Supplementary material: Evolutionary processes, not environmental drivers, determine the resilience of natural populations

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S1. Species List

Table S1. A complete list of the 556 species for which data was extracted from the COMPADRE[1] & COMADRE[2] databases for this study. Entries are colour coded to distinguish each of the six algae (Grey), 112 animal (White), and 438 plant (Red) species extracted. Each species is listed along with their corresponding realm classification (Terrestrial, Freshwater or Marine), the number of population replicates extracted initially, the number of population replicates retained in our final refined sample, and the original data source(s) (if provided). Population replicates dropped following initial extraction corresponded with either: (1) highly migratory species making it difficult to link demographic properties to the environment in which they were measured, or (2) Matrix Population Models (MPMs) exhibiting population growth rates >2, and/or (3) *reducible*, *non-ergodic* or *imprimitive* characteristics, and therefore representing untenable life cycles that defy logical biological processes.

Species	Realm	Extracted	Retained	Source
Ascophyllum nodosum	Marine	1	1	3,4
Cystoseira zosteroides	Marine	4		5
Gracilaria gracilis	Marine	8	8	6
Laminaria digitata	Marine	1	1	7
Macrocystis pyrifera	Marine	1		8
Pterygophora californica	Marine	6		9
Alces alces	Terrestrial	15	8	10–12
Alouatta seniculus	Terrestrial	4		13
Amazona vittata	Terrestrial	1	1	14

Ambloplites rupestris	Aquatic	3		
Ammocrypta pellucida	Aquatic	1	1	15
Amphimedon compressa	Marine	2		16
Anser anser	Terrestrial	1		17
Anthropoides paradiseus	Terrestrial	11		18
Astroblepus ubidiai	Aquatic	6	4	19
Bostrychia hagedash	Terrestrial	1	1	20
Brachyteles hypoxanthus	Terrestrial	25	25	21,22
Buteo solitarius	Terrestrial	4	4	23
Calidris temminckii	Terrestrial	2		24
Callorhinus ursinus	Marine	1		25
Callospermophilus lateralis	Terrestrial	18	7	26
Calyptorhynchus lathami	Terrestrial	2		27
Canis lupus	Terrestrial	1	1	28
Capra ibex	Terrestrial	4		29
Cardisoma guanhumi	Terrestrial	3	3	
Cebus capucinus	Terrestrial	22	22	21,22
Cercopithecus mitis	Terrestrial	28	28	21
Certhia americana	Terrestrial	1		30
Cervus elaphus	Terrestrial	3		31–33
Chelodina expansa	Aquatic	2	2	34
Chelydra serpentina	Aquatic	1	1	35,36
Chen caerulescens	Terrestrial	6		37
Chrysemys picta	Aquatic	3	1	38–40
Cicindela ohlone	Terrestrial	14	5	41
Colias alexandra	Terrestrial	5		42
Connochaetes taurinus	Terrestrial	2		43
Cottus bairdi	Aquatic	3		
Crocodylus johnsoni	Aquatic	4	2	44
Crocodylus niloticus	Aquatic	2		45
Cryptophis nigrescens	Terrestrial	1	1	46
Dasypus novemcinctus	Terrestrial	3	3	47
Diadema antillarum	Marine	4		48
Dipodomys spectabilis	terrestrial	2	1	49
Eidolon helvum	Terrestrial	1		50
Elephas maximus	Terrestrial	1		51
Emydura macquarii	Aquatic	2	2	34
Epidalea calamita	Aquatic	1		52
Epinephelus morio	Marine	1		53
Etheostoma flabellare	Aquatic	3		
Eumetopias jubatus	Marine	1		54
Falco peregrinus	Terrestrial	13		55
Fulmarus glacialis	Terrestrial	1	1	56
Giraffa camelopardalis	Terrestrial	4	4	57,58
Gorilla beringei	Terrestrial	41	41	21,22
Haliaeetus albicilla	Terrestrial	2		59

Homo sapiens	Terrestrial	26		
Hoplocephalus bungaroides	Terrestrial	1	1	46
Hystrix refossa	Terrestrial	1		60
Kinosternon subrubrum	Aquatic	3	3	61
Kobus ellipsiprymnus defassa	Terrestrial	2		62
Lagopus muta	Terrestrial	1	1	63
Larus heermanni	Terrestrial	2		
Leptonychotes weddellii	Marine	21		64
Macaca mulatta	Terrestrial	12	12	65–67
Malaclemys terrapin	Aquatic	1	1	68
Marmota flaviventris	Terrestrial	2	2	69
Montastraea annularis	Marine	13		70–72
Nipponia nippon	Terrestrial	1		73
Nocomis leptocephalus	Aquatic	3		
Nuttallia obscurata	Marine	2	1	74
Odocoileus virginianus	Terrestrial	14	13	75
Oncorhynchus tshawytscha	Marine	5		76,77
Onychogalea fraenata	Terrestrial	1	1	78
Ovis aries	Terrestrial	6		79
Ovis canadensis	Terrestrial	22	6	80–82
Pan troglodytes schweinfurthii	Terrestrial	45	45	21
Panthera pardus	Terrestrial	1	1	83
Papio cynocephalus	Terrestrial	37	37	21
Paramuricea clavata	Marine	11	10	84,85
Phoca vitulina	Marine	1		86
Phoebastria immutabilis	Terrestrial	1	1	87
Phrynosoma cornutum	Terrestrial	2	2	88
Plexaura sp.	Marine	4		89
Pocillopora damicornis	Marine	1		90,91
Podocnemis expansa	Aquatic	1	1	92
Presbytis thomasi	Terrestrial	1		93
Propithecus edwardsi	Terrestrial	2	2	94
Propithecus verreauxi	Terrestrial	24	24	21,95
Rangifer tarandus platyrhynchus	Terrestrial	1		96
Rutilus rutilus	Aquatic	1	1	97
Saguinus fuscicollis	Terrestrial	4		98
Saguinus imperator	Terrestrial	3		98
Sceloporus grammicus	Terrestrial	8	8	99–101
Sceloporus mucronatus mucronatus	Terrestrial	1	1	102
Scolytus ventralis	Terrestrial	5	5	103
Spermophilus dauricus	Terrestrial	1	1	104
Sterna hirundo	Terrestrial	8		105
Sternotherus odoratus	Aquatic	2		40
Sternula antillarum browni	Terrestrial	1		
Strix occidentalis occidentalis	Terrestrial	12	11	106
Sus scrofa scrofa	Terrestrial	1		107

Tamias striatus	Terrestrial	11		108
Tamiasciurus hudsonicus	Terrestrial	1	1	109
Thalassarche melanophris	Terrestrial	1		110,111
Umbonium costatum	Marine	8	8	112
Urocitellus armatus	Terrestrial	1	1	113
Urocitellus beldingi	Terrestrial	1		114
Urocyon littoralis	Terrestrial	2	2	115
Ursus americanus	Terrestrial	4	4	116–118
Ursus arctos horribilis	Terrestrial	1		119
Ursus maritimus	Terrestrial	5	5	120
Vipera aspis	Terrestrial	1	1	121
Xenosaurus grandis	Terrestrial	4	4	122
Xenosaurus platyceps	Terrestrial	6	6	123
Xestospongia muta	Marine	5	2	124
Zalophus californianus	Marine	9	7	125
Zoarces viviparus	Marine	4	1	126
Zootoca vivipara	Terrestrial	1		127
Abies balsamea	Terrestrial	2		128
Abies concolor	Terrestrial	12	11	129
Abies homolepis	Terrestrial	1		130
Abies magnifica	Terrestrial	11	9	129
Abies sachalinensis	Terrestrial	3	2	131,132
Acacia aneura	Terrestrial	1		
Acacia victoriae	Terrestrial	1		133
Acer palmatum	Terrestrial	2	2	134
Acer pictum	Terrestrial	2	2	134
Acer rufinerve	Terrestrial	2	2	134
Acer saccharum	Terrestrial	6	6	135
Achnatherum calamagrostis	Terrestrial	3	3	136
Actaea cordifolia	Terrestrial	5	3	137
Actaea elata	Terrestrial	4	2	138,139
Actaea spicata	Terrestrial	12	12	140
Adenocarpus gibbsianus	Terrestrial	13	2	141
Aesculus turbinata	Terrestrial	3		142
Agave marmorata	Terrestrial	2		143
Agave potatorum	Terrestrial	2		144
Agave vivipara	Terrestrial	2		145
Agrimonia eupatoria	Terrestrial	10	6	146
Agropyron cristatum	Terrestrial	2		147
Ailanthus altissima	Terrestrial	1	1	148,149
Alliaria petiolata	Terrestrial	38		149–151
Allium monanthum	Terrestrial	2	1	152
Allium vineale	Terrestrial	2		149
Alnus rubra	Terrestrial	6	5	
Ambrosia deltoidea	Terrestrial	1	1	
Anarrhinum fruticosum	Terrestrial	5	3	141

Andira aubletii	Terrestrial	1	1	
Andropogon gerardii	Terrestrial	20	9	153
Androsace vitaliana	Terrestrial	2	2	
Anemone patens	Terrestrial	1	1	154
Anthericum liliago	Terrestrial	6		155
Anthericum ramosum	Terrestrial	11		155
Anthyllis vulneraria	Terrestrial	40	23	156,157
Antirrhinum lopesianum	Terrestrial	3	2	141
Antirrhinum subbaeticum	Terrestrial	2	2	141
Aquilaria crassna	Terrestrial	1	1	158
Aquilegia chrysantha	Terrestrial	1	1	159
Aquilegia sp.	Terrestrial	1		160
Araucaria cunninghamii	Terrestrial	4	4	161
Araucaria muelleri	Terrestrial	4	4	162
Arctophila fulva	Terrestrial	3		163
Arenaria grandiflora	Terrestrial	5	3	141
Arisaema serratum	Terrestrial	1	1	164
Arisaema triphyllum	Terrestrial	4		165
Armeria maritima	Terrestrial	1	1	166
Armeria merinoi	Terrestrial	10	4	141
Arnica angustifolia	Terrestrial	1		167
Artemisia genipi	Terrestrial	4	4	157
Asclepias meadii	Terrestrial	2	2	168
Aspasia principissa	Terrestrial	1	1	169
Asplenium adulterinum	Terrestrial	18		170
Asplenium cuneifolium	Terrestrial	12	12	170
Asplenium scolopendrium	Terrestrial	6	6	171
Aster amellus	Terrestrial	27		172
Aster pyrenaeus	Terrestrial	5		141
Astragalus alopecurus	Terrestrial	15	6	
Astragalus bibullatus	Terrestrial	4	4	173
Astragalus cremnophylax	Terrestrial	2		174
Astragalus michauxii	Terrestrial	1	1	175
Astragalus scaphoides	Terrestrial	115	101	176,177
Astragalus tremolsianus	Terrestrial	5	3	141
Astragalus tyghensis	Terrestrial	45	36	138
Astrocaryum mexicanum	Terrestrial	7	5	178
Astrophytum asterias	Terrestrial	8	7	179
Astrophytum capricorne	Terrestrial	3	3	180
Astrophytum ornatum	Terrestrial	3	3	181
Atriplex acanthocarpa	Terrestrial	3	2	182
Atriplex canescens	Terrestrial	3	3	182
Aurinia saxatilis subsp. Saxatilis	Terrestrial	6		
Avicennia germinans	Terrestrial	1	1	183
Balsamorhiza sagittata	Terrestrial	5		184
Banksia ericifolia	Terrestrial	1	1	185

