SNAPSHOT WISCONSIN

Measuring Biodiversity: Google Sheets Tutorial

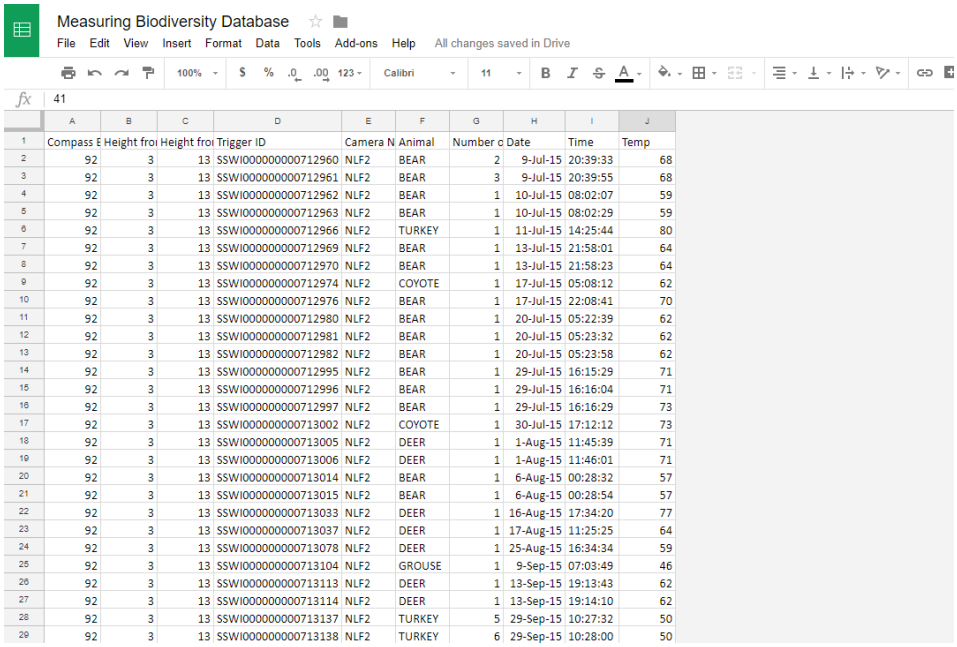
INTRODUCTION

This database contains a subset of data from Snapshot Wisconsin cameras deployed in two different Wisconsin ecoregions: Southern Wisconsin Till Plains (SWTP) and Northern Lakes and Forests (NLF). The columns of the spreadsheet refer to different pieces of metadata, metadata is defined as a set of data describing and giving information about other data (in this case the trail camera photos). The metadata describes the compass bearing of the trail camera, height from the ground, height from the trail, trigger ID (the name that the photo is stored as), camera number, animal, number of animals, data the photo was taken, time, and temperature.

These step-by-step instructions are designed to help students take a raw dataset and convert it into a series of Pivot Tables. The Pivot Tables will allow students to view the abundance of species for specific ecoregions, and calculate biodiversity indices.

PART I: ACCESSING THE DATABASE

1. Download “Measuring Biodiversity Database.xlsx” file.
2. Go to google.com/sheets. Under “Start a new spreadsheet” at the top of the page, select “Blank.” Once in Google Sheets, select File → Open → Upload → Select a file from your computer → navigate to “Measuring Biodiversity Database.xlsx”.
3. Now that Google Sheets will display the Measuring Biodiversity Database we can begin manipulating the data to calculate biodiversity indices.


