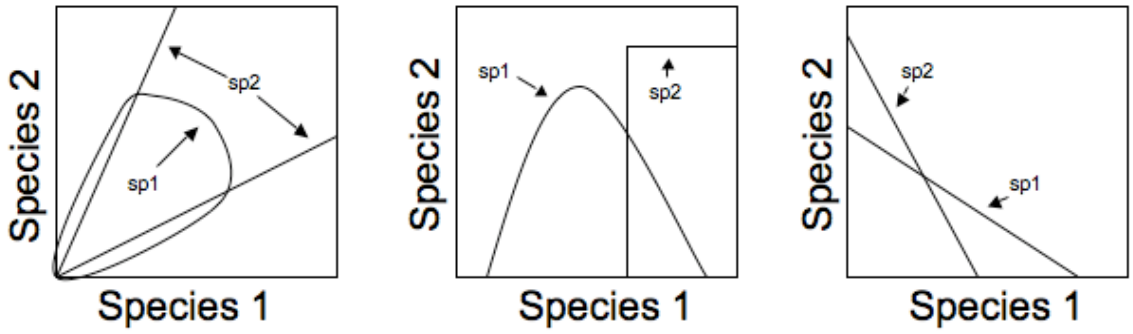
Ecology **4-9-10**
Biol 228 **Prof. Kerkhoff**
Review Materials for Exam 2

Like last time, the exam will include mostly short-response questions, though there may be some matching or even multiple choice. Most of the questions will ask you to synthesize ideas or display facility with reasoning, rather than just spitting back jargon. Any necessary equations or graphs will be provided. You may be asked to interpret graphical representations of data like those shown in the book, in class, or in the papers we've read.

Book resources: The chapter review questions in the book (for Chapters 12 – 15 and 17-18) are an excellent source of review information.

Below, I've included some further review questions (in no particular order), to highlight other important information. Several are questions from past exams. They may appear *verbatim* on the test, or just serve as a starting place, but this should give you an idea of what to expect

1. What is a ZNGI? What do they tell us? From the graphs below, identify the models that we examined describing competition, exploitation, and mutualism. In the three graphs, locate any equilibria, and tell whether they are stable or unstable. Also, for the two non-competition models, tell which species is which. Remember, the "mutualism" model describes an interaction in which one of the mutualists also exploits the other.



Match the authors to the models:

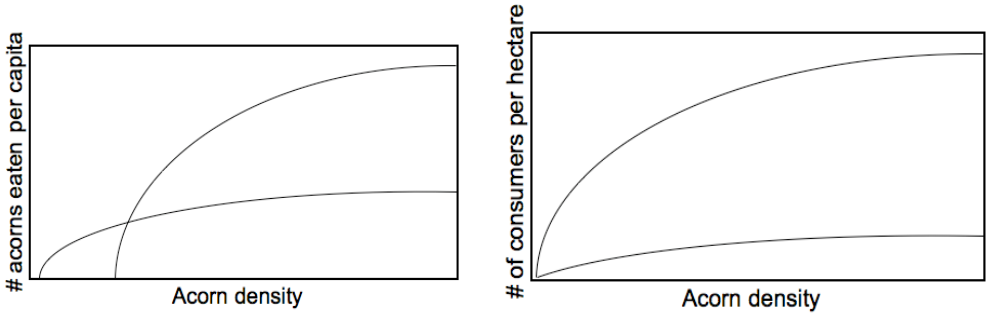
A. Lotka – Volterra B. Rosenzweig and MacArthur C. Holland and DeAngelis

2. Design an experiment to evaluate the relative roles of competition and herbivory as controlling factors in a meadow plant community. One possible hypothesis is that in the absence of predation, one plant species outcompetes all others, and that predation reduces the strongest competitors and enables less competitive species to remain in the community. Assume that the community contains 20 species of plants and the prominent herbivores include several species of insect as well as elk, marmots, and mice. Remember

to include controls and replicates in your experiment

3. From the Jones et al. study of acorns, mice, deer, ticks, Borellia, and gypsy moths, we learned that important ecological interactions may be indirect. How do indirect effects complicate the classification of pairwise interactions as competitive (-/-), exploitive (+/-), mutualistic (+/+), etc.? Considering just the interaction between mice and oaks, describe the positive and negative aspects of their interactions, both direct and indirect. How would you go about quantifying the net effect of the two species on one another? How might the net effect of mice on oaks change between boom and bust years of acorn production? Which species interact only indirectly?

4. The graphs below show the *functional* and *numerical* response curves of either white footed mice or white tail deer. Designate which graph shows which response, then label each curve with the appropriate animal species, deer or mouse. Briefly explain your choices and describe the differences between the species' responses.



5. In Tuesday Lake, researchers carefully quantified average organism size, numerical abundance, total biomass, and trophic relationships among all primary producers and various invertebrate and vertebrate consumers (see figure from class notes). Among consumers, how are body size, total abundance, and total biomass related to trophic level? How might the size of a lake foodweb be affected by the size of the lake? What differences in the foodweb would you expect to see in much larger or smaller lakes?

6. In central and southern Florida, there are 17 different species of oaks, and each species tends to be found in one of three different environments. Five species are characteristic of "scrub" habitats, four occur on "sandhill", and the other eight are found most frequently in "hammocks." The three environments differ principally in terms of soil moisture and fertility (low in scrub and sandhill, higher in hammocks) and fire frequency (which is highest in sandhill, intermediate in scrub, and low and unpredictable in hammocks). Using Hutchinson's niche hypervolume framework, how would you describe the fundamental and realized niches of the different species? Which groups of species would you expect to exhibit the greatest degree of fundamental niche overlap? How would you explain the coexistence of several oak species *within* each of the habitat types? What are the links between a species' life-history and it's niche?

7. For each of the pairs of environments below, describe the principal factors that will determine how rates of primary production will differ between the communities. In which community will the rate be faster or slower?

a. A temperate deciduous forest vs. a tropical savanna

b. A small headwater stream in the Appalachians vs. a broad river flowing through the central plains

c. An oak-dominated forest stand vs. an adjacent stand on very similar soils dominated by maples.

d. A lake surrounded by agricultural and residential development vs. a nearby lake of similar size surrounded by intact forest and a few cabins.

8. Huffaker's predator – prey experiments demonstrated the importance of environmental heterogeneity and refugia for the maintenance of stable predator prey cycles. Be able to describe the basic components of his experiments. How do his results inform our understanding of natural predator – prey cycles like those observed among snowshoe hares and lynx? Hypothesize an environment in which you would not expect the cycles to be sustainable. How do these considerations reflect on Krebs' food addition and exclosure experiments?

9. Recall the relationship between Senita cacti and Senita moths, which both pollinate flowers and consume seeds. Describe tradeoffs in the interaction in terms of the ratio of available flowers to flying moths in a particular growing season. What are the costs and benefits for each species if the ratio is high (that is, if there are many more flowers than there are moths)? Alternatively, what if there are many more moths than there are flowers? What if due to a mutation, a cactus phenotype occurred that could resist seed predation or kill the moth larva after pollination? Initially, would this "cheating" phenotype be successful? What about after a long period of time?

10. A few decades ago, in the so-called "Overkill Hypothesis," Dr. Paul Martin proposed that at the end of the last ice age, newly arrived *Homo sapiens* hunter-gatherers from Asia precipitated the extinction of the North American megafauna, including herbivores like wooly mammoths, omnivores like giant ground sloths, and top carnivores like sabre-tooth tigers and dire wolves. However, there is no evidence that humans hunted and consumed all of these species, especially the carnivores. If they did not hunt all the species, how could human hunters have driven this extinction?