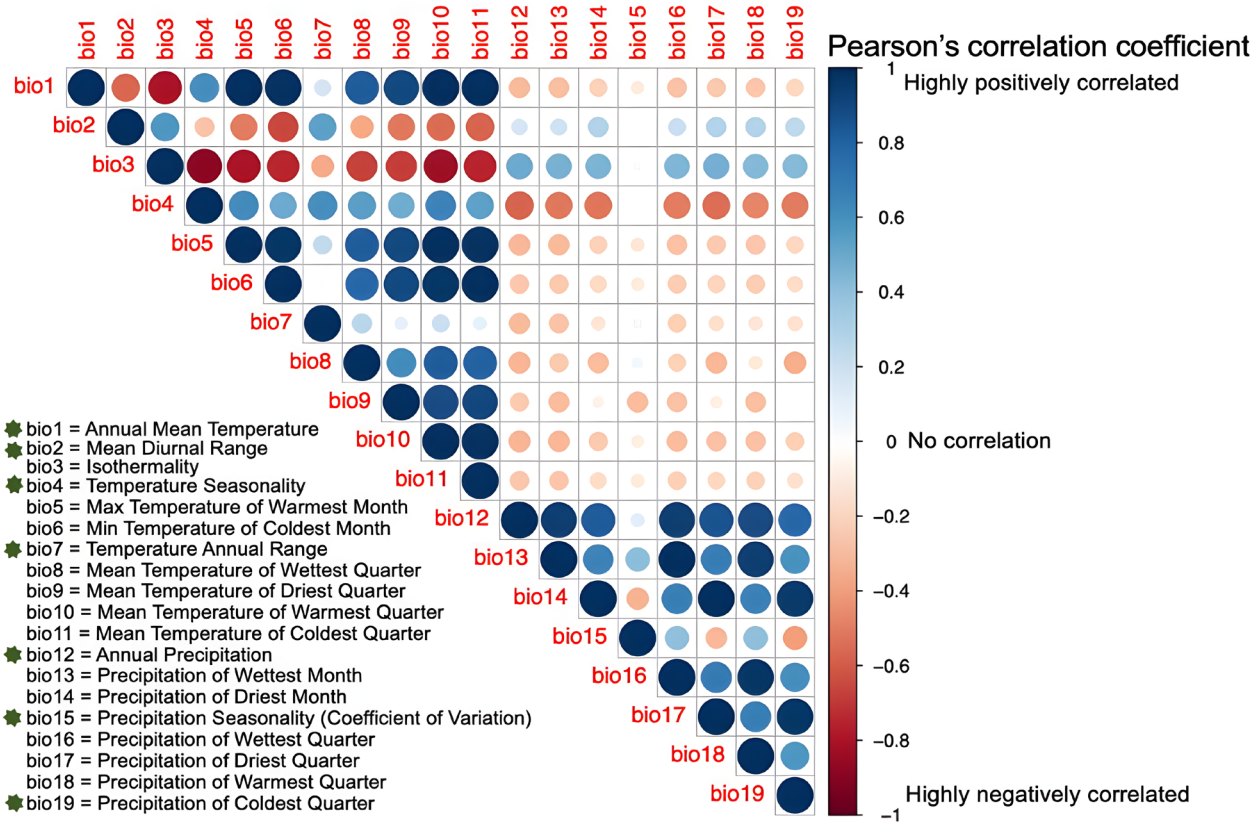
The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S1

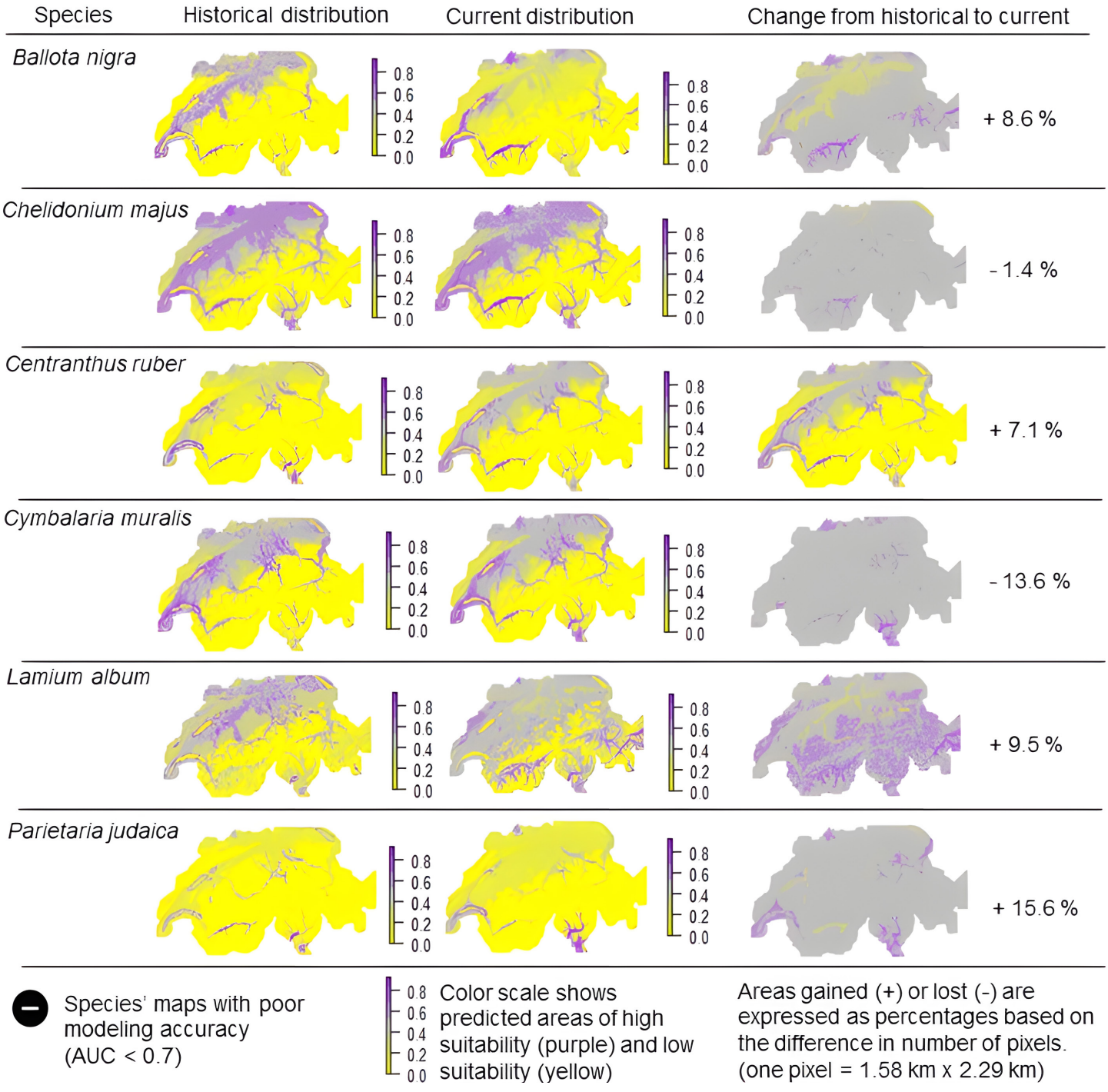
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S1: Correlation plot of the pairwise Pearson's correlation coefficient for the 19 bioclimatic variables. The y-axis shows the legend color of Pearson's correlation coefficient with positive correlations in blue and negative correlations in red. The color intensity and the circle size are proportional to the correlation coefficients. Green stars indicate the seven uncorrelated variables ($|r| < 0.8$) that were chosen for further analysis.

