

BIO 211-006 – Study Guide for Exam 2

Exam 2 will be in lecture on Monday, October 20. The exam will include the following types of questions: multiple choice, short answer, problem solving, and short essay.

This study guide is provided for your use and benefit. However, it is not meant to be an exhaustive list of what will (and will not) be on the exam. The study guide will be most useful if you work through the questions and problems well in advance of the exam.

Species interactions

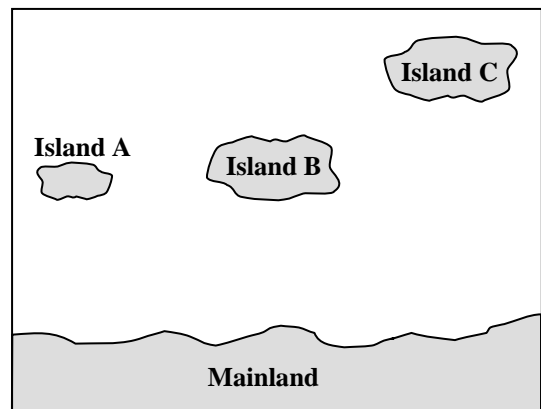
- 1) Be able to use the following words and phrases: biotic environment, abiotic environment, intraspecific competition, interspecific competition, competitive exclusion, niche, fundamental niche, realized niche, niche differentiation, niche partitioning, generalist, specialist, competitive release, predation, carnivore, herbivore, parasite, host, vector, parasitoid, pathogen, cryptic coloration, aposematic coloration, mimicry, mutualism, commensalism, symbiosis
- 2) Explain why resource limitation is essential for competition.
- 3) Describe how changes in (a) the quantity and (b) the variety of resources will affect the outcome of competition.
- 4) Compare and contrast the conditions for competitive exclusion and coexistence.
- 5) Compare and contrast the concepts of fundamental and realized niches. Discuss at least two similarities and one difference. Include how these ideas relate to the biotic and abiotic environment.
- 6) Design an experiment to determine the fundamental and realized niche of a species. Graphically represent two different possible outcomes of such an experiment, and verbally describe what each outcome would tell you about the fundamental and realized niche of the species.
- 7) Thoroughly describe at least two alternative hypotheses to explain the observation that two species partition resources when they co-occur. Describe an experiment that could differentiate between these two hypotheses.
- 8) Compare and contrast herbivores, predators, parasites, parasitoids, and pathogens.
- 9) Describe how predator and prey population dynamics can interact. Consider conditions under which populations may cycle and conditions under which population cycling is not expected.
- 10) Describe two adaptations that help prey avoid predators.
- 11) Describe how parasites can contribute to density-dependence of host populations.
- 12) Imagine a new mutation in a pathogen that helps it infect its host. Do you expect the frequency of this mutation to change within the pathogen population? Why? Describe the evolutionary effect that you expect this mutation to have on a genetically variable host population.
- 13) In what ways is a typical parasite population at an evolutionary advantage over its host? Describe at least two advantages. Explain what evolutionary advantage a typical host population has over its parasites.
- 14) Provide several examples of mutualism. For each example, explain the benefit for each participant in the interaction.
- 15) Design an experiment to determine whether an association between two species is mutualistic, commensalistic, or parasitic. Sketch the results that you would expect if the relationship is mutualistic and another set of results that you would expect if the relationship is parasitic.
- 16) Design an experiment to determine the how biotic and abiotic components affect the distribution of plants within a New England salt marsh community.

Community ecology

- 1) Be able to use the following words and phrases: community, equilibrium, nonequilibrium, intermediate disturbance hypothesis, species diversity, species richness, keystone species, indirect effects, succession, primary succession, secondary succession, pioneer community, climax community, shifting mosaic, biogeography, island biogeography, species richness
- 2) Thoroughly explain how environmental complexity can promote the coexistence of competitors. Consider both the biotic and the abiotic environment in your explanation. Also, consider different types of environmental complexity. Does this invalidate the competitive exclusion principle? Why or why not?
- 3) Be able to predict the effects on community structure if the top predator prefers to eat species that are competitively superior. Does the outcome change if the predator prefers the competitively inferior species?
- 4) Jane Lubchenko studied the effects of a snail, *Littorina*, on an algal community. She found that when the snails were common, a red alga, *Chondrus*, was the most abundant species in the community. When snails were removed, the green alga, *Enteromorpha*, became most abundant within the community. What species of algae

does *Littorina* prefer to eat? Which species of algae is competitively superior? Lubchenko also found that algal species richness was highest when *Littorina* was at an intermediate density. Explain this result.

- 5) In lecture, we discussed research on the effects of rock size on species diversity in a rocky intertidal community. Compare and contrast the results of this study and Lubchenko's findings on the effect of *Littorina* on algal species richness. Consider the mechanisms that can promote or inhibit species diversity in each case.
- 6) According to the intermediate disturbance hypothesis, both low and high levels of disturbance can reduce species diversity. Explain possible mechanisms producing this relationship. Include trade-offs between competitive and dispersal abilities in your discussion.
- 7) Compare and contrast primary and secondary succession.
- 8) Explain the role of competition in succession. Predict how succession will affect biodiversity (Consider the intermediate disturbance hypothesis).
- 9) Imagine that a new volcanic island has been formed. Predict how biodiversity on the island would change over time. Explain your prediction.
- 10) Explain how human efforts to decrease the effects of naturally-occurring disturbances, like hurricanes, floods and fire, can affect biodiversity. Support your answer with an example.
- 11) Explain how island biogeography theory can be applied to conservation biology.
- 12) Suppose you are planning to study the bird communities on the islands shown in this figure. Islands A and B lie equal distances from the mainland but differ in area, while islands B and C are identical in area but lie at different distances from the mainland. According to the equilibrium model of island biogeography, which of the islands should experience higher rates of immigration? Explain your prediction. What does the equilibrium model of island biogeography predict concerning relative rates of extinction on these three islands? Explain your prediction.
- 13) Describe how a New England salt marsh would be affected by a reduction in the occurrence of disturbance.
- 14) Discuss the role of facilitation in succession, using the New England salt marsh as an example. How does this process influence species diversity?
- 15) Use the shifting mosaic model to explain how disturbance, succession, and habitat heterogeneity influence biodiversity? Use a sketch to support your answer.



Ecosystems and Human Impacts

- 1) Be able to use the following words and phrases: ecosystem, biosphere, food chain, food web, trophic level, biomass, primary producer, consumer, decomposers, detritivores, biogeochemical cycle, net primary productivity, climate, Hadley cell, microclimate, biome, ecological footprint, anthropogenic
- 2) Explain how energy flow limits the number of trophic levels in an ecosystem.
- 3) Why are carnivores typically less specialized in diet than herbivores?
- 4) Why is the biomass of producers within an ecosystem greater than the biomass of consumers within the same ecosystem?
- 5) Tropical rainforests are known for tremendous biodiversity, yet they have very nutrient poor soils. Apply concepts of nutrient cycling to address this apparent paradox.
- 6) Compare and contrast how energy and nutrients are moved through ecosystems. Discuss at least one similarity and one difference.
- 7) Explain how the shape and tilt of the earth result in different seasons, climates, and biomes. Be sure to include information about both temperature and precipitation.
- 8) Describe two ways in which humans are altering the global carbon cycle. Include a sketch of the carbon cycle. How are anthropogenic effects on the carbon cycle affecting global climate?
- 9) How are humans influencing the earth's productivity? Be specific! What might be the consequences of anthropogenic changes in terrestrial and marine productivity?
- 10) Describe the relationship between per capita resource and carrying capacity of the human population.