Bertholletia excelsa	Terrestrial	2	2	186
Betula pubescens pumila	Terrestrial	3		187
Boechera fecunda	Terrestrial	14	13	188
Borassus aethiopum	Terrestrial	4	4	189
Bothriochloa insculpta	Terrestrial	4		190
Bouteloua rigidiseta	Terrestrial	3		191
Brassica insularis	Terrestrial	36	31	192
Brosimum alicastrum	Terrestrial	1		193
Bursera glabrifolia	Terrestrial	3	1	194
Calamagrostis canescens	Terrestrial	1		195
Calamus nambariensis	Terrestrial	1		196
Calamus rhabdocladus	Terrestrial	1		196
Calocedrus decurrens	Terrestrial	6	6	129
Calochortus albus	Terrestrial	2	2	197
Calochortus lyallii	Terrestrial	44	44	198
Calochortus obispoensis	Terrestrial	2	1	197
Calochortus pulchellus	Terrestrial	2	1	197
Calochortus tiburonensis	Terrestrial	2	2	197
Camellia japonica	Terrestrial	2	1	199
Carduus nutans	Terrestrial	5	4	151,200
Carex bigelowii	Terrestrial	1		201
Carex humilis	Terrestrial	8		202
Carlina vulgaris	Terrestrial	8	3	
Carnegiea gigantea	Terrestrial	1	1	203
Castanea dentata	Terrestrial	24	23	204
Catopsis compacta	Terrestrial	3	3	205
Catopsis sessiliflora	Terrestrial	2	1	206
Cecropia obtusifolia	Terrestrial	3	3	207
Cedrela odorata	Terrestrial	15		208
Centaurea horrida	Terrestrial	3	3	209
Centaurea jacea	Terrestrial	4		210
Cephalocereus senilis	Terrestrial	1		
Chamaecrista lineata	terrestrial	12	11	211
Chamaedorea radicalis	Terrestrial	8	7	212
Cheirolophus metlesicsii	Terrestrial	5	2	141
Cherleria obtusiloba	Terrestrial	1	1	213
Chlorocardium rodiei	Terrestrial	1	1	214
Cirsium acaule	Terrestrial	2	2	148,215
Cirsium dissectum	Terrestrial	13		216
Cirsium palustre	Terrestrial	3		217
Cirsium pannonicum	Terrestrial	1	1	215
Cirsium perplexans	Terrestrial	2	2	218
Cirsium pitcheri	Terrestrial	142	87	219,220
Cirsium vulgare	Terrestrial	3		221–223
Cleistesiopsis bifaria	Terrestrial	7		224
Cleistesiopsis divaricata	Terrestrial	5		224

Clidemia hirta	Terrestrial	6	4	225
Coccothrinax readii	Terrestrial	1	1	226
Coespeletia spicata	Terrestrial	1	1	227
Coespeletia timotensis	Terrestrial	1	1	227
Conradina glabra	Terrestrial	4	3	228
Coprinopsis cinerea	Terrestrial	2	2	141
Corallorhiza trifida	Terrestrial	5	4	141
Cornus florida	Terrestrial	1	1	
Cucurbita pepo	Terrestrial	3	3	229
Cynoglossum officinale	Terrestrial	1		230
Cypripedium calceolus	Terrestrial	30		231
Cypripedium fasciculatum	Terrestrial	24	23	
Cypripedium lentiginosum	Terrestrial	1		232
Cyrtandra dentata	Terrestrial	20	20	233
Cytisus scoparius	Terrestrial	20	18	234
Dactylorhiza lapponica	Terrestrial	4	2	235,236
Daemonorops poilanei	Terrestrial	1		196
Danthonia sericea	Terrestrial	10	8	237
Daphne rodriguezii	Terrestrial	41		238
Dendropanax trifidus	Terrestrial	1		199
Dicentra canadensis	Terrestrial	9		239
Dicerandra frutescens	Terrestrial	59	40	240
Dicorynia guianensis	Terrestrial	1	1	241
Dicymbe altsonii	Terrestrial	1	1	
Digitaria eriantha	Terrestrial	4		190
Dioon caputoi	Terrestrial	3	3	242
Dioon edule	Terrestrial	3		243
Dioon merolae	Terrestrial	8	3	244
Dioon sonorense	Terrestrial	1	1	245
Dioon spinulosum	Terrestrial	2	2	
Dioscorea chouardii	Terrestrial	1	1	246
Dipsacus fullonum	Terrestrial	2		247
Disporum sessile	Terrestrial	2	1	152
Disporum smilacinum	Terrestrial	2	1	152
Dracocephalum austriacum	Terrestrial	36	28	248
Duguetia neglecta	Terrestrial	1	1	
Echeveria longissima	Terrestrial	1		249
Echinacea angustifolia	Terrestrial	8	8	250,251
Echinocactus platyacanthus	Terrestrial	12	12	252
Echinospartum ibericum	Terrestrial	5	1	141
Encephalartos cycadifolius	Terrestrial	1	1	253
Encephalartos villosus	Terrestrial	1	1	253
Entandrophragma cylindricum	Terrestrial	1	1	254
Eperua falcata	Terrestrial	1	1	255
Epilobium latifolium	Terrestrial	2		256
Epipactis atrorubens	Terrestrial	11	3	257

Eremophila forrestii	Terrestrial	9	9	258
Eremophila maitlandii	Terrestrial	12	10	258
Eriogonum longifolium	Terrestrial	16	16	259
Eritrichium caucasicum	Terrestrial	4	2	260
Erodium paularense	Terrestrial	10	10	141
Erophila verna	Terrestrial	1		151
Erycina crista-galli	Terrestrial	2	2	
Eryngium alpinum	Terrestrial	9	8	261
Eryngium cuneifolium	Terrestrial	48	38	262
Eryngium maritimum	Terrestrial	2	2	263
Erythranthe cardinalis	Terrestrial	12	10	264
Erythranthe lewisii	Terrestrial	12	8	264
Erythronium japonicum	Terrestrial	2	2	152,265
Escobaria robbinsorum	Terrestrial	12	9	266
Escontria chiotilla	Terrestrial	2	2	
Eupatorium perfoliatum	Terrestrial	3		267
Eupatorium resinosum	Terrestrial	3		267
Euphorbia fontqueriana	Terrestrial	5	4	141
Euterpe edulis	Terrestrial	3	3	268
Euterpe precatoria	Terrestrial	4	4	269
Fagus crenata	Terrestrial	1		130
Fagus grandifolia	Terrestrial	3	3	270
Festuca eskia	Terrestrial	2		271
Frasera speciosa	Terrestrial	34		272
Fritillaria biflora	Terrestrial	2		273
Fuscospora fusca	terrestrial	6	6	274
Gardenia actinocarpa	Terrestrial	4	2	275
Gentiana pneumonanthe	Terrestrial	4	2	276
Gentianella campestris	Terrestrial	1		277
Geonoma deversa	Terrestrial	4		278
Geonoma macrostachys	Terrestrial	1	1	279
Geonoma pohliana	Terrestrial	2	2	280
Geonoma schottiana	Terrestrial	4	2	281
Geranium sylvaticum	Terrestrial	3	3	282
Geum reptans	Terrestrial	4		283
Geum rivale	Terrestrial	6	3	146
Goeppertia ovandensis	Terrestrial	16	3	284
Grias peruviana	Terrestrial	1	1	193
Guaiacum sanctum	Terrestrial	4	2	
Guarianthe aurantiaca	Terrestrial	3	3	285
Guettarda viburnoides	Terrestrial	3	3	286
Helenium virginicum	Terrestrial	1	1	287
Helianthemum juliae	Terrestrial	9	7	288
Helianthemum polygonoides	Terrestrial	5	5	141
Helianthemum teneriffae	Terrestrial	5	3	141
Helianthus divaricatus	Terrestrial	8		289

Heliconia acuminata	Terrestrial	9	9	290
Heteropogon contortus	Terrestrial	4	3	190
Heteropsis flexuosa	Terrestrial	2		291
Heteropsis macrophylla	Terrestrial	2		291
Heteropsis oblongifolia	Terrestrial	2		291
Hilaria mutica	Terrestrial	4	4	292
Himantoglossum hircinum	Terrestrial	1	1	293
Himatanthus drasticus	Terrestrial	8	8	294
Horkelia congesta	Terrestrial	6		
Hudsonia montana	Terrestrial	1		295
Hydrastis canadensis	Terrestrial	29		296,297
Hylocomium splendens	Terrestrial	12		298,299
Hypericum cumulicola	Terrestrial	66	35	300
Hypochaeris radicata	Terrestrial	2		301
Iriartea deltoidea	Terrestrial	5	5	302
Isatis tinctoria	Terrestrial	1		303
Jacobaea vulgaris	Terrestrial	3		304
Jacquiniella leucomelana	Terrestrial	3		305
Jacquiniella teretifolia	Terrestrial	3		305
Juniperus procera	Terrestrial	1	1	306
Jurinea fontqueri	Terrestrial	5	3	141
Khaya senegalensis	Terrestrial	12	11	307
Knautia arvensis	Terrestrial	1		308
Kosteletzkya pentacarpos	Terrestrial	8	7	309
Lantana camara	Terrestrial	10		310
Laserpitium longiradium	Terrestrial	5	3	141
Lathyrus vernus	Terrestrial	32	17	311
Lechea cernua	Terrestrial	8	8	312
Lechea deckertii	Terrestrial	8	7	312
Leontodon saxatilis	Terrestrial	4	4	
Lepidium davisii	Terrestrial	22	4	
Leptocoryphium lanatum	Terrestrial	1		313
Lespedeza juncea sericea	Terrestrial	3		151,314
Lespedeza virginica	Terrestrial	1		315
Liatris scariosa	Terrestrial	15	7	316
Ligularia sibirica	Terrestrial	33	6	317
Limonium carolinianum	Terrestrial	1	1	318
Limonium erectum	Terrestrial	5	5	141
Limonium malacitanum	Terrestrial	5	2	141
Linum catharticum	Terrestrial	1		319
Lomatium bradshawii	Terrestrial	9	9	138
Lomatium cookii	Terrestrial	10	9	138
Lonicera maackii	Terrestrial	2	2	149
Lophophora diffusa	Terrestrial	2	2	
Lotus arinagensis	Terrestrial	6		141
Lupinus tidestromii	Terrestrial	9	9	320

Lycaste aromatica	Terrestrial	3		305
Machaerium cuspidatum	Terrestrial	3		321
Magnolia macrophylla	Terrestrial	3	3	322
Mammillaria crucigera	Terrestrial	2	2	323
Mammillaria dixanthocentron	Terrestrial	1	1	
Mammillaria gaumeri	Terrestrial	24		
Mammillaria hernandezii	Terrestrial	6	5	
Mammillaria huitzilopochtli	Terrestrial	5	5	324
Mammillaria magnimamma	Terrestrial	4	4	325
Mammillaria napina	Terrestrial	3	2	
Mammillaria pectinifera	Terrestrial	1	1	326
Mammillaria solisioides	Terrestrial	3	3	
Mammillaria supertexta	Terrestrial	1	1	
Manilkara zapota	Terrestrial	2	2	327
Mauritia flexuosa	Terrestrial	1	1	328
Melaleuca viridiflora	Terrestrial	3		329
Melocactus bahiensis	Terrestrial	2	2	330
Melocactus ernestii	Terrestrial	4	4	
Miconia albicans	Terrestrial	1	1	331
Miconia prasina	Terrestrial	8		332
Microberlinia bisulcata	Terrestrial	1	1	333
Mimulus guttatus	Terrestrial	22		334,335
Molinia caerulea	Terrestrial	12	6	336
Myrsine guianensis	Terrestrial	1		331
Nardostachys jatamansi	Terrestrial	1	1	337
Neobuxbaumia macrocephala	Terrestrial	7	7	338,339
Neobuxbaumia mezcalaensis	Terrestrial	6	6	338
Neobuxbaumia polylopha	Terrestrial	2	2	340
Neobuxbaumia tetetzo	Terrestrial	6	6	338,339,341
Neotinea ustulata	Terrestrial	5	5	342
Oenothera deltoides	Terrestrial	16	16	343
Olearia flocktoniae	Terrestrial	8		344
Oncidium poikilostalix	Terrestrial	2	2	345,346
Opuntia macrocentra	Terrestrial	2		347
Opuntia macrorhiza	Terrestrial	27	6	348
Opuntia microdasys	Terrestrial	4		
Opuntia rastrera	Terrestrial	14	9	349
Orchis purpurea	Terrestrial	36	28	350
Oreocarya flava	Terrestrial	3	3	351
Oxalis acetosella	Terrestrial	6		352
Oxandra asbeckii	Terrestrial	1	1	255
Oxytropis jabalambrensis	Terrestrial	4	2	141
Pachycereus pecten-aboriginum	Terrestrial	3	3	353
Paeonia officinalis	Terrestrial	15		354
Paliurus ramosissimus	Terrestrial	2		355
Panax quinquefolius	Terrestrial	2	1	

