New Analysis with Revisions

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Main critque that is addressed in new analysis:

- Cameras too close to one another, breaking independence assumption - *Gridding attempts to solve*
- Logged and Logged sites intermixed, breaking independence assumption - *Gridding attempts to solve*
- Lumped years frowned upon - *separated the years*
- single species is typically not done in these types of analyses - *switched to multi-species community model*

Run it back

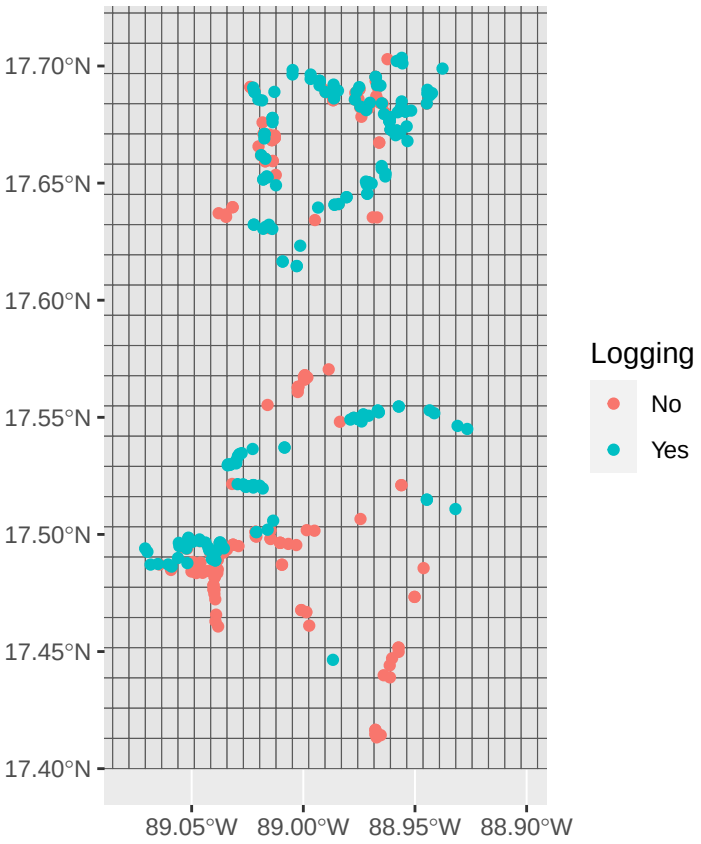
New analysis where years are separated - running single-season, multi-species models using JAGS. 2014, 2015, and 2016 were cut because they didn't have a good balance of logged and unlogged sites.

Referenced code from: https://cran.r-project.org/web/packages/camtrapR/vignettes/camtrapr5.html

Gridding

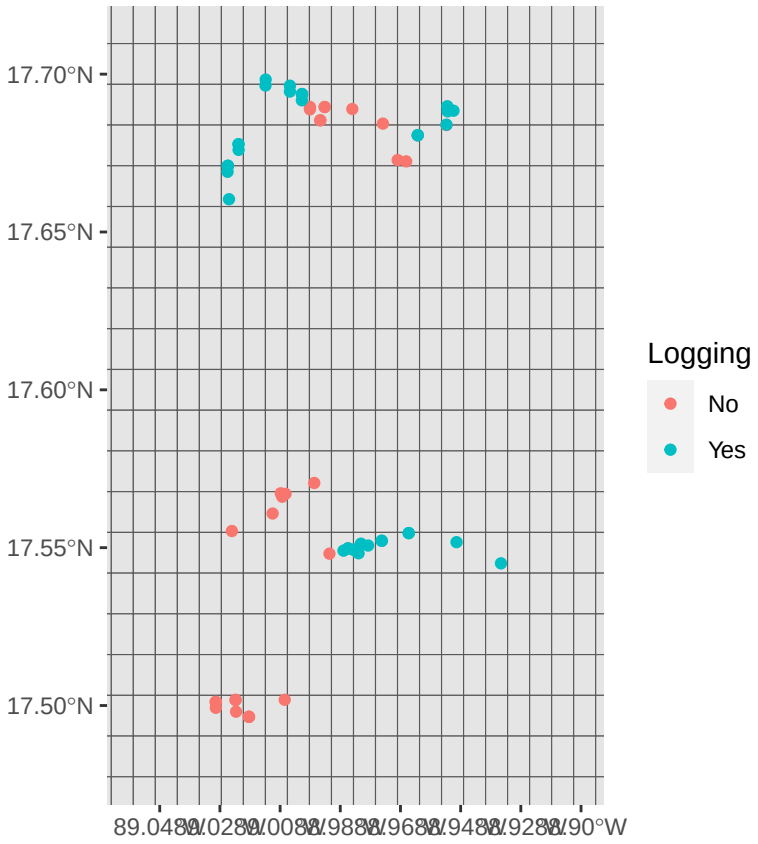
Making a 0.01 by 0.01 decimal degree grid (equating each grid to be a little bigger than 1km2). *"Our general recommendation is to separate cameras by as much as you can, with 500-1000m spacing being best, and anything >200m probably being acceptable."* These 1km2 grids allow for better distance separation between individual cameras by lumping those nearby into the same sampling grid. We are still able to reference the specific camera to account for differences in number of cameras in each grid.

All cameras from every year in the grid colored by logged or not:



2018 cameras in the grid colored by logged or not:

```
## Warning: There was 1 warning in `stopifnot()`.
## i In argument: `year(Date.Placement) == 2018`.
## Caused by warning:
## ! tz(): Don't know how to compute timezone for object of class factor; returning "UTC".
```



Draft Analysis By Year

Need to increase iterations and chains for models, but preliminary code and workflow.

Used the threshold of 40 detection, some species did not meet that threshold for all 4 years, treated each year separately and outputted results for any species meeting that threshold in the single single year.

Each call defines a model with a fixed effect of logging on occupancy probability of all species (have the option to add a species-specific (random) effect on occupancy probability). Furthermore, we specified effort as a covariate on detection probability (constant across species), and there are random effects of species on the intercepts of detection and occupancy probabilities.

All these test models only have logging as a covariate of interest. We are not sure if or what covariates we will ad in as fixed or random effects on occupancy and/or detection.

2017 Prelim Results

```
mod.jags <- communityModel(data_list,
                           occuCovs = list(fixed = "Logging_Grid"),
                           detCovsObservation = list(fixed = "effort"),
                           intercepts = list(det = "ranef", occu = "ranef"),
                           modelFile = modelfile1)
```

```
## Wrote model to /var/folders/pt/nm1ggvdd2113cblty7_8wylw0000gn/T//Rtmp9Cgxif/file1064733e0a574.txt
```

```
summary(mod.jags)
```

```
## commOccu object (for JAGS)
```

```
##
## 11 species,  24 stations,  316 occasions
## 2209 occasions with effort
## Number of detections (by species): 30 - 283
##
## Available site covariates:
##  group, Logging_Grid
##
## Used site covariates:
##  Logging_Grid
##
## Available site-occasion covariates:
##  effort
```

```
#will need to increase iterations and maybe chains when running for real
 fit.jags <- fit(mod.jags,
                 n.iter = 1000,
                 n.burnin = 500,
                 chains = 3)
```

```
## Warning in searchCommandline(parallel, cpus = cpus, type = type,
## socketHosts = socketHosts, : Unknown option on commandline:
## rmarkdown::render('/Users/elise/Desktop/MP/Belize-MP-Bruno-Boos/RedoAnalysis.Rmd',~+~~+~encoding~+~
```

```
## snowfall 1.84-6.2 initialized: sequential execution, one CPU.
```

```
## sfExportAll() ignored in sequential mode.
```

```
## Warning in snowfall::sfClusterSetupRNG(): Uniform random number streams
## (currently) not available in serial execution. Random numbers may differ in
## serial & parallel execution.
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 24299
##    Unobserved stochastic nodes: 142841
##    Total graph size: 186930
##
## Initializing model
##
## NOTE: Stopping adaptation
##
##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 24299
##    Unobserved stochastic nodes: 142841
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## Initializing model
##
## NOTE: Stopping adaptation
##
```

```
##
## Compiling model graph
##    Resolving undeclared variables
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## Graph information:
##    Observed stochastic nodes: 24299
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##    Total graph size: 186930
##
## Initializing model
##
## NOTE: Stopping adaptation
```
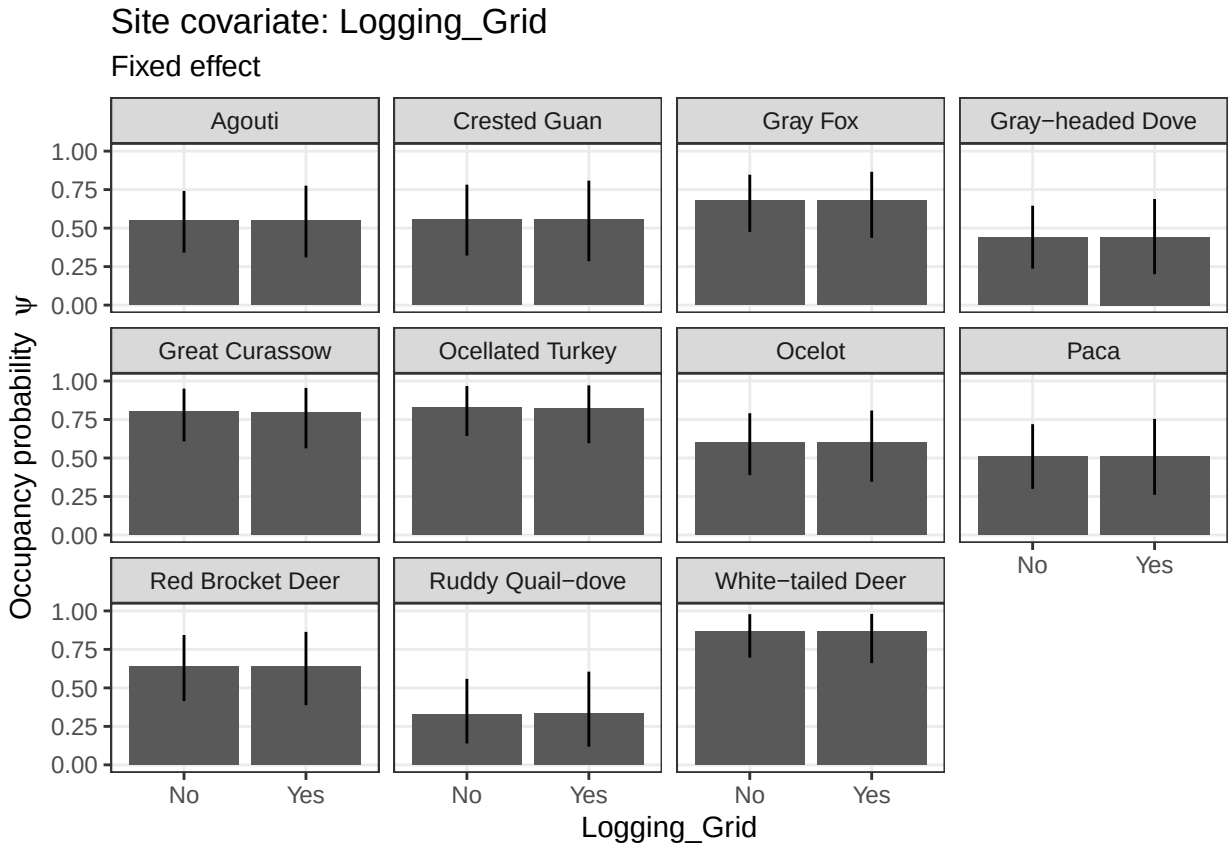
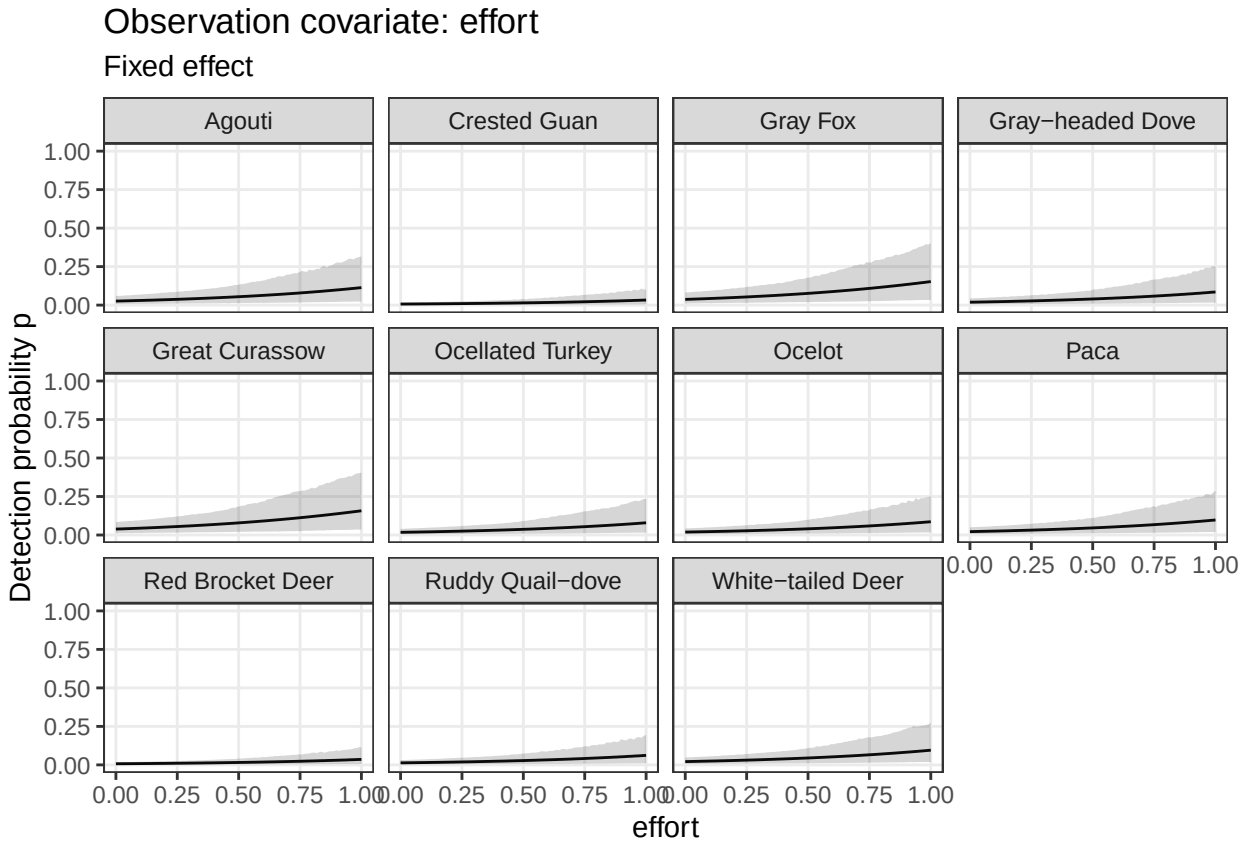

