

Question 1 ANOVA insect richness

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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
```