

**I. Short Answer Questions**

SAQ #1. Consider the simplest possible model of two species **mutualism** below:

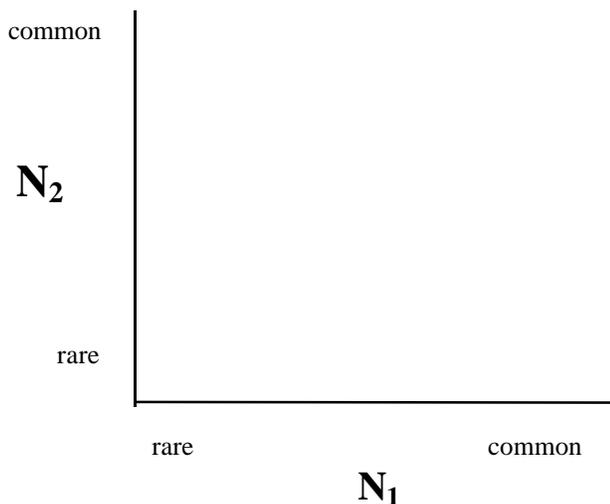
for species 1:

$$\frac{1}{N_1} * \frac{\Delta N_1}{\Delta t} = -r_1 + a * N_2$$

for species 2

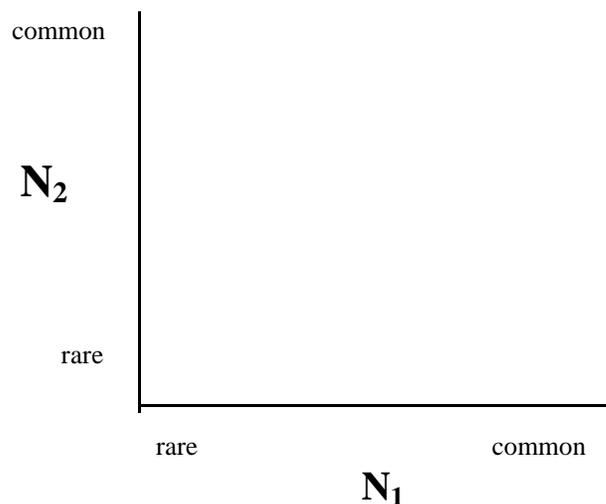
$$\frac{1}{N_2} * \frac{\Delta N_2}{\Delta t} = -r_2 + b * N_1$$

a. In the graph below, plot the change in the population size of **species N1** using four little arrows corresponding to when N1 and N2 are common and rare.



(2 pts.)

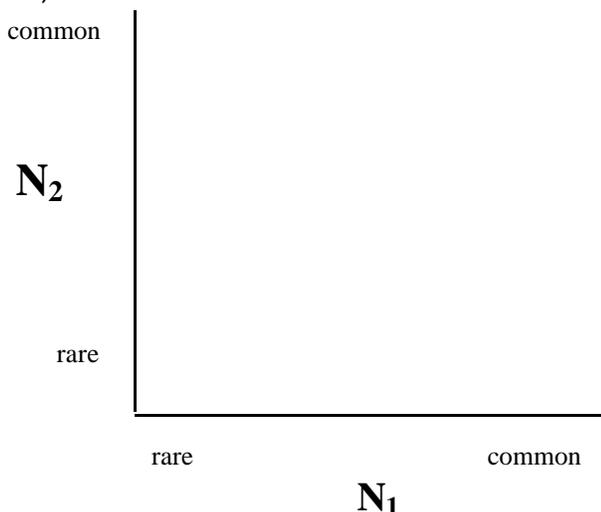
b. In the graph below, plot the change in the population size of **species N2** using four little arrows corresponding to when N1 and N2 are common and rare.



(2 pts.)

SAQ #2. a. In the graph at right, combine the arrows from the two plots above..

(2 pts)



b. Does this model ever lead to stable mutualistic coexistence?

**Yes or No ???** (2 pts.)

c. Briefly explain why or why not.

(2 pts)

SAQ #3. Please briefly explain what is a coevolutionary mutualism. Specifically address why it is coevolution.

(5 pts)

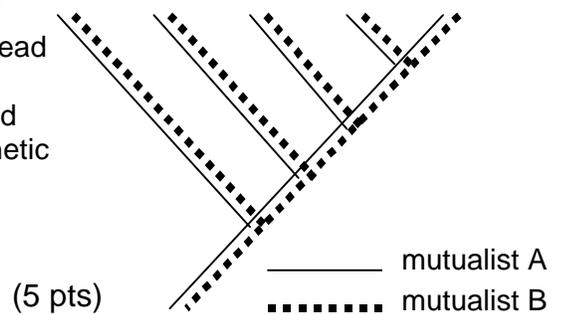
SAQ #4. Please explain how the story of the acacia tree and the acacia ants might be an example of coevolution due to mutualism.

