Appendix. Data tables for Chapter 2

Table 1. Visitation rates for flying visitors, standardized in different ways. Mean ± SD/SE (range). n = 235

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Shrub |  |  |  | Open |  |
|  | Visits/hour | Fl/hour | Visits/flr/hour | Fls/flr/hour | Visits/hour | Fl/hour | Visits/flr/hour | Flrs/fl/hour |
| Pre | 3.00 ± 3.13/0.41 (0 – 19.62) | 3.78 ± 4.74/0.62 (0 – 31.40) | 0.35 ± 0.32/0.04 (0 – 1.66) | 0.43 ± 0.47/0.06 (0 – 2.61) | 4.29 ± 4.62/0.61 (0 – 20.10) | 5.76 ± 7.55/1.00 (0 - 40.21) | 0.50 ± 0.58/0.08 (0 – 3.35) | 0.67 ± 1.01/0.13 (0 – 6.70) |
| Post | 0.95 ± 1.27/0.16 (0 – 5.80) | 1.27 ± 2.05/0.26 (0 – 9.37) | 0.10 ± 0.13/0.02 (0 – 0.64) | 0.13 ± 0.20/0.03 (0 – 1.02) | 1.25 ± 1.38/0.18 (0 – 5.49) | 1.72 ± 2.22/0.29 (0 – 11.49) | 0.13 ± 0.14/0.02 (0 – 0.69) | 0.16 ± 0.20/0.03 (0 – 0.77) |
| Total (pre + post) | 1.96 ± 2.59/0.23 (0 – 19.62) | 2.51 ± 3.84/0.35 (0 – 31.40) | 0.22 ± 0.28/0.03 (0 – 1.66) | 0.28 ± 0.39/0.04 (0 – 2.61) | 2.75 ± 3.70/0.34 (0 – 20.10) | 3.71 ± 5.86/0.54 (0 – 40.21) | 0.31 ± 0.46/0.04 (0 – 3.35) | 0.41 ± 0.76/0.07 (0 – 6.70) |
| Total (shrub + open) | Pre: 3.64 ± 3.97/0.37 (0 - 20.10) | Pre: 4.75 ± 6.33/0.59 (0 – 40.21) | Pre: 0.42 ± 0.47/0 .04 (0 - 3.35) | Pre: 0.55 ± 0.79/0.07 (0 – 6.70) | Post: 1.10 ± 1.33/0.12 (0 – 5.80) | Post: 1.49 ± 2.14/ 0.20 (0 – 11.49) | Post: 0.11 ± 0.14/0.01 (0 – 0.69) | Post: 0.15 ± 0.20/0.02 (0 – 1.02) |

Table 2. Visitation rates for all visitors, standardized in different ways. Total visits/Mean ± SD/SE (range)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Shrub |  |  |  | Open |  |
|  | Visits/hour | Fl/hour | Visits/flr/hour | Fls/flr/hour | Visits/hour | Fl/hour | Visits/flr/hour | Flrs/fl/hour |
| Pre | 4.47 ± 3.52/0.46 (0 – 20.61) | 5.27 ± 4.87/0.63 (0 – 32.38) | 0.54 ± 0.43/0.06 (0 – 2.14) | 0.63 ± 0.53/0.017 (0 – 2.70) | 6.34 ± 5.94/0.79 (0 – 23.97) | 7.84 ± 8.31/1.10 (0 – 43.93) | 0.73 ± 0.73/0.10 (0 – 3.97) | 0.91 ± 1.11/0.15 (0 – 7.32) |
| Post | 2.07 ± 2.98/0.38 (0 – 16.69) | 2.40 ± 3.49/0.45 (0 – 16.69) | 0.21 ± 0.33/0.04 (0 – 2.09) | 0.24 ± 0.38/0.05 (0 – 2.07) | 2.61 ± 3.19/0.42 (0 – 17.85) | 3.25 ± 3.88/0.50 (0 – 17.85) | 0.26 ± 0.36/0.05 (0 – 2.23) | 0.31 ± 0.40/0.05 (0 – 2.23) |
| Total (pre + post) | 3.26 ± 3.46/0.32 (0 – 20.61) | 3.82 ± 4.45/0.41 (0 – 32.38) | 0.37 ± 0.42/0.04 (0 – 2.14) | 0.43 ± 0.49/0.05 (0 – 2.67) | 4.45 ± 5.08/0.47 (0 – 23.97) | 5.50 ± 6.82/0.63(0 – 43.93) | 0.49 ± 0.62/0.06 (0 – 3.97) | 0.61 ± 0.87/0.08 (0 – 7.32) |
| Total (shrub + open) | Pre: 5.39 ± 4.93/0.49 (0 – 23.97) | Pre: 6.53 ± 6.87/0.64 (0 – 43.93) | Pre: 0.63 ± 0.60/0.06 (0 – 3.97) | Pre: 0.77 ± 0.87/0.08 (0 – 7.32) | Post: 2.34 ± 3.08/0.28 (0 – 17.85) | Pre: 2.82 ± 3.69/0.34 (0 – 17.85) | Pre: 0.24 ± 0.35/0.03 (0 – 2.23) | Post: 0.28 ± 0.39/0.04 (0 – 2.23) |

Table 3: Number of flowers in pots

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| treatment | flowering | mean | sd | se | min | max |
| open | bloom | 10.49153 | 3.212974 | 0.418294 | 6 | 21 |
| open | pre | 9.508772 | 2.77825 | 0.367988 | 5 | 18 |
| shrub | bloom | 10.48333 | 3.186261 | 0.411345 | 6 | 21 |
| shrub | pre | 9.338983 | 2.623568 | 0.341559 | 5 | 16 |

Table 4: Shrub sizes (cm)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | mean | sd | se | min | max |
| Width | 336.67 | 103.09 | Na right now | 148 | 552 |
| Height | 209.46 | 45.39 |  | 115 | 340 |
| Volume |  |  |  |  |  |

Table 5: Results from negative binomial mixed effects model, null model and comparison of models.

