CFR501
October 24, 2006
Wenatchee Multivariate Data Analysis
Due: Monday Oct 29, midnight

OVERVIEW

In the Wenatchee Mountains we collected a large data set involving 17 x 6 transects (observations) and plant species (variables). We will use the most popular type of ordination analysis (Detrended Correspondence Analysis (DCA)) to describe and interpret the major trends in our transect data.

PURPOSE

In addition to becoming familiar with the use of DCA (PC-ORD software package), the goals of this assignment are to:

1) describe variations among the plant communities visited in Wenatchee Mountains,

2) identify environmental factors closely associated with those patterns, and

3) suggest mechanistic hypotheses about how those environmental factors influence species composition.

COMPUTER LAB LOGISTICS

The PC-ORD software package is installed on computers in the Blodel 261 computer teaching lab. Additional copies are available on computers in Halpern, Peterson, and CUH labs (please ask permission and convenient times to use these lab versions). Let me know if these arrangements will not work for you. Expect to spend 2-4 hours working on this lab (excluding write up).

HOW TO RUN PC-ORD

If you are using the lab computers, you need to set the working directory to C:\TEMP. Download the data files (in .wk1) format from the course web site. Then, open the main matrix: select File, Open, Main Matrix, and one of the following files:

Under_2007.wk1 (understory cover)
Over_2007.wk1 (overstory cover)
Combined_2007.wk1 (both overstory and understory cover, overstory are coded with a 2, (e.g., PIPO2, ABGR2)).

Then open the corresponding secondary matrix: select File, Open, Second Matrix, and one of the following files:

Under_Labels_2007.wk1
Over_Labels_2007.wk1
Combi_Labels_2007.wk1

The second matrix just contains a code for transects from the same sites (e.g., AS, BN, CS) so that they will have the same symbol when graphed. The ordination will work fine without the coding, but it will be harder to visualize. The codes are as follows:

Site	Code
AN	1
AS	2
BN	3
BS	4
CN	5
CS	6

ORDINATION BACKGROUND AND FAMILIARITY

Perform a DCA ordination of the combined understory and overstory data (i.e. files Combined_2007.wk1 and Combi_Labels_2007.wk1). On the top bar, select Ordination, then DCA. Specify Rescale axes (without rescaling axes you can see the raw ordination scores which will help you examine the "zero point"). The default options are reasonable for the purposes of our exercise, but you might want to try some other options (like Downweight rare species) to see how your results vary. As the DCA runs, give your results file a distinctive title. Several of tables will appear. Minimize them. Graph your results by selecting Graph, Graph Ordination. Nothing will happen until you select a button with many small plus signs (on top bar).

Become familiar with the ordination results by creating a variety of scatter plots. Graph ordinations separately for transects (plots) and species by changing the preferences under Options. For transects: select Options, Preferences, and then select "plots" under both "label points" and "plot points". For species: select species under "label points" and "plot points". Click on the small numbered boxes at the top of the screen to make graphs of all combinations of the first 3 axes: 1 vs. 2, 1 vs. 3, and 2 vs. 3. Using these graphs, ask yourself (i.e. do not include in write up) the following questions:

Transect ordinations:

- In general, where on axis 1 and 2 are south-facing sites located? What about north-facing sites?
- More specifically, where are AN transects located relative to AS transects? What about the south- and north-facing transects for sites B and C?

Species ordinations:

- Where in ordination space do you find various tree species?
- Where in ordination space do you find various shrub and herb species?

- Where do you find litter, wood, bare ground, and moss in ordination space?

Create graphs showing trends in tree species cover along site ordination axes by using overlays from the main matrix by selecting Graph, Overlay from Main Matrix. (NOTE: this works only for the transect plot described above). Ask yourself:

- Where does each tree species (overstory and understory categories) reach maximum and minimum cover along each axis?
- Where are the big triangles for each species in the ordination space?

NOTE: Feel free to "play around" with the program to explore its other options.

HOW TO ANNOTATE YOUR FIGURES

Figures, tables, appendices and references need to be electronic. One straightforward way to accomplish this is to import your figures into Microsoft Word and use Autoshapes to indicate groupings or point out features. For ovals, set the options to be "no fill" and "in front of text". Ovals are useful for grouping species into a community or grouping transects. For arrows, set the fill transparency in order not to obscure important data. Arrows are useful for indicating the precise portion of a graph your inference references. Using the McKenzie/Littell graphs requires a line or an arrow to be precise.

Prior to beginning the writing assignment, please refer to the general comments on the first discussion question, the writing tips on the web site, the lectures (especially those concerned with describing vegetation) and the memo on species naming conventions.

ASSIGNMENT

Answer the following questions. Text limit: 4 pages (excluding figures, tables, appendices and references), 12 point font, double spaced, 1" margins all around. Documents submitted with smaller margins, fonts or spacing will be converted to the assigned spacing and truncated at four pages.

1) **What alterations did you make to the data set before running ordinations, and what was the rationale for those modifications?**

2) **What are the major variations in the combined overstory and understory community composition in our data?**
   Describe the major associations of species and transects in ordination space (i.e., locations along ordination axes). Do these patterns agree with your field notes and/or group descriptions?

3) **Which environmental factors of McKenzie *et al.* are closely associated with the observed patterns of community composition?**
   Using both the McKenzie's species-response curves for various environmental variables and the DCA graphs of species cover along ordination axes, identify environmental factor(s) for which the relationship of species responses corresponds to the trends in species cover along the ordination axis. List and describe the major correspondences you see. Briefly identify problems you encounter.

4) **Are your conclusions influenced by choices in data analysis?**
   Reanalyze the data in **one** of three ways:
   a. Delete non-biological substrate categories from the data set
   b. Consider only overstory species
   c. Consider only understory species

   Briefly summarize how the new results **and** interpretation differ from 2 – 4 above.

5) **Consider the location in ordination space of the understory and overstory points for the major conifer species** (e.g. compare the location of PIPO vs. PIPO2, PSME vs. PSME2, ABGR vs. ABGR2, ABLA vs. ABLA2). Interpret the differences in distances between these pairs in terms of each species' tolerance to shade (very short answer). Clearly differentiate between tree species in the understory and the overstory in all of your answers.

6) **OPTIONAL: Has the composition of these stands been changed by fire exclusion or succession in a way that would materially change the ordination?** Base an answer to this optional question on field observations, data, the ordinations, and citations, with a minimum of loose speculation.