	Mean	SD	Naive SE
Bpvalue	1.000000000	0.00000000	0.000000000
Bpvalue_species[1]	1.000000000	0.00000000	0.000000000
Bpvalue_species[2]	1.000000000	0.00000000	0.000000000
Bpvalue_species[3]	1.000000000	0.00000000	0.000000000
Bpvalue_species[4]	1.000000000	0.00000000	0.000000000
Bpvalue_species[5]	1.000000000	0.00000000	0.000000000
Bpvalue_species[6]	1.000000000	0.00000000	0.000000000
Bpvalue_species[7]	1.000000000	0.00000000	0.000000000
Bpvalue_species[8]	1.000000000	0.00000000	0.000000000
Bpvalue_species[9]	0.946107784	0.22588004	0.005826374
Bpvalue_species[10]	0.993346640	0.08132338	0.002097664
Bpvalue_species[11]	1.000000000	0.00000000	0.000000000
Nspecies	11.000000000	0.00000000	0.000000000
R2[1]	30.389573169	1.82568122	0.047091818
R2[2]	16.247870360	2.53274441	0.065329882
R2[3]	46.436407900	2.16956244	0.055961927
R2[4]	19.954850695	1.79388700	0.046271715
R2[5]	60.947205848	2.59655912	0.066975926
R2[6]	27.122117400	1.89882454	0.048978485
R2[7]	24.489290395	1.93389318	0.049883049
R2[8]	22.365907334	1.81262815	0.046755126
R2[9]	9.479917862	2.49430383	0.064338342
R2[10]	7.178766828	1.53259914	0.039532027
R2[11]	28.935034221	1.84869594	0.047685462
R3	293.546942010	7.01756904	0.181011932
alpha.obs.fixed.cont.effort	1.481237562	0.54374328	0.014025373
alpha0[1]	-3.751663514	0.55050366	0.014199751
alpha0[2]	-5.144556862	0.58340619	0.015048442
alpha0[3]	-3.382113583	0.54110515	0.013957325
alpha0[4]	-4.086231567	0.55333453	0.014272770
alpha0[5]	-3.344517465	0.54127581	0.013961727
alpha0[6]	-4.167938020	0.54819741	0.014140263
alpha0[7]	-4.075426692	0.55157754	0.014227451
alpha0[8]	-3.930239543	0.54734830	0.014118361
alpha0[9]	-5.053084053	0.57060656	0.014718287
alpha0[10]	-4.462635832	0.57524918	0.014838039
alpha0[11]	-3.956034381	0.54716724	0.014113691
alpha0.mean	-4.115822330	0.57097842	0.014727879
alpha0.sigma	0.649778475	0.16219761	0.004183743
beta.fixed.categ.Logging_Grid[1]	0.000000000	0.00000000	0.000000000

```
## beta.fixed.categ.Logging_Grid[2]   0.007841683 0.30270136 0.007807911
## beta0[1]                           0.209626500 0.43430605 0.011202537
## beta0[2]                           0.234342863 0.52720064 0.013598670
## beta0[3]                           0.782735643 0.45219195 0.011663888
## beta0[4]                          -0.259099879 0.46003433 0.011866175
## beta0[5]                           1.504260486 0.63889075 0.016479617
## beta0[6]                           1.715222293 0.72210566 0.018626071
## beta0[7]                           0.422231653 0.45669243 0.011779974
## beta0[8]                           0.038180285 0.46689642 0.012043177
## beta0[9]                           0.608386605 0.52134240 0.013447562
## beta0[10]                         -0.769140729 0.54434654 0.014040933
## beta0[11]                          2.102212291 0.80039077 0.020645366
## beta0.mean                         0.601037190 0.40695333 0.010496998
## beta0.sigma                        1.055646067 0.37572901 0.009691595
## new.R2[1]                          3.540879161 1.48504380 0.038305380
## new.R2[2]                          4.399963610 1.90660657 0.049179215
## new.R2[3]                          4.177113390 1.45822974 0.037613735
## new.R2[4]                          2.603248110 1.37936867 0.035579584
## new.R2[5]                          5.066583061 1.70094799 0.043874436
## new.R2[6]                          6.259919737 2.23847021 0.057739342
## new.R2[7]                          4.015924993 1.78973358 0.046164581
## new.R2[8]                          3.161604139 1.56318473 0.040320955
## new.R2[9]                          5.192013086 2.14505989 0.055329906
## new.R2[10]                         1.899668732 1.25893268 0.032473045
## new.R2[11]                         6.348320153 2.13811560 0.055150784
## new.R3                            46.665238172 5.79321434 0.149430795
##                                  Time-series SE
## Bpvalue                           0.000000000
## Bpvalue_species[1]                0.000000000
## Bpvalue_species[2]                0.000000000
## Bpvalue_species[3]                0.000000000
## Bpvalue_species[4]                0.000000000
## Bpvalue_species[5]                0.000000000
## Bpvalue_species[6]                0.000000000
## Bpvalue_species[7]                0.000000000
## Bpvalue_species[8]                0.000000000
## Bpvalue_species[9]                0.005828283
## Bpvalue_species[10]               0.002098922
## Bpvalue_species[11]               0.000000000
## Nspecies                          0.000000000
## R2[1]                             0.046993183
## R2[2]                             0.070885444
## R2[3]                             0.054614623
## R2[4]                             0.046367447
## R2[5]                             0.081891451
## R2[6]                             0.066566036
## R2[7]                             0.056193209
## R2[8]                             0.045979884
## R2[9]                             0.097557389
## R2[10]                            0.059448039
## R2[11]                            0.056957601
## R3                                0.224795021
## alpha.obs.fixed.cont.effort       0.112509166
## alpha0[1]                         0.108736373
```

