

Exploratory Data Analysis

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```
library(readr)
library(tidyr)
library(dplyr)
library(ggplot2)
library(arm)
```

Read dataset

```
dataset <- read_csv("data/fulldata.csv")
```

```
## Parsed with column specification:
## cols(
##   site = col_character(),
##   town = col_character(),
##   lat = col_double(),
##   long = col_double(),
##   altitude = col_integer(),
##   inside = col_integer(),
##   shrub_height = col_double(),
##   species = col_character(),
##   acronym = col_character(),
##   shrub_tree = col_character(),
##   cover = col_double(),
##   presence = col_integer(),
##   damage = col_integer(),
##   palatability = col_integer(),
##   resprouter = col_integer(),
##   Herrera_type = col_integer(),
##   Coca = col_character()
## )
```

```
dataset <- mutate(dataset, inside = ifelse(inside == 1, "in", "out"))
str(dataset)
```

```
## Classes 'tbl_df', 'tbl' and 'data.frame':   3520 obs. of  17 variables:
## $ site      : chr  "Aljibe" "Aljibe" "Aljibe" "Aljibe" ...
## $ town      : chr  "Jerez" "Jerez" "Jerez" "Jerez" ...
## $ lat       : num  36.5 36.5 36.5 36.5 36.5 ...
## $ long      : num  -5.61 -5.61 -5.61 -5.61 -5.61 ...
## $ altitude  : int  1039 1039 1039 1039 1039 1039 1039 1039 1039 1039 ...
## $ inside    : chr  "in" "in" "in" "in" ...
## $ shrub_height: num  2 2 2 2 2 2 2 2 2 2 ...
## $ species   : chr  "Adenocarpus telonensis" "Adenocarpus telonensis" "Thymus baeticus" "Thymus baeti
## $ acronym   : chr  "Adentelo" "Adentelo" "Thymbaet" "Thymbaet" ...
## $ shrub_tree : chr  "shrub" "tree" "tree" "shrub" ...
## $ cover     : num  0 0 0 0 0 0 16.7 0 0.5 0 ...
## $ presence  : int  0 0 0 0 0 0 1 0 1 0 ...
## $ damage    : int  NA NA NA NA NA NA 0 NA 0 NA ...
```

```
## $ palatability: int  2 2 NA NA 2 2 2 2 3 3 ...
## $ resprouter : int  NA NA NA NA NA NA NA NA 1 1 ...
## $ Herrera_type: int  1 1 1 1 1 NA NA NA 2 2 ...
## $ Coca      : chr  "intermedio" "intermedio" NA NA ...
```

```
summary(dataset)
```

```
##      site      town      lat      long
## Length:3520    Length:3520    Min.   :36.10    Min.   : -5.650
## Class :character Class :character 1st Qu.:36.26    1st Qu.: -5.599
## Mode  :character Mode  :character Median :36.32    Median : -5.575
##                                     Mean  :36.33    Mean   : -5.573
##                                     3rd Qu.:36.44    3rd Qu.: -5.533
##                                     Max.   :36.52    Max.   : -5.502
##
##      altitude      inside      shrub_height      species
## Min.   : 158.0    Length:3520    Min.   :0.50    Length:3520
## 1st Qu.: 269.8    Class :character 1st Qu.:1.00    Class :character
## Median : 288.0    Mode  :character Median :1.50    Mode  :character
## Mean   : 365.7
## 3rd Qu.: 428.5
## Max.   :1039.0
##                                     Mean   :1.43
##                                     3rd Qu.:2.00
##                                     Max.   :3.50
##
##      acronym      shrub_tree      cover      presence
## Length:3520    Length:3520    Min.   : 0.000    Min.   :0.0000
## Class :character Class :character 1st Qu.: 0.000    1st Qu.:0.0000
## Mode  :character Mode  :character Median : 0.000    Median :0.0000
##                                     Mean   : 1.164    Mean   :0.1716
##                                     3rd Qu.: 0.000    3rd Qu.:0.0000
##                                     Max.   :50.000    Max.   :1.0000
##                                     NA's   :12      NA's   :12
##
##      damage      palatability      resprouter      Herrera_type
## Min.   :0.000    Min.   :1.000    Min.   :0.0000    Min.   :1.00
## 1st Qu.:0.000    1st Qu.:2.000    1st Qu.:0.0000    1st Qu.:1.00
## Median :0.000    Median :3.000    Median :1.0000    Median :1.00
## Mean   :1.045    Mean   :3.316    Mean   :0.6667    Mean   :1.41
## 3rd Qu.:2.000    3rd Qu.:5.000    3rd Qu.:1.0000    3rd Qu.:2.00
## Max.   :5.000    Max.   :6.000    Max.   :1.0000    Max.   :2.00
## NA's   :3051    NA's   :480     NA's   :1360     NA's   :400
##
##      Coca
## Length:3520
## Class :character
## Mode  :character
##
##
##
##
```

```
head(dataset)
```

```
## # A tibble: 6 x 17
##   site town lat long altitude inside shrub_height species acronym
##   <chr> <chr> <dbl> <dbl> <int> <chr> <dbl> <chr> <chr>
## 1 Alji~ Jerez 36.5 -5.61 1039 in 2 Adenoc~ Adente~
## 2 Alji~ Jerez 36.5 -5.61 1039 in 2 Adenoc~ Adente~
## 3 Alji~ Jerez 36.5 -5.61 1039 in 2 Thymus~ Thymba~
## 4 Alji~ Jerez 36.5 -5.61 1039 in 2 Thymus~ Thymba~
## 5 Alji~ Jerez 36.5 -5.61 1039 in 2 Teucri~ Teucfr~
```

```
## 6 Alji~ Jerez 36.5 -5.61 1039 in 2 Rubus ~ Rubuul~
## # ... with 8 more variables: shrub_tree <chr>, cover <dbl>,
## # presence <int>, damage <int>, palatability <int>, resprouter <int>,
## # Herrera_type <int>, Coca <chr>
```

```
tail(dataset)
```

```
## # A tibble: 6 x 17
##   site town lat long altitude inside shrub_height species acronym
##   <chr> <chr> <dbl> <dbl> <int> <chr> <dbl> <chr> <chr>
## 1 Teja1 Los_~ 36.3 -5.57 261 out 1 Cerato~ Cerasi~
## 2 Teja1 Los_~ 36.3 -5.57 261 out 1 Calico~ Calivi~
## 3 Teja1 Los_~ 36.3 -5.57 261 out 1 bare Bare
## 4 Teja1 Los_~ 36.3 -5.57 261 out 1 bare Bare
## 5 Teja1 Los_~ 36.3 -5.57 261 out 1 Viburn~ Vibuti~
## 6 Teja1 Los_~ 36.3 -5.57 261 out 1 Viburn~ Vibuti~
## # ... with 8 more variables: shrub_tree <chr>, cover <dbl>,
## # presence <int>, damage <int>, palatability <int>, resprouter <int>,
## # Herrera_type <int>, Coca <chr>
```

Derive some useful datasets:

```
shrubs <- filter(dataset, shrub_tree == "shrub")
trees <- filter(dataset, shrub_tree == "tree")

## Only present species, and excluding bare soil
shrubs_present <- filter(shrubs, presence == 1, acronym != "Bare")
trees_present <- filter(trees, presence == 1, acronym != "Bare")
```

Sites

```
sites <- dataset %>%
  distinct(site, inside, .keep_all = TRUE) %>%
  dplyr::select(site:inside)
```

Number of sites

There are 20 sites, with 2 transects in each site (in and out of the exclosure).

```
kable(sites)
```

site	town	lat	long	altitude	inside
Aljibe	Jerez	36.51343	-5.609290	1039	in
Aljibe	Jerez	36.51343	-5.609290	1039	out
Barrancones	Alcala	36.46303	-5.603590	420	in
Barrancones	Alcala	36.46297	-5.603480	422	out
Beatas1	Los_Barrios	36.31554	-5.550760	286	in
Beatas1	Los_Barrios	36.31604	-5.551050	287	out
Caheruelas4	Tarifa	36.10454	-5.597740	273	in
Caheruelas4	Tarifa	36.10456	-5.597870	274	out
Caheruelas5	Tarifa	36.09880	-5.582020	282	in
Caheruelas5	Tarifa	36.09862	-5.521250	280	out
Cucarretes1	Los_Barrios	36.25913	-5.523540	289	in
Cucarretes1	Los_Barrios	36.25948	-5.524770	270	out
Cucarretes2	Los_Barrios	36.26286	-5.532377	280	in

site	town	lat	long	altitude	inside
Cucarretes2	Los_Barrios	36.26292	-5.533230	280	out
Cuevas_Hospital2	Los_Barrios	36.25525	-5.502830	268	in
Cuevas_Hospital2	Los_Barrios	36.25443	-5.502270	267	out
Faldas_Rubio1	Los_Barrios	36.32633	-5.588960	280	in
Faldas_Rubio1	Los_Barrios	36.32690	-5.589580	291	out
Faldas_Rubio2	Los_Barrios	36.32642	-5.578340	310	in
Faldas_Rubio2	Los_Barrios	36.32650	-5.578540	306	out
Garganta_Honda	Jimena	36.39708	-5.522840	485	in
Garganta_Honda	Jimena	36.39640	-5.522390	477	out
Gavilanes	Jimena	36.43768	-5.550860	469	in
Gavilanes	Jimena	36.43735	-5.550910	466	out
Hernan_Martin	Alcala	36.51212	-5.642190	542	in
Hernan_Martin	Alcala	36.51267	-5.642020	523	out
Laguna_Picacho	Alcala	36.52032	-5.649900	390	in
Laguna_Picacho	Alcala	36.52000	-5.650210	394	out
Las_Naranjas	Jimena	36.39825	-5.524870	451	in
Las_Naranjas	Jimena	36.39813	-5.525240	448	out
Laurel	Alcala	36.45050	-5.592710	400	in
Laurel	Alcala	36.45063	-5.592660	408	out
Mogea_Luenga2	Los_Barrios	36.26671	-5.557820	250	in
Mogea_Luenga2	Los_Barrios	36.26671	-5.557820	250	out
Palancar	Los_Barrios	36.24806	-5.574650	191	in
Palancar	Los_Barrios	36.24796	-5.574840	184	out
Puertollano	Tarifa	36.11932	-5.631520	169	in
Puertollano	Tarifa	36.11925	-5.631770	158	out
Tejal	Los_Barrios	36.27039	-5.567700	269	in
Tejal	Los_Barrios	36.27033	-5.567260	261	out

Map of sites

