

There should be 8 pages to this exam - take a moment and count them now. Put your name on the first page of the exam, and on each of the last 3 pages (those with short answer questions). Please fill in your name on the front page of the bubble sheet  
The following equations and constants may be helpful:

$$N_t = N_0 e^{rt}$$

$$dN/dt = rN(1-N/K)$$

$$dN_1/dt = r_1N_1(1-N_1/K_1 - a_{12}N_2/K_1)$$

$$dN_2/dt = r_2N_2(1-N_2/K_2 - a_{21}N_1/K_2)$$

$$dN_h/dt = r_hN_h - pN_hN_p$$

$$dN_p/dt = cpN_hN_p - d_pN_p$$

$$PV = nRT$$

$$N_t = \lambda^t N_0$$

$$N = nM/x$$

$$e = 2.72$$

$$\pi = 3.14$$

$$\ln(2) = 0.69$$

$$\ln(1) = 0$$

$$D = 1/\sum p_i^2$$

$$H = -\sum p_i \ln(p_i)$$

$$\log S = \log c + z \log A$$

Multiple Choice: \_\_\_\_/19 = \_\_\_\_\_/38

Question 20 \_\_\_\_\_/ 3

Question 21 \_\_\_\_\_/ 6

Quest. 22, Prepared essay: \_\_\_\_\_/ 16

\_\_\_\_\_

Total \_\_\_\_\_/63

**Loose Parts** by Dave Blazek



Bart Bumble: Party Bee

**Loose Parts** by Dave Blazek

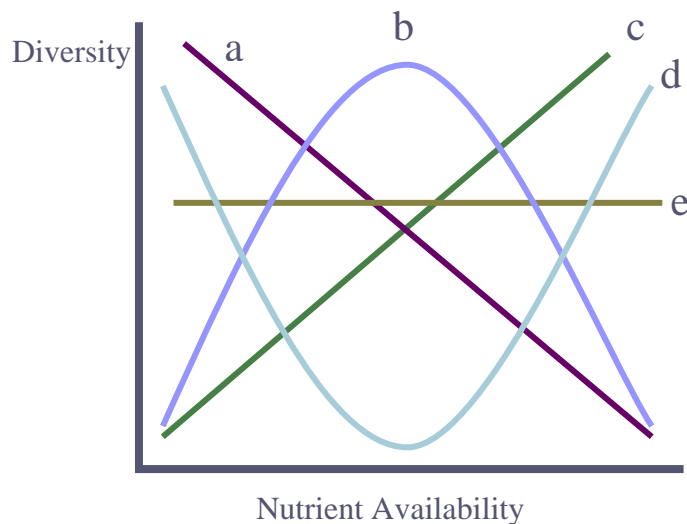


"We make bobs and jigs. Why?"

**Multiple Choice questions: 2 points each.** Please put your answers for this section on the bubble sheet. Feel free to use the question sheet for scratch work. Each question has only one correct answer. You will not be penalized for guessing on this section. Fill in your bubble sheet carefully. Make sure that the number of the question matches the number whose bubble you're filling in!

- 1) Which of the following factors helps to stabilize models of mutualism?
- Unlimited resources
  - Changing the  $a_{ij}$
  - Increased growth of both species
  - Facultative or diffuse relationships
  - Refuges

- 2) Which of the traces on the following graph best represent the way that community diversity is related to nutrient availability?



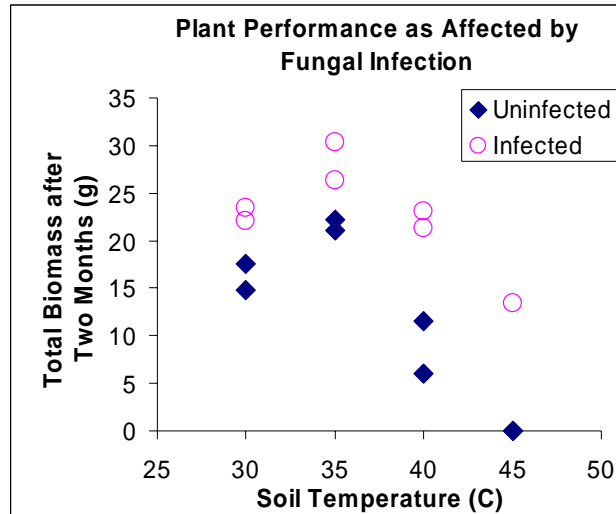
- 3) Which of the following is the most correct to this question: How does the carbon dioxide content of the Earth's atmosphere now compare to that billions of years ago?
- It is unchanged – the biosphere has natural homeostatic mechanisms that maintain a very stable atmospheric composition of gases
  - It is much higher, because of human activities that liberate carbon dioxide
  - It is much lower – photosynthetic organisms long ago removed the great majority of atmospheric carbon dioxide
  - It is much higher, the earth's crust has gradually released more and more carbon dioxide through natural processes.
  - It is much lower, because solar radiation breaks the carbon dioxide down into hydrogen and oxygen.
- 4) According to the intermediate disturbance hypothesis:
- Species diversity is highest in the absence of disturbance
  - Species diversity is lowest at intermediate intensities or frequencies of disturbance
  - Species diversity is highest at intermediate intensities or frequencies of disturbance

