

N=42

YOUR NAME: KEY your TA's name: _____

Environmental Biology 206 EXAM II 11 March 2005 (exam worth 100 points)

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

1. The most dangerous threat to biodiversity is
a) disease, b) over exploitation, c) pollution, d) alien species, **e) habitat loss**
2. What percentage of US citizens drive to work alone?
a) 10%, b) 25%, c) 45%, d) 65%, **e) 75%**
3. What species did Taylor Edwards study for his masters thesis?
a. Desert Tortoise
b. Desert Box Turtle
c. Lowland Leopard Frog
d. Bullfrog
e. Coyote
4. Which value is the best estimate of realistic replacement level fertility rates for humans?
a. 0.1
b. 0.8
c. 1.4
d. 1.9
e. 2.1
5. Current population in the U.S.A. is closest to:
a. 30 million
b. 100 million
c. 300 million
d. 1 billion
e. 3 billion
6. What was the first national park in the USA?
a. Banff
b. Grand Canyon
c. Great Smoky Mountains
d. Yellowstone
e. Yosemite
7. 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
8. The term UN, in the context of this class, generally means:
a. Ugly Nations
b. Unlimited N
c. 'not' or 'negative'
d. United Nations
e. None of the above
9. Which fossil fuel source tends to produce the least amount of pollution?
a. Coal **b. Natural Gas** c. Oil d. Methane **e. Two of the other answers**

⇒
⇒

d

!

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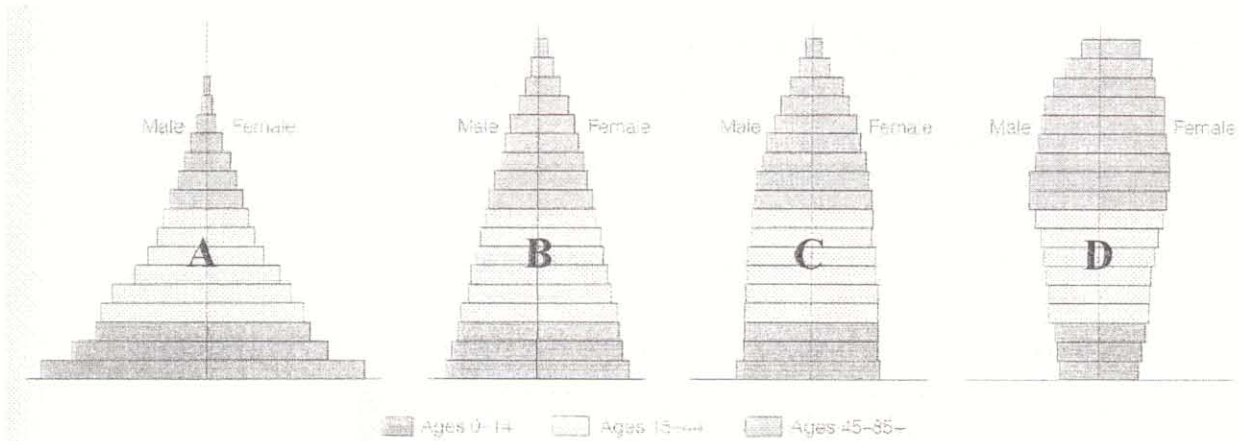
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1.5 - 1.5 partial
1.5 - 1.5 2 right

KEY
13.5

KEY

Using the diagram below, answer the following questions:

- 10. Which diagram (A, B, C, or D) represents the highest population growth rate? **A**
- 11. Which diagram represents a country like Japan or Sweden? **D**
- 12. Which diagram best represents the USA? **B**
- 13. Which diagram would most closely resemble exponential growth? **A**
- 14. Which diagram likely has the highest infant mortality? **A**



