Part 1.

As I mentioned in class, ecology is a hierarchical discipline involving four "levels": individual, population, community and ecosystem. Please briefly explain:

#1. How does the level of the **individual** relate to the level of the **population**?

(3 pts)

#2. How does the level of the **population** relate to the level of the **community**?

(3 pts)

#3. How does the level of the **community** relate to the level of the **ecosystem**?

(3 pts)

#4. How does the level of the **ecosystem** relate back to the level of the **individual**?

(3 pts)

#5. Approximately how many species are there at present on Earth? _____

(2 pts)

#6. What percentage of species on Earth live in tropical habitats? _____

(2 pts)

#7. Please use a diagram AND briefly explain exactly why there are four seasons in Pennsylvania (and throughout the temperate zone).

(6 pts)

#8. Please write in the spaces below what are the five environmental types that directly affect the day to day lives of individual organisms?

(10 pts)

_____ _____

_____ _____

_____

#9. Please offer a brief but concise definition of altruism and describe one specific example of altruism in an animal either from lecture or from the text.

(8 pts)

#10. Using your knowledge of how natural selection causes the evolution of animal behavior, please briefly explain why play behavior might be adaptive?

(8 pts)

#11. According to your studies of a population of head lice on a randomly chosen seat in Kirkbride 108, each female louse has 5 female baby lice per week, and 1 out of 2 adult females are killed each week. Assume head lice can breed after only one week of life.

If there are 1000 adult females alive and breeding now (N_0), how many would there be in one week from now? {Note 1: ignore the males} {Note 2: you do not need a calculator to find the numerical values asked for. The calculations involve only simple arithmetic.}

how many in one week (N_1)? (8 pts)

#12. Please list and briefly define four major ways in which two populations may interact. (8 pts)

#13. Please use a diagram and briefly explain what is the greenhouse effect? (8 pts)

#14. 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)

#15. Current models predict that +2-5^{o}C warming is likely by 2100 if nothing is done and atmospheric CO_2 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 - 3 - (6 pts)

Part 2.

Question #1. Please diagram and explain the two major objectives of **population ecology**. Please use a diagram for each, AND write an explanation.

diagram and explain objective 1 - (10 pts)
diagram and explain objective 2 - (10 pts)

Question #2. Consider the simple logistic model of single species population growth

$$\frac{1}{N} * \frac{\Delta N}{\Delta t} = r * \left[1 - \frac{N}{K} \right]$$

(a). Draw a little graph below showing the per capita population growth rate (Y) vs. the population size (X) for this model. LABEL the AXES and indicate ALL relevant constants! (7 pts)

(b). **Without using any math symbols or notation**, explain in words what is the main prediction of this model? (6 pts)

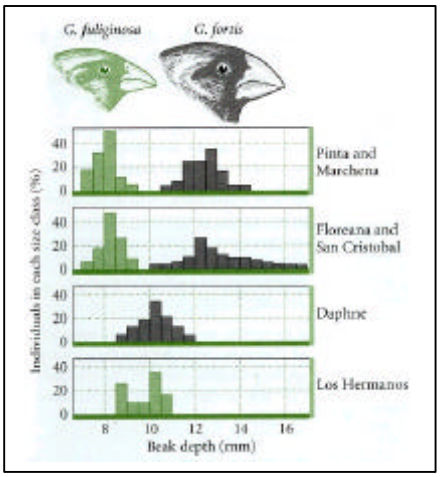
(c). Draw a little graph below showing the population size vs. time beginning with an initially large (N >> K) and with an initially small (N << K) population size for this model. LABEL THE AXES AND ALL CONSTANTS! (7 pts)

Question #3. This question will assess your understanding of some of the issues surrounding coexistence of interacting species in ecological communities.

(a). One of the most important lab studies of predator prey dynamics was Huffaker's (1957) study of predator and prey mites living in trays of rotting oranges. WHY exactly did the predators coexist with their prey (as opposed to hunting their prey to extinction) and what are the general conclusions we can draw from Huffaker's research? (10 pts)

(b). The figure at right shows the distributions of beak sizes for two species of finches on four different Galapagos Islands (on the top two islands the species co-occur, and on the bottom two, the species are alone). WHY might the two species of birds show very different beak sizes when coexisting together and what are the general conclusions we can draw from these data about competitive coexistence in nature?

(10 pts)



Question #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.

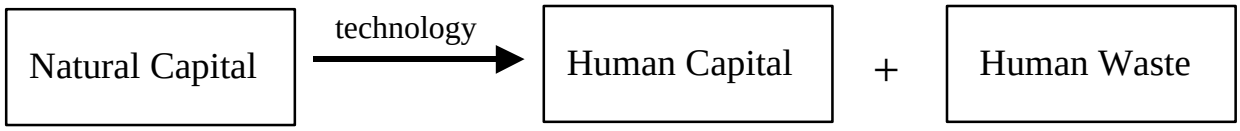
Imagine yourself as one of the members of this community at about 6100 b.c., just prior to its abandonment. What were the major environmental signposts that the 'Ain Ghazal culture and way of life were nearing a collapse?

(10 pts)

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

(10 pts)

Question #5. This question will test your understanding of ecological economics. Below is a sketch of the relationships between "natural capital," "human capital," and "human-generated waste" that we used in class to describe the present unsustainable economic system (referred to as the "Neolithic" model).



(a). List and briefly explain the three basic assumptions under which this economic model operates:
1 – 2 – 3 - (7 pts)

(b). List and briefly explain the three basic assumptions under which a "sustainable" economic system (or the "post-Neolithic" model) would operate:
1 – 2 – 3 - (7 pts)

(c). Herman E. Daly, an internationally recognized economist, once wrote that "There is something fundamentally wrong in treating the earth as if it were a business in liquidation..." Please briefly explain what he meant by this comment. Exactly what is being liquidated?

(6 pts)