

## Study Guide for Final Exam

1. The final exam is comprehensive. The two previous study guides cover material from the first part of the course. This will cover material since the last study guide was issued. You should be familiar with the material from all three study guides.
2. The final exam will be roughly 50:50 old material and new, but you should look for linkages between topics, concepts and mechanisms. How is information from the different levels of ecology (physiological, population, community, and ecosystem) relevant to each of the other levels?
3. Use the lecture outlines and overviews as guidelines as well.
4. Know the material on this study guide, but also be prepared to apply it to examples given in the book and in class, as well as to new situations.

## Biodiversity and Community Ecology

### COMMUNITY INTERACTIONS

#### Chap. 13 Competition

What are Lotka-Volterra competition equations? How do they relate to logistic growth equations? What predictions do they make for coexistence of two species? What parameters do those predictions depend on? What are the assumptions of the Lotka-Volterra models? How do these assumptions and predictions relate to other concepts that we've discussed in competition and population growth (e.g., competitive exclusion, niche partitioning, carrying capacity, etc.)?

#### Chap. 14 Exploitation

Terms: Predation, Parasitism, Parasitoids, Herbivory

Can predation regulate the population size of the prey? How is this regulation exemplified by the invasive species examples of enemy release and mesopredator release? Understand the examples in the book and from lecture with respect to these concepts. Why do theoretical predator-prey cycles arise? What factors influence the degree of fluctuations in predator-prey cycles? How do experimental results with predator-prey cycles compare to model results? In experiments and in the real world, what conditions are necessary to get persistence of both predator and prey in the long term? Under what conditions can predation lead to increased species diversity in a community?

What is the difference between predator functional response and numerical response? What are two mechanisms responsible for the leveling off of rates of predation as prey populations increase in Types II and III functional responses? Why do rates of predation initially increase slowly as prey populations increase in the Type III functional response? How do numerical and functional responses of predators relate to predator satiation? What consequences might predator satiation have for dynamics of prey reproduction?

How might predation act as an evolutionary selection force on prey? What roles do plant nutrient content and plant defenses play in herbivory dynamics? What is the difference between cryptic vs. aposematic (warning) coloration? What are the two main types of mimicry and how do they differ from one another? What is co-evolution and how does it differ from convergent evolution?

For the specific example of the lynx-hare population cycles, which of the above concepts are involved? How have ecologists tested the various mechanisms that may influence these population cycles? What controls are necessary to rule out various potentially confounding influences?

Think about ways in which exploitation interactions affect ecological dynamics at the level of physiological/behavioral ecology, population ecology, community ecology, and ecosystem ecology.

#### Chap. 15 Mutualism

Terms: symbiosis, mutualism, obligate, facultative, specialists, generalists.

What is the difference between symbiosis and mutualism? What do the terms "obligate" and "facultative" mean with respect to mutualisms? How do the mutualisms discussed in the book and Powerpoint differ in their degree of dependence? What are specialists and generalists? If one species in a mutualism is a specialist, does that mean the other must be as well? What are the different types of "currency" exchanged in mutualisms? Which ones are important for the different examples in the book and Powerpoint? What is co-evolution and how does it differ from convergent evolution? How might mutualisms affect the realized niche of the species involved? For the different examples of mutualisms in the book and Powerpoint, know what the different currencies are, the relative degrees of dependence and specificity, and how those mutualisms are important in community and/or ecosystem processes.

## PROCESSES AFFECTING DIVERSITY

### **Chap. 16 Species abundance and diversity, Chap. 17. Food Webs**

What are the different equilibrium and non-equilibrium processes that can affect patterns of community diversity? How does the influence of environmental heterogeneity on species diversity relate to the concept of the niche, the "law of tolerance" (from the first exam), competitive exclusion, fundamental vs. realized niches, and the effects of environmental conditions on competitive outcomes? How is the intermediate disturbance hypothesis similar to and different from the intermediate stress hypothesis? What are the mechanisms that operate at the high and low ends of these gradients to restrict species' coexistence? How do fertilization experiments in grasslands relate to the intermediate stress hypothesis?

What is a food web? What is a keystone species? How do you differentiate between a keystone species and a dominant species? Are top predators always keystones? What conditions would lead to a keystone species increasing diversity in a community? How might these conditions change across environmental gradients? How would you test to see if a species is a keystone species? What might be some difficulties with detecting keystone species in natural ecosystems?

### **Energy flux and secondary production, Chap. 18**

What are food webs and food chains? Know the basic trophic levels - primary producers, herbivores, carnivores (predators), detritivores/decomposers, and omnivores.

Energy budget - how much energy passes through a forest ecosystem compared to how much is stored in that system (i.e., in GPP and NPP)? What is the rough rule of thumb for the transfer of biomass or energy up the trophic pyramid? Why are big, fierce animals so scarce? Why are some aquatic trophic pyramids "inverted"? What are the relationships between consumption, assimilation, and secondary production? How do you calculate assimilation, production, and growth efficiencies? How do these efficiencies differ for different types of consumers, and how do these differences relate to those consumers' physiology (e.g., heat metabolism)?

### **Chap. 22 Geographic ecology**

In the Equilibrium Model of Island Biogeography (EMIB), how do island size and distance affect diversity individually? Why? How do they interact? Given islands of differing sizes and distances from source populations, which would have the highest and which the lowest species richness according to EMIB? Be able to sketch a graph (including appropriate axis labels!) that illustrates your prediction using appropriate immigration and extinction rates to those islands. What are some limitations/assumptions of EMIB that affect its applicability? How is EMIB used to predict species extinction rates?

*We didn't get to the following material, so it will not be covered in the final exam.*

What is the latitudinal species gradient? Does it hold for all types of organisms? What are the seven main hypotheses that might account for this pattern? Which one (or ones) do you think best explains the latitudinal species gradient? What evidence is there for or against the different hypotheses?

### **Chap. 20. Disturbance and succession**

What is the ecological definition of disturbance? In addition to the type of disturbance (fire, hurricane, etc.), what are the 3 primary variables that describe a disturbance regime? What are some examples of human-altered disturbance regimes? What is the difference between resistance and resilience in terms of a community's stability in response to disturbance? Is a high resilience community necessarily a high resistance one as well?

What is the difference between primary and secondary succession? What types of disturbance are associated with each? What are the typical characteristics of pioneer and climax species? Do these traits tend to vary independently or together? How do these relate to r- and K-selected species (chap. 12 – Merrill will cover this concept briefly on Friday, as it is pretty important)? Why are plants with N-fixing mutualisms important in early succession? Why might mycorrhizal associations be important for plants early in succession? Late in succession? (hint: how might they relate to decomposition of organic matter?) What is the difference between a monoclimate and polyclimate community? Are there general patterns of how species diversity changes through succession? Why or why not? How might this relate to the intermediate disturbance hypothesis? From back in ecosystem ecology, how do plant biomass, soil organic matter, total respiration, GPP and NPP change through succession? What implications does this have for carbon sequestration in older forests?