BIOL 687, Vegetation Description and Analysis
Laboratory 7, 25 Oct 2017
Sorted table analysis method using EXCEL, 100 points

Sorted Table due 5 pm Friday 6 Nov 2017

I. OBJECTIVE:

To familiarize students with the method of table sorting and to use the table to describe some of the major vegetation units occurring in the Colleen study area.

II. WHY MAKE A SORTED TABLE?

Sorted tables are the heart of vegetation classification. They are the essential element of any publication of a classification, and provide the justification for dividing the vegetation into the units described. They present the relevé information in an ordered way so that readers can readily see the pattern of distribution of key plant species. When taken to the level of association tables, they show the relationship of the described vegetation units to other published units.

In this exercise, we will produce a sorted table of the Lake Colleen Site A study area and identify the key differential species for separating the units. Unlike the ordination, which provides a much more abstract synthesis of species information, the table presents all the species information, so it is easier to see problems that may be due to sampling errors or misidentified species. As we will see in the exercise, the sorted table can also be helpful in interpreting the ordination. Often it is best to do the sorted table before doing an ordination.

III. METHOD OF TABLE SORTING:

A. RAW TABLE.

The raw table should have the species in rows and the relevé numbers in the columns. To access this file, go to Plot Archive in the Alaska Arctic Geoecological Atlas and access plot dataset nr. 32: Prudhoe Bay – ArcSEES Road Study (http://alaskaaga.gina.alaska.edu/plot-archive/plot-datasets/28-prudhoe-bay-arcsees-road-study). Download the dataset: aava_pruarc_dwalker_2015_spp_modsrc.xlsx.

Trim off the unnessary header rows, down to the Author Plot number row.

Trim off the unnecessary columns, so you retain Column A (PASL taxon scientific names) and columns D — AG (Field species codes through plot 14-5).

B. CALCULATE FREQUENCY VALUES FOR ALL SPECIES.

1. At the right side of your species data matrix create a column called 'frequency'. (Note: In some descriptions of the Braun-Blanquet method this is referred to as 'Constancy'. This, however, is easily confused with the 'constancy' classes (i.e., species occurrence within vegetation units) discussed below (Section F.2.b).
2. Remove all the zeros in the matrix. Otherwise the 'Count' formula in Excel will count all cells with data in them. Highlight the body of the table (exclude the header). Then 'Edit/Replace'. Then fill in 0 in the 'find what' line, and leave the 'replace with' line blank. Then click 'Replace all'.
3. Calculate the frequency for the first species. In the cell corresponding to frequency for the first species, sum the total occurrences of the first species across all the plots. To do this, enter '=COUNTA(Xy:Zy)', where X is the first column of species data, Z is the last column of species data, and y is the row. You can also highlight the entire line after entering the first parentheses and follow with the closed parentheses. Hit return. The frequency of the first species should appear in the cell.

4. Repeat for all the species. Select the cell with the 'count' formula. Then pull the right corner of the highlighted cell to the bottom of the Frequency column. Frequency values should appear in the all the cells. Check to see if there are any "0" values.

C. ARRANGE THE ROWS (SPECIES) IN DESCENDING ORDER OF THEIR FREQUENCY VALUES.

Highlight the entire table. Select 'Data/Sort/Options/Orientation/Sort from top to bottom'. This will specify that you are sorting by rows. Click OK. Then specify the column number for the frequency values and 'descending'. This should arrange all the species in descending order of their frequency values.

D. ARRANGE THE COLUMNS (PLOTS) ACCORDING TO FIRST-CUT VEGETATION TYPES.

(a) Add a row at the top of the table that contains the preliminary vegetation types.
Create a new row at the top of raw data table.

Go to Alaska Arctic Geoecological Atlas and access environmental dataset nr. 32: Prudhoe Bay – ArcSEES Road Study (http://alaskaaga.gina.alaska.edu/plot-archive/plot-datasets/28-prudhoe-bay-arcsees-road-study). Download the dataset: aava_pruarc_dwalker_2015_allenv_modsrc.xlsx.

Column BD has the preliminary Vegetation type codes that were used in the field. Copy and transpose this column into the new row at the top of sorted table. (Edit/Copy/ Paste Special/ Transpose). Edit the row header to read "Preliminary Veg Type".

You can now sort according to the preliminary vegetation types. Group the types as follows: U3, U4, U4d, M2, M2d, M4, E1d, E4d, (Dupfis dust, Caraqu-Salova, Pucphr, & Caraqu in one group), by moving the columns with the same vegetation type next to each other.

