

Supporting Information

All data and code is stored in an online repository (www.github.com/paleo13/genetic.surrogates) to replicate analyses in this study. See the *README* file for instructions.

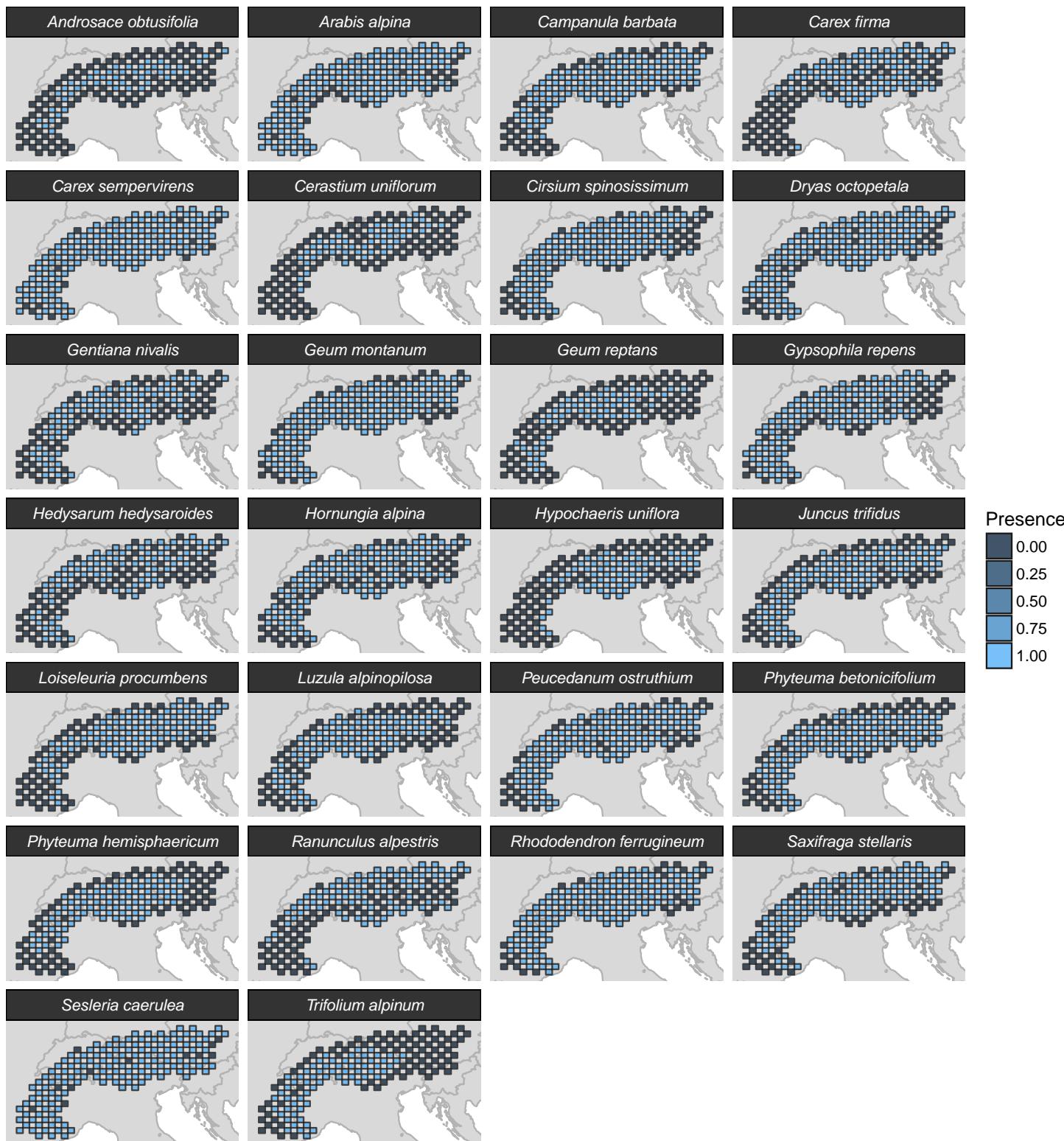


Figure S1 Species distributions. Squares represent planning units. For a given species, planning units that were found to be inhabited are denoted with bright blue. Note that *Ligusticum mutellinoides* was omitted from analysis.

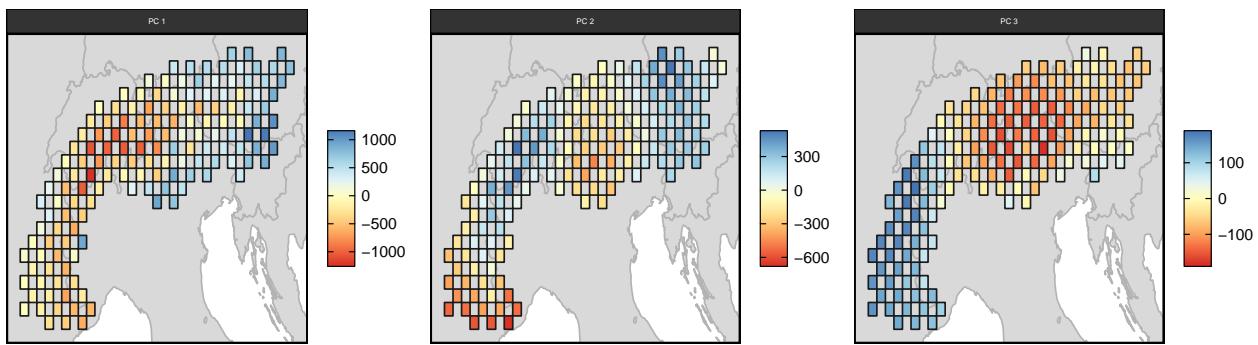


Figure S2 Climatic variation. Each panel depicts variation based on a different principle component (PC). Squares represent planning units. The color of each planning unit denotes the average PC value of pixels inside it. Planning units with more similar colors have more similar climate regimes.

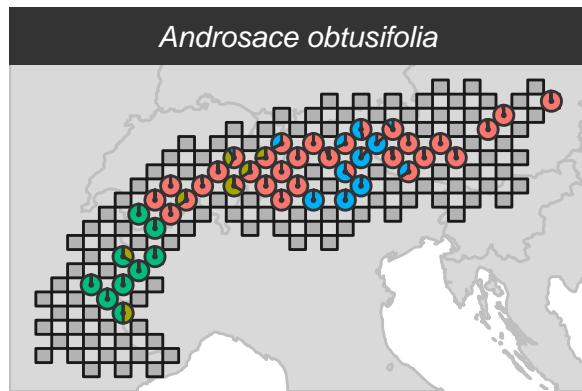


Figure S3 Distribution of *Androsace obtusifolia* populations. Squares denote planning units. Pie charts denote quadrats where individuals were sampled, and colors denote the average probability that individuals in the quadrat belong to different populations on average.

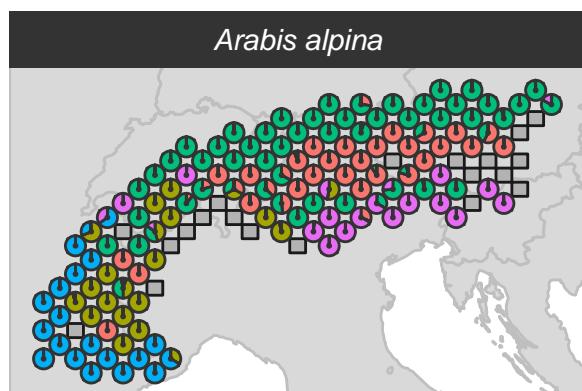


Figure S4 Distribution of *Arabis alpina* populations. See Figure S3 caption for conventions.

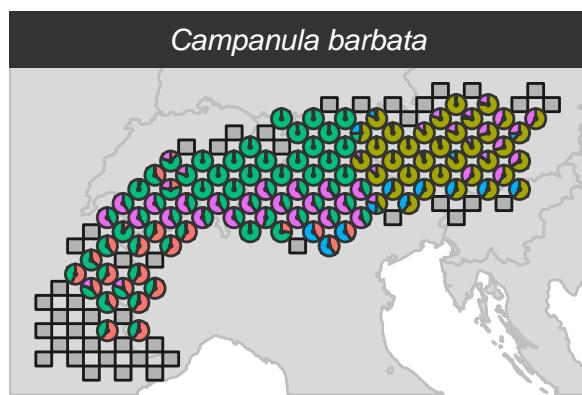


Figure S5 Distribution of *Campanula barbata* populations. See Figure S3 caption for conventions.

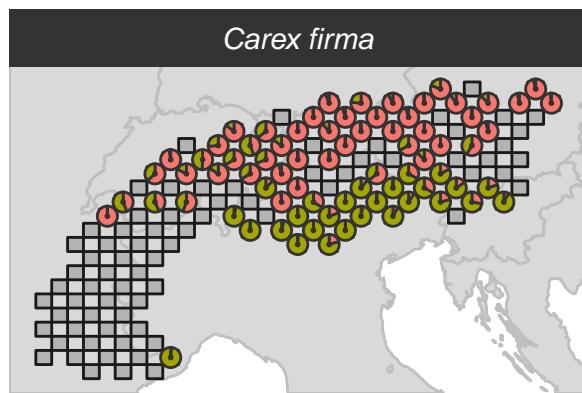


Figure S6 Distribution of *Carex firma* populations. See Figure S3 caption for conventions.



