

Note the exam is worth 85 points. Your points will be rescaled to 100 points. CIRCLE QUESTION NUMBERS FOR ME TO EVALUATE!

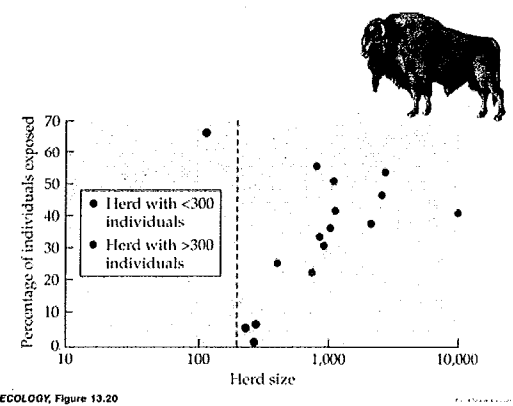
$N_t = N_0 \lambda^t$	$dH/dt = rH - aHP$	$dN_1/dt = r_1 N_1 (K_1 - N_1 - \alpha_{12} N_2) / K_1$
$N_t = N_0 e^{rt}$	$dP/dt = acRP - dP$	$dN_2/dt = r_2 N_2 (K_2 - N_2 - \alpha_{21} N_1) / K_2$
$H' = - \sum [p_i * \ln(p_i)]$	$dN/dt = rN(1-N/K)$	$dU/dt = \Lambda_0 v * \epsilon + \epsilon^c * \theta_\lambda \theta * \gamma^y$

Provide **precise descriptions** of the four, easily observed characteristics of natural selection. (2 pts first missed, 5 pts total)

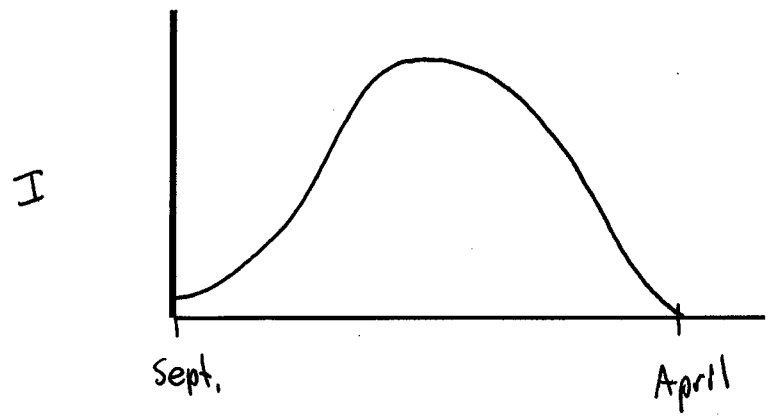
- a. 5/50 syllables
- b. _____
- c. _____
- d. _____

Answer **EIGHT** of the following **TEN** short-answer questions. **Circle** the questions you want graded. (5 pts each, 40 pts total)

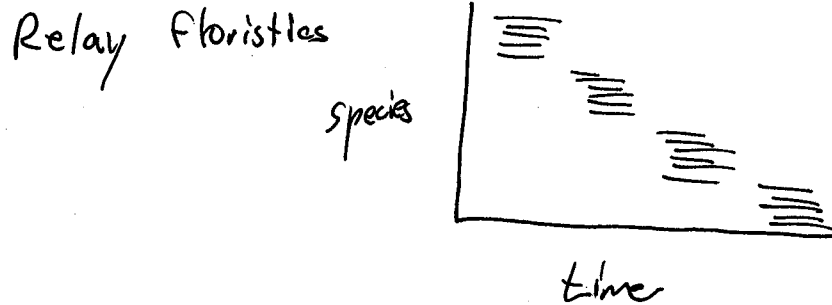
1. The graph to the right depicts the exposure of bison to brucellosis (Fig 13.20 from your text). Which of the following is consistent with these data?
 - a. Bison exhibit a "Type II" survivorship curve.
 - b. The bacterium follows a "Type III" survivorship curve.
 - c. $S_T = 300$.
 - d. $\beta_{max} = 67$.
 - e. All of the above are true.



2. Since I got a flu shot recently that hurt my arm will you please draw an "epidemic curve" for influenza? This should be for people in the USA over one year. Label your axes correctly (especially dates). The curve should be relatively accurate (numbers maybe not, timing yes, axis labels absolutely).



3. What's the Shannon diversity index (H') for a community that has 5 species with the following number of individuals in each of the five species: 15, 40, 25, 75, 10?
- 1.2
 - 1.0
 - 1.28
 - 1.38**
 - 5
 - none of the above.
4. Frank Egler offered \$10,000 to anyone who could show convincing evidence of what pattern? Provide a diagram of what that evidence would look like.

