Model selection for Richness as response variable. An AIC comparison was used to test which of the listed generalized linear mixed models best predicted the data. Models with a dAICc score of less than 2 are bold. Season and nested effect of block, plot and trap, were represented as random effect. The most parsimonious model is marked with an asterisk (*).

Response		Model	AICc	dAICc	df	weight	R^2
Richness		~ 1	1930.9	371.1	1	<0.001	-
		~ OM + R + SHR + GWF + UWF + TRE + GRA + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1625.2	65.5	29	<0.001	-
		~ OM + R + GWF + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	**1561.5**	**1.7**	**16**	**0.2346**	**0.55**
		~ OM + R + MUL + BGT + VWC + I(VWC ^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1563.9	4.1	15	0.0710	-
		~ OM + R + GWF + MUL + BGT + VWC + I(VWC ^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1569.7	9.9	21	0.0039	-
		~ OM + R + BD + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1613.3	53.5	8	<0.001	-
		~ OM + R + TCTN + pH + (1|SEASON) + (1 |BLOCK/PLOT/TRAP)	1613.1	53.3	9	<0.001	-
		~ OM + R + GWF + MUL + BGT + VWC + I(VWC ^2) + BD + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1570.3	10.6	24	0.0028	-
		~ OM + R + PRCP + TMIN + TMAX + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1606.7	47.0	10	<0.001	-
		~ OM + R + SHR + GWF + UWF + TRE + GRA + MUL + BGT + VWC + I(VWC ^2) + PRCP + TAVG + BD + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1587.7	28.0	42	<0.001	-
		~ BD + R + SHR + GWF + UWF + TRE + GRA + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1624.2	64.4	29	<0.001	-
	*	~ BD + R + GWF + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	**1559.8**	**0.0**	**16**	**0.5512**	**0.55**
		~ BD + R + MUL + BGT + VWC + I(VWC ^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1562.7	3.0	15	0.1244	-
		~ BD + R + GWF + MUL + BGT + VWC + I(VWC ^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1568.4	8.6	21	0.0073	-
		~ BD + R + TCTN + pH + OM + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1613.7	53.9	10	<0.001	-
		~ BD + R + GWF + MUL + BGT + VWC + I(VWC^2) + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1569.3	9.5	23	0.0047	-
		~ BD + R + PRCP + TMIN + TMAX + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1603.9	44.2	10	<0.001	-
		~ BD + R + SHR + GWF + UWF + TRE + GRA + MUL + BGT + VWC + I(VWC^2) + PRCP + TAVG + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	1586.8	27.0	41	<0.001	-

Model outputs for the fixed factors of the Richness response variable. Factors that had a significant impact on the response variable are in bold. The numerical covariates are scaled to represent a fair comparison to the effect size of the fixed factors.

Response	Factor	Estimate	Std. Error	z value	Pr(>|z|)
Richness	Intercept	-1.35840	0.21209	6.405	1.15e-10
	BD: Bulk Density	-0.08304	0.04493	-1.848	0.0646
	R1: Weekly irrigation	0.04782	0.09017	0.530	0.5958
	GWF2: Ground cover wildflowers 1-5%	0.05497	0.21556	0.255	0.7987
	GWF3: Ground cover wildflowers 6-25%	0.18151	0.18468	0. 983	0.3257
	GWF4: Ground cover wildflowers 26-50%	0.35748	0.18716	1.910	0.0561
	GWF5: Ground cover wildflowers 51-75%	0.41348	0.18040	2.292	**0.0219**
	GWF6: Ground cover wildflowers 76-95%	0.43953	0.18207	2.259	**0.0183**
	GWF7: Ground cover wildflowers 96-100%	0.52883	0.20016	2.642	**0.0082**
	BGT: Below ground temperature	0.28846	0.06827	4.226	**2.38e-05**
	VWC: Soil moisture	0.07653	0.04933	1.552	0.1207
	VWC^2: Soil Moisture^2	-0.10882	0.02140	-5.085	**3.68e-07**

Model outputs for the random factors of the Richness response variable. The standard deviation for each factor is listed and is scaled to represent a fair comparison to the effect size of the fixed factors.