- d) Species diversity is highest when disturbance is both frequent and intense
- 5) Paine found that removal of the starfish *Pisaster* from areas of the rocky intertidal zone of the Washington coast resulted in:
- More mutualism
  - Biomagnification
  - Greater species diversity
  - No change in species diversity
  - Lower species diversity
- 6) Your book states that the element that most frequently limits primary production in fresh water lakes and ponds is:
- Calcium
  - Nitrogen
  - Sulfur
  - Carbon
  - Phosphorus
- 7) You have been employed to help assess the species diversity of the Insect Communities of the Bath Nature Preserve. Among the data you are to interpret are the following results from equal sized samples of several communities. Based on the best estimator of overall diversity, which of these communities is most diverse?

	Number of Species	Shannon-Weaver Index ( $H'$ )
A. Wetland Scrub-Shrub	43	3.4
B. Disturbed Grassland	10	1.2
C. Mature Woods	85	4.2
D. Disturbed Woods	13	2.2
E. Mature Grassland	98	3.9

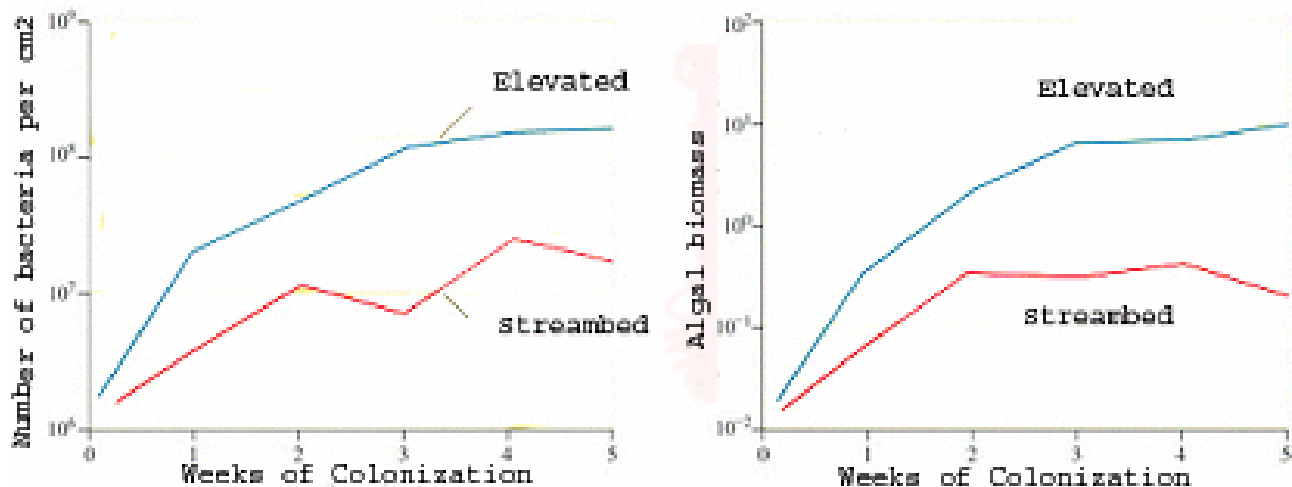
- 8) Which of the following statements is True?
- Usually, all species in a food web exert a similar degree of influence on community structure.
  - Removal of a single species from a food web seldom affects community structure.
  - The species with the greatest influence on community structure is the one with the greatest energy flow or the greatest biomass.
  - Removal of a single species of top predator can cause a collapse of the community.
  - All of the statements above are false
- 9) The first (lowest) trophic level in a biomass pyramid is made up of
- Carnivores
  - Omnivores
  - Decomposers
  - Producers

Scientists studying plants growing in the geothermally heated soils of Yellowstone National Park discovered that a fungus has infected roots of most individuals of Hot Springs Panicgrass. To determine the impact of this infection, Regina Redman and her colleagues grew some plants with the fungus and some plants without the fungus, at different soil temperatures. They also grew the fungus at a range of temperatures – the fungus did fine at 30-35C, but died out at 40C and above. They reported their results in the November 22, 2002 issue of the Journal “Science” (volume 298, page 1581).