Parkinsonia aculeata	Terrestrial	1	1	356
Parolinia glabriuscula	Terrestrial	5	4	141
Paronychia pulvinata	Terrestrial	1	1	213
Pediomelum esculentum	Terrestrial	8	6	
Pentaclethra macroloba	Terrestrial	1	1	
Periandra mediterranea	Terrestrial	1	1	357
Persoonia bargoensis	Terrestrial	4	3	
Persoonia glaucescens	Terrestrial	3	3	
Petrophile pulchella	Terrestrial	1	1	185
Phyllanthus emblica	Terrestrial	8	6	316,358
Phyllanthus indofischeri	Terrestrial	3	3	358
Picea glehnii	Terrestrial	1		132
Picea jezoensis	Terrestrial	1		132
Pilosella floribunda	Terrestrial	1		359
Pinguicula alpina	Terrestrial	1	1	360
Pinguicula villosa	Terrestrial	1	1	360
Pinguicula vulgaris	Terrestrial	1		360
Pinus jeffreyi	Terrestrial	1		129
Pinus lambertiana	Terrestrial	6	6	129
Pinus maximartinezii	Terrestrial	1	1	361
Pinus nigra	Terrestrial	3	1	362
Pinus ponderosa	Terrestrial	1	1	129
Pinus strobus	Terrestrial	9	9	363
Pityopsis aspera	Terrestrial	2	1	364
Plantago coronopus	Terrestrial	35	29	365
Plantago lanceolata	Terrestrial	3		
Platanthera hookeri	Terrestrial	4		366
Poa alpina	Terrestrial	6		157
Polemonium van-bruntiae	Terrestrial	9		367
Polygonum basiramium	Terrestrial	8	2	312
Potentilla anserina	Terrestrial	3		368
Potentilla recta	Terrestrial	1		369
Primula elatior	Terrestrial	21	13	370
Primula farinosa	Terrestrial	16	7	371
Primula veris	Terrestrial	4	1	372,373
Primula vulgaris	Terrestrial	44	37	374
Prioria copaifera	Terrestrial	2	2	375
Prosartes lanuginosa	Terrestrial	4	4	376
Prosopis glandulosa	Terrestrial	4	4	377
Prosopis laevigata	Terrestrial	2	2	378
Prunus africana	Terrestrial	2	2	379
Prunus serotina	Terrestrial	3	2	380
Pseudomitrocereus fulviceps	Terrestrial	1	1	326
Pseudophoenix sargentii	Terrestrial	7	7	381
Pterocarpus angolensis	Terrestrial	1	1	
Pterocereus gaumeri	Terrestrial	4	4	382

Ptychosperma macarthurii	Terrestrial	1	1	383
Purshia subintegra	Terrestrial	14	8	384
Pyrrocoma radiata	Terrestrial	85	65	138
Quercus mongolica	Terrestrial	1	1	131
Quercus rugosa	Terrestrial	1	1	
Ramonda myconi	Terrestrial	15	13	385
Ranunculus acris	Terrestrial	2		386
Ranunculus peltatus	Terrestrial	5	3	
Rhizophora mangle	Terrestrial	1	1	183
Rhododendron maximum	Terrestrial	3	1	387
Rhododendron ponticum	Terrestrial	20	4	388
Rhopalostylis sapida	Terrestrial	2	2	389
Rhus aromatica	Terrestrial	8		289
Rhus copallinum	Terrestrial	3		390
Rosa multiflora	Terrestrial	1		149
Rosmarinus tomentosus	Terrestrial	12		141
Roupala montana	Terrestrial	1		331
Rourea induta	Terrestrial	2		331
Rubus praecox	Terrestrial	3		391
Rubus saxatilis	Terrestrial	6		392
Rubus ursinus	Terrestrial	3		391
Rumex rupestris	Terrestrial	5	4	141
Ruppia maritima	Terrestrial	3		393
Sabal minor	Terrestrial	3	2	
Salix arctica	Terrestrial	7		394
Santolina melidensis	Terrestrial	5	3	141
Saponaria bellidifolia	Terrestrial	14	5	395
Sarcocapnos baetica	Terrestrial	2	1	396
Sarcocapnos pulcherrima	Terrestrial	4	2	396
Sarracenia purpurea	Terrestrial	3	3	397,398
Saussurea medusa	Terrestrial	4		399
Saxifraga aizoides	Terrestrial	4	3	157
Saxifraga cotyledon	Terrestrial	8		400
Scaphium macropodum	Terrestrial	6	6	401
Scorzonera hispanica	Terrestrial	1	1	402
Serapias cordigera	Terrestrial	39	24	403
Shorea leprosula	Terrestrial	3	3	404
Silene acaulis	Terrestrial	25	13	405
Silene ciliata	Terrestrial	7	5	406
Silene douglasii	Terrestrial	3	3	407
Silene spaldingii	Terrestrial	12		408
Solidago fistulosa	Terrestrial	3	1	
Sonchus pustulatus	Terrestrial	1	1	409
Spartina alterniflora	Terrestrial	1		410
Spathoglottis plicata	Terrestrial	3	3	411
Stenocereus eruca	Terrestrial	15	3	

Stryphnodendron microstachyum	Terrestrial	1	1	
Succisa pratensis	Terrestrial	12	9	412,413
Swallenia alexandrae	Terrestrial	1	1	414
Swietenia macrophylla	Terrestrial	1	1	415
Syngonanthus nitens	Terrestrial	15		416
Syzygium jambos	Terrestrial	1	1	417
Taraxacum campylodes	Terrestrial	1		149
Taraxacum erythrospermum	Terrestrial	2		149
Tetraberlinia bifoliolata	Terrestrial	1	1	333
Tetraneuris herbacea	Terrestrial	3		418
Thrinax radiata	Terrestrial	3	3	226
Thymus vulgaris	Terrestrial	4	1	141
Tillandsia brachycaulos	Terrestrial	3		419
Tillandsia deppeana	Terrestrial	2	2	305
Tillandsia juncea	Terrestrial	2	1	305
Tillandsia macdougallii	Terrestrial	5	5	420
Tillandsia multicaulis	Terrestrial	2	2	305,421
Tillandsia punctulata	Terrestrial	2	2	305,421
Tillandsia violacea	Terrestrial	3	3	420
Tolumnia variegata	Terrestrial	1		422
Tragopogon pratensis	Terrestrial	1		423
Triadica sebifera	terrestrial	12	12	
Trillium camschatcense	Terrestrial	1	1	424
Trillium grandiflorum	Terrestrial	46	41	425
Trillium ovatum	Terrestrial	23	2	
Trillium persistens	Terrestrial	12	12	
Trollius laxus	Terrestrial	11	10	426
Tsuga canadensis	Terrestrial	4	4	427
Vella pseudocytisus	Terrestrial	29	24	141
Verbascum fontqueri	Terrestrial	6	4	141
Verbascum thapsus	Terrestrial	1		151
Verticordia staminosa	Terrestrial	4		428
Vincetoxicum rossicum	Terrestrial	20		429
Viola elatior	Terrestrial	2	2	430
Viola pumila	Terrestrial	2	2	430
Viola sagittata	Terrestrial	1	1	431
Vriesea sanguinolenta	Terrestrial	4	4	432
Vulpicida pinastri	Terrestrial	6	6	433
Zamia amblyphyllidia	Terrestrial	2		434
Zamia inermis	Terrestrial	1	1	435
Zea diploperennis	Terrestrial	4	3	436
	Total	**3890**	**2242**	

S2. Data cleaning

Table S2. The relative effect of data cleaning on our demographic and environmental variables. Descriptive summary showing the number of outlying values omitted, the transformation format used to achieve normality, and the total number of populations missing estimates for each our demographic and environmental variables. Total number of populations is 2242 across all variables.

Variable	**Omissions**	**Transformation**	**Missing***
DAMPING RATIO (ρ)	29	$1/y^{1.1}$	29
Survival	112	*NA*	112
Progression	112	*NA*	112
Retrogression	114	*NA*	114
Reproduction	112	*NA*	112
PERIOD OF OSCILLATION (ψ)	33	$1/y^{0.4}$	799
Survival	71	*NA*	837
Progression	71	*NA*	837
Retrogression	71	*NA*	837
Reproduction	68	*NA*	834
REACTIVITY ($\bar{\rho}$)	55	$1/y^{0.6}$	55
Survival	112	$log(\lvert y_{max}\rvert - y)$	113
Progression	60	$log(\lvert y_{max}\rvert - y)$	60
Retrogression	69	$log(y + \lvert y_{min}\rvert)$	69
Reproduction	81	$log(\lvert y_{max}\rvert - y)$	81
ATTENUATION ($\underline{\rho}$)	0	$y^{0.7}$	0
Survival	44	*NA*	45
Progression	60	$log(\lvert y_{max}\rvert - y)$	60
Retrogression	41	*NA*	41
Reproduction	54	$log(\lvert y_{max}\rvert - y)$	54

MAXIMAL AMPLIFICATION ($\overline{\rho}_{max}$)	55	$1/y^{0.5}$	55
Survival	112	*NA*	113
Progression	68	$log(\lvert y_{max}\rvert - y)$	68
Retrogression	112	*NA*	112
Reproduction	103	$log(\lvert y_{max}\rvert - y)$	103
MAXIMAL ATTENUATION ($\underline{\rho}_{max}$)	0	$y^{0.4}$	0
Survival	62	*NA*	63
Progression	87	$log(\lvert y_{max}\rvert - y)$	87
Retrogression	63	$log(y + \lvert y_{min}\rvert)$	63
Reproduction	89	*NA*	89
FREQUENCY SPECTRUM (Temperature, β_T)	7	*NA*	70
AUTOCORRELATION (Temperature, a_T)	37	*NA*	100
THERMAL RANGE (m)	1	*NA*	307
FREQUENCY SPECTRUM (Precipitation, β_P)	0	*NA*	63
AUTOCORRELATION (Precipitation, a_P)	0	*NA*	84

**includes omitted values*

S3. Constructing population-level phylogenetic trees

A phylogenetic tree was constructed to ensure all our analyses accounted for covariance between closely related species. The scientific names of all unique species within our subset of Matrix Population Models (MPMs) extracted from the COMPADRE[1] and COMADRE databases[2], were cross-checked and taxonomically updated using the R package '*taxize*'[437,438]. We used the R package '*rotl*'[439], to extract phylogenetic data for each species from the Open tree of Life (OTL)[440]. With this phylogenetic data, we constructed separate subtrees for brown/red algae, plants, and animal entities at the species level. We fused the three subtrees using the *bind.tree* tool from the '*phytools'* package[441]. Whilst binding our subtrees, we combined the algae and plant subtrees first before then adding the animal subtree with marine sponges (*Demospongiae*) set as the outgroup.