```
rSDM::occmap(as.matrix(sites[, c("long", "lat")]), type = "satellite", exp = 2)
```

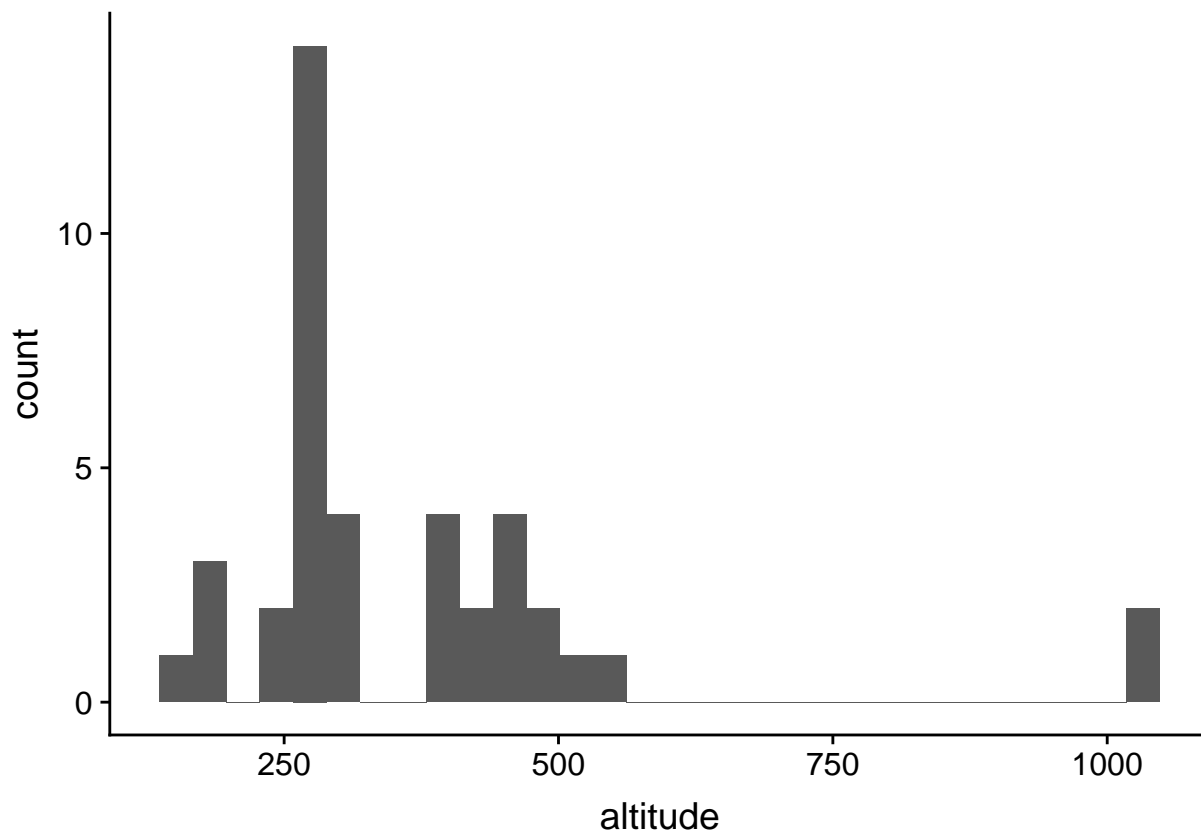
```
## As locs is a matrix, assuming first two columns are longitude and latitude, respectively.
```



Altitude of sites

```
siteplots <- ggplot(sites)
siteplots + geom_histogram(aes(altitude))
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Shrubs

Shrubs: number of species present, their mean cover, and damage at each site

```
shrubcover <- shrubs %>%
  group_by(site, inside) %>%
  filter(acronym == "Bare") %>%
  dplyr::select(cover) %>%
  transmute(shrubcover = 100*(50 - cover)/50) # shrub cover in %

## Adding missing grouping variables: `site`, `inside`
shrubs.summary <- shrubs_present %>%
  group_by(site, inside) %>%
  summarise(shrub_height = unique(shrub_height),
            nspp = sum(presence),
            mean_cover = round(mean(cover), 1),
            sd_cover = round(sd(cover), 1),
            median_cover = round(median(cover), 1),
            mean_damage = round(mean(damage, na.rm = TRUE), 1))

shrubs.summary <- left_join(shrubcover, shrubs.summary, by = c("site", "inside"))

kable(shrubs.summary)
```

site	inside	shrubcover	shrub_height	nspp	mean_cover	sd_cover	median_cover	mean_damage
site	inside	shrubcover	shrub_height	nspp	mean_cover	sd_cover	median_cover	mean_damage
Aljibe	in	93.8	2.0	11	6.5	7.0	2.1	0.0
Aljibe	out	81.4	0.5	8	7.2	8.7	2.4	1.9
Barrancones	in	28.8	1.5	6	2.6	3.4	0.8	0.8
Barrancones	out	51.3	1.5	8	3.4	6.8	0.8	1.6
Beatas1	in	81.1	2.0	13	4.5	5.3	2.9	1.0
Beatas1	out	69.9	1.5	15	3.0	4.9	1.0	1.3
Caheruelas4	in	81.9	0.5	14	4.1	4.2	2.8	0.1
Caheruelas4	out	43.1	0.5	11	2.0	3.1	0.5	1.8
Caheruelas5	in	71.7	1.0	13	3.2	2.7	2.5	2.3
Caheruelas5	out	54.6	0.5	8	3.7	6.4	1.2	4.0
Cucarretes1	in	90.3	2.0	16	4.0	6.2	1.5	0.4
Cucarretes1	out	62.0	2.0	13	2.9	2.3	1.9	1.7
Cucarretes2	in	69.8	2.0	9	4.3	4.5	1.9	0.3
Cucarretes2	out	62.9	0.5	13	2.8	3.7	1.1	0.6
Cuevas_Hospital2	in	73.6	1.5	12	4.5	4.0	4.0	0.7
Cuevas_Hospital2	out	73.1	1.5	14	3.3	3.8	1.5	1.4
Faldas_Rubio1	in	72.4	1.5	16	2.8	3.1	1.8	0.3
Faldas_Rubio1	out	73.9	1.5	9	4.6	10.0	1.5	0.8
Faldas_Rubio2	in	75.4	2.5	12	4.5	6.1	2.0	0.7
Faldas_Rubio2	out	49.5	1.0	12	2.6	2.5	1.6	2.7
Garganta_Honda	in	88.4	1.5	11	5.1	6.5	2.4	0.0
Garganta_Honda	out	67.5	0.5	12	3.6	4.4	2.6	1.1
Gavilanes	in	45.4	1.5	9	3.0	5.1	0.6	0.0
Gavilanes	out	52.9	1.0	11	3.1	4.3	0.7	0.4
Hernan_Martin	in	74.7	3.5	14	3.9	4.6	2.3	0.8
Hernan_Martin	out	46.4	1.0	15	1.9	1.5	1.2	1.7
Laguna_Picacho	in	66.8	2.5	13	3.4	3.5	1.8	0.2
Laguna_Picacho	out	50.1	1.5	13	2.2	2.0	1.3	2.1
Las_Naranjas	in	80.0	2.0	11	4.9	5.6	3.7	0.9
Las_Naranjas	out	70.4	0.7	10	4.3	4.7	2.6	1.8
Laurel	in	88.0	2.0	9	6.5	8.6	2.8	1.4
Laurel	out	80.3	1.0	10	5.0	9.7	2.3	1.4
Mogea_Luenga2	in	91.4	1.0	14	4.8	5.5	3.3	0.4
Mogea_Luenga2	out	85.8	1.0	16	3.9	6.1	1.3	1.2
Palancar	in	46.8	2.5	10	3.6	3.9	2.5	0.0
Palancar	out	69.6	1.5	8	5.4	5.0	3.8	0.2
Puertollano	in	74.8	1.5	13	3.6	4.0	1.6	0.7
Puertollano	out	61.4	1.0	13	2.7	4.5	0.9	2.6
Tejal	in	56.5	1.5	9	4.1	4.0	1.6	0.1
Tejal	out	44.4	1.0	10	2.3	2.5	1.0	1.3

Shrubs: quick comparison in-out

```
kable(shrubs.summary %>%
  group_by(inside) %>%
  summarise(mean_shrub.cover = mean(shrubcover),
             mean_shrub.height = mean(shrub_height),
             mean_nspp = mean(nspp),
             mean_cover = mean(mean_cover),
             mean_damage = mean(mean_damage)))
```

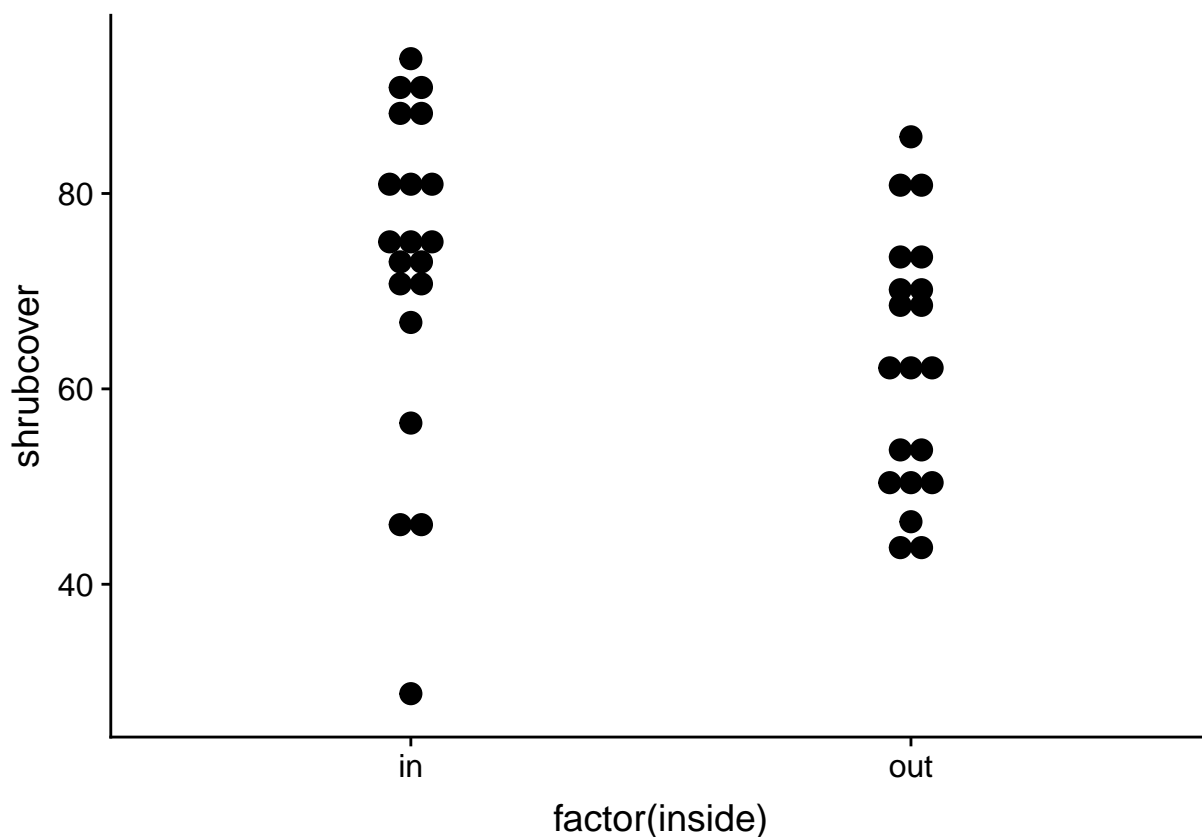
inside	mean_shrub.cover	mean_shrub.height	mean_nspp	mean_cover	mean_damage
in	72.580	1.80	11.75	4.195	0.555
out	62.525	1.06	11.45	3.495	1.580

N.B. Given the hierarchical structure of the data (obs within sites), the most correct way of comparing average cover & damage in and out of exclosures is using mixed models.

Is shrub cover higher within exclosures?

```
shrubplots <- ggplot(shrubs.summary, aes(x = factor(inside)))
shrubplots + geom_dotplot(aes(y = shrubcover), binaxis = "y", stackdir = "center")
```

```
## `stat_bindot()` using `bins = 30`. Pick better value with `binwidth`.
```



Only Barrancones has low cover within the exclosure.