Response	Factor	Std. Dev.
Richness	Season	0.13255
	Trap:Plot:Block	0.18615
	Plot:Block	0.06494
	Block	0.15737

Model selection for the Abundance response variable. An AIC comparison was used to test which of the listed generalized linear mixed models best predicted the data. Models with a dAICc score of less than 2 are bold. Season and nested effect of block, plot and trap, were represented as random effect. The most parsimonious model is marked with an asterisk (*).

Response		Model	AICc	dAICc	df	weight	R^2
Abundance		~ 1	1089.3	280.6	2	<0.001	-
		~ OM + R + SHR + GWF + UWF + TRE + GRA + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	857.2	48.5	30	<0.001	-
		~ OM + R + GWF + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	812.1	3.4	17	0.0857	-
		~ OM + R + MUL + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	**810.0**	**1.3**	**16**	**0.2414**	**0.60**
		~ OM + R + GWF + MUL + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	820.0	11.3	22	0.0016	-
		~ OM + R + BD + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	829.4	20.7	9	<0.001	-
		~ OM + R + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	832.3	23.7	10	<0.001	-
		~ OM + R + GWF + MUL + BGT + VWC + I(VWC^2) + BD + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	823.0	14.4	25	<0.001	-
		~ OM + R + PRCP + TMIN + TMAX + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	819.3	10.6	11	0.0023	-
		~ OM + R + SHR + GWF + UWF + TRE + GRA + MUL + BGT + VWC + I(VWC^2) + PRCP + TAVG + BD + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	829.8	11.1	43	0.0018	-
		~ BD + R + SHR + GWF + UWF + TRE + GRA + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	855.7	47.0	30	<0.001	-
		~ BD + R + GWF + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	**810.5**	**1.8**	**17**	**0.1868**	**0.62**
	*	~ BD + R + MUL + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	**808.7**	**0.0**	**16**	**0.4644**	**0.61**
		~ BD + R + GWF + MUL + BGT + VWC + I(VWC^2) + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	818.7	10.0	22	0.0032	-
		~ BD + R + TCTN + pH + OM + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	831.6	23.0	11	<0.001	-
		~ BD + R + GWF + MUL + BGT + VWC + I(VWC^2) + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	821.9	13.3	24	0.0041	-
		~ BD + R + PRCP + TMIN + TMAX + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	816.7	8.0	11	0.0083	-
		~ BD + R + SHR + GWF + UWF + TRE + GRA + MUL + BGT + VWC + I(VWC^2) + PRCP + TAVG + TCTN + pH + (1|SEASON) + (1|BLOCK/PLOT/TRAP)	818.4	9.8	43	0.0035	-

Model outputs for the fixed factors of the Abundance response variable. Factors that had a significant impact on the response variable are in bold. The numerical covariates are scaled to represent a fair comparison to the effect size of the fixed factors.

Response	Factor	Estimate	Std. Error	z value	Pr(>|z|)
Abundance	Intercept	2.85564	0.36541	7.815	5.50e-15
	BD: Bulk density	-0.12088	0.09756	-1.239	0.2153
	R1: Weekly irrigation	0.19012	0.19029	0.999	0.3177
	MUL2: Mulch 1-5%	-0.11746	0.14489	-0.811	0.4175
	MUL3: Mulch 6-25%	-0.32538	0.16580	0.1962	**0.0497**
	MUL4: Mulch 26-50%	-0.19008	0.16634	-1.143	0.2531
	MUL5: Mulch 51-75%	-0.36415	0.22734	-1.602	0.1091
	MUL6: Mulch 76-95%	-0.53753	0.28647	-1.876	0.0606
	BGT: Below ground temperature	0.27478	0.12202	2.252	**0.0243**
	VWC: Soil moisture	0.34315	0.08951	3.834	**0.0001**
	VWC^2: Soil Moisture^2	-0.15303	0.03214	-4.761	**1.92e-06**

Model outputs for the random factors of the Abundance response variable. The standard deviation for each factor is listed and is scaled to represent a fair comparison to the effect size of the fixed factors.