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

- 1. A sink population is one in which the number of deaths is greater than the number of births. The opposite would be called a source population.
- 2. A piece of land set aside as a reserve but without either the legal or economic means to be enforced and protected as a reserve is often called a paper park.
- 3. The dominant species at the first low elevation stop at Tumamoc Hill would be creosote.
- 4. As you drive north from Tucson towards Flagstaff saguaro cacti eventually disappear. The most northern individuals are almost exclusively found on south - facing slopes.
 Frost
- 5. In the context of population growth, a lambda value = one indicates a population that is not changing in size whereas a lambda value < one indicates a population that is shrinking.
 Protected vs. Endangered (saguaro)
- 6. Give an example of an endangered species found in Arizona: ?
- 7. How about an endangered species not naturally found in the USA?: ?
- 8. Three of the most important contributors to an individual's ecological footprint are 1) the type and size of a person's home, 2) # offspring, and 3) vegetarian?
 4) how they travel around

KEY
29.5

KEY

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

1. Calculate the doubling time for a population growing at 2.0% per year. Show your work.

$$70\% / 2 = 35 \text{ yrs}$$

→ open

2. What does Guy McPherson, in *Killing the Natives*, suggest is the lesson we should learn from Biosphere 2?

Earth has a carrying capacity. Hard for us to survive in closed system even as hard-working vegetarians.

3. In *The Lorax*, by Dr. Seuss, what was the meaning of the word "UNLESS" on a pile of rocks as explained by the Once-ler?

Unless someone like you cares a whole lot it's not going to get better.

4. Why are people worried about buffelgrass in the Tucson area?

Invasive species, fire adapted and may carry fire into Sonoran desert that is not fire adapted. Competes for water.

5. Explain how the cost of gasoline should perhaps be higher than the current ~\$2/gallon.

Externalities -- pollution, national defense/offense, etc.

→

6. Describe two reasons why the SDCP biologically preferred alternative was based on models of likely habitat as opposed to maps of known species' residency.

- 1. Difficult + expensive to find that many individual animals
- 2. Wanted to protect areas where species perhaps were in past.

7. Briefly list 2 pros and 2 cons of using nuclear reactions as an energy source.

open

pros: plenty available
; relatively little air pollution

cons: pollution (long term!)
cost
etc.

→

8. Draw a compound leaf.



→

9. Explain how a dichotomous key works.

bifurcating set of questions to help identify taxa

(lots called to say anything about 2 directions at each step (-1))

→

10. How and why are saguaro cacti and palo verde trees associated? (lots called to say why (-2))

needs shade + increased humidity when young
nurse plant

11. Describe how loss of one species in an area can lead to the loss of one or more other species.

lots of possible answers including one species being food or habitat for another

KEY
/33

KEY

Short Answer (25 points total; 5 points each; a few sentences required)

1. Use the following Leslie Matrix and initial population ($N_0=12$) to figure out the population at time $t=1$ (i.e., 1 time step into the future you will get N_1). Show your work.

$$\begin{pmatrix} 2 & 4 & 10 \\ 0.5 & 0 & 0 \\ 0 & 0.1 & 0 \end{pmatrix} \begin{pmatrix} 0 \\ 10 \\ 2 \end{pmatrix} = \begin{pmatrix} 0 + 40 + 20 \\ 0 + 0 + 0 \\ 0 + 1 + 0 \end{pmatrix} = \begin{pmatrix} 60 \\ 0 \\ 1 \end{pmatrix}$$

12 $\frac{1}{61}$

2. Describe five factors affecting human birth rates that differ between a developed European country like Sweden and a developing African country like Nigeria.

children in labor force
 amount of urbanization
 costs to raise + educate children
 level of female education + employment
 infant mortality rate
 age of ♀ at first reproduction

availability of pension/social security
 availability of abortions
 availability of birth control
 religious + cultural beliefs

3. Draw a linear representation of species-area relationships as described by Alona Bachi in lecture. Be sure to label your axes. What is important about this relationship in the context of conservation biology?



