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).

These questions will assess your understanding of inquiry methods in ecology.

SAQ #2. Please list the principal strengths and weaknesses of **controlled laboratory experiments** to understand ecological phenomena. (please avoid unnecessary repetition)
strengths: weaknesses:

SAQ #3. Please list the principal strengths and weaknesses of **controlled field experiments** to understand ecological phenomena. (please avoid unnecessary repetition)
strengths: weaknesses:

SAQ #4. Please list the principal strengths and weaknesses of **"natural experiments"** to understand ecological phenomena. (please avoid unnecessary repetition)
strengths: weaknesses:

SAQ #5. Why it is a **misconception** to assert that "good science and scientists are totally objective"? Please list 3 totally different ways that subjectivity enters and is of value to productive scientific endeavor.

SAQ #6. How does the problem of temporal or time scale pose such a challenge to ecosystem modeling?

SAQ #7. How does the problem of spatial scale pose such a challenge to ecosystem modeling?

SAQ #8. Why does detritus pose such a challenge to ecosystem modeling?

SAQ #9. Why is there a distinct dry season in December-February in tropical regions centered at about 10^o North latitude? Please use a clear diagram. (hint: during June-Aug the dry season occurs at 10^o South latitude...)

PLEASE SELECT ANY 3 Questions from the list below and answer them in the next three spaces provided. (Please make clear which question you are answering.)

choose from:

a. According to analyses in Costanza et al (1997), the "ecosystem services" of the natural world are greatly undervalued. What are some of the major services, and what is the total approximate annual value of all of these services combined? (Value is estimated as the replacement cost, ie the $ amount we would have to pay for the technologies and labor to do 'it' if nature can't).

b. According to analyses in Costanza et al (1997), the "ecosystem services" of the natural world are greatly undervalued. Stiling notes that "the majority of these services are currently outside of the market system" (these are called market externalities). What does this mean? What would happen to the prices of commodities if these services were included in the market?

c. According to Stiling, why might it be that ecologists devote greater research activity to individual and population ecology yet profess that community and ecosystem level analyses are more important?

d. According to Stiling (p. 20), what is the difference between a phenomenological vs. a mechanistic approach to studying nature? What makes a good mechanistic experimental study of, say, competition between 2 species?

e. 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?

f. Why does Stiling note that the proportions of top predators, intermediate species, and basal species "remains constant in webs [among different communities] regardless of the number of species"?

g. Why might big and fierce top predators be rare?

SAQ #10. answers which Stiling Q ??? (a) (b) (c) (d) (e) (f) (g) (circle one)
SAQ #11 answers which Stiling Q ??? (a) (b) (c) (d) (e) (f) (g) (circle one)
SAQ #12 answers which Stiling Q ??? (a) (b) (c) (d) (e) (f) (g) (circle one)

I. Longer Answer Questions (15 points each) CHOOSE ANY 2 QUESTIONS and put a big "X" across the pages of the questions you do not want.

LAQ #1. This question will assess your understanding of "ecological ethics" as presented in the preface and introduction of Stiling's text and in class.

According to Stiling, (p. *xvi*), "researchers are aware that change and fluctuation are pervasive in nature and that there are no moral imperatives to species. This can create tension among students seeking moral enlightenment from an ecology class as well as factual knowledge because many professors' life philosophy is to teach the integrity of evidence and rigorous logic, not a life philosophy of ecology as a quasi religion with moral positions."

(a). Explain why Stiling argues that the fact of "change and fluctuation" in nature means that species have no "moral imperative" for their existence.

(b). According to anthropologists studying Easter Island, Polynesians colonized the island by about 400 AD, but by 1500 AD, they had thoroughly deforested and degraded the landscape. Further writes Stiling, "once the population exceeded the carrying capacity of the island, warfare was rampant, as were chronic cannibalism and slavery" (p. 2).
Q - What does this text imply about whether scientific disciplines should or should not include morality and moral positions?

(c). Stiling lists some of the effects of humans upon our world today including acid rain, global atmospheric imbalances in CO_2 and N, pesticide residues, extinctions, etc. and notes that "Now, more than ever, there is strong impetus to understand how natural systems work, how humans change those systems, and how in the future we can reverse these changes" (p. 3).
Q - What does this text imply about whether scientific disciplines should or should not include morality and moral positions?

LAQ #2. 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 #3. Please diagram and label the two basic "functional characteristics", i.e. energy flow and biogeochemical cycling, of an ecosystem. In addition to your diagram, please also write somewhere on the page what are the basic differences between the paths of energy and biogeochemicals in an ecosystem, i.e. highlight the unique differences between them. (Please OMIT OMNIVORES for simplicity)
functional characteristic 1: energy flow -
functional characteristic 2: biogeochemical cycling -

LAQ #4. Please state what are the two principal objectives of individual ecology.

Please briefly explain the basic design features of a "wait-ambush" vs. a "wide foraging" snake (I used a rattlesnake and whipsnake in class), and explain how this anecdote applies to the objectives of individual ecology.

LAQ #5. This question will further assess your understanding of individual ecology.

a. Please state why the concept of the "ecological energy budget" is critical to so many research questions in individual ecology.

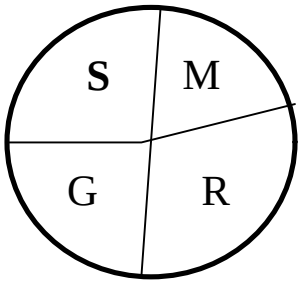
b. Please define the components of an individual energy budget. [hint: what do M, G, S, and R represent in the figure below.]

M =

G =

S =

R =



c. For an ectothermic animal such as a lizard, how might environmental constraints and limitations affect the total **size** of its energy budget (EB) from the environmental types listed below?
how might the resource environment limit total EB size? -
how might the biophysical environment limit total EB size? -
how might the social/demographic environment limit total EB size? -
how might the predation environment limit total EB size? -

LAQ #6. Data from a recent census of tree species from a woodlot include 45 individuals of species 1, 35 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? _____

(b). According to the equation for the Shannon Diversity Index, H',

$$H' = -\sum_{i}^{S} p_i * \ln(p_i)$$

(for which p_i is the proportion of data from the ith species, and S 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?