Response	Factor	Std. Dev.
Richness	Season	0.5464
	Trap:Plot:Block	0.4302
	Plot:Block	0.1318
	Block	0.1997

Family and num.lv selection for Gllvm

```
Call:
gllvm(y = y, family = poisson())
family:
[1] "poisson"
method:
[1] "VA"


log-likelihood:  -9301.279
Residual degrees of freedom:  32743
AIC:  19242.56
AICc:  19248.83
BIC:  21932.53
>  fit_ord <- gllvm(y, family = "negative.binomial")
>  fit_ord

Call:
gllvm(y = y, family = "negative.binomial")
family:
[1] "negative.binomial"
method:
[1] "VA"


log-likelihood:  -7846.125
Residual degrees of freedom:  32636
AIC:  16546.25
AICc:  16557.45
BIC:  20135.68
```

```
fitx1 <- gllvm(y = sp, X = env, family = "negative.binomial", num.lv = 1)
fitx2 <- gllvm(y = sp, X = env, family = "negative.binomial", num.lv = 2)
fitx3 <- gllvm(y = sp, X = env, family = "negative.binomial", num.lv = 3)

>   AIC(fitx1)
[1] 16150.89
>   AIC(fitx2)
[1] 16280.9
>   AIC(fitx3)
[1] 16602.67
```

Gllvm model selection. Assessment of the contribution of species traits by comparing model fits for trait-environment interaction models against models with only environmental predictors. To evaluate model performance, we conducted likelihood ratio tests (LRTs) using the `anova` function to compare the goodness of fit between nested generalized linear latent variable models (GLLVMs).

```
>  anova(gllvm1a, gllvm2a)
Model  1 :  y ~ BGT
Model  2 :  y ~ (BGT):(Diet + Wings + Body_Size + Larval_Substrate)
  Resid.Df        D Df.diff P.value
1    32737   0.0000       0
2    32719 143.5206      18       0
>  anova(gllvm1b, gllvm2b)
Model  1 :  y ~ VWC
Model  2 :  y ~ (VWC):(Diet + Wings + Body_Size + Larval_Substrate)
  Resid.Df        D Df.diff     P.value
1    32737  0.00000       0
2    32719 69.77604      18 4.93117e-08
>  anova(gllvm1c, gllvm2c)
Model  1 :  y ~ GWF
Model  2 :  y ~ (GWF):(Diet + Wings + Body_Size + Larval_Substrate)
```

```
  Resid.Df        D Df.diff    P.value
1    32737  0.00000       0
2    32719 60.31941      18 1.8166e-06
>  anova(gllvm1d, gllvm2d)
Model  1 :  y ~ MUL
Model  2 :  y ~ (MUL):(Diet + Wings + Body_Size + Larval_Substrate)
  Resid.Df        D Df.diff     P.value
1    32737  0.00000       0
2    32719 77.97844      18 1.93028e-09
```