- 10) Based on those results, what sort of relationship is most likely to occur between the plant and fungus?
- Competition
  - Parasitism
  - Predation
  - Mutualism
  - Both b and d
- 11) In the meadows of Northeastern Ohio, spiders, preying mantids, birds, raptors, and coyotes are important predators, deer, mice, grasshoppers, crickets, spittlebugs, and other insects are important herbivores, and a variety of grasses and other plants are the important autotrophs. Based on what we've learned in class about trophic dynamics, which of these groups should generally have the greatest biomass in a given area?
- Predators
  - Herbivores
  - Plants
  - They should all be about equal
- 12) Fill in the blanks of this sentence from the options below:  
 Most species are \_\_\_\_\_; few are \_\_\_\_\_ or \_\_\_\_\_.
- moderately abundant; very abundant; extremely rare
  - carnivores; detritivores; producers
  - diverse; even; species rich
  - mutualists; predators; competitors
  - keystone species; unimportant; invasive
- 13) The main source of carbon dioxide in the atmosphere is:
- Burning of fossil fuels
  - Photosynthesis
  - Respiration
  - Dissolution of carbonate
  - None of the above

- 14) Which of the following best fits the definition of an ecological community used in the book and in lecture?
- A group of monkeys in the tropical rainforest that work together to defend one another
  - Yuccas and Yucca Moths
  - All the species living in a temporary pond
  - All of the species living on Earth
- 15) Your book presents results of a study of *Helicopsyche* caddisflies, in which the following results were presented:

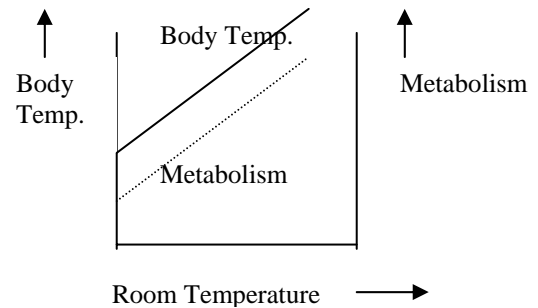


You should be familiar with this example. Remember that the tiles on the streambed were available to the caddisflies, while they could not reach those in the “elevated” treatment. The results in this figure (Figure 14.9) most clearly indicate that:

- Helicopsyche* shows a classic predator-prey cycle
  - Helicopsyche* is limited by competitors
  - Helicopsyche* requires the presence of mutualistic bacteria
  - Helicopsyche* reduces the abundance of its prey
  - Helicopsyche* uses refuges to avoid its predators
- 16) When a fat-soluble toxin such as PCB is added to an ecosystem, the pollutant is usually
- Most abundant in the insects
  - Spread equally among the trophic levels
  - Found equally in the aquatic and terrestrial parts of the community
  - Concentrated primarily in the producers, rather than in the consumers
  - Concentrated in the organisms at the highest trophic levels

- 17) The phenomenon of character displacement is most likely the result of which of the following?
- Mutualism
  - Dispersal
  - Competition
  - Exploitation
- 18) In class, we discussed the mutualistic relationship between yucca plants and yucca moths. This relationship would BEST be described as:
- Facultative and diffuse
  - Obligatory and diffuse
  - Facultative and tight
  - Obligatory and tight

- 19) During your physiology class a friend brings in an odd animal that you have never seen before. As part of a class project, you place the animal in a small chamber and measure its body temperature and metabolic rate as you vary the room's temperature. Your results are shown to the right. Which of the following statements is most correct, based on these results?



- This is a homeotherm
- This is a cold-blooded animal
- This animal is well suited for the boreal biomes
- Metabolism increases with room temperature
- There is a distinct thermal neutral zone

20) (3 points). Answer EITHER ONE (but not both) of the following:

Explain your answer to one of the multiple choice questions: (Your task is to demonstrate your mastery of the material. This is a good opportunity to discuss questions for which you had two answers that were hard choose among).

Question \_\_\_\_\_. Your Answer \_\_\_\_\_.

Explanation:

Briefly contrast the concepts of top-down and bottom-up control of ecological communities.

21) Your book suggests that diversity is related to the complexity (heterogeneity) of the environment in a predictable way.

a) (3 points) Please construct a properly labeled graph demonstrating that relationship.

b) **(3 points)** In a sentence or two, explain the reasons for this relationship

22) **16 points.** YOUR REVIEW SHEET HAD 3 QUESTIONS YOU WERE TO PREPARE FOR. OF THOSE, THIS IS THE ONE YOU MUST ANSWER. REMEMBER: your answer should be well reasoned and well written -- outline format is not acceptable (though you may outline the answer for your own benefit on the back of another page)

Ecologists are currently re-evaluating their views of the importance and commonness of mutualistic interactions in natural populations. Recent estimates indicate that mutualism is one of the most common of species interactions. If this new estimate is correct, what would the implications of this be for our understanding of how loss of biodiversity (extinction, habitat destruction) would affect natural communities? Explain your answer.