As lose natural areas you will decrease species richness, therefore preserving large, intact areas important

4. Explain how, in the context of environmental biology, it might be wise to think hierarchically about recycling, reduction, and reuse as well as about reconciliation, reserve, and restoration ecology.

3 2 1 3 1 2

2nd Law of Thermodynamics
 Intact Ecosystems
 Preferred vs. realistic solutions?
 Effects on environment + biodiversity

5. Write (and answer) one question from THIS WEEK'S PAIR OF LECTURES that you think your instructors would feel is challenging, fair, and worth 5 points.

open

∴ a question w/ a one-word answer not sufficient

25

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YOUR NAME: _____

your TA's name: Alona Badi

Environmental Biology 206 EXAM II 11 March 2005 (exam worth 100 points)

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

1. The most dangerous threat to biodiversity is
 a) disease, b) over exploitation, c) pollution, d) alien species, e) habitat loss ✓
2. What percentage of US citizens drive to work alone?
 a) 10%, b) 25%, c) 45%, d) 65%, e) 75% ✓
3. What species did Taylor Edwards study for his masters thesis?
 a. Desert Tortoise
 b. Desert Box Turtle
 c. Lowland Leopard Frog
 d. Bullfrog
 e. Coyote ✓
4. Which value is the best estimate of realistic replacement level fertility rates for humans?
 a. 0.1
 b. 0.8
 c. 1.4
 d. 1.9
 e. 2.1 ✓
5. Current population in the U.S.A. is closest to:
 a. 30 million
 b. 100 million
 c. 300 million
 d. 1 billion
 e. 3 billion ✓
6. What was the first national park in the USA?
 a. Banff
 b. Grand Canyon
 c. Great Smoky Mountains
 d. Yellowstone
 e. Yosemite ✓
7. 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 ✓
8. The term UN, in the context of this class, generally means:
 a. Ugly Nations
 b. Unlimited N
 c. 'not' or 'negative'
 d. United Nations
 e. None of the above ✓
9. Which fossil fuel source tends to produce the least amount of pollution?
 a. Coal b. Natural Gas c. Oil d. Methane e. Two of the other answers ✓

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Using the diagram below, answer the following questions:

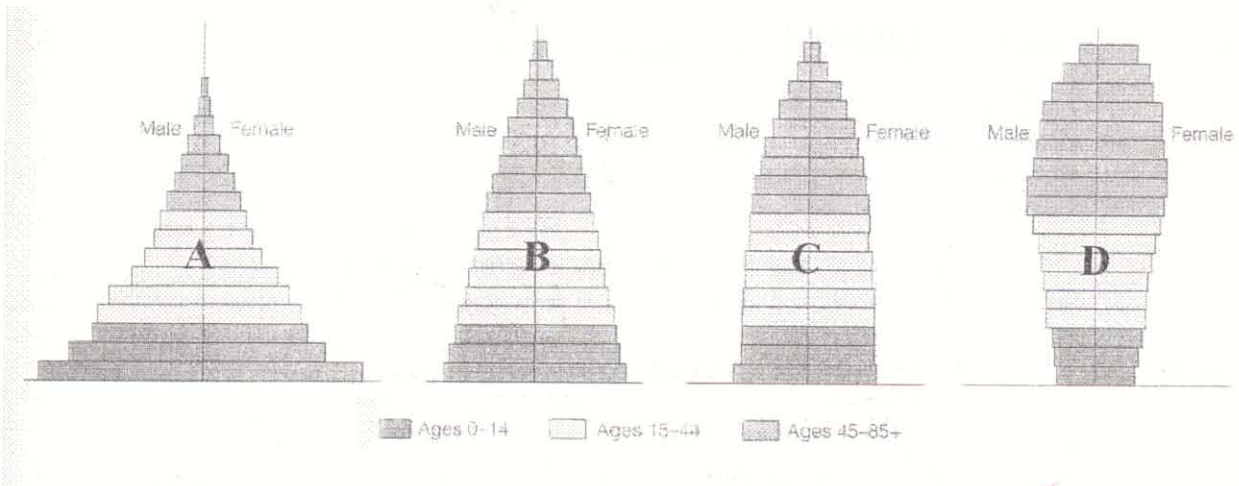
10. Which diagram (A, B, C, or D) represents the highest population growth rate? **A** ✓