Gllvm model selection. Alternative GLLVMs were developed using insights from GLMM outcomes, varying in their inclusion of environmental predictors (GWF, MUL, BGT, VWC) and their interactions with functional traits (diet, wing morphology, body size, and larval substrate). Seasonality was included as a random effect to account for pseudo replication. An AIC comparison was used to test which of the listed generalized linear mixed models best predicted the data.

```
gllvm null:  y ~ 1
gllvm01:  y ~ (GWF + MUL):(Diet + Wings + Body Size + Larval Substrate)
gllvm02:  y ~ (BGT + VWC):(Diet + Wings + Body Size + Larval Substrate)
gllvm03:  y ~ (GWF + BGT):(Diet + Wings + Body Size + Larval Substrate)
gllvm04:  y ~ (GWF + VWC):(Diet + Wings + Body Size + Larval Substrate)
gllvm05:  y ~ (MUL + BGT):(Diet + Wings + Body Size + Larval Substrate)
gllvm06:  y ~ (MUL + VWC):(Diet + Wings + Body Size + Larval Substrate)
gllvm07:  y ~ (GWF + BGT + VWC):(Diet + Wings + Body Size + Larval Substrate)
gllvm08:  y ~ (MUL + BGT + VWC):(Diet + Wings + Body Size + Larval Substrate)
gllvm09:  y ~ (GWF + MUL + BGT + VWC):(Diet + Wings + Body Size + Larval Substrate)


           df     AIC
gllvm09    401 15966.16
gllvm08    382 15983.01
gllvm04    363 15988.57
gllvm07    382 15989.61
gllvm05    363 16029.24
gllvm03    363 16029.97
gllvm02    363 16032.51
gllvm06    363 16130.33
gllvm01    363 16157.27
gllvm_null 322 16559.57

>  pseudo_R2 <- 1 - (gllvm09$logL / gllvm_null$logL)
>  pseudo_R2
[1] 0.04721206

>  summary(gllvm09)


Call:
gllvm(y = y, X = env, TR = TR, formula = y ~ (GWF + MUL + BGT +
    VWC):(Diet + Wings + Body_Size + Larval_Substrate), family = "negative.binomial",
    num.lv = 1, row.eff = "random", randomX = ~SEASON, seed = 123,
    control.start = list(n.init = 3, jitter.var = 0.01))


Family:  negative.binomial


AIC:  15966.16 AICc:  15976.03 BIC:  19337.03 LL:  -7582 df:  401


Informed LVs:  0
Constrained LVs:  0
Unconstrained LVs:  1


Formula:
~GWF:DietCOP+GWF:DietCOP+DET+GWF:DietDET+GWF:DietMYC+GWF:DietMYC+DET+GWF:DietPHY+GWF:DietPOL+GWF:
```

```
DietPRD+GWF:WingsDIM+GWF:WingsMAC+GWF:Body_Size+GWF:Larval_SubstrateDPL+GWF:Larval_SubstrateDPL+L
PL+GWF:Larval_SubstrateFRT+GWF:Larval_SubstrateLPL+GWF:Larval_SubstrateSOI+GWF:Larval_SubstrateSO
I+DNG+GWF:Larval_SubstrateSOI+DPL+GWF:Larval_SubstrateSOI+LPL+MUL:DietCOP+MUL:DietCOP+DET+MUL:Die
tDET+MUL:DietMYC+MUL:DietMYC+DET+MUL:DietPHY+MUL:DietPOL+MUL:DietPRD+MUL:WingsDIM+MUL:WingsMAC+MU
L:Body_Size+MUL:Larval_SubstrateDPL+MUL:Larval_SubstrateDPL+LPL+MUL:Larval_SubstrateFRT+MUL:Larva
l_SubstrateLPL+MUL:Larval_SubstrateSOI+MUL:Larval_SubstrateSOI+DNG+MUL:Larval_SubstrateSOI+DPL+MU
L:Larval_SubstrateSOI+LPL+BGT:DietCOP+BGT:DietCOP+DET+BGT:DietDET+BGT:DietMYC+BGT:DietMYC+DET+BGT
:DietPHY+BGT:DietPOL+BGT:DietPRD+BGT:WingsDIM+BGT:WingsMAC+BGT:Body_Size+BGT:Larval_SubstrateDPL+
BGT:Larval_SubstrateDPL+LPL+BGT:Larval_SubstrateFRT+BGT:Larval_SubstrateLPL+BGT:Larval_SubstrateS
OI+BGT:Larval_SubstrateSOI+DNG+BGT:Larval_SubstrateSOI+DPL+BGT:Larval_SubstrateSOI+LPL+VWC:DietCO
