

N=41 in class

YOUR NAME: KEY your TA's name: _____
Environmental Biology 206 EXAM III 20 April 2005 (exam worth 100 points)

True or False (write 'true' or 'false'; 6 points total; 1 point each)

1. T In the western U.S., the majority of freshwater used is for irrigating agricultural fields.
2. T The U.S. has the highest per capita water-use rate in the world.
3. T It takes more than 1,000 gallons of water to produce one kilogram of beef in the U.S.
4. T The Shannon Diversity Index is used to compare species richness and evenness across study sites.
5. T The poles are heating at a faster rate than the rest of the planet.
6. T About 98.5% of the solid waste produced in the U.S. is industrial solid waste (ISW).

Multiple Choice (questions have only one correct answer; 12 points total; 2 points each)

1. A rain shadow is when
 - a) it rains but the sun is shining.
 - b) it snows but it should be raining.
 - c) prevailing winds push air up and over a mountain range leaving precipitation on the windward side, leading to dry air on the other, leeward side.
 - d) it rains and is cloudy but you wish it was sunny.
 - e) you stand under an umbrella.
2. The leading cause of death in the world is:
 - a) jumbo jet crashes
 - b) poverty and malnutrition
 - c) tobacco use
 - d) automobile accidents
 - e) malaria and AIDS
3. About 50% of the calories consumed by humans comes from:
 - a) Wheat
 - b) Rice
 - c) Corn
 - d) All of the above
 - e) None of the above
4. The ratio of fossil fuel energy inputs to food energy outputs for industrialized agriculture in the U.S. is closest to:
 - a) 1:1
 - b) 2:1
 - c) 5:1
 - d) 10:1
 - e) 20:1
5. The percentage of large predatory fish left in the ocean (today compared to ~1920) is estimated to be about:
 - a) 10%
 - b) 20%
 - c) 30%
 - d) 50%
 - e) 70%
6. As mentioned by Susanne Hinrichs in her lecture, POP is an acronym for
 - a) Polluting organic people
 - b) Persistent organic pollutant
 - c) Pesticide or pollutant
 - d) People over pesticides
 - e) None of the above

KEY
18

Fill in the Blank (2 points per blank; 14 points total)

1. What day of the year has the highest flow rate through wastewater treatment plants in the United States?
super bowl in late January Sunday
2. Biologists at Saguaro National Park often use infrared triggered remote cameras to document the presence of large mammal species. *Fecal Matter / Hair snats*
3. List three sources of data that scientists use to reconstruct prehistoric climate (e.g., before we had thermometers and fancy CO₂ detectors).
1. tree rings
 2. *ice cores* *stalactites/stalagmites* *fossils*
 3. *sediment deposits* *pack rat middens*
4. Los Reales landfill, like other landfills, produces methane *(CH₄)* gas that is captured and either burned immediately or used to produce electricity.
5. The incidental marine organisms caught and killed in pursuit of one marketable species is known as bycatch.
- ~~6.~~ According to Alana Levine, the 4 Rs are reduce, reuse, recycle, and repurchase.

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

1. Why does the Los Reales landfill separate yard waste from other trash?

Yard waste can be composted + reused; otherwise takes up space + increases methane production

2. Why are the aeration tanks at Sweetwater Wetland more likely to be used in winter than in summer?

*bacterial activity is higher when T is higher, so they don't need the help that aeration provides
cold water has more O₂*

3. Don Swann talked about threats to leopard frog populations around Tucson. How did he suggest that recent habitat loss and fire ecology are related?

Firesuppression led to build up of fuels which led to stand destroying fires when they finally did burn. The loss of vegetation led to lots of erosion which caused sediment to fill the pools where leopard frogs are typically found. Ash.

4. From the points of view of both conservation and population biology, how does the idea of a metapopulation fit into the above leopard frog example?

A metapopulation is a group of smaller populations wherein occasionally one or two go extinct and are then recolonized from adjacent populations. If there are no adjacent populations, or if there is no connectivity, then the larger metapopulation may go extinct.

5. Proponents of genetically modified organisms (GMOs) often argue that humans have been genetically modifying crops and livestock for thousands of years. Do you agree with this argument? Why or why not?

open, but the idea is that selective breeding is much different than moving individual genes from one taxa to another using sophisticated microbiology + genetic transfer techniques.

6. Describe one lifestyle change that Susanne Hinrichs discussed in lecture on Monday 18 April 2005 that you think you will also pursue for yourself. If you don't plan to pursue a lifestyle change explain why.

open

7. What is a pseudoestrogen and why are they important in environmental biology?

Pseudoestrogens and other hormone mimics can influence and alter the normal development of animals, leading to incomplete gonad development or hermaphroditism. Pseudoestrogens are found in pesticides, cleaning products, plastics, etc.