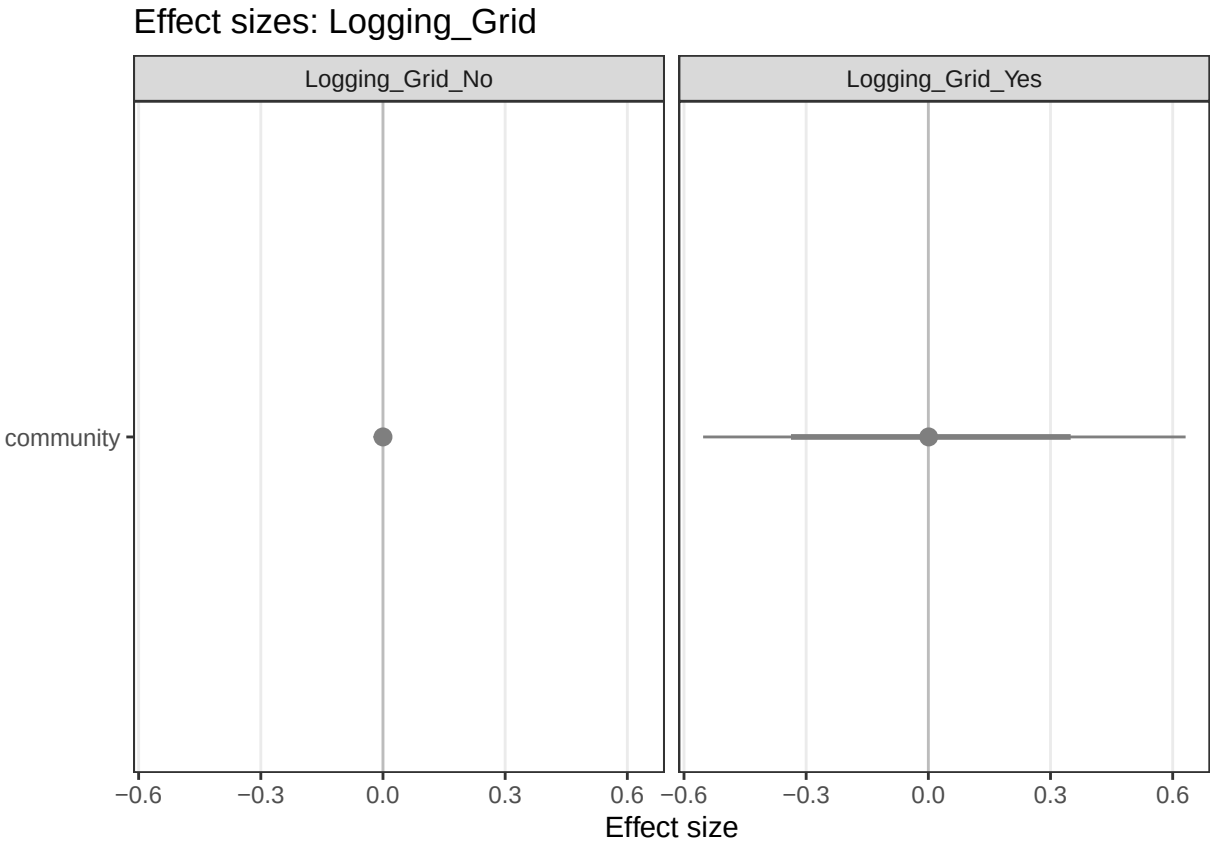
```
## alpha0[2]                                0.084198444
## alpha0[3]                                0.095271122
## alpha0[4]                                0.098996246
## alpha0[5]                                0.100477380
## alpha0[6]                                0.107227767
## alpha0[7]                                0.104451272
## alpha0[8]                                0.110102337
## alpha0[9]                                0.092694643
## alpha0[10]                               0.096311022
## alpha0[11]                               0.105106112
## alpha0.mean                              0.089154808
## alpha0.sigma                             0.005298092
## beta.fixed.categ.Logging_Grid[1]         0.000000000
## beta.fixed.categ.Logging_Grid[2]         0.017453458
## beta0[1]                                 0.018193821
## beta0[2]                                 0.024216930
## beta0[3]                                 0.016467746
## beta0[4]                                 0.021178210
## beta0[5]                                 0.027301030
## beta0[6]                                 0.036010646
## beta0[7]                                 0.017623010
## beta0[8]                                 0.017863747
## beta0[9]                                 0.024969833
## beta0[10]                                0.028551454
## beta0[11]                                0.046202342
## beta0.mean                               0.019361402
## beta0.sigma                              0.022146594
## new.R2[1]                                0.036312971
## new.R2[2]                                0.051946946
## new.R2[3]                                0.037635063
## new.R2[4]                                0.035598195
## new.R2[5]                                0.045201523
## new.R2[6]                                0.059676128
## new.R2[7]                                0.047578018
## new.R2[8]                                0.038711229
## new.R2[9]                                0.058695723
## new.R2[10]                               0.032438119
## new.R2[11]                               0.055153929
## new.R3                                   0.167256596

## $Logging_Grid
```


Site covariate: Logging_Grid
Fixed effect
Agouti
Crested Guan
Gray Fox
Gray−headed Dove
Great Curassow
Ocellated Turkey
Ocelot
Paca
Red Brocket Deer
Ruddy Quail−dove
White−tailed Deer
Occupancy probability ψ
1.00
0.75
0.50
0.25
0.00
No
Yes
Logging_Grid

```
## $effort
```




```
## $Logging_Grid
```



2018 Prelim Results

```
mod.jags <- communityModel(data_list,
                           occuCovs = list(fixed = "Logging_Grid"),
                           detCovsObservation = list(fixed = "effort"),
                           intercepts = list(det = "ranef", occu = "ranef"),
                           modelFile = modelfile1)
```

```
## Wrote model to /var/folders/pt/nm1ggvdd2113cblty7_8wylw0000gn/T//Rtmp9Cgxif/file106477ab10036.txt
```

```
summary(mod.jags)
```

```
## commOccu object (for JAGS)
##
## 13 species,  24 stations,  361 occasions
## 2699 occasions with effort
## Number of detections (by species): 40 - 445
##
## Available site covariates:
##  group, Logging_Grid
##
## Used site covariates:
##  Logging_Grid
##
## Available site-occasion covariates:
##  effort
```

```r
fit.jags <- fit(mod.jags,
                n.iter = 1000,
                n.burnin = 500,
                chains = 3)
```

```
## Warning in searchCommandline(parallel, cpus = cpus, type = type,
## socketHosts = socketHosts, : Unknown option on commandline:
## rmarkdown::render('/Users/elise/Desktop/MP/Belize-MP-Bruno-Boos/RedoAnalysis.Rmd',~+~~+~encoding~+~
```

```
## snowfall 1.84-6.2 initialized: sequential execution, one CPU.
```

```
## sfExportAll() ignored in sequential mode.
```

```
## Warning in snowfall::sfClusterSetupRNG(): Uniform random number streams
## (currently) not available in serial execution. Random numbers may differ in
## serial & parallel execution.
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 35087
##    Unobserved stochastic nodes: 190521
##    Total graph size: 248390
##
## Initializing model
##
## NOTE: Stopping adaptation
##
##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 35087
##    Unobserved stochastic nodes: 190521
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##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 35087
##    Unobserved stochastic nodes: 190521
##    Total graph size: 248390
##
## Initializing model
##
## NOTE: Stopping adaptation
```
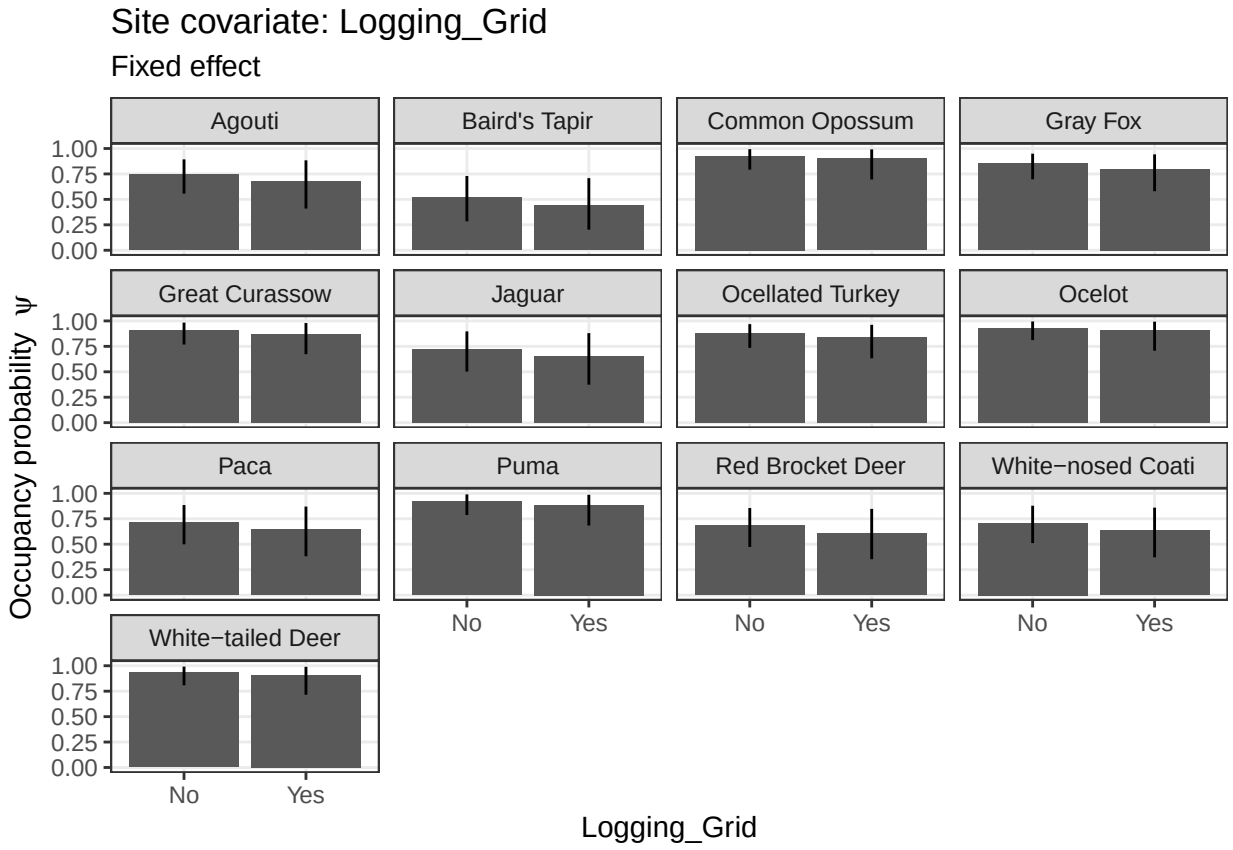

```
##                                        Mean         SD    Naive SE
```