For this variable (cover), bounded between 0 and 100 %, we should use beta regression, or logit-transform the data Wharton et al. 2011. Here we opt in for the latter:

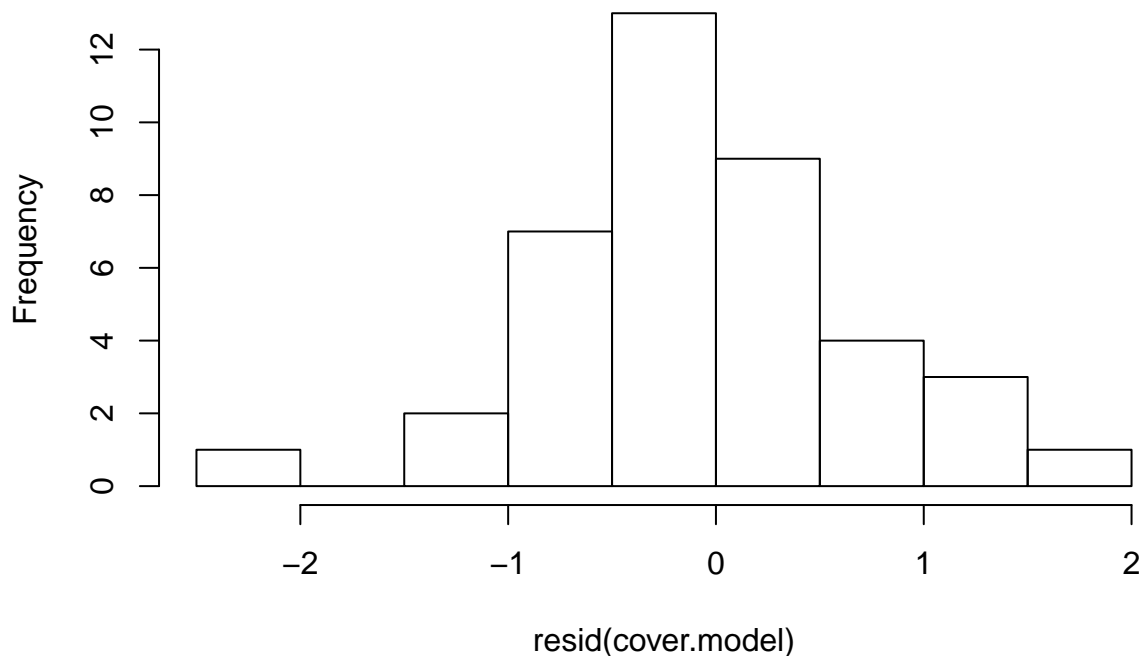
```
shrubs.summary$logitcover <- arm::logit(shrubs.summary$shrubcover/100)
cover.model <- lm(logitcover ~ inside, data = shrubs.summary)
summary(cover.model)
```

```
##
## Call:
## lm(formula = logitcover ~ inside, data = shrubs.summary)
##
## Residuals:
```



```
##      Min      1Q   Median      3Q      Max
## -2.02899 -0.45791 -0.03855  0.39971  1.59274
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.1239     0.1722   6.526 1.08e-07 ***
## insideout    -0.5659     0.2436  -2.323  0.0256 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7702 on 38 degrees of freedom
## Multiple R-squared:  0.1244, Adjusted R-squared:  0.1013
## F-statistic: 5.398 on 1 and 38 DF,  p-value: 0.02561
hist(resid(cover.model))
```

Histogram of resid(cover.model)



```
cover.sim <- sim(cover.model, n.sims = 1000)
coefs <- coef(cover.sim)
coefs[,2] <- coefs[, 1] + coefs[, 2]
coefs <- as.data.frame(invlogit(coefs))
names(coefs) <- c("inside", "outside")
apply(coefs, 2, quantile, c(0, 0.025, 0.25, 0.5, 0.75, 0.975, 1))
```

```
##      inside  outside
## 0%    0.6370760 0.4545320
## 2.5%  0.6818656 0.5523349
## 25%   0.7329316 0.6063493
## 50%   0.7554288 0.6342924
## 75%   0.7763608 0.6635847
## 97.5% 0.8108179 0.7143304
```

```
## 100% 0.8565754 0.7608043
```

```
apply(coefs, 2, mean)
```

```
##      inside      outside
```

```
## 0.7531419 0.6342808
```

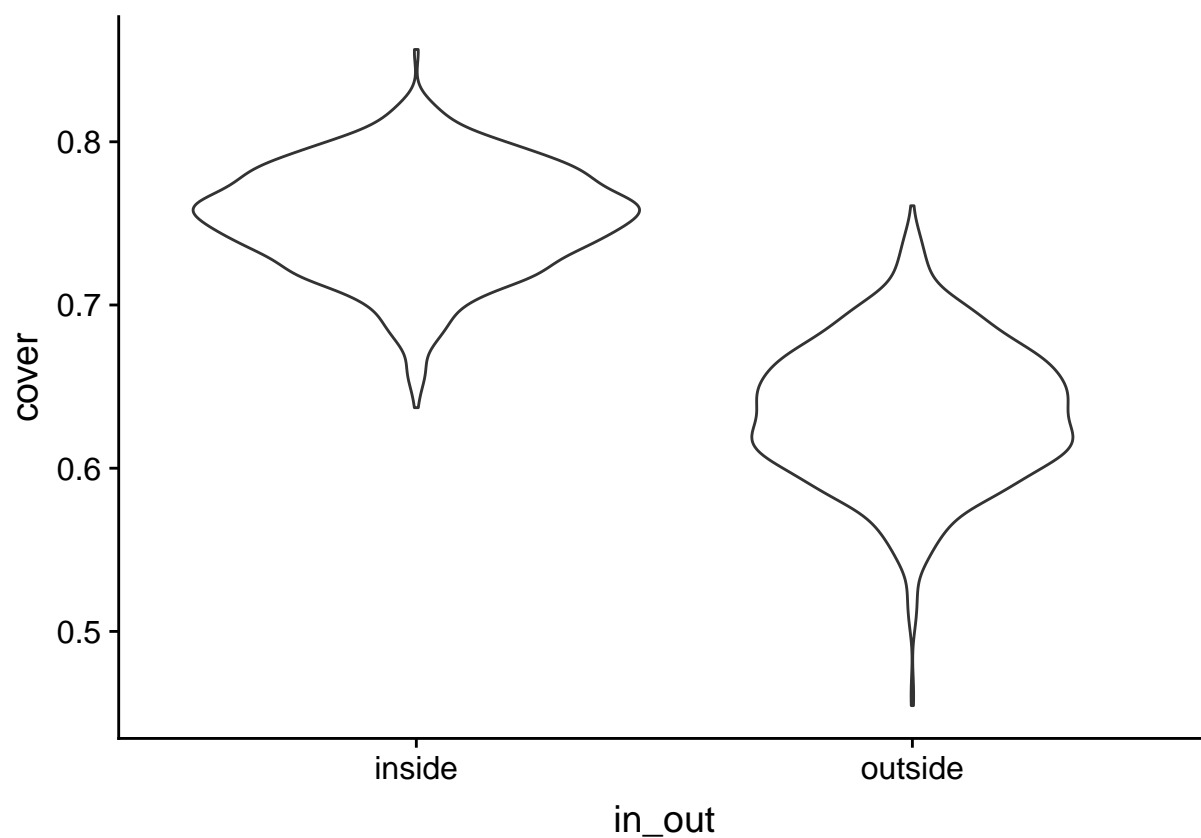
```
apply(coefs, 2, sd)
```

```
##      inside      outside
```

```
## 0.03271632 0.04186369
```

```
coefs <- gather(coefs, "in_out", "cover", 1:2)
```

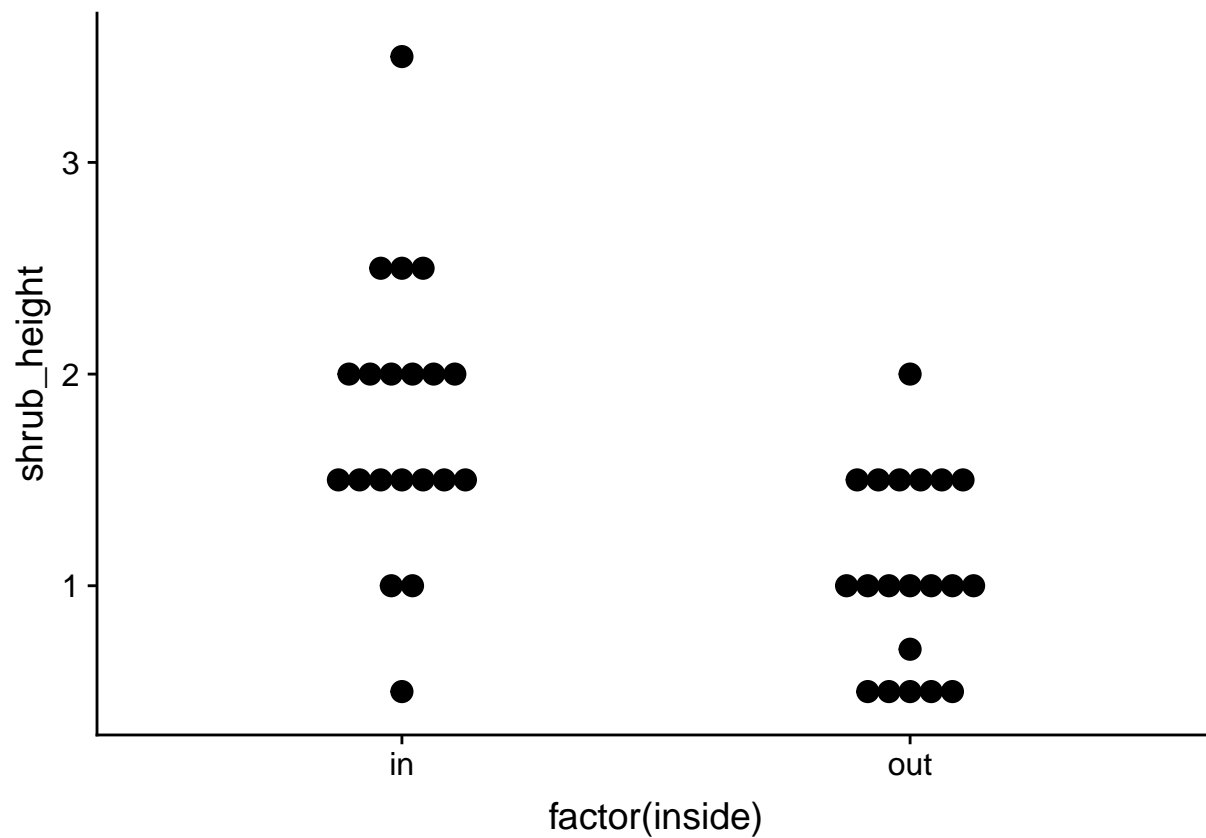
```
ggplot(coefs, aes(in_out, cover)) +  
  geom_violin()
```



Is shrub height higher within exclosures?

```
shrubplots + geom_dotplot(aes(y = shrub_height), binaxis = "y", stackdir = "center")
```