Generalized linear mixed model fit by maximum likelihood (Laplace

Approximation) [glmerMod]

Family: Negative Binomial(3.7999) ( log )

Formula: percent.cover ~ treatment + blooming + (1 | repID)

Data: metadata

AIC BIC logLik deviance df.resid

1553.9 1571.1 -772.0 1543.9 223

Scaled residuals:

Min 1Q Median 3Q Max

-1.5609 -0.6787 -0.2420 0.4861 4.2883

Random effects:

Groups Name Variance Std.Dev.

repID (Intercept) 0.1616 0.402

Number of obs: 228, groups: repID, 126

Fixed effects:

Estimate Std. Error z value Pr(>|z|)

(Intercept) 1.15132 0.10182 11.307 < 2e-16 \*\*\*

treatmentshrub 2.14420 0.11424 18.770 < 2e-16 \*\*\*

bloomingpre 0.28083 0.08482 3.311 0.00093 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) trtmnt

tretmntshrb -0.713

bloomingpre -0.474 0.105

Table 5: For understory annual richness

Generalized linear mixed model fit by maximum likelihood (Laplace

Approximation) [glmerMod]

Family: poisson ( log )

Formula: understory.richness ~ treatment + flowering + (1 | repID)

Data: visits

AIC BIC logLik deviance df.resid

707.6 721.3 -349.8 699.6 227

Scaled residuals:

Min 1Q Median 3Q Max

-1.51239 -0.28764 -0.08821 0.47124 1.62890

Random effects:

Groups Name Variance Std.Dev.

repID (Intercept) 0 0

Number of obs: 231, groups: repID, 122

Fixed effects:

Estimate Std. Error z value Pr(>|z|)

(Intercept) 0.75551 0.07700 9.811 <2e-16 \*\*\*

treatmentshrub 0.07186 0.08546 0.841 0.4

floweringpre 0.14068 0.08560 1.643 0.1

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) trtmnt

tretmntshrb -0.580

floweringpr -0.595 -0.004

Table 1: Main results for all flying visitors.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total flower visits | | | Plant visits | | | Proportion of flowers visited | | | Visit Duration | | |
|  | **Coeff** | **χ2** | **p** | **Coeff** | **χ2** | **p** |  |  |  | **Coeff** | **χ2** | **p** |
| Microsite (shrub) | -0.3493 | 4.4979 | **0.03396** | -0.3258 | 5.1183 | **0.0237** |  |  |  | -0.047260 | NA | 0.829 |
| Blooming (bloom) | -1.2473 | 61.52 | **<0.0001** | -1.2513 | 76.883 | **<0.0001** |  |  |  | -0.777931 | 24.4 | <0.0001 |
| Flowers.pot | 0.0694 | 6.9013 | **0.0086** | 0.0474 | 4.1109 | **0.0426** |  |  |  | 0.006253 | NA | 0.829 |
| Microsite \* Blooming | NA | NA | NA | NA | NA | NA |  |  |  | NA | NA | NA |

Comparison of random intercept model, additive and interaction models for total flower visits.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Model | DF | AIC | BIC | Chisq | P > Chisq |
| Null | 4 | 1164.8 | 1178.6 |  |  |
| Additive | 6 | 1111.6 | 1132.3 | 57.1788 | <0.00001 |
| Interaction term | 7 | 1113.6 | 1137.8 | 0.0322 | 0.8576 |

Rejected models containing interaction terms:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total flower visits | | | Plant visits | | | Proportion of flowers visited | | | Visit Duration | | |
|  | **Coeff** | **χ2** | **p** | **Coeff** | **χ2** | **p** |  |  |  | **Coeff** | **χ2** | **p** |
| Microsite (shrub) | -0.3752 | **2.964** | **0.08512** | -0.33984 | 3.3532 | **0.067076** |  |  |  |  |  |  |
| Blooming (bloom) | -1.27421 | 34.0384 | **<0.00001** | -1.26759 | 42.7007 | **<0.00001** |  |  |  |  |  |  |
| Flowers.pot | 0.06938 | 6.9100 | **0.00857** | 0.04735 | 4.1287 | **0.042161** |  |  |  |  |  |  |
| Microsite \* Blooming | 0.05608 | 0.0324 | 0.85707 | 0.03522 | 0.0160 | 0.899375 |  |  |  |  |  |  |

Total visits model comparison

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Model | DF | AIC | BIC | Chisq | P > Chisq |
| Null | 4 | 1066.0 | 1079.8 |  |  |
| Additive | 6 | 1000.7 | 1021.5 | 69.2940 | <0.00001 |
| Interaction term | 7 | 1002.7 | 1026.9 | 0.0072 | 0.9326 |

For hypothesis testing:

Null models are random intercept + flowers in the pot

Variance function:

Structure: fixed weights

Formula: ~invwt

Fixed effects: total.flowers ~ flowering + rtu \* treatment + offset(log(dec.Length))

Value Std.Error DF t-value p-value

(Intercept) -0.389561 0.24 1277 -1.630779 0.1032

floweringbloom -1.164789 0.14 1277 -8.383796 0.0000

rtubombylid -0.405465 0.35 1277 -1.159210 0.2466

rtuhoneybee -26.672531 83088.62 1277 -0.000321 0.9997

rtulep -1.280934 0.47 1277 -2.699769 0.0070

rtuother 0.567521 0.28 1277 2.049444 0.0406

rtusyrphid 1.396657 0.25 1277 5.652776 0.0000

treatmentshrub -0.780113 0.42 120 -1.863456 0.0648

rtubombylid:treatmentshrub 0.582396 0.58 1277 1.011929 0.3118

rtuhoneybee:treatmentshrub 25.541129 83088.62 1277 0.000307 0.9998

rtulep:treatmentshrub 0.331853 0.80 1277 0.417302 0.6765

rtuother:treatmentshrub 0.623465 0.47 1277 1.314708 0.1888

rtusyrphid:treatmentshrub 0.334142 0.44 1277 0.756989 0.4492

Correlation:

(Intr) flwrng rtbmby rthnyb rtulep rtuthr rtsyrp trtmnt rtbmb: rthny:

floweringbloom -0.167

rtubombylid -0.586 0.000

rtuhoneybee 0.000 0.000 0.000

rtulep -0.432 0.000 0.295 0.000

rtuother -0.740 0.000 0.505 0.000 0.372

rtusyrphid -0.829 0.000 0.566 0.000 0.417 0.715

treatmentshrub -0.554 -0.002 0.334 0.000 0.246 0.422 0.473

rtubombylid:treatmentshrub 0.356 0.000 -0.608 0.000 -0.179 -0.307 -0.344 -0.675

rtuhoneybee:treatmentshrub 0.000 0.000 0.000 -1.000 0.000 0.000 0.000 0.000 0.000

rtulep:treatmentshrub 0.258 0.000 -0.176 0.000 -0.597 -0.222 -0.249 -0.488 0.355 0.000

rtuother:treatmentshrub 0.432 0.000 -0.295 0.000 -0.218 -0.584 -0.418 -0.819 0.596 0.000

rtusyrphid:treatmentshrub 0.464 0.000 -0.317 0.000 -0.234 -0.400 -0.560 -0.880 0.640 0.000

rtlp:t rtthr:

floweringbloom

rtubombylid

rtuhoneybee

rtulep

rtuother

rtusyrphid

treatmentshrub

rtubombylid:treatmentshrub

rtuhoneybee:treatmentshrub

rtulep:treatmentshrub

rtuother:treatmentshrub 0.431

rtusyrphid:treatmentshrub 0.463 0.777

Standardized Within-Group Residuals:

Min Q1 Med Q3 Max

-2.16877081 -0.38136380 -0.21733495 -0.09492873 12.99433800

Number of Observations: 1410

Number of Groups: 122

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Total flower visits | | | Plant visits | | |
|  | **Coeff** | **χ2** | **p** | **Coeff** | **χ2** | **p** |
| Microsite (shrub) | -0.337480 | 4.1903 | 0.040655 | -0.311383 | 4.6322 | **0.03137** |
| Blooming (bloom) | -1.729417 | 15.4730 | < 0.0001 | -1.683054 | 12.2157 | **0.0004739** |
| RTU | NA | 197.0575 | <0.0001 | NA | 217.5031 | **<0.00001** |
| Flowers.pot | 0.064325 | 7.8743 | 0.005014 | 0.042763 | 4.0741 | **0.4354** |
| RTU\*blooming | NA | 70.0222 | <0.0001 | NA | 70.35 | <0.0001 |

Posthoc (lsmeans, Tukey method for multiple comparisons) of interaction term in Quasipoisson model, flower visits.