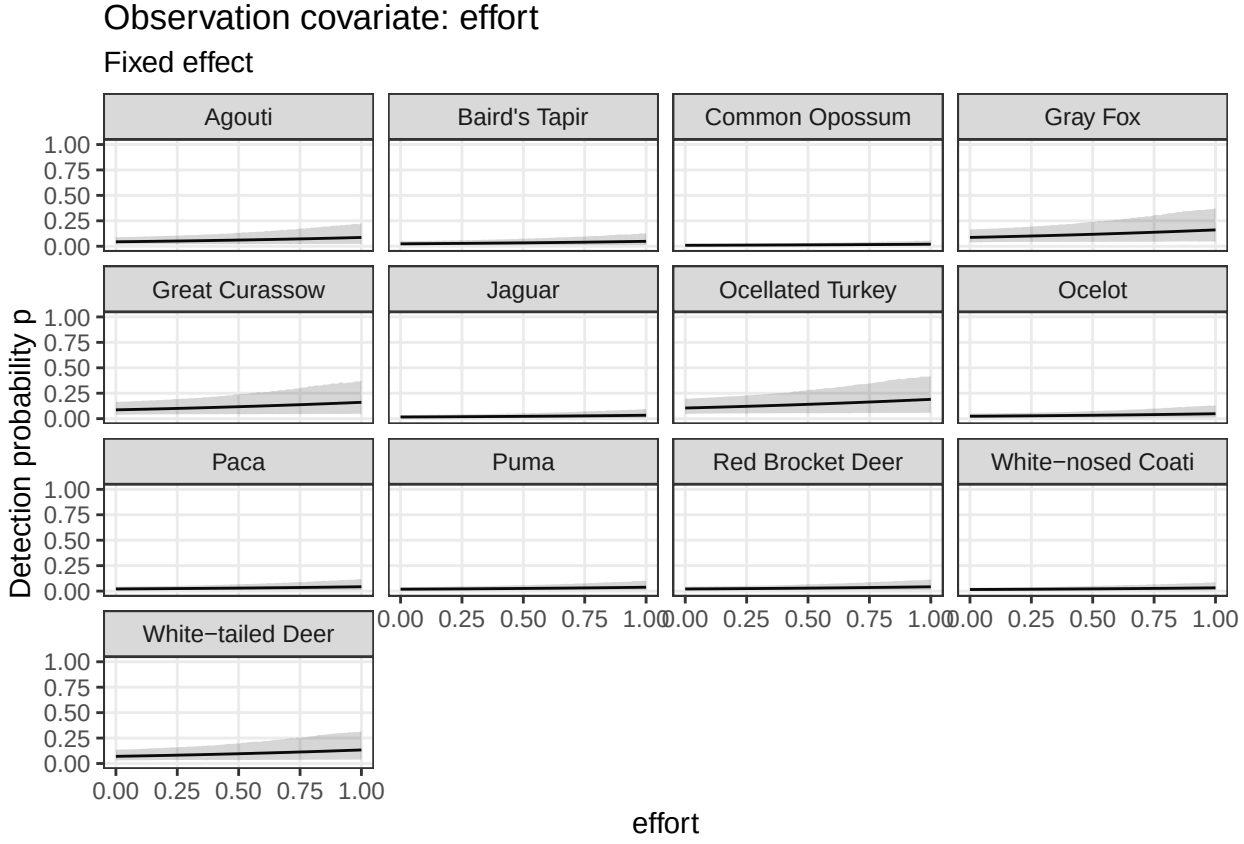
```
## Bpvalue                              1.0000000 0.00000000 0.000000000
## Bpvalue_species[1]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[2]                   0.9973387 0.05153667 0.001329342
## Bpvalue_species[3]                   0.7025948 0.45726848 0.011794832
## Bpvalue_species[4]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[5]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[6]                   0.9773786 0.14874278 0.003836687
## Bpvalue_species[7]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[8]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[9]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[10]                  0.6946108 0.46072538 0.011884000
## Bpvalue_species[11]                  1.0000000 0.00000000 0.000000000
## Bpvalue_species[12]                  0.5834997 0.49314258 0.012720173
## Bpvalue_species[13]                  1.0000000 0.00000000 0.000000000
## Nspecies                            13.0000000 0.00000000 0.000000000
## R2[1]                               27.0996770 2.16674736 0.055889315
## R2[2]                               10.3849332 2.00566983 0.051734464
## R2[3]                               10.4022896 1.48173948 0.038220148
## R2[4]                               96.9024981 2.58437419 0.066661626
## R2[5]                               65.2788179 1.99955461 0.051576727
## R2[6]                               11.6558222 2.40672632 0.062079358
## R2[7]                               76.3566886 1.85224850 0.047777097
## R2[8]                               23.4403857 1.76368459 0.045492670
## R2[9]                               25.0473262 2.58921140 0.066786398
## R2[10]                               9.0508067 1.43629083 0.037047840
## R2[11]                              16.6448314 2.42168371 0.062465171
## R2[12]                               6.2522262 2.24740556 0.057969821
## R2[13]                              76.2687411 2.41102573 0.062190257
## R3                                 454.7850438 7.55772988 0.194944899
## alpha.obs.fixed.cont.effort          0.6541370 0.44519289 0.011483353
## alpha0[1]                           -3.1727410 0.45303906 0.011685738
## alpha0[2]                           -3.8075653 0.45694972 0.011786610
## alpha0[3]                           -4.7369116 0.46887221 0.012094140
## alpha0[4]                           -2.4345109 0.44562785 0.011494573
## alpha0[5]                           -2.4338888 0.44366357 0.011443906
## alpha0[6]                           -4.2053248 0.47506584 0.012253899
## alpha0[7]                           -2.2215615 0.44631329 0.011512253
## alpha0[8]                           -3.8046269 0.45150167 0.011646083
## alpha0[9]                           -3.9403634 0.45797350 0.011813018
## alpha0[10]                          -4.0679407 0.45115176 0.011637057
## alpha0[11]                          -3.9543933 0.46330128 0.011950443
## alpha0[12]                          -4.2518064 0.46836226 0.012080987
## alpha0[13]                          -2.6657886 0.44702446 0.011530597
## alpha0.mean                         -3.5063670 0.52353430 0.013504100
## alpha0.sigma                         0.8928778 0.20028750 0.005166237
## beta.fixed.categ.Logging_Grid[1]     0.0000000 0.00000000 0.000000000
## beta.fixed.categ.Logging_Grid[2]    -0.3339841 0.33175934 0.008557436
## beta0[1]                             1.1262345 0.48323438 0.012464600
## beta0[2]                             0.0828861 0.48362623 0.012474707
## beta0[3]                             2.8852768 0.97928093 0.025259678
## beta0[4]                             1.8367232 0.53706998 0.013853241
## beta0[5]                             2.4335171 0.72594651 0.018725142
## beta0[6]                             1.0360501 0.54984933 0.014182873
## beta0[7]                             2.1184049 0.61174134 0.015779322
```

```
## beta0[8]                          2.9695553 0.96982677 0.025015816
## beta0[9]                          0.9855755 0.52651362 0.013580949
## beta0[10]                         2.6445286 0.82638420 0.021315843
## beta0[11]                         0.8087485 0.48976243 0.012632985
## beta0[12]                         0.9390033 0.48516447 0.012514385
## beta0[13]                         2.8916687 0.81142685 0.020930032
## beta0.mean                        1.7368676 0.45447293 0.011722724
## beta0.sigma                       1.1987533 0.40835545 0.010533164
## new.R2[1]                         4.3213605 1.84643260 0.047627082
## new.R2[2]                         3.0704318 1.69837807 0.043808147
## new.R2[3]                         8.9212934 2.74333102 0.070761776
## new.R2[4]                         4.3978711 1.42705555 0.036809625
## new.R2[5]                         5.0148363 1.60792082 0.041474883
## new.R2[6]                         5.6209262 2.37033215 0.061140603
## new.R2[7]                         4.5018020 1.43273918 0.036956229
## new.R2[8]                         7.1221367 2.50804408 0.064692759
## new.R2[9]                         5.2054448 2.18734403 0.056420588
## new.R2[10]                        7.7774282 2.59309977 0.066886695
## new.R2[11]                        4.8580747 2.07392340 0.053495004
## new.R2[12]                        5.7609215 2.29755087 0.059263275
## new.R2[13]                        5.3853807 1.76991882 0.045653477
## new.R3                           71.9579081 7.48656502 0.193109265
##                                 Time-series SE
## Bpvalue                            0.000000000
## Bpvalue_species[1]                 0.000000000
## Bpvalue_species[2]                 0.001330006
## Bpvalue_species[3]                 0.011800592
## Bpvalue_species[4]                 0.000000000
## Bpvalue_species[5]                 0.000000000
## Bpvalue_species[6]                 0.003833629
## Bpvalue_species[7]                 0.000000000
## Bpvalue_species[8]                 0.000000000
## Bpvalue_species[9]                 0.000000000
## Bpvalue_species[10]                0.011881567
## Bpvalue_species[11]                0.000000000
## Bpvalue_species[12]                0.012334634
## Bpvalue_species[13]                0.000000000
## Nspecies                           0.000000000
## R2[1]                              0.055786187
## R2[2]                              0.056056057
## R2[3]                              0.057476206
## R2[4]                              0.066690901
## R2[5]                              0.053063225
## R2[6]                              0.080644257
## R2[7]                              0.046329818
## R2[8]                              0.051613804
## R2[9]                              0.071584294
## R2[10]                             0.044267339
## R2[11]                             0.076710224
## R2[12]                             0.068487272
## R2[13]                             0.067258586
## R3                                 0.212139931
## alpha.obs.fixed.cont.effort        0.076136671
## alpha0[1]                          0.068114716
```