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S2

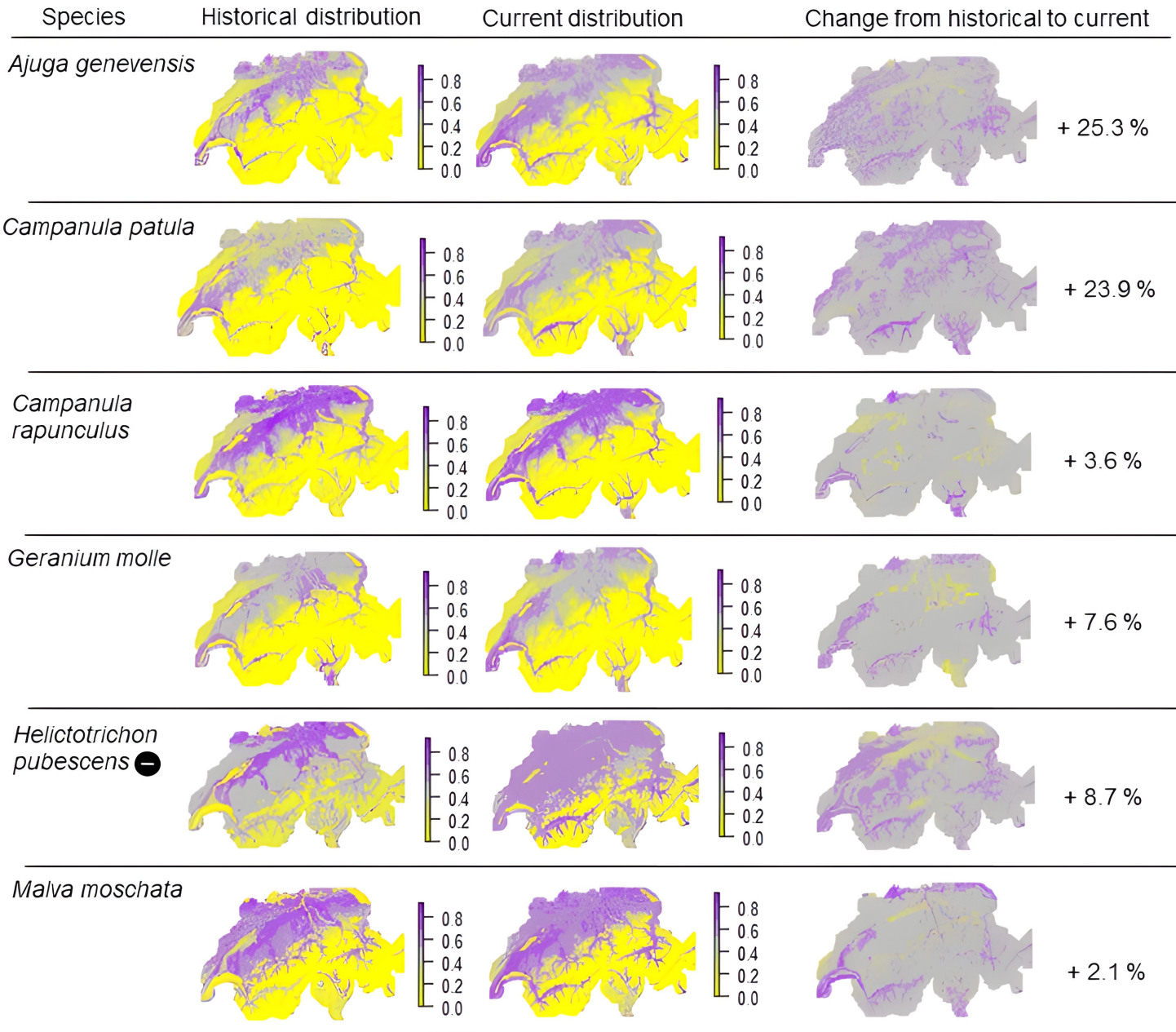
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S2: Summary of the prediction maps for the six plant species of the perennial ruderals (historical and current distribution plus the difference map showing the change from historical to current distribution).