Measuring Biodiversity Database

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

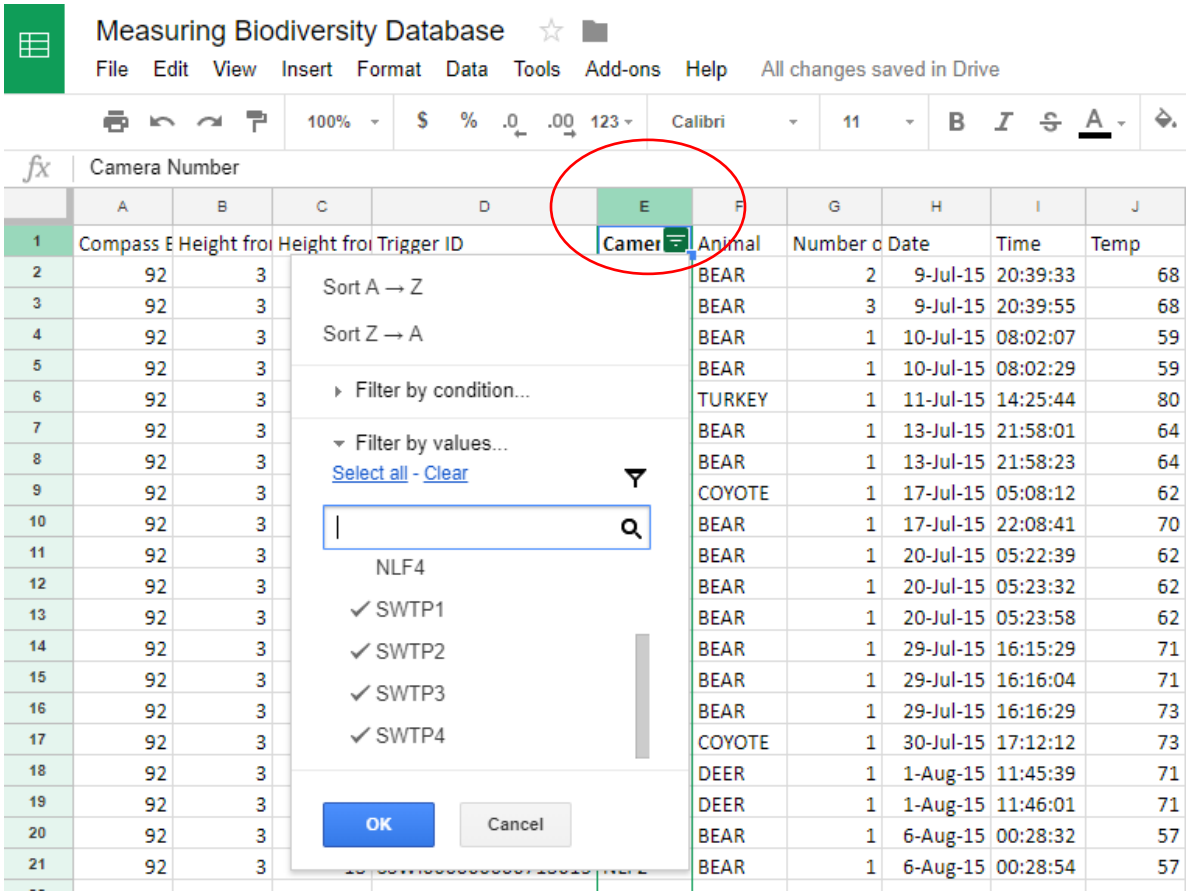
fx 41

	A	B	C	D	E	F	G	H	I	J
1	Compass E	Height fro	Height fro	Trigger ID	Camera N	Animal	Number o	Date	Time	Temp
2	92	3	13	SSWI000000000712960	NLF2	BEAR	2	9-Jul-15	20:39:33	68
3	92	3	13	SSWI000000000712961	NLF2	BEAR	3	9-Jul-15	20:39:55	68
4	92	3	13	SSWI000000000712962	NLF2	BEAR	1	10-Jul-15	08:02:07	59
5	92	3	13	SSWI000000000712963	NLF2	BEAR	1	10-Jul-15	08:02:29	59
6	92	3	13	SSWI000000000712966	NLF2	TURKEY	1	11-Jul-15	14:25:44	80
7	92	3	13	SSWI000000000712969	NLF2	BEAR	1	13-Jul-15	21:58:01	64
8	92	3	13	SSWI000000000712970	NLF2	BEAR	1	13-Jul-15	21:58:23	64
9	92	3	13	SSWI000000000712974	NLF2	COYOTE	1	17-Jul-15	05:08:12	62
10	92	3	13	SSWI000000000712976	NLF2	BEAR	1	17-Jul-15	22:08:41	70
11	92	3	13	SSWI000000000712980	NLF2	BEAR	1	20-Jul-15	05:22:39	62
12	92	3	13	SSWI000000000712981	NLF2	BEAR	1	20-Jul-15	05:23:32	62
13	92	3	13	SSWI000000000712982	NLF2	BEAR	1	20-Jul-15	05:23:58	62
14	92	3	13	SSWI000000000712995	NLF2	BEAR	1	29-Jul-15	16:15:29	71
15	92	3	13	SSWI000000000712996	NLF2	BEAR	1	29-Jul-15	16:16:04	71
16	92	3	13	SSWI000000000712997	NLF2	BEAR	1	29-Jul-15	16:16:29	73
17	92	3	13	SSWI000000000713002	NLF2	COYOTE	1	30-Jul-15	17:12:12	73
18	92	3	13	SSWI000000000713005	NLF2	DEER	1	1-Aug-15	11:45:39	71
19	92	3	13	SSWI000000000713006	NLF2	DEER	1	1-Aug-15	11:46:01	71
20	92	3	13	SSWI000000000713014	NLF2	BEAR	1	6-Aug-15	00:28:32	57
21	92	3	13	SSWI000000000713015	NLF2	BEAR	1	6-Aug-15	00:28:54	57
22	92	3	13	SSWI000000000713033	NLF2	DEER	1	16-Aug-15	17:34:20	77
23	92	3	13	SSWI000000000713037	NLF2	DEER	1	17-Aug-15	11:25:25	64
24	92	3	13	SSWI000000000713078	NLF2	DEER	1	25-Aug-15	16:34:34	59
25	92	3	13	SSWI000000000713104	NLF2	GROUSE	1	9-Sep-15	07:03:49	46
26	92	3	13	SSWI000000000713113	NLF2	DEER	1	13-Sep-15	19:13:43	62
27	92	3	13	SSWI000000000713114	NLF2	DEER	1	13-Sep-15	19:14:10	62
28	92	3	13	SSWI000000000713137	NLF2	TURKEY	5	29-Sep-15	10:27:32	50
29	92	3	13	SSWI000000000713138	NLF2	TURKEY	6	29-Sep-15	10:28:00	50