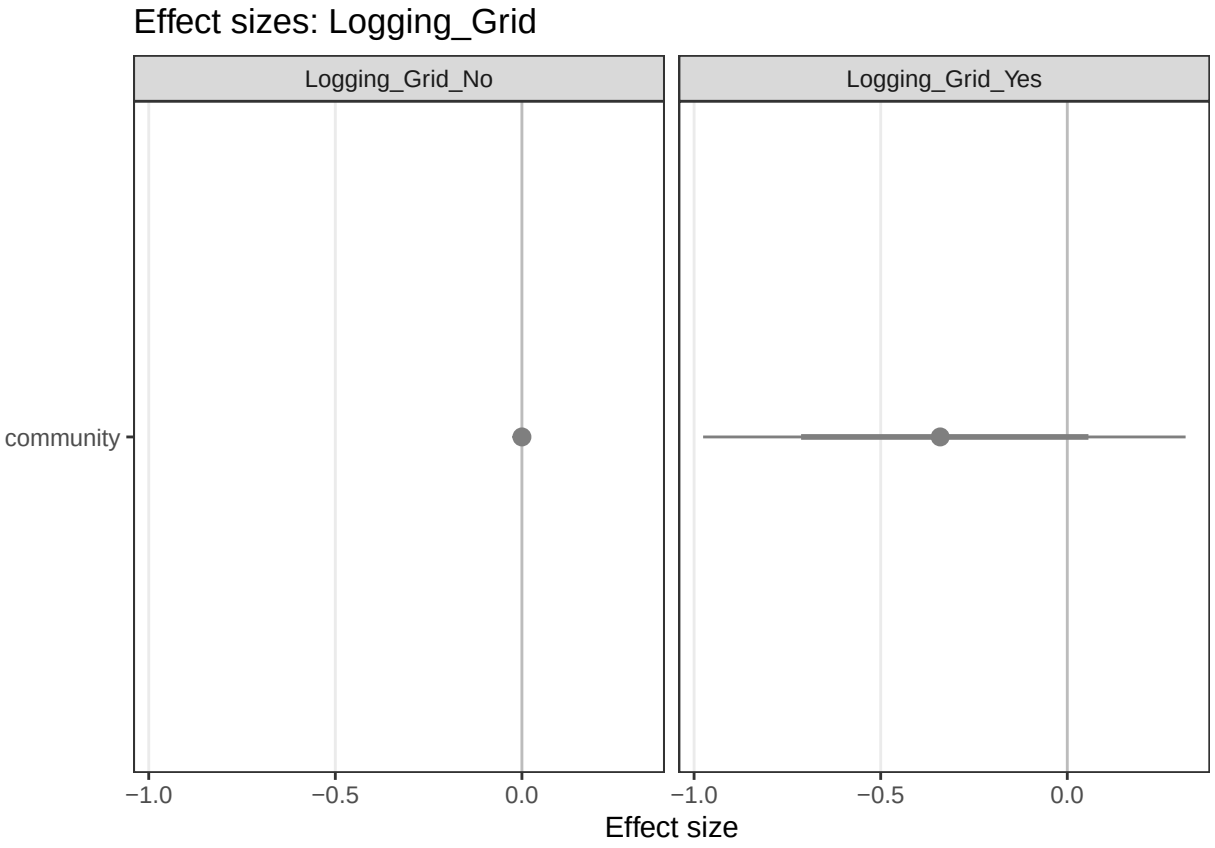
```
## alpha0[2]                                0.067264673
## alpha0[3]                                0.072800951
## alpha0[4]                                0.067872423
## alpha0[5]                                0.074646049
## alpha0[6]                                0.074715530
## alpha0[7]                                0.072494932
## alpha0[8]                                0.072472966
## alpha0[9]                                0.070679938
## alpha0[10]                               0.074162837
## alpha0[11]                               0.068730346
## alpha0[12]                               0.069994305
## alpha0[13]                               0.074641289
## alpha0.mean                              0.060484803
## alpha0.sigma                             0.006077792
## beta.fixed.categ.Logging_Grid[1]         0.000000000
## beta.fixed.categ.Logging_Grid[2]         0.020664435
## beta0[1]                                 0.018838283
## beta0[2]                                 0.019197836
## beta0[3]                                 0.055220656
## beta0[4]                                 0.022268939
## beta0[5]                                 0.028279389
## beta0[6]                                 0.023906868
## beta0[7]                                 0.020204790
## beta0[8]                                 0.051658643
## beta0[9]                                 0.023293524
## beta0[10]                                0.036262760
## beta0[11]                                0.021589216
## beta0[12]                                0.018944092
## beta0[13]                                0.040083167
## beta0.mean                               0.021332091
## beta0.sigma                              0.022935618
## new.R2[1]                                0.051349345
## new.R2[2]                                0.044868796
## new.R2[3]                                0.069267236
## new.R2[4]                                0.036814967
## new.R2[5]                                0.050664903
## new.R2[6]                                0.060531823
## new.R2[7]                                0.038055978
## new.R2[8]                                0.064650937
## new.R2[9]                                0.051443662
## new.R2[10]                               0.066914217
## new.R2[11]                               0.053526703
## new.R2[12]                               0.063865900
## new.R2[13]                               0.048084575
## new.R3                                   0.189221703

## $Logging_Grid
```


Site covariate: Logging_Grid
Fixed effect
Agouti
Baird's Tapir
Common Opossum
Gray Fox
Great Curassow
Jaguar
Ocellated Turkey
Ocelot
Paca
Puma
Red Brocket Deer
White−nosed Coati
White−tailed Deer
Occupancy probability ψ
1.00
0.75
0.50
0.25
0.00
No
Yes
Logging_Grid

```
## $effort
```




```
## $Logging_Grid
```



2019 Prelim Results

```
mod.jags <- communityModel(data_list,
                           occuCovs = list(fixed = "Logging_Grid"),
                           detCovsObservation = list(fixed = "effort"),
                           intercepts = list(det = "ranef", occu = "ranef"),
                           modelFile = modelfile1)
```

```
## Wrote model to /var/folders/pt/nm1ggvdd2113cblty7_8wylw0000gn/T//Rtmp9Cgxif/file106471c3891f7.txt
```

```
summary(mod.jags)
```

```
## commOccu object (for JAGS)
##
## 12 species,  18 stations,  339 occasions
## 1847 occasions with effort
## Number of detections (by species): 18 - 363
##
## Available site covariates:
##  group, Logging_Grid
##
## Used site covariates:
##  Logging_Grid
##
## Available site-occasion covariates:
##  effort
```

```r
fit.jags <- fit(mod.jags,
                n.iter = 1000,
                n.burnin = 500,
                chains = 3)
```

```
## Warning in searchCommandline(parallel, cpus = cpus, type = type,
## socketHosts = socketHosts, : Unknown option on commandline:
## rmarkdown::render('/Users/elise/Desktop/MP/Belize-MP-Bruno-Boos/RedoAnalysis.Rmd',~+~~+~encoding~+~
```

```
## snowfall 1.84-6.2 initialized: sequential execution, one CPU.
```

```
## sfExportAll() ignored in sequential mode.
```

```
## Warning in snowfall::sfClusterSetupRNG(): Uniform random number streams
## (currently) not available in serial execution. Random numbers may differ in
## serial & parallel execution.
```

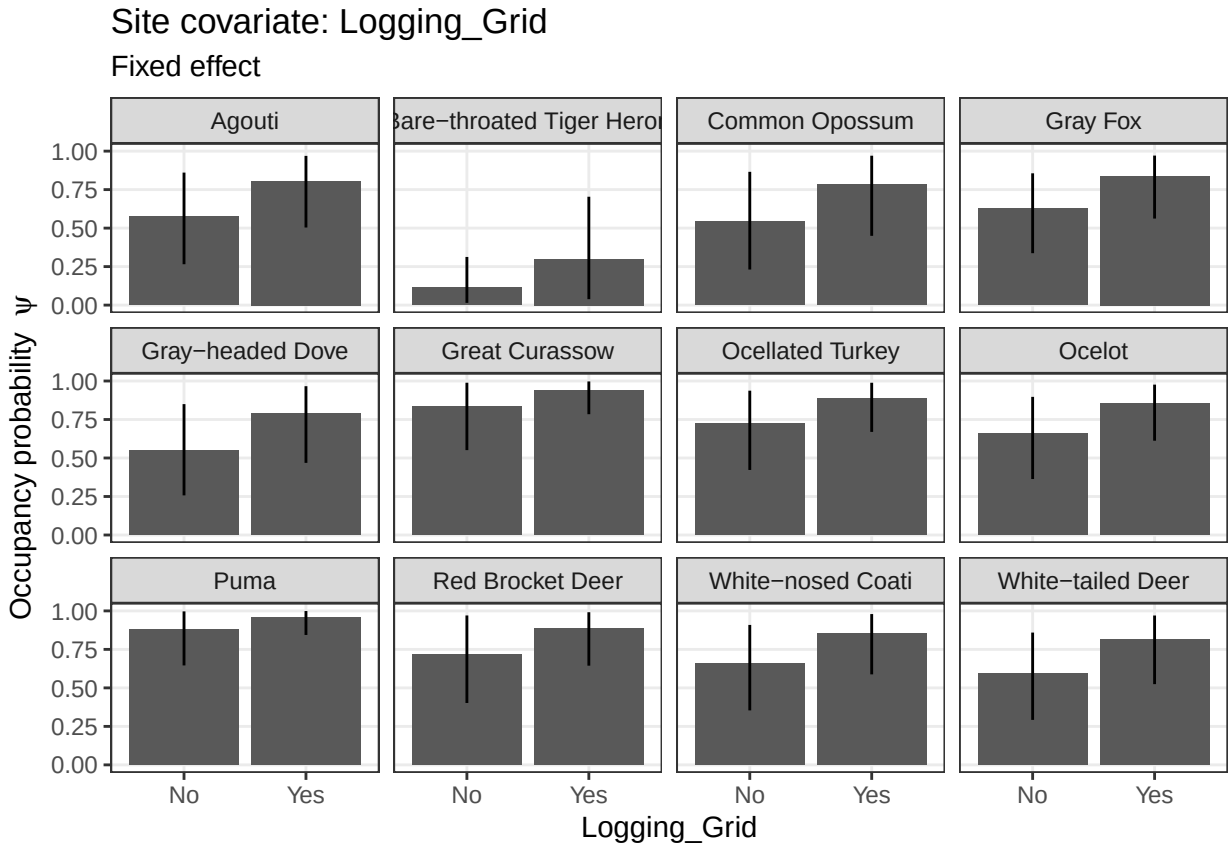
```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 22164
##    Unobserved stochastic nodes: 124530
##    Total graph size: 162778
##
## Initializing model
##
## NOTE: Stopping adaptation
##
##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 22164
##    Unobserved stochastic nodes: 124530
##    Total graph size: 162778
##
## Initializing model
##
## NOTE: Stopping adaptation
##
##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 22164
##    Unobserved stochastic nodes: 124530
##    Total graph size: 162778
##
## Initializing model
##
## NOTE: Stopping adaptation
```

```
##                                        Mean         SD    Naive SE
```

