Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lab 12: Lichen project data analysis**

Part 1: Thinking about the research questions and data

1. Clearly state a **site-scale** research question that we could address with the data that our class collected.
2. Clearly state a **continental-scale** research question that we could address using all participants’ data, along with NEON data.
3. Think about the variables we measured last week. We’ll discuss this as a class, but try to answer on your own:
	1. Which of these variables are **continuous response variables?**
	2. Which of these variables are **continuous independent variables?**
	3. Which of these variables are **categorical response variables?**
	4. Which of these variables are **categorical independent variables?**
4. Once you’ve answered #3, examine the lichen data simple flow chart shown [here](https://drive.google.com/file/d/1drdO8A_HF6nOgxGGaFz8pD_6aPBAa7Ns/view?usp=sharing). What type of analysis or graph would be appropriate to address the hypothesis you wrote in #1?
5. What type of analysis or graph would be appropriate to address the hypothesis you wrote in #2?

Part 2: Getting the data

1. Make a folder on your desktop where you can put all the files we’ll use so you can find them easily.
2. Get the three files of data that we will work with and put them in the desktop folder:
	1. NEON data: Go to Moodle and download the Excel file “NEONcomplete.”
	2. EREN Lichen data:
		1. Go to iNaturalist and click on the EREN lichen project.
		2. Scroll down to find the “Export Observations/ csv” link. Click on “csv.”
		3. Scroll down a bunch to find “Observation Fields” and select “All” to make sure all the lichen data fields are selected.
		4. Click “Create Export” and wait a moment until the file is ready.
		5. Click the “Download” link, which will download a zipped folder containing a csv file.
		6. Find and open the csv file and save it as an Excel file in your desktop folder. I suggest naming it “EREN Lichen data.”
	3. Our class lichen data:
		1. Go to iNaturalist and click on our class project.
		2. Scroll down to find the “Export Observations/ csv” link. Click on “csv.”
		3. Change the date range to 2020-11-4 through 2020-11-6 (this will include an observation I did prior to our lab).
		4. Scroll down a bunch to find “Observation Fields” and select “All” to make sure all the lichen data fields are selected.
		5. Click “Create Export” and wait a moment until the file is ready.
		6. Click the “Download” link, which will download a zipped folder containing a csv file.
		7. Find and open the csv file and save it as an Excel file in your desktop folder. I suggest naming it “GC Lichen data.”

Part 3: Exploring our class data

1. Before we do any types of analysis, let’s look over our data (it’s a pretty manageable size!) and see if you notice any irregularities. What are some things that could be cleaned up, corrected, etc.? Look on your own and then we’ll discuss as a class.
2. Once we’ve cleaned up some of the data, let’s make a radar plot summarizing our lichen % cover. Somewhere to the right of all the data, make a small table with the following headings:

|  |  |  |  |
| --- | --- | --- | --- |
| % north | % east | % south | % west |
|  |  |  |  |

Below each heading type “=AVG(“ and then select the column of cells corresponding to that heading (note that %east is first in the iNaturalist download, but we want it arranged this way so it plots like a normal compass).

1. Copy these four calculated values and then “paste special 🡪 values” on top of where you had the formulas. The purpose of doing this is because if you leave the formulas in place they could get messed up when you sort the data in different ways for later analyses.
2. Select all 8 cells of this table. Then go to Insert 🡪 Chart and select the Radar chart, which looks like a spider web. Choose the first radar plot type. If you had the table of data selected, it should plot it automatically.
3. Change the chart title to “% Lichen Cover.”
4. Did there appear to be more lichen on one side of the trees than others?
5. What type of plot would we make to determine if % lichen cover varied with % canopy cover? Go ahead and make this plot (and ask me for help if you need it).
6. Does there appear to be a strong relationship between % lichen cover and canopy?
7. What type of plot would we make to determine if % lichen cover varied across tree species or taxa? Go ahead and make this plot (and ask me for help if you need it – I suggest we focus on oaks, maples, pines, and elms).
8. Does % lichen cover appear to differ across tree taxa?
9. What statistical approach would we use to test this? (recall the leaf thickness lab)
10. Rather than submitting your Excel files on Moodle, I will come around and briefly check your work. I’ll initial here once I’ve seen your graphs for this part:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Part 4: Exploring all of the EREN Lichen project data

1. Before we do any types of analysis, let’s look over the data and see if you notice any irregularities (yes, it’s a lot!). What are some things that could be cleaned up, corrected, etc.? Look on your own and then we’ll discuss as a class.
2. Once we’ve cleaned up some of the data, let’s make another radar plot summarizing lichen % cover. Follow the steps as we did for our class data.
3. Did there appear to be more lichen on one side of the trees than others?
4. Does % lichen cover appear to differ across tree taxa?
	1. To answer this, we’ll make the same type of plot as we did with just our class data, but tidying up the data will be a little more difficult (sort the data by tree species ID and you’ll see what I mean!). I suggest making new sheets and pasting all the maple tree rows into a maple sheet, all the oak rows into an oak sheet, etc. Let’s try to compare the same taxa that we did for just our class data.
	2. Once you’ve made a sheet of data for each tree species of interest, calculate the average % Lichen cover for North, East, South, and West for each species.
	3. Make another new sheet where you can paste in the values to make a graph, something like this:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | % east | % north | % south | % west |
| maple | 25 | 14.4 | 20.6 | 1.8 |
| elm | 13.33333 | 22 | 8.333333 | 10.66667 |
| pine | 0.666667 | 0.666667 | 0 | 0 |
| oak | 23.55556 | 31.66667 | 5.444444 | 3.857143 |

* 1. Graph the data as you did before.
	2. So, does % lichen cover appear to differ across tree taxa?
	3. Once again, what statistical approach would we use to test this? (recall the leaf thickness lab)
	4. I’ll initial here when I’ve seen your graph for this section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(one more section – see the back!)

Part 5: Exploring NEON Lichen data

1. Open the NEONcomplete.xls file and examine the different variables. Which variables might be useful to us for testing some of the hypotheses of this project?
2. Thinking about the variables you noted above, what type of plot should we do to test the hypothesis that lichens and related to air quality metrics? (we can discuss as a class)
3. Make at least three plots to test the lichen-air quality hypothesis. Be sure to sort the data by which ever air quality parameter you are focused on so you can exclude the “NA” rows (rows without air quality data).
4. Do there appear to be any relationships between lichens and air quality parameters? Explain.
5. I’ll initial here when I’ve seen your graph for this section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_