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S3

Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



⊖ Species' maps with poor modeling accuracy (AUC < 0.7)

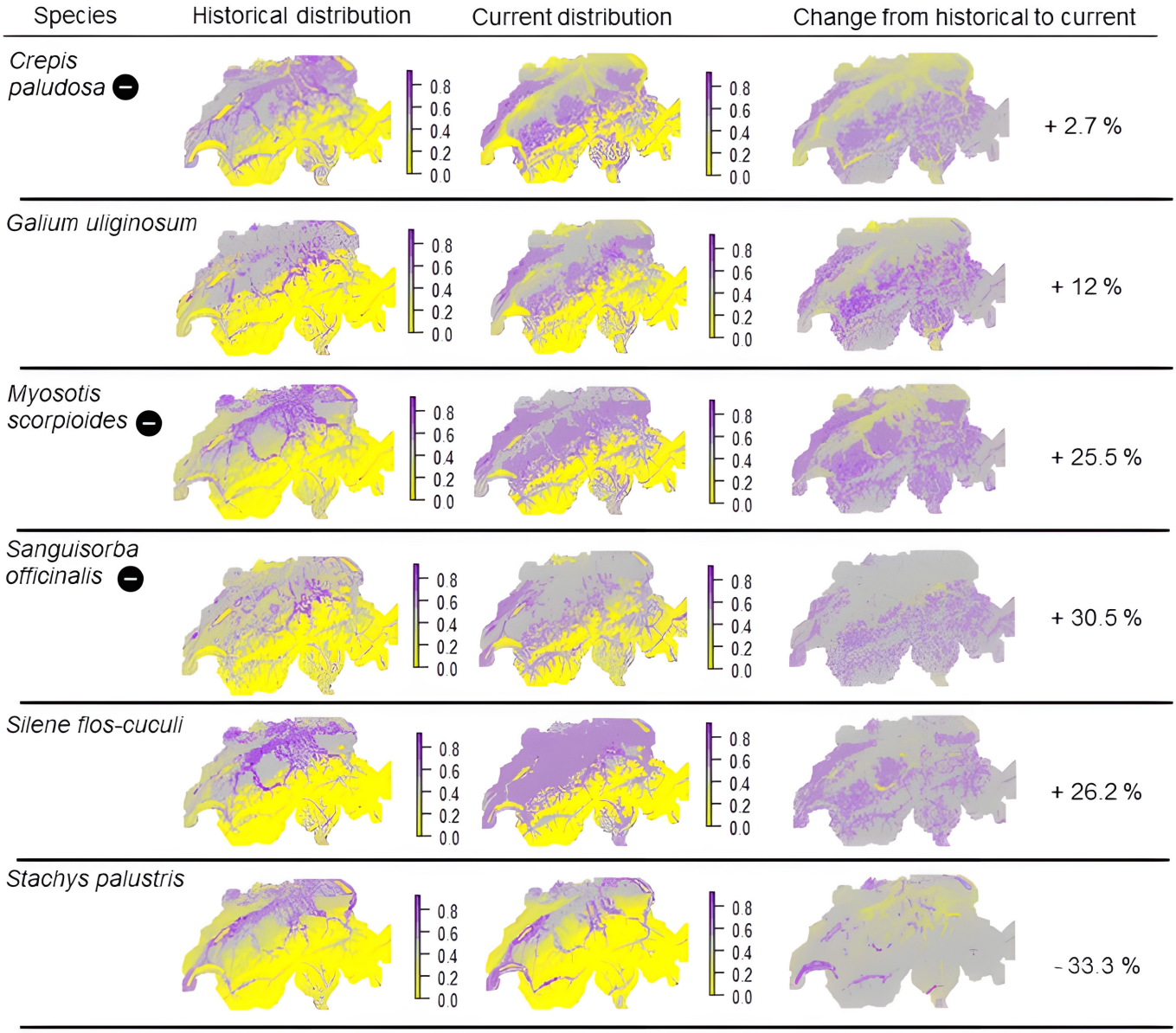
0.8 0.6 0.4 0.2 0.0 Color scale shows predicted areas of high suitability (purple) and low suitability (yellow)

Areas gained (+) or lost (-) are expressed as percentages based on the difference in number of pixels. (one pixel = 1.58 km x 2.29 km)

Supplementary Figure S3: Summary of the prediction maps for the six plant species of the semi-arid grasslands (historical and current distribution plus the difference map showing the change from historical to current distribution).

