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Appendix 1

Table A1. Taxa names, resistance/resilience (Res) group and occurrence in 311 samples, ordered alphabetically by Res group then occurrence. N/As in the *Res group* column indicate that trait information necessary to determine Res scores was incomplete.

Taxa	Order/Class	Res group	Occurrence
Dixella sp.	Diptera	High	1
Gerris sp.	Heteroptera	High	1
Graptodytes pictus	Coleoptera	High	1
Hesperocorixa sahlbergi	Heteroptera	High	1
Hydrometra stagnorum	Heteroptera	High	1
Hyphydrus ovatus	Coleoptera	High	1
Mesoveliidae	Heteroptera	High	1
Ochthebius sp.	Coleoptera	High	1
Plea minutissima	Heteroptera	High	1
Sympetrum striolatum	Odonata	High	1
Tetanocera sp.	Diptera	High	1
Corixa punctata	Heteroptera	High	2
Caenis rivulorum	Ephemeroptera	High	3
Hydraena sp.	Coleoptera	High	3
Hydroporus sp.	Coleoptera	High	3
Notonecta sp.	Heteroptera	High	3
Syrphidae	Diptera	High	3
Ptychoptera sp.	Diptera	High	4
Pyralidae	Lepidoptera	High	5
Ischnura elegans	Odonata	High	8
Tabanidae	Diptera	High	8
Glyphotaelius pellucidus	Trichoptera	High	10

Ephydridae	Diptera	High	11
Micronecta poweri/scholtzi	Heteroptera	High	14
Sigara sp.	Heteroptera	High	14
Velia caprai	Heteroptera	High	14
Caenis horaria	Ephemeroptera	High	15
Helophorus sp.	Coleoptera	High	16
Dixa sp.	Diptera	High	19
Muscidae	Diptera	High	32
Haliplus sp.	Coleoptera	High	37
Stratiomyidae	Diptera	High	82
Caenis luctuosa	Ephemeroptera	High	97
Empididae	Diptera	High	164
Simulium sp.	Diptera	High	232
Anacaena lutescens	Coleoptera	Intermediate	1
Asellus meridianus	Crustacea	Intermediate	1
Brachycentrus subnubilus	Trichoptera	Intermediate	1
Brychius elevatus	Coleoptera	Intermediate	1
Calopteryx virgo	Odonata	Intermediate	1
Gyraulus laevis	Gastropoda	Intermediate	1
Limnephilus decipiens	Trichoptera	Intermediate	1
Limnephilus rhombicus	Trichoptera	Intermediate	1
Musculium lacustre	Bivalvia	Intermediate	1
Nepa cinerea	Heteroptera	Intermediate	1
Noterus clavicornis	Coleoptera	Intermediate	1
Oecetis testacea	Trichoptera	Intermediate	1
Rhantus exsoletus/suturalis	Coleoptera	Intermediate	1
Anabolia nervosa	Trichoptera	Intermediate	2
Cyrnus trimaculatus	Trichoptera	Intermediate	2
Ferrissia wautieri	Gastropoda	Intermediate	2
Limnephilus vittatus	Trichoptera	Intermediate	2
Polycentropus kingi	Trichoptera	Intermediate	2
Potamophylax latipennis	Trichoptera	Intermediate	2
Anacaena globulus	Coleoptera	Intermediate	3
Apatania muliebris	Trichoptera	Intermediate	3
Hippeutis complanatus	Gastropoda	Intermediate	3
Limnephilus flavicornis	Trichoptera	Intermediate	3
Hydrobius fuscipes	Coleoptera	Intermediate	4
Lype phaeopa	Trichoptera	Intermediate	4