P+VWC:DietCOP+DET+VWC:DietDET+VWC:DietMYC+VWC:DietMYC+DET+VWC:DietPHY+VWC:DietPOL+VWC:DietPRD+VWC
:WingsDIM+VWC:WingsMAC+VWC:Body_Size+VWC:Larval_SubstrateDPL+VWC:Larval_SubstrateDPL+LPL+VWC:Larv
al_SubstrateFRT+VWC:Larval_SubstrateLPL+VWC:Larval_SubstrateSOI+VWC:Larval_SubstrateSOI+DNG+VWC:L
arval_SubstrateSOI+DPL+VWC:Larval_SubstrateSOI+LPL
LV formula:  ~ 0
Row effect:  ~(1 | site)


Random effects:
 Name     Variance Std.Dev Corr
 SEASONSP 0.3731   0.6108
 SEASONSU 0.0704   0.2653  -0.9955


Coefficients predictors:
                           Estimate Std. Error z value Pr(>|z|)
GWF:DietCOP                 0.36162    0.93675   0.386 0.699468
GWF:DietCOP+DET             0.46446    0.48269   0.962 0.335932
GWF:DietDET                 0.31025    0.56377   0.550 0.582104
GWF:DietMYC                 0.74134    0.63845   1.161 0.245579
GWF:DietMYC+DET            -0.15747    0.51865  -0.304 0.761416
GWF:DietPHY                 0.06659    0.62709   0.106 0.915431
GWF:DietPOL                 0.09468    0.61331   0.154 0.877310
GWF:DietPRD                -0.06633    0.56982  -0.116 0.907333
GWF:WingsDIM               -0.76556    0.47923  -1.597 0.110157
GWF:WingsMAC               -0.36467    0.23508  -1.551 0.120835
GWF:Body_Size               0.01310    0.08561   0.153 0.878341
GWF:Larval_SubstrateDPL     0.22035    0.44202   0.499 0.618119
GWF:Larval_SubstrateDPL+LPL -0.39108    0.89598  -0.436 0.662482
GWF:Larval_SubstrateFRT     0.18605    0.60748   0.306 0.759399
GWF:Larval_SubstrateLPL    -0.27952    0.55944  -0.500 0.617328
GWF:Larval_SubstrateSOI     0.43674    0.53395   0.818 0.413389
GWF:Larval_SubstrateSOI+DNG 3.97834    5.75542   0.691 0.489419
GWF:Larval_SubstrateSOI+DPL 0.45544    0.51396   0.886 0.375545
GWF:Larval_SubstrateSOI+LPL 14.82859   27.40944   0.541 0.588505
MUL:DietCOP                -2.03319    1.68319  -1.208 0.227071
MUL:DietCOP+DET            -0.22095    0.50858  -0.434 0.663972
MUL:DietDET                -0.50396    0.58200  -0.866 0.386543
MUL:DietMYC                -0.83004    0.68723  -1.208 0.227125
MUL:DietMYC+DET            -0.86097    0.53676  -1.604 0.108710
MUL:DietPHY                -0.66907    0.66528  -1.006 0.314564
MUL:DietPOL                -0.40323    0.64728  -0.623 0.533305
MUL:DietPRD                -1.02980    0.58898  -1.748 0.080385 .
MUL:WingsDIM                0.02008    0.54137   0.037 0.970411
MUL:WingsMAC               -0.10613    0.25730  -0.412 0.680004
MUL:Body_Size               0.06020    0.09100   0.662 0.508257
MUL:Larval_SubstrateDPL     0.63392    0.44533   1.423 0.154600
MUL:Larval_SubstrateDPL+LPL -0.25298    1.09712  -0.231 0.817634
MUL:Larval_SubstrateFRT     0.59162    0.63574   0.931 0.352059
MUL:Larval_SubstrateLPL     0.23416    0.58896   0.398 0.690941
MUL:Larval_SubstrateSOI     0.65540    0.54696   1.198 0.230819
MUL:Larval_SubstrateSOI+DNG 1.03856    4.97461   0.209 0.834627
MUL:Larval_SubstrateSOI+DPL 0.69266    0.52339   1.323 0.185698