1. Highlight the column you want to move.
2. Move the cursor to the left or right side of the highlighted column depending on which way you want to move column. Hold the Shift key while moving the cursor. You should get an "open hand" cursor. When you are at the boundary of the column. The cursor should change from an open hand to a closed "grab hand". Continue moving the cursor to the column boundary of the column next to where you want to drop it. The boundary between the columns where you want to drop the column should become highlighted. Release the shift key and cursor, and the column should appear where you want it.
5. NOTE: It is easy to lose columns or rows during the sorting process. So keep a tally of the total number of species and relevés and check this periodically during the sorting.
6. Color the columns with the same Veg type according to a logical color scheme from drier types to wetter types (e.g., U3, yellow; U4, light yellow; U4d, dirty light yellow; M2, light green; M2d, dirty light green; M4, darker green; E1d, dirty light blue; E4d, darker blue; (Dupfis dust, Caraqu-Salova, Pucphr, & Caraqu group, gray)

E. CALCULATE SPECIES RICHNESS FOR EACH RELEVE

Calculate the total number of species in each relevé.

1. Trim off the unnecessary rows at the bottom of the table.
2. Create a new row labeled 'Species Richness' at the bottom of the table.
3. In the cell corresponding to the species richness for the first relevé, write the equation '=countA(Xy:Xz)' where X is the relevé column, y is the row of the first species in the table, and z is the row of the last species in the table.
4. Hit 'Return'. The number of species in the first relevé should appear in the cell. Count the species occurrences to check if correct.
5. Repeat for all the plots. Select the cell with the 'count' formula. Then pull the right lower corner of the highlighted cell to the right so all the plot columns with data are highlighted. Frequency values should appear in the all the cells. Check to see if there are any "0" values.

F. CREATE A WAY TO CHECK IF YOU HAVE LOST COLUMNS OR ROWS DURING THE SORTING PROCESS

1. Copy the "Total Richness" row to a spot lower on the spread sheet, so you can periodically check to see if you have lost rows (species) during the sorting process. (Copy/ paste special/ value).
2. Write down the number of columns in your table.

F. ARRANGE SPECIES ACCORDING TO DIFFERENTIAL TAXA WITHIN THE VEGETATION TYPES.

1. Put in 14 blank rows above the first species in the table. Label the rows according to these groups:
   a. Ubiquitous taxa occurring broadly across moist, wet, aquatic nonacidic tundra (U3, U4, U4d, M2, M2d, M4, E1d, E4D):
   b. Taxa occurring broadly in moist to wet nonacidic tundra (U3, U4, U4d, M2, M2d, M4):
   c. Differential taxa for moist nonacidic tundra types (U3, U4, & U4d):
   d. Differential taxa for U3: E*riophorum angustifolium, Dryas integrifolia, Tomentypnum nitens, Thamnolia vermicularis* comm.:
   e. Differential taxa for U4 & U4d:
   f. Differential taxa for U4: *Carex aquatilis, Dryas integrifolia, Salix arctica, Tomentypnum nitens* comm.
   g. Differential taxa for U4d:
   h. Differential taxa for M2 & U3:
   i. Differential taxa for nonacidic aquatic marshes (M4, E1d, E4d):
   j. Differential taxa for M4 and E4d
   k. Differential taxa for E1d: *Carex aquatilis* comm.
   l. Differential taxa for disturbed types and M2d (near road):
   m. Nondifferential taxa:
   n. Single occurrences:

2. Determine the group (see 1a to 1g above) for each species:
   a. Move all species with 'species richness=1' below the 'Single occurrences' line.
   b. Look for "differential" species for each type. Use the rules in Table IV (next page) to determine if species are differential for a given group. Calculate the constancy of each species for each group. Constancy classes are as follows: I = the species occurs in 1-20% of plots in the category; II = 21-40%; III = 41-60%; IV = 61-80%; V = 81-100%. You can color code the species using the same highlight color as for the vegetation type columns (e.g., dark yellow for differential species for the U3; light yellow for U4, dirty light yellow U4d; light green for M2, M2d; dark green for M4; light blue for E1d; dark blue for E4d; gray for heavily disturbed types.

Rules for determining fidelity according Westhoff and van der Maarel (1978):

TABLE IV

Determination of fidelity according to SZAFER and PAWŁOWSKI (BRAUN-BLANQUET 1932)

F = fidelity degree;
A = cover-abundance combined estimation;
C = presence or constancy class;
V = vitality.