We refined the structure of our species-level phylogenetic tree, specifically ensuring the tree was rooted and free of polytomies using the *is.rooted* and *multi2di* tools from the '*ape*' package[442]. Branch lengths were calculated using the Grafen method[443] assuming a Brownian motion mode of trait evolution, whereby the variance between species' characteristics is directly proportional to time since divergence[444]. The phylogenetic tree was then time-calibrated using the *chronos* function and checked to confirm ultrametricity, with any duplicated node labels renamed. Lastly, to accommodate intra-specific spatial variation in vital rates, we expanded this phylogenetic tree to include population-level information for the 257 species where data was available for more than one population (Fig. S1). For these repeated species, a number of artificial branches equal to the number of replicates, were bound to the corresponding species' tip of the original phylogenetic tree. This process was carried out using the *bind.tip* function, with each of these artificial branches assigned an equal length of infinitesimally small value (*i.e*., 0.0000001). The branch lengths for our taxonomic tree were then used in all further analyses to ensure our findings accounted for ancestral relationships[445].

Figure S1. Population-level phylogenetic tree displaying the relatedness of the 61 [37] animals, 305 [219] plants, and 3 [1] red/brown algae species used in this comparative assessment. All our analyses have accounted for the phylogenetic signal between species. However, we have also allowed for the existence of multiple population entries for a number of species (shown above in square brackets), whilst assuming no within species trait variation.

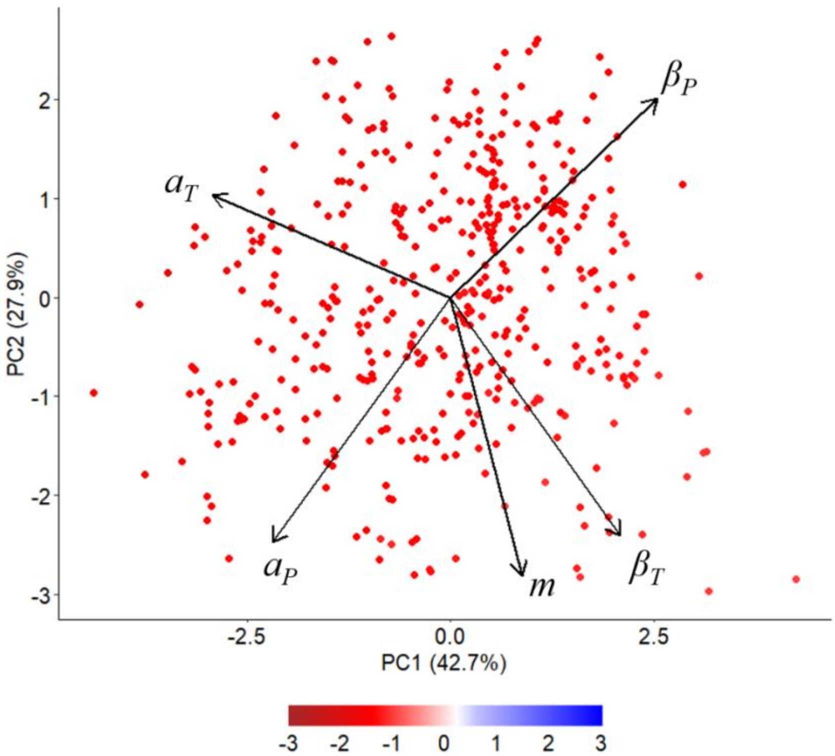
S4. Quantifying exposure to environmental stochasticity

We quantified abiotic stochasticity to which each population has been exposed to examine the role of environmental stochasticity in shaping the resilience characteristics of *resistance*, *compensation*, and *recovery* across our 369 species. Using the GPS location information supplied with each extracted MPM from the COMPADRE[1] & COMADRE[2] databases, we linked each natural population to their corresponding abiotic environments.

To determine environmental stochasticity, we focused on maximum, and minimum monthly temperature (°C), and mean monthly precipitation records (kg m^{-2}). These abiotic variables were selected as they are universally important across all ecoregions, except for in marine environments that are not directly affected by precipitation. Accordingly, we excluded MPMs associated with marine populations for this portion of our analysis (29 populations from 6 animal species, and 10 populations from 3 algal species). For our remaining 2184 terrestrial and 19 freshwater populations, we sourced high resolution (1 km^2) monthly temperature and precipitation records from the CHELSA climate database[446]. For each population, we extracted maximum, and minimum temperature readings, and mean precipitation records for a timeframe equal to the period during which the population was surveyed plus an additional 50 years prior to survey onset, to account for the effects of environmental legacy[447]. Within our sample there was a total of 2 freshwater and 277 terrestrial populations for which no environmental data could be sourced. Subsequently, these 279 populations (12.7%) were excluded from our analyses into the role of environmental variance in shaping resilience attributes.

We used five metrics to quantify the extent of environmental variance imposed on each population: thermal autocorrelation (a_T), thermal range (m), thermal frequency spectrum (β_T), precipitation autocorrelation (a_P), and precipitation frequency spectrum (β_P). Extracted abiotic variables were arranged into time series depicting the 50+ year abiotic regimes to which each population was exposed. We then estimated the temporal autocorrelation of each temperature (a_T) and precipitation (a_P) time series, using the '*colorednoise*' package[448]. Next, we calculated the frequency spectrum of each time series. This metric is often referred to as the colour of environmental variation, and represented by a red to blue colour scale, with blue describing higher frequency variation and red variation dominated by low frequencies[449]. The frequency spectrum of a time series is expressed by its spectral exponent (β), which is calculated as the negative slope coefficient of the linear regression between the log spectral density and log frequency of the time series[450]. The spectral exponent of the temperature (β_T) and precipitation (β_P) regimes to which each population was exposed were calculated using the *spectrum* command from the '*stats*' package[451]. Finally, thermal range (m) was estimated as the mean difference between maximum and minimum monthly temperatures throughout a time series, providing a measure of the magnitude of any abiotic variation. Finally, prior to further analyses, outliers outside of the 95% confidence intervals were discarded for each of the aforementioned metrics of environmental stochasticity (Table S2), and each variable was checked for normality.

A Principal Components analysis (PCA) was used to explore the interrelationships between our five abiotic variables (Fig. S2), whilst we also evaluated their collinearity using variance-inflation factors (VIF). VIF reflects the degree to which, in a regression model, estimates of coefficients for any given variable are inflated by collinearity, with values of between 1 and 10 representing low collinearity[452,453]. VIF values were estimated using the *multicol* function from the '*fuzzySim*' package[454]. In our PCA the majority of the variation across our abiotic variables could be explained using the just the first two principal components (Proportional variance: PC1 0.43; PC2 0.28; PC3 0.16, PC4 0.08, PC5 0.05; Fig. S2). Here the first two principal components describe a gradient between the autocorrelation (a_T & a_P) and frequency spectrum (β_T & β_P) characteristics of abiotic environments (Table S3), reflecting a transition from red coloured environments characterised by positive autocorrelation (future abiotic conditions are conditional and similar to current conditions) and low frequency oscillations (seasonality), towards blue coloured environments with higher frequency oscillations, and negative temporal autocorrelation (i.e. future conditions contrast with current conditions). This trend corresponds with conditions expected of natural environments, as terrestrial environments are typically characterised by red coloured variation with marine environments considered even less variable[450,455]; hence the lack of blue coloured environments within our PCA (Fig. S2). However, with VIF confirming there was no collinearity among our five abiotic variables (VIF: β_T = 1.85; a_T = 2.12; m = 1.17; β_P = 1.83; a_P = 1.93), all variables



were retained in further analyses.

Figure S2. Variation in the exposure of populations to environmental stochasticity corresponded with gradients in the autocorrelation and frequency spectrum characteristics of local abiotic regimes. Principal component analysis (PCA) of the five metrics used to quantify exposure to environmental stochasticity: thermal autocorrelation (a_T), thermal range (m), thermal frequency spectrum (β_T), precipitation autocorrelation (a_P), and precipitation frequency spectrum (β_P) illustrating the degree of collinearity between the different variables. Colour scale depicts the gradient of environmental noise corresponding with transitions from red coloured environments characterised by positive autocorrelation and low frequency oscillations, towards blue coloured environments with higher frequency oscillations, and negative temporal autocorrelation. The colour of each environment was defined based on its associated thermal frequency exponent (β_T) to demonstrate how abiotic variance regimes align with our five selected metrics.

Table S3. Patterns within temperature and precipitation regimes characterised the relative exposure of populations to environmental stochasticity. Principal component loadings of the five measures of environmental stochasticity, thermal autocorrelation (a_T), thermal range (m), thermal frequency spectrum (β_T), precipitation autocorrelation (a_P), and precipitation frequency spectrum (β_P) showing the relative influence of each abiotic variable across each principal component.

Abiotic variable	PC1	PC2	PC3	PC4	PC5
Frequency spectrum (Temperature, β_{temp})	0.418	-0.482	0.513	-0.158	-0.551
Temporal autocorrelation (Temperature, a_{temp})	-0.586	0.207	-0.065	-0.583	-0.519
Thermal range (m)	0.176	-0.563	-0.744	-0.315	0.024
Frequency spectrum (Precipitation, β_{prec})	0.509	0.403	0.112	-0.675	0.332
Temporal autocorrelation (Precipitation, a_{prec})	-0.438	-0.495	0.408	-0.282	0.562

S5. Phylogenetically imputed Partial Least Squares Regression analyses

We initially carried out all pPLS analyses using only complete entries, omitting all populations missing estimates for any one variable, scaling and mean centring all predictor and response variables in each case. Across our dataset, no variable was missing from more than 6% of populations, except for the five variables describing the period of oscillation and its vital rate sensitivities, which were missing in 35-38% of populations (Table S2). To maximise our sample size (*n*) across each regression analysis, we omitted populations with incomplete entries separately across subsets of our data relating to each transient metric (n_{ρ} = 1969; n_{ψ} = 1263; $n_{\bar{\rho}}$ = 2055; $n_{\bar{\rho}max}$ = 2017; $n_{\underline{\rho}}$ = 2044; $n_{\underline{\rho}max}$ = 1988). However, we also repeated each analysis, with missing entries across the demographic variables estimated using phylogenetic imputation. To impute missing values, we first calculated the phylogenetic signal (Pagel's λ[456]) of each transient and sensitivity variable using the *phylosig* function from the '*phytools*' package[441]. Pagel's λ exists on the scale $0 < \lambda > 1$, with 0 indicating traits have evolved independently of phylogeny, and 1 representing a high phylogenetic signal. Next, for all variables exhibiting a strong phylogenetic signal (Pagel's $\lambda \geq 0.65$) that differed significantly from 0 ($p < 0.05$), missing entries were imputed assuming a Brownian motion evolutionary model using the *phylopars* function of the '*Rphylopars*' package[457].