Figure S7 Distribution of *Carex sempervirens* populations. See Figure S3 caption for conventions.

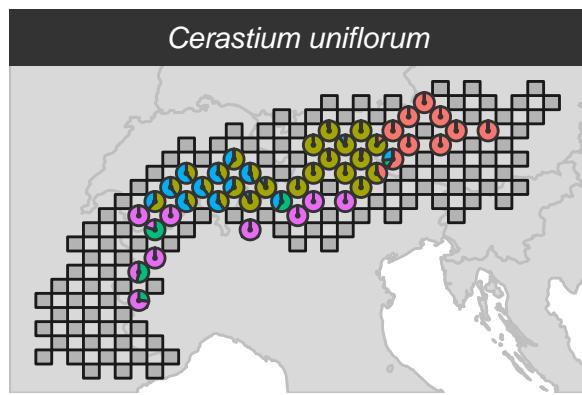


Figure S8 Distribution of *Cerastium uniflorum* populations. See Figure S3 caption for conventions.



Figure S9 Distribution of *Cirsium spinosissimum* populations. See Figure S3 caption for conventions.

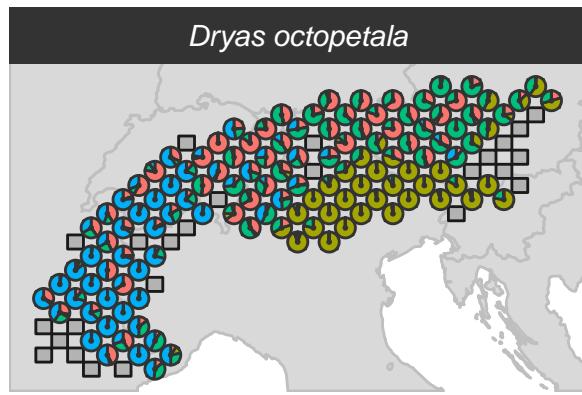


Figure S10 Distribution of *Dryas octopetala* populations. See Figure S3 caption for conventions.

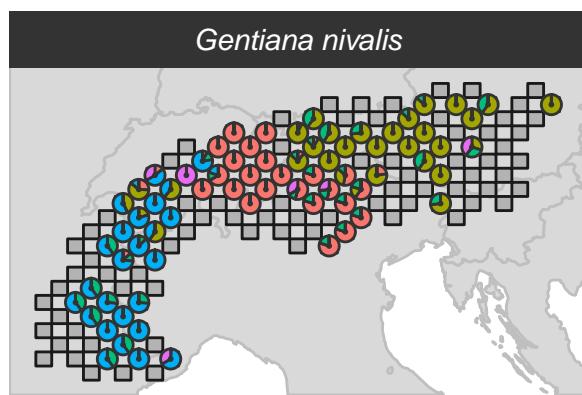


Figure S11 Distribution of *Gentiana nivalis* populations. See Figure S3 caption for conventions.

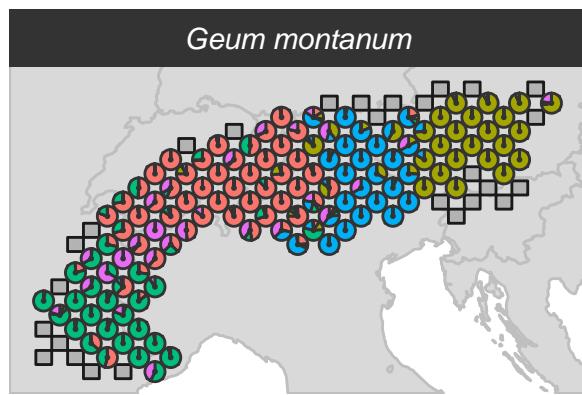


Figure S12 Distribution of *Geum montanum* populations. See Figure S3 caption for conventions.

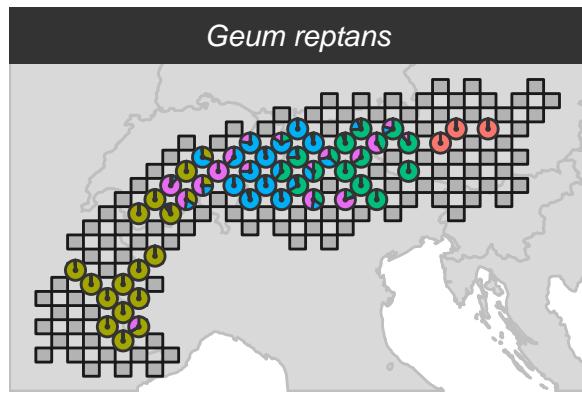


Figure S13 Distribution of *Geum reptans* populations. See Figure S3 caption for conventions.

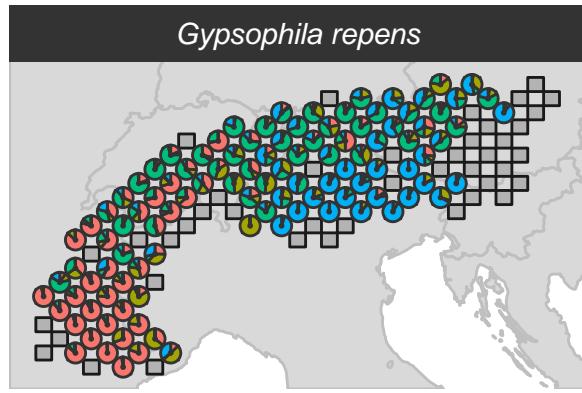


Figure S14 Distribution of *Gypsophila repens* populations. See Figure S3 caption for conventions.

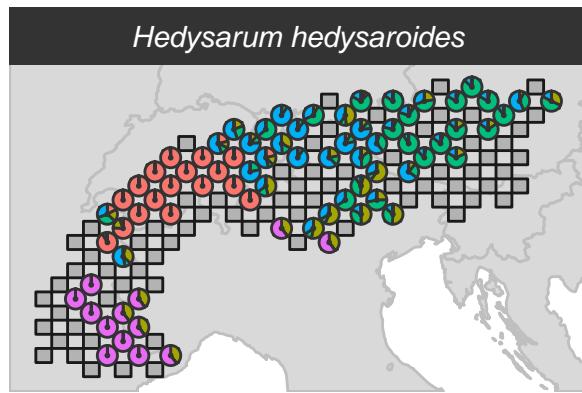


Figure S15 Distribution of *Hedysarum hedysaroides* populations. See Figure S3 caption for conventions.

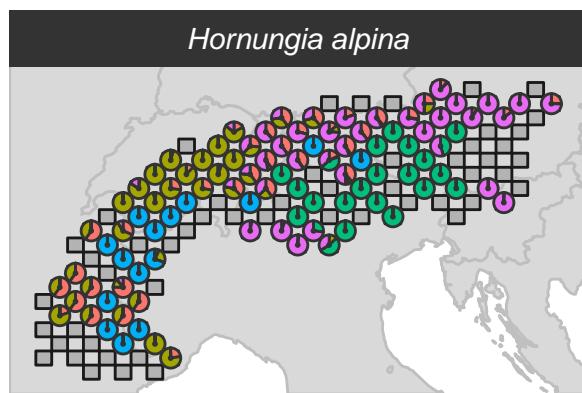


Figure S16 Distribution of *Hornungia alpina* populations. See Figure S3 caption for conventions.

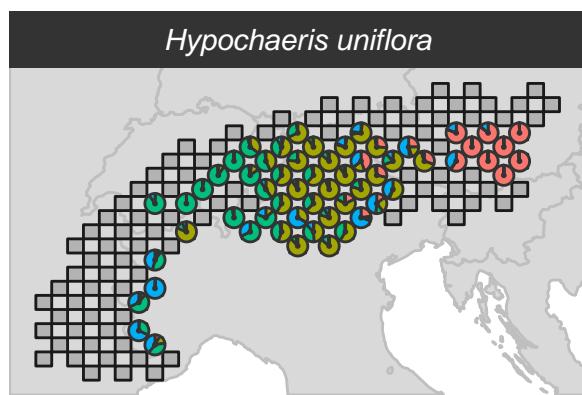


Figure S17 Distribution of *Hypochaeris uniflora* populations. See Figure S3 caption for conventions.

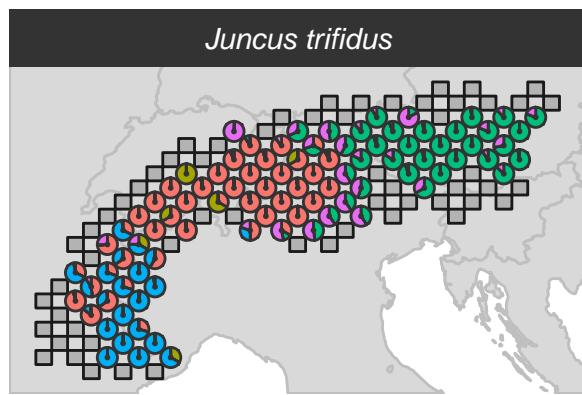


Figure S18 Distribution of *Juncus trifidus* populations. See Figure S3 caption for conventions.

