N=41 @ 905 42 @ 909 43 @ 911

YOUR NAME: KEY your TA's name: _____

Environmental Biology 206 EXAM I 16 February 2005 (exam worth 100 points)

Multiple Choice **(questions have only one correct answer; 21 points total; 1.5 points each)**

1. Current human population is closest to
   a) 5.2 billion, b) 6.2 billion, c) 7.2 billion, d) 8.2 billion, e) 9.2 billion.

2. The most dangerous threat to biodiversity is
   a) disease, b) over exploitation, c) pollution, d) alien species, e) habitat loss

3. 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%

4. What do *Rhizobium* bacteria do?
   a. fix nitrogen
   b. convert nitrogen to ammonia
   c. convert ammonia to nitrogen
   d. two of the above
   e. none of the above

   0.5 for a or b only.

5. 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

6. A mutualism 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.

7. According to *Ishmael*, where did the story of the Garden of Eden originate?
   a. In the native cultures of North America.
   b. In the savannahs of Africa.
   c. In an early agricultural society.
   d. In a pastoral culture displaced by an early agricultural society.
   e. Among early Christians.

8. 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

9. 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

b e a d b a d d e

Key 13.5

KEY

10. 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

11. Which of the following is a an example of a biocontrol management strategy that seems to have worked rather well?
    a. Zebra Mussels introduced to great lakes to control Lampreys
    b. Myxoma virus introduced to Australia to control Rabbits
    c. Beetle (Diorhabda elongata) introduced in U.S. to control Salt Cedar (Tamarisk)
    d. Cane Toads introduced in Australia to control Cane Grub
    e. Rosy Wolfsnail introduced to Hawaii to control Giant African Snail

12. 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

13. Which amount above was the global GNP (gross national product) estimate for ~1995?
    c

14. According to Chuck Price's lecture, how different are current extinction rates thought to be when compared to background extinction rates estimated from long-term average trends in the fossil record?
    a. 10-100x greater
    b. 100-1,000x greater
    c. 1,000-10,000x greater
    d. 10,000-100,000x greater
    e. 10-100x less

Fill in the Blank **(2 points per blank; 26 points total)**

1. In the biosphere, matter is recycled but there is a _____(one-way) unidirectional_____ flow of energy.

2. $CO_2 + H_2O +$ _____solar_____ energy → $C_6H_{12}O_6 +$ _____O_2_____

   in a process known as _____photosynthesis_____.

3. Life first evolved on this planet about 3.5 _____billion_____ years ago.

4. _____solar/wind/tides/etc_____ is an example of a perpetual resource.

5. A generalist species (e.g., cockroach or coyote) has a _____broad (wide)_____ niche.
   A specialist species (e.g., giant panda) has a narrow niche.

6. The three important characteristics of pollution are its a) _____concentration_____,
   b) chemical composition and activity, and c) persistence.

7. _____Tamarisk, buffel grass, etc. (Bushel grass?)_____ is a non-native species commonly seen around Tucson.

8. _____Externality_____ is a term for consequences of human activities not typically included in economic decision making.

9. Please give two examples of ecosystem services discussed in class:
   a) b) nutrient cycling, H_2O purifying, pollution removal, etc

10. In the context of graphing data, _____regression_____ implies a causal relationship whereas correlation does not.

Causality

Key 33/5

KEY

Really Short Answer **(not more than a sentence; 33 points total; 3 points each)**

1. What point does McPherson make in *Killing the Natives* by discussing Lifeboats, Elevators, and Restaurants?
   planet may have carrying capacity for humans
2. What is the goal of the Kyoto Protocol?
   slow global climate Δ by ↓ greenhouse gas emissions
3. Why is genetic variation thought to be important for long-term persistence of populations of plants and animals?
   allows populations to adapt/evolve in face of environmental Δ
   maybe ½ missed
4. List each of the terms in the IPAT model.
   Impact Population Affluence (consumption) Technology
5. Answer A or B:
   a. List two adaptations that plants have for existence in arid environments.
   b. List three of the four mountain ranges surrounding Tucson.
      Tucson, Santa Rita, Catalina, Rincon