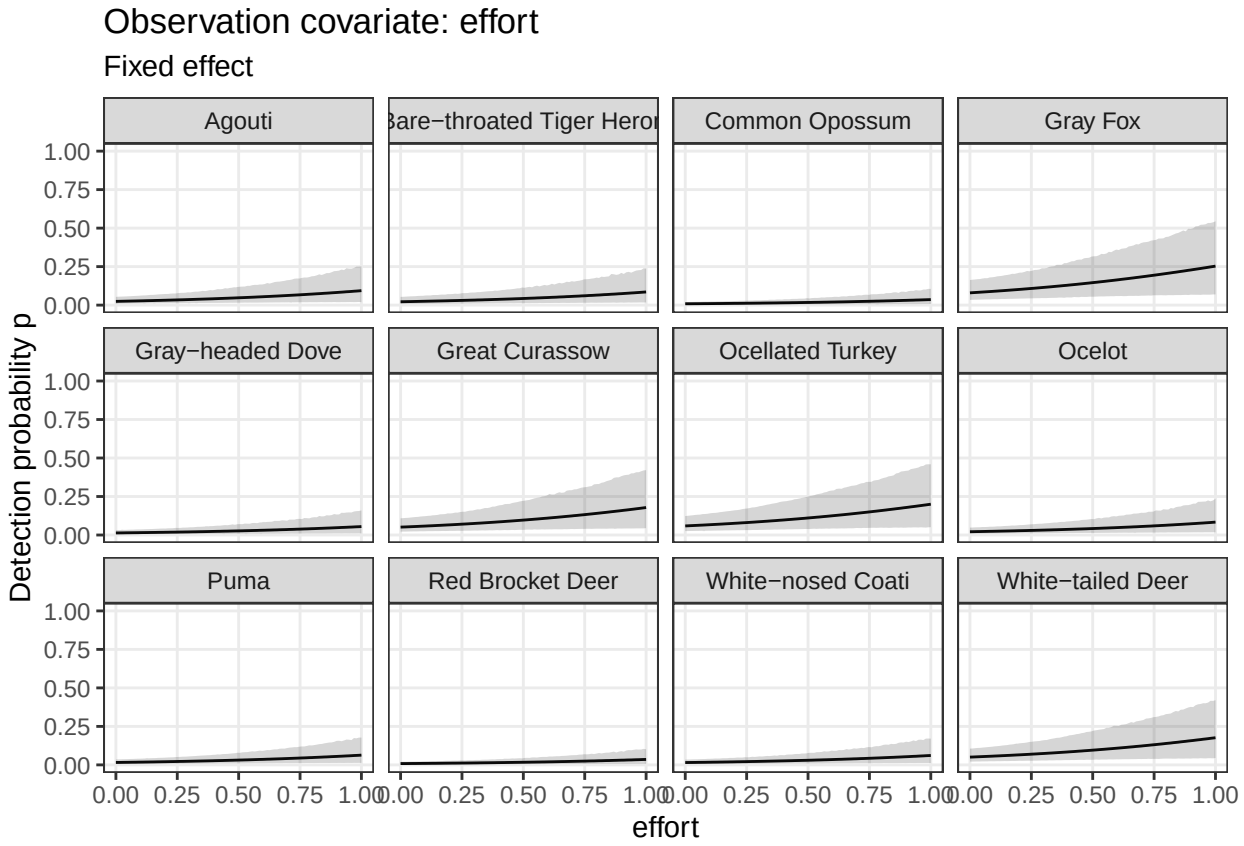
```
## Bpvalue                              1.0000000 0.00000000 0.000000000
## Bpvalue_species[1]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[2]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[3]                   0.9660679 0.18111480 0.004671695
## Bpvalue_species[4]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[5]                   0.8436460 0.36331146 0.009371295
## Bpvalue_species[6]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[7]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[8]                   1.0000000 0.00000000 0.000000000
## Bpvalue_species[9]                   0.4537591 0.49802290 0.012846056
## Bpvalue_species[10]                  0.8443114 0.36268056 0.009355022
## Bpvalue_species[11]                  0.9946773 0.07278655 0.001877464
## Bpvalue_species[12]                  1.0000000 0.00000000 0.000000000
## Nspecies                            12.0000000 0.00000000 0.000000000
## R2[1]                               30.7456990 2.43830058 0.062893788
## R2[2]                                7.7289409 1.14386362 0.029504942
## R2[3]                                9.0973578 1.98911633 0.051307481
## R2[4]                               56.3123908 1.64512176 0.042434448
## R2[5]                                6.6532304 2.52106550 0.065028635
## R2[6]                               34.0338676 2.19881817 0.056716553
## R2[7]                               57.1899909 2.34524125 0.060493406
## R2[8]                               16.4928498 2.09514895 0.054042498
## R2[9]                                5.2145878 0.50132047 0.012931114
## R2[10]                               7.8876582 2.02823027 0.052316390
## R2[11]                              12.1656808 1.64691691 0.042480752
## R2[12]                              40.7882881 2.32116408 0.059872356
## R3                                 284.3105422 7.32294563 0.188888849
## alpha.obs.fixed.cont.effort          1.3555804 0.50361687 0.012990348
## alpha0[1]                           -3.8227157 0.51330635 0.013240279
## alpha0[2]                           -3.9463587 0.55034350 0.014195620
## alpha0[3]                           -4.8809088 0.52168526 0.013456406
## alpha0[4]                           -2.5543857 0.50410527 0.013002946
## alpha0[5]                           -4.4305641 0.52289059 0.013487496
## alpha0[6]                           -3.0374396 0.50457006 0.013014935
## alpha0[7]                           -2.8856924 0.50677660 0.013071850
## alpha0[8]                           -3.9563316 0.51433588 0.013266835
## alpha0[9]                           -4.2630024 0.50970709 0.013147440
## alpha0[10]                          -4.8942174 0.52453696 0.013529963
## alpha0[11]                          -4.3054562 0.51680911 0.013330630
## alpha0[12]                          -3.0492881 0.50274375 0.012967827
## alpha0.mean                         -3.8204236 0.57302019 0.014780544
## alpha0.sigma                         0.8677531 0.21369975 0.005512194
## beta.fixed.categ.Logging_Grid[1]     0.0000000 0.00000000 0.000000000
## beta.fixed.categ.Logging_Grid[2]     1.2851743 0.52197232 0.013463810
## beta0[1]                             0.3489777 0.69562724 0.017943084
## beta0[2]                            -2.3295782 0.90625690 0.023376088
## beta0[3]                             0.2142344 0.77633554 0.020024883
## beta0[4]                             0.5620610 0.61951080 0.015979728
## beta0[5]                             0.2184014 0.70491096 0.018182549
## beta0[6]                             1.9583766 1.09599035 0.028270093
## beta0[7]                             1.0785906 0.78952282 0.020365037
## beta0[8]                             0.7184435 0.69779563 0.017999016
## beta0[9]                             2.4730308 1.30038594 0.033542295
## beta0[10]                            1.1049858 0.95164443 0.024546819
```

```
## beta0[11]                          0.7489252 0.73487949 0.018955561
## beta0[12]                          0.4131737 0.66495020 0.017151797
## beta0.mean                         0.6157670 0.56943307 0.014688018
## beta0.sigma                        1.4581417 0.58664538 0.015131994
## new.R2[1]                          3.6332402 1.58772238 0.040953882
## new.R2[2]                          0.6831523 0.74448728 0.019203385
## new.R2[3]                          4.3745980 1.91376109 0.049363760
## new.R2[4]                          2.8883144 1.22919140 0.031705895
## new.R2[5]                          4.1491998 1.82535418 0.047083382
## new.R2[6]                          3.9425302 1.58034533 0.040763598
## new.R2[7]                          3.3941230 1.39868377 0.036077800
## new.R2[8]                          4.2948196 1.75424127 0.045249088
## new.R2[9]                          5.7003625 2.03627050 0.052523781
## new.R2[10]                         5.4358613 2.05990338 0.053133370
## new.R2[11]                         4.7106064 1.87104842 0.048262025
## new.R2[12]                         3.0729898 1.32396389 0.034150467
## new.R3                            46.2797975 5.81389142 0.149964142
##                                  Time-series SE
## Bpvalue                             0.000000000
## Bpvalue_species[1]                  0.000000000
## Bpvalue_species[2]                  0.000000000
## Bpvalue_species[3]                  0.004999112
## Bpvalue_species[4]                  0.000000000
## Bpvalue_species[5]                  0.008938384
## Bpvalue_species[6]                  0.000000000
## Bpvalue_species[7]                  0.000000000
## Bpvalue_species[8]                  0.000000000
## Bpvalue_species[9]                  0.012127496
## Bpvalue_species[10]                 0.010168553
## Bpvalue_species[11]                 0.001878558
## Bpvalue_species[12]                 0.000000000
## Nspecies                            0.000000000
## R2[1]                               0.087174126
## R2[2]                               0.029496867
## R2[3]                               0.080510560
## R2[4]                               0.041396977
## R2[5]                               0.102430913
## R2[6]                               0.084590363
## R2[7]                               0.069909475
## R2[8]                               0.068908681
## R2[9]                               0.014665999
## R2[10]                              0.072903425
## R2[11]                              0.045608707
## R2[12]                              0.075416300
## R3                                  0.288600548
## alpha.obs.fixed.cont.effort         0.122980678
## alpha0[1]                           0.107433442
## alpha0[2]                           0.094884273
## alpha0[3]                           0.097353155
## alpha0[4]                           0.111568263
## alpha0[5]                           0.095658484
## alpha0[6]                           0.126208549
## alpha0[7]                           0.110926369
## alpha0[8]                           0.113480431
```

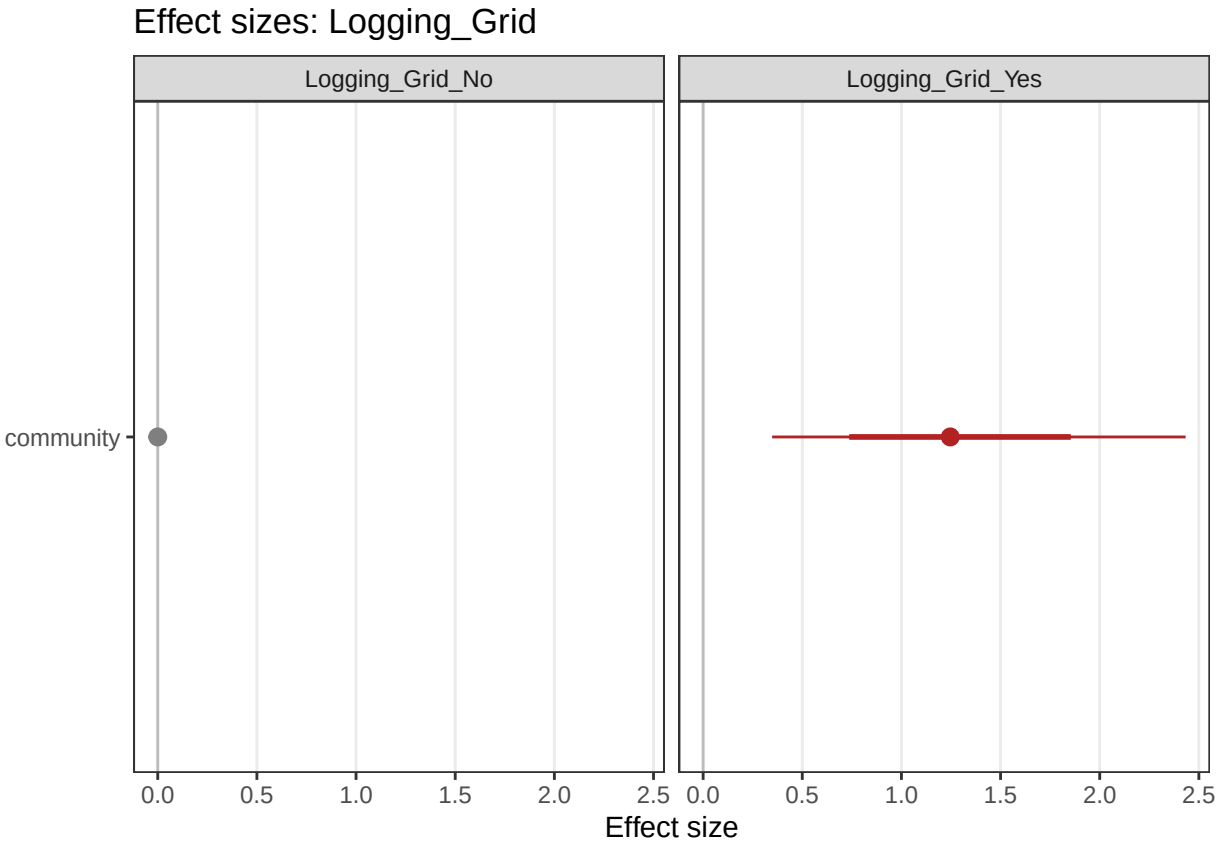
```
## alpha0[9]                                0.104777667
## alpha0[10]                               0.108539724
## alpha0[11]                               0.107556815
## alpha0[12]                               0.111679027
## alpha0.mean                              0.096596789
## alpha0.sigma                             0.006439612
## beta.fixed.categ.Logging_Grid[1]         0.000000000
## beta.fixed.categ.Logging_Grid[2]         0.041523951
## beta0[1]                                 0.029944872
## beta0[2]                                 0.057400289
## beta0[3]                                 0.042740398
## beta0[4]                                 0.029522547
## beta0[5]                                 0.030548620
## beta0[6]                                 0.056667265
## beta0[7]                                 0.031863093
## beta0[8]                                 0.027180146
## beta0[9]                                 0.070251080
## beta0[10]                                0.049134695
## beta0[11]                                0.033758697
## beta0[12]                                0.029221703
## beta0.mean                               0.028746476
## beta0.sigma                              0.035015562
## new.R2[1]                                0.039541480
## new.R2[2]                                0.020104152
## new.R2[3]                                0.053294871
## new.R2[4]                                0.031641570
## new.R2[5]                                0.047060216
## new.R2[6]                                0.037591294
## new.R2[7]                                0.036084652
## new.R2[8]                                0.045260493
## new.R2[9]                                0.052552776
## new.R2[10]                               0.057751549
## new.R2[11]                               0.048112400
## new.R2[12]                               0.034145164
## new.R3                                   0.149594101

## $Logging_Grid
```