Cloeon dipterum	Ephemeroptera	Intermediate	5
Laccobius sp.	Coleoptera	Intermediate	5
Polycentropus irroratus	Trichoptera	Intermediate	5
Procloeon pennulatum	Ephemeroptera	Intermediate	5
*Agrayl*i*a* sp.	Trichoptera	Intermediate	6
Anacaena limbata	Coleoptera	Intermediate	6
Chaetopteryx villosa	Trichoptera	Intermediate	6
Dryops sp.	Coleoptera	Intermediate	6
Ilybius fuliginosus	Coleoptera	Intermediate	6
Micropterna sequax	Trichoptera	Intermediate	7
Orectochilus villosus	Coleoptera	Intermediate	7
Plectrocnemia conspersa	Trichoptera	Intermediate	7
Odontocerum albicorne	Trichoptera	Intermediate	9
Riolus subviolaceus	Coleoptera	Intermediate	9
Limnephilus extricatus	Trichoptera	Intermediate	10
Anisus leucostoma	Gastropoda	Intermediate	14
Limnephilus marmoratus	Trichoptera	Intermediate	14
Calopteryx splendens	Odonata	Intermediate	15
Oxyethira sp.	Trichoptera	Intermediate	17
Polycentropus flavomaculatus	Trichoptera	Intermediate	17
Halesus digitatus	Trichoptera	Intermediate	18
Baetis scambus/fuscatus	Ephemeroptera	Intermediate	21
Oulimnius tuberculatus	Coleoptera	Intermediate	21
Centroptilum luteolum	Ephemeroptera	Intermediate	22
Tinodes waeneri	Trichoptera	Intermediate	22
Planorbis carinatus/planorbis	Gastropoda	Intermediate	24
Agabus sp.	Coleoptera	Intermediate	32
Halesus radiatus	Trichoptera	Intermediate	34
Baetis vernus	Ephemeroptera	Intermediate	35
Gyraulus crista	Gastropoda	Intermediate	35
Scirtidae	Coleoptera	Intermediate	35
Gyraulus albus	Gastropoda	Intermediate	39
Tipulidae	Diptera	Intermediate	45
Goera pilosa	Trichoptera	Intermediate	48
Lype reducta	Trichoptera	Intermediate	48
Sphaerium sp.	Bivalvia	Intermediate	60
Dendrocoelum lacteum	Turbellaria	Intermediate	65
Limnius volckmari	Coleoptera	Intermediate	65

Bathyomphalus contortus	Gastropoda	Intermediate	69
Sericostoma personatum	Trichoptera	Intermediate	75
Crangonyx pseudogracilis	Crustacea	Intermediate	78
Ephemera danica	Ephemeroptera	Intermediate	85
Psychodidae	Diptera	Intermediate	85
Rhyacophila dorsalis/fasciata	Trichoptera	Intermediate	86
Dicranota sp.	Diptera	Intermediate	100
Potamopyrgus antipodarum	Gastropoda	Intermediate	106
Hydroptila sp.	Trichoptera	Intermediate	111
Limoniidae	Diptera	Intermediate	113
Serratella ignita	Ephemeroptera	Intermediate	115
Anisus vortex	Gastropoda	Intermediate	148
Hydropsyche angustipennis	Trichoptera	Intermediate	168
Elmis aenea	Coleoptera	Intermediate	202
Ceratopogonidae	Diptera	Intermediate	203
Agapetus sp.	Trichoptera	Intermediate	207
Asellus aquaticus	Crustacea	Intermediate	219
Limnephilus lunatus	Trichoptera	Intermediate	246
Baetis rhodani	Ephemeroptera	Intermediate	248
Pisidium sp.	Bivalvia	Intermediate	261
Chironomidae	Diptera	Intermediate	306
Alboglossiphonia heteroclita	Hirudinea	Low	1
Physa heterostropha	Gastropoda	Low	1
Planorbarius corneus	Gastropoda	Low	1
Athripsodes bilineatus	Trichoptera	Low	2
Haemopis sanguisuga	Hirudinea	Low	2
Leuctra inermis	Plecoptera	Low	2
Leuctra nigra	Plecoptera	Low	2
Lepidostoma hirtum	Trichoptera	Low	3
Mystacides longicornis	Trichoptera	Low	3
Platambus maculatus	Coleoptera	Low	3
Adicella reducta	Trichoptera	Low	4
Planaria torva	Turbellaria	Low	4
Dugesia tigrina	Turbellaria	Low	5
Erpobdella testacea	Hirudinea	Low	6
Nemoura cinerea	Plecoptera	Low	7
Niphargus aquilex	Crustacea	Low	8
Trocheta pseudodina	Hirudinea	Low	8