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S4

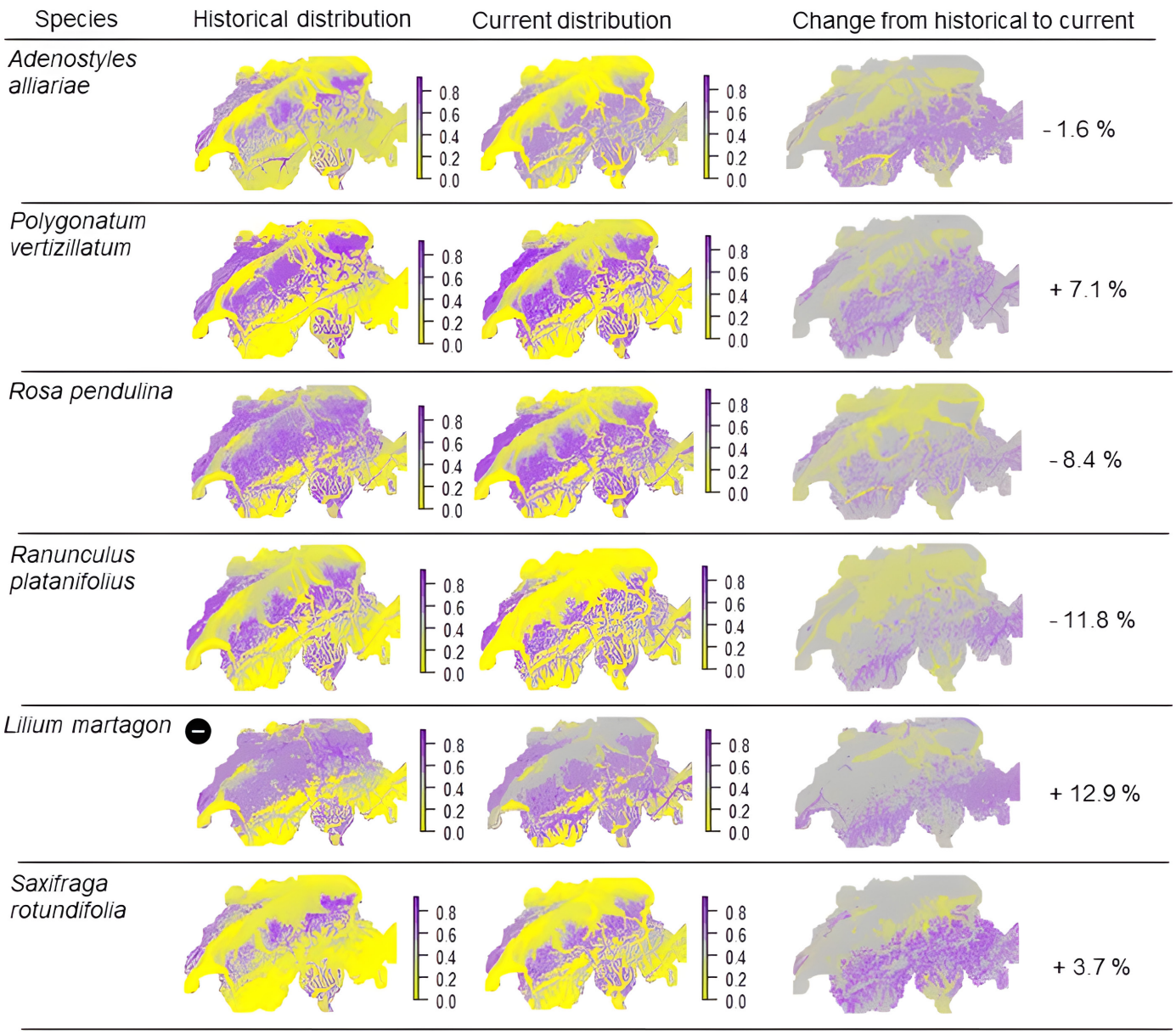
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S4: Summary of the prediction maps for the six plant species of the moist grasslands (historical and current distribution plus the difference map showing the change from historical to current distribution).

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S5

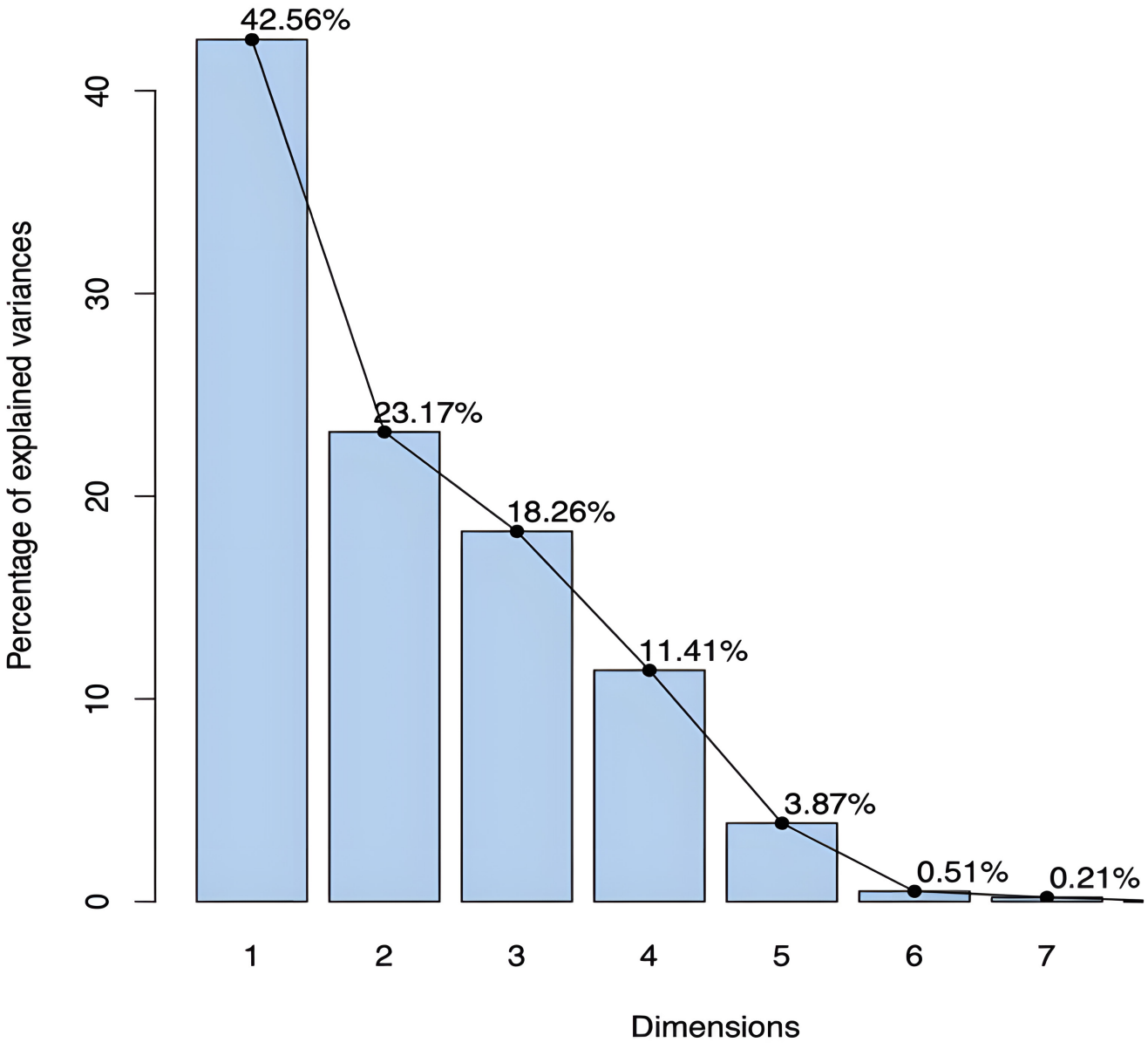
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S5: Summary of the prediction maps for the six plant species of the tall herb fringes (historical and current distribution plus the difference map showing the change from historical to current distribution).

