

Assignment 1: Species-Habitat Interactions

Introduction

Dr. Smith's burying beetle research has targeted three different sites in the East River Valley: Kettle Ponds, Maxfield Meadow, and Bellview. These sites occur along an altitudinal gradient; as the elevation increases, environmental variables are expected to change in a predictable manner. In this assignment, you will investigate how these changes affect organisms.

Learning Goal

Students will be able to answer the question, "How do species interact with their habitat?"

Instructions

Part I: Lessons from the past

1) Access the online Burying Beetle module at <http://kmrobson.jimdo.com/burying-beetle-module/>. Click on the download button for the publication titled "Altitudinal Variation in Body Size and Population Density of *Nicrophorus investigator*." Read the **abstract** and **introduction**.

Answer the following questions about the reading:

- a) How can scientists use elevation gradients to study the effects of global warming on organisms? *2 pts*
- b) What was the purpose of the study? *1 pt*
- c) How do *N. investigator* populations vary across elevations? Provide **three** specific examples. *3 pts*

Part II: Experiment

1) Return to the online module. Click on the download button for the experiment titled "Burying Beetle Respiration." Follow the directions to carry out the experiment. Complete all the tables and questions.

Part III: Visualizing the elevation gradient

1) Return to the online module and navigate to the Supplementary Materials section. Click on the download button for the "East River Valley Sampling Sites Diagram." Print out the diagram and make note of what information needs to be filled in on **both** sides.

2) Review the videos "Google Earth tour" and "The Story Behind the Data" to learn where the sampling sites are located, and what the topography and vegetation of the sites is like.

3) Click on the download button for the publication titled "Resource Availability and Population Dynamics of *Nicrophorus investigator*, an obligate carrion breeder." Read the paragraph titled **Study Sites** in the materials and methods section. Record relevant details (such as elevation, vegetation, and soil characteristics) on your sampling sites diagram.

4) Click on the button to access the “Climate Data”. Download the Google Sheets file as an Excel document. In Excel, calculate temperature and precipitation averages for each month. Record the averages, and the min-max range, in the charts on your sampling sites diagram. Only five months are considered because this is when burying beetles are most active (June-August), or could be active depending on annual climatic conditions (May and September).

Important note: There is no climate data for Bellview and Maxfield Meadow because weather stations have not been established at these sites. As a result, the nearest weather stations (Schofield Pass and billy barr) have been used.

5) Return to the online module. Click on the buttons labeled “Beetle Census” and “Rodent Census.” Download each Google Sheets file as an Excel document.

6) Open the *Tableau* application on your computer. If it is not already installed, you can download the free software at <https://public.tableau.com/s/>. You will have to enter an email address to initiate the download.

7) Watch the following *Tableau* tutorials, available at <https://public.tableau.com/en-us/s/resources>, before moving on to the next steps:

- a) Data Preparation- Joins and Unions (start at 3:25 in the video)
- b) Creating Your First Chart
- c) Using the Show Me Tool Bar

8) Connect to the Beetle Census Excel file. Create a union between all of the sheets (years 2010 through 2015). Click on Sheet 1 in the bottom left corner of your *Tableau* console. Start exploring the dataset and creating visualizations.

9) Use *Tableau* to sum the number of records for beetle species at different sites. Fill in the appropriate charts on your sampling sites diagram.

10) Now connect to the Rodent Census Excel file. Carry out the same steps in *Tableau* to sum the number of records for rodent species at different sites. Fill in the appropriate charts on your sampling sites diagram.

11) Make sure that **both sides** of your sampling sites diagram are complete. *18 pts*

12) Answer the following questions:

- a) Describe **three** key differences between beetle populations (*N. investigator*, *N. guttula*, *N. defodiens*) at the three sampling sites. *1.5 pts*
- b) Describe **three** key differences between rodent populations (*P. maniculatus*, *Z. hudsonius*, *M. montanus*) at the three sampling sites. *1.5 pts*
- c) Does the weather station data from Schofield Pass, billy barr, and Kettle Ponds support the assumption that environmental variables change in a predictable manner along an elevation gradient? *2 pts*
- d) Return to the online module and navigate to the Supplementary Materials section. Download the images titled “Google Earth: Maxfield Meadow vs. billy barr” and “Google Earth: Bellview vs. Schofield.” Consider slope, aspect, and general topography. Do you think the weather station data from Schofield Pass and billy barr provides an accurate measure of conditions at Bellview and Maxfield Meadow? Justify your answer. *3 pts*

13) When evidence doesn’t support a hypothesis, scientists reject the hypothesis and propose a new one. This is a very important part of the scientific process.

- a) Re-state your hypothesis about how temperature is linked to changes in burying beetle populations along an elevation gradient (copy and paste your answer from question 8 of the Burying Beetle Respiration experiment).
- b) Does the evidence from the sampling sites diagram support your hypothesis? *1 pt*
- c) What other factors (biotic or abiotic) might affect beetle populations? *2 pts*
- d) Propose an alternate hypothesis about what is driving changes in beetle populations along the elevation gradient. *2 pts*