   deep roots
   broad, shallow roots
   few, small leaves
   waxy cuticle
   drop leaves/branches etc.
6. How would you explain to someone the difference between Environment and Ecology?
   p5 maybe ½ missed
   everything that affects + surrounds a living organism
   study of distribution + abundance of organisms (+ how they interact w/ environment)
7. Define keystone species and give an appropriate example discussed in class.
   species whose function in ecosystem is greater/more important than might be predicted by the # of indivs or biomass of that species
   eg. wolf
8. What is the 'tens rule' in the context of invasive species?
   missed often 10% aliens establish, 10% of those become invasive
9. What two criteria, other than heritability, must be met for evolution by natural selection to take place?
   trait variable among indivs
   trait differentially affects fitness
   missed very often
10. Why did megafaunal extinctions take place in several areas of the world within the last 50,000 years, but not in Africa?
    (humans evolved in Africa + the species there adapted over time to prevent extinction. Naive faunas in areas where humans migrated to were in trouble, and indeed became easy prey.
11. Give two examples of ways humans are affecting the carbon cycle.
    removing CO_2 sinks such as forests
    adding CO_2 to atmosphere when combust fossil fuels that have been sequestered underground for millions of years.
    etc.

Key
/33

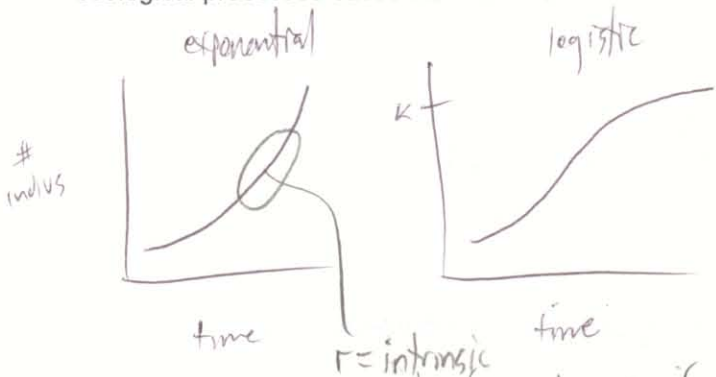
KEY

Short Answer **(20 points total; 5 points each; a few sentences required)**

1. The baobab tree is a native of Madagascar The individual on campus is one of the oldest individuals of that species in North America. It is a monocious tree that is pollinated by nocturnal pollinators, such as moths and lemurs. Although the individual on campus flowers, it has never produced fruit. List two possible hypotheses to explain why it does not produce fruit.

No appropriate pollinators,
No other trees to exchange genetic material w/
Self incompatible
Wrong environmental conditions or cues,
etc.)

2. Distinguish between exponential and logistic population growth using graphs with labelled axes. What ecological processes cause them to differ?



environmental constraints in habitat, carrying capacity
(competition for scarce resources, predation, etc.)
(above or below K pop ↓ or ↑ to go toward K over time)

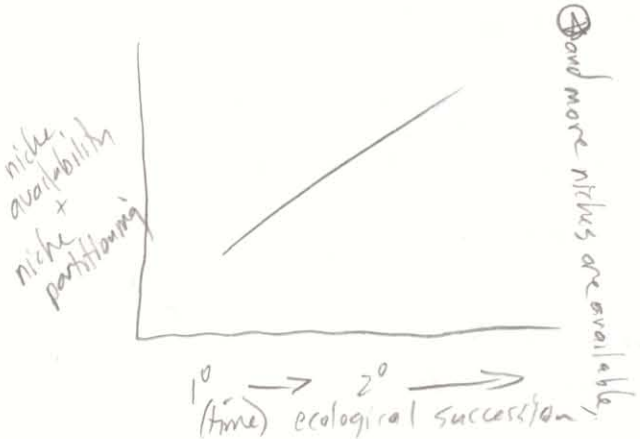
r = intrinsic rate of pop. increase if resources (space, food, etc.) unlimited

3. In Annie Dillard's chapter entitled 'fecundity' she relates a story about trains. How is her discussion of 9,000 vs. 3 trains both similar to, and different than, what happens in natural biotic populations?

go over in lecture

In both cases more individuals are produced than the habitat can support, Over time # indivs reduced to carrying capacity of the habitat, With train story 9000 → 3 all b/c of chance. In nature lots of chance but also heritable variation among individuals that might contribute to fitness differences and therefore evolution by natural selection across generations.

4. Explain how stage of ecological succession and degree of niche partitioning might be related over time. Provide a simple, labelled graph of the hypothesized relationship.



I might expect the two to be ⊕ correlated.
In very early stages of succession soil is simple, plants are few, and the habitat has very little structure,
Over time as the habitat becomes more complex ⊕ specialists w/ narrow niches will be able to persist whereas early on pioneer species + generalists would do well

Very / 20