MUL:Larval_SubstrateSOI+LPL 8.91151   15.48969   0.575 0.565076
BGT:DietCOP                 2.88157    1.12290   2.566 0.010282 *
BGT:DietCOP+DET             2.21027    0.63681   3.471 0.000519 ***
BGT:DietDET                 2.28648    0.70160   3.259 0.001118 **
BGT:DietMYC                 0.36539    0.74127   0.493 0.622068
BGT:DietMYC+DET             0.97228    0.67523   1.440 0.149891
BGT:DietPHY                 1.96137    0.75233   2.607 0.009132 **
```

```
BGT:DietPOL                   2.22391    0.72877   3.052 0.002276 **
BGT:DietPRD                   1.60175    0.70818   2.262 0.023711 *
BGT:WingsDIM                  0.95869    0.48811   1.964 0.049521 *
BGT:WingsMAC                 -0.13479    0.25858  -0.521 0.602172
BGT:Body_Size                -0.60399    0.11814  -5.113 3.18e-07 ***
BGT:Larval_SubstrateDPL      -0.83257    0.60986  -1.365 0.172195
BGT:Larval_SubstrateDPL+LPL   1.72582    2.55919   0.674 0.500080
BGT:Larval_SubstrateFRT      -0.27011    0.76122  -0.355 0.722711
BGT:Larval_SubstrateLPL      -1.53681    0.69586  -2.208 0.027210 *
BGT:Larval_SubstrateSOI      -1.02461    0.66254  -1.546 0.121985
BGT:Larval_SubstrateSOI+DNG 27.48474   24.94146   1.102 0.270475
BGT:Larval_SubstrateSOI+DPL -1.14035    0.67311  -1.694 0.090237 .
BGT:Larval_SubstrateSOI+LPL -2.37777    4.53057  -0.525 0.599703
VWC:DietCOP                  -0.75037    0.89218  -0.841 0.400323
VWC:DietCOP+DET              -0.12114    0.39288  -0.308 0.757824
VWC:DietDET                  -1.06204    0.46712  -2.274 0.022992 *
VWC:DietMYC                  -0.20719    0.55276  -0.375 0.707794
VWC:DietMYC+DET              -0.45443    0.42776  -1.062 0.288078
VWC:DietPHY                  -0.58371    0.54299  -1.075 0.282382
VWC:DietPOL                  -0.91952    0.52544  -1.750 0.080117 .
VWC:DietPRD                  -0.65925    0.47071  -1.401 0.161353
VWC:WingsDIM                  0.65323    0.45327   1.441 0.149546
VWC:WingsMAC                  0.17122    0.22591   0.758 0.448492
VWC:Body_Size                 0.24012    0.07658   3.135 0.001716 **
VWC:Larval_SubstrateDPL      -0.02012    0.33699  -0.060 0.952394
VWC:Larval_SubstrateDPL+LPL -0.29134    1.08685  -0.268 0.788656
VWC:Larval_SubstrateFRT      -0.77251    0.64278  -1.202 0.229430
VWC:Larval_SubstrateLPL       0.18609    0.46606   0.399 0.689676
VWC:Larval_SubstrateSOI       0.26434    0.43277   0.611 0.541326
VWC:Larval_SubstrateSOI+DNG   1.68010    3.09078   0.544 0.586728
VWC:Larval_SubstrateSOI+DPL   0.53391    0.40688   1.312 0.189450
VWC:Larval_SubstrateSOI+LPL -0.95516    4.33049  -0.221 0.825430
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Model selection for the FRic response variable. The GLMMs applied here follow the same structure as those used for the richness and abundance models. An AIC comparison was used to evaluate which of the listed models best predicted the data. Season was included as a random effect. The numerical covariates are scaled to represent a fair comparison to the effect size of the fixed factors.