|  |
| --- |
| **pre,bee - bloom,bee** 1.72941690 4.418547e-01 1276 3.914 **0.0054** |
| pre,bee - pre,bombylid 0.80792270 3.489781e-01 1276 2.315 0.4662 |
| pre,bee - bloom,bombylid 0.85394816 3.230044e-01 1276 2.644 0.2564 |
| pre,bee - pre,honeybee 2.11625551 5.909488e-01 1276 3.581 0.0183 |
| pre,bee - bloom,honeybee 27.11314567 7.783803e+04 1276 0.000 1.0000 |
| pre,bee - pre,lep 3.72569343 1.263289e+00 1276 2.949 0.1253 |
| pre,bee - bloom,lep 1.32395179 3.785374e-01 1276 3.498 0.0244 |
| pre,bee - pre,other -0.14550758 2.646058e-01 1276 -0.550 1.0000 |
| pre,bee - bloom,other -0.16519996 2.506680e-01 1276 -0.659 1.0000 |
| pre,bee - pre,syrphid -1.66337830 2.113441e-01 1276 -7.870 <.0001 |
| pre,bee - bloom,syrphid 1.39294466 3.882155e-01 1276 3.588 0.0179 |
| bloom,bee - pre,bombylid -0.92149420 4.918537e-01 1276 -1.874 0.7756 |
| bloom,bee - bloom,bombylid -0.87546874 4.698576e-01 1276 -1.863 0.7818 |
| bloom,bee - pre,honeybee 0.38683862 6.850948e-01 1276 0.565 1.0000 |
| bloom,bee - bloom,honeybee 25.38372877 7.783803e+04 1276 0.000 1.0000 |
| bloom,bee - pre,lep 1.99627653 1.309975e+00 1276 1.524 0.9340 |
| bloom,bee - bloom,lep -0.40546511 5.096321e-01 1276 -0.796 0.9997 |
| bloom,bee - pre,other -1.87492448 4.360626e-01 1276 -4.300 0.0011 |
| bloom,bee - bloom,other -1.89461685 4.234014e-01 1276 -4.475 0.0005 |
| bloom,bee - pre,syrphid -3.39279520 4.059565e-01 1276 -8.358 <.0001 |
| bloom,bee - bloom,syrphid -0.33647224 5.168613e-01 1276 -0.651 1.0000 |
| **pre,bombylid - bloom,bombylid** 0.04602546 3.886082e-01 1276 0.118 1.0000 |
| pre,bombylid - pre,honeybee 1.30833282 6.292098e-01 1276 2.079 0.6378 |
| pre,bombylid - bloom,honeybee 26.30522298 7.783803e+04 1276 0.000 1.0000 |
| pre,bombylid - pre,lep 2.91777073 1.281634e+00 1276 2.277 0.4940 |
| pre,bombylid - bloom,lep 0.51602909 4.358613e-01 1276 1.184 0.9901 |
| pre,bombylid - pre,other -0.95343028 3.416149e-01 1276 -2.791 0.1850 |
| pre,bombylid - bloom,other -0.97312265 3.309365e-01 1276 -2.941 0.1281 |
| pre,bombylid - pre,syrphid -2.47130100 3.022430e-01 1276 -8.177 <.0001 |
| pre,bombylid - bloom,syrphid 0.58502197 4.442925e-01 1276 1.317 0.9770 |
| bloom,bombylid - pre,honeybee 1.26230736 6.151838e-01 1276 2.052 0.6573 |
| bloom,bombylid - bloom,honeybee 26.25919751 7.783803e+04 1276 0.000 1.0000 |
| bloom,bombylid - pre,lep 2.87174527 1.274806e+00 1276 2.253 0.5113 |
| bloom,bombylid - bloom,lep 0.47000363 4.108786e-01 1276 1.144 0.9926 |
| bloom,bombylid - pre,other -0.99945574 3.150347e-01 1276 -3.173 0.0677 |
| bloom,bombylid - bloom,other -1.01914812 2.972626e-01 1276 -3.428 0.0307 |
| bloom,bombylid - pre,syrphid -2.51732646 2.718400e-01 1276 -9.260 <.0001 |
| bloom,bombylid - bloom,syrphid 0.53899650 4.198118e-01 1276 1.284 0.9811 |
| **pre,honeybee - bloom,honeybee** 24.99689016 7.783803e+04 1276 0.000 1.0000 |
| pre,honeybee - pre,lep 1.60943791 1.367487e+00 1276 1.177 0.9906 |
| pre,honeybee - bloom,lep -0.79230373 6.460727e-01 1276 -1.226 0.9869 |
| pre,honeybee - pre,other -2.26176310 5.866306e-01 1276 -3.856 0.0068 |
| pre,honeybee - bloom,other -2.28145547 5.804772e-01 1276 -3.930 0.0051 |
| pre,honeybee - pre,syrphid -3.77963382 5.646111e-01 1276 -6.694 <.0001 |
| pre,honeybee - bloom,syrphid -0.72331085 6.517903e-01 1276 -1.110 0.9943 |
| bloom,honeybee - pre,lep -23.38745224 7.783803e+04 1276 0.000 1.0000 |
| bloom,honeybee - bloom,lep -25.78919388 7.783803e+04 1276 0.000 1.0000 |
| bloom,honeybee - pre,other -27.25865326 7.783803e+04 1276 0.000 1.0000 |
| bloom,honeybee - bloom,other -27.27834563 7.783803e+04 1276 0.000 1.0000 |
| bloom,honeybee - pre,syrphid -28.77652397 7.783803e+04 1276 0.000 1.0000 |
| bloom,honeybee - bloom,syrphid -25.72020101 7.783803e+04 1276 0.000 1.0000 |
| **pre,lep - bloom,lep** -2.40174164 1.289996e+00 1276 -1.862 0.7827 |
| pre,lep - pre,other -3.87120101 1.261275e+00 1276 -3.069 0.0908 |
| pre,lep - bloom,other -3.89089338 1.258425e+00 1276 -3.092 0.0853 |
| pre,lep - pre,syrphid -5.38907173 1.251186e+00 1276 -4.307 0.0011 |
| pre,lep - bloom,syrphid -2.33274877 1.292869e+00 1276 -1.804 0.8157 |
| bloom,lep - pre,other -1.46945937 3.717601e-01 1276 -3.953 0.0046 |
| bloom,lep - bloom,other -1.48915175 3.568246e-01 1276 -4.173 0.0019 |
| bloom,lep - pre,syrphid -2.98733009 3.359401e-01 1276 -8.892 <.0001 |
| bloom,lep - bloom,syrphid 0.06899287 4.638972e-01 1276 0.149 1.0000 |
| **pre,other - bloom,other** -0.01969237 2.403112e-01 1276 -0.082 1.0000 |
| pre,other - pre,syrphid -1.51787072 1.989507e-01 1276 -7.629 <.0001 |
| pre,other - bloom,syrphid 1.53845224 3.816101e-01 1276 4.031 0.0034 |
| bloom,other - pre,syrphid -1.49817834 1.799989e-01 1276 -8.323 <.0001 |
| bloom,other - bloom,syrphid 1.55814462 3.670756e-01 1276 4.245 0.0014 |
| **pre,syrphid - bloom,syrphid** 3.05632296 3.468089e-01 1276 8.813 **<.0001** |
|  |

Full model for flower visits, output from Wald’s Type 3 test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Chisq | Df | P |  |
| Flowering | 16.3114 | 1 | <0.0001 |  |
| Rtu | 121.6832 | 5 | <0.0001 |  |
| Treatment | 6.7008 | 1 | 0.009637 |  |
| Flowers.pot | 9.4194 | 1 | 0.002147 |  |
| Flowering:rtu | 56.9111 | 5 | <0.0001 |  |
| Flowering:treatment | 3.6394 | 1 | 0.056426 |  |
| Rtu:treatment | 5.4996 | 5 | 0.357984 |  |
| Flowering:rtu:treatment | 7.5190 | 5 | 0.184812 |  |
|  |  |  |  |  |
|  |  |  |  |  |

Full model for plant visits

flowering 11.2812 1 0.0007829 \*\*\*

rtu 131.3404 5 < 2.2e-16 \*\*\*

treatment 3.6569 1 0.0558390 .