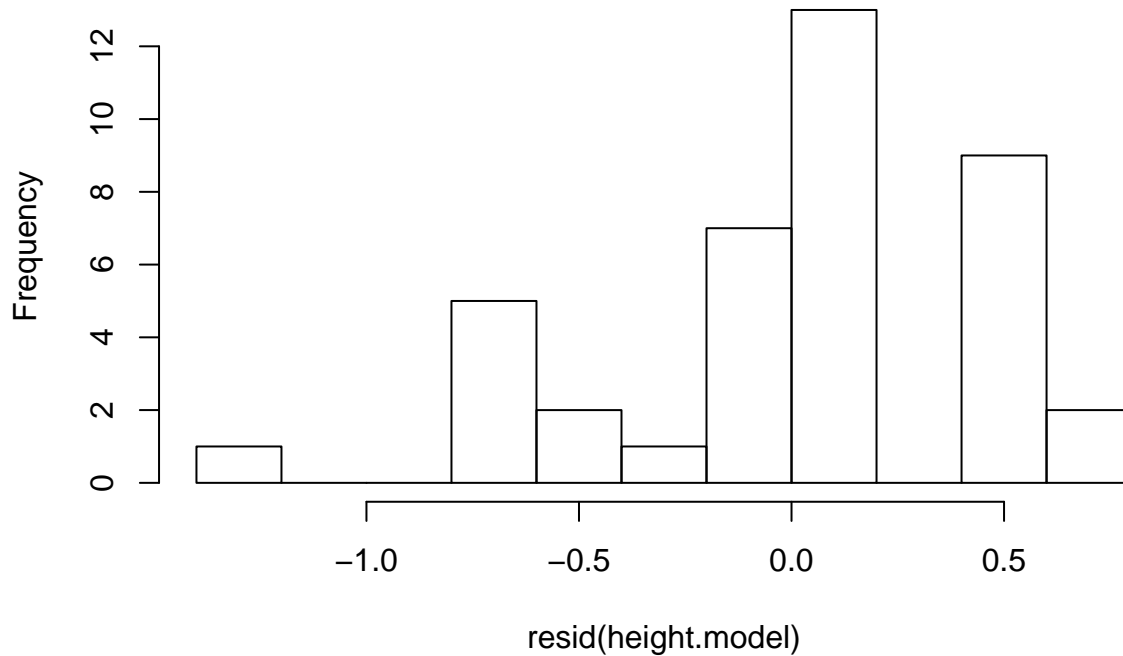
```
## `stat_bindot()` using `bins = 30`. Pick better value with `binwidth`.
```



```
height.model <- lm(log(shrub_height) ~ inside, data = shrubs.summary)
summary(height.model)
```

```
##
## Call:
## lm(formula = log(shrub_height) ~ inside, data = shrubs.summary)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.20843 -0.10982  0.03482  0.40101  0.73748
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.51528    0.09776   5.271 5.68e-06 ***
## insideout   -0.55010    0.13826  -3.979 0.000301 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4372 on 38 degrees of freedom
## Multiple R-squared:  0.2941, Adjusted R-squared:  0.2755
## F-statistic: 15.83 on 1 and 38 DF,  p-value: 0.0003007
hist(resid(height.model))
```

Histogram of resid(height.model)



```
height.sim <- sim(height.model, n.sims = 1000)
coefs <- coef(cover.sim)
coefs[,2] <- coefs[, 1] + coefs[, 2]
coefs <- as.data.frame(exp(coefs))
names(coefs) <- c("inside", "outside")
apply(coefs, 2, quantile, c(0, 0.025, 0.25, 0.5, 0.75, 0.975, 1))
```

```
##      inside  outside
## 0%    1.755397 0.8332881
## 2.5%  2.143326 1.2338129
## 25%   2.744359 1.5403237
## 50%   3.088789 1.7344250
## 75%   3.471489 1.9725164
## 97.5% 4.285912 2.5005492
## 100%  5.972306 3.1806764
```

```
apply(coefs, 2, mean)
```

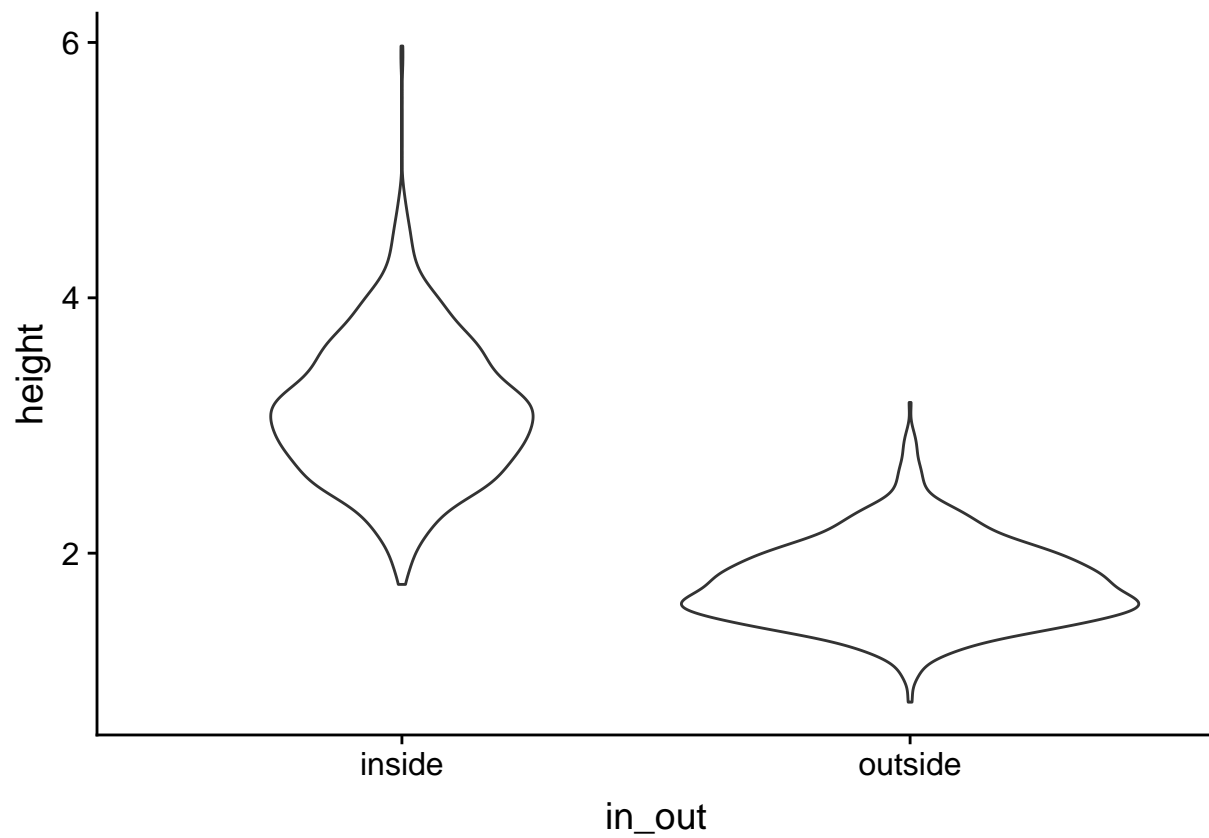
```
##      inside  outside
## 3.122480 1.771077
```

```
apply(coefs, 2, sd)
```

```
##      inside  outside
## 0.5508820 0.3260483
```

```
coefs <- gather(coefs, "in_out", "height", 1:2)
```

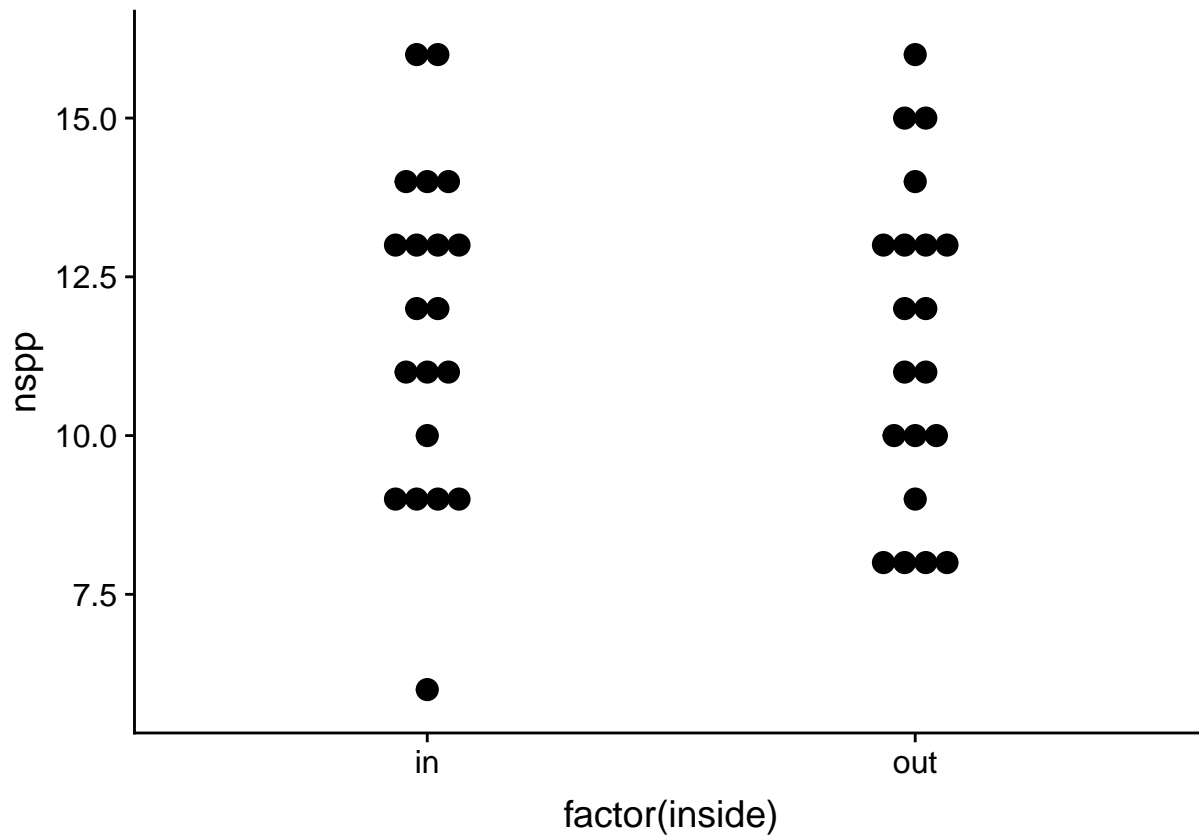
```
ggplot(coefs, aes(in_out, height)) +
  geom_violin()
```



Are there more species within exclosures?

```
shrubplots + geom_dotplot(aes(y = nspp), binaxis = "y", stackdir = "center")
```

```
## `stat_bindot()` using `bins = 30`. Pick better value with `binwidth`.
```