Site covariate: Logging_Grid
Fixed effect
Agouti
Bare−throated Tiger Hero
Common Opossum
Gray Fox
Gray−headed Dove
Great Curassow
Ocellated Turkey
Ocelot
Puma
Red Brocket Deer
White−nosed Coati
White−tailed Deer
Occupancy probability ψ
1.00
0.75
0.50
0.25
0.00
No
Yes
Logging_Grid

```
## $effort
```




```
## $Logging_Grid
```



2020 Prelim Results

```
mod.jags <- communityModel(data_list,
                           occuCovs = list(fixed = "Logging_Grid"),
                           detCovsObservation = list(fixed = "effort"),
                           intercepts = list(det = "ranef", occu = "ranef"),
                           modelFile = modelfile1)
```

```
## Wrote model to /var/folders/pt/nm1ggvdd2113cblty7_8wylw0000gn/T//Rtmp9Cgxif/file106471c5e038d.txt
```

```
summary(mod.jags)
```

```
## commOccu object (for JAGS)
##
## 11 species,  20 stations,  302 occasions
## 2204 occasions with effort
## Number of detections (by species): 41 - 415
##
## Available site covariates:
##  group, Logging_Grid
##
## Used site covariates:
##  Logging_Grid
##
## Available site-occasion covariates:
##  effort
```

```r
fit.jags <- fit(mod.jags,
                n.iter = 1000,
                n.burnin = 500,
                chains = 3)
```

```
## Warning in searchCommandline(parallel, cpus = cpus, type = type,
## socketHosts = socketHosts, : Unknown option on commandline:
## rmarkdown::render('/Users/elise/Desktop/MP/Belize-MP-Bruno-Boos/RedoAnalysis.Rmd',~+~~+~encoding~+~
```

```
## snowfall 1.84-6.2 initialized: sequential execution, one CPU.
```

```
## sfExportAll() ignored in sequential mode.
```

```
## Warning in snowfall::sfClusterSetupRNG(): Uniform random number streams
## (currently) not available in serial execution. Random numbers may differ in
## serial & parallel execution.
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 24244
##    Unobserved stochastic nodes: 108884
##    Total graph size: 149122
##
## Initializing model
##
## NOTE: Stopping adaptation
##
##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 24244
##    Unobserved stochastic nodes: 108884
##    Total graph size: 149122
##
## Initializing model
##
## NOTE: Stopping adaptation
##
##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 24244
##    Unobserved stochastic nodes: 108884
##    Total graph size: 149122
##
## Initializing model
##
## NOTE: Stopping adaptation
```

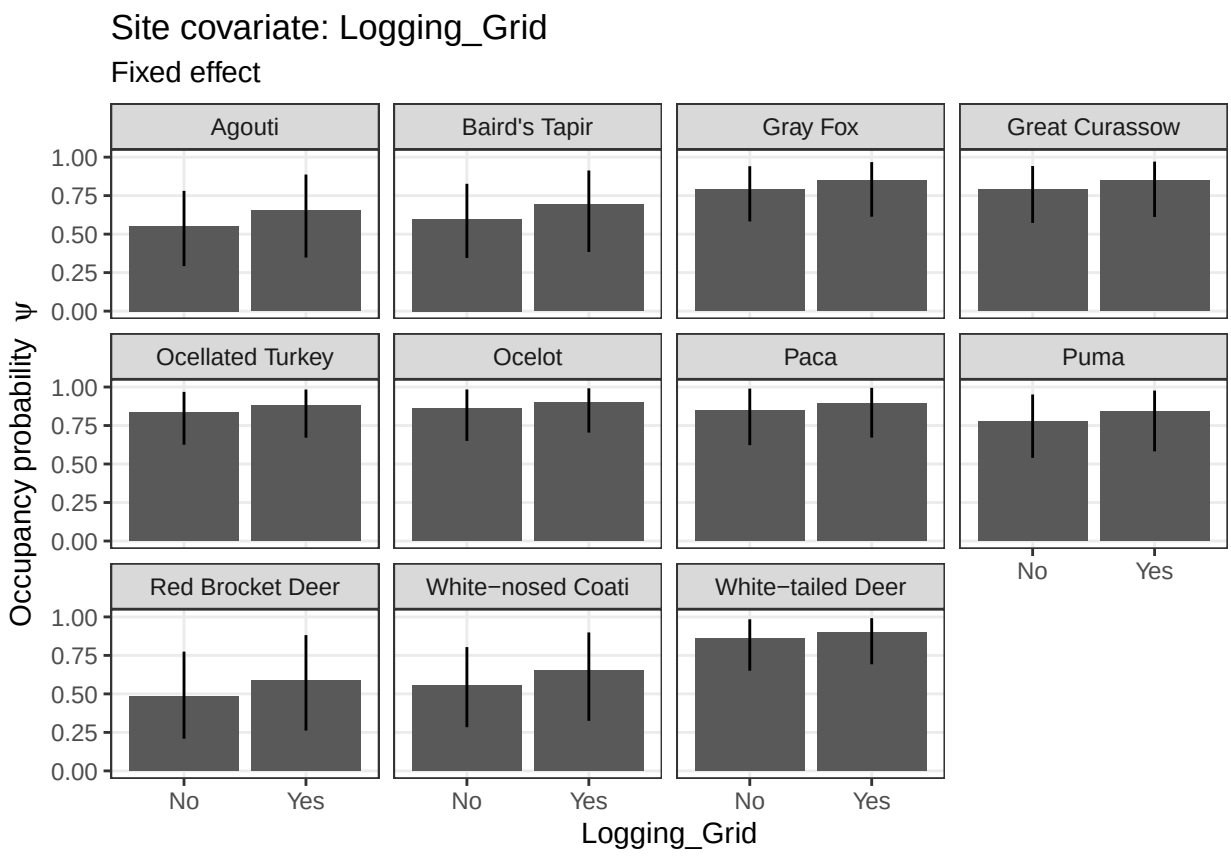
```
##                                         Mean         SD    Naive SE
```

```
## Bpvalue                              1.00000000 0.00000000 0.000000000
## Bpvalue_species[1]                   0.99933466 0.02579411 0.000665336
## Bpvalue_species[2]                   1.00000000 0.00000000 0.000000000
## Bpvalue_species[3]                   1.00000000 0.00000000 0.000000000
## Bpvalue_species[4]                   1.00000000 0.00000000 0.000000000
## Bpvalue_species[5]                   1.00000000 0.00000000 0.000000000
## Bpvalue_species[6]                   0.99733866 0.05153667 0.001329342
## Bpvalue_species[7]                   1.00000000 0.00000000 0.000000000
## Bpvalue_species[8]                   0.98137059 0.13525725 0.003488840
## Bpvalue_species[9]                   0.99401198 0.07717597 0.001990685
## Bpvalue_species[10]                  0.99800399 0.04464695 0.001151628
## Bpvalue_species[11]                  1.00000000 0.00000000 0.000000000
## Nspecies                            11.00000000 0.00000000 0.000000000
## R2[1]                               13.76288771 2.28631337 0.058973413
## R2[2]                               24.72206463 2.11874901 0.054651240
## R2[3]                               56.92706883 1.48930198 0.038415216
## R2[4]                               44.00392465 1.20835455 0.031168427
## R2[5]                               39.59011264 1.53701168 0.039645845
## R2[6]                               14.75493791 1.55761775 0.040177360
## R2[7]                               16.71689613 1.94732008 0.050229384
## R2[8]                               11.97957573 2.67300732 0.068947839
## R2[9]                                9.85075326 2.60264040 0.067132787
## R2[10]                              12.51304118 2.45690360 0.063373636
## R2[11]                              51.84772768 2.29717376 0.059253547
## R3                                 296.66899036 6.76963241 0.174616628
## alpha.obs.fixed.cont.effort          1.74562926 0.37166863 0.009586861
## alpha0[1]                           -4.68532562 0.39276155 0.010130934
## alpha0[2]                           -4.43988396 0.38502902 0.009931480
## alpha0[3]                           -3.10579550 0.37188526 0.009592448
## alpha0[4]                           -3.46726180 0.37347277 0.009633397
## alpha0[5]                           -3.35997147 0.37166620 0.009586798
## alpha0[6]                           -4.43467867 0.37719482 0.009729404
## alpha0[7]                           -5.55046299 0.39951641 0.010305169
## alpha0[8]                           -4.72808271 0.38224654 0.009859709
## alpha0[9]                           -5.12200768 0.41101596 0.010601790
## alpha0[10]                          -4.97796023 0.39499965 0.010188663
## alpha0[11]                          -3.94879193 0.37624360 0.009704868
## alpha0.mean                         -4.34089877 0.45900644 0.011839661
## alpha0.sigma                         0.86347291 0.22486506 0.005800194
## beta.fixed.categ.Logging_Grid[1]     0.00000000 0.00000000 0.000000000
## beta.fixed.categ.Logging_Grid[2]     0.48086249 0.42959159 0.011080932
## beta0[1]                             0.22429845 0.55165528 0.014229456
## beta0[2]                             0.43056518 0.57258352 0.014769281
## beta0[3]                             1.42794146 0.61431879 0.015845805
## beta0[4]                             1.41433813 0.62397129 0.016094783
## beta0[5]                             1.77768871 0.72589300 0.018723762
## beta0[6]                             2.06434588 0.89409090 0.023062277
## beta0[7]                             2.02546680 1.07465539 0.027719777
## beta0[8]                             1.40023916 0.75220723 0.019402514
## beta0[9]                            -0.06700675 0.65636922 0.016930458
## beta0[10]                            0.24326323 0.61831812 0.015948964
## beta0[11]                            2.05644195 0.94442578 0.024360620
## beta0.mean                           1.17074845 0.52305122 0.013491639
## beta0.sigma                          1.08156277 0.47637907 0.012287773
```