Step 3. View of Measuring Biodiversity Database in Google Sheets.

PART II: CONDENSING THE DATA

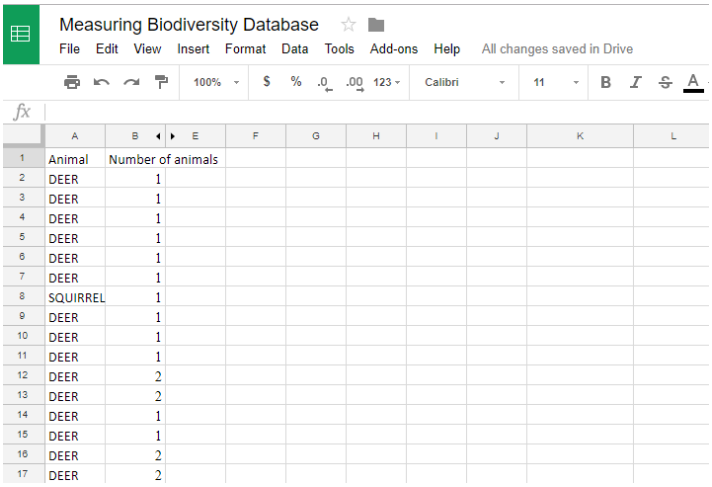
4. Highlight the "Camera Number" column by clicking on the "E" button above the heading. Under the Data tab, click the Filter tool. A downward facing arrow will now appear on the "Camera Number" heading. Click on the downward facing arrow, click "Clear" and then select the cameras appropriate for the ecoregion of interest (Southern Wisconsin Till Plains or Northern Lakes and Forests, whichever you start with – you will calculate the other later). Click "OK".



Step 4. Filtering the data for only cameras from ecoregion of interest, in this case Southern Wisconsin Till Plains.

5. Google Sheets will now show a condensed version of the data only displaying the ecoregion of interest. Highlight the filtered data by clicking in the upper left corner of the Google Sheet under the fx icon. Use Ctrl + C to copy the data, paste the data in the Workspace sheet using Ctrl + V. This will allow you to manipulate the data that you want, while leaving the original dataset intact. In the original Database sheet, select the Data tab and click "Turn off filter" to restore the original dataset.

6. For this exercise, we are only interested in the abundance of animals in each ecoregion. In the Workspace sheet delete all columns, except for “Animal” and “Number of animal”, by right clicking on the column heading letter and selecting “Delete column.” You can select multiple columns to delete by using the Ctrl button while you select columns.

