

YOUR NAME: KEY your TA's name: _____

Environmental Biology 206 EXAM I 15 February 2006 (exam worth 100 points)

Filler (1 point): Who wrote Silent Spring in 1962? Rachel Carson

Multiple Choice (questions have only one correct answer; 18 points total; 1.5 points each)

- Compared to the number of individuals in a population, the effective population size (N_e) is usually
a) the same, b) larger, **c) smaller**, d) none of these answers.
- The most significant threat to biodiversity seems to be
a) disease, **b) habitat loss**, c) pollution, d) alien species, e) over exploitation
- On average, what percent of the useful energy in organisms at one trophic level is passed on to the next, higher trophic level?
a) 10%, b) 15%, c) 20%, d) 25%, e) 30%
- What mountains are found to the south of Tucson?
a. Santa Catalinas
b. Rincons
c. Tucsons
d. Santa Ritas
e. Tortolitas
- Which of these ecosystem types has the highest net primary productivity per square meter? (fig. 2-20)
a. Lakes and Streams
b. Swamps and Marshes
c. Savanna
d. Agricultural Land
e. Desert
- A commensalism is an interaction between two species in which
a. both species benefit.
b. one species benefits and one is not affected.
c. one species benefits and one is hurt.
d. both species are hurt.
e. one species is hurt and one is not affected.
- What is the most appropriate definition of the biological species concept introduced by Ernst Mayr in the 1950's?
a. a unique, shared evolutionary history for a group of organisms
b. shared morphological similarity within a group of organisms
c. genetic variation less than 2% for a group of organisms
d. interbreeding populations reproductively isolated from other such populations
e. none of the above
- Which of the following is an example of biodiversity?
a. Genetic variation
b. Species richness
c. Ecological variation
d. Functional variation
e. All of the above
- Which of the following is not typical of invasive species?
a. Limited geographic distribution
b. Great dispersal ability or migratory tendencies
c. Early maturation and short generation time
d. Small body size
e. Capacity for clonal/asexual reproduction

Key
14.5

10. According to your Costanza et al. (1997) reading, what is an average estimate of the economic value of ecosystem services?
 a) \$20 billion, b) \$240 billion, c) \$18 trillion, **d) \$33 trillion**, e) \$147 trillion
11. Which amount above was the global GNP (gross national product) estimate for ~1995? **e**
12. Humans use about what percentage of global net primary productivity?
 a. 0-5%
 b. 5-20%
c. 25-40%
 d. 45-60%
 e. 65-80%

Fill in the Blank (2 points per blank; 22 points total)

1. *Rhizobium* bacteria in the root nodules of legumes convert nitrogen into a form that plants can use.
2. $\text{CO}_2 + \text{H}_2\text{O} + \text{solar energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$ in a process known as photosynthesis.
3. Life first evolved on this planet about 3.5 billion years ago.
4. bald eagle, black-footed ferret, quinn rail is an example of a species that has recovered from the brink of extinction in the U.S. (as told to us by Chuck Price).
5. (very open) is an example of a trait exhibited by plants adapted to living in arid environments.
6. A panda bear is an example of a specialized species with a narrow niche.
7. Buffelgrass, etc. is a non-native species commonly seen around Tucson.
8. Please give two examples of ecosystem services discussed in class: (see slide 13, lecture 1)
 a) b)

Really Short Answer (about a sentence; 39 points total; 3 points each)

1. Distinguish between preservation and conservation. use or harvest sustainably
limit as much as possible the influence of humans
2. What is the goal of the Montreal Protocol?
reduce CFC emissions + restore ozone layer in stratosphere
3. Why is genetic variation thought to be important for long-term persistence of populations of plants and animals?
allows for populations to respond to environmental changes; allowing for continuation of the process of evolution
4. List each of the terms in the IPAT model.
Environmental Impact is a function of Population size, Affluence (aka consumption) and Technology

very
38.5

5. Why were Cane Toads introduced to Australia? Have they done what they were supposed to do?

help get rid of cane grub beetle attacking sugar cane crop.