11. Which diagram represents a country like Japan or Sweden? **C D**

12. Which diagram best represents the USA? **B** ✓

13. Which diagram would most closely resemble exponential growth? **A** ✓

14. Which diagram likely has the highest infant mortality? **A** ✓



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

- A sink population is one in which the number of deaths is greater than the number of births. The opposite would be called a source population. ✓
- A piece of land set aside as a reserve but without either the legal or economic means to be enforced and protected as a reserve is often called a paper park. ✓
- The dominant species at the first low elevation stop at Tumamoc Hill would be creosote. ✓
- As you drive north from Tucson towards Flagstaff saguaro cacti eventually disappear. The most northern individuals are almost exclusively found on south - facing slopes. ✓
- In the context of population growth, a lambda value = 1 indicates a population that is not changing in size whereas a lambda value < 1 indicates a population that is shrinking. ✓
- Give an example of an endangered species found in Arizona: Sonoran Pronghorn ✓
- How about an endangered species not naturally found in the USA?: mountain gorilla ✓
- Three of the most important contributors to an individual's ecological footprint are 1) the type and size of a person's home, 2) food, and 3) transportation. ✓

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

1. Calculate the doubling time for a population growing at 2.0% per year. Show your work.

$$73.2/R \quad 73.2/2 \approx 40.5 \text{ years}$$

2. What does Guy McPherson, in *Killing the Natives*, suggest is the lesson we should learn from Biosphere 2?

We cannot replicate the ecosystems of the Earth and should therefore focus on not destroying them in the first place. We are not smarter than nature. *carrying capacity*

3. In *The Lorax*, by Dr. Seuss, what was the meaning of the word "UNLESS" on a pile of rocks as explained by the Once-ler?

The nothing will get better unless someone cares enough to do something about it.

4. Why are people worried about buffelgrass in the Tucson area?

Buffelgrass is an invasive species which is not only outcompeting native grass, but which also serves as excellent kindling for wildfires, a serious problem in Tucson area mountains.

5. Explain how the cost of gasoline should perhaps be higher than the current ~\$2/gallon.

The government subsidies make gas prices in US artificially low. In addition, if we paid the true cost of gas (externalities included) we would pay ~\$9/gallon.

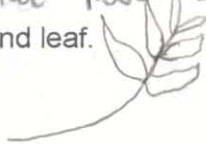
6. Describe two reasons why the SDCP biologically preferred alternative was based on models of likely habitat as opposed to maps of known species' residency.

- It would have been extremely expensive to find all the places where a species actually lives (as opposed to projections)
- Preserving likely habitat could encourage confined populations to expand again (low-land leopard frogs)

7. Briefly list 2 pros and 2 cons of using nuclear reactions as an energy source.

- | <u>Pros</u> | <u>Cons</u> |
|--|--------------------------------------|
| • Relatively little pollution (retired rods aside) | • No way to get rid of toxic waste |
| • Massive potential "reserves" | • Vulnerability to terrorism is high |

8. Draw a compound leaf.



9. Explain how a dichotomous key works.

You go down a list of sets of opposing characteristics, eliminating as you go, until the item you're trying to identify is described by the characteristics above it but not below it.

10. How and why are saguaro cacti and palo verde trees associated?

They are associated through a relationship of commensualism - the palo verde is the nurse plant for a young saguaro (which grows under the tree) providing the saguaro the shade it needs to survive the heat when it is young.

11. Describe how loss of one species in an area can lead to the loss of one or more other species.

For example, species related in predator/prey relationships: the loss of the prey species could easily cause the loss of the predator species if that was the only species it fed on.