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S6

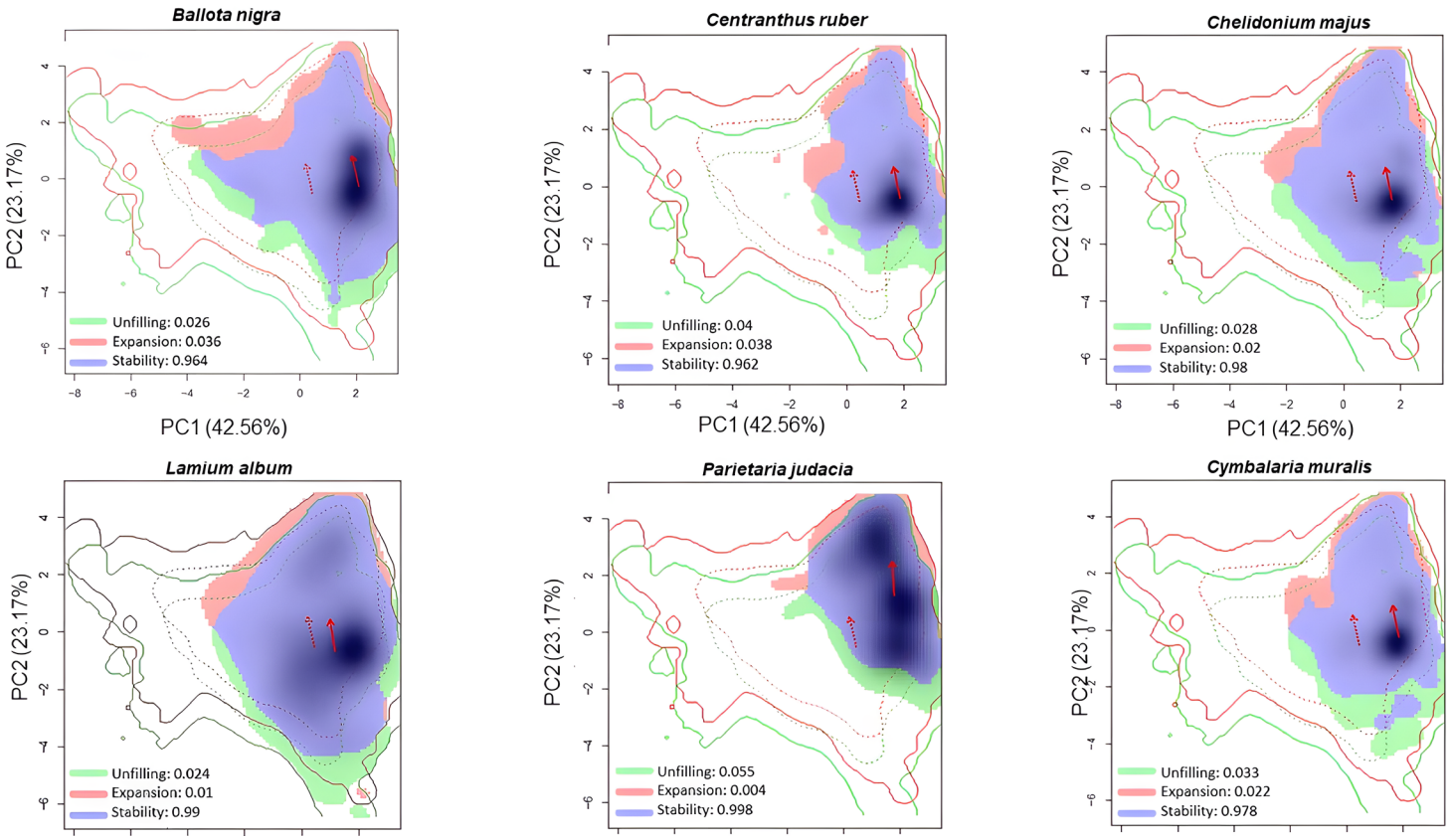
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S6 Screeplot from the environmental principal component analysis (PCA-env). Shown are the dimensions of explained variance within the data.