Here we present the outputs of our regression analyses involving this imputed data as further evidence for any emerging patterns in the relationships between the transient dynamics of populations, their exposure to gradients in environmental stochasticity (Fig. S3), and their vital-rate sensitivities (Fig. S4). Our analysis using this imputed data displays congruent patterns to those reported using only complete entries. Indeed, our observations of limited association between gradients in environmental stochasticity and patterns in the transient dynamics of populations are maintained within the imputed data (Fig. S3; $r^2 < 0.006$), whereas

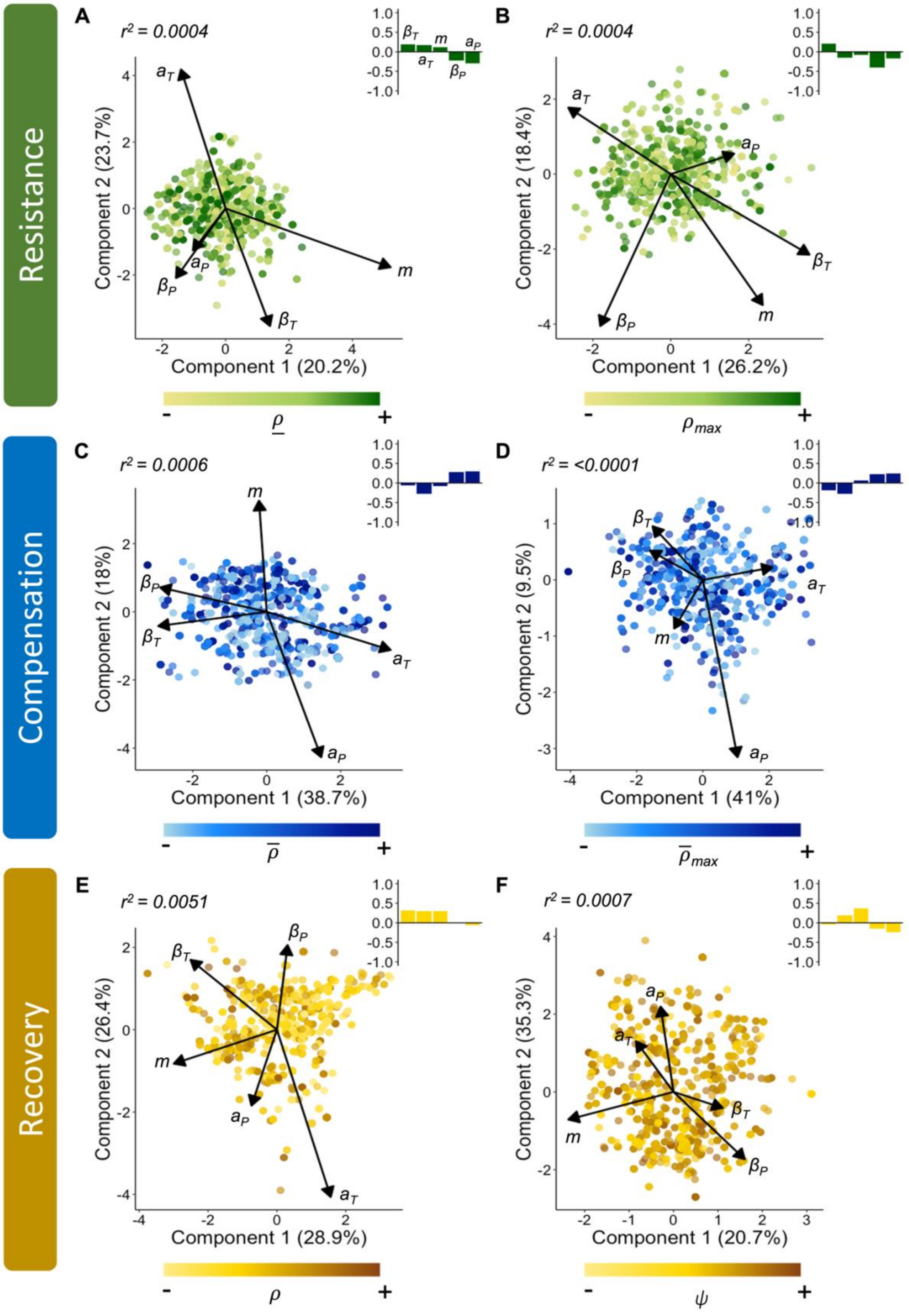

Resistance
Compensation
Recovery
A
r² = 0.0004
Component 2 (23.7%)
Component 1 (20.2%)
B
r² = 0.0004
Component 2 (18.4%)
Component 1 (26.2%)
C
r² = 0.0006
Component 2 (18%)
Component 1 (38.7%)
D
r² = <0.0001
Component 2 (9.5%)
Component 1 (41%)
E
r² = 0.0051
Component 2 (26.4%)
Component 1 (28.9%)
F
r² = 0.0007
Component 2 (35.3%)
Component 1 (20.7%)

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Figure S3. The limited association between patterns across the demographic resilience attributes of resistance (green), compensation (blue), and recovery (orange) and the relative exposure of populations to environmental stochasticity is insensitive to phylogenetic imputation. Scores and loadings from a phylogenetically-weighted Partial Least Squares regression analysis exploring the correlation between patterns in the variation of the six transient metrics of **(A)** first-step attenuation ($\underline{\rho}$), **(B)** maximal attenuation ($\underline{\rho}_{max}$), **(C)** reactivity ($\overline{\rho}$), **(D)** maximal amplification ($\overline{\rho}_{max}$), **(E)** damping ratio (ρ), and **(F)** period of oscillation (ψ), and our five measures of environmental stochasticity, temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range/magnitude (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P) using a dataset with missing entries estimated through phylogenetic imputation. Colour gradation reflects the relative magnitude of each transient metric estimated for each population, with darker shades indicating higher estimates. Insert barplots are the standardised regression coefficients (b) highlighting the relative weighting of each abiotic variable in the overall capacity of each model to explain variation within each transient metric (r^2).

the predictive capacity of our imputed vital rate sensitivity variables remains almost identical to those originally reported (r^2; Fig S4). We note here that whilst each transient metric relating to the resilience attributes of resistance and compensation, and their vital rate sensitivities all displayed a strong phylogenetic signal (Pagel's λ > 0.94, p <0.001; *see results*), this was not the case for our measures of demographic recovery. Both the transient metrics of damping ratio and period of oscillation displayed strong phylogenetic signal (Pagel's λ: ρ = 0.996; ψ = 0.992; p <0.001 in both cases), but their vital rate sensitivities did not (*see results*). Subsequently, we were only able to examine patterns in the demographic selection pressures of recovery using complete entries.

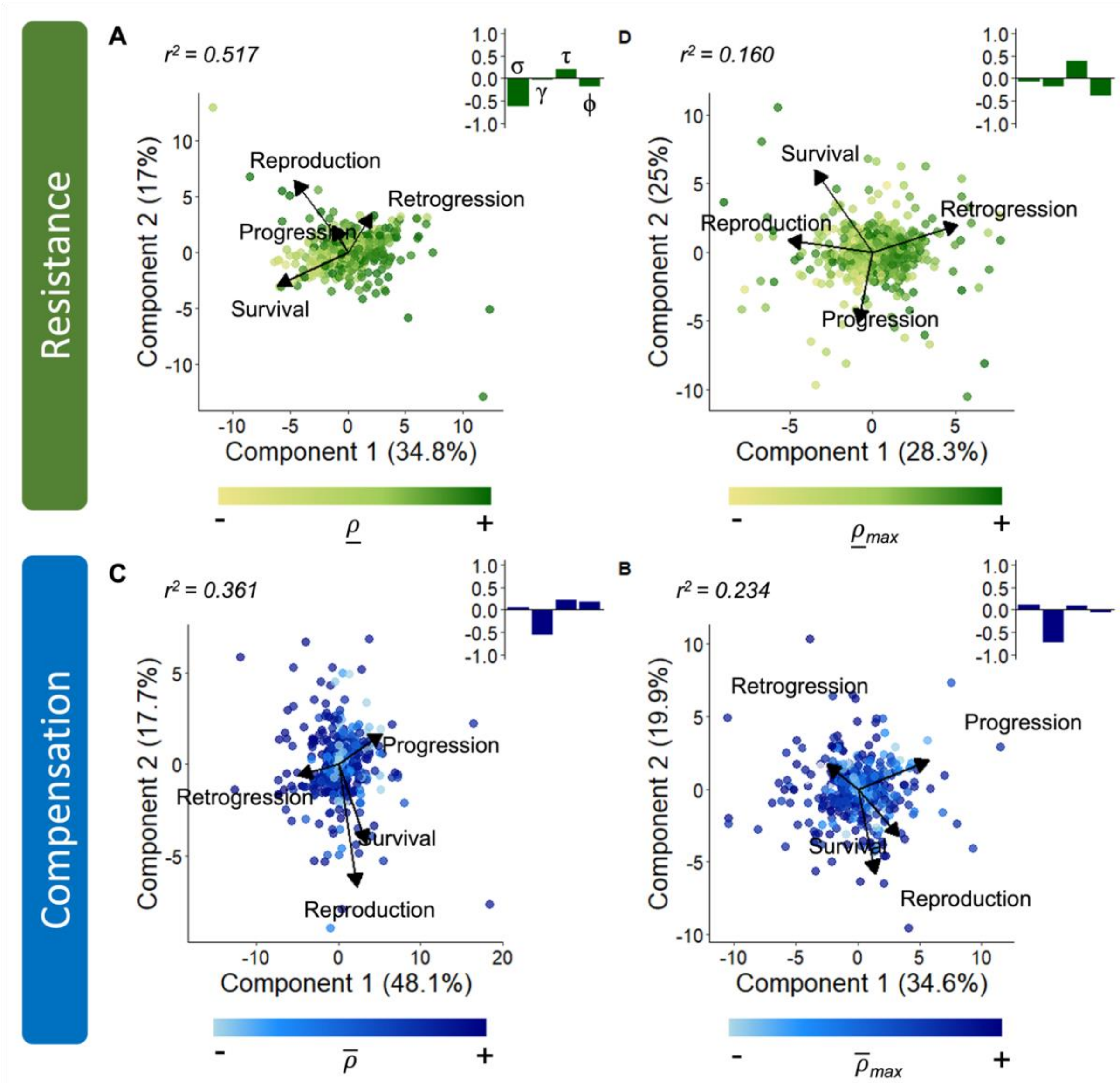


Figure S4. Patterns within the vital rate sensitivities of the resilience attributes of resistance (green) and compensation (blue) are insensitive to phylogenetic imputation. Scores and loadings from Partial Least Squares regression analysis of the sensitivity patterns of the four metrics of transient dynamics **(A)** first-step attenuation ($\underline{\rho}$), **(B)** maximal attenuation ($\underline{\rho}_{max}$), **(C)** reactivity ($\overline{\rho}$), and **(D)** maximal amplification ($\overline{\rho}_{max}$) with regards to the vital rates of survival (σ), progression (γ), retrogression (τ), and reproduction (ϕ) using a dataset with missing demographic entries phylogenetically imputed. Note that the transient metrics of damping ratio and period of oscillation have been excluded from this analysis due to a limited phylogenetic signal within the vital rate sensitivity variables of these two metrics. Colour gradation represents the magnitude of each transient metric recorded across each population, with darker shades indicating higher estimates. Insert barplots are the standardised regression coefficients (*b*) highlighting the relative weighting of each vital rate in the overall capacity of each model to explain variation within each transient metric (r^2).

S6. Accounting for population longevity

We quantified the exposure of each population, within our sample, to environmental stochasticity using local temperature and precipitation records collected during the 50 years prior to the collection of any demographic data. However, the significance of any abiotic patterns experienced by each population during this 50-year window is likely contingent on their longevity. Across a 50-year period long-lived species, with generations spanning multiple decades, will experience fewer generations than shorter-lived species thereby diminishing the observable impact of any selection pressures on their trait characteristics[458]. Thus, it was necessary we ensured that our capacity for exploring the selection pressures exerted by environmental stochasticity on the resilience attributes of natural populations was not inhibited by the inclusion of long-lived species.

To evaluate the influence of population longevity on our observations we repeated our phylogenetically weighted Partial Least Squares analyses evaluating the relationship between environmental stochasticity and the transient dynamics of populations using only short-lived species (Fig. S5). Each population was categorised as long- or short-lived according to its mean life expectancy (η_e), which we estimated from its associated MPM using the R package '*IPMpack*'[459]. We then repeated our pPLS analyses using only populations for which $\eta_e \leq 10$ years (n = 1606 populations). This threshold was selected to maximise the number of generations experienced by populations during our 50-year abiotic time series, whilst maintaining a suitable sample size for our analyses. Overall, whilst omitting longer-lived species did improve the predictive capacity our abiotic variables by an order of magnitude, the association between gradients in environmental variation and the resilience attributes of populations still remained negligible ($r^2 < 0.001$; Fig. S5). Indeed, the absolute magnitude of the Pearson's coefficients ($|r|$) obtained when exploring the correlation between our measures of environmental stochasticity and transient dynamics all reflected a limited correlation between our abiotic and demographic variables ($|r| < 0.03$; Table S4).