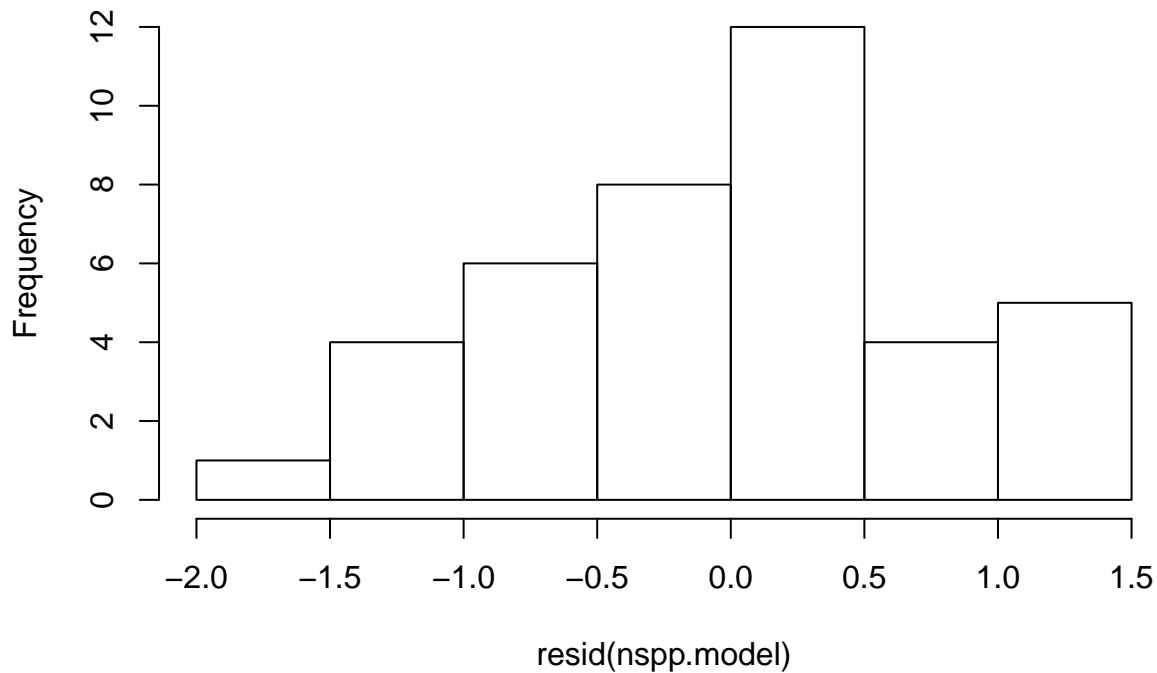


```
nspp.model <- glm(nspp ~ inside, data = shrubs.summary, family = poisson)
summary(nspp.model)
```

```
##
## Call:
## glm(formula = nspp ~ inside, family = poisson, data = shrubs.summary)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.85334  -0.58116   0.07268   0.44827   1.26774
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  2.46385    0.06523  37.770  <2e-16 ***
## insideout   -0.02586    0.09286  -0.279   0.781
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##      Null deviance: 22.065  on 39  degrees of freedom
## Residual deviance: 21.987  on 38  degrees of freedom
## AIC: 197.15
##
## Number of Fisher Scoring iterations: 4
```

```
hist(resid(nspp.model))
```

Histogram of resid(nspp.model)



```
nspp.sim <- sim(nspp.model, n.sims = 1000)
coefs <- coef(nspp.sim)
coefs[,2] <- coefs[, 1] + coefs[, 2]
coefs <- as.data.frame(exp(coefs))
names(coefs) <- c("inside", "outside")
apply(coefs, 2, quantile, c(0, 0.025, 0.25, 0.5, 0.75, 0.975, 1))
```

```
##      inside  outside
## 0%      9.411615  8.814468
## 2.5%    10.348083 10.115142
## 25%     11.202504 10.926889
## 50%     11.734333 11.473454
## 75%     12.222946 11.961002
## 97.5%   13.314719 13.037982
## 100%   14.436826 14.203173
```

```
apply(coefs, 2, mean)
```

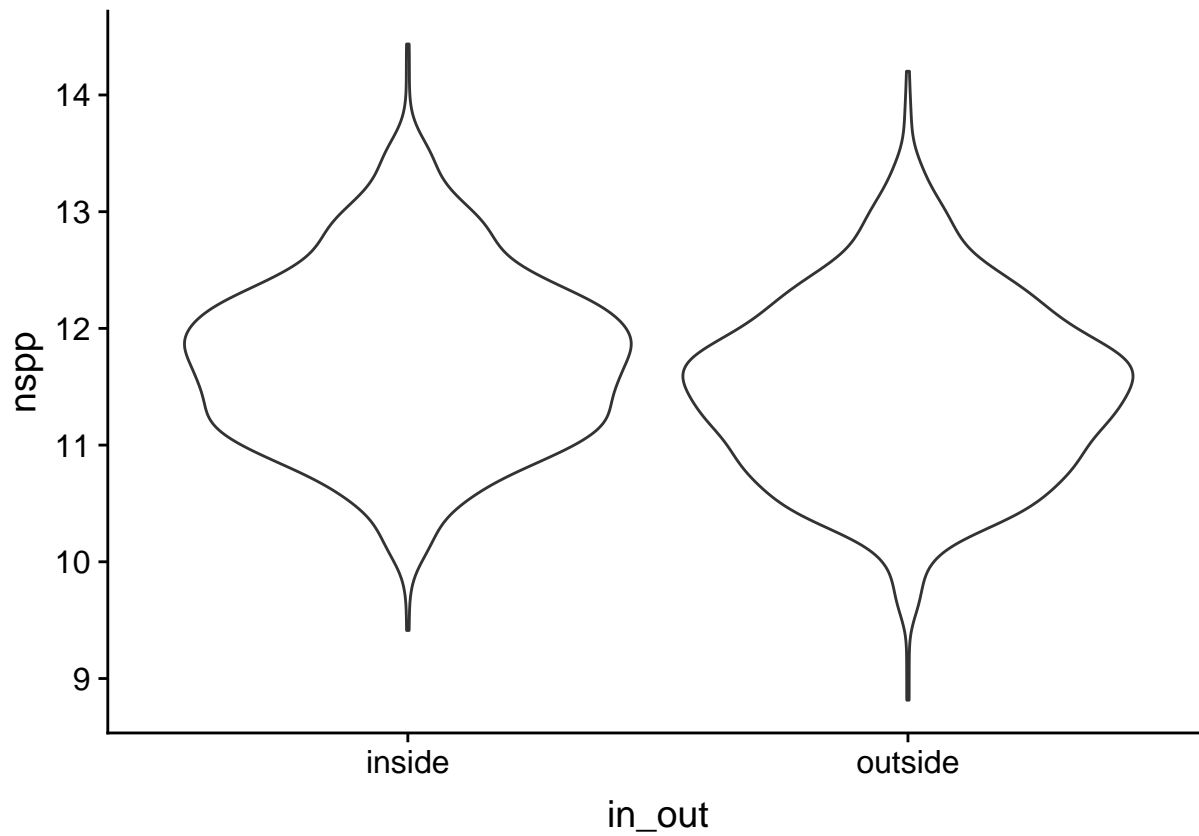
```
##      inside  outside
## 11.74979 11.47939
```

```
apply(coefs, 2, sd)
```

```
##      inside  outside
## 0.7439433 0.7636598
```

```
coefs <- gather(coefs, "in_out", "nspp", 1:2)
```

```
ggplot(coefs, aes(in_out, nspp)) +
  geom_violin()
```



Shrubs: spp appearing in and out of exclosures

species appearing within

```
shrubs.in <- shrubs_present %>%
  filter(inside == "in") %>%
  distinct(species) %>%
  mutate(id = seq(1:nrow(.))) %>%
  dplyr::select(id, species)
kable(shrubs.in)
```

id	species
1	Rubus ulmifolius
2	Quercus pyrenaica
3	Genista tridentata
4	Arbutus unedo
5	Ulex borgiae
6	Teucrium fruticans
7	Quercus lusitanica
8	Cistus populifolius
9	Ilex aquifolium
10	Erica australis
11	Genista triacanthos
12	Erica scoparia
13	Phillyrea latifolia
14	Quercus canariensis

id	species
15	Pinus pinaster
16	Quercus suber
17	Phlomis purpurea
18	Pistacia lentiscus
19	Calicotome villosa
20	Olea europaea
21	Lavandula stoechas
22	Stauracanthus boivinii
23	Cistus salvifolius
24	Calluna vulgaris
25	Myrtus communis
26	Genista tridens
27	Lithodora prostrata
28	Cistus ladanifer
29	Thymus baeticus
30	Erica arborea
31	Dittrichia viscosa
32	Daphne gnidium
33	Pyrus bourgaeana
34	Cistus crispus
35	Viburnum tinus
36	Crataegus monogyna
37	Halimium halimifolium
38	Cistus albidus
39	Phillyrea angustifolia
40	Rosa sempervirens

species appearing outside

```
shrubs.out <- shrubs_present %>%
  filter(inside == "out") %>%
  distinct(species) %>%
  mutate(id = seq(1:nrow(.))) %>%
  dplyr::select(id, species)
kable(shrubs.out)
```

id	species
1	Ulex borgiae
2	Quercus lusitanica
3	Erica arborea
4	Rubus ulmifolius
5	Calluna vulgaris
6	Genista triacanthos
7	Arbutus unedo
8	Cistus populifolius
9	Phillyrea latifolia
10	Erica scoparia
11	Teucrium fruticans
12	Lavandula stoechas
13	Pinus pinaster
14	Stauracanthus boivinii
15	Myrtus communis
16	Phlomis purpurea

id	species
17	Quercus suber
18	Pistacia lentiscus
19	Erica australis
20	Calicotome villosa
21	Olea europaea
22	Cistus salvifolius
23	Daphne gnidium
24	Genista tridens
25	Cistus ladanifer
26	Crataegus monogyna
27	Cytisus striatus
28	Genista tridentata
29	Halimium halimifolium
30	Quercus canariensis
31	Cistus crispus
32	Adenocarpus telonensis
33	Phillyrea angustifolia
34	Viburnum tinus

Shrubs: species occurring only in or out of exclosures

only in

```
in.only <- anti_join(shrubs.in, shrubs.out, by = "species") %>%
  dplyr::select(-id) %>%
  arrange(species)
kable(in.only)
```

species
Cistus albidus
Dittrichia viscosa
Ilex aquifolium
Lithodora prostrata
Pyrus bourgaeana
Quercus pyrenaica
Rosa sempervirens
Thymus baeticus

only out

```
out.only <- anti_join(shrubs.out, shrubs.in, by = "species") %>%
  dplyr::select(-id) %>%
  arrange(species)
kable(out.only)
```

species
Adenocarpus telonensis
Cytisus striatus

Shrubs: summary of species frequency, cover, and damage

```
kable(shrubs_present %>%
  group_by(species, inside) %>%
  summarise(freq = sum(presence),
    mean_cover = round(mean(cover), 1),
    sd_cover = round(sd(cover), 1),
    median_cover = round(median(cover), 1),
    mean_damage = round(mean(damage, na.rm = TRUE), 1)))
```