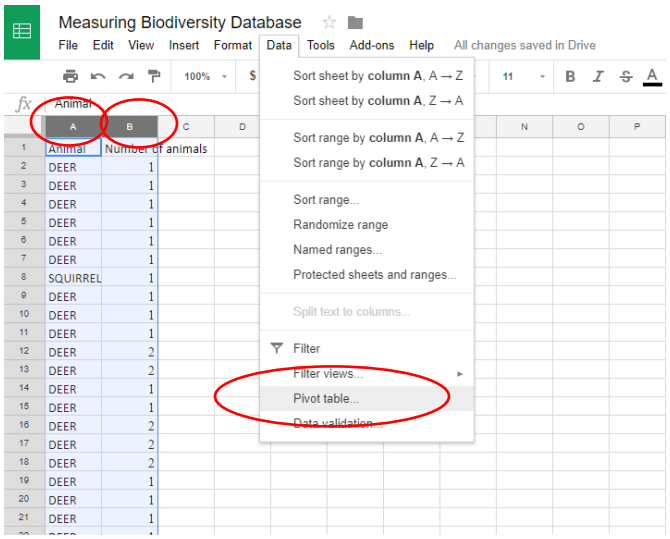


	A	B
1	Animal	Number of animals
2	DEER	1
3	DEER	1
4	DEER	1
5	DEER	1
6	DEER	1
7	DEER	1
8	SQUIRREL	1
9	DEER	1
10	DEER	1
11	DEER	1
12	DEER	2
13	DEER	2
14	DEER	1
15	DEER	1
16	DEER	2
17	DEER	2

Step 6. View of condensed data of interest in Workspace sheet.

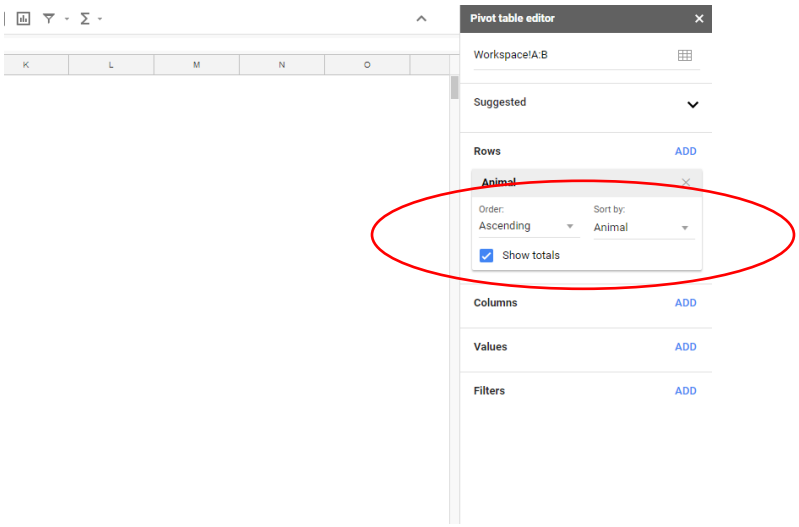
PART III: CREATING A PIVOT TABLE

7. The next step is to create a Pivot Table to summarize the data. Highlight the “Animal” and “Number of animals” columns by clicking on the “A” column heading + shift + “B” column heading. While these columns are highlighted, click on the Data tab and select “Pivot Table.” Google Sheets will create a new sheet called Pivot Table 1, navigate to this sheet. The Pivot Table will initially be blank -this is OK! Continue to the next step.



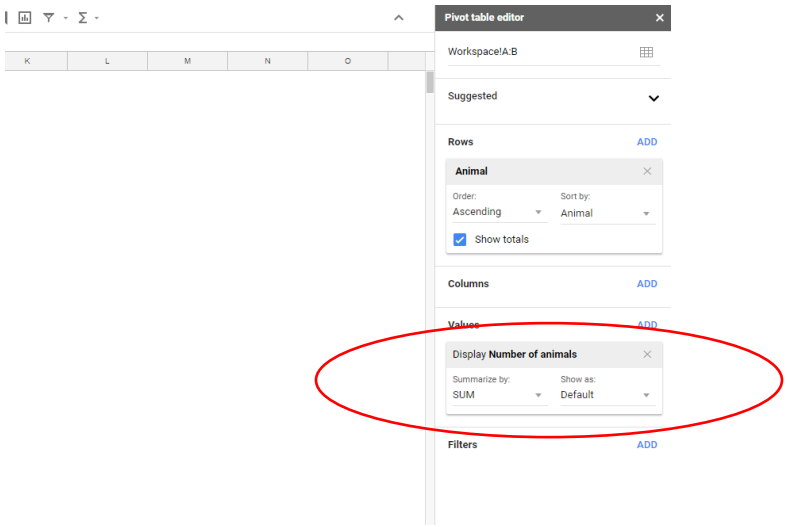
Step 7. Highlight columns A and B (or whichever columns your data are stored in) and create a Pivot Table.