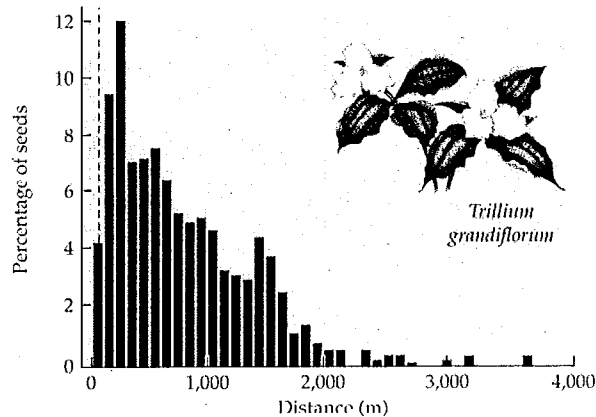


5. Compare and contrast (similarities and differences) of "mutualism" and "coevolution" and provide an example of mutualism.

mutualisms evolved btwn species over time, leading to positive interactions
 coevolution is more general but requires close interactions, resulting in dependent evolutionary changes in both species over time

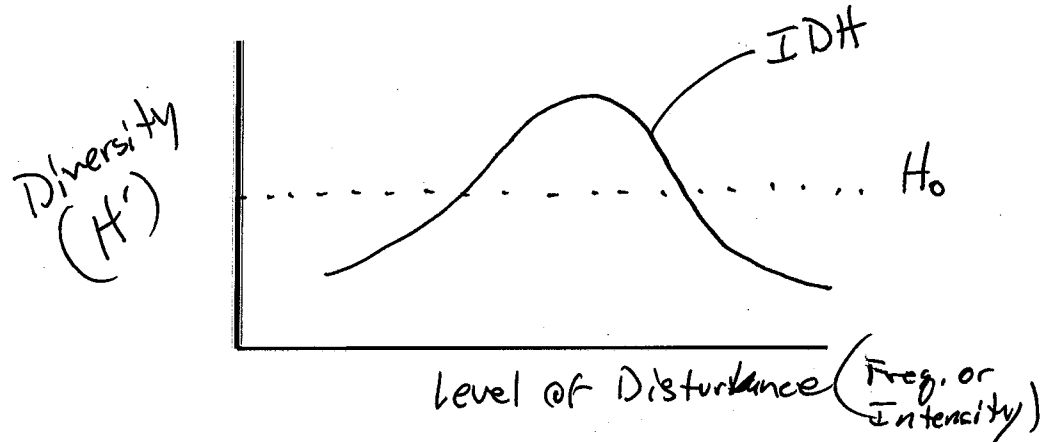
6. When I asked in lecture what the graph to the right (figure 14.7) you were too shy to say. So now it's your chance. What do these data show and why are they important for this Trillium?

It shows that most seeds are dispersed close to parent plant and rarely to long distances. However, some seeds do make it a long ways away. The dashed vertical line is the furthest moved by ants.