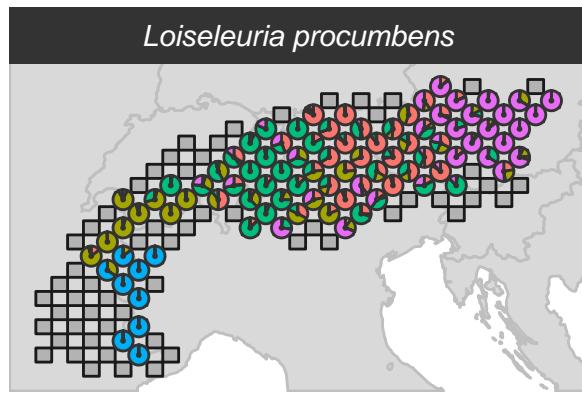


Figure S19 Distribution of *Loiseleuria procumbens* populations. See Figure S3 caption for conventions.



Figure S20 Distribution of *Luzula alpinopilosa* populations. See Figure S3 caption for conventions.



Figure S21 Distribution of *Peucedanum ostruthium* populations. See Figure S3 caption for conventions.

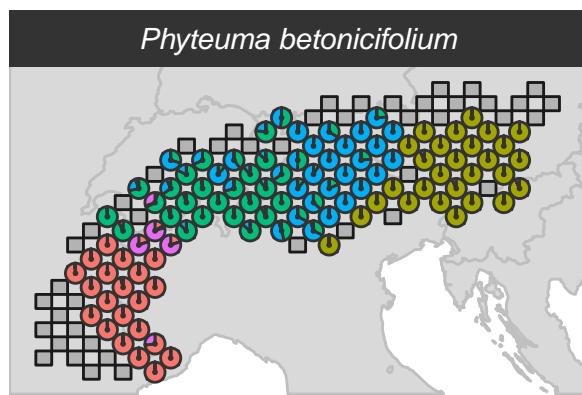


Figure S22 Distribution of *Phyteuma betonicifolium* populations. See Figure S3 caption for conventions.

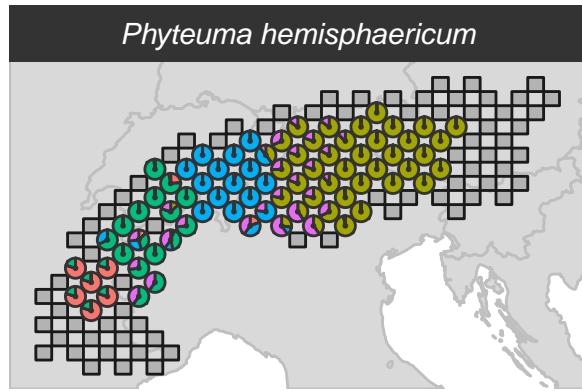


Figure S23 Distribution of *Phyteuma hemisphaericum* populations. See Figure S3 caption for conventions.

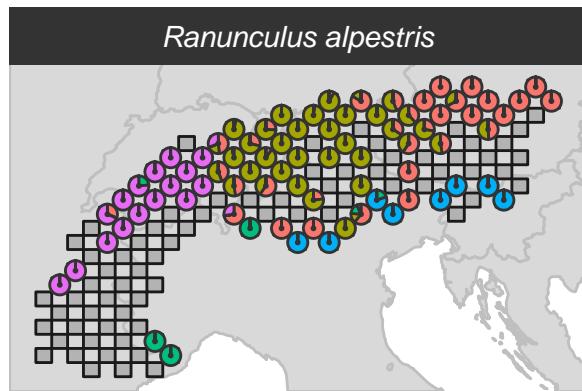


Figure S24 Distribution of *Ranunculus alpestris* populations. See Figure S3 caption for conventions.

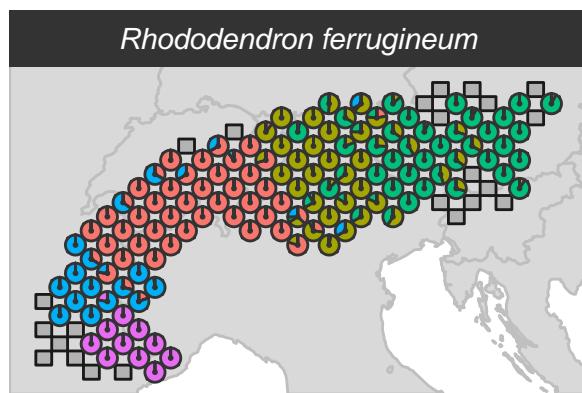


Figure S25 Distribution of *Rhododendron ferrugineum* populations. See Figure S3 caption for conventions.



Figure S26 Distribution of *Saxifraga stellaris* populations. See Figure S3 caption for conventions.

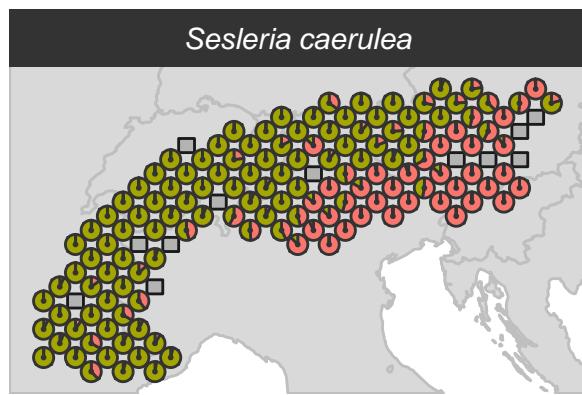


Figure S27 Distribution of *Sesleria caerulea* populations. See Figure S3 caption for conventions.

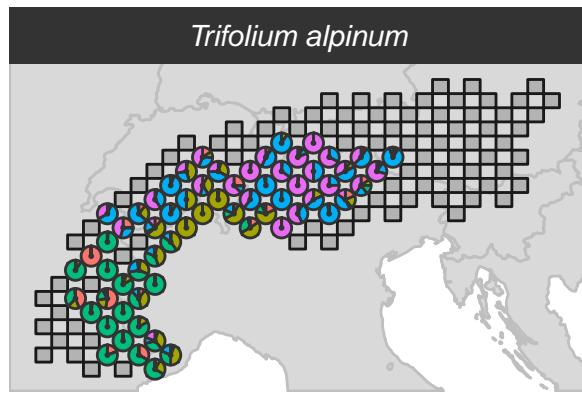


Figure S28 Distribution of *Trifolium alpinum* populations. See Figure S3 caption for conventions.

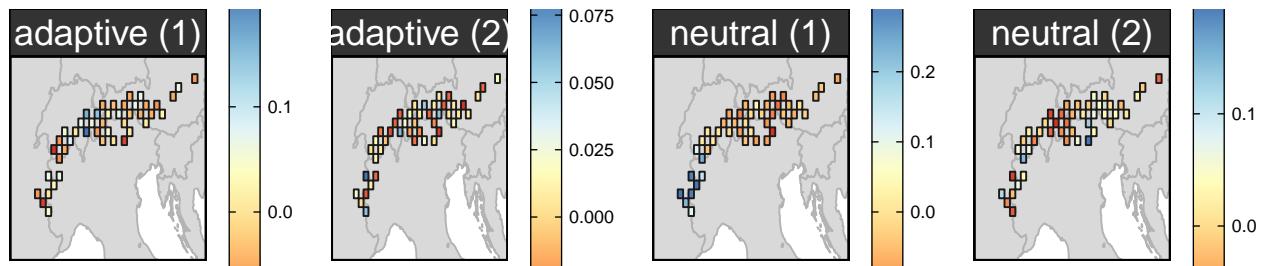


Figure S29 Distribution of adaptive and neutral genetic variation in *Androsace obtusifolia*. Each panel shows a different dimension of the variation as indicated by its title. Squares represent planning units. The color of each planning unit panel corresponds to the average ordinated values associated with individuals sampled inside it. No individuals of this species were found inside the gray planning units.

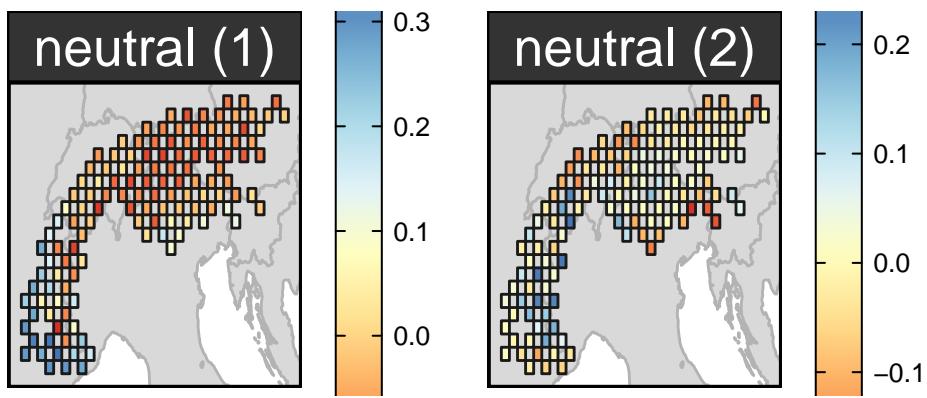


Figure S30 Distribution of adaptive and neutral genetic variation in *Arabis alpina*. See Figure S6 caption for conventions.