flowers.pot 4.5640 1 0.0326507 \*

flowering:rtu 53.0033 5 3.358e-10 \*\*\*

flowering:treatment 2.3436 1 0.1258002

rtu:treatment 3.8289 5 0.5743031

flowering:rtu:treatment 4.1995 5 0.5210663

All contrasts for plant? visits

|  |
| --- |
| $contrasts |
| contrast estimate SE df t.ratio p.value |
| **pre,bee - bloom,bee** 1.6830539 4.839527e-01 1276 3.478 0.0261 |
| pre,bee - pre,bombylid 0.2513144 3.234185e-01 1276 0.777 0.9998 |
| pre,bee - bloom,bombylid 0.6469619 3.367936e-01 1276 1.921 0.7461 |
| pre,bee - pre,honeybee 2.1972246 6.764783e-01 1276 3.248 0.0541 |
| pre,bee - bloom,honeybee 26.5321484 6.530236e+04 1276 0.000 1.0000 |
| pre,bee - pre,lep 3.1135153 1.037022e+00 1276 3.002 0.1089 |
| pre,bee - bloom,lep 1.0364267 3.808712e-01 1276 2.721 0.2169 |
| pre,bee - pre,other -0.7259370 2.605865e-01 1276 -2.786 0.1872 |
| pre,bee - bloom,other -0.5918797 2.573842e-01 1276 -2.300 0.4773 |
| pre,bee - pre,syrphid -1.9863511 2.281242e-01 1276 -8.707 <.0001 |
| pre,bee - bloom,syrphid 1.1365101 3.941893e-01 1276 2.883 0.1481 |
| bloom,bee - pre,bombylid -1.4317394 4.972777e-01 1276 -2.879 0.1496 |
| bloom,bee - bloom,bombylid -1.0360919 5.036254e-01 1276 -2.057 0.6535 |
| bloom,bee - pre,honeybee 0.5141707 7.747958e-01 1276 0.664 1.0000 |
| bloom,bee - bloom,honeybee 24.8490945 6.530236e+04 1276 0.000 1.0000 |
| bloom,bee - pre,lep 1.4304615 1.103675e+00 1276 1.296 0.9797 |
| bloom,bee - bloom,lep -0.6466272 5.341081e-01 1276 -1.211 0.9882 |
| bloom,bee - pre,other -2.4089909 4.589019e-01 1276 -5.249 <.0001 |
| bloom,bee - bloom,other -2.2749336 4.543734e-01 1276 -5.007 <.0001 |
| bloom,bee - pre,syrphid -3.6694050 4.412780e-01 1276 -8.315 <.0001 |
| bloom,bee - bloom,syrphid -0.5465437 5.436853e-01 1276 -1.005 0.9976 |
| **pre,bombylid - bloom,bombylid** 0.3956475 3.556753e-01 1276 1.112 0.9942 |
| pre,bombylid - pre,honeybee 1.9459101 6.860742e-01 1276 2.836 0.1661 |
| pre,bombylid - bloom,honeybee 26.2808340 6.530236e+04 1276 0.000 1.0000 |
| pre,bombylid - pre,lep 2.8622009 1.043307e+00 1276 2.743 0.2063 |
| pre,bombylid - bloom,lep 0.7851123 3.976655e-01 1276 1.974 0.7110 |
| pre,bombylid - pre,other -0.9772514 2.845703e-01 1276 -3.434 0.0301 |
| pre,bombylid - bloom,other -0.8431941 2.816409e-01 1276 -2.994 0.1114 |
| pre,bombylid - pre,syrphid -2.2376655 2.551776e-01 1276 -8.769 <.0001 |
| pre,bombylid - bloom,syrphid 0.8851957 4.104390e-01 1276 2.157 0.5816 |
| bloom,bombylid - pre,honeybee 1.5502627 6.924798e-01 1276 2.239 0.5216 |
| bloom,bombylid - bloom,honeybee 25.8851865 6.530236e+04 1276 0.000 1.0000 |
| bloom,bombylid - pre,lep 2.4665534 1.047530e+00 1276 2.355 0.4382 |
| bloom,bombylid - bloom,lep 0.3894648 4.055751e-01 1276 0.960 0.9984 |
| bloom,bombylid - pre,other -1.3728989 2.996844e-01 1276 -4.581 0.0003 |
| bloom,bombylid - bloom,other -1.2388416 2.927028e-01 1276 -4.232 0.0015 |
| bloom,bombylid - pre,syrphid -2.6333130 2.719302e-01 1276 -9.684 <.0001 |
| bloom,bombylid - bloom,syrphid 0.4895482 4.181071e-01 1276 1.171 0.9910 |
| **pre,honeybee - bloom,honeybee** 24.3349238 6.530236e+04 1276 0.000 1.0000 |
| pre,honeybee - pre,lep 0.9162907 1.200630e+00 1276 0.763 0.9998 |
| pre,honeybee - bloom,lep -1.1607979 7.149554e-01 1276 -1.624 0.9004 |
| pre,honeybee - pre,other -2.9231616 6.587896e-01 1276 -4.437 0.0006 |
| pre,honeybee - bloom,other -2.7891043 6.575295e-01 1276 -4.242 0.0014 |
| pre,honeybee - pre,syrphid -4.1835757 6.466367e-01 1276 -6.470 <.0001 |
| pre,honeybee - bloom,syrphid -1.0607144 7.221382e-01 1276 -1.469 0.9487 |
| bloom,honeybee - pre,lep -23.4186331 6.530236e+04 1276 0.000 1.0000 |
| bloom,honeybee - bloom,lep -25.4957217 6.530236e+04 1276 0.000 1.0000 |
| bloom,honeybee - pre,other -27.2580854 6.530236e+04 1276 0.000 1.0000 |
| bloom,honeybee - bloom,other -27.1240281 6.530236e+04 1276 0.000 1.0000 |
| bloom,honeybee - pre,syrphid -28.5184995 6.530236e+04 1276 0.000 1.0000 |
| bloom,honeybee - bloom,syrphid -25.3956382 6.530236e+04 1276 0.000 1.0000 |
| **pre,lep - bloom,lep** -2.0770886 1.062522e+00 1276 -1.955 0.7240 |
| pre,lep - pre,other -3.8394523 1.025570e+00 1276 -3.744 0.0103 |
| pre,lep - bloom,other -3.7053950 1.024761e+00 1276 -3.616 0.0162 |
| pre,lep - pre,syrphid -5.0998664 1.017806e+00 1276 -5.011 <.0001 |
| pre,lep - bloom,syrphid -1.9770052 1.067368e+00 1276 -1.852 0.7884 |
| bloom,lep - pre,other -1.7623637 3.484876e-01 1276 -5.057 <.0001 |
| bloom,lep - bloom,other -1.6283064 3.425024e-01 1276 -4.754 0.0001 |
| bloom,lep - pre,syrphid -3.0227778 3.249291e-01 1276 -9.303 <.0001 |
| bloom,lep - bloom,syrphid 0.1000835 4.543638e-01 1276 0.220 1.0000 |
| pre,other - bloom,other 0.1340573 2.064640e-01 1276 0.649 1.0000 |
| pre,other - pre,syrphid -1.2604141 1.685865e-01 1276 -7.476 <.0001 |
| pre,other - bloom,syrphid 1.8624471 3.629958e-01 1276 5.131 <.0001 |
| bloom,other - pre,syrphid -1.3944714 1.635932e-01 1276 -8.524 <.0001 |
| bloom,other - bloom,syrphid 1.7283899 3.572537e-01 1276 4.838 0.0001 |
| pre,syrphid - bloom,syrphid 3.1228613 3.404428e-01 1276 9.173 <.0001 |

