Forest Community Analysis

What are the questions?
The composition of a community integrates all the ecological processes operating in an area. These processes influence the dynamics of colonization, establishment, growth, and reproduction. Establishing the nature of similarity or difference among communities can help us to formulate hypotheses about what processes are especially important in the systems we are studying.

Our first goal is to establish pattern. What species are present and in what relative abundances? How diverse are the communities? How large are the individuals, and what is the distribution of sizes?

Our second goal is to look for particular patterns that might suggest mechanisms. Are differences correlated with aspects of the physical environment, such as soil type, slope, aspect, or local temperature? Does the specific composition of the community suggest climatic or disturbance differences? Does the age or size distribution suggest asynchronous replacement or a pulse of colonization?

Understand the data.
Class data are entered into Excel spreadsheets (one per study area) and saved in:

P:\data\biology\biol229\PointQuarterLab\forest summary.xls *and*
P:\data\biology\biol229\PointQuarterLab\north forest.xls *and*
P:\data\biology\biol229\PointQuarterLab\BB riparian.xls

Each spreadsheet has several worksheets, indicated by tabs at the bottom of the screen. The site worksheets ("north forest data" and "bb riparian data") contain the raw data collected with the PDA's in the field; the field data are aggregated in the same format that was used in field work.

The "IVcalculations" worksheets were constructed by copying data from "data" and pasting it so that there is just one column for each of the data types (e.g., all the tree names were appended to a single column). After all the data were transferred, the data were sorted according to species of tree (with point i.d. as a secondary sorting criterion) using "sort" from the "data" toolbar option. By selecting all the data, rows were kept in the same relationship. After sorting, all the individuals of the same species are in a block ordered by point, which facilitates counting the number of individuals and the number of different points in which the species was found.

The "IVcalculations" worksheet has additional columns. Place the cursor over a cell in each column to see what formulas or values are used. One column converts diameter data in inches to basal area in units of meters. Click on one of the "basal area" cells and you will see the formula used for the conversion. Other columns are created for entering or calculating 'No. Ind', 'Av domin,' 'Rel Density,' 'Density,' 'dominance,' 'rel domin,' 'No. points,' 'freq,' 'rel freq,' and 'I.V.' To calculate basal areas for each species, the Excel "sum" function can be used.

You will be given summary data for the your study sites, as well as data from previous studies of Bishop's Backbone, South Border Forest and South Slope forests.

Link the questions and the data.
Calculate the importance values for "BB Riparian" tree species, using instructions in Exercise 8 of your lab manual or the Excel spreadsheet.

Calculate indices of species diversity (S and D_s) and dominance (C_d) for the different communities using instructions in Exercise 28 of your lab manual.

Transfer data from the Excel files to a Minitab file for comparing sizes of trees. Construct histograms to see whether sizes are distributed normally (in a bell-shaped curve). If not, then statistical comparisons should use non-parametric tests (e.g., Mann-Whitney).

Numbers do not tell the whole story. Each species of tree has a unique suite of characteristics. For example, Hawthorn is an understory tree of open habitats (such as old fields and forest edges). Dogwood and Ironwood are understory species normally found in closed-canopy conditions. Oak and Hickory typically tolerate drought stress better than do Beech and Sugar Maple. Red Maple and Ash-leaved Maple are colonizing species, while Sugar Maple seedlings are intolerant to high heat conditions. Oaks and hickories have nuts that must be transported by vertebrates, while maples produce winged seeds that are carried by wind.

Write a report.
You have collaborated on data collection and analysis, but you must write your report independently. Be sure to acknowledge your primary collaborators and indicate who did what.

The report should include the major sections of a scientific paper (see your Biology 109 lab manual or the Biology 109 web site for guidelines). You do not need to integrate outside literature.

In your discussion, be sure to address the following questions. Based on class results, what factors do you hypothesize to be especially important in influencing the composition of the study sites? What experiments or further observations do you suggest to test your hypothesis or hypotheses? [We may follow up on your ideas with some field work after Spring Break.]