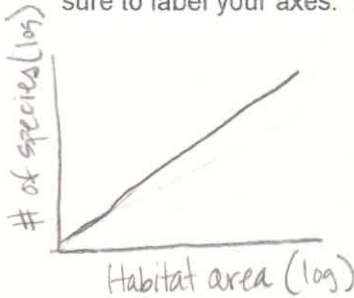
Short Answer (25 points total; 5 points each; a few sentences required)

1. Use the following Leslie Matrix and initial population ($N_0=12$) to figure out the population at time $t=1$ (i.e., 1 time step into the future you will get N_1). Show your work.

$$\begin{pmatrix} 2 & 4 & 10 \\ 0.5 & 0 & 0 \\ 0 & 0.1 & 0 \end{pmatrix} \begin{pmatrix} 0 \\ 10 \\ 2 \end{pmatrix} \quad \begin{array}{l} 0 \cdot 2 + 10 \cdot 4 + 2 \cdot 10 = 60 \\ 0 \cdot 0.5 + 10 \cdot 0 + 2 \cdot 0 = 0 \\ 0 \cdot 0 + 10 \cdot 0.1 + 2 \cdot 0 = 1 \end{array}$$

61

2. Describe five factors affecting human birth rates that differ between a developed European country like Sweden and a developing African country like Nigeria.
- Levels of urbanization (the more urbanized environment discourages ↑ birth rates)
 - Access to reliable methods of birth control (more developed countries have greater access to birth control)
 - Women's access to education/employment opportunities
 - Infant mortality rates (if more children die young, women are likely to have a greater # of them)
 - Wage-earning potential of children (if children can work, people in poor countries will have more to help support themselves)
3. Draw a linear representation of species-area relationships as described by Alona Bachi in lecture. Be sure to label your axes. What is important about this relationship in the context of conservation biology?



This relationship demonstrates that it is important to preserve large tracts of land rather than small patches, as a larger land area is more likely to support a greater level of biodiversity (at least at the species level).

4. Explain how, in the context of environmental biology, it might be wise to think hierarchically about recycling, reduction, and reuse as well as about reconciliation, reserve, and restoration ecology.

Stacked hierarchically the lists would read reduction, reuse, recycling, and reserve, restoration, reconciliation. These understood hierarchically as what takes the top is what should be the highest priority. It is more important to create less waste in the first place (reduction) than it is to recycle the waste [in the context of environmental biology] just as it is more important to focus on reservation ecology rather than reconciliation.

5. Write (and answer) one question from THIS WEEK'S PAIR OF LECTURES that you think your instructors would feel is challenging, fair, and worth 5 points.

Q: Describe why the deforestation of tropical rainforests constitutes an ecological emergency.

A: Tropical rainforests are not only hotspots of biodiversity, but also play a role in the climate regulation of the planet. Aside from their intrinsic value, rainforests also contain a wealth of plants which could be cures for cancer, AIDS etc. They are also the areas of the world which are disappearing the fastest, with very little happening to curb the destruction.

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YOUR NAME: _____

your TA's name: Matt Herron

Environmental Biology 206 EXAM II 11 March 2005 (exam worth 100 points)