8. How are ozone molecules depleted in the stratosphere? What are the implications for life on earth?

When chlorofluorocarbons are released into the atmosphere they make their way to the stratosphere, degrade, and then the Cl molecule catalyzes the breakdown of O_3 . Ozone is important in the stratosphere for reducing the amount of damaging UV radiation that makes it to the earth and can damage DNA leading to skin cancer etc.

9. A Chinese proverb states: "To protect your rivers, protect your mountains." What does this mean?

It's all about watersheds!
Pollution, flooding, siltation, aquifer recharge, etc.

10. How are dead zones in marine or freshwater ecosystems related to industrial food production and modern lawn care?

Huge inputs of fertilizers w/ extra P, N, K are responsible for adding these limiting nutrients to aquatic ecosystems where they trigger algal blooms, when these algae die + are decomposed the O_2 content of the water drops and can kill off fish communities.

11. Does a switch to dolphin-safe fishing practices for tuna impact other marine organisms? Why or why not?

Data presented by Katima Margin suggest that dolphin safer practices end up killing lots of turtles, thousands and thousands of sharks, and other marine life. Ends up being a trade-off, not a real environmental solution.

1/21

Short Answer (35 points total; 5 points each; a few sentences required)

1. Which of the following would have the highest species diversity: a mature forest where fire has been suppressed for 100 years, a mature forest that burns about once every 10 years, or a pine grove owned by a paper mill? Why?

intermediate disturbance hypothesis

2. If you wanted to perform a statistical test on data collected for the previous question, what would be your alternative and null hypotheses?

H_A : Not all equal spp diversity across the 3 scenarios.

H_0 : All three scenarios have same spp diversity

(could test with χ^2)

3. Global warming is a potential threat to the Sky Island ecosystems in this area. What is a Sky Island and why are they threatened by global warming?

islands of relictual / cooler + wetter habitats atop mountains separated by sea of hot, dry desert. If global warming Δ s temp + precip on mts these habitat types may disappear if the mountain isn't tall enough for ranges to shift up.

4. Discuss two pros and two cons of pesticide use. Relevant examples to support your arguments will help you gain full credit on this question.

Pros

↑ yields in short term
prevent human illness
companies profit

Cons

pollution
resistance
cost
health effects

5. How does mercury typically get into our bodies and how is the concept of food webs relevant? What types of effects does mercury have on humans?

Mercury typically gets in our bodies through our diet. Pollution from burning coal, etc. will end up in streams, rivers, and oceans where it is integrated into the base of the food chain. As the tissues + energy @ the base of the food chain move up trophic levels bioaccumulation/biomagnification mean that if we eat predatory fish we are eating very high levels of mercury. Mercury at high levels can harm adults, but the more insidious threat is to the nervous systems and brains of developing fetuses.

6. Describe three ways that dams and reservoirs impact natural lotic ecosystems and the organisms that rely on them.

- Water temp ↓, especially when released @ bottom of dam (= flowing)
- Water still so fish have to swim downstream instead of side current.
- As flood regime and deposit of rich silt
- habitat for alien species.
- etc.

7. Write (and answer) one question from Rob Robichaux's lecture on Hawaiian Silverswords that you think your instructors would feel is challenging, fair, and worth 5 points.

Open

EXTRA CREDIT:

Worth 5 points. If you were in lecture on Monday 18 April 2005 you heard about the extra credit opportunity. Turn in a one-page (double-spaced) write-up by 0900h Monday 25 April 2005 if interested in getting this extra credit.

2100h Wed 20 April 2005 PBS

"Strange Days on Planet Earth"

KES/15

9:47 98

YOUR NAME: [redacted] your TA's name: Nat'l Herron
Environmental Biology 206 EXAM III 20 April 2005 (exam worth 100 points)

we should just use yours as the key.

True or False (write 'true' or 'false'; 6 points total; 1 point each)

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16/18

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Super Bowl Sunday
2. Biologists at Saguaro National Park often use cameras to document the presence of large mammal species.
3. List three sources of data that scientists use to reconstruct prehistoric climate (e.g., before we had thermometers and fancy CO₂ detectors).
 1. tree rings
 2. ice cores
 3. ocean/sediments
stream/lake/etc
4. Los Reales landfill, like other landfills, produces methane gas that is captured and either burned immediately or used to produce electricity.
5. The incidental marine organisms caught and killed in pursuit of one marketable species is known as bycatch.
6. According to Alana Levine, the 4 Rs are reduce, reuse, recycle, and repurchase.