Posthoc test for interaction term: LSMeans, plant visits

|  |
| --- |
|  |
| $contrasts |
| rtu = bee: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 1.6830539 4.839527e-01 1276 3.478 0.0005 |
|  |
| rtu = bombylid: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 0.3956475 3.556753e-01 1276 1.112 0.2662 |
|  |
| rtu = honeybee: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 24.3349238 6.530236e+04 1276 0.000 0.9997 |
|  |
| rtu = lep: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom -2.0770886 1.062522e+00 1276 -1.955 0.0508 |
|  |
| rtu = other: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 0.1340573 2.064640e-01 1276 0.649 0.5163 |
|  |
| rtu = syrphid: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 3.1228613 3.404428e-01 1276 9.173 <.0001 |

Flower visits post-hoc test.

|  |
| --- |
| rtu = bee: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 1.72941690 4.418547e-01 1276 3.914 0.0001 |
|  |
| rtu = bombylid: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 0.04602546 3.886082e-01 1276 0.118 0.9057 |
|  |
| rtu = honeybee: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 24.99689016 7.783803e+04 1276 0.000 0.9997 |
|  |
| rtu = lep: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom -2.40174164 1.289996e+00 1276 -1.862 0.0629 |
|  |
| rtu = other: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom -0.01969237 2.403112e-01 1276 -0.082 0.9347 |
|  |
| rtu = syrphid: |
| contrast estimate SE df t.ratio p.value |
| pre - bloom 3.05632296 3.468089e-01 1276 8.813 <.0001 |

Pan Traps

Table 2: GLMM results for pan trap abundances. Non-significant interactions were removed models.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Insect abundance (Melyridae: Dastyine excluded) | | | Insect abundance (Melyridae: Dastyine included) | | | Melyridae:Dastynine abundance only | | |
|  |  |  | |  |  | |  |  | |
| Presence | **Est** | **χ**2 value | p – value | **Est** | **χ**2 value | p – value | **Est** | **χ**2 value | p – value |
| Microsite  (shrub) | 0.40610 | 15.4926 | **<0.0001** | -0.09872 | 1.808 | 0.1787 | 1.1920 | 38.0394 | **0<0.0001** |
| Blooming  (in bloom) | -0.39624 | 13.5868 | 0.000228 | -0.39280 | 33.553 | **<0.00001** | -0.2989 | 3.3485 | 0.067267 |
| Microsite \* Blooming | -0.27673 | 3.4553 | 0.063049 | NA | NA | NA | 0.6521 | 7.1290 | 0.007585 |

Abundance contrasts

$contrasts

contrast estimate SE df z.ratio p.value

pre,open - post,open 0.3962370 0.1074971 NA 3.686 0.0013

pre,open - pre,shrub -0.4060998 0.1031742 NA -3.936 0.0005

pre,open - post,shrub 0.2668669 0.1060437 NA 2.517 0.0574

post,open - pre,shrub -0.8023367 0.1044866 NA -7.679 <.0001

post,open - post,shrub -0.1293701 0.1073211 NA -1.205 0.6234

pre,shrub - post,shrub 0.6729667 0.1029908 NA 6.534 <.0001

Models:

m2: abun ~ treatment + blooming + (1 | repID)

m1: abun ~ treatment \* blooming + (1 | repID)

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

m2 5 1372.2 1389.3 -681.08 1362.2

m1 6 1370.7 1391.3 -679.37 1358.7 3.4254 1 0.0642 .

m3 3 1426.5 1436.8 -710.27 1420.5

m2 5 1372.2 1389.3 -681.08 1362.2 58.3768 2 2.107e-13 \*\*\*

m1 6 1370.7 1391.3 -679.37 1358.7 3.4254 1 0.0642 .

There is no difference between the models – thus I used AIC to choose the best model, and ran a posthoc test on the nearly significant interaction to see what is going ont.