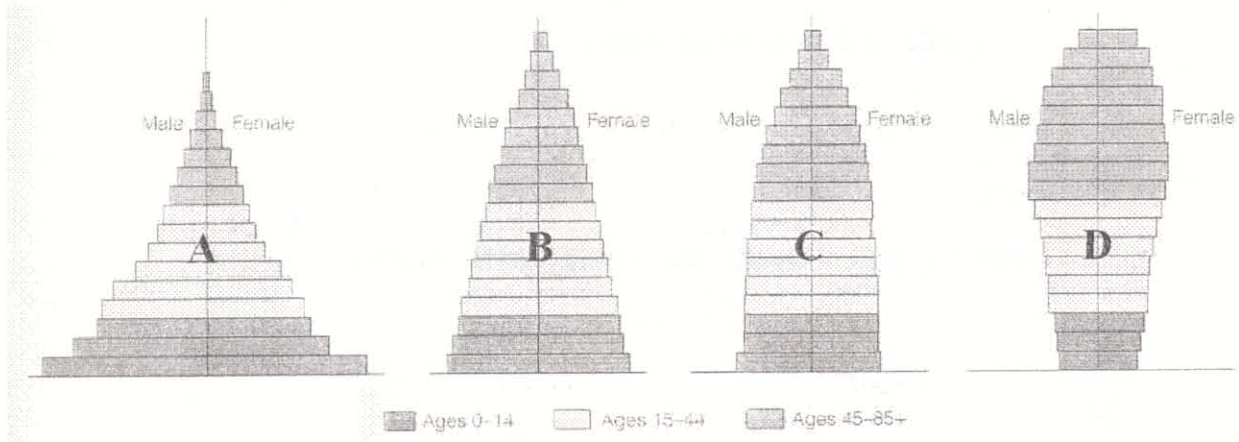
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c. genetic variation less than 2% for a group of organisms
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e. none of the above
8. The term UN, in the context of this class, generally means:
a. Ugly Nations
b. Unlimited N
c. 'not' or 'negative'
(d) United Nations
e. None of the above
9. Which fossil fuel source tends to produce the least amount of pollution?
a. Coal b. Natural Gas c. Oil d. Methane **(e) Two of the other answers**

12/13.5

Using the diagram below, answer the following questions:

- 10. Which diagram (A, B, C, or D) represents the highest population growth rate? **A** ✓
- 11. Which diagram represents a country like Japan or Sweden? ~~B~~ **C D**
- 12. Which diagram best represents the USA? ~~A~~ **B** ✓
- 13. Which diagram would most closely resemble exponential growth? **A** ✓
- 14. Which diagram likely has the highest infant mortality? **A** ✓



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

- 1. A sink population is one in which the number of deaths ^{emigrations or emigrations} is greater than the number of births. The opposite would be called a source population.
- 2. A piece of land set aside as a reserve but without either the legal or economic means to be enforced and protected as a reserve is often called a paper park.
- 3. The dominant species at the first low elevation stop at Tumamoc Hill would be creosote.
- 4. As you drive north from Tucson towards Flagstaff saguaro cacti eventually disappear. The most northern individuals are almost exclusively found on south - facing slopes.
- 5. In the context of population growth, a lambda value = 1 indicates a population that is not changing in size whereas a lambda value < 1 indicates a population that is shrinking.
- 6. Give an example of an endangered species found in Arizona: gila chub.
- 7. How about an endangered species not naturally found in the USA?: Indian tigers
- 8. Three of the most important contributors to an individual's ecological footprint are 1) the type and size of a person's home, 2) food resources, and 3) transportation.

28 / 29.5

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

1. Calculate the doubling time for a population growing at 2.0% per year. Show your work.

$$2P = 1.02^t$$

$$P = P_0(1+r)^t$$

$$P_0 = P_0 e^{rt}$$

$$2P_0 = P_0 + P_0 r t$$

doubling time is $\frac{70}{2} = 35$ years

$$t = \frac{\log 2}{\log 1.02}$$

2. What does Guy McPherson, in *Killing the Natives*, suggest is the lesson we should learn from Biosphere 2?

It would be difficult to transport ~~of~~ our life elsewhere because of problems related to space, food, our pollutants, etc.
carrying capacity

3. In *The Lorax*, by Dr. Seuss, what was the meaning of the word "UNLESS" on a pile of rocks as explained by the Once-ler?

"Unless" something, some type of action was taken, everything would remain as it had been destroyed, as the ~~was~~ killing of the trees had ~~disrupted~~ disrupted the ecosystem.

4. Why are people worried about buffelgrass in the Tucson area?

It is taking over the habitat of native species, and it ~~is~~ can be associated with fire, which is not natural here.