species	inside	freq	mean_cover	sd_cover	median_cover	mean_damage
Adenocarpus telonensis	out	3	0.8	0.3	0.6	1.3
Arbutus unedo	in	4	3.6	3.6	3.3	0.5
Arbutus unedo	out	1	0.4	NaN	0.4	2.0
Calicotome villosa	in	10	3.3	3.0	2.0	1.2
Calicotome villosa	out	10	5.6	5.3	4.6	2.7
Calluna vulgaris	in	7	3.8	3.9	3.1	0.1
Calluna vulgaris	out	8	1.2	0.9	0.9	1.0
Cistus albidus	in	1	2.8	NaN	2.8	0.0
Cistus crispus	in	2	0.5	0.0	0.5	0.5
Cistus crispus	out	2	1.7	1.6	1.7	1.5
Cistus ladanifer	in	2	2.9	1.7	2.9	1.5
Cistus ladanifer	out	1	0.2	NaN	0.2	4.0
Cistus populifolius	in	1	17.8	NaN	17.8	0.0
Cistus populifolius	out	1	11.3	NaN	11.3	1.0
Cistus salvifolius	in	17	5.8	4.2	5.6	0.5
Cistus salvifolius	out	18	4.4	4.2	2.8	1.3
Crataegus monogyna	in	4	3.5	2.5	3.6	1.0
Crataegus monogyna	out	3	2.9	3.7	0.8	1.3
Cytisus striatus	out	1	0.3	NaN	0.3	0.0
Daphne gnidium	in	5	5.4	9.2	2.1	0.0
Daphne gnidium	out	10	1.1	0.9	0.9	0.1
Dittrichia viscosa	in	1	11.6	NaN	11.6	0.0
Erica arborea	in	7	4.4	4.4	2.4	0.0
Erica arborea	out	7	6.6	6.6	4.0	1.7
Erica australis	in	9	7.0	5.1	5.9	0.4
Erica australis	out	10	9.0	9.4	5.9	1.4
Erica scoparia	in	11	13.2	6.4	13.4	0.4
Erica scoparia	out	10	9.3	5.8	7.2	2.4
Genista triacanthos	in	6	1.2	0.8	1.2	0.0
Genista triacanthos	out	9	2.0	0.9	1.6	0.9
Genista tridens	in	8	2.7	5.3	0.8	0.2
Genista tridens	out	7	1.4	1.5	1.0	0.7
Genista tridentata	in	4	1.6	1.6	1.2	0.0
Genista tridentata	out	2	0.4	0.4	0.4	0.0
Halimium halimifolium	in	1	0.5	NaN	0.5	0.0
Halimium halimifolium	out	1	0.1	NaN	0.1	0.0
Ilex aquifolium	in	2	1.3	0.3	1.3	0.0
Lavandula stoechas	in	8	3.7	3.3	3.3	0.8
Lavandula stoechas	out	13	1.2	1.5	0.4	1.2
Lithodora prostrata	in	2	0.2	0.0	0.2	0.0
Myrtus communis	in	6	1.4	1.1	0.9	0.8
Myrtus communis	out	3	1.1	0.6	0.8	2.7
Olea europaea	in	9	1.3	0.9	1.2	2.0
Olea europaea	out	10	0.8	0.6	0.7	3.7

species	inside	freq	mean_cover	sd_cover	median_cover	mean_damage
Phillyrea angustifolia	in	1	0.9	NaN	0.9	4.0
Phillyrea angustifolia	out	1	0.2	NaN	0.2	4.0
Phillyrea latifolia	in	10	1.3	1.8	0.5	1.3
Phillyrea latifolia	out	8	0.6	0.6	0.5	3.1
Phlomis purpurea	in	7	4.1	3.8	3.1	0.3
Phlomis purpurea	out	5	2.2	3.4	0.5	0.0
Pinus pinaster	in	1	0.3	NaN	0.3	0.0
Pinus pinaster	out	2	0.2	0.1	0.2	0.5
Pistacia lentiscus	in	14	6.1	5.8	4.4	0.6
Pistacia lentiscus	out	13	6.6	5.8	4.2	2.2
Pyrus bourgaeana	in	1	0.2	NaN	0.2	0.0
Quercus canariensis	in	1	0.1	NaN	0.1	1.0
Quercus canariensis	out	1	0.1	NaN	0.1	0.0
Quercus lusitanica	in	4	6.3	6.7	6.3	0.2
Quercus lusitanica	out	3	8.9	9.2	6.5	0.7
Quercus pyrenaica	in	1	0.5	NaN	0.5	0.0
Quercus suber	in	13	2.4	1.7	1.8	0.9
Quercus suber	out	14	1.1	1.3	0.3	2.7
Rosa sempervirens	in	1	5.9	NaN	5.9	0.0
Rubus ulmifolius	in	11	3.2	4.9	1.6	1.0
Rubus ulmifolius	out	11	2.3	4.4	0.7	1.8
Stauracanthus boivinii	in	12	5.7	7.2	3.4	0.2
Stauracanthus boivinii	out	13	3.9	8.7	1.2	0.8
Teucrium fruticans	in	14	1.8	1.7	1.3	0.4
Teucrium fruticans	out	11	1.1	1.5	0.8	0.8
Thymus baeticus	in	2	0.4	0.0	0.4	0.0
Ulex borghiae	in	14	5.6	3.8	5.6	0.0
Ulex borghiae	out	16	4.2	3.8	3.2	1.0
Viburnum tinus	in	1	0.8	NaN	0.8	0.0
Viburnum tinus	out	1	0.4	NaN	0.4	3.0

Trees

trees: number of species present, their mean cover, and damage at each site

```

treecover <- trees %>%
  group_by(site, inside) %>%
  filter(acronym == "Bare") %>%
  dplyr::select(cover) %>%
  transmute(treecover = 100*(50 - cover)/50) # tree cover in %

## Adding missing grouping variables: `site`, `inside`
trees.summary <- trees_present %>%
  group_by(site, inside) %>%
  summarise(nspp = sum(presence),
            mean_cover = round(mean(cover), 1),
            sd_cover = round(sd(cover), 1),
            median_cover = round(median(cover), 1)) %>%
  left_join(treecover, by = c("site", "inside"))

kable(trees.summary)

```

site	inside	nspp	mean_cover	sd_cover	median_cover	treecover
Aljibe	in	2	6.4	6.5	6.4	25.5
Barrancones	in	4	16.8	21.1	9.1	96.2
Barrancones	out	3	14.2	13.1	12.1	71.2
Beatas1	in	2	10.1	7.4	10.1	40.4
Beatas1	out	2	3.2	0.4	3.2	62.6
Caheruelas4	in	1	18.8	NaN	18.8	37.6
Caheruelas4	out	1	24.5	NaN	24.5	49.0
Caheruelas5	in	1	1.0	NaN	1.0	52.0
Caheruelas5	out	1	4.5	NaN	4.5	59.0
Cucarretes1	out	2	6.5	0.4	6.5	26.2
Cucarretes2	in	1	7.7	NaN	7.7	15.4
Cucarretes2	out	2	8.0	5.9	8.0	32.0
Cuevas_Hospital2	in	3	9.1	12.8	1.8	47.6
Cuevas_Hospital2	out	2	14.2	7.6	14.2	54.4
Faldas_Rubio1	in	3	11.6	16.2	3.7	69.8
Faldas_Rubio1	out	1	34.5	NaN	34.5	69.0
Faldas_Rubio2	in	2	7.9	4.8	7.9	31.6
Faldas_Rubio2	out	1	8.6	NaN	8.6	67.2
Garganta_Honda	in	1	8.6	NaN	8.6	67.2
Garganta_Honda	out	1	11.6	NaN	11.6	73.2
Gavilanes	in	1	50.0	NaN	50.0	100.0
Gavilanes	out	1	39.0	NaN	39.0	78.0
Hernan_Martin	in	1	9.9	NaN	9.9	69.8
Hernan_Martin	out	1	20.5	NaN	20.5	41.0
Laguna_Picacho	in	3	9.4	8.5	6.2	54.2
Laguna_Picacho	out	2	7.3	5.4	7.3	28.2
Las_Naranjas	in	1	21.4	NaN	21.4	42.8
Las_Naranjas	out	1	8.1	NaN	8.1	66.2
Laurel	in	1	4.4	NaN	4.4	58.8
Laurel	out	1	2.5	NaN	2.5	55.0
Mogea_Luenga2	in	1	10.0	NaN	10.0	20.0
Mogea_Luenga2	out	1	19.9	NaN	19.9	39.8
Palancar	in	3	7.9	7.4	6.7	44.6
Palancar	out	1	40.9	NaN	40.9	81.8
Puertollano	in	1	15.6	NaN	15.6	31.2
Puertollano	out	1	24.9	NaN	24.9	49.8
Tejal	in	2	9.8	12.2	9.8	39.0
Tejal	out	2	12.2	5.5	12.2	44.4

trees: quick comparison in-out

```
kable(trees.summary %>%
  group_by(inside) %>%
  summarise(mean_nspp = mean(nspp),
            mean_treecover = mean(treecover),
            mean_cover = mean(mean_cover)))
```

inside	mean_nspp	mean_treecover	mean_cover
in	1.789474	49.66842	12.44211
out	1.421053	55.15789	16.05789

N.B. Given the hierarchical structure of the data (obs within sites), the most correct way of comparing average cover, damage, etc in and out of exclosures is using mixed models.

trees: spp in and out

```
trees.in <- trees_present %>%
  filter(inside == "in") %>%
  distinct(species) %>%
  mutate(id = seq(1:nrow(.))) %>%
  dplyr::select(id, species)
kable(trees.in)
```

id	species
1	Ilex aquifolium
2	Arbutus unedo
3	Phillyrea latifolia
4	Quercus suber
5	Quercus canariensis
6	Olea europaea
7	Pyrus bourgaeana
8	Ceratonia siliqua
9	Erica arborea

```
trees.out <- trees_present %>%
  filter(inside == "out") %>%
  distinct(species) %>%
  mutate(id = seq(1:nrow(.))) %>%
  dplyr::select(id, species)
kable(trees.out)
```

id	species
1	Quercus canariensis
2	Arbutus unedo
3	Quercus suber
4	Olea europaea

trees: species occurring only in or out of exclosures

```
in.only <- anti_join(trees.in, trees.out, by = "species") %>%
  dplyr::select(-id) %>%
  arrange(species)
kable(in.only)
```

species
Ceratonia siliqua
Erica arborea
Ilex aquifolium
Phillyrea latifolia
Pyrus bourgaeana

```

out.only <- anti_join(trees.out, trees.in, by = "species") %>%
  dplyr::select(-id) %>%
  arrange(species)
kable(out.only)

```

species

Appendix: species cover and damage per site

Shrubs

```

shrubdam <- shrubs_present %>%
  dplyr::select(site, inside, species, damage) %>%
  mutate(inside = ifelse(inside == "in", "damage_in", "damage_out")) %>%
  spread(inside, damage)

shrubcov <- shrubs_present %>%
  dplyr::select(site, inside, species, cover) %>%
  mutate(inside = ifelse(inside == "in", "cover_in", "cover_out")) %>%
  spread(inside, cover) %>%
  arrange(site, desc(cover_in)) %>%
  left_join(shrubdam, by = c("site", "species"))

kable(shrubcov)