8. On the right-hand side of the screen in the Pivot table editor toolbar, select the “ADD” button next to “Rows”, select “Animal.” Ensure that the box that says “Show totals” is checked.



Step 8. Adding animals to the Pivot table.

9. Next, select the “ADD” button next to “Values” and select “Number of animals.” Make sure that they are summarized by SUM (this accounts for cameras where multiple individuals of a species appear in an image, for example three deer in one shot). The Grand Total will reflect the total number of individuals in the entire ecoregion.



Step 9. Adding the number of photos that animals appeared in to generate species abundance

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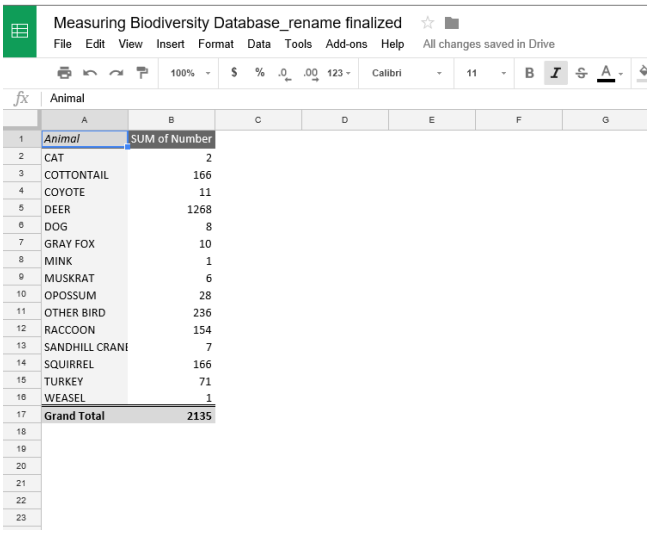
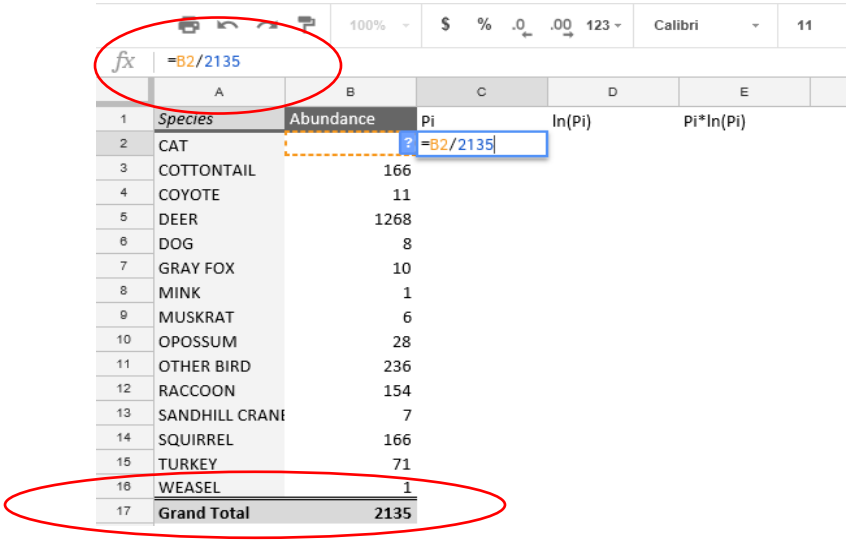


Step 9. Example of what your Pivot Table should look like.

