

ECOLOGY 301 - EXAM 1, Monday 29 Sept, 1997

I. Short Answer Questions (4-9 points each) DO ALL QUESTIONS

- SAQ #1. Please state and briefly explain the three major objectives of this course (listed on page two of the syllabus).
 state and explain objective 1 -
 state and explain objective 2 -
 state and explain objective 3 -
- SAQ #2. Please briefly define an “environmental signpost.”
- SAQ #3. Please list the four “levels” of ecological organization.
- SAQ #4. Radon gas is a natural radioactive by-product of the slow radioactive decay of uranium. Houses in many areas in southeastern PA were built on shallow soils overlying ancient uranium-containing bedrock layers. Thus, as this uranium decays, radon gas is released into the soil and then leaks into and accumulates in poorly ventilated basements.
- SAQ #5. Why exactly do rain clouds form as heated tropical air rises above the rainforest during a summer afternoon?
- SAQ #6. If the Earth rotated east to west (instead of west to east) but all else were equal, what would be the climatic conditions and the general description of the ecosystem in New England on the **eastern and western** slopes of the Appalachian Mountains? (note: the Appalachian Mountains run north and south)
 climatic conditions - (3 pts)
 general description of the ecosystem - (3 pts)
- SAQ #7. According to Stiling, the tropical ecologists Peters, Gentry, and Mendelsohn showed that the “value” of an intact tropical forest in Peru was worth more standing than cut down and sold. What was the basis of this claim?
- SAQ# 8. Please state what are the two principal objectives of individual ecology.
 state objective 1 - state objective 2 -
- SAQ #9. What is an organism’s “biophysical environment?” Please define.
- SAQ #10. Please list how an organism’s “biophysical environment” might constrain or limit its gross productivity (i.e. the total amount of energy it amasses in its energy budget in a given time)?
- SAQ #11. On page 20, Stiling uses an example drawn from his own work on parasitism rates for two species of insects. Using large samples of data he found “statistically different” rates of parasitism for averages of 8.33% and 8.24%, but then he asked “But is it biologically meaningful?” What does Stiling mean by this?

I. Longer Answer Questions (12 points each) CHOOSE ANY 3

LAQ #1. This question will assess your understanding of “multiple causality.”

- (a). Please explain the concept of “multiple causality” in very general terms without using any specific examples.
- (b). In the example in class of the car not starting, numerous hypotheses were raised to explain the phenomenon. Why exactly isn’t this an example of “multiple causality?”
- (c). Please explain why it is so difficult to apply the standard hypothetico-deductive process discussed in class to research questions in evolutionary ecology because of the problem of “multiple causality.”

LAQ #2. Please list and explain the two basic "functional characteristics", i.e. energy flow and biogeochemical cycling, of an ecosystem. Please use a diagram in each of your explanations and be sure to indicate what are the basic differences between the paths of energy and biogeochemicals in an ecosystem. (Please OMIT OMNIVORES for simplicity)

- functional characteristic 1: energy flow -
- functional characteristic 2: biogeochemical cycling -

LAQ #3. This question will assess your understanding of the strengths and weaknesses of using “compartment diagrams” (i.e. flow diagrams of little boxes and little arrows to map the network of connections) to study ecosystems.

- (a). What are some of the interesting and critically important ecological and evolutionary questions that can be addressed using compartment diagrams? {Hint: this question presumes that simply making a systems model is not enough and instead asks what questions can you answer using your new model?}
- (b). Please list and briefly explain three of the major challenges, problems, flaws, limitations, etc., of using compartment diagrams to study ecosystem level ecology? challenge 1 - challenge 2 - challenge 3 -

LAQ #4. Please briefly explain four totally different ways in which maintaining high levels of biodiversity in nature might be important to ecosystem function and/or be directly beneficial our economy?

LAQ #5. Data from a recent census of tree species from a woodlot include 55 individuals of species 1, 25 of species 2, and 10 each of species 3 and 4 (note that the total number of individuals is 100).

- (a). What is the total number of species present? _____ (2 pts)
- (b). According to the equation for the Shannon Diversity Index, H',

$$H' = - \sum_i^S p_i \ln(p_i) \quad \text{(for which } p_i \text{ is the proportion of data from the } i\text{th species, and } S \text{ is the total number of species)}$$

...what is the diversity of species present? Please set up the problem, i.e. write out the equation for diversity, but you need not solve it numerically.

- (c). Please briefly explain what are the advantages of using a diversity index, such as H', to estimate biodiversity rather than simply using the number of species censused?

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