Question 1 ANOVA insect richnnes

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2024-12-08

Question 1

Biodiversity loss is a critical environmental concern. Urban environments can significantly influence the survival and reproduction of insect species. Built environments are often warmer, dominated by non-native plants, and have lower water availability, particularly in drier regions like California. These factors may negatively affect essential ecosystem processes, such as pollination, food webs, and the decomposition of plant material.

To investigate the effects of urbanization on insects, Adams et al. (2019) conducted a study across the Los Angeles area, trapping insects and measuring species richness at each site.

In this study, insect species richness was recorded across three levels of urbanization: Suburban, Developed Dense, and Natural environments. Perform an ANOVA to assess whether there are significant differences in species richness among these urbanization levels. If the results are significant, conduct a Tukey post hoc test to identify pairwise differences.

Write a complete and concise paragraph summarizing your results and conclusions based on the analysis.

```
data <- read.csv('insect_richness.csv')
head(data)
```

```
##   urbanType urbanName Richness lawn
## 1         3  Suburban       30  Yes
## 2         8 Developed        3  Yes
## 3         9     Dense       22   No
## 4         9     Dense        1  Yes
## 5         8 Developed       22   No
## 6         8 Developed       15   No
```

```
data$urbanName <- as.factor(data$urbanName)
unique(data$urbanName)
```

```
## [1] Suburban  Developed Dense     Natural
## Levels: Dense Developed Natural Suburban
```

Variance

```
bartlett.test(Richness  ~ urbanName, data)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  Richness by urbanName
## Bartlett's K-squared = 1.2091, df = 3, p-value = 0.7508
```

Normality

```
byf.shapiro(Richness  ~ urbanName, data)
```

```
##
##  Shapiro-Wilk normality tests
##
## data:  Richness by urbanName
##
##                W p-value
## Dense     0.9751 0.10249
## Developed 0.9616 0.05604 .
## Natural   0.9156 0.25144
## Suburban  0.9809 0.24606
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Set up ANOVA

```
mod <- aov(Richness  ~ urbanName, data)
summary(mod)
```

```
##              Df Sum Sq Mean Sq F value  Pr(>F)
## urbanName     3   1944   647.9   4.898 0.00254 **
## Residuals   236  31216   132.3
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

PostHoc comparison

```
tukeyT <- TukeyHSD(mod)
tukeyT
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = Richness ~ urbanName, data = data)
##
## $urbanName
##                           diff         lwr        upr     p adj
## Developed-Dense       1.433333  -3.5966663  6.4633329 0.8819569
## Natural-Dense        12.583333   3.3998525 21.7668141 0.0026479
## Suburban-Dense        3.785714  -0.8060261  8.3774547 0.1456297
## Natural-Developed    11.150000   1.7397324 20.5602676 0.0128693
## Suburban-Developed    2.352381  -2.6776186  7.3823805 0.6210733
## Suburban-Natural     -8.797619 -17.9810999  0.3858618 0.0658910
```

Response Key:

Hypothesis (2pt): We tested to see if there is a difference between insect richness across four level of urbanization

Test (considering assumptions) (6 pts): ANOVA, normally distributed, equal variance, Tukey post hoc

Shorthand format and correct values (5 pts): F(3,236) = 4.898, p = 0.00254, r2 = 0.05861809.

Significance (1 pt): Yes

Meaningful (1 pt): some discussion of the r2 as a proportion of total variability accounted for by species.

Post hoc tests significance and description (3 pts): spring is higher than winter (all others are equal)

Interpretation/Conclusions (2 pts): some link back to the original question. Furbearers expand their range in the spring to support new litters, but range less in the winter when energy is conserved.