Wiedlisbach	N47° 14′ 48″	E7° 39′ 34″	50	Yes	34	266.9	6.2
Heimiswil	N47° 03′ 38″	E7° 38′ 43″	500	No	51	307.6	4.8
Walliswil	N47° 14′ 51″	E7° 49′ 30″	500	No	42	320.8	5.5
Bätterkinden	N47° 07′ 34″	E7° 32′ 17″	500	Yes	25	215.9	5.6
Rüderswil	N46° 59′ 31.81″	E7° 42′ 49.31″	500	Yes	28	374.1	6.5

We calculated mean indicator values to nutrients per site according to Ellenberg et al. (1).

1. Ellenberg H, Weber HE, Düll R, Wirth V, Werner W (2001) Zeigerwerte von Pflanzen in Mitteleuropa. *Scripta Geobotanica* 18:1–262.

Table S7. Pearson's correlation coefficients between the measured species traits

	Seed mass	Germination percentage	Relative growth rate	Shoot–root ratio	Response to competition	Herbivore resistance
Germination percentage	−0.512					
Relative growth rate	0.008	0.209				
Shoot–root ratio	−0.092	0.157	−0.307			
Response to competition	−0.060	−0.258	0.086	−0.019		
Herbivore resistance	−0.091	0.194	−0.091	0.199	−0.055	
Response to shading	0.058	−0.063	0.111	0.145	0.160	0.049

All correlations are <0.7; $n = 45$.

Table S8. Mean trait values ± SE of all measured species traits, separately for native and alien plant species

Species traits	Native species, mean ± SE	Alien species mean ± SE	n	P
Seed mass, g	2.93 ± 0.10	3.17 ± 0.13	93	0.16
Germination percentage, %	0.22 ± 0.04	0.52 ± 0.04	93	<0.0001
Relative growth rate, g g^{-1}·d^{-1}	0.10 ± 0.01	0.11 ± 0.01	67	0.61
Shoot–root ratio	3.04 ± 0.59	5.64 ± 0.76	67	0.02
Response to shading, cm	0.38 ± 0.21	0.47 ± 0.06	55	0.61
Response to competition, g	−1.66 ± 0.17	−1.87 ± 0.11	62	0.30
Herbivore resistance, g	−0.37 ± 0.04	−0.35 ± 0.03	58	0.73