Athripsodes aterrimus	Trichoptera	Low	9
Bithynia tentaculata	Gastropoda	Low	11
Leuctra fusca	Plecoptera	Low	12
Dugesia lugubris/polychroa	Turbellaria	Low	14
Theromyzon tessulatum	Hirudinea	Low	14
Lymnaea stagnalis	Gastropoda	Low	16
Sialis lutaria	Megaloptera	Low	18
Pacifastacus leniusculus	Crustacea	Low	20
Trocheta subviridis	Hirudinea	Low	20
Physa fontinalis	Gastropoda	Low	26
Piscicola geometra	Hirudinea	Low	31
Physella acuta	Gastropoda	Low	32
Valvata piscinalis	Gastropoda	Low	36
Drusus annulatus	Trichoptera	Low	39
Valvata cristata	Gastropoda	Low	47
Athripsodes albifrons	Trichoptera	Low	49
Paraleptophlebia submarginata	Plecoptera	Low	50
Nemurella picteti	Plecoptera	Low	57
Mystacides azurea	Trichoptera	Low	62
Acroloxus lacustris	Gastropoda	Low	67
Lymnaea palustris	Gastropoda	Low	73
Helobdella stagnalis	Hirudinea	Low	80
Athripsodes cinereus	Trichoptera	Low	85
Erpobdella octoculata	Hirudinea	Low	89
Silo nigricornis/pallipes	Trichoptera	Low	98
Ancylus fluviatilis	Gastropoda	Low	100
Glossiphonia complanata	Hirudinea	Low	109
Radix balthica	Gastropoda	Low	126
Polycelis sp.	Turbellaria	Low	129
Gammarus pulex/fossarum	Crustacea	Low	288
Bibio sp.	Diptera	N/A	1
Cercyon sp.	Coleoptera	N/A	1
Ellobiidae	Gastropoda	N/A	1
Euconulidae	Gastropoda	N/A	1
Megasternum sp.	Coleoptera	N/A	1
Omphiscola glabra	Gastropoda	N/A	1
Trichia hispida	Gastropoda	N/A	1
Trichia striolata	Gastropoda	N/A	1

Beraeidae	Trichoptera	N/A	2
Cochliopidae	Gastropoda	N/A	2
Rhagionidae	Diptera	N/A	3
Staphylinidae	Coleoptera	N/A	3
Chrysomelidae	Chrysomelidae	N/A	4
Zonitoides nitidus	Gastropoda	N/A	4
Dolichopodidae	Diptera	N/A	5
Nematomorpha	Nematomorpha	N/A	5
Curculionidae	Coleoptera	N/A	9
Isotomidae	Collembola	N/A	13
Succineidae	Gastropoda	N/A	16
Nematoda	Nematoda	N/A	21
Hydracarina	Acarina	N/A	189
Oligochaeta	Annelida	N/A	304

Table A2. Definition of hydrological metrics and their temporal and spatial scale. See also Fig. A1 for a schematic representation.

[1] See Sefton et al. (2019, https://doi.org/10.1127/fal/2019/1149); [2] See Gallart, F. et al. 2012. A novel approach to analysing the regimes of temporary streams in relation to their controls on the composition and structure of aquatic biota. – Hydrol. Earth Syst. Sci. 16: 3165–3182.

Local hydrological metrics				
Metric	Characteristic	Definition	Type[1]	Time period
TotalFlow	Long-term flow permanence	Proportion of months in which a flowing state was observed	Composition	Period of record
DryMonth	Occurrence of dry state	Proportion of months in which a dry state was observed	Composition	Preceding year (to February)
PoolMonth	Occurrence of ponded state	Proportion of months in which a ponded state was observed	Composition	Preceding year (to February)
Pred	Seasonality of no-flow periods	Sd6[2]	Configuration	Period of record
MonthSince	Duration of pre-sample flowing period	Number of consecutive months in which flow was observed prior to sampling	Configuration	Pre-sampling
Regional/catchment-scale hydrological metrics				
DistPer	Site-specific connectivity	Distance from a site to the nearest downstream reach with perennial flow	Configuration	N/A
FlowRiv	River-scale spatial extent of flowing reaches	Proportion of the surveyed river length in flowing state (mean of 12 monthly values)	Configuration	Preceding year (to February)
Frag	River-scale hydrological habitat heterogeneity	Number of changes in state along the river as a proportion of all reaches (mean of 12 monthly values)	Configuration	Preceding year (to February)

Table A3. Interactions between hydrological metrics used in models and their rationale. Each metric is described and its definition is defined in Table A2 and the main text.