```
AICc   dAICc  df weight
BD_GC2     -547.2    0.0 13 0.435
OM_GC2     -547.1    0.1 13 0.417
OM_GC_soil -544.5    2.7 22 0.110
BD_GC_soil -540.5    6.8 21 0.015
BD_GC3     -540.0    7.2 19 0.012
OM_GC3     -540.0    7.3 19 0.012
BD_GC1     -513.5   33.7 14 <0.001
OM_GC1     -512.2   35.0 14 <0.001
OM_full    -504.7   42.6 40 <0.001
BD_full    -499.6   47.7 39 <0.001
BD_chem    -484.1   63.1 8  <0.001
OM_chem    -480.7   66.5 7  <0.001
OM_veg     -470.6   76.7 27 <0.001
OM_phys    -469.5   77.7 6  <0.001
BD_veg     -469.2   78.0 27 <0.001
BD_weather -467.8   79.4 8  <0.001
OM_weather -464.1   83.1 8  <0.001
null       -439.5  107.7 2  <0.00

> summary(BD_GC2)
 Family: beta  ( logit )
Formula:          FRic ~ sBD + fR + fMUL + sBGT + sVWC + I(sVWC^2) + (1 | fSEASON)
Data: Sunbridge
```

```
AIC      BIC   logLik deviance df.resid
  -548.8   -503.3    287.4   -574.8      232

Random effects:

Conditional model:
 Groups  Name        Variance  Std.Dev.
 fSEASON (Intercept) 1.256e-10 1.121e-05
Number of obs: 245, groups:  fSEASON, 3

Dispersion parameter for beta family (): 17.1

Conditional model:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.35495    0.07307 -18.543  < 2e-16 ***
sBD         -0.02012    0.04153  -0.485  0.62797
fR1         -0.15492    0.08115  -1.909  0.05625 .
fMUL2       -0.16845    0.11515  -1.463  0.14350
fMUL3       -0.34164    0.12894  -2.650  0.00806 **
fMUL4       -0.34911    0.12135  -2.877  0.00402 **
fMUL5       -0.53252    0.21171  -2.515  0.01189 *
fMUL6       -1.62044    0.24592  -6.589 4.42e-11 ***
sBGT         0.30596    0.04753   6.438 1.21e-10 ***
sVWC         0.05553    0.06611   0.840  0.40096
I(sVWC^2)   -0.08864    0.03080  -2.878  0.00400 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> r.squaredGLMM(BD_GC2)
          R2m      R2c
[1,] 0.513175 0.513175
```

Model selection for the FEve response variable. The GLMMs applied here follow the same structure as those used for the richness and abundance models. An AIC comparison was used to evaluate which of the listed models best predicted the data. Season was included as a random effect. The numerical covariates are scaled to represent a fair comparison to the effect size of the fixed factors.

```
AICc   dAICc  df weight
BD_weather -259.2    0.0 8  0.3413
OM_weather -258.8    0.4 8  0.2760
OM_chem    -257.6    1.5 7  0.1579
BD_chem    -256.1    3.1 8  0.0739
OM_GC2     -255.2    4.0 13 0.0469
BD_GC2     -254.9    4.2 13 0.0410
OM_GC1     -253.2    6.0 14 0.0170
BD_GC1     -252.8    6.3 14 0.0143
OM_GC_soil -252.5    6.7 22 0.0118
BD_GC_soil -251.2    8.0 21 0.0064
OM_GC3     -250.9    8.3 19 0.0054
OM_phys    -250.4    8.8 6  0.0042
BD_GC3     -250.1    9.0 19 0.0037
OM_veg     -232.4   26.8 27 <0.001
BD_veg     -232.0   27.2 27 <0.001
OM_full    -231.2   28.0 40 <0.001
BD_full    -228.8   30.4 39 <0.001
null       -224.0   35.2 2  <0.001