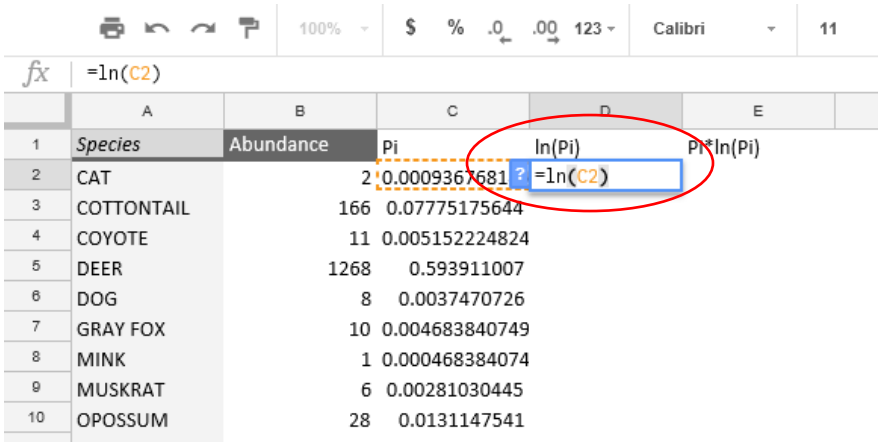
PART IV: PERFORMING CALCULATIONS IN GOOGLE SHEETS

10. Now your Pivot Table should display each species and the total number of sighting on the trail cameras. Rename the headings to "Species" and "Abundance", and create new headings for P_i, $\ln(P_i)$, and $P_i*\ln(P_i)$ in the adjacent columns.
11. To have Google Sheets calculate the P_i value, enter in =(CELL_LOCATION / Total Abundance). For this exercise, the Grand Total value reflects the total number of individuals, do not reference the cell of the total abundance, or the following step will not work correctly. For example, enter =(B2/2135). To autofill the P_i value for each species, click on the calculated cell and drag down blue square in the bottom right corner.



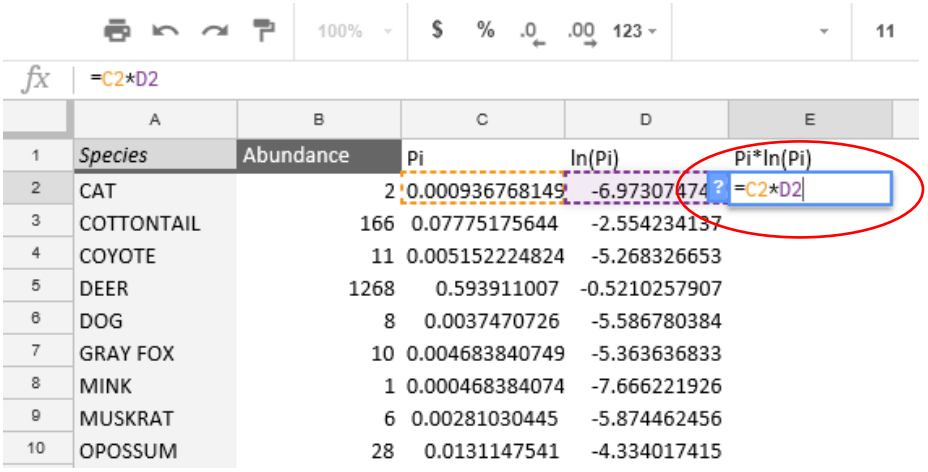
Step 11. Example of what your Pivot Table should look like with added columns for Google Sheets to help organize calculations, the red circles show the total abundance and equation for calculating P_i.

12. Use Google Sheets to calculate ln(P_i) by typing in the equation =ln(CELL_LOCATION) into the corresponding cell. For example, =ln(C2) [*these cell locations may vary based on your dataset*]