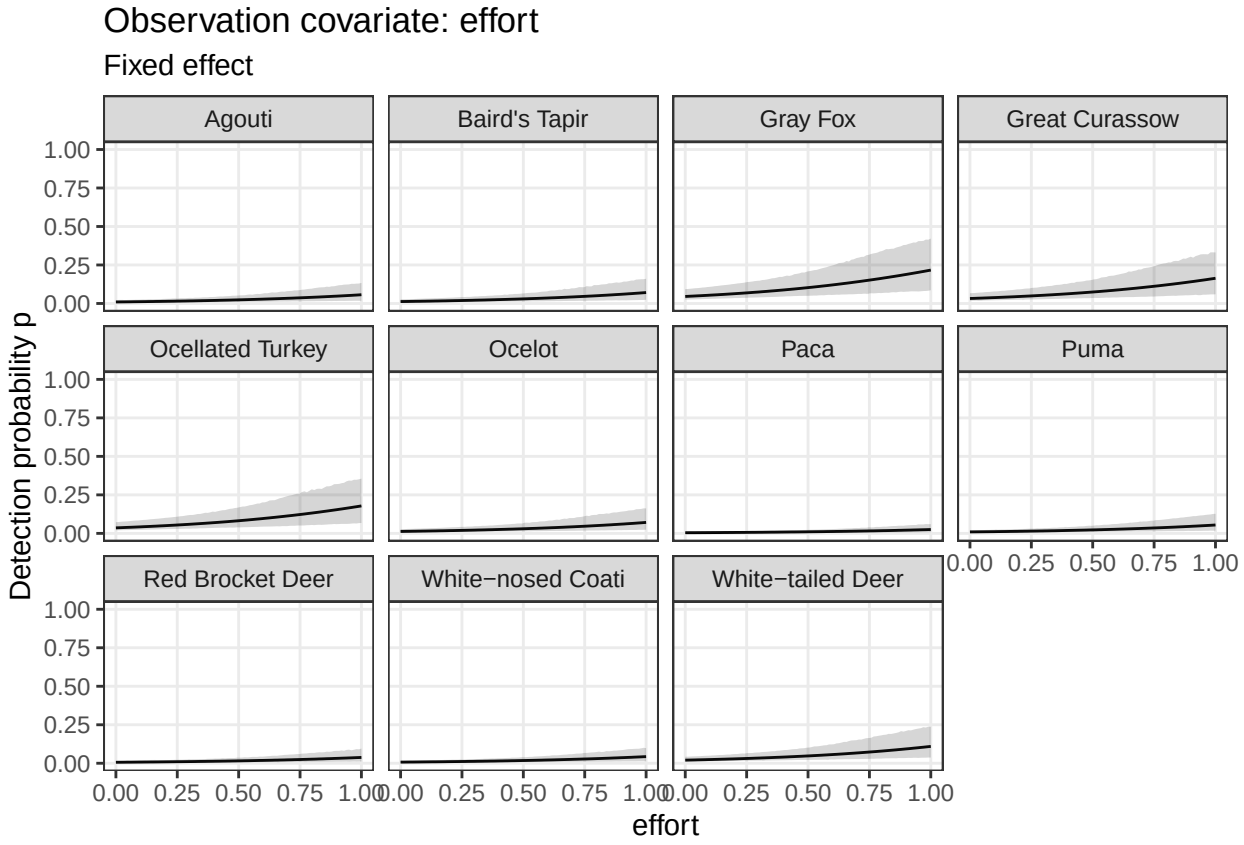
```
## new.R2[1]                            3.51046694 1.77635317 0.045819445
## new.R2[2]                            3.47252720 1.70951886 0.044095514
## new.R2[3]                            3.52580984 1.33400672 0.034409513
## new.R2[4]                            3.87973667 1.48130644 0.038208978
## new.R2[5]                            4.04599690 1.42354134 0.036718979
## new.R2[6]                            5.25194009 2.13243994 0.055004386
## new.R2[7]                            6.98677583 2.41022878 0.062169701
## new.R2[8]                            5.02010334 2.18653553 0.056399733
## new.R2[9]                            3.32867755 1.90040260 0.049019189
## new.R2[10]                           3.76654808 1.96647676 0.050723514
## new.R2[11]                           4.69108180 1.78098108 0.045938818
## new.R3                              47.47966425 6.11658645 0.157771890
##                                    Time-series SE
## Bpvalue                              0.000000000
## Bpvalue_species[1]                   0.000665336
## Bpvalue_species[2]                   0.000000000
## Bpvalue_species[3]                   0.000000000
## Bpvalue_species[4]                   0.000000000
## Bpvalue_species[5]                   0.000000000
## Bpvalue_species[6]                   0.001328674
## Bpvalue_species[7]                   0.000000000
## Bpvalue_species[8]                   0.004161060
## Bpvalue_species[9]                   0.002297021
## Bpvalue_species[10]                  0.001151627
## Bpvalue_species[11]                  0.000000000
## Nspecies                             0.000000000
## R2[1]                                0.065349622
## R2[2]                                0.054616270
## R2[3]                                0.036719257
## R2[4]                                0.034972721
## R2[5]                                0.044497777
## R2[6]                                0.046879478
## R2[7]                                0.068624616
## R2[8]                                0.090489305
## R2[9]                                0.096310043
## R2[10]                               0.085802792
## R2[11]                               0.066533585
## R3                                   0.230923177
## alpha.obs.fixed.cont.effort          0.075355890
## alpha0[1]                            0.063224985
## alpha0[2]                            0.064917786
## alpha0[3]                            0.066585175
## alpha0[4]                            0.073252283
## alpha0[5]                            0.073166624
## alpha0[6]                            0.071297600
## alpha0[7]                            0.061183843
## alpha0[8]                            0.061869061
## alpha0[9]                            0.067692780
## alpha0[10]                           0.060429167
## alpha0[11]                           0.066582300
## alpha0.mean                          0.050141895
## alpha0.sigma                         0.007073448
## beta.fixed.categ.Logging_Grid[1]     0.000000000
## beta.fixed.categ.Logging_Grid[2]     0.034493442
```

```
## beta0[1]                    0.033739013
## beta0[2]                    0.037805547
## beta0[3]                    0.031769082
## beta0[4]                    0.032365356
## beta0[5]                    0.038274007
## beta0[6]                    0.047358462
## beta0[7]                    0.070991852
## beta0[8]                    0.040824591
## beta0[9]                    0.038815128
## beta0[10]                   0.041935202
## beta0[11]                   0.051138698
## beta0.mean                  0.036749824
## beta0.sigma                 0.039361597
## new.R2[1]                   0.054573080
## new.R2[2]                   0.044107767
## new.R2[3]                   0.034413798
## new.R2[4]                   0.036403292
## new.R2[5]                   0.038124049
## new.R2[6]                   0.055036300
## new.R2[7]                   0.071423110
## new.R2[8]                   0.058616935
## new.R2[9]                   0.052290970
## new.R2[10]                  0.050731640
## new.R2[11]                  0.050077056
## new.R3                      0.154594292
```

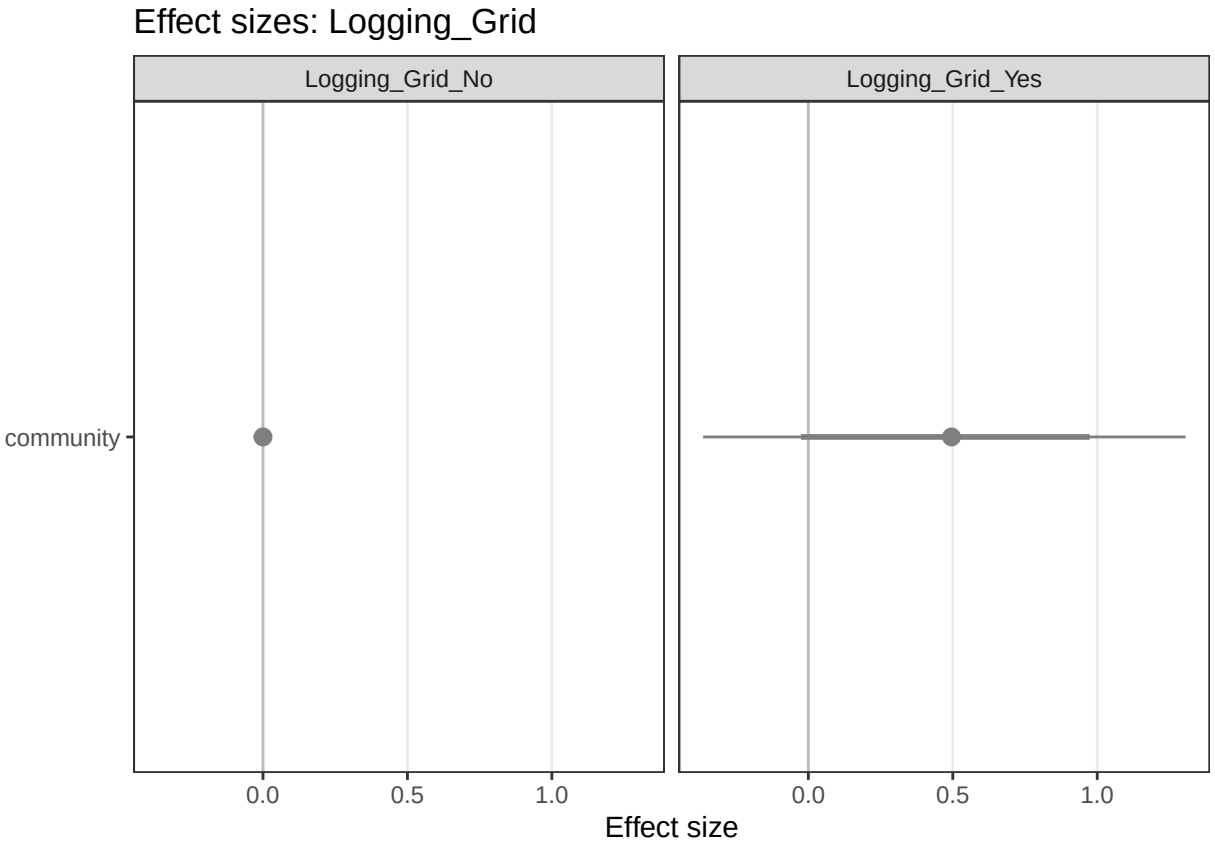
```
## $Logging_Grid
```



```
## $effort
```




```
## $Logging_Grid
```


Effect sizes: Logging_Grid
Logging_Grid_No
Logging_Grid_Yes
community
0.0
0.5
1.0
0.0
0.5
1.0
Effect size