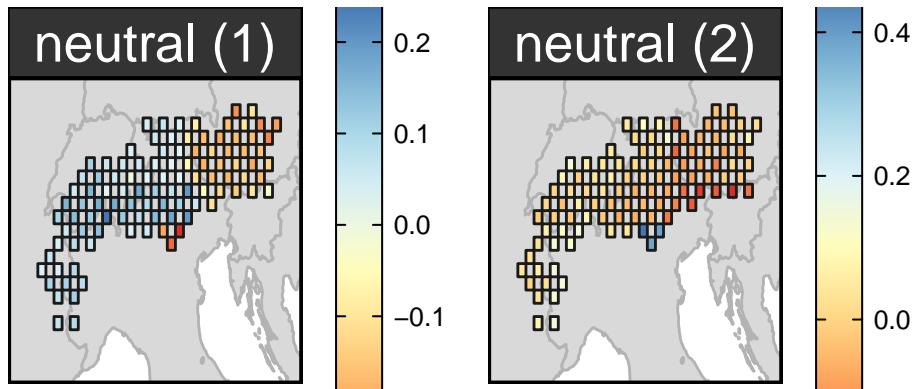


Figure S31 Distribution of adaptive and neutral genetic variation in *Campanula barbata*. See Figure S6 caption for conventions.

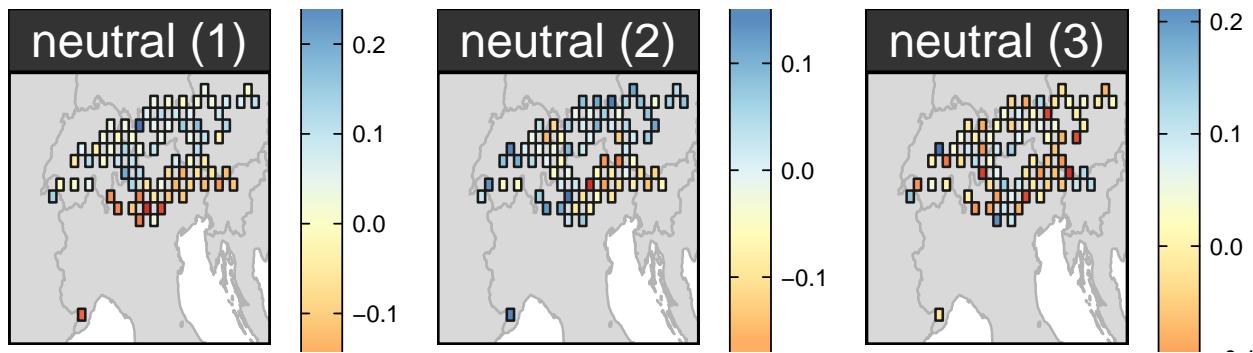


Figure S32 Distribution of adaptive and neutral genetic variation in *Carex firma*. See Figure S6 caption for conventions.

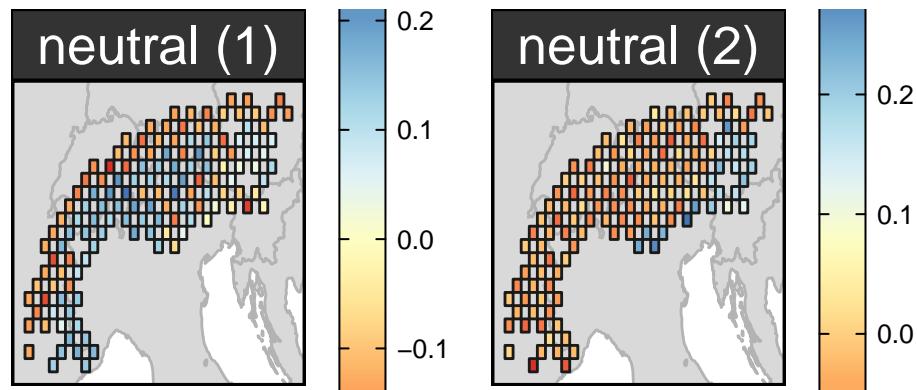


Figure S33 Distribution of adaptive and neutral genetic variation in *Carex sempervirens*. See Figure S6 caption for conventions.

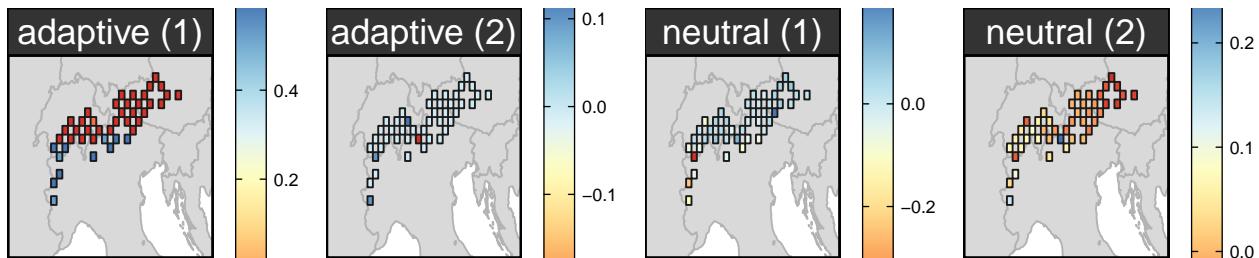


Figure S34 Distribution of adaptive and neutral genetic variation in *Cerastium uniflorum*. See Figure S6 caption for conventions.

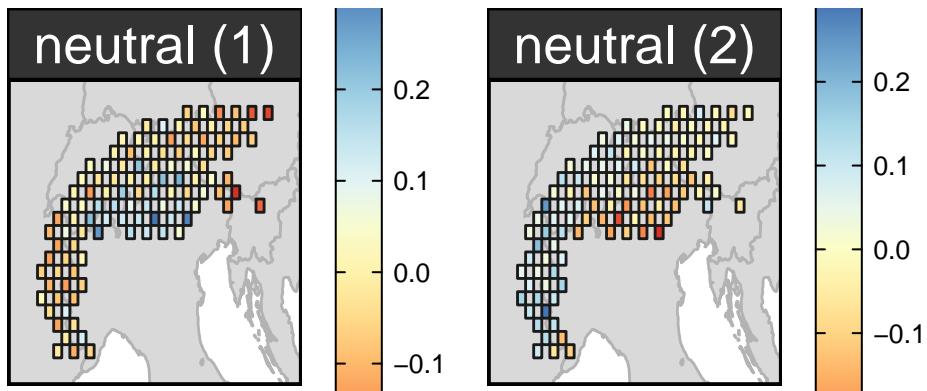


Figure S35 Distribution of adaptive and neutral genetic variation in *Cirsium spinosissimum*. See Figure S6 caption for conventions.

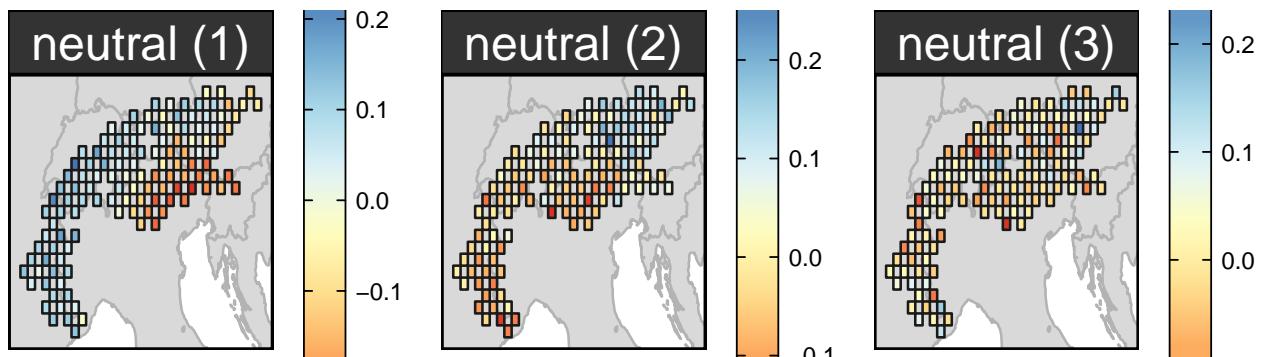


Figure S36 Distribution of adaptive and neutral genetic variation in *Dryas octopetala*. See Figure S6 caption for conventions.

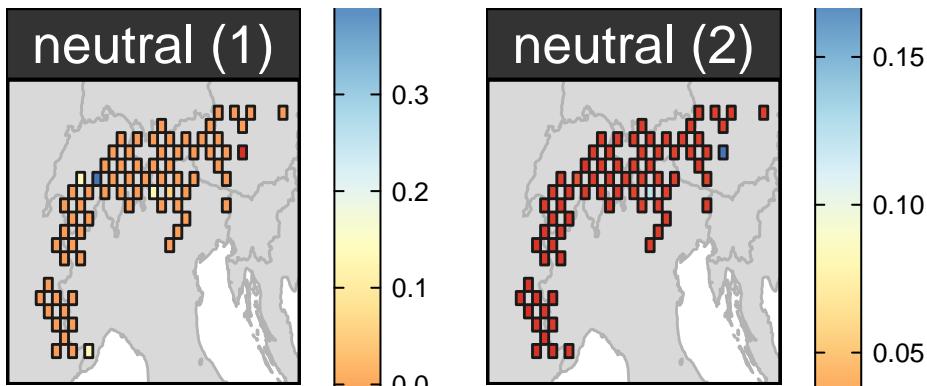


Figure S37 Distribution of adaptive and neutral genetic variation in *Gentiana nivalis*. See Figure S6 caption for conventions.