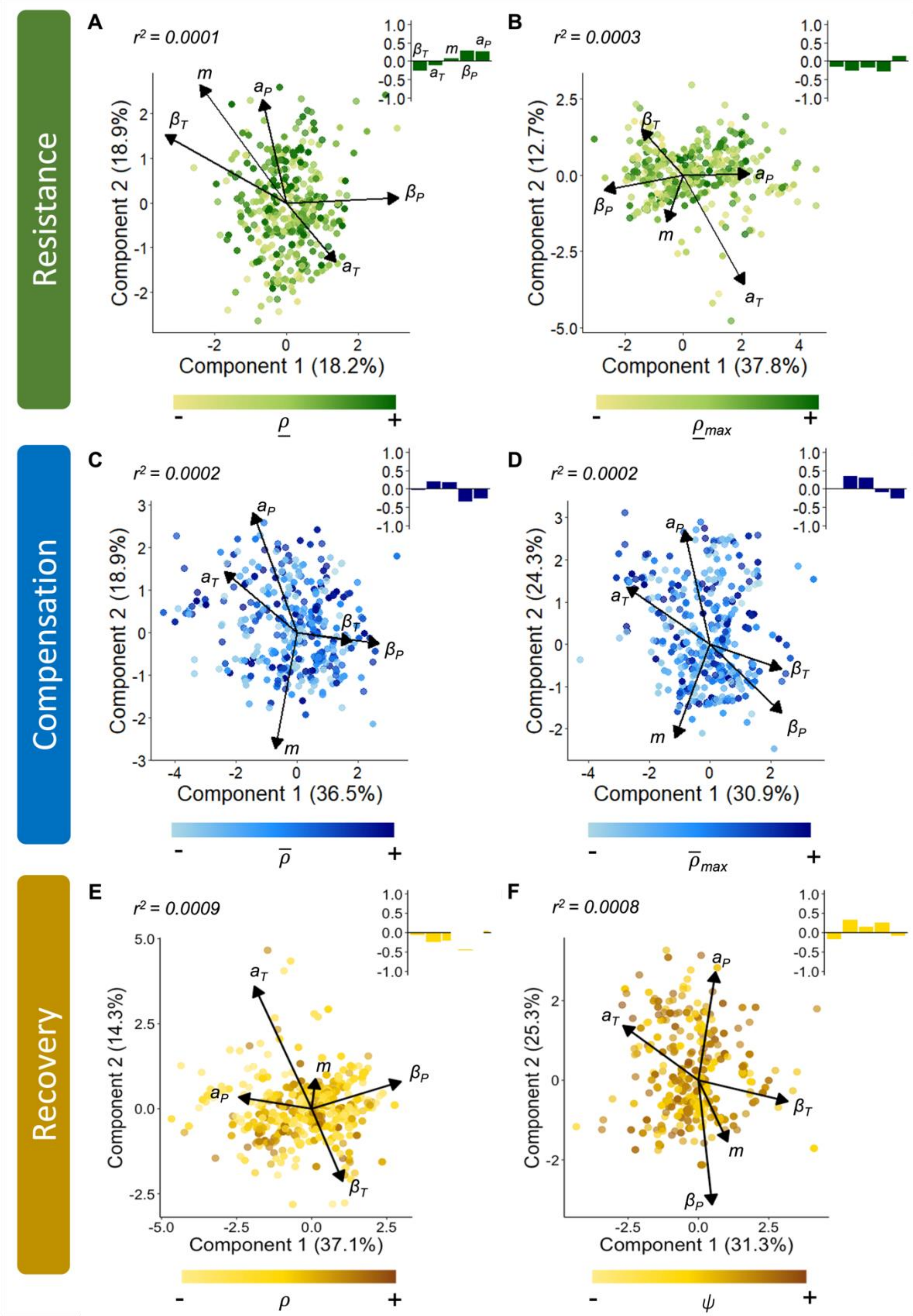


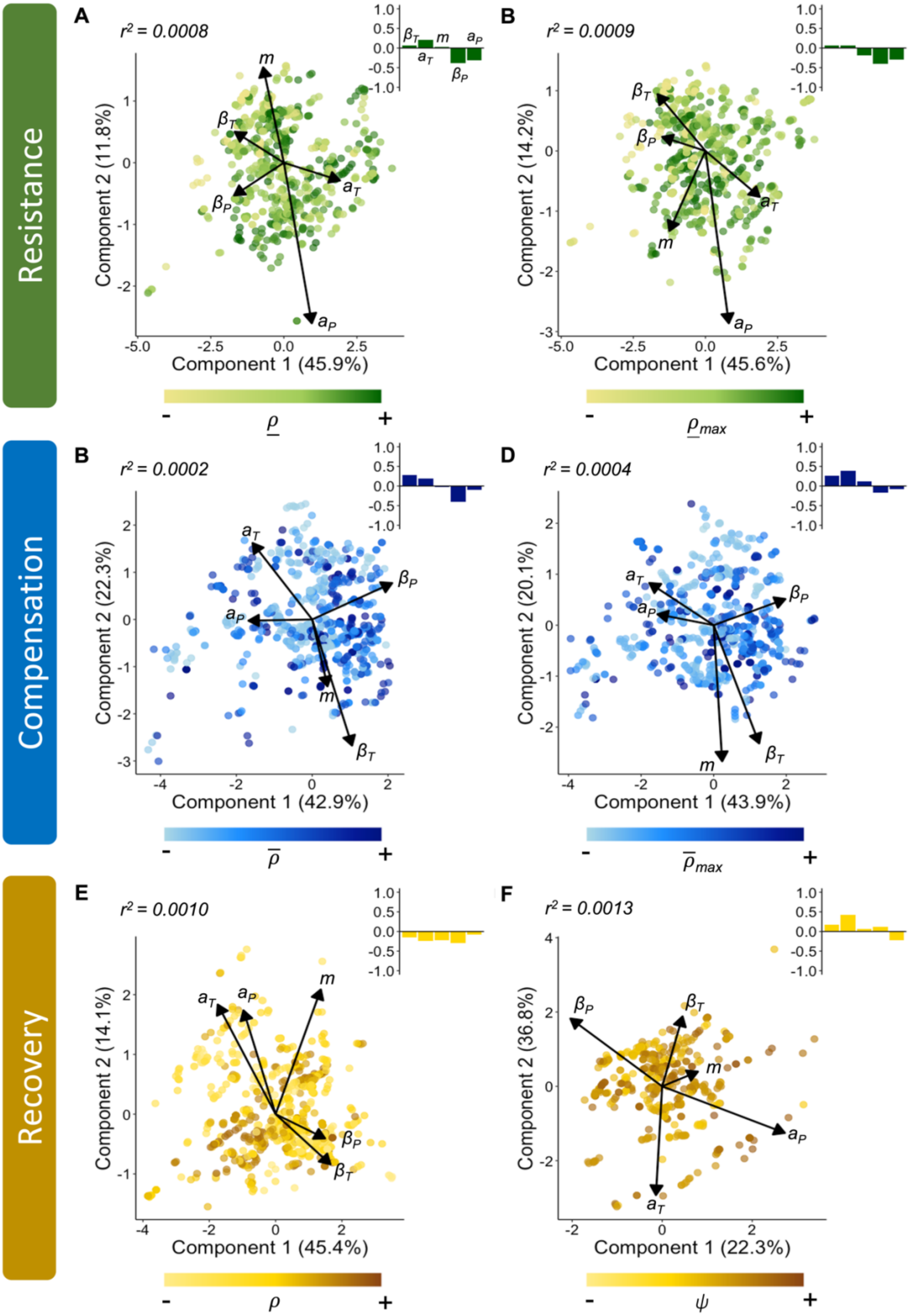
Figure S5. The limited correlation between patterns across the demographic resilience attributes of resistance (green), compensation (blue), and recovery (orange) and the relative exposure of populations to environmental stochasticity is evident across short-lived populations. Scores and loadings from a phylogenetically-weighted Partial Least Squares regression analysis exploring the correlation between patterns in the variation of the six transient metrics of **(A)** first-step attenuation ($\underline{\rho}$), **(B)** maximal attenuation ($\underline{\rho}_{max}$), **(C)** reactivity ($\overline{\rho}$), **(D)** maximal amplification ($\overline{\rho}_{max}$), **(E)** damping ratio (ρ), and **(F)** period of oscillation (ψ), and our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range/magnitude (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P). Populations were selected for the analysis on the basis that they possess life expectancies of ≤ 10 years. Colour gradation reflects the relative magnitude of each transient metric estimated for each population, with darker shades indicating higher estimates. Insert barplots are the standardised regression coefficients (b) highlighting the relative weighting of each abiotic variable in the overall capacity of each model to explain variation within each transient metric (r^2).

Table S4. Patterns across the resilience attributes of resistance (green), compensation (blue), and recovery (orange) of short-lived populations do not correlate with their relative exposure to environmental stochasticity. Using a phylogenetically-corrected Pearson's test of correlation, we explored the correlation between the transient metrics of first-step attenuation ($\underline{\rho}$), maximal attenuation ($\underline{\rho}_{max}$), reactivity ($\overline{\rho}$), maximal amplification ($\overline{\rho}_{max}$), damping ratio (ρ), and period of oscillation (ψ), and each of our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P). Populations were selected for the analysis on the basis that they possessed life expectancies of ≤ 10 years.

Transient metric	β_T	a_T	m	β_P	a_P
$\bar{\rho}$	-0.0061	0.0078	0.0058	-0.0108	0.0003
$\bar{\rho}_{max}$	-0.0054	-0.0077	0.0070	-0.0047	-0.0022
$\underline{\rho}$	-0.0040	-0.0001	-0.0002	0.0047	0.0025
$\underline{\rho}_{max}$	-0.0055	0.0017	-0.0051	-0.0125	0.0086
ρ	-0.0048	0.0029	-0.0059	-0.0252	0.0136
ψ	-0.0196	0.0189	<0.0001	0.0051	-0.0075

S7. Accounting for legacy period length

Evaluating how climate drivers influence demographic processes requires the identification of appropriate intervals of time during which climatic characteristics can be expected to impact upon vital rate properties[460]. Accordingly, it was appropriate that we demonstrated that our observation, that the recent-past exposure of populations to environmental stochasticity does not predict their demographic resilience, is not sensitive to the breadth of time window (henceforth exposure legacy) used to quantify exposure to environmental stochasticity (Fig. S6 – Fig. S9). Originally, using the CHELSA climate database[446], we quantified exposure legacy across our population sample using high-resolution temperature and precipitation records covering the 50-years prior to demographic census (Supplementary S4). To illustrate the limited sensitivity of our observations to exposure legacy period length, we repeated our phylogenetically weighted Partial Least Squares analyses exploring the relationship between environmental stochasticity and the transient dynamics of populations using both 100-year (Fig. S6) and 5-year environmental legacy periods (Fig. S7). However, with the earliest CHELSA records dated from January 1901[461], it was not possible for us to consistently estimate environmental legacy periods of 100-years across our entire population sample (which consisted of census start dates ranging from 1906 to 2016). Instead, to evaluate the relationship between environmental stochasticity and the transient dynamics of populations using 100-year environmental legacies we retained only studies for which it was possible to obtain 100-years of historical abiotic readings (915 populations). In both cases we demonstrate a neglible association between environmental stochasticity and the resilience attributes of populations ($r^2 < 0.003$; $|r| < 0.04$, Table S5 & Table S6). Moreover, this limited sensitivity continues to persist when considering only short-lived populations ($\eta_e \leq 10$; Supplementary S6) across both 100-year (Fig. S8 & Table S7) and 5-year environmental legacy periods (Fig. S9 & Table S8).

