Plant Ecology – IB 154
Spring 2002
Take-Home Final Exam (300pts) – Due May 24
Print out your exam and turn it into Jeff's Box in VLSB 3060 by 5PM

Answers must be written in essay format. Each answer will be limited to a maximum of **two** typed pages (Double spaced, 12 pt font, 1" margins). We won't read past two pages. Remember, there is no right length to any of these, and a long answer isn't necessarily better than a short one.

This is an open book exam, and you are welcome to work in groups to discuss answers. BUT, EVERYONE MUST WRITE THEIR OWN ANSWER. If any two people turn in the same answer, both will receive a zero for that question. I also expect that we all respect an honor code of academics.

You MUST reference literature where appropriate – including examples from lecture/handouts, assigned readings, or references you pursued on your own in the library. For all outside literature references (e.g. ones that you didn't get from the handouts), you must write out the complete citation at the end of your essay, *in the style I have used on my handouts, or of the journal Ecology.*. (This doesn't count against your two pages). DO NOT INCLUDE OUR LECTURES IN YOUR CITATION LIST – your references must be published authors for examples that you give or ideas that different scientists have presented.

Choose five of the following seven questions (60pts each):

(1) Elevated atmospheric nitrogen (N) deposition has been associated with increased frequency of species invasions in western European ecosystems. Explain how this relates to Davis et al's (2000) model of invasibility.

This figure (from Lilleskov et al. 2001. Ectomycorrhizal fungal aboveground community change over an atmospheric nitrogen deposition gradient. Ecological Applications 11:397-410) is an ordination diagram of the **genera of ectomycorrhizal fungi** (EMF) in the soil community along a N deposition gradient in Alaska. Traditionally, plant community responses to N inputs have focused on plant-plant interactions. Explain how effects of N inputs on the mycorrhizal community may be important in understanding vegetation responses to atmospheric N deposition. (Be sure to refer to this figure's results in your answer).

(2) You have been hired to explore management strategies available to resource managers concerned about forest responses to Sudden Oak Death (SOD). Write a memo to your boss in which you: (a) Assess the appropriateness of using Markov models vs. gap models such as JABOWA to predict forest responses to SOD; (b) Compare the sort of information each model type can tell you, and the assumptions on which each model relies; (c) Recommend the development of one model type or the other, based on which type is most likely to yield practical information or predictions. (You can recommend either one, as long as you justify your choice).

(3) Fire suppression has been an official management policy in a variety of North American ecosystems. Discuss examples of how this has impacted community composition. Describe how these examples are either consistent or inconsistent with the predictions of the Intermediate Disturbance Hypothesis. Be sure to take into account various aspects of the disturbance regime (e.g. frequency <u>and</u> intensity).

(4) Efforts to relate vegetation type and climate, such as Stephenson (1990) and Whittaker (1975; both discussed in lecture April 9) are reasonably successful in predicting continental-scale vegetation types. At smaller spatial scales (e.g. within a region such as California), vegetation type and climate are less closely related. Discuss the difficulty in using climate alone to predict vegetation composition at smaller scales. Be sure to address alternative mechanisms besides climate that may govern patterns in vegetation type, and to include at least one of your assigned readings.

(5) Compare how chance and early colonists affect the pathways of succession in each of the succession models presented by Connell and Slatyer (1977). Explain which of these is closest to how Clements argued succession takes place, and why. In what ways did Clements' view differ from any of Connell and Slatyer's models? Provide examples where appropriate.

(6) A particular challenge to successful plant reproduction is the fact that environmental conditions and/or risk of seed predation can be especially harsh in certain seasons or certain regions. For example, drought conditions in certain years may substantially reduce seedling survival. Also, seed predation rates may be very high in certain areas of a forest. What are some strategies that plants employ to "escape" such harsh conditions that may vary in space and in time? Describe **two** strategies that would be useful where environmental conditions/seed predation is likely to vary in SPACE and **two** strategies that would be useful where environmental conditions/seed predation are likely to vary in TIME.

(7) You are working near Iquitos, Peru in a lowland rainforest that has large patches of white sand soil spread throughout the area. This soil has a unique chemistry, different from the soil of the neighboring clay-rich areas of the forest, and results in a different composition of trees. In particular, you notice one shrub that is common throughout many of the white sand patches. However, you also notice that some smaller patches of white sand do not have this shrub, though they do have other forest species usually found on the white sand.

a) Briefly describe three factors that you hypothesize may explain the patchy distribution of the shrub;
b) Describe an experiment to test **one** of these hypotheses. What results would you expect to show support for your hypothesis? What results would not support your hypothesis?
c) What characteristics of the populations on the various patches would be consistent with a metapopulation model for this species?