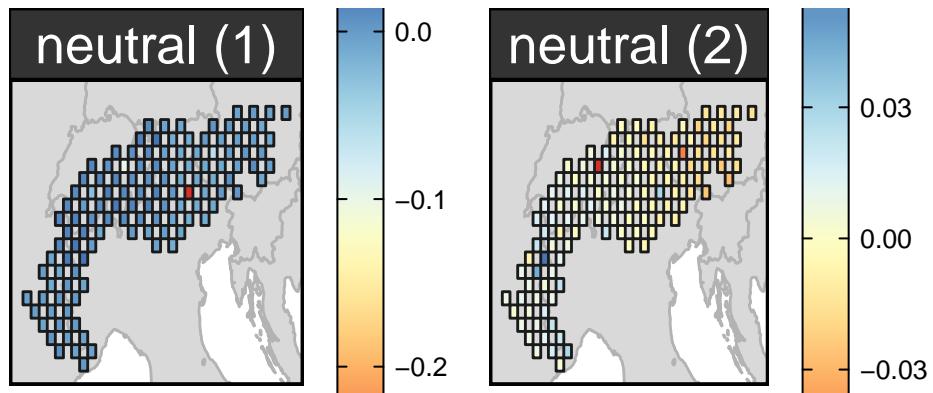


Figure S38 Distribution of adaptive and neutral genetic variation in *Geum montanum*. See Figure S6 caption for conventions.

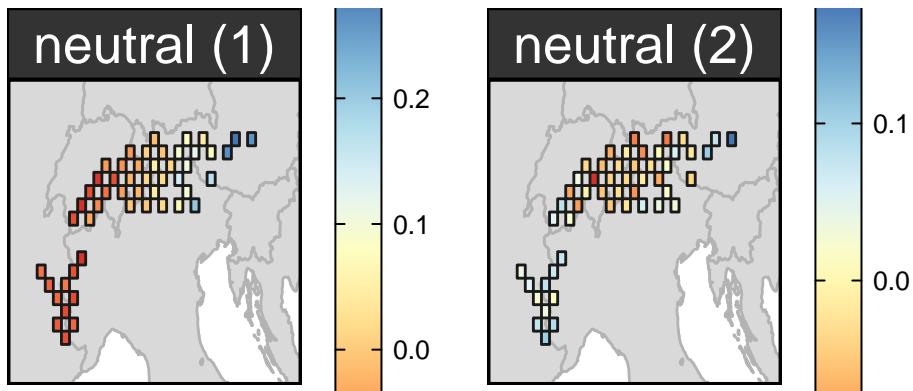


Figure S39 Distribution of adaptive and neutral genetic variation in *Geum reptans*. See Figure S6 caption for conventions.

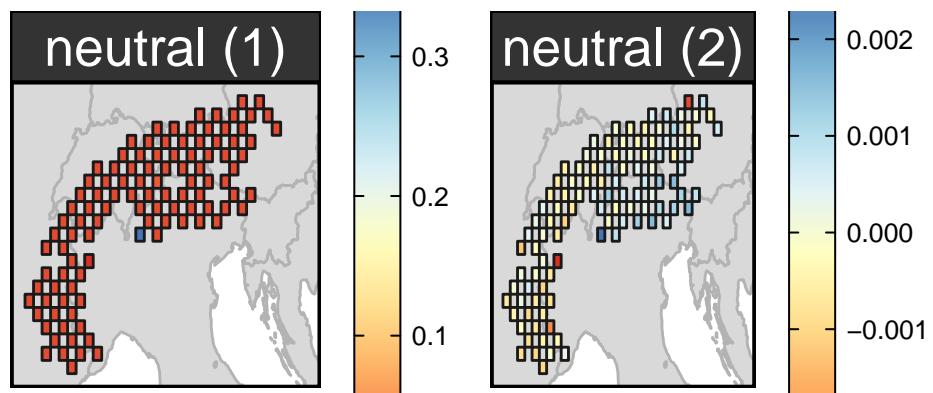


Figure S40 Distribution of adaptive and neutral genetic variation in *Gypsophila repens*. See Figure S6 caption for conventions.

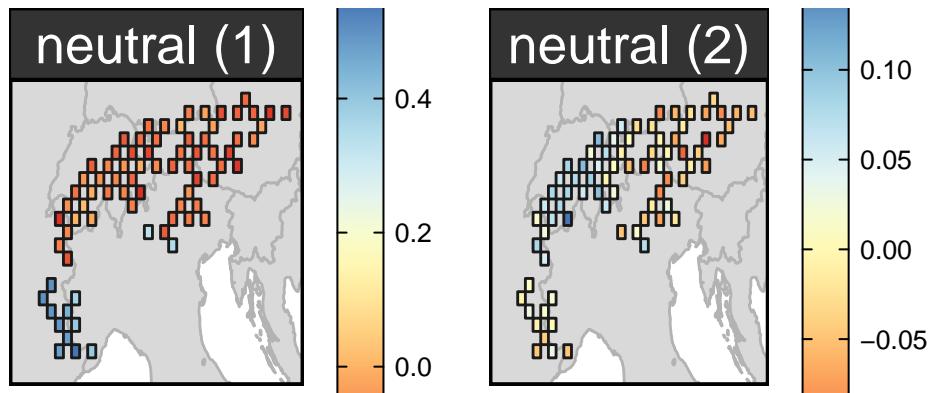


Figure S41 Distribution of adaptive and neutral genetic variation in *Hedsarum hedysaroides*. See Figure S6 caption for conventions.

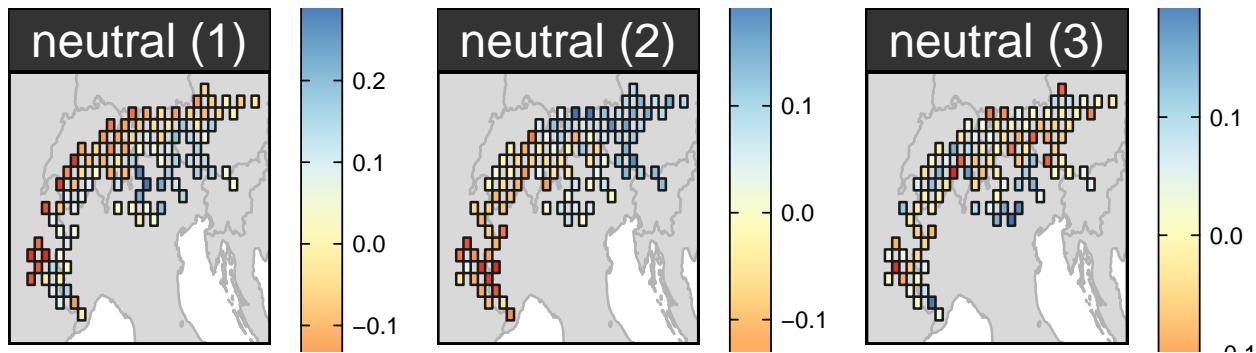


Figure S42 Distribution of adaptive and neutral genetic variation in *Hornungia alpina*. See Figure S6 caption for conventions.

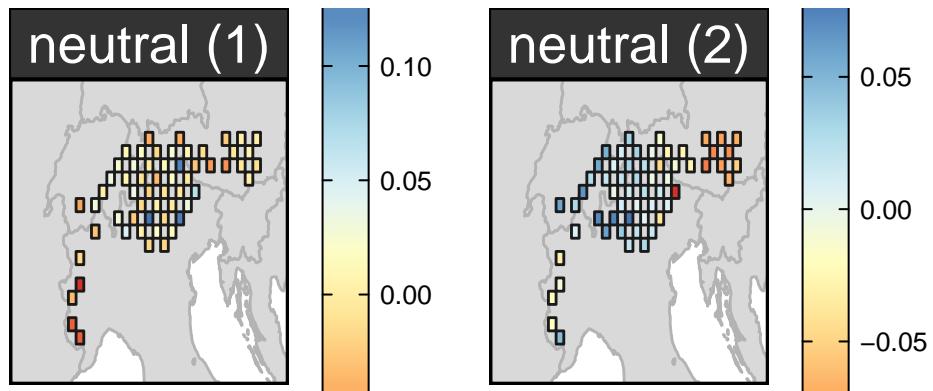


Figure S43 Distribution of adaptive and neutral genetic variation in *Hypochaeris uniflora*. See Figure S6 caption for conventions.

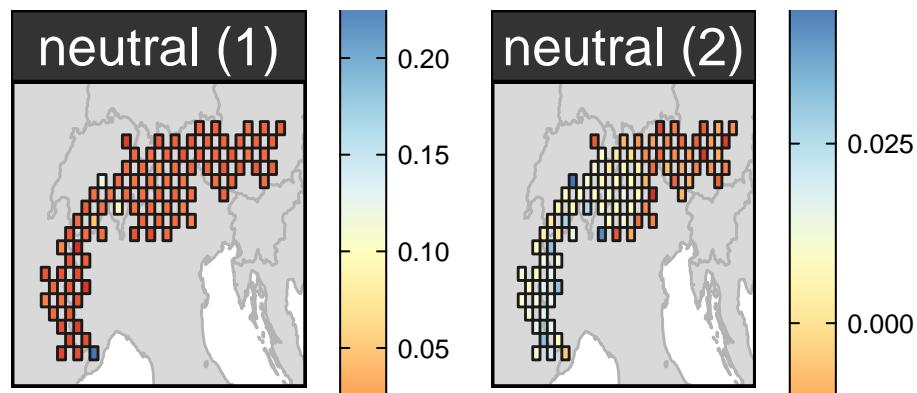


Figure S44 Distribution of adaptive and neutral genetic variation in *Juncus trifidus*. See Figure S6 caption for conventions.

