The Effect of Biosolids Treatment on Soil and Plant Cover

1) Read the summary given by the client. Note that there are many questions to be answered. We'll first focus on four plant species that were of main interest for the client: ASAG, HECO, KOMA, and LITT to answer the question: does the plant cover value differ among species? Is that affected by the biosolids treatment?

2) Write any additional question you would like to ask to your client?

3) Based on the data given in Table 1 below (constructed from client's data):
   a. Write, in mathematical terms, a hypothesis of interest.
   b. Name the response variable and one explanatory variable (or factor) in this study.
   c. Suggest a method to test your hypothesis. Are the results in Table 1 sufficient to test your hypothesis? Explain.

Table 1: Average Plant Cover Value per species before (Control) and after treatment (Biosolids)

	ASAG	**HECO**	**KOMA**	**LITT**
Biosolids	2.73	33.26	1.93	88.76
Control	4.30	30.89	6.91	34.41

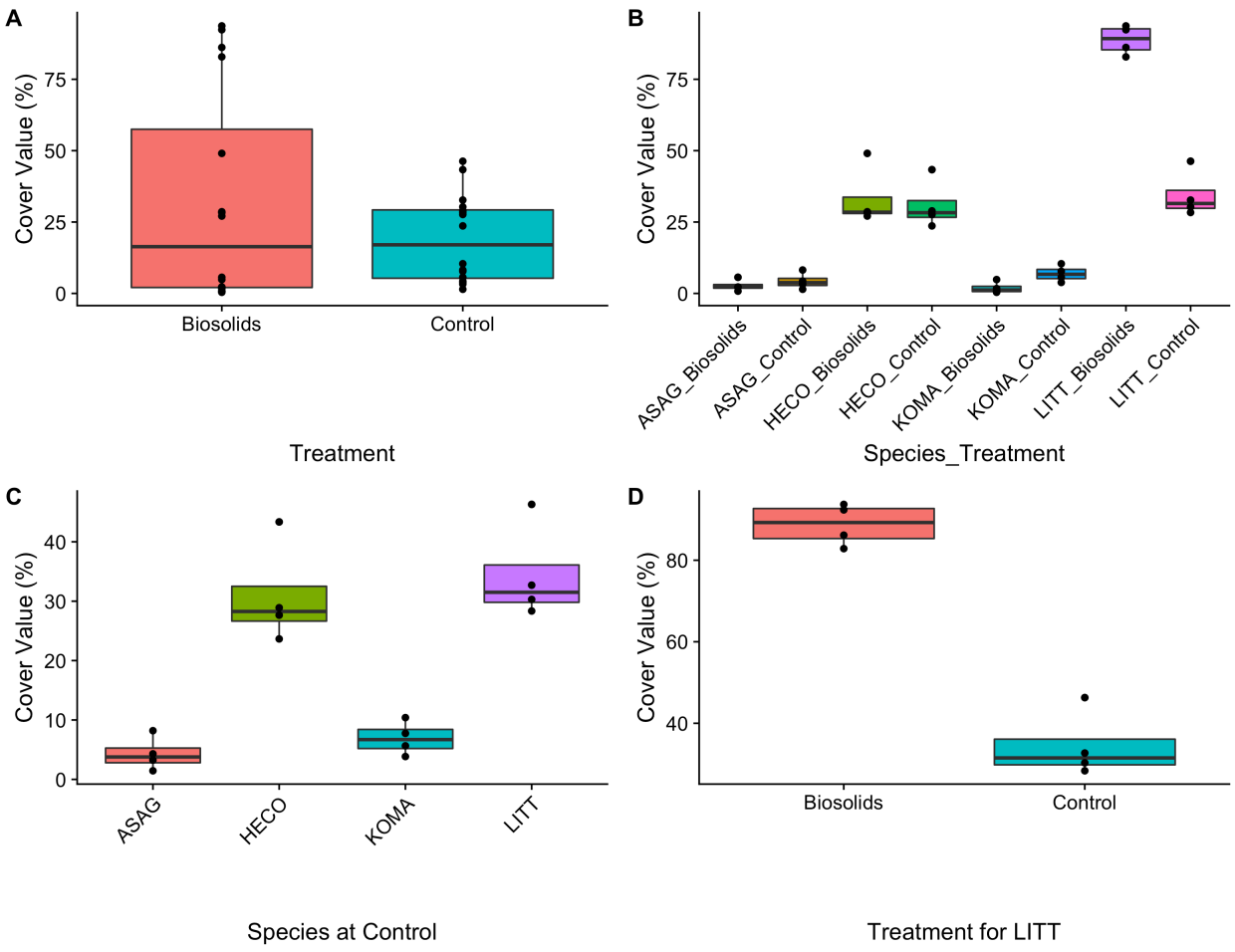
4) Based on Figure 1 below:
   a. Do any of the following plots illustrate the hypothesis you are trying to test?
   b. Formulate a hypothesis that can be illustrated with each of these plots (note, your hypothesis does not have to test all the information illustrated in the plot).

