

Example script

Analysis of change in Pileated woodpecker (PIWO) abundance versus forest habitat

Script written 11/21/2017

by Nathan L Brouwer

brouwern@gmail.com

ENS 495 CalU

Load PIWO data

```
BBS_PA_PIWO_4 <- read.csv(file = "Brouwer_NL_PIWO_vs_forest_cover.csv" )
```

Data Exploration

Load libraries

```
library(ggplot2)
```

```
library(ggpubr)
```

Exploring abundance-habitat data

Boxplots

number of birds seen

saved as object; displayed later with plot_grid

```
plot1.spp.total <- ggboxplot(data = BBS_PA_PIWO_4,  
  y = "SpeciesTotal",  
  xlab = "")
```

Deciduous landcover

```
plot2.decid.percent <- ggboxplot(data = BBS_PA_PIWO_4,  
  y = "decid.percent",  
  xlab = "")
```

Coniferous landcover

```
plot3.confir.percent <- ggboxplot(data = BBS_PA_PIWO_4,  
  y = "conifer.percent", xlab = "")
```

Mixed forest landcover

```
plot4.mixed.percent <- ggboxplot(data = BBS_PA_PIWO_4,  
  y = "mixed.forest.percent", xlab = "")
```

Plot as grid

```
library(cowplot)
```

This plot shows the distribution of the y variable (SpeciesTotal) and 3 different predictor

variables that represent different amounts of forest cover.

```
plot_grid(plot1.spp.total,  
  plot2.decid.percent,  
  plot3.confir.percent,  
  plot4.mixed.percent,  
  labels = c("A", "B", "C", "D"))
```

Histograms

Make each plot with gghistogram() and save to an R object

number of birds seen

```
plot1.spp.total <- gghistogram(data = BBS_PA_PIWO_4,  
  x = "SpeciesTotal",  
  xlab = "")
```

Deciduous landcover

```
plot2.decid.percent <- gghistogram(data = BBS_PA_PIWO_4,  
  x = "decid.percent",  
  xlab = "")
```

Coniferous landcover

```
plot3.confir.percent <- gghistogram(data = BBS_PA_PIWO_4,  
  x = "conifer.percent", xlab = "")
```

Mixed forest landcover

```
plot4.mixed.percent <- gghistogram(data = BBS_PA_PIWO_4,  
  x = "mixed.forest.percent", xlab = "")
```

Layout the four plots in a grid.

This plot shows the distribution of the y variable (SpeciesTotal) and 3 different predictor
variables that represent different amounts of forest cover.

```
plot_grid(plot1.spp.total,  
  plot2.decid.percent,  
  plot3.confir.percent,  
  plot4.mixed.percent,  
  labels = c("A", "B",  
    "C", "D"))
```

Data modeling

Modeling habitat

Null model representing not change in number of PIWO observed as habitat changes
m.null <- lm(SpeciesTotal ~ 1, BBS_PA_PIWO_4)

Alternative model of how PIWO counts change as deciduous forest cover increases
m.decid <- lm(SpeciesTotal ~ decid.percent, BBS_PA_PIWO_4)

Alternative model of how PIWO counts change as mixed forest cover increases
m.mixed <- lm(SpeciesTotal ~ mixed.forest.percent, BBS_PA_PIWO_4)

```
### Results
```

```
## Compare two alt model against null model
```

```
#### Significance test with anova()
```

```
#### null vs. deciduous forest model
```

```
##### p value is "sig" (0.001424)
```

```
##### reject the null, slope is sig diff than zero
```

```
anova(m.null, m.decid)
```

```
# Analysis of Variance Table
```

```
#
```

```
# Model 1: SpeciesTotal ~ 1
```

```
# Model 2: SpeciesTotal ~ decid.percent
```

```
# Res.Df  RSS Df Sum of Sq   F  Pr(>F)
```

```
# 1  136 169.12
```

```
# 2  135 156.80  1  12.321 10.608 0.001424 **
```

```
# ---
```

```
# Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#### null vs. mixed forest model
```

```
##### p value is sig
```

```
anova(m.null, m.mixed)
```

```
# Analysis of Variance Table
```

```
#
```

```
# Model 1: SpeciesTotal ~ 1
```

```
# Model 2: SpeciesTotal ~ mixed.forest.percent
```

```
# Res.Df  RSS Df Sum of Sq   F  Pr(>F)
```

```
# 1  136 169.12
```

```
# 2  135 127.16  1  41.961 44.547 5.888e-10 ***
```

```
#### Model comparison
```

```
### anova() only allows you to compare 1 model at a time
```

```
### AIC allows you to compare multiple models at the
```

```
### same time
```

```
library(bbmle)
```

```
AICtab(m.null,
```

```
      m.decid,
```

```
      m.mixed)
```

```
#### BOth mixed and decid slopes sig but
#### m.mixed fits the data much better (delta AIC much more then 2)
```

```
#      dAIC df
# m.mixed 0.0 3
# m.decid 28.7 3
# m.null 37.1 2
```

```
#### Summary of "best" model
```

```
#### Use summary() command to get slopes, SEs, R^2 etc
summary(m.mixed)
```

```
## Key output pasted below
```

```
#
# Coefficients:
# Estimate Std. Error t value Pr(>|t|)
# (Intercept)      0.1468    0.1165   1.260    0.21
# mixed.forest.percent 16.1218    2.4155   6.674 5.89e-10 ***
# ---
# Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
#
# Residual standard error: 0.9705 on 135 degrees of freedom
# Multiple R-squared:  0.2481,    Adjusted R-squared:  0.2425
# F-statistic: 44.55 on 1 and 135 DF, p-value: 5.888e-10
```

```
#### Create focal figure
```

```
#### Scatterplot with regression line for best model
```

```
##### Error band is 95% confidence interval
```

```
ggscatter(data = BBS_PA_PIWO_4,
  y = "SpeciesTotal",
  x = "mixed.forest.percent",
  add = "reg.line",
  conf.int = TRUE,
  xlab = "Percent mixed forest landcover",
  ylab = "Number of PIWO observed on BBS route")
```