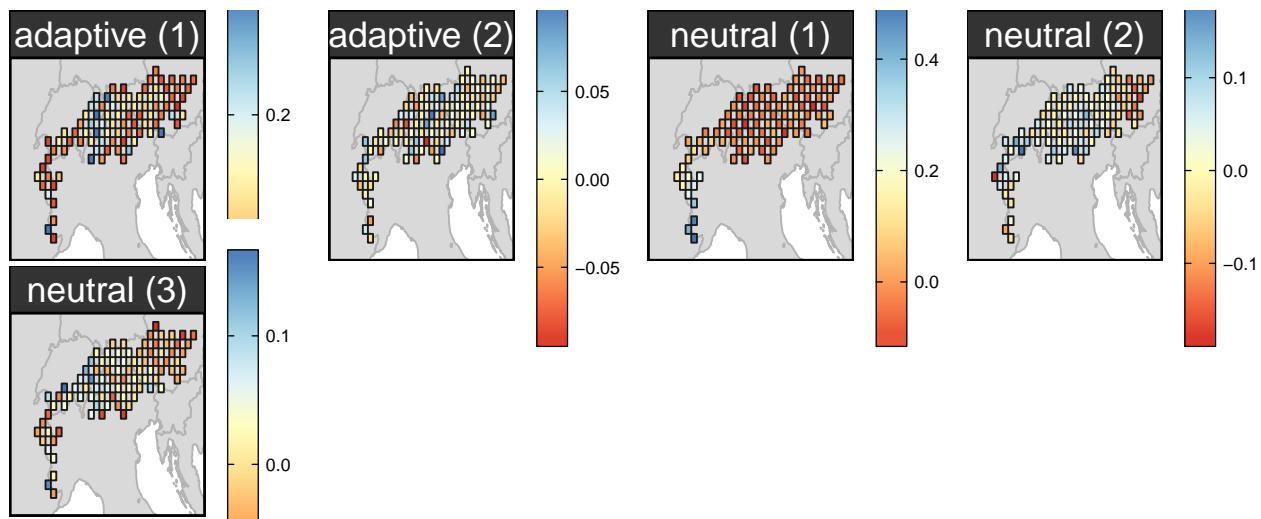


Figure S45 Distribution of adaptive and neutral genetic variation in *Loiseleuria procumbens*. See Figure S6 caption for conventions.

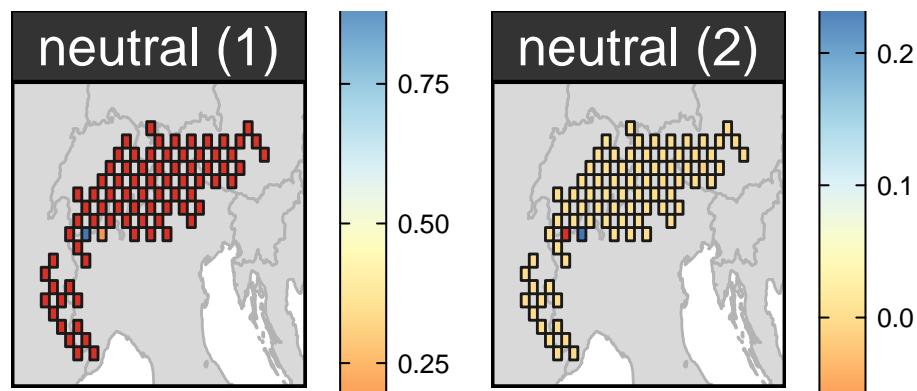


Figure S46 Distribution of adaptive and neutral genetic variation in *Luzula alpinopilosa*. See Figure S6 caption for conventions.

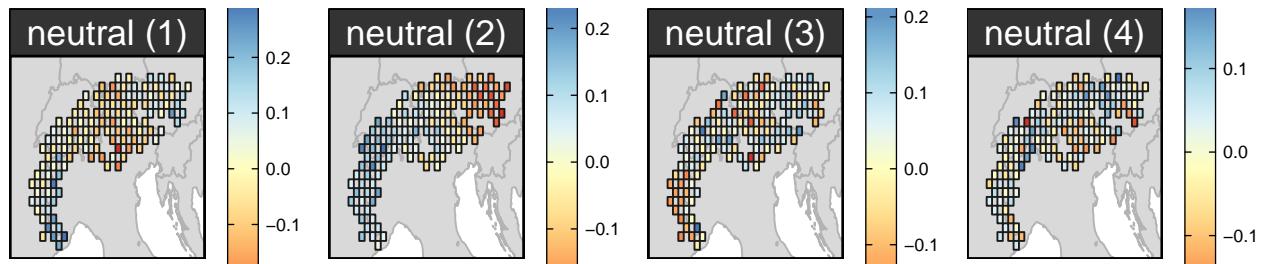


Figure S47 Distribution of adaptive and neutral genetic variation in *Peucedanum ostruthium*. See Figure S6 caption for conventions.

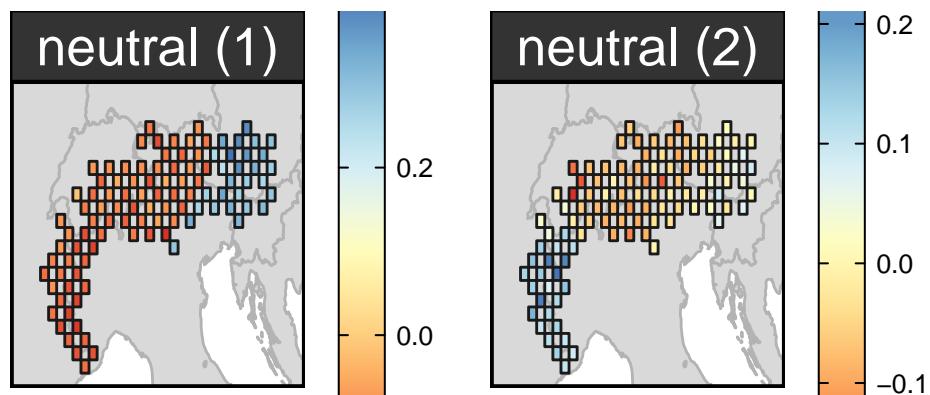


Figure S48 Distribution of adaptive and neutral genetic variation in *Phyteuma betonicifolium*. See Figure S6 caption for conventions.

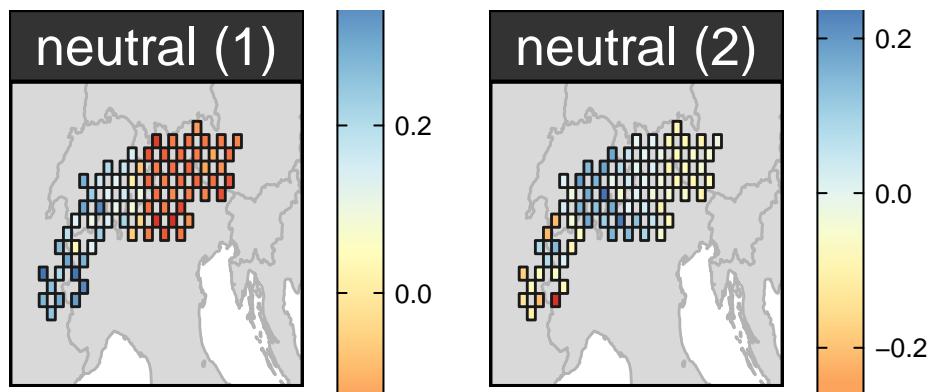


Figure S49 Distribution of adaptive and neutral genetic variation in *Phyteuma hemisphaericum*. See Figure S6 caption for conventions.