F	in phytocoenon under consideration		in comparable phytocoena	
	C	A	C	A
5	IV–V	3–5	I–II	+–2(1)
	IV–V	+–2	I	+–2
	I–III	+–5	absent or very rare	
4	IV–V	3–5	II–III (IV) (relic or pioneer)	+–2(1)
	IV–V	+–2	II–III	+–1(2)
	III–IV	+–2	I–II (III)	+–1(2)
	I–III	+–2	I (rare)	+
3	I–V	3–5	I–V	+–2
	C, A various	V normal	C, A lower	V reduced
2	C, A, V various		similar	
1	I	+–1	higher	
	V reduced			
	– outskirts and disturbed parts of the stand(s) –			

Fidelity: 5 = Exclusive taxa occurring only or nearly so within the vegetation unit. 4 = Selective or differential taxa, occurring with a clear preference for the unit. 3 = Preferential taxa, occurring in several units but with higher cover abundance in the unit in question. 2 = indifferent taxa. 1 = Strange taxa.
Constancy classes (C) (occurring in percent of plots in the vegetation unit): I=1-20%, II=21-40%, III=41-60%, IV=61-80%, V=81-100%

Rules for deciding if a species is differential for a vegetation type when compared against another vegetation type (from Daniels 1982)

- A vegetation type must have at least two differential species. Their presence is high in the vegetation type under consideration and relatively low in other types.
- The rules for determining differential species for four situations are as follows:

Situation I. The vegetation type under consideration, A, is based on 5 or more relev˘s, and the comparable vegetation type, B, is based on 5 or more relev˘s

Vegetation Type A		Vegetation Type B	
Constancy	Cover	Constancy	Cover
V	Arbitrary	II, I, +, r or absent	As in Type A or less
IV	Arbitrary	I, +, r or absent	As in Type A or less
III	Arbitrary	I, +, r or absent	As in Type A or less _

Situation II. The vegetation type under consideration, C, is based on 2-4 relev˘s, and the comparable vegetation type, D, is based on 5 or more relev˘s

Vegetation Type C		Vegetation Type D	
Constancy	Cover	Constancy	Cover
In all records	Arbitrary	I, +, r, or absent	As in Type C or less
In 2 of 3,m or in 2 of 4 records	Arbitrary	Absent	Absent

Rules for deciding if a species is differential for a vegetation type (continued)

Situation III. The vegetation type under consideration, E, is based on 5 or more relev˘s, and the comparable vegetation type, F, is based on 2-4 relev˘s

Vegetation Type E		Vegetation Type F	
Constancy	Cover	Constancy	Cover
V	arbitrary	absent	_
IV	arbitrary	absent	_
III	arbitrary	absent	_

Situation IV. The vegetation type under consideration, G, is based on 2-4 relev˘s, and the comparable vegetation type, H, is based on 2-4 relev˘s

Vegetation Type G		Vegetation Type H	
Constancy	Cover	Constancy	Cover
In at least 2 records	arbitrary	absent	_

3. Put all the differential taxa for each group together in the table, using a procedure similar to that which you used to move the columns. Once you have a complete list of the differential taxa, create a row at the bottom of the table that has a count of the differential species for each vegetation type.
4. Reorder the columns within the subtypes based on the number of differential taxa in each group, with the plot having the most differential taxa on the far left.
5. Within each group of differential taxa, arrange the order so that the species occurring in the most plots of the group is at the top of the group and the species occurring in the fewest plots is at the bottom.
6. Arrange the companion taxa by order of their frequency.
7. Arrange the single occurrences by the order in which they appear from left to right in the table (i.e. single occurrences in the first plot on the left side of the table should be at the top of the list of single occurrences and single occurrences in the far-right hand plot are at the bottom of the table.

G. REARRANGE THE COLUMNS (PLOTS) WITHIN EACH VEGETATION TYPE.

You may notice new subgroups within the preliminary vegetation types that have differential taxa of their own. You would then repeat the process, identifying differential taxa for these subgroups and further rearrange the table.

I. POLISH THE TABLE.

1. Label the appropriate groups of columns with the community-type names.
2. Label the groups of differential species with the proper community-type names.
3. Draw boxes with solid lines around the groups of differential taxa. You might see some weaker groups of plots that that do not satisfy the rules,

IV. SUMMARY OF SORTED TABLE TO BE TURNED IN:

Each class member should turn in a finished sorted table with a short paper describing the process and resulting units.

A. The Table. The tables should contain the following elements:
- The columns (relevés) should be sorted according to the broad community types mentioned above.
- The rows (species) should be sorted, from top to bottom according to frequency, into the following categories described above.
- Draw boxes around the set of differential species for each type.
- The right-hand column of the table should contain the frequency of each species in the plots.
- The bottom row of the table should list the total number of species (richness) for each relevé.

B. The description. Write a **one page summary of the lab including** descriptions of the plant community units. Do not present detailed methods for this. Include the following.
1. A brief introduction (1-2 sentences) with a description of the goals of the classification.
2. A brief description (1-2 sentences) of the Colleen study area.
3. A brief description of the methods used in releve sampling (1-2 sentences, refer to the Colleen data report) and the methods used in table sorting (1-2 sentences, refer to this handout).
4. Use the table to describe the major vegetation units. Include a brief description of the dominant plant taxa, the differential taxa and species richness in each of the units.
5. A brief summary of what was achieved and what could be the next step in the table analysis process for this dataset.

Note: I will count off for misspellings, so check the spelling of species names carefully. Taxa names are italicized; genus name is capitalized; species name is lower case.