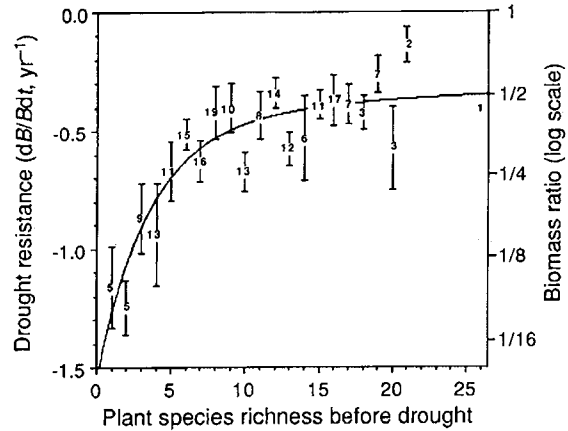
ECOLOGY, Figure 14.7

7. Graph the intermediate disturbance hypothesis and a reasonable null hypothesis. Label everything.

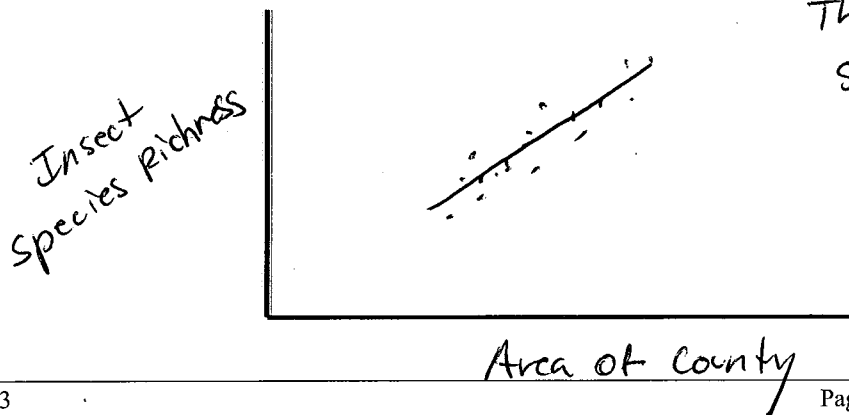


8. What's the significance of the graph with regards to the function of diversity? Note this is the graph from the original paper, published by Tilman and Downing in 1994, and discussed in your text (figure 18.21).

These data show that increasing levels of species richness increases stability in these grassland communities



9. The state of Illinois has many counties which range from small to large. The state lies within the same biome (tall-grass prairie). Graph the relationship between the number of insects found in each of the counties and the size of the counties. Label axes. In one sentence, provide the principle of ecology that leads you to this conclusion.



This is the species-area relationship

10. Which of the following is not a factor affecting (influencing) biodiversity?
- Evolution
 - Climate
 - Plate tectonics
 - Disturbance
 - (e)** None of the above (they all strongly influence biodiversity).

Answer **ONE** of the following **TWO** questions. **Circle** the question you want graded. (10 pts total)

1. We talked a lot about “why the world is green” and not eaten up by herbivores. (10 pts)
- First, there are communities where there are growing things and herbivores, on average, eat most everything. Under what conditions does that happen? (2 pts)

aquatic algal systems

- What type of community is not eaten much by herbivores (the “green world”)? (2 pts)

terrestrial systems

Identify two reasons why herbivores eat little in this type of community. (3 pts each).

- poor/low nutrients in plants.

- Plants are well defended — constituent — induced.

2. As seen in the figure *G. fuliginosa* and *G. fortis* have different beak depth distributions in the top graph (large islands) and similar distributions when compared from the two small islands (lower two graphs). Explain in detail

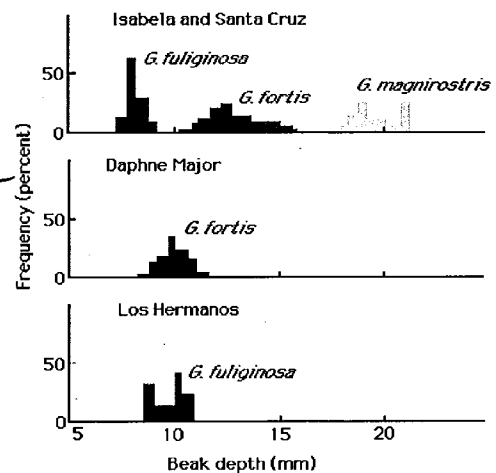
- the best hypothesis to explain this pattern. (4 pts)

Competition in the past led to divergence due to character displacement

- two alternative hypotheses by which this pattern might have been produced. Provide a graph to depict each hypothesis. (3 pts each)

- H_0 - colonizers simply had these beak distributions

- Colonizers had even more divergent characters but have been evolving toward each other in trait space



Answer **TWO** of the following **THREE** longer questions (pgs 5-7). **Circle** the questions you want graded. (15 pts each, 30 pts total)

1a. The graph on the left depicts what ecological model predator-prey dynamics (3 pts).

Each line ("a" and "b") is a zero isoclines (or null cline) for one of the two species represented in the graph. For example, line "a" means something for just one of the species. In terms of each respective species:

1b. Write an equation that represents line "a". $dN/dt = 0$ (2 pts).

1c. Write an equation that represents line "b". $dP/dt = 0$ (2 pts)