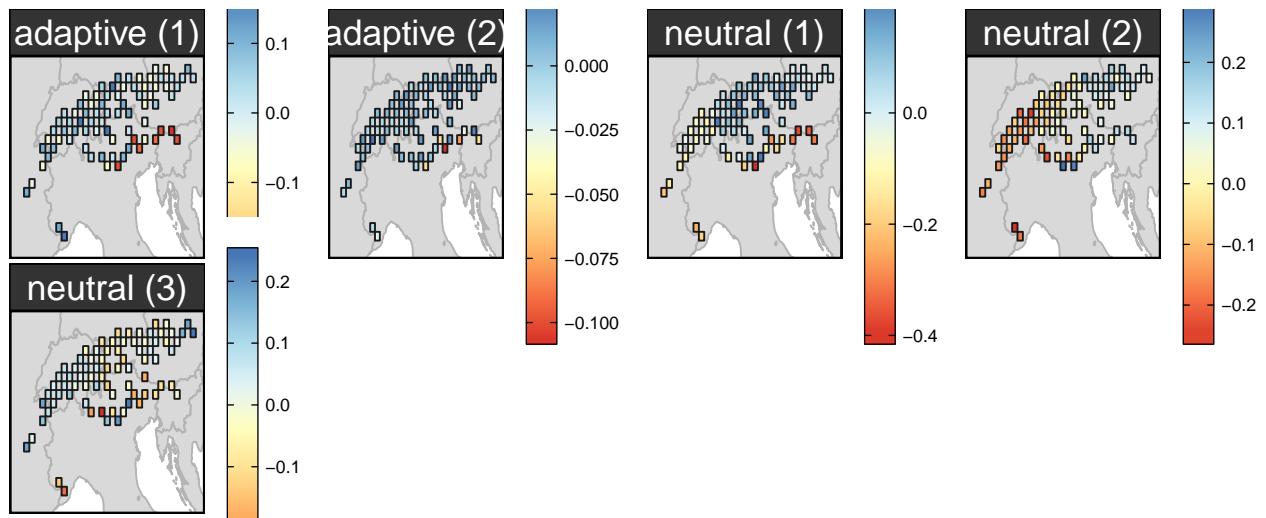


Figure S50 Distribution of adaptive and neutral genetic variation in *Ranunculus alpestris*. See Figure S6 caption for conventions.

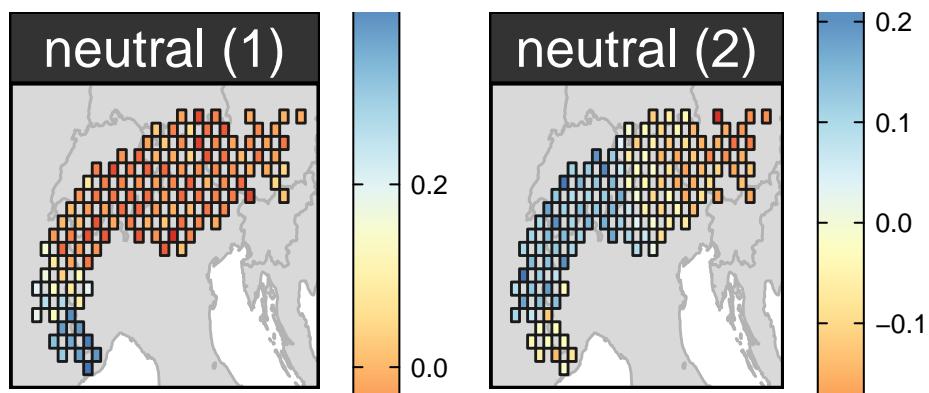


Figure S51 Distribution of adaptive and neutral genetic variation in *Rhododendron ferrugineum*. See Figure S6 caption for conventions.

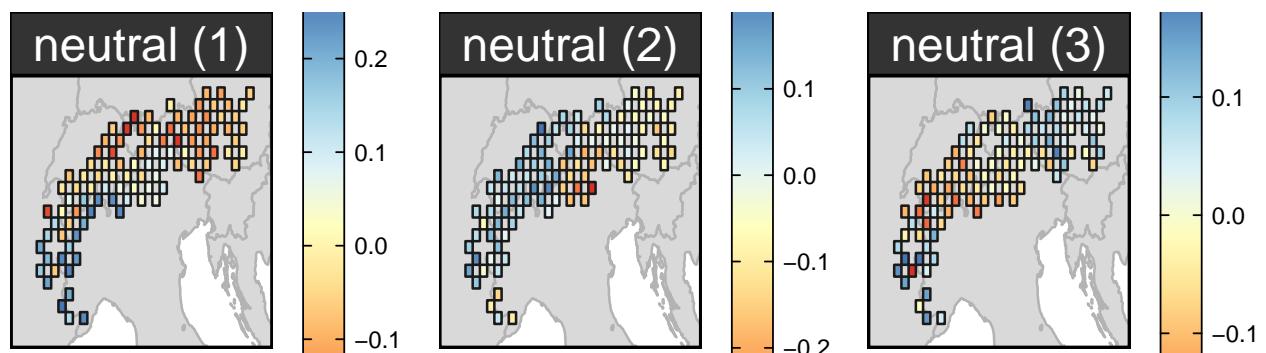


Figure S52 Distribution of adaptive and neutral genetic variation in *Saxifraga stellaris*. See Figure S6 caption for conventions.

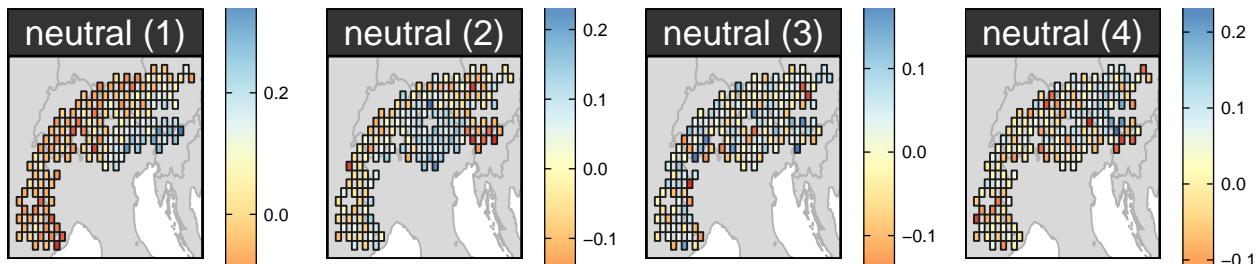


Figure S53 Distribution of adaptive and neutral genetic variation in *Sesleria caerulea*. See Figure S6 caption for conventions.

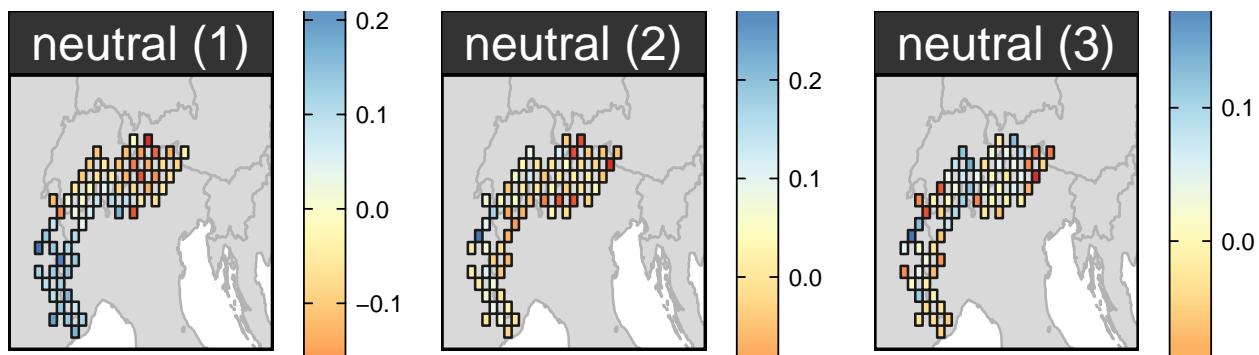


Figure S54 Distribution of adaptive and neutral genetic variation in *Trifolium alpinum*. See Figure S6 caption for conventions.

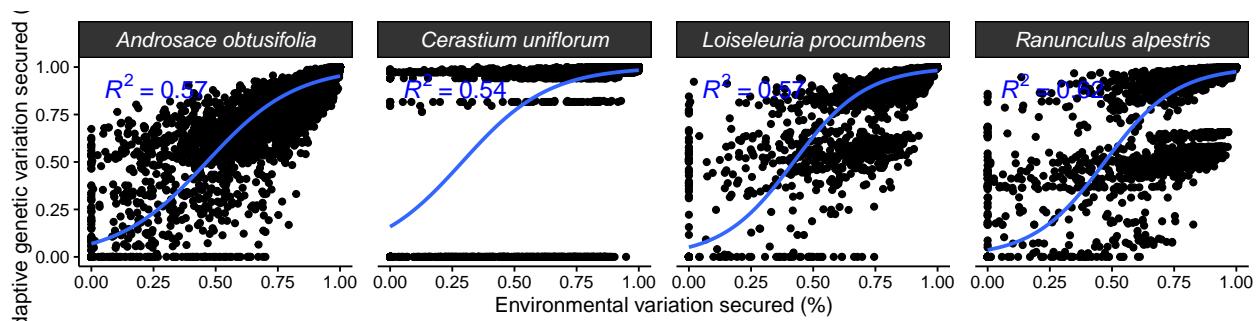


Figure S55 The relationship between the proportion of adaptive genetic variation secured in a prioritization and the proportion of environmental variation it also secures. Points represent values associated with randomly generated prioritizations. Blue lines indicate average trends computed using a generalised linear model with a logit link. Each panel shows data for a different species.