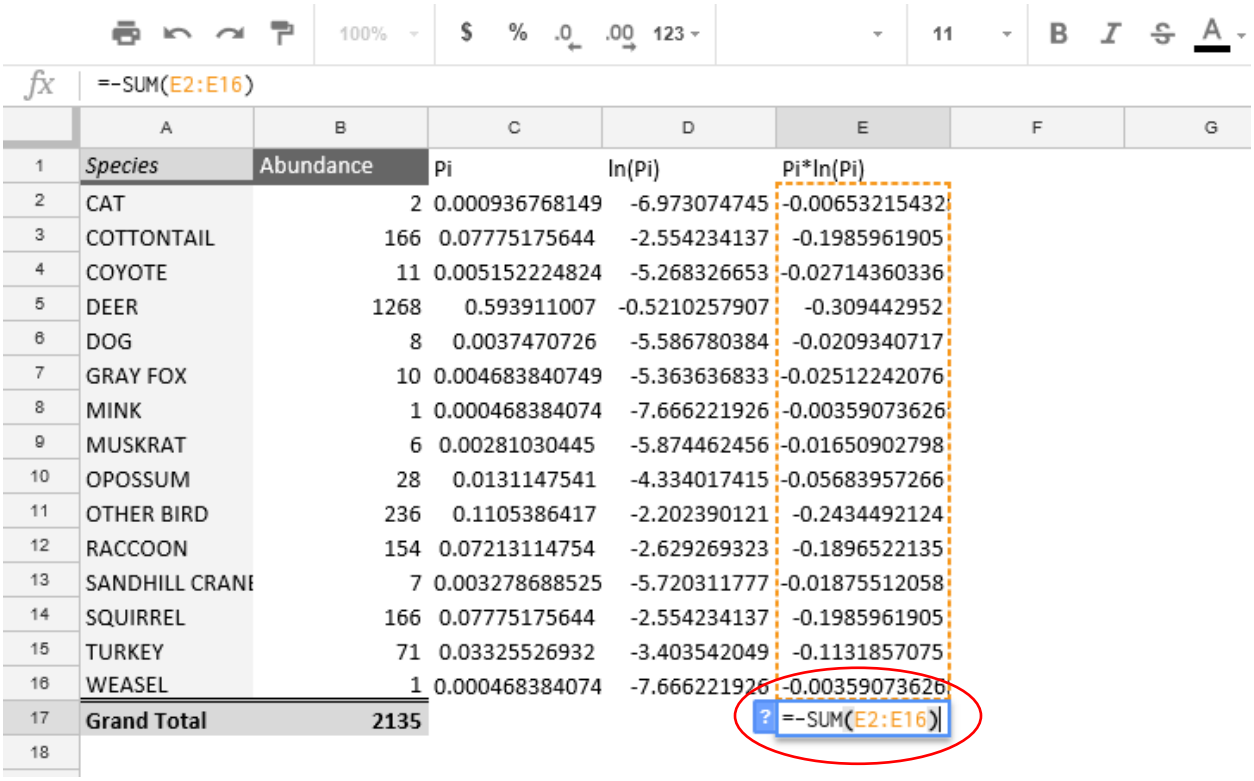
Step 12. Calculation for ln(P_i).

13. Calculate P_i*ln(P_i) using the equation =(CELL_LOCATION * CELL_LOCATION). For example, =(C2*D2) [*these cell locations may vary based on your dataset]*



*Step 12. Calculation for P_i * ln(P_i).*

14. Calculate the Shannon diversity index using the equation H = -SUM (P_i * ln(P_i)). You can perform this calculation in Google Sheets using the equation =-SUM(FIRST_CELL_LOCATION:LAST_CELL_LOCATION). For example, =-SUM(E2:E16) [*these cell locations may vary based on your dataset*].



	A	B	C	D	E	F	G
1	*Species*	Abundance	Pi	ln(Pi)	Pi*ln(Pi)		
2	CAT	2	0.000936768149	-6.973074745	-0.00653215432		
3	COTTONTAIL	166	0.07775175644	-2.554234137	-0.1985961905		
4	COYOTE	11	0.005152224824	-5.268326653	-0.02714360336		
5	DEER	1268	0.593911007	-0.5210257907	-0.309442952		
6	DOG	8	0.0037470726	-5.586780384	-0.0209340717		
7	GRAY FOX	10	0.004683840749	-5.363636833	-0.02512242076		
8	MINK	1	0.000468384074	-7.666221926	-0.00359073626		
9	MUSKRAT	6	0.00281030445	-5.874462456	-0.01650902798		
10	OPOSSUM	28	0.0131147541	-4.334017415	-0.05683957266		
11	OTHER BIRD	236	0.1105386417	-2.202390121	-0.2434492124		
12	RACCOON	154	0.07213114754	-2.629269323	-0.1896522135		
13	SANDHILL CRANE	7	0.003278688525	-5.720311777	-0.01875512058		
14	SQUIRREL	166	0.07775175644	-2.554234137	-0.1985961905		
15	TURKEY	71	0.03325526932	-3.403542049	-0.1131857075		
16	WEASEL	1	0.000468384074	-7.666221926	-0.00359073626		
17	**Grand Total**	**2135**			=-SUM(E2:E16)		
18							

Step 14. Calculation for finding the Shannon diversity index.

15. You can use a calculator to calculate Evenness (E), or take advantage of Google Sheets to do this calculation for you! Use some of the techniques that you have learned in this tutorial.
16. Repeat these steps for the next ecoregion. Record your answers in your Student Worksheet.