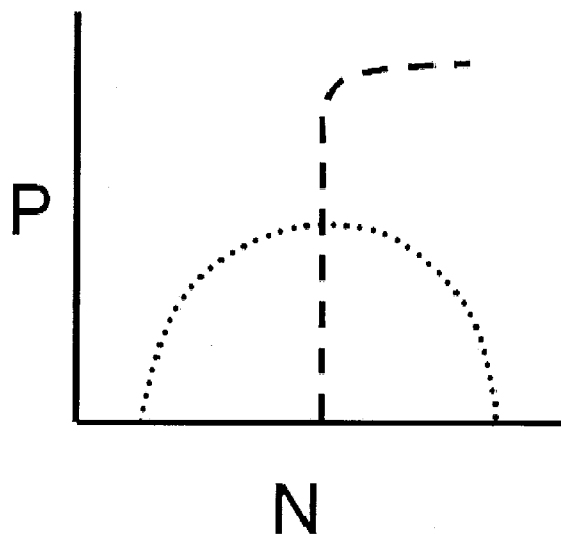
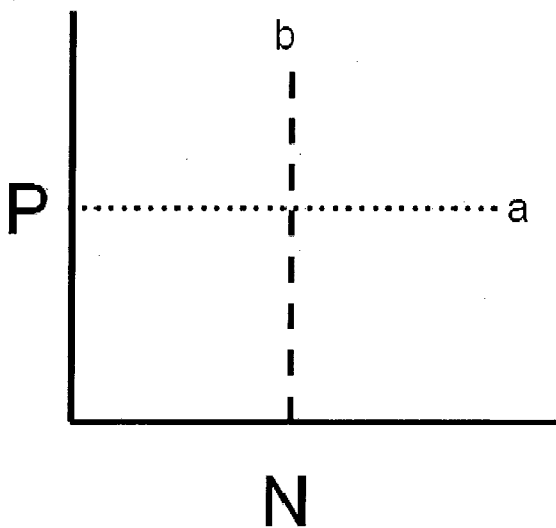
1d. What two principles of ecology were added to line "a" in graph on the right. (3 pts each)

i. Allee effect to herbivores (prey)

ii. Density dependent regulation to predators + prey

1e. What principle of ecology was added to line "b" in graph on the right. (2 pts)

density dependent regulation to predators



2. Refer to the compartment model below (15 pts total).

Briefly identify what each parameter means. (2 pts each)

$\beta =$ Transmission rate of disease

$d =$ background death rate

$\alpha =$ disease-induced death rate

$\nu =$ recovery rate

$\gamma =$ rate at which recovered individuals become susceptible

To minimize the negative effect of a pathogen on a population what should S_T be? (2 pts)

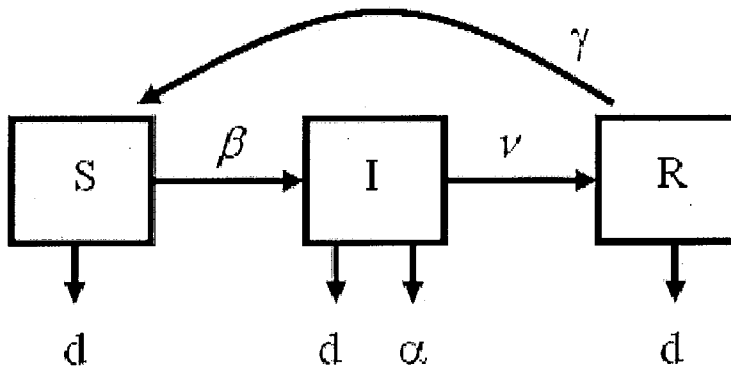
As large as it's possible

Given only this model what three approaches could be taken to minimize the spread of a pathogen? (3 pts)