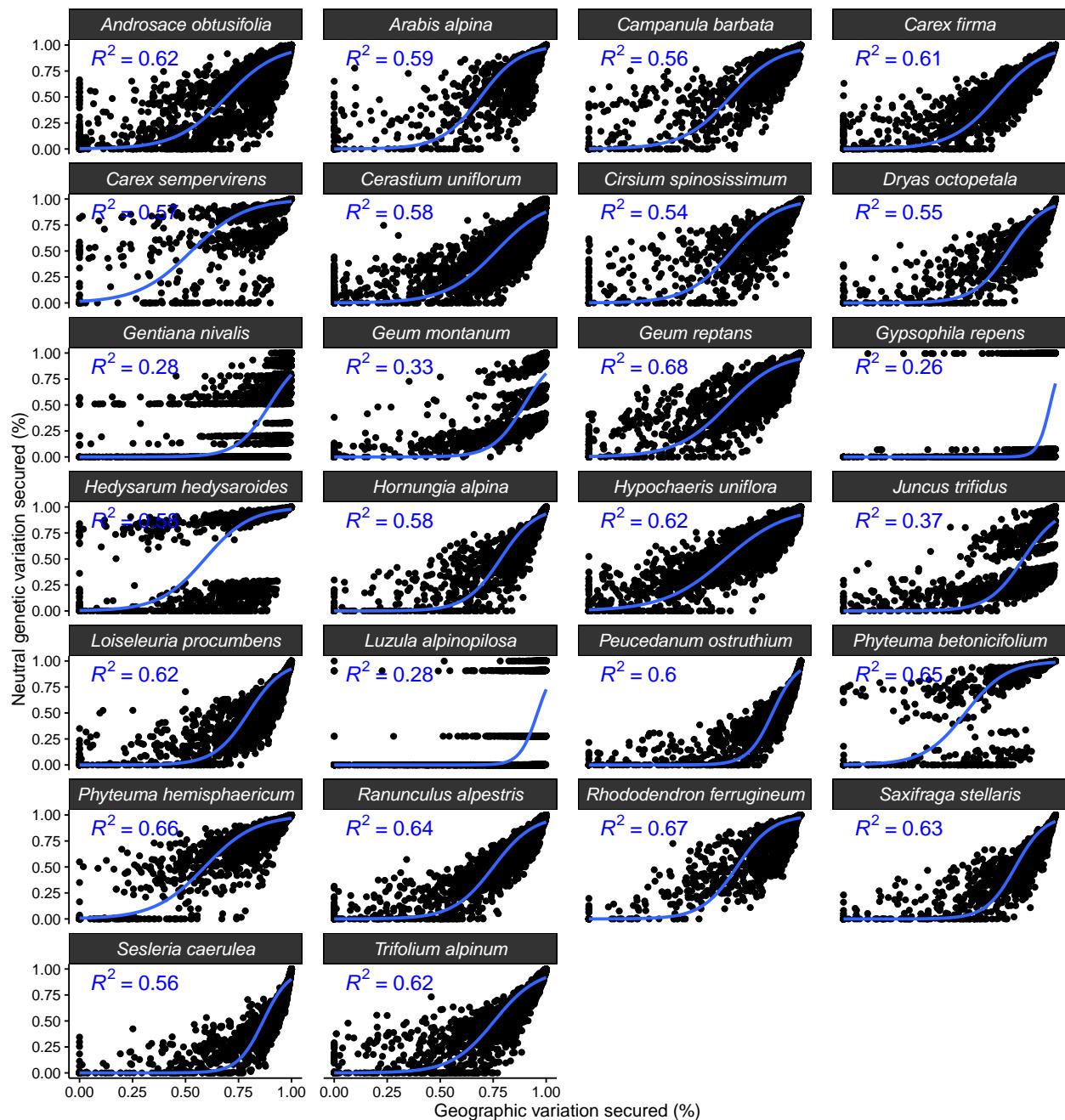


Figure S56 The relationship between the proportion of neutral genetic variation secured in a prioritization and the proportion of geographic variation it also secures. Conventions are detailed in Figure S55.

Table S1 Summary of principle components analysis (PCA) on bioclimatic variation across the study area. The first three principle components (PCs) were used for subsequent analysis.

Principle Component	Eigen value	Variation explained (%)	Cumulative variation explained (%)
1	84136.77	80.2	80.2
2	17296.54	16.49	96.69
3	2583.39	2.46	99.15
4	489.43	0.47	99.62
5	200.8	0.19	99.81
6	83.23	0.079	99.89
7	53.2	0.051	99.94
8	29.29	0.028	99.97
9	16.66	0.016	99.99
10	10.74	0.010	100
11	2.13	0.002	100
12	0.93	<0.001	100
13	0.59	<0.001	100
14	0.39	<0.001	100
15	0.26	<0.001	100
16	0.05	<0.001	100
17	0.02	<0.001	100
18	0.02	<0.001	100
19	<0.001	<0.001	100

Table S2 Summary of non-metric multi-dimensional scaling (NMDS) analyses on genetic variation for each species. The analyses were used to identify the main gradients of variation in binary adaptive and neutral loci data. Bold stress values indicate NMDS analyses that have converged.

Species	Adaptive		Neutral	
	K	Stress	K	Stress
<i>Androsace obtusifolia</i>	2	<0.001	2	0.219
<i>Arabis alpina</i>			2	0.235
<i>Campanula barbata</i>			2	0.204
<i>Carex firma</i>			3	0.241
<i>Carex sempervirens</i>			2	0.207
<i>Cerastium uniflorum</i>	2	<0.001	2	0.205
<i>Cirsium spinosissimum</i>			2	0.248
<i>Dryas octopetala</i>			3	0.218
<i>Gentiana nivalis</i>			2	0.046
<i>Geum montanum</i>			2	0.163
<i>Geum reptans</i>			2	0.19
<i>Gypsophila repens</i>			2	0.06
<i>Hedysarum hedsyaroides</i>			2	0.196
<i>Hornungia alpina</i>			3	0.2
<i>Hypochaeris uniflora</i>			2	0.241
<i>Juncus trifidus</i>			2	0.151
<i>Loiseleuria procumbens</i>	2	<0.001	3	0.207
<i>Luzula alpinopilosa</i>			2	0.051
<i>Peucedanum ostruthium</i>			4	0.218
<i>Phyteuma betonicifolium</i>			2	0.172
<i>Phyteuma hemisphaericum</i>			2	0.204
<i>Ranunculus alpestris</i>	2	<0.001	3	0.214
<i>Rhododendron ferrugineum</i>			2	0.208
<i>Saxifraga stellaris</i>			3	0.201
<i>Sesleria caerulea</i>			4	0.209
<i>Trifolium alpinum</i>			3	0.212

Table S3 Summary of post-hoc analyses on generalized linear models. Briefly, two generalized linear models were fit to correlate the proportion of adaptive genetic variation and environmental variation secured, and the proportion of neutral genetic variation and geographic variation secured in a prioritization. These models also included a predictor variable indicating the species for which the prioritizations were generated, and an interaction term. A post-hoc analysis was conducted to determine if the slopes for each species were significantly different to zero (detailed in the *Z* and *P* columns). All tests used a single degree of freedom. Cragg and Uhler's pseudo- R^2 values were calculated to show the proportion of variation explained by the slopes for each species (R^2 column).

Species	Environmental			Geographic		
	<i>Z</i>	<i>P</i>	R^2	<i>Z</i>	<i>P</i>	R^2
<i>Androsace obtusifolia</i>	5.6 ± 0.14	<0.001	0.57	8.39 ± 0.26	<0.001	0.62
<i>Arabis alpina</i>				10.76 ± 0.45	<0.001	0.59
<i>Campanula barbata</i>				8.84 ± 0.34	<0.001	0.56
<i>Carex firma</i>				9.13 ± 0.28	<0.001	0.61
<i>Carex sempervirens</i>				7.91 ± 0.33	<0.001	0.57
<i>Cerastium uniflorum</i>	5.75 ± 0.15	<0.001	0.54	8.33 ± 0.27	<0.001	0.58
<i>Cirsium spinosissimum</i>				9.37 ± 0.37	<0.001	0.54
<i>Dryas octopetala</i>				11.98 ± 0.47	<0.001	0.55
<i>Gentiana nivalis</i>				12.85 ± 0.47	<0.001	0.28
<i>Geum montanum</i>				13.5 ± 0.58	<0.001	0.33
<i>Geum reptans</i>				8.26 ± 0.26	<0.001	0.68
<i>Gypsophila repens</i>				34.59 ± 1.19	<0.001	0.26
<i>Hedysarum hedysaroides</i>				9.31 ± 0.31	<0.001	0.58
<i>Hornungia alpina</i>				12.18 ± 0.45	<0.001	0.58
<i>Hypochaeris uniflora</i>				6.95 ± 0.2	<0.001	0.62
<i>Juncus trifidus</i>				12.12 ± 0.49	<0.001	0.37
<i>Loiseleuria procumbens</i>	6.94 ± 0.22	<0.001	0.57	12.31 ± 0.42	<0.001	0.62
<i>Luzula alpinopilosa</i>				24.03 ± 0.83	<0.001	0.28
<i>Peucedanum ostruthium</i>				17.31 ± 0.62	<0.001	0.60
<i>Phyteuma betonicifolium</i>				10.27 ± 0.39	<0.001	0.65
<i>Phyteuma hemisphaericum</i>				8.39 ± 0.29	<0.001	0.66
<i>Ranunculus alpestris</i>	6.95 ± 0.21	<0.001	0.62	10.55 ± 0.33	<0.001	0.64
<i>Rhododendron ferrugineum</i>				11.92 ± 0.46	<0.001	0.67
<i>Saxifraga stellaris</i>				14.42 ± 0.52	<0.001	0.63
<i>Sesleria caerulea</i>				16.71 ± 0.65	<0.001	0.56
<i>Trifolium alpinum</i>				9.87 ± 0.33	<0.001	0.62