Interaction term	Rationale	Hypotheses tested
TotalFlow × Frag	The effect of fragmentation (Frag) on diversity differs depending on site permanence regime (TotalFlow)	H3
TotalFlow × MonthSince	Changes in diversity with increasing period since the most recent no-flow record (MonthSince) differs among sites with different permanence regimes (TotalFlow)	H3
TotalFlow × DryMonth	The effect of drying occurrence (DryMonth) on diversity differs among sites with different permanence regimes (TotalFlow)	H1, H2
DistPer × Frag	The effect of fragmentation (Frag) on diversity differs depending on site connectivity to a perennial reach (DistPer)	H3
DistPer × MonthSince	Changes in diversity with increasing period since the most recent no-flow observation (MonthSince) differ depending on connectivity with a perennial reach (DistPer)	H1, H3
DistPer × DryMonth	Diversity responses to drying occurrence (DryMonth) differ depending on site connectivity with a perennial reach (DistPer)	H2

Table A4. Total number of models with ΔAIC < 4 and the proportion of models including each hydrological variable and variable interaction, i.e. variable importance. N/A indicates that the variable was not selected in any of the top models. Each variable is illustrated in Fig. A1 and described and its abbreviation defined in Table A2 and the main text.

	Diversity measure	α	Temporal β	Spatial β
	Total number of models	27	52	73
Scale	Variable	Variable importance		
Local	TotalFlow	1.00	0.54	1.00
	DryMonth	1.00	0.73	0.68
	PoolMonth	1.00	0.43	0.59
	MonthSince	0.28	0.25	0.97
Regional	DistPer	0.51	0.21	0.84
	Frag	0.22	0.29	0.30
	FlowRiv	0.20	1.00	0.17
Interactions	DistPer × DryMonth	0.14	0.01	0.33
	DistPer × MonthSince	0.02	N/A	0.34
	DistPer × Frag	0.03	N/A	0.01
	TotalFlow × DryMonth	0.14	0.21	0.48
	TotalFlow × Frag	0.05	0.04	0.10
	TotalFlow × MonthSince	0.04	0.01	0.97

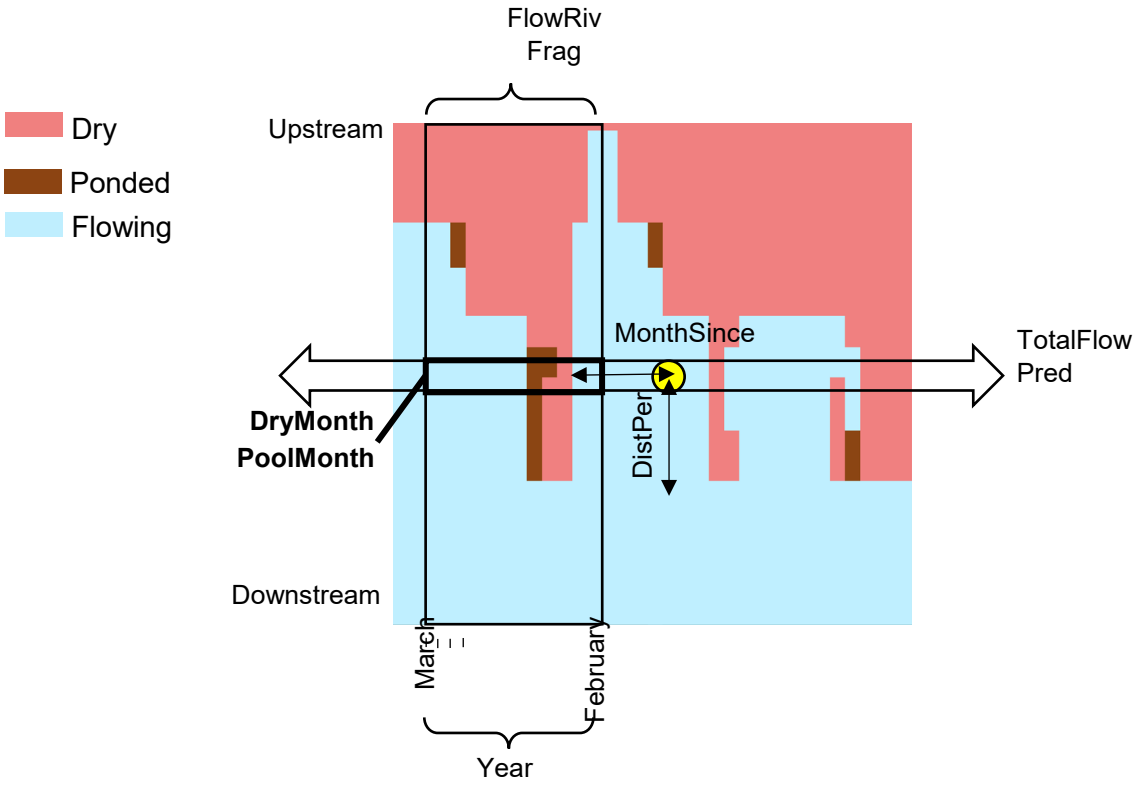

Figure A1. Schematic of the spatial (y-axis) and temporal (x-axis) composition and configuration of hydrological states in a river, indicating the temporal and spatial scale at which each variable was measured. The yellow dot represents an invertebrate sample. Each variable is described and its abbreviation defined in Table A2 and the main text.