i. reduce β

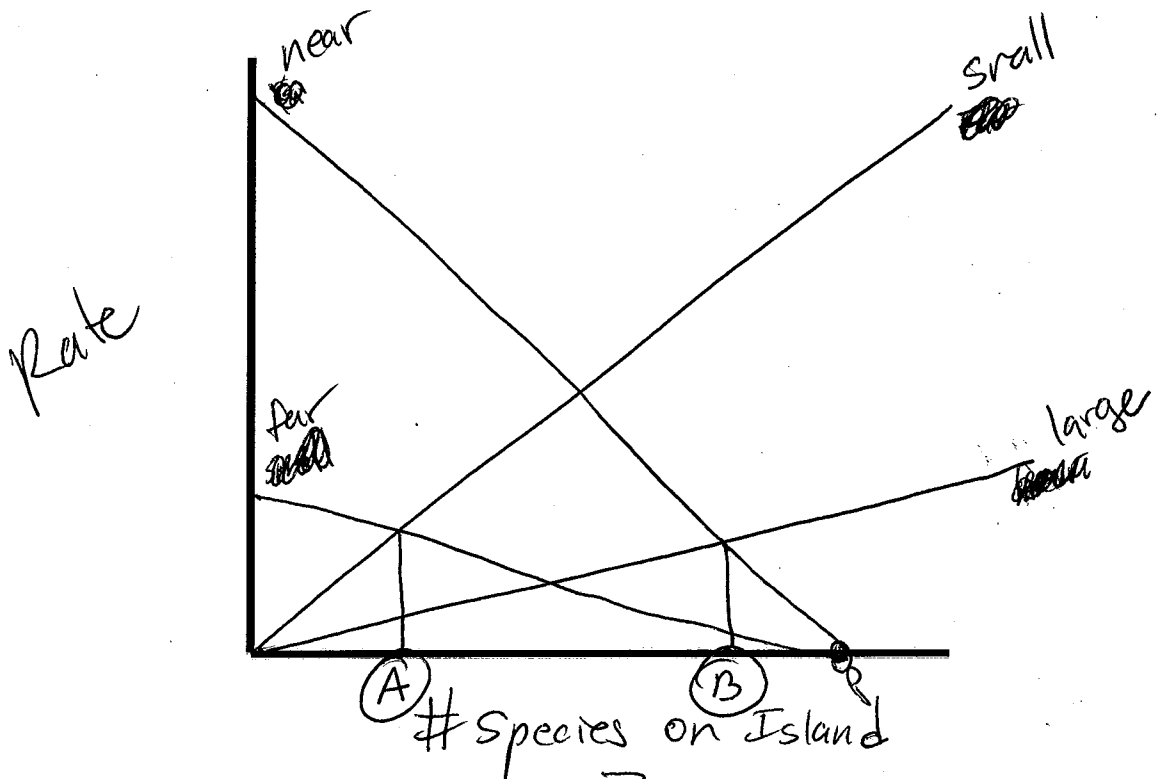
ii. increase ν

iii. increase α



3. The following questions refer to the "theory of island biogeography." (15 pts)

- a. This theory relies on perhaps the best supported principle of ecology, which is what? (3 pts):
species area relationship, which is a positive relationship.
- b. The theory predicts the number of species expected on an island. This is a balance between the following two rates (2 pts each):
- i. Colonization
- ii. extinction
- c. Graph the generalized theory of island biogeography for two islands (one small, far away island and one large, near island). Analyze the graph. Label all lines and axes. (8 pts)

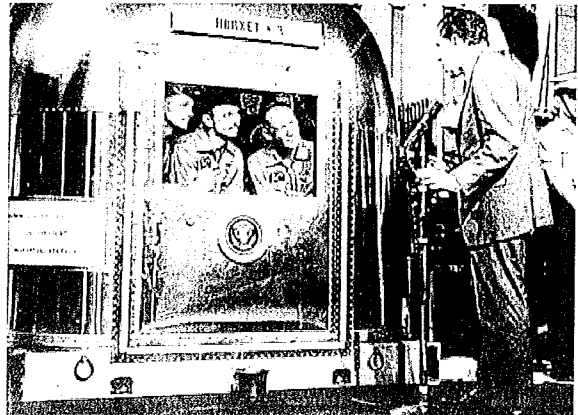


A = small, far island } both GSE
 B = large, near island }

Extra Credit (13 possible pts)

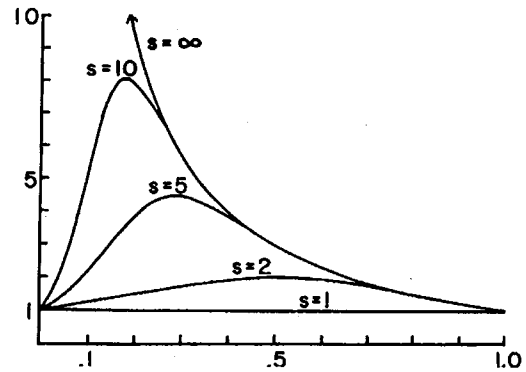
1. Provide the names the people in the photo. (1 pt each)

Michael Collins
 Buzz Aldrin
 Neil Armstrong



2. Regarding the graph to the right. (1 pt each)

- a. Name of author? Henry Horn
 b. What's the principle is depicted? Intermediate Disturbance Hypothesis
 c. Name of who fixed it and got famous? Joseph Connell



3. Name a critter endemic to the Northeast USA. (1 pt)

Unknown?

4. Species name of this bird, which is found in the Arboretum. (1 pt)

Cedar waxwing



5. We discussed two reasons why the world is green but I briefly mentioned six. Name one of the ones we didn't talk about in depth. (1 pt)

6. Krakatau is located on the west side of what island? (1 pt)

Java

7. What are some of those crunchy things in figs, which were mentioned in lecture? (1 pt)

wasps

8. What is the formal name of the infection caused by flesh eating bacteria (*Streptococcus A*)? (1 pt)

~ necrotizing fasciitis