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S7

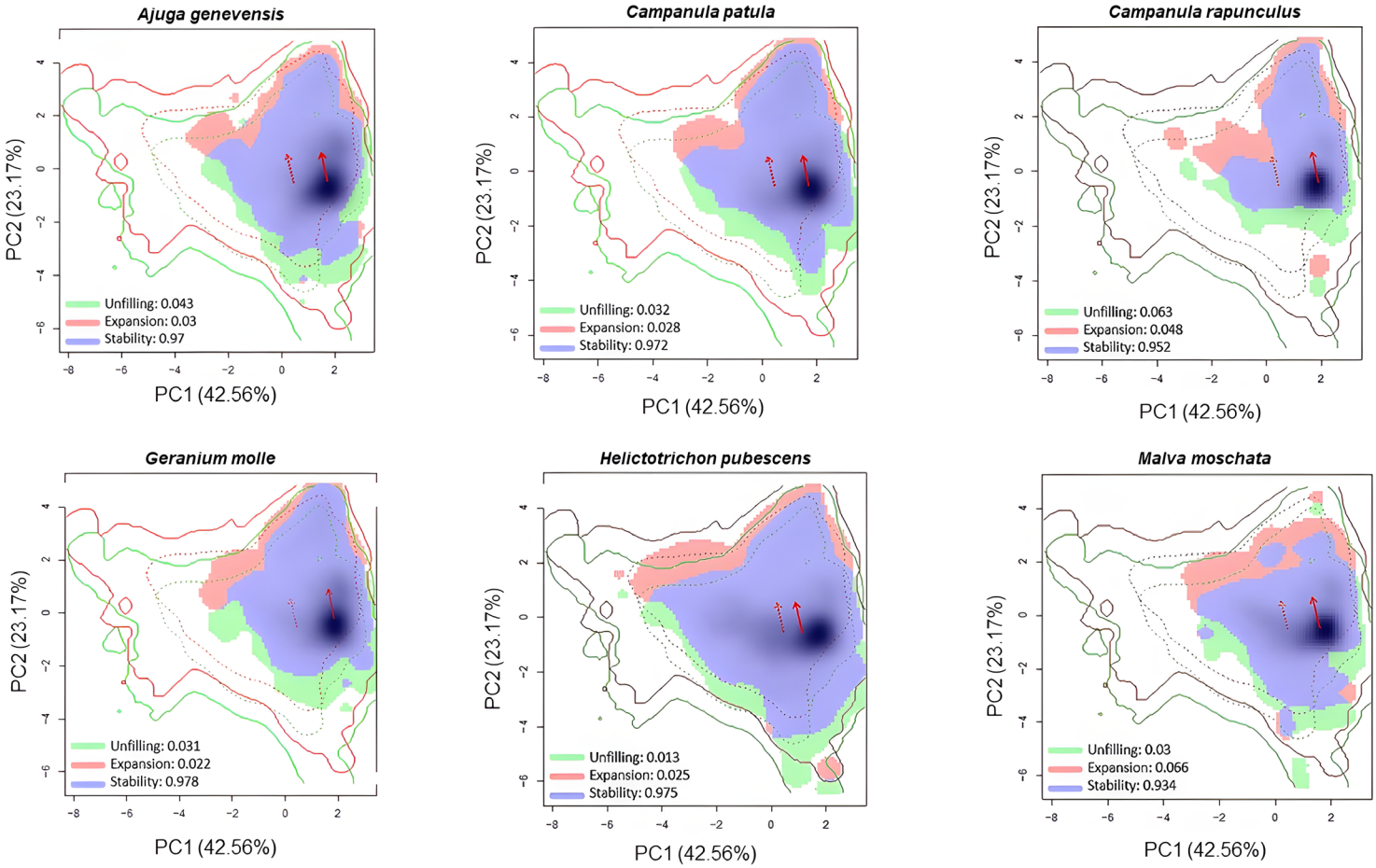
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S7 Niche dynamics plot for the six plant species of the habitat perennial ruderals. Solid range lines (red = current, green= historical) represent 100% of the available environmental space, and dashed lines represent 50% of that space. Blue shading represents the density of occurrences in the shared niche space (= niche stability) between the historical and current niches. Red shading indicates the expansion of the current niche and green shading shows the unfilling (contraction). The calculated values for niche stability, niche unfilling (contraction), and niche expansion are also indicated.

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S8

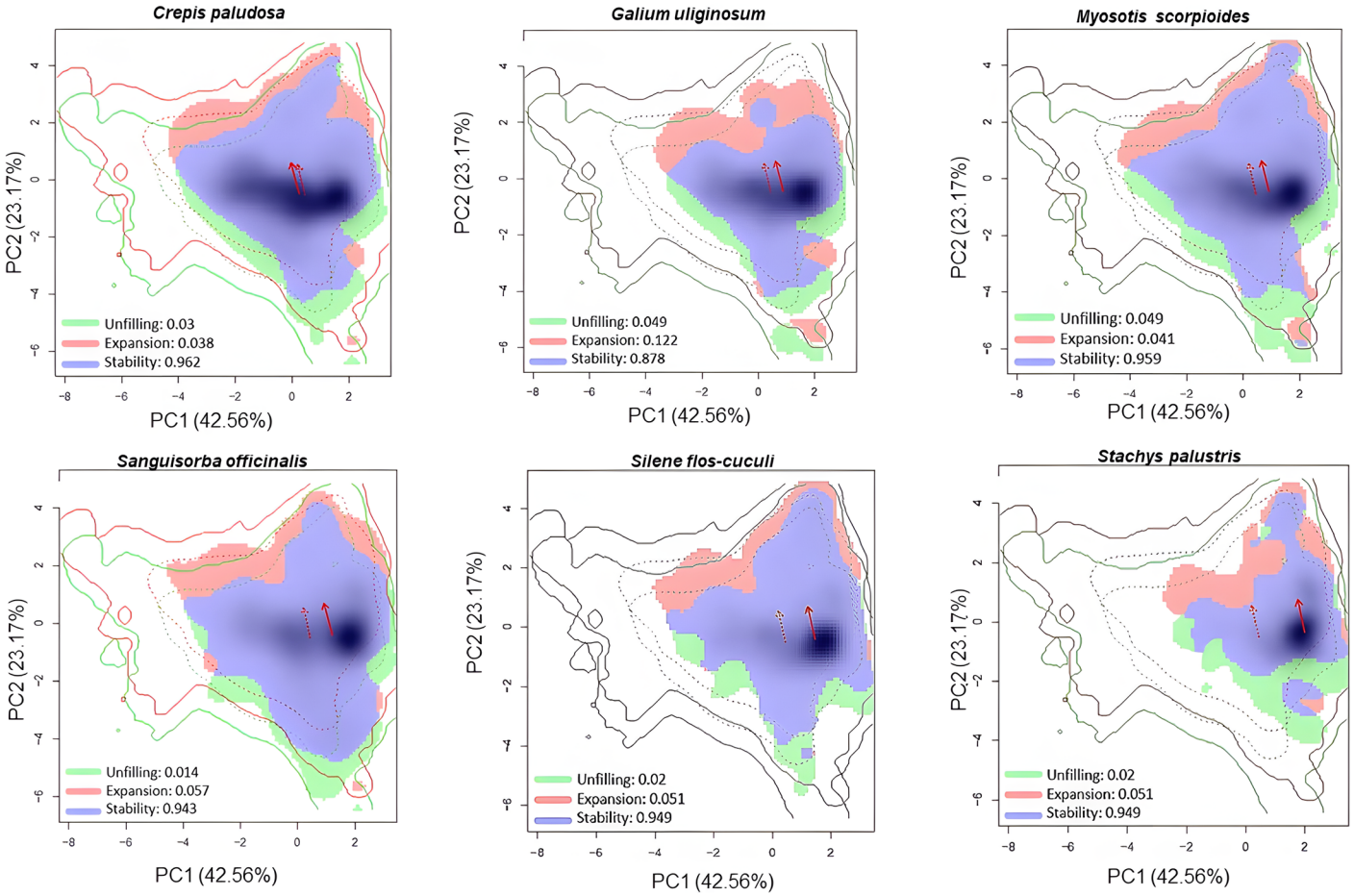
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S8 Niche dynamics plot for the six plant species of the habitat semi-arid grasslands. Solid range lines (red = current, green= historical) represent 100% of the available environmental space, and dashed lines represent 50% of that space. Blue shading represents the shared niche space (= niche stability) between the historical and current niches. Red shading indicates the expansion of the current niche and green shading shows the unfilling (contraction) of the historical niche when compared to the current niche. The calculated values for niche stability, niche unfilling (contraction), and niche expansion are also indicated.