> summary(BD_weather)
 Family: beta  ( logit )
Formula:          FEve ~ sBD + fR + sPRCP + sTMIN + sTMAX + (1 | fSEASON)
Data: Sunbridge

     AIC      BIC   logLik deviance df.resid
  -259.8   -231.8    137.9   -275.8      237

Random effects:

Conditional model:
 Groups  Name        Variance  Std.Dev.
 fSEASON (Intercept) 4.752e-11 6.894e-06
Number of obs: 245, groups:  fSEASON, 3
```

```
Dispersion parameter for beta family (): 9.76

Conditional model:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  0.756102   0.061776  12.239   <2e-16 ***
sBD          0.026613   0.040704   0.654   0.5132
fR1         -0.000594   0.082594  -0.007   0.9943
sPRCP       -0.154561   0.065534  -2.358   0.0184 *
sTMIN       -0.193747   0.095716  -2.024   0.0430 *
sTMAX        0.024615   0.097364   0.253   0.8004
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> r.squaredGLMM(BD_weather)
          R2m       R2c
[1,] 0.6784597 0.6784597
```

Model selection for the FDiv response variable. The GLMMs applied here follow the same structure as those used for the richness and abundance models. An AIC comparison was used to evaluate which of the listed models best predicted the data. Season was included as a random effect. The numerical covariates are scaled to represent a fair comparison to the effect size of the fixed factors.

```
 AICc   dAICc  df weight
OM_weather -495.4    0.0 8  0.4831
BD_weather -495.2    0.3 8  0.4245
OM_chem    -491.0    4.5 7  0.0518
BD_chem    -488.8    6.6 8  0.0178
BD_GC2     -487.6    7.8 13 0.0096
OM_GC2     -487.2    8.2 13 0.0080
OM_phys    -485.7    9.8 6  0.0036
BD_GC_soil -482.9   12.5 21 <0.001
OM_GC_soil -481.5   13.9 22 <0.001
BD_GC3     -478.8   16.6 19 <0.001
OM_GC3     -478.5   16.9 19 <0.001
BD_GC1     -477.1   18.4 14 <0.001
OM_GC1     -476.7   18.8 14 <0.001
BD_full    -470.5   25.0 39 <0.001
OM_full    -467.7   27.8 40 <0.001
OM_veg     -464.6   30.8 27 <0.001
BD_veg     -463.1   32.3 27 <0.001
null       -417.2   78.2 2  <0.001

> summary(OM_weather)
 Family: beta  ( logit )
Formula:          FDiv ~ sOM + fR + sPRCP + sTMIN + sTMAX + (1 | fSEASON)
Data: Sunbridge

     AIC      BIC   logLik deviance df.resid
  -496.1   -468.0    256.0   -512.1      237

Random effects:

Conditional model:
 Groups  Name        Variance  Std.Dev.
 fSEASON (Intercept) 2.701e-10 1.644e-05
Number of obs: 245, groups:  fSEASON, 3

Dispersion parameter for beta family (): 14.7

Conditional model:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.54100    0.06144  25.081  < 2e-16 ***
sOM         -0.05011    0.04055  -1.236 0.216527
fR1         -0.06434    0.08171  -0.787 0.431029
sPRCP        0.26126    0.06612   3.951 7.77e-05 ***
sTMIN       -0.17719    0.08813  -2.010 0.044379 *
sTMAX        0.32014    0.09167   3.492 0.000479 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> r.squaredGLMM(OM_weather)
          R2m      R2c
[1,] 0.922343 0.922343
```