The toads did not do anything to the beetles, but did become invasive and harm native species

6. How would you explain to someone the difference between Environment and Ecology?

combination of biotic/abiotic factors external to organism or population in question

study of how organisms interact with each other + their environment

7. Give an example of an externality and explain how it could be internalized.

~open

8. What are the implications for a positive discount rate (positive inflation) in the context of environmental conservation?

consume now!, bc far enough into the future everything becomes worthless

9. What two criteria, other than heritability, must be met for evolution by natural selection to take place?

variable trait, differential fitness w/c of trait

10. How do fundamental and realized niches differ? Why do they differ?

zone of biological conditions that organism can tolerate (includes prey base, physiology, etc.)

where animal is actually found: usually smaller b/c of competition or predation by other organisms

11. Give two examples of ways humans are affecting the carbon cycle.

- deforestation

- green house gas emissions

~open

12. Explain how the Genuine Progress Indicator (GPI) measures something different than GDP does.

GPI takes into account quality of life, equality, environmental health, etc. GDP (gross domestic product) only looks @ the overall size of the economy and its value

13. Why is the 2nd Law of Thermodynamics important in this course?

when energy converted from one form to another, some of the useful energy is degraded to low quality, dispersed energy (heat).

- important b/c of how we consume energy + waste much; important in trophic cascades

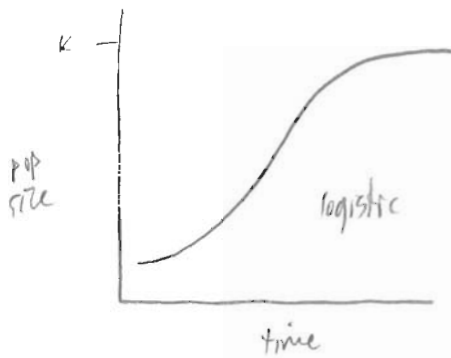
Short Answer (20 pts total; 5 pts each; a few complete sentences and/or graphs required)

1. What does the ecological footprint measure? What are typically the top three contributors to the size of an individual's ecological footprint?

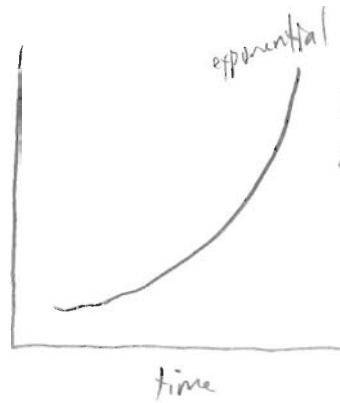
Measures # of productive acres needed to maintain a given lifestyle. These acres include fishing grounds, forests, agricultural fields, etc.

Top three contributors are typically reproduction (# offspring), whether you eat high or low on the trophic cascade (and how far you food travels), and the energy required for your annual transportation. Size of housing, recreational activities, and other lifestyle and consumption choices can also have a large impact.

- other natural selection arguments possible
2. Distinguish between exponential and logistic population growth using graphs with labelled axes. What ecological processes cause them to differ? How does natural selection play a role?



K = carrying capacity where pop size limited by scarcity of resources



no limitation on growth
often seen in early stages
of population boom
of r-selected species
like aphids

Nat Sel plays a role in logistic especially b/c more indivs born than can be sustained so some individuals w/ diff't traits do better than competitors

3. Explain what Daniel Quinn's goal was in writing *Ishmael*. How and why do you think Aldo Leopold would react to the book's main premise?

Quinn's goal, using the leavers + takers as a metaphor, was to effect change such that humans will do less ruling + consuming, and instead will begin to appreciate that they are part of an everevolving and complex planet w/ myriad interconnected species and ecosystems.

I believe Leopold would strongly agree w/ Quinn's main premise. In Leopold's writings he argues that we need to embrace a land ethic that understands our role is to be part of a larger community rather than its ruler.

4. Explain how fluctuation in weather patterns in the Galapagos Islands alters beak size in finches on one of the islands. Provide a simple, labelled graph to aid your explanation.

Beak size varies w/ precipitation. More rain means more small seeds which smaller beaks are more efficient @ utilizing. After wet years the proportion of small beak individuals ↑. During dry years, the seeds available are larger + harder and a bigger beak is better. The fluctuation in beak size is driven by alternating directional selection

graph fairly open but needs to be labelled and should show how precipitation and mean population beak size are related.