```

site	species	cover_in	cover_out	damage_in	damage_out
Aljibe	Cistus populifolius	17.75	11.35	0	1
Aljibe	Rubus ulmifolius	16.70	0.10	0	3
Aljibe	Quercus lusitanica	12.25	19.10	0	1
Aljibe	Erica australis	11.50	NA	0	NA
Aljibe	Arbutus unedo	7.70	0.40	0	2
Aljibe	Genista triacanthos	2.15	2.05	0	1
Aljibe	Ilex aquifolium	1.10	NA	0	NA
Aljibe	Ulex borgiae	0.65	1.15	0	2
Aljibe	Quercus pyrenaica	0.50	NA	0	NA
Aljibe	Genista tridentata	0.45	NA	0	NA
Aljibe	Teucrium fruticans	0.20	NA	0	NA
Aljibe	Calluna vulgaris	NA	2.70	NA	3
Aljibe	Erica arborea	NA	20.86	NA	2
Barrancones	Erica scoparia	8.20	20.05	1	3
Barrancones	Arbutus unedo	5.40	NA	1	NA
Barrancones	Ulex borgiae	1.20	3.00	0	0
Barrancones	Pinus pinaster	0.30	0.20	0	1
Barrancones	Phillyrea latifolia	0.20	0.10	2	4
Barrancones	Quercus canariensis	0.10	NA	1	NA
Barrancones	Calluna vulgaris	NA	0.40	NA	2
Barrancones	Lavandula stoechas	NA	0.30	NA	2
Barrancones	Stauracanthus boivinii	NA	1.15	NA	0
Barrancones	Teucrium fruticans	NA	2.00	NA	1
Beatas1	Pistacia lentiscus	20.00	14.30	2	3
Beatas1	Cistus salvifolius	8.40	0.70	1	1
Beatas1	Calicotome villosa	7.55	5.80	0	2

site	species	cover_in	cover_out	damage_in	damage_out
Beatas1	Ulex borghiae	5.40	1.00	0	0
Beatas1	Erica australis	4.20	14.55	0	0
Beatas1	Olea europaea	3.10	1.75	3	4
Beatas1	Rubus ulmifolius	2.90	0.20	2	2
Beatas1	Lavandula stoechas	2.40	0.10	1	0
Beatas1	Quercus suber	1.80	2.00	2	3
Beatas1	Phlomis purpurea	1.50	0.30	0	0
Beatas1	Stauracanthus boivinii	1.30	NA	0	NA
Beatas1	Teucrium fruticans	0.30	0.10	0	0
Beatas1	Phillyrea latifolia	0.20	0.45	2	3
Beatas1	Daphne gnidium	NA	0.50	NA	0
Beatas1	Genista triacanthos	NA	1.00	NA	0
Beatas1	Myrtus communis	NA	1.80	NA	2
Caheruelas4	Erica scoparia	13.40	10.75	0	5
Caheruelas4	Lavandula stoechas	9.45	0.30	0	2
Caheruelas4	Stauracanthus boivinii	9.45	0.30	0	2
Caheruelas4	Cistus salvifolius	6.80	3.10	0	0
Caheruelas4	Pistacia lentiscus	4.80	3.60	0	1
Caheruelas4	Cistus ladanifer	4.10	NA	0	NA
Caheruelas4	Calluna vulgaris	3.10	0.20	0	0
Caheruelas4	Myrtus communis	2.45	NA	1	NA
Caheruelas4	Teucrium fruticans	1.50	0.10	0	1
Caheruelas4	Olea europaea	1.20	0.20	1	5
Caheruelas4	Quercus suber	0.90	NA	0	NA
Caheruelas4	Genista tridens	0.40	2.00	0	2
Caheruelas4	Lithodora prostrata	0.20	NA	0	NA
Caheruelas4	Calicotome villosa	0.10	1.40	0	2
Caheruelas4	Rubus ulmifolius	NA	0.50	NA	0
Caheruelas5	Erica scoparia	8.25	1.60	2	3
Caheruelas5	Lavandula stoechas	6.75	NA	2	NA
Caheruelas5	Pistacia lentiscus	6.10	19.20	2	4
Caheruelas5	Cistus salvifolius	6.10	2.18	3	5
Caheruelas5	Phlomis purpurea	4.40	NA	2	NA
Caheruelas5	Stauracanthus boivinii	2.50	0.15	2	4
Caheruelas5	Calicotome villosa	2.45	4.85	3	5
Caheruelas5	Cistus ladanifer	1.75	0.20	3	4
Caheruelas5	Erica australis	1.15	NA	2	NA
Caheruelas5	Olea europaea	1.10	0.70	4	3
Caheruelas5	Genista tridens	0.95	NA	2	NA
Caheruelas5	Thymus baeticus	0.40	NA	0	NA
Caheruelas5	Teucrium fruticans	0.10	NA	3	NA
Caheruelas5	Ulex borghiae	NA	0.85	NA	4
Cucarretes1	Erica scoparia	22.40	6.75	0	2
Cucarretes1	Genista tridens	15.80	1.35	0	0
Cucarretes1	Teucrium fruticans	4.80	1.00	0	2
Cucarretes1	Calluna vulgaris	4.75	NA	0	NA
Cucarretes1	Erica arborea	3.90	4.65	0	2
Cucarretes1	Ulex borghiae	3.40	5.05	0	0
Cucarretes1	Cistus salvifolius	1.60	4.40	0	1
Cucarretes1	Phillyrea latifolia	1.55	1.90	2	3
Cucarretes1	Erica australis	1.40	NA	0	NA
Cucarretes1	Rubus ulmifolius	1.10	1.15	2	2
Cucarretes1	Calicotome villosa	0.95	5.80	0	2
Cucarretes1	Pistacia lentiscus	0.85	4.60	0	1
Cucarretes1	Myrtus communis	0.55	0.60	1	3

site	species	cover_in	cover_out	damage_in	damage_out
Cucarretes1	Genista tridentata	0.25	NA	0	NA
Cucarretes1	Lithodora prostrata	0.20	NA	0	NA
Cucarretes1	Arbutus unedo	0.10	NA	1	NA
Cucarretes1	Crataegus monogyna	NA	0.75	NA	1
Cucarretes1	Quercus suber	NA	0.20	NA	3
Cucarretes2	Ulex borgiae	11.55	13.50	0	0
Cucarretes2	Erica scoparia	11.10	6.55	0	2
Cucarretes2	Erica arborea	7.40	4.00	0	1
Cucarretes2	Quercus suber	2.80	0.10	1	1
Cucarretes2	Genista tridentata	1.90	0.70	0	0
Cucarretes2	Stauracanthus boivinii	1.60	1.10	0	0
Cucarretes2	Cistus salvifolius	1.45	4.15	0	1
Cucarretes2	Teucrium fruticans	1.00	0.60	0	0
Cucarretes2	Phillyrea latifolia	0.30	0.60	2	2
Cucarretes2	Calicotome villosa	NA	2.35	NA	1
Cucarretes2	Cytisus striatus	NA	0.30	NA	0
Cucarretes2	Genista tridens	NA	1.00	NA	0
Cucarretes2	Lavandula stoechas	NA	1.80	NA	0
Cuevas_Hospital2	Dittrichia viscosa	11.60	NA	0	NA
Cuevas_Hospital2	Ulex borgiae	9.40	10.05	0	0
Cuevas_Hospital2	Erica australis	8.70	11.20	0	2
Cuevas_Hospital2	Rubus ulmifolius	7.60	3.20	2	3
Cuevas_Hospital2	Calicotome villosa	4.70	6.50	1	1
Cuevas_Hospital2	Teucrium fruticans	4.00	0.90	0	1
Cuevas_Hospital2	Pistacia lentiscus	3.95	1.70	2	2
Cuevas_Hospital2	Calluna vulgaris	1.80	NA	0	NA
Cuevas_Hospital2	Genista triacanthos	1.20	1.60	0	0
Cuevas_Hospital2	Olea europaea	0.30	1.10	1	4
Cuevas_Hospital2	Phillyrea latifolia	0.30	0.50	2	3
Cuevas_Hospital2	Cistus salvifolius	0.10	1.40	0	2
Cuevas_Hospital2	Crataegus monogyna	NA	7.10	NA	2
Cuevas_Hospital2	Daphne gnidium	NA	1.00	NA	0
Cuevas_Hospital2	Pinus pinaster	NA	0.30	NA	0
Cuevas_Hospital2	Quercus suber	NA	0.20	NA	0
Faldas_Rubio1	Erica australis	11.80	31.10	0	1
Faldas_Rubio1	Ulex borgiae	8.10	1.50	0	0
Faldas_Rubio1	Quercus suber	3.55	0.20	1	3
Faldas_Rubio1	Pistacia lentiscus	3.50	NA	0	NA
Faldas_Rubio1	Phillyrea latifolia	3.40	NA	0	NA
Faldas_Rubio1	Stauracanthus boivinii	3.20	1.80	0	0
Faldas_Rubio1	Cistus salvifolius	2.80	0.20	0	2
Faldas_Rubio1	Daphne gnidium	2.10	0.80	0	0
Faldas_Rubio1	Ilex aquifolium	1.55	NA	0	NA
Faldas_Rubio1	Genista triacanthos	1.20	3.85	0	0
Faldas_Rubio1	Rubus ulmifolius	1.20	NA	2	NA
Faldas_Rubio1	Myrtus communis	0.70	NA	0	NA
Faldas_Rubio1	Calluna vulgaris	0.50	1.65	0	0
Faldas_Rubio1	Teucrium fruticans	0.50	NA	0	NA
Faldas_Rubio1	Olea europaea	0.40	NA	2	NA
Faldas_Rubio1	Lavandula stoechas	0.10	0.40	0	1
Faldas_Rubio2	Daphne gnidium	21.80	0.90	0	0
Faldas_Rubio2	Cistus salvifolius	8.10	7.70	2	2
Faldas_Rubio2	Stauracanthus boivinii	7.90	3.65	0	2
Faldas_Rubio2	Calicotome villosa	5.10	3.50	1	3
Faldas_Rubio2	Pistacia lentiscus	2.50	4.20	1	3

site	species	cover_in	cover_out	damage_in	damage_out
Faldas_Rubio2	Rubus ulmifolius	2.10	0.70	0	3
Faldas_Rubio2	Genista triacanthos	1.90	1.40	0	3
Faldas_Rubio2	Teucrium fruticans	1.70	NA	1	NA
Faldas_Rubio2	Quercus suber	1.50	0.30	0	4
Faldas_Rubio2	Olea europaea	0.60	1.80	2	4
Faldas_Rubio2	Cistus crispus	0.50	NA	1	NA
Faldas_Rubio2	Pyrus bourgaeana	0.20	NA	0	NA
Faldas_Rubio2	Erica australis	NA	6.60	NA	2
Faldas_Rubio2	Phillyrea latifolia	NA	0.20	NA	3
Faldas_Rubio2	Ulex borgiae	NA	0.50	NA	3
Garganta_Honda	Erica scoparia	22.00	15.55	0	3
Garganta_Honda	Quercus lusitanica	11.95	6.55	0	0
Garganta_Honda	Calluna vulgaris	4.70	0.50	0	0
Garganta_Honda	Stauracanthus boivinii	4.60	4.80	0	2
Garganta_Honda	Lavandula stoechas	4.20	3.70	0	0
Garganta_Honda	Quercus suber	2.40	2.30	0	5
Garganta_Honda	Daphne gnidium	2.30	3.00	0	0
Garganta_Honda	Cistus salvifolius	1.80	5.30	0	0
Garganta_Honda	Myrtus communis	1.10	0.80	0	3
Garganta_Honda	Genista tridens	0.40	0.30	0	0
Garganta_Honda	Genista triacanthos	0.40	NA	0	NA
Garganta_Honda	Halimium halimifolium	NA	0.10	NA	0
Garganta_Honda	Rubus ulmifolius	NA	0.20	NA	0
Gavilanes	Erica scoparia	15.60	14.20	0	1
Gavilanes	Cistus salvifolius	5.60	6.55	0	0
Gavilanes	Erica arborea	2.40	3.60	0	3
Gavilanes	Quercus suber	1.70	0.30	0	0
Gavilanes	Genista tridens	0.60	4.60	0	0
Gavilanes	Stauracanthus boivinii	0.30	2.40	0	0
Gavilanes	Daphne gnidium	0.20	0.50	0	0
Gavilanes	Phillyrea latifolia	0.20	NA	0	NA
Gavilanes	Rubus ulmifolius	0.10	NA	0	NA
Gavilanes	Calluna vulgaris	NA	0.70	NA	0
Gavilanes	Erica australis	NA	0.40	NA	0
Gavilanes	Lavandula stoechas	NA	0.30	NA	0
Gavilanes	Quercus canariensis	NA	0.10	NA	0
Hernan_Martin	Pistacia lentiscus	18.25	5.10	0	2
Hernan_Martin	Cistus salvifolius	6.70	2.40	1	2
Hernan_Martin	Phillyrea latifolia	5.60	NA	1	NA
Hernan_Martin	Teucrium fruticans	5.00	0.80	0	1
Hernan_Martin	Crataegus monogyna	4.50	NA	1	NA
Hernan_Martin	Phlomis purpurea	3.15	0.25	0	0
Hernan_Martin	Myrtus communis	3.10	NA	3	NA
Hernan_Martin	Rubus ulmifolius	1.55	NA	3	NA
Hernan_Martin	Quercus suber	1.50	0.60	1	3
Hernan_Martin	Erica arborea	1.40	3.80	0	2
Hernan_Martin	Arbutus unedo	1.20	NA	0	NA
Hernan_Martin	Viburnum tinus	0.80	NA	0	NA
Hernan_Martin	Ulex borgiae	0.75	3.50	0	2
Hernan_Martin	Quercus lusitanica	0.70	1.10	1	1
Hernan_Martin	Calluna vulgaris	NA	1.15	NA	2
Hernan_Martin	Cistus crispus	NA	0.55	NA	1
Hernan_Martin	Erica australis	NA	1.80	NA	3
Hernan_Martin	Genista triacanthos	NA	3.05	NA	2
Hernan_Martin	Lavandula stoechas	NA	2.50	NA	1