5. Explain how the cost of gasoline should perhaps be higher than the current ~\$2/gallon.

The environmental impacts (externalities) are not included in the price, and oil is highly subsidized.

6. Describe two reasons why the SDCP biologically preferred alternative was based on models of likely habitat as opposed to maps of known species' residency.

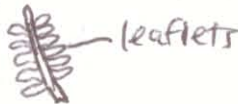
In order to restore the habitat, species can fill back in these niches.
 Too expensive to go out in the field, cheaper to model.

7. Briefly list 2 pros and 2 cons of using nuclear reactions as an energy source.

cons
 1) nuclear waste must be stored
 2) expensive to initiate

pros
 1) not much matter used to make large amounts of energy
 2) waste can be contained and localized

8. Draw a compound leaf.



9. Explain how a dichotomous key works.

Have two choices about characters in a species. Choose the best fitting one, and go on to the next choice. Like a choose your own adventure book.
 work down to the species level.

10. How and why are saguaro cacti and palo verde trees associated?

Saguaro use the palo verde as a nurse plant, to protect from weather, animals, etc, because they ~~are~~ are very vulnerable at young ages.

11. Describe how loss of one species in an area can lead to the loss of one or more other species.

Keystone species have a large impact on their ecosystem, may be predators or prey for other species in the area.

Short Answer (25 points total; 5 points each; a few sentences required)

1. Use the following Leslie Matrix and initial population ($N_0=12$) to figure out the population at time $t=1$ (i.e., 1 time step into the future you will get N_1). Show your work.

$$\begin{bmatrix} 2 & 4 & 10 \\ 0.5 & 0 & 0 \\ 0 & 0.1 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 10 \\ 2 \end{bmatrix} = \begin{bmatrix} 0+40+20 \\ 0+0+0 \\ 0+1+0 \end{bmatrix} = \begin{bmatrix} 60 \\ 0 \\ 1 \end{bmatrix} \text{ pop} = 60+1 = 61$$

2. Describe five factors affecting human birth rates that differ between a developed European country like Sweden and a developing African country like Nigeria.

There are a number of factors that affect birth rate. Opportunities for women such as employment and social services which are usually available in countries like Sweden will lower the birth rate, while in Nigeria, they will not be available. Average age at first birth for the mother is high in Sweden, young in Nigeria. The need for children in the labor force (not needed in Sweden, yes in Nigeria). Finally, the infant mortality rate which is dependent on health care etc. affects the birth rate.

3. Draw a linear representation of species-area relationships as described by Alona Bachi in lecture. Be sure to label your axes. What is important about this relationship in the context of conservation biology?



This shows that with increased land area, there is an increase in the # of species present. For cons. bio. efforts, this indicates that large tracts of land needs to be preserved to maintain biodiversity. Also, having corridors to connect reserves can accomplish this.

4. Explain how, in the context of environmental biology, it might be wise to think hierarchically about recycling, reduction, and reuse as well as about reconciliation, reserve, and restoration ecology.

1) reduction
2) reuse
3) recycle } With this hierarchy, greater emphasis is placed on measures that help reduce overall consumption of matter, while lesser efforts are good but to a certain degree due to the amount of energy wasted in order to get the job done, as in recycling.

1) reserve
2) restoration
3) reconciliation } This is a similar hierarchy, because it relies on the ecosystems to maintain themselves if they are preserved rather than us having to fix or create ecosystems.
These hierarchies indicate the ease in doing what is environmentally sound.

5. Write (and answer) one question from THIS WEEK'S PAIR OF LECTURES that you think your instructors would feel is challenging, fair, and worth 5 points.

What is the problem with land ownership and indigenous peoples and how does this have an effect on the environment?

Because locals do not own the land, according to their government they can easily be displaced by development and sent away. They are then forced into small and confining areas with others where they must exploit the resources beyond sustainability to survive, while their homelands are destroyed by roads, logging, etc.