5) Are the results in Table 2 below (extracted from client's summary file) sufficient to test your hypothesis? Explain. Use examples or plots to support your explanation.

Table 2: Summaries of Plant Cover Value measured before (Control) and after treatment (Biosolids)

Treatment	**Species**	**Average**	**SD**
Biosolids	ASAG	2.73	2.06
Biosolids	HECO	33.26	10.54
Biosolids	KOMA	1.93	2.03
Biosolids	LITT	88.76	5.13
Control	ASAG	4.30	2.85
Control	HECO	30.89	8.60
Control	KOMA	6.91	2.82
Control	LITT	34.41	8.12

Figure 1: Boxplots of Plant Cover Value for the Selected Species



STAT450: Class Activity 2

The Effect of Biosolids Treatment on Soil and Plant Cover

This activity is based on the information given in Table 2 from Activity 1. In addition, you now know that the averages and standard deviations (SD) reported in the table were calculated from the observations collected in 4 experimental blocks (n=4 per group).

1) Based on the data given:
   a. Write, in plain language, the following null hypothesis of interest:

      $H_0: \mu_0 = \mu_x$
      $H_1: \mu_0 \neq \mu_x$

      where μ_0 is the population mean of the cover value of LITT plants without treatment (control) and μ_x is the population mean of the cover value of LITT plants treated with Biosolids.

   b. Write the following null hypothesis in mathematical terms. Clearly define the variables and parameters used in your formulation.

      H_0: all plant species grow equally without treatment

   c. Use a two-sample t-test to test H_0 in (a) at a 5% significance level. Write all the assumptions made.

   d. Use ANOVA to test H_0 in (a) at a 5% significance level? Write all the assumptions made. Compare with your results in c)

2) Based on the data given:

   a. Use ANOVA to test H_0 in (1-b) at a 5% significance level. Write all the assumptions made.

   b. If the null hypothesis in (1-b) was rejected by your test, the client may ask you to test the significance (at 5% level) of all pairwise differences between species. Write a test statistics that you would use test these hypotheses. Explain how you would proceed.

3) Test the hypothesis that you formulated on Activity 1. If it is the same as one of those in previous point, state a different hypothesis of interest and test it.

STAT450: Class Activity 3

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1) Use R and the data uploaded in Connect to respond to the following questions:

a. Test the following hypothesis using anova (i.e., aov()):
   H_0: all species (without biosolids treatment) are equally effective
b. If the null hypothesis in 1-a) was rejected by your test, the client may ask you to test the significance (5% level) of all pairwise differences between drugs. Explain how you would proceed.
c. Can you use a linear model to test the hypothesis in a)? Compare the outcome of aov() with that of lm(). Write the linear model and explain which are the covariates in the model.
d. Is LITT more active than HECO? Test this hypothesis at a significance level of 5%. Compare the output of lm using "LITT" as the reference level with a simple two-sample t-test. Do you get the same result? Explain.