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S9

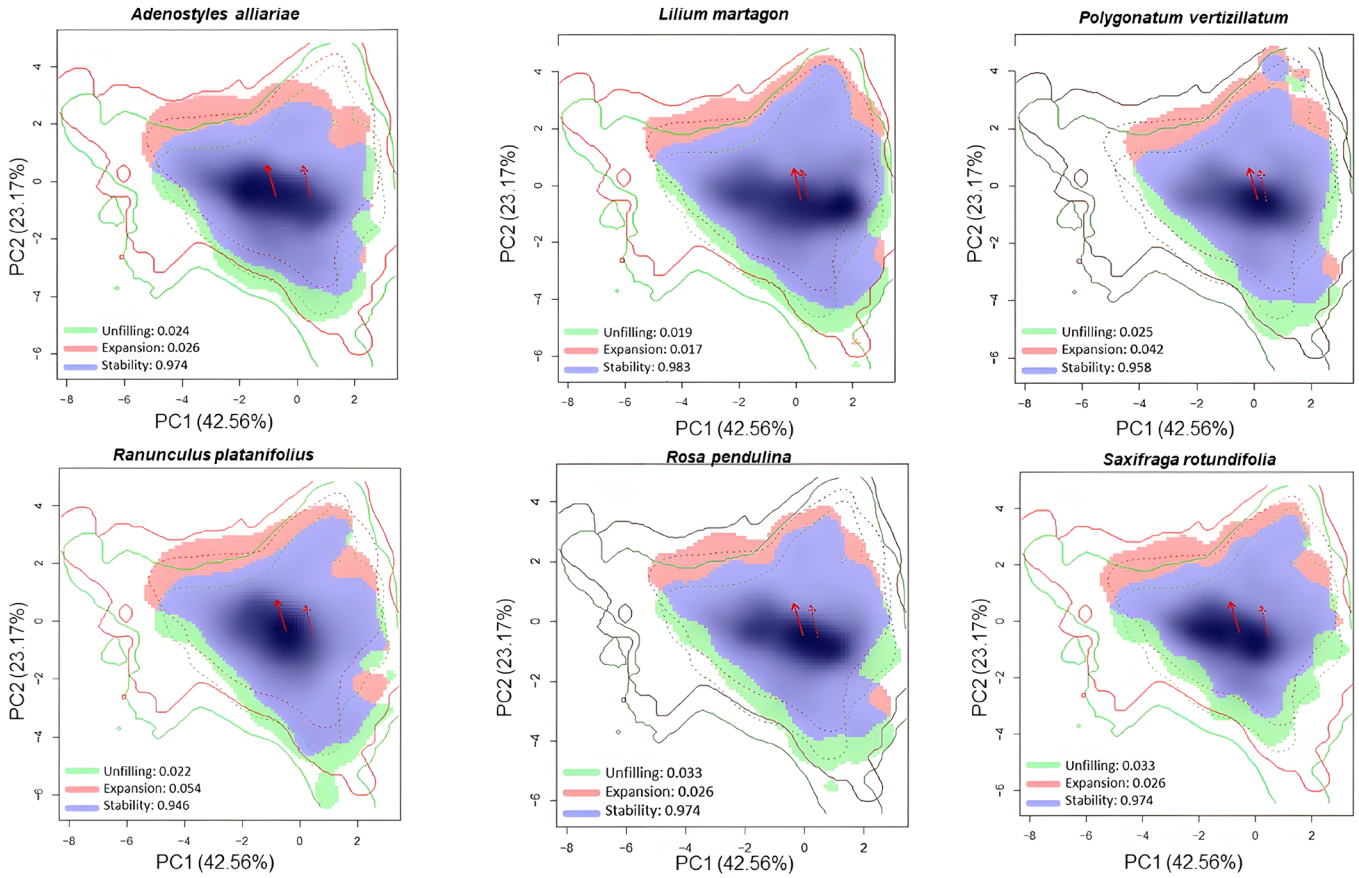
Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S9 Niche dynamics plot for the six plant species of the habitat moist grasslands. Solid range lines (red = current, green= historical) represent 100% of the available environmental space, and dashed lines represent 50% of that space. Blue shading represents the shared niche space (= niche stability) between the historical and current niches. Red shading indicates the expansion of the current niche and green shading shows the unfilling (contraction) of the historical niche when compared to the current niche. The calculated values for niche stability, niche unfilling (contraction), and niche expansion are also indicated.

