

ESA 21: ENVIRONMENTAL SCIENCE EXERCISES

Basic Skills and Principles: Module Capstone Activity

Capstone Activity

Introduction

At the end of each laboratory module, you will complete a Capstone Activity that integrates the material from the weekly exercises into one assignment. This is intended to help you to realize the "big picture", and give you practice synthesizing the skills and concepts from the individual exercises. In the assignment for this module, you will take measurements (Measurement lab), statistically analyze and graph your data (Statistics and Graphing lab), compare groups with a t-test (Measurement lab), and provide a written report on your findings (Experimental Analysis lab).

Leaves and Air Pollution

In the late spring and summer, many parts of the United States experience smog alert days - days when the concentration of pollutants in the air has been considered unhealthy. Many of these pollutants are produced by automobiles - particularly hydrocarbons, carbon monoxide, nitrogen oxides and, indirectly, ozone. Most discussion of the adverse effects of smog center on humans, and the effects on other forms of life, such as plants, are scarcely mentioned.



So how does air pollution from automobiles affect plant growth? Let's think about how this hypothesis might be tested. Two problems must be addressed. The first is how to obtain two sets of plants, one of which exposed to more automobile pollution than the other set. One way to do this would be to look at plants that are close to a busy road (within 10 meters) and compare them to plants that are a distance from such a road. The second problem is how to assess the health of the plants. One way is to measure the size of the leaves or needles in plants (evergreen needles are simply a modified leaf). Most photosynthesis in plants occurs in the leaves, so they are the "food factory" of the plant. Do you think a healthier plant is more likely to have larger or smaller leaves than a less healthy one? Look at the leaves and at the measuring devices available at Station 3 and think about the characteristic (length, width, mass, etc.) you will use to assess leaf size.

We will assume that the plants in each group receive the same amount of sunlight, water, and soil nutrients.

At Station 3, you will find two sets of leaves. Set A was collected from plants situated within 10 meters of a busy road, and Set B was collected from plants of the same species situated more than 20 meters from a busy road. All leaves were collected on the same day and have since been treated in the same way.

Leaves and Air Pollution:

1. Examine the leaves and choose a method for measuring the leaves that you think would be the most appropriate.
2. Construct a data table for your experiment on the Capstone Activity Sheet.
3. Randomly pick 10 leaves from each set and do your measurements, recording your data on the data table you have constructed.
4. Complete the Capstone Activity Sheet as directed.

ESA 21: Environmental Science Activities

Capstone Activity
Module 1

Name:

Lecture Professor:

Experimental Design:

List the null hypothesis, independent variable, and dependent variable for the study.

H_0 :

Independent variable:

Dependent variable:

Explain how you chose to measure the size of the leaves/needles, along with your rationale.

Data:

Create a table for your data in the space below. Include a title and follow all formatting requirements.

Table 1:

Descriptive Statistics:

Provide the statistics below for your two groups.

Table 2:

	Mode	Median	Mean	Std. Dev.

Inferential statistics:

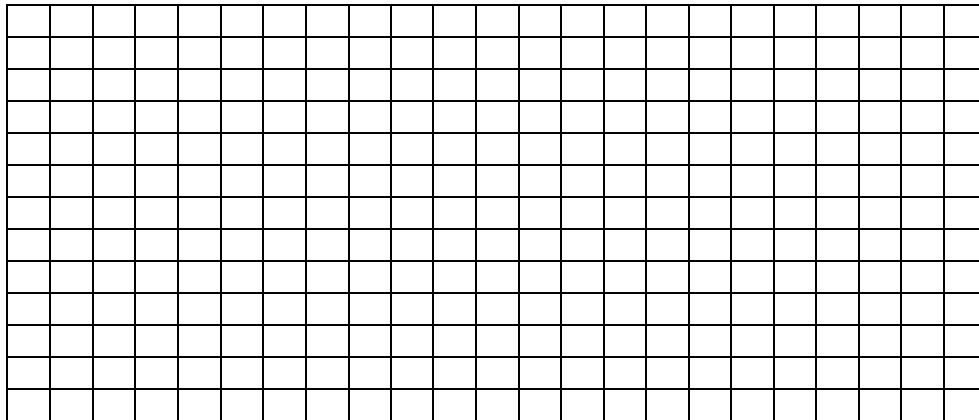
Refer back to your null hypothesis, and complete the t-test table for your data set.

t-statistic	p-value	Do you reject the H ₀ ?

Data presentation:

Graph your data below, following all formatting requirements. It is advisable that you review the sections on graphing, particularly the one on *what* to graph, prior to creating the graph.

Figure 1:



Conclusion:

Summarize the results of the study in your own words, referencing the descriptive statistics and Figure 1. Restate your null hypothesis, and evaluate it based upon the results of the t-test. Address the assumptions of the study and comment on any facet of the experimental design you deem appropriate.