## 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 laterwith 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 dover.

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 dover.

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")