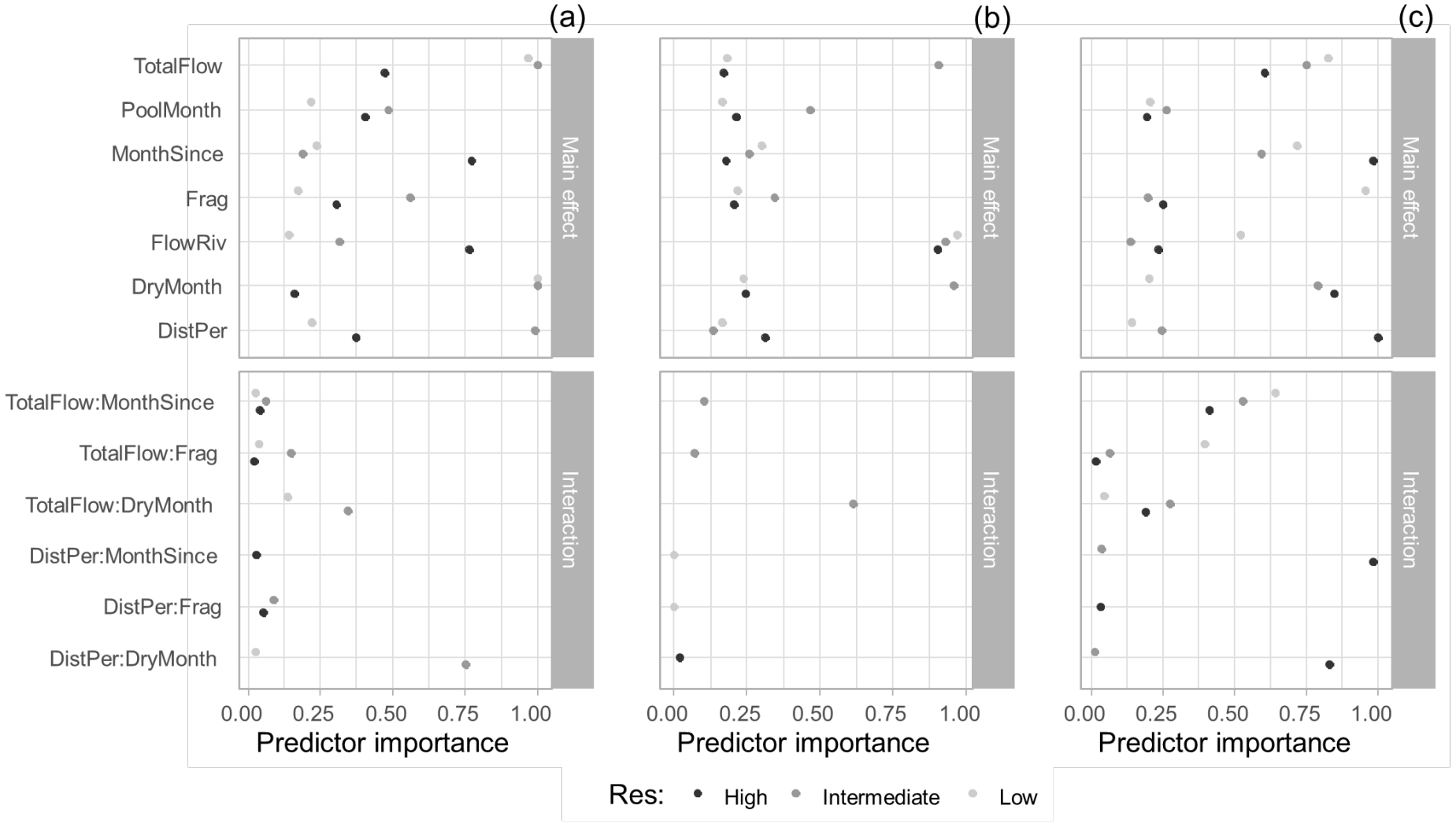

Figure A2. Predictor importance for (a) α diversity, (b) temporal β diversity and (c) spatial β diversity for the low (light grey), intermediate (dark grey) and high (black) resistance/resilience (Res) capacity groups.