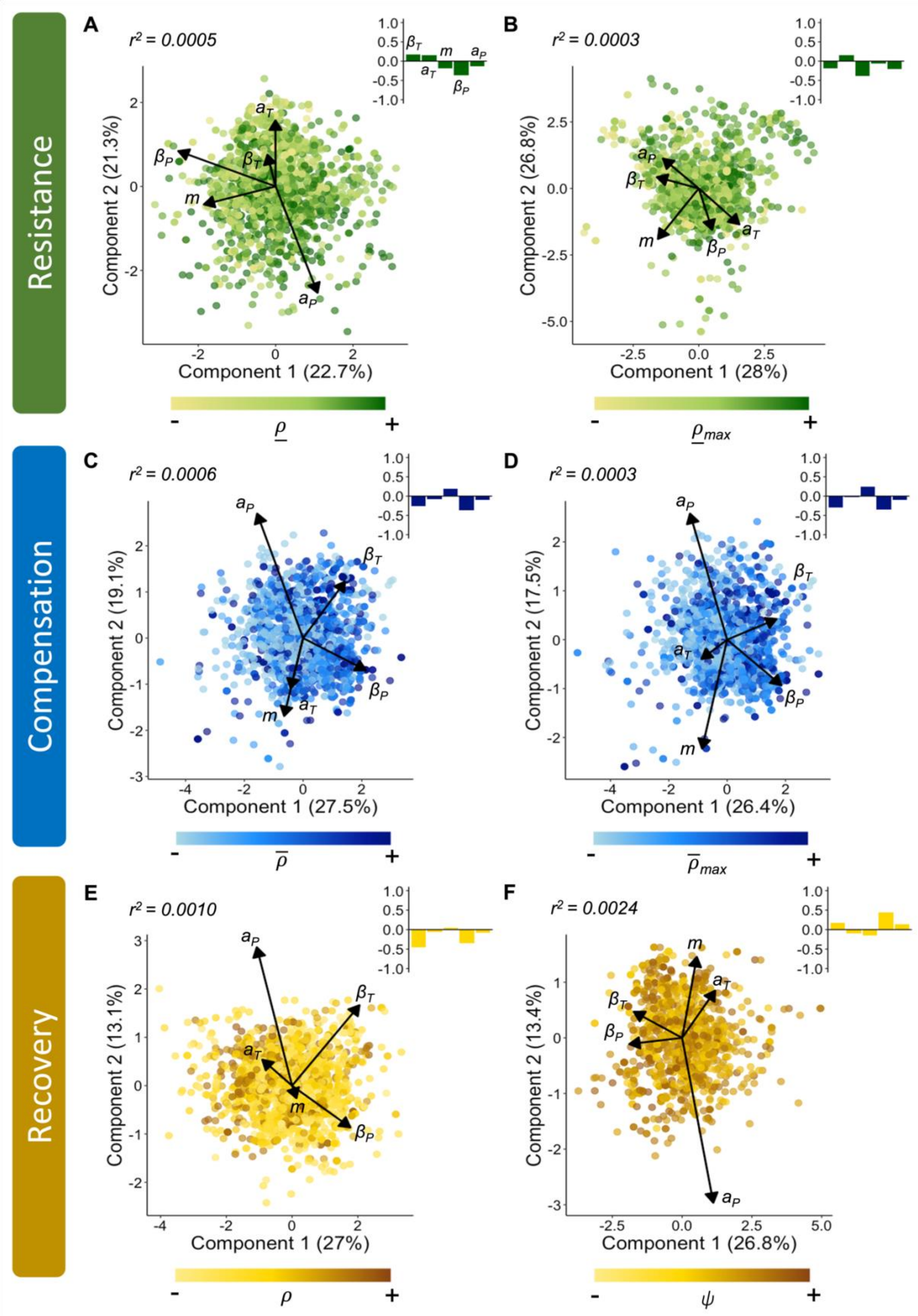

Resistance
Compensation
Recovery
A
r^2 = 0.0008
Component 1 (45.9%)
Component 2 (11.8%)
B
r^2 = 0.0009
Component 1 (45.6%)
Component 2 (14.2%)
B
r^2 = 0.0002
Component 1 (42.9%)
Component 2 (22.3%)
D
r^2 = 0.0004
Component 1 (43.9%)
Component 2 (20.1%)
E
r^2 = 0.0010
Component 1 (45.4%)
Component 2 (14.1%)
F
r^2 = 0.0013
Component 1 (22.3%)
Component 2 (36.8%)
m
a_P
a_T
β_P
β_T
- $\underline{\rho}$ +
- $\underline{\rho}_{max}$ +
- $\overline{\rho}$ +
- $\overline{\rho}_{max}$ +
- ρ +
- ψ +

313

Figure S6. The limited correlation between patterns across the demographic resilience attributes of resistance (green), compensation (blue), and recovery (orange) and the relative exposure of populations to environmental stochasticity persists when the exposure of populations is calculated using 100-year legacy periods. Scores and loadings from a phylogenetically-weighted Partial Least Squares regression analysis exploring the correlation between patterns in the variation of the six transient metrics of **(A)** first-step attenuation ($\underline{\rho}$), **(B)** maximal attenuation ($\underline{\rho}_{max}$), **(C)** reactivity ($\overline{\rho}$), **(D)** maximal amplification ($\overline{\rho}_{max}$), **(E)** damping ratio (ρ), and **(F)** period of oscillation (ψ), and our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range/magnitude (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P). Colour gradation reflects the relative magnitude of each transient metric estimated for each population, with darker shades indicating higher estimates. Insert barplots are the standardised regression coefficients (b) highlighting the relative weighting of each abiotic variable in the overall capacity of each model to explain variation within each transient metric (r^2).

Table S5. Patterns across the resilience attributes of resistance (green), compensation (blue), and recovery (orange) do not correlate with the exposure of populations to environmental stochasticity regimes over a 100-year period. Using a phylogenetically-corrected Pearson's test of correlation, we explored the correlation between the transient metrics of first-step attenuation ($\underline{\rho}$), maximal attenuation ($\underline{\rho}_{max}$), reactivity ($\overline{\rho}$), maximal amplification ($\overline{\rho}_{max}$), damping ratio (ρ), and period of oscillation (ψ), and each of our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P).

Transient metric	β_T	a_T	m	β_P	a_P
$\overline{\rho}$	0.0005	0.0055	-0.0009	-0.0112	0.0049
$\overline{\rho}_{max}$	-0.0010	0.0129	0.0029	-0.0128	0.0062
$\underline{\rho}$	0.0114	-0.0173	0.0025	0.0201	0.0015
$\underline{\rho}_{max}$	0.0109	-0.0152	0.0151	0.0196	0.0022
ρ	-0.0147	0.0072	-0.0191	-0.0183	0.0039
ψ	-0.0014	0.0133	-0.0017	0.0110	-0.0177

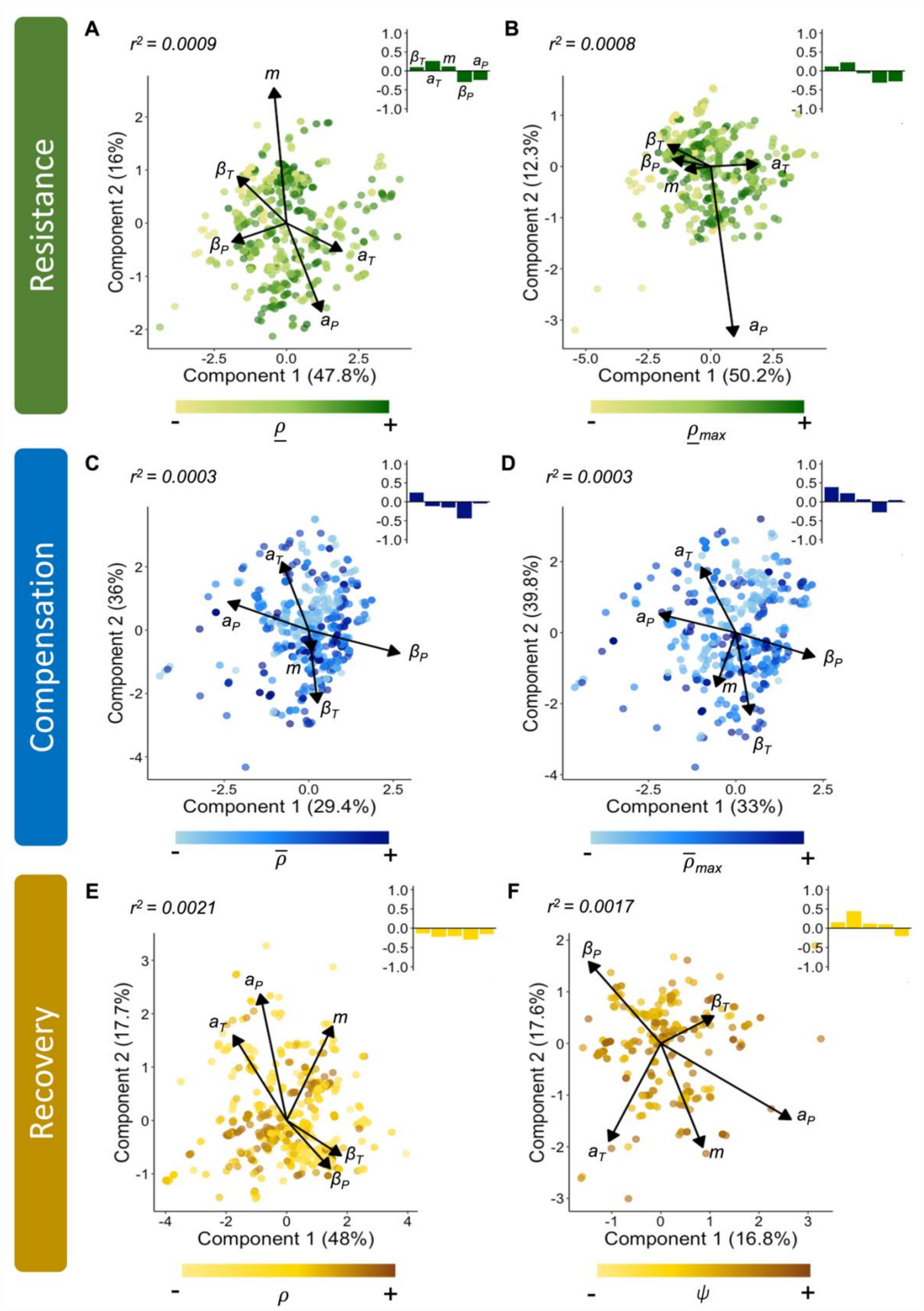

Resistance
Compensation
Recovery
A
r^2 = 0.0005
Component 2 (21.3%)
Component 1 (22.7%)
ρ
B
r^2 = 0.0003
Component 2 (26.8%)
Component 1 (28%)
ρ_{max}
C
r^2 = 0.0006
Component 2 (19.1%)
Component 1 (27.5%)
$\bar{\rho}$
D
r^2 = 0.0003
Component 2 (17.5%)
Component 1 (26.4%)
$\bar{\rho}_{max}$
E
r^2 = 0.0010
Component 2 (13.1%)
Component 1 (27%)
ρ
F
r^2 = 0.0024
Component 2 (13.4%)
Component 1 (26.8%)
ψ

352

Figure S7. The limited correlation between patterns across the demographic resilience attributes of resistance (green), compensation (blue), and recovery (orange) and the relative exposure of populations to environmental stochasticity persists when the exposure of populations is calculated using a 5-year legacy period. Scores and loadings from a phylogenetically-weighted Partial Least Squares regression analysis exploring the correlation between patterns in the variation of the six transient metrics of **(A)** first-step attenuation ($\underline{\rho}$), **(B)** maximal attenuation ($\underline{\rho}_{max}$), **(C)** reactivity ($\overline{\rho}$), **(D)** maximal amplification ($\overline{\rho}_{max}$), **(E)** damping ratio (ρ), and **(F)** period of oscillation (ψ), and our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range/magnitude (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P). Colour gradation reflects the relative magnitude of each transient metric estimated for each population, with darker shades indicating higher estimates. Insert barplots are the standardised regression coefficients (b) highlighting the relative weighting of each abiotic variable in the overall capacity of each model to explain variation within each transient metric (r^2).