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

1. Why does the Los Reales landfill separate yard waste from other trash?
For composting, organic waste can be used as fertilizer, etc.
2. Why are the aeration tanks at Sweetwater Wetland more likely to be used in winter than in summer?
Stimulate bacterial growth with O₂, which is inhibited by cold weather.
3. Don Swann talked about threats to leopard frog populations around Tucson. How did he suggest that recent habitat loss and fire ecology are related?
Fire reduces trees, trees had prevented erosion, erosion leads to sediment buildup in previous wet areas where these frogs had lived - destroying their habitats. Big fires due to years of suppression.
4. From the points of view of both conservation and population biology, how does the idea of a metapopulation fit into the above leopard frog example?
Metapopulation includes smaller populations that are linked and populate between occasionally. When some of these smaller ones are lost, makes travel between more difficult, isolating them and loss of genetic diversity.

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26

5. Proponents of genetically modified organisms (GMOs) often argue that humans have been genetically modifying crops and livestock for thousands of years. Do you agree with this argument? Why or why not?

Disagree, we have been selectively breeding for existing traits but not introducing alien or foreign gene sequences into these GMO's as is now being done. This is a new invention.

6. Describe one lifestyle change that Susanne Hinrichs discussed in lecture on Monday 18 April 2005 that you think you will also pursue for yourself. If you don't plan to pursue a lifestyle change explain why.

Changing cleaning product ~~regimen~~ choices to safer ones, such as citrus and vinegar based rather than chlorine bleach based.

7. What is a pseudoestrogen and why are they important in environmental biology?

These are ~~endroen~~ endocrine disruptors that affect our hormonal system and lead to the feminization of male organisms. They have possible disastrous health affects including cancer and decreased fertility in native wildlife populations.

8. How are ozone molecules depleted in the stratosphere? What are the implications for life on earth?

CFCs that are human produced react with O_3 and change it. O_3 is responsible for absorbing UV light, but w/o it UV can come to the surface, leading to possible mutations in organisms and other health problems.

9. A Chinese proverb states: "To protect your rivers, protect your mountains." What does this mean?

To keep rivers clean, safe, & protected, it is necessary to prevent erosion which occurs on mountains/watersheds. This would involve keeping biomass in place, etc. These cycles are all connected.

10. How are dead zones in marine or freshwater ecosystems related to industrial food production and modern lawn care?

Fertilizers and chemicals high in nitrogen and phosphorus get into water, produce algal blooms, reduce oxygen, and thus kill fish and other wildlife populations, creating a dead zone.

11. Does a switch to dolphin-safe fishing practices for tuna impact other marine organisms? Why or why not?

Yes, when the catching methods are changed, this usually leads to other marine animals being killed, such as more sharks, turtles, etc, usually in similar or higher #s.

Short Answer (35 points total; 5 points each; a few sentences required)

1. Which of the following would have the highest species diversity: a mature forest where fire has been suppressed for 100 years, a mature forest that burns about once every 10 years, or a pine grove owned by a paper mill? Why? 5

A mature forest that burns every 10 years is an example of intermediate disturbance, an area of high diversity. The pine grove would be a monoculture, virtually no diversity and the suppressed region would not have disturbances that would allow for niche filling by a broad array of species. The mature forest would have the greatest diversity because lots of different species would be able to enter in and would not be outcompeted in a ten year time span, leaving the diversity in place.

2. If you wanted to perform a statistical test on data collected for the previous question, what would be your alternative and null hypotheses? 5

$$H_0: \mu_{\text{paper mill}} = \mu_{\text{mature}} (= \mu_{\text{suppressed}})$$

$$H_a: \mu_{\text{mature}} > \mu_{\text{paper mill}} \quad \text{or} \quad \mu_{\text{mature}} > \mu_{\text{paper mill}}$$

$$\text{or } \mu_{\text{mature}} \neq \mu_{\text{paper mill}} (\neq \mu_{\text{suppressed}})$$

just one, please!

3. Global warming is a potential threat to the Sky Island ecosystems in this area. What is a Sky Island and why are they threatened by global warming? 5

Sky Island indicates a mountainous area, or region of them, that is/are cut off from other areas by distance and elevation changes. Travel between these regions may be difficult for some organisms and endemic species may arise. Global warming would effectively shrink the size of these islands as biomes retreat further up the mountains, making species dispersal ever more difficult.

4. Discuss two pros and two cons of pesticide use. Relevant examples to support your arguments will help you gain full credit on this question. 5

DDT →  a gold star for Rachel Carson

pros

- 1) kills mosquitoes, stops malaria
- 2) allows for increased crop production

cons

- 1) persistent in the environ. bioaccumulates, large predators eagle egg shells break
- 2) results in decreased 20% diversity, monocultures / 20

5. How does mercury typically get into our bodies and how is the concept of food webs relevant? What types of effects does mercury have on humans? 5

We get mercury in our bodies from canned tuna. This is an example of magnification and bioaccumulation. Large predators such as tuna end up