With beetles:

Models:

m3: abun ~ (1 | repID)

m1: abun ~ blooming + treatment + (1 | repID)

m2: abun ~ blooming \* treatment + (1 | repID)

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

m3 3 1586.9 1597.2 -790.46 1580.9

m1 5 1560.1 1577.3 -775.05 1550.1 30.8081 2 2.042e-07 \*\*\*

m2 6 1561.8 1582.4 -774.91 1549.8 0.2883 1 0.5913

---

Melyridae only

m3: abun ~ (1 | repID)

m2: abun ~ blooming + treatment + (1 | repID)

m1: abun ~ blooming \* treatment + (1 | repID)

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

m3 3 1267.5 1277.8 -630.74 1261.5

m2 5 1238.9 1256.1 -614.46 1228.9 32.5610 2 8.501e-08 \*\*\*

m1 6 1234.0 1254.5 -610.99 1222.0 6.9548 1 0.00836 \*\*

Melyridae only constrasts

pre,open - post,open 0.2989089 0.1633482 NA 1.830 0.2592

pre,open - pre,shrub 1.1920062 0.1932688 NA 6.168 <.0001

pre,open - post,shrub 0.8388073 0.1826136 NA 4.593 <.0001

post,open - pre,shrub 0.8930973 0.1906721 NA 4.684 <.0001

post,open - post,shrub 0.5398984 0.1799142 NA 3.001 0.0143

pre,shrub - post,shrub -0.3531989 0.1815186 NA -1.946 0.2090

Table 3: GLMM results for pan trap diversity measures. Non-significant interactions were removed.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Species Richness | |  | **Bee abundance** | |  | |
|  |  |  | |  |  | |  | |
| Presence | **Coef** | **χ**2 value | p – value | **Coef** | **χ**2 value | p – value | **χ**2 value | p – value |
| Microsite | 0.14541 | 6.6289 | 0.01 | 0.05766 | 0.0792 | 0.778323 |  |  |
| Blooming | -0.25442 | 25.6295 | **<0.0001** | -0.0787 | 0.2104 | 0.646419 |  |  |
| Microsite \* Blooming | NA | NA | **NA** | NA | NA | NA |  |  |

Used poisson for species richness

Anova

Models:

s3: Species ~ (1 | repID)

s1: Species ~ blooming + treatment + (1 | repID)

s2: Species ~ blooming \* treatment + (1 | repID)

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

s3 2 1170.9 1177.7 -583.44 1166.9

s1 4 1142.5 1156.2 -567.23 1134.5 32.4159 2 9.141e-08 \*\*\*

s2 5 1143.0 1160.2 -566.52 1133.0 1.4229 1 0.2329

Used poisson for bee abundance

beenull: Quantity ~ (1 | repID)

bee2: Quantity ~ blooming + treatment + (1 | repID)

bee1: Quantity ~ blooming \* treatment + (1 | repID)

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

beenull 2 489.58 496.44 -242.79 485.58

bee2 4 493.29 507.01 -242.65 485.29 0.2911 2 0.8645

bee1 5 495.04 512.19 -242.52 485.04 0.2514 1 0.6161

Visit duration

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

m2 3 -3497.8 -3484.2 1751.9 -3503.8

m1 6 -3515.2 -3487.9 1763.6 -3527.2 23.366 3 3.388e-05 \*\*\*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bee |  |  |  |  | Other |  |  |
|  | Coef | X | P | t | Coef | X | p | t |
| Blooming | -0.9341 |  | 0.208 | -1.379 | -1.0703 |  | 0.000605 | -3.503 |

Bee visit duration

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

l2 3 230.88 236.95 -112.44 224.88

l1 4 230.94 239.04 -111.47 222.94 1.935 1 0.1642

Other visit duration

l2: log(dec.total.time) ~ (1 | repID)

l1: log(dec.total.time) ~ flowering + (1 | repID)

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

l2 3 863.53 873.41 -428.77 857.53

l1 4 853.55 866.73 -422.78 845.55 11.979 1 0.0005382 \*\*\*

Proportion of flowers visited per visit

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | Other |  |  |
|  | Coef | X | P | t | Coef | X | p | t |
| Blooming | -0.03538 |  | 0.46515 |  |  |  |  |  |
| Microsite | 0.08050 |  | 0.31609 |  |  |  |  |  |
| Blooming\*microsites | -0.20443 |  | 0.00784 |  |  |  |  |  |