(5 pts)



SAQ #5. This question will assess your understanding of the role of coevolutionary mutualisms in the origin of biological diversity. Hopefully, you found on the previous page that it is not possible for two mutualist species to regulate each others' population sizes alone.

What does this finding imply about the mechanisms of regulation for these species, and why does this implication lead to the argument that tight obligatory mutualisms, for which essential needs of each species are met by the other, should directly lead to rapid speciation of both lineages in phylogenetic parallel (their phylogenetic trees perfectly overlap)?



SAQ #6. Of what economic value is biodiversity to humans? Please list and briefly explain four totally different ways in which biodiversity is of economic value. {Hint: this question is NOT about aesthetics, it's about economics. }

(8 pts)

- 1 –
- 2 –
- 3 –
- 4 –

SAQ #7. This question will assess your understanding of the "intermediate disturbance hypothesis" for the maintenance of local species diversity.

On the axes at right plot the relationship between disturbance and diversity according to the "intermediate disturbance hypothesis." Please LABEL THE AXES!

(4 pts)



- SAQ #8. According to the "intermediate disturbance hypothesis," why is diversity low at very low levels of disturbance?  
(6 pts)
- SAQ #9. According to the "intermediate disturbance hypothesis," why is diversity low at very high levels of disturbance?  
(6 pts)
- SAQ #10. According to the "intermediate disturbance hypothesis," why is diversity high at intermediate levels of disturbance?  
(6 pts)
- 

**I. Longer Answer Questions (15 points each).**

LAQ#1. Please BRIEFLY explain the two major objectives of **ecosystems ecology**. Please use a diagram for each, AND write an explanation.

diagram and explain objective 1, and explain the key “emergent properties” that this objective aims to explain –  
(7.5 pts)

diagram and explain objective 2, and explain the key “emergent properties” that this objective aims to explain –  
(7.5 pts)

LAQ #2. (a). Please use a diagram and briefly explain what is the greenhouse effect?  
(6 pts)

(b). What are four of the principal greenhouse gasses and what are their main sources?

- | Greenhouse gas: | its main source: |        |
|-----------------|------------------|--------|
| 1 –             |                  | (1 pt) |
| 2 –             |                  | (1 pt) |
| 3 –             |                  | (1 pt) |
| 4 –             |                  | (1 pt) |

(c.) Current models predict that +2-5°C warming is likely by 2100 if nothing is done and atmospheric CO<sub>2</sub> concentration is allowed to double. Please list at least three of the principal predictions for what is likely if global warming on this magnitude were to occur.

- |     |         |
|-----|---------|
| 1 - | (2 pts) |
| 2 - | (2 pts) |
| 3 - | (1 pts) |

LAQ 3#. This question will assess your understanding of the role and effects of disturbance on forested ecosystems such as Yellowstone National Park.

- (a). Please briefly explain two totally different ways in which fire is “beneficial” to the Yellowstone ecosystems. (Hint: what are the relationships between the fire and forest ecology?)
  - 1 - (10 pts)
  - 2 -
  
- (b). How might clearcutting and replanting local patches of forest (such as on a 35 year cycle for pulp production for paper) negatively affect biodiversity and ecosystem function? In what specific ways do forests “benefit” from fire but are “devastated” by clearcutting? (5 pts)

LAQ #4. According to archeologist Gary Rollefson, the dramatic abandonment of the Neolithic settlements such as the ‘Ain Ghazal at 6000 b.c. was due to anthropogenic degradation of the fragile Jordan Valley ecosystem.

Imagine yourself as one of the members of this community at about 6100 b.c., just prior to its abandonment. What were the major environmental signposts that the ‘Ain Ghazal culture and way of life were nearing a collapse?



(7.5 pts)

Please list 5 major global environmental signposts that our “modern” culture and way of life are not sustainable. (note: precision is not expected for any numbers you give)

(7.5 pts)

Please Read This Comment: You are welcome to download some or all of the material I have posted at this site for your use in your ecology course. This does not include commercial uses for profit. If you do use any lengthy excerpts (more than 2 lines) of the material above, I request that you formally acknowledge this site and/or sites I have acknowledged as the source(s). I also request that you reciprocate and send me a copy of your ecology materials so that I may see what you have put together. Please send comments to me: grant@pop1.science.widener.edu. Copyright - Bruce W. Grant, 2001.