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Fig. S10

Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]



Supplementary Figure S10 Niche dynamics plot for the six plant species of the habitat tall herb fringes. Solid range lines (red = current, green= historical) represent 100% of the available environmental space, and dashed lines represent 50% of that space. Blue shading represents the shared niche space (= niche stability) between the historical and current niches. Red shading indicates the expansion of the current niche and green shading shows the unfilling (contraction) of the historical niche when compared to the current niche. The calculated values for niche stability, niche unfilling (contraction), and niche expansion are also indicated.

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Table S1

Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]

Supplementary Table S1 Evaluation of the MaxEnt models of each species for predictive model performance and accuracy. Indicated are the AUC values for the tested models. Models performing poorly (AUC <0.7) are highlighted in grey shade. AUC = Area under the Curve (indication of model performance).

Species	AUC historical	AUC current
Adenostyles alliariae	0.740	0.738
Ajuga genevensis	0.750	0.756
Ballota nigra	0.828	0.820
Campanula patula	0.741	0.743
Campanula rapunculus	0.784	0.788
Centhranthus ruber	0.800	0.801
Chelidonium majus	0.733	0.743
Crepis paludosa	0.701	0.699
Crepis vesicaria subsp. *taraxacifolia*	0.499	0.475
Cymbalaria muralis	0.850	0.813
Descurainia sophia	0.788	0.802
Galium uliginosum	0.740	0.735
Geranium molle	0.795	0.791
Geranium rotundifolium	0.833	0.822
Helictotrichon pubescens	0.632	0.639
Lactuca serriola	0.780	0.790
Lamium album	0.755	0.739
Lilium martagon	0.663	0.653
Malva moschata	0.727	0.734
Myosotis scorpioides	0.690	0.689
Parietaria judaica	0.934	0.936
Polygonatum verticillatum	0.729	0.725
Ranunculus platanifolius	0.790	0.795
Reseda lutea	0.737	0.745
Rosa pendulina	0.740	0.741
Sanguisorba officinalis	0.654	0.663
Saxifraga rotundifolia	0.737	0.738
Silene flos-cuculi	0.706	0.706
Sisymbrium officinale	0.804	0.807
Stachys palustris	0.781	0.776

The impact of climate change on plant distribution and niche dynamics over the past 250 years in Switzerland | ESM Table S2

Jessica Wang[1], Markus Fischer[1,2], Stefan Eggenberg[3], Katja Rembold[1]

Supplementary Table S2 Niche characteristics using the environmental principal component analysis (PCA-env), indicated are the values of each species of the niche overlap in terms of Schoeners' D, niche equivalency, niche similarity, niche stability, niche expansion and niche unfilling.

Species	Over-lap D	Equiva-lency	Simila-rity	Stability	Expan-sion	Unfilling	Equivalency (p-value)
Adenostyles alliariae	0.66	0.7	0.7	0.974	0.026	0.024	0.0198
Ajuga genevensis	0.62	0.6	0.6	0.970	0.030	0.043	0.0198
Ballota nigra	0.64	0.6	0.6	0.964	0.036	0.026	0.0198
Campanula patula	0.74	0.1	0.1	0.972	0.028	0.032	0.0198
Campanula rapunculus	0.70	0.7	0.7	0.952	0.048	0.063	0.0198
Centhranthus ruber	0.68	0.7	0.7	0.962	0.038	0.040	0.0198
Chelidonium majus	0.77	0.6	0.6	0.980	0.020	0.028	0.0198
Crepis paludosa	0.65	0.7	0.6	0.962	0.038	0.030	0.0198
Crepis vesicaria subsp. *taraxacifolia*	0.52	0.5	0.5	0.447	0.553	0.361	0.0396
Cymbalaria muralis	0.72	0.7	0.5	0.978	0.022	0.033	0.0198
Descurainia sophia	0.61	0.6	0.6	0.924	0.076	0.019	0.0198
Galium uliginosum	0.55	0.5	0.5	0.878	0.122	0.049	0.0198
Geranium molle	0.74	0.5	0.6	0.978	0.022	0.031	0.0198
Geranium rotundifolium	0.67	0.7	0.7	0.987	0.013	0.037	0.0198
Helictotrichon pubescens	0.67	0.7	0.7	0.975	0.025	0.013	0.0198
Lactuca serriola	0.73	0.5	0.5	0.968	0.032	0.032	0.0198
Lamium album	0.58	0.6	0.6	0.990	0.010	0.024	0.0198
Lilium martagon	0.67	0.7	0.7	0.983	0.017	0.019	0.0198
Malva moschata	0.62	0.6	0.6	0.934	0.066	0.030	0.0198
Myosotis scorpioides	0.60	0.6	0.6	0.959	0.041	0.049	0.0198
Parietaria judaica	0.79	0.6	0.6	0.996	0.004	0.055	0.0396
Polygonatum verticillatum	0.66	0.7	0.7	0.958	0.042	0.025	0.0198
Ranunculus platanifolius	0.60	0.6	0.6	0.946	0.054	0.022	0.0198
Reseda lutea	0.73	0.7	0.5	0.967	0.033	0.013	0.0198
Rosa pendulina	0.68	0.7	0.7	0.974	0.026	0.033	0.0198
Sanguisorba officinalis	0.60	0.6	0.6	0.943	0.057	0.014	0.0198
Saxifraga rotundifolia	0.65	0.7	0.7	0.970	0.030	0.036	0.0198
Silene flos-cuculi	0.63	0.6	0.6	0.949	0.051	0.020	0.0198
Sisymbrium officinale	0.65	0.7	0.6	0.968	0.032	0.021	0.0198
Stachys palustris	0.63	0.6	0.6	0.886	0.114	0.094	0.0396