$contrasts

contrast estimate SE df z.ratio p.value

pre,open - bloom,open 0.03537548 0.04843350 NA 0.730 0.8849

pre,open - pre,shrub -0.08050042 0.08029773 NA -1.003 0.7479

pre,open - bloom,shrub 0.15930471 0.08775466 NA 1.815 0.2660

bloom,open - pre,shrub -0.11587589 0.08384195 NA -1.382 0.5106

bloom,open - bloom,shrub 0.12392924 0.09113159 NA 1.360 0.5247

pre,shrub - bloom,shrub 0.23980513 0.05952906 NA 4.028 0.0003

Proportions: RTU \* microsite

floweringbloom -0.116064 0.140156 -0.828 0.40761

rtu.agbombylid -0.247470 0.112323 -2.203 0.02758 \*

rtu.aghoneybee 0.186243 0.240711 0.774 0.43910

rtu.aglep -0.329590 0.262264 -1.257 0.20886

rtu.agother -0.300436 0.095633 -3.142 0.00168 \*\*

rtu.agsyrphid -0.173276 0.085192 -2.034 0.04196 \*

floweringbloom:rtu.agbombylid 0.202234 0.174650 1.158 0.24689

floweringbloom:rtu.aglep 0.069411 0.297303 0.233 0.81540

floweringbloom:rtu.agother 0.033465 0.153065 0.219 0.82693

floweringbloom:rtu.agsyrphid 0.006737 0.171338 0.039 0.96863

m2null 3 -2221.5 -2207.8 1113.7 -2227.5

m2 13 -2237.4 -2178.3 1131.7 -2263.4 35.968 10 8.525e-05 \*\*\*

Proportions: RTU\*microsite

$contrasts

contrast estimate SE df z.ratio p.value

open,bee - shrub,bee 0.2956276573 0.14985202 NA 1.973 0.7122

open,bee - open,bombylid 0.3373346514 0.12256770 NA 2.752 0.2009

open,bee - shrub,bombylid 0.3441132058 0.14651352 NA 2.349 0.4416

open,bee - open,honeybee nonEst NA NA NA NA

open,bee - shrub,honeybee -0.0574869201 0.25355693 NA -0.227 1.0000

open,bee - open,lep 0.4733697023 0.14724349 NA 3.215 0.0588

open,bee - shrub,lep 0.5633106534 0.17433386 NA 3.231 0.0559

open,bee - open,other 0.4737968665 0.11166278 NA 4.243 0.0013

open,bee - shrub,other 0.5039043466 0.13091459 NA 3.849 0.0066

open,bee - open,syrphid 0.3420691106 0.10785656 NA 3.172 0.0669

open,bee - shrub,syrphid 0.2850254482 0.12878960 NA 2.213 0.5399

shrub,bee - open,bombylid 0.0417069941 0.12615312 NA 0.331 1.0000

shrub,bee - shrub,bombylid 0.0484855485 0.12020937 NA 0.403 1.0000

shrub,bee - open,honeybee nonEst NA NA NA NA

shrub,bee - shrub,honeybee -0.3531145774 0.24153215 NA -1.462 0.9507

shrub,bee - open,lep 0.1777420450 0.14698298 NA 1.209 0.9884

shrub,bee - shrub,lep 0.2676829961 0.15108510 NA 1.772 0.8336

shrub,bee - open,other 0.1781692092 0.11358834 NA 1.569 0.9205

shrub,bee - shrub,other 0.2082766893 0.09790312 NA 2.127 0.6029

shrub,bee - open,syrphid 0.0464414533 0.11193343 NA 0.415 1.0000

shrub,bee - shrub,syrphid -0.0106022091 0.09076039 NA -0.117 1.0000

open,bombylid - shrub,bombylid 0.0067785545 0.12221348 NA 0.055 1.0000

open,bombylid - open,honeybee nonEst NA NA NA NA

open,bombylid - shrub,honeybee -0.3948215715 0.24089088 NA -1.639 0.8948

open,bombylid - open,lep 0.1360350509 0.12259911 NA 1.110 0.9943

open,bombylid - shrub,lep 0.2259760021 0.15473968 NA 1.460 0.9510

open,bombylid - open,other 0.1364622151 0.07698542 NA 1.773 0.8332

open,bombylid - shrub,other 0.1665696953 0.10315326 NA 1.615 0.9041

open,bombylid - open,syrphid 0.0047344593 0.07415790 NA 0.064 1.0000

open,bombylid - shrub,syrphid -0.0523092032 0.10021837 NA -0.522 1.0000

shrub,bombylid - open,honeybee nonEst NA NA NA NA

shrub,bombylid - shrub,honeybee -0.4016001260 0.24177578 NA -1.661 0.8858

shrub,bombylid - open,lep 0.1292564964 0.14359931 NA 0.900 0.9991

shrub,bombylid - shrub,lep 0.2191974476 0.15004047 NA 1.461 0.9509

shrub,bombylid - open,other 0.1296836607 0.10918274 NA 1.188 0.9900

shrub,bombylid - shrub,other 0.1597911408 0.09347639 NA 1.709 0.8644

shrub,bombylid - open,syrphid -0.0020440952 0.10744288 NA -0.019 1.0000

shrub,bombylid - shrub,syrphid -0.0590877576 0.09455611 NA -0.625 1.0000

open,honeybee - shrub,honeybee nonEst NA NA NA NA

open,honeybee - open,lep nonEst NA NA NA NA

open,honeybee - shrub,lep nonEst NA NA NA NA

open,honeybee - open,other nonEst NA NA NA NA

open,honeybee - shrub,other nonEst NA NA NA NA

open,honeybee - open,syrphid nonEst NA NA NA NA

open,honeybee - shrub,syrphid nonEst NA NA NA NA

shrub,honeybee - open,lep 0.5308566224 0.25220463 NA 2.105 0.6193

shrub,honeybee - shrub,lep 0.6207975736 0.25742634 NA 2.412 0.3979

shrub,honeybee - open,other 0.5312837866 0.23440374 NA 2.267 0.5008

shrub,honeybee - shrub,other 0.5613912668 0.23199483 NA 2.420 0.3923

shrub,honeybee - open,syrphid 0.3995560308 0.23341944 NA 1.712 0.8633

shrub,honeybee - shrub,syrphid 0.3425123683 0.22770807 NA 1.504 0.9399

open,lep - shrub,lep 0.0899409512 0.17203545 NA 0.523 1.0000

open,lep - open,other 0.0004271642 0.10980099 NA 0.004 1.0000

open,lep - shrub,other 0.0305346444 0.12772068 NA 0.239 1.0000

open,lep - open,syrphid -0.1313005916 0.10732476 NA -1.223 0.9872

open,lep - shrub,syrphid -0.1883442541 0.12543347 NA -1.502 0.9406

shrub,lep - open,other -0.0895137870 0.14459661 NA -0.619 1.0000

shrub,lep - shrub,other -0.0594063068 0.13290699 NA -0.447 1.0000

shrub,lep - open,syrphid -0.2212415428 0.14319762 NA -1.545 0.9280

shrub,lep - shrub,syrphid -0.2782852052 0.13056337 NA -2.131 0.5999

open,other - shrub,other 0.0301074801 0.08727658 NA 0.345 1.0000

open,other - open,syrphid -0.1317277558 0.05018389 NA -2.625 0.2655

open,other - shrub,syrphid -0.1887714183 0.08385587 NA -2.251 0.5120

shrub,other - open,syrphid -0.1618352360 0.08503134 NA -1.903 0.7575

shrub,other - shrub,syrphid -0.2188788984 0.06367091 NA -3.438 0.0290

open,syrphid - shrub,syrphid -0.0570436624 0.08160285 NA -0.699 0.9999

odels:

m2null: prop.visited ~ (1 | repID)

m3: prop.visited ~ microsite \* rtu.ag + (1 | repID)

Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)

m2null 3 -2221.5 -2207.8 1113.7 -2227.5

m3 13 -2240.1 -2181.0 1133.1 -2266.1 38.652 10 2.921e-05 \*\*\*

So decrease in proportion of flowers visited, per visit at the shrub microsite as well with blooming. Does not appear to be strongly driven by any one species.