Table S6. Patterns across the resilience attributes of resistance (green), compensation (blue), and recovery (orange) do not correlate with the exposure of populations to environmental stochasticity regimes over a 5-year period. Using a phylogenetically-corrected Pearson's test of correlation, we explored the correlation between the transient metrics of first-step attenuation ($\underline{\rho}$), maximal attenuation ($\underline{\rho}_{max}$), reactivity ($\overline{\rho}$), maximal amplification ($\overline{\rho}_{max}$), damping ratio (ρ), and period of oscillation (ψ), and each of our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P).

Transient metric	$\boldsymbol{\beta_T}$	$\boldsymbol{a_T}$	$\boldsymbol{m}$	$\boldsymbol{\beta_P}$	$\boldsymbol{a_P}$
$\overline{\rho}$	-0.0137	0.0023	0.0083	-0.0191	0.0075
$\overline{\rho}_{max}$	-0.0110	0.0042	0.0075	-0.0120	0.0046
$\underline{\rho}$	-0.0027	-0.0038	0.0108	0.0151	<0.0001
$\underline{\rho}_{max}$	0.0099	-0.0085	0.0139	-0.0008	0.0083
ρ	-0.0261	0.0069	-0.0003	-0.0210	0.0076
ψ	0.0266	-0.0189	-0.0122	0.0365	-0.0086



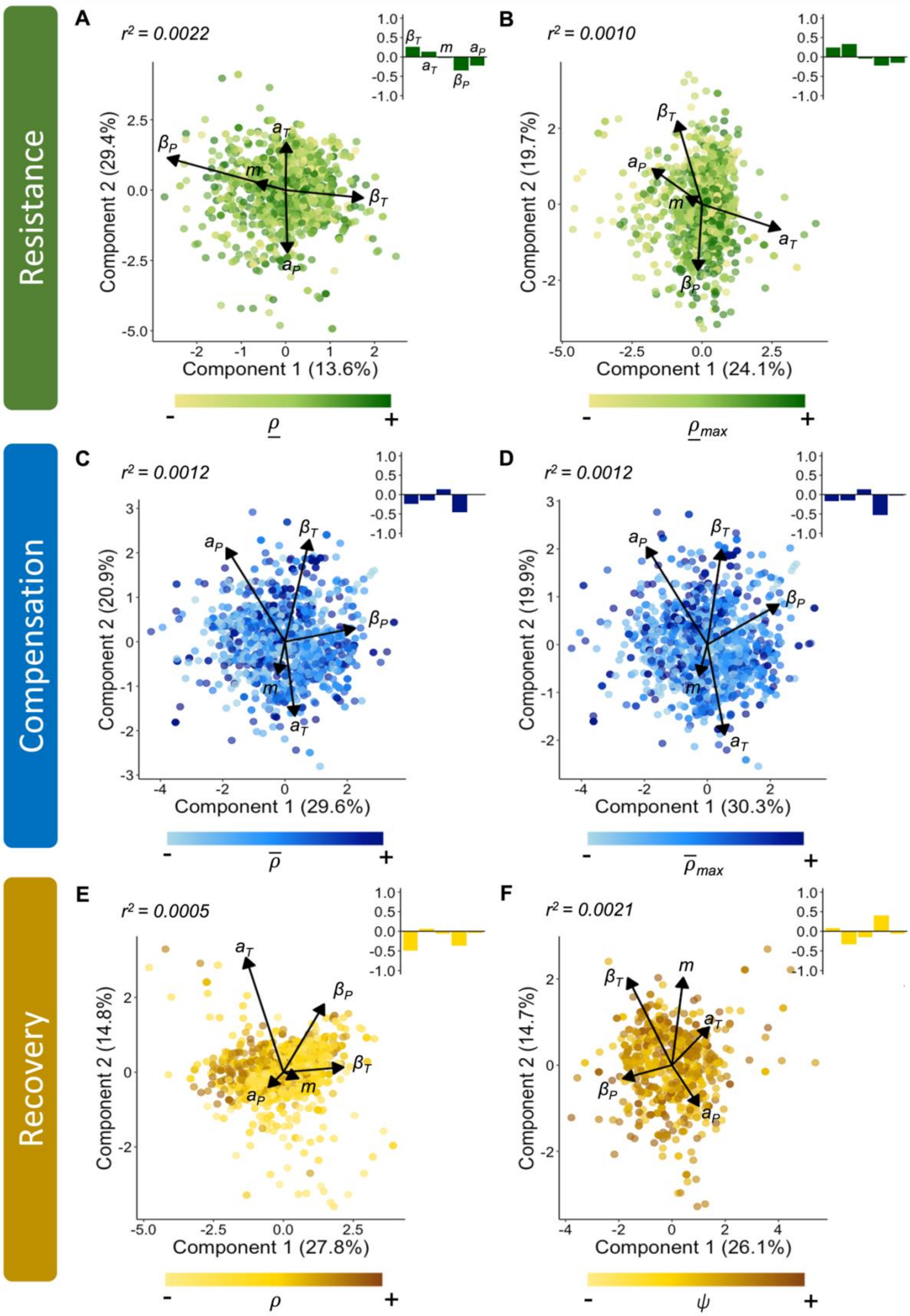
Resistance
Compensation
Recovery
A
r² = 0.0009
B
r² = 0.0008
C
r² = 0.0003
D
r² = 0.0003
E
r² = 0.0021
F
r² = 0.0017
Component 1 (47.8%)
Component 2 (16%)
Component 1 (50.2%)
Component 2 (12.3%)
Component 1 (29.4%)
Component 2 (36%)
Component 1 (33%)
Component 2 (39.8%)
Component 1 (48%)
Component 2 (17.7%)
Component 1 (16.8%)
Component 2 (17.6%)
m
β_T
β_P
a_T
a_P
ρ
ρ_max
ψ
-
+

391

Figure S8. The limited correlation between patterns across the demographic resilience attributes of resistance (green), compensation (blue), and recovery (orange) and the relative exposure of short-lived populations to environmental stochasticity remains when the exposure of populations is calculated using 100-year legacy periods. Scores and loadings from a phylogenetically-weighted Partial Least Squares regression analysis exploring the correlation between patterns in the variation of the six transient metrics of **(A)** first-step attenuation ($\underline{\rho}$), **(B)** maximal attenuation ($\underline{\rho}_{max}$), **(C)** reactivity ($\overline{\rho}$), **(D)** maximal amplification ($\overline{\rho}_{max}$), **(E)** damping ratio (ρ), and **(F)** period of oscillation (ψ), and our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range/magnitude (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P). Colour gradation reflects the relative magnitude of each transient metric estimated for each population, with darker shades indicating higher estimates. Insert barplots are the standardised regression coefficients (b) highlighting the relative weighting of each abiotic variable in the overall capacity of each model to explain variation within each transient metric (r^2).

Table S7. Patterns across the resilience attributes of resistance (green), compensation (blue), and recovery (orange) in short-lived populations do not correlate with their exposure to environmental stochasticity regimes over a 100-year period. Using a phylogenetically-corrected Pearson's test of correlation, we explored the correlation between the transient metrics of first-step attenuation ($\underline{\rho}$), maximal attenuation ($\underline{\rho}_{max}$), reactivity ($\overline{\rho}$), maximal amplification ($\overline{\rho}_{max}$), damping ratio (ρ), and period of oscillation (ψ), and each of our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P).

Transient metric	$\boldsymbol{\beta_T}$	$\boldsymbol{a_T}$	$\boldsymbol{m}$	$\boldsymbol{\beta_P}$	$\boldsymbol{a_P}$
$\overline{\rho}$	0.0050	-0.0018	-0.0021	-0.0122	0.0057
$\overline{\rho}_{max}$	0.0047	0.0032	0.0044	-0.0107	0.0084
$\underline{\rho}$	0.0100	-0.0177	-0.0044	0.0203	<0.0001
$\underline{\rho}_{max}$	0.0114	-0.0186	0.0087	0.0181	0.0018
ρ	-0.0214	0.0092	-0.0282	-0.0243	-0.0003
ψ	-0.0038	0.0173	0.0025	0.0089	-0.0175


Resistance
Compensation
Recovery
A
$r^2 = 0.0022$
B
$r^2 = 0.0010$
C
$r^2 = 0.0012$
D
$r^2 = 0.0012$
E
$r^2 = 0.0005$
F
$r^2 = 0.0021$
Component 1 (13.6%)
Component 2 (29.4%)
Component 1 (24.1%)
Component 2 (19.7%)
Component 1 (29.6%)
Component 2 (20.9%)
Component 1 (30.3%)
Component 2 (19.9%)
Component 1 (27.8%)
Component 2 (14.8%)
Component 1 (26.1%)
Component 2 (14.7%)
β_T
β_P
a_T
a_P
m
$\underline{\rho}$
$\underline{\rho}_{max}$
$\bar{\rho}$
$\bar{\rho}_{max}$
ρ
ψ
-
+

430

Figure S9. The limited correlation between patterns across the demographic resilience attributes of resistance (green), compensation (blue), and recovery (orange) and the relative exposure of short-lived populations to environmental stochasticity remains when the exposure of populations is calculated using 5-year legacy periods. Scores and loadings from a phylogenetically-weighted Partial Least Squares regression analysis exploring the correlation between patterns in the variation of the six transient metrics of **(A)** first-step attenuation ($\underline{\rho}$), **(B)** maximal attenuation ($\underline{\rho}_{max}$), **(C)** reactivity ($\overline{\rho}$), **(D)** maximal amplification ($\overline{\rho}_{max}$), **(E)** damping ratio (ρ), and **(F)** period of oscillation (ψ), and our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range/magnitude (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P). Colour gradation reflects the relative magnitude of each transient metric estimated for each population, with darker shades indicating higher estimates. Insert barplots are the standardised regression coefficients (b) highlighting the relative weighting of each abiotic variable in the overall capacity of each model to explain variation within each transient metric (r^2).

Table S8. Patterns across the resilience attributes of resistance (green), compensation (blue), and recovery (orange) in short-lived populations do not correlate with their exposure to environmental stochasticity regimes over a 5-year period. Using a phylogenetically-corrected Pearson's test of correlation, we explored the correlation between the transient metrics of first-step attenuation ($\underline{\rho}$), maximal attenuation ($\underline{\rho}_{max}$), reactivity ($\overline{\rho}$), maximal amplification ($\overline{\rho}_{max}$), damping ratio (ρ), and period of oscillation (ψ), and each of our five measures of environmental stochasticity: temperature frequency spectrum (β_T), temperature autocorrelation (a_T), thermal range (m), precipitation frequency spectrum (β_P), and precipitation autocorrelation (a_P).

Transient metric	β_T	a_T	m	β_P	a_P
$\overline{\rho}$	-0.0140	-0.0044	0.0054	-0.0315	0.0182
$\overline{\rho}_{max}$	-0.0085	-0.0061	0.0056	-0.0324	0.0177
$\underline{\rho}$	-0.0188	-0.0074	0.0043	0.0254	0.0103
$\underline{\rho}_{max}$	-0.0047	-0.0213	0.0037	0.0088	0.0115
ρ	-0.0189	0.0090	-0.0041	-0.0134	0.0033
ψ	0.0209	-0.0261	-0.0106	0.0329	-0.0132

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