site	species	cover_in	cover_out	damage_in	damage_out
Hernan_Martin	Olea europaea	NA	0.20	NA	3
Hernan_Martin	Stauracanthus boivinii	NA	1.20	NA	0
Laguna_Picacho	Ulex borgiae	11.70	4.30	0	0
Laguna_Picacho	Cistus salvifolius	7.35	0.95	0	2
Laguna_Picacho	Pistacia lentiscus	6.30	6.20	0	3
Laguna_Picacho	Crataegus monogyna	6.30	NA	0	NA
Laguna_Picacho	Quercus suber	3.80	3.70	0	4
Laguna_Picacho	Cistus albidus	2.80	NA	0	NA
Laguna_Picacho	Olea europaea	1.80	0.10	1	4
Laguna_Picacho	Phlomis purpurea	1.40	1.65	0	0
Laguna_Picacho	Teucrium fruticans	1.10	0.20	0	0
Laguna_Picacho	Phillyrea latifolia	0.75	1.05	1	4
Laguna_Picacho	Erica arborea	0.70	1.30	0	2
Laguna_Picacho	Halimium halimifolium	0.50	NA	0	NA
Laguna_Picacho	Rubus ulmifolius	0.20	NA	0	NA
Laguna_Picacho	Adenocarpus telonensis	NA	0.60	NA	1
Laguna_Picacho	Cistus crispus	NA	2.75	NA	2
Laguna_Picacho	Erica australis	NA	5.10	NA	3
Laguna_Picacho	Lavandula stoechas	NA	0.90	NA	2
Las_Naranjas	Erica scoparia	18.10	6.80	0	1
Las_Naranjas	Phlomis purpurea	11.80	NA	0	NA
Las_Naranjas	Pistacia lentiscus	6.00	2.10	1	3
Las_Naranjas	Ulex borgiae	5.40	7.50	0	3
Las_Naranjas	Quercus suber	4.30	2.90	2	2
Las_Naranjas	Cistus salvifolius	3.70	15.55	0	1
Las_Naranjas	Erica arborea	2.10	NA	0	NA
Las_Naranjas	Calicotome villosa	1.10	4.40	4	5
Las_Naranjas	Genista tridens	0.50	NA	0	NA
Las_Naranjas	Crataegus monogyna	0.40	0.80	3	1
Las_Naranjas	Quercus lusitanica	0.20	NA	0	NA
Las_Naranjas	Lavandula stoechas	NA	0.30	NA	1
Las_Naranjas	Rubus ulmifolius	NA	2.20	NA	1
Las_Naranjas	Teucrium fruticans	NA	0.10	NA	0
Laurel	Stauracanthus boivinii	26.50	32.40	0	0
Laurel	Calluna vulgaris	11.68	2.10	1	1
Laurel	Erica scoparia	10.35	2.80	1	1
Laurel	Cistus salvifolius	4.15	2.55	1	2
Laurel	Erica australis	2.80	1.40	1	1
Laurel	Lavandula stoechas	1.35	4.70	3	3
Laurel	Phillyrea angustifolia	0.90	0.25	4	4
Laurel	Thymus baeticus	0.45	NA	0	NA
Laurel	Quercus suber	0.30	NA	2	NA
Laurel	Daphne gnidium	NA	2.40	NA	1
Laurel	Genista triacanthos	NA	1.30	NA	0
Laurel	Genista tridens	NA	0.30	NA	1
Mogea_Luenga2	Cistus salvifolius	18.10	12.90	0	0
Mogea_Luenga2	Erica australis	15.10	14.50	1	2
Mogea_Luenga2	Stauracanthus boivinii	7.10	1.50	0	0
Mogea_Luenga2	Ulex borgiae	6.30	0.20	0	0
Mogea_Luenga2	Lavandula stoechas	4.90	0.40	0	0
Mogea_Luenga2	Pistacia lentiscus	4.00	3.60	1	2
Mogea_Luenga2	Genista tridentata	3.80	0.20	0	0
Mogea_Luenga2	Teucrium fruticans	2.80	1.30	1	2
Mogea_Luenga2	Genista tridens	1.50	NA	0	NA
Mogea_Luenga2	Phillyrea latifolia	0.90	0.40	1	3

site	species	cover_in	cover_out	damage_in	damage_out
Mogea_Luenga2	Calicotome villosa	0.80	19.80	1	2
Mogea_Luenga2	Daphne gnidium	0.80	1.10	0	0
Mogea_Luenga2	Quercus suber	0.50	2.40	0	2
Mogea_Luenga2	Genista triacanthos	0.20	2.10	0	0
Mogea_Luenga2	Adenocarpus telonensis	NA	0.60	NA	2
Mogea_Luenga2	Olea europaea	NA	0.60	NA	2
Mogea_Luenga2	Rubus ulmifolius	NA	1.20	NA	2
Palancar	Erica arborea	13.20	8.15	0	0
Palancar	Rosa sempervirens	5.90	NA	0	NA
Palancar	Phlomis purpurea	5.80	8.25	0	0
Palancar	Crataegus monogyna	2.70	NA	0	NA
Palancar	Teucrium fruticans	2.55	5.15	0	1
Palancar	Pistacia lentiscus	2.50	2.40	0	0
Palancar	Rubus ulmifolius	1.60	15.20	0	1
Palancar	Ulex borgiae	1.30	2.15	0	0
Palancar	Erica scoparia	0.70	NA	0	NA
Palancar	Stauracanthus boivinii	0.20	NA	0	NA
Palancar	Cistus salvifolius	NA	1.50	NA	0
Palancar	Daphne gnidium	NA	0.15	NA	0
Puertollano	Erica scoparia	14.60	7.60	0	3
Puertollano	Quercus suber	6.10	0.20	3	5
Puertollano	Ulex borgiae	5.80	5.30	0	2
Puertollano	Pistacia lentiscus	5.30	15.50	0	3
Puertollano	Cistus salvifolius	5.20	1.90	0	1
Puertollano	Stauracanthus boivinii	3.60	0.10	0	1
Puertollano	Calicotome villosa	1.60	1.20	2	4
Puertollano	Olea europaea	1.40	0.90	4	5
Puertollano	Genista tridens	1.10	0.30	0	2
Puertollano	Phlomis purpurea	1.00	0.50	0	0
Puertollano	Myrtus communis	0.50	NA	0	NA
Puertollano	Teucrium fruticans	0.30	NA	0	NA
Puertollano	Calluna vulgaris	0.20	NA	0	NA
Puertollano	Genista triacanthos	NA	1.60	NA	2
Puertollano	Lavandula stoechas	NA	0.20	NA	3
Puertollano	Rubus ulmifolius	NA	0.10	NA	3
Tejal	Cistus salvifolius	10.15	5.40	1	1
Tejal	Calicotome villosa	8.50	NA	0	NA
Tejal	Ulex borgiae	8.00	7.60	0	0
Tejal	Erica australis	5.90	3.70	0	0
Tejal	Olea europaea	1.60	0.50	0	3
Tejal	Pistacia lentiscus	1.50	2.90	0	2
Tejal	Cistus crispus	0.50	NA	0	NA
Tejal	Rubus ulmifolius	0.30	NA	0	NA
Tejal	Lavandula stoechas	0.30	NA	0	NA
Tejal	Adenocarpus telonensis	NA	1.20	NA	1
Tejal	Daphne gnidium	NA	0.90	NA	0
Tejal	Quercus suber	NA	0.30	NA	3
Tejal	Stauracanthus boivinii	NA	0.50	NA	0
Tejal	Viburnum tinus	NA	0.40	NA	3

Trees

```
kable(trees_present %>%
  dplyr::select(site, inside, species, cover) %>%
  mutate(inside = ifelse(inside == "in", "cover_in", "cover_out")) %>%
  spread(inside, cover) %>%
  arrange(site, desc(cover_in)))
```

site	species	cover_in	cover_out
Aljibe	Ilex aquifolium	10.95	NA
Aljibe	Arbutus unedo	1.80	NA
Barrancones	Quercus canariensis	47.80	28.2
Barrancones	Phillyrea latifolia	11.60	NA
Barrancones	Arbutus unedo	6.70	2.2
Barrancones	Quercus suber	1.30	12.1
Beatas1	Quercus suber	15.30	2.9
Beatas1	Olea europaea	4.90	3.4
Caheruelas4	Quercus suber	18.80	24.5
Caheruelas5	Quercus suber	1.00	4.5
Cucarretes1	Arbutus unedo	NA	6.3
Cucarretes1	Quercus suber	NA	6.8
Cucarretes2	Quercus suber	7.70	12.2
Cucarretes2	Quercus canariensis	NA	3.8
Cuevas_Hospital2	Quercus suber	23.80	19.5
Cuevas_Hospital2	Arbutus unedo	1.80	8.8
Cuevas_Hospital2	Pyrus bourgaeana	1.60	NA
Faldas_Rubio1	Quercus suber	30.30	34.5
Faldas_Rubio1	Olea europaea	3.70	NA
Faldas_Rubio1	Ilex aquifolium	0.90	NA
Faldas_Rubio2	Quercus suber	11.30	8.6
Faldas_Rubio2	Olea europaea	4.50	NA
Garganta_Honda	Quercus suber	8.60	11.6
Gavilanes	Quercus suber	50.00	39.0
Hernan_Martin	Quercus suber	9.90	20.5
Laguna_Picacho	Quercus suber	19.10	11.1
Laguna_Picacho	Olea europaea	6.20	3.5
Laguna_Picacho	Ceratonia siliqua	3.00	NA
Las_Naranjas	Quercus suber	21.40	8.1
Laurel	Quercus suber	4.40	NA
Laurel	Arbutus unedo	NA	2.5
Mogea_Luenga2	Quercus suber	10.00	19.9
Palancar	Quercus suber	15.80	40.9
Palancar	Quercus canariensis	6.70	NA
Palancar	Erica arborea	1.10	NA
Puertollano	Quercus suber	15.60	24.9
Teja1	Quercus suber	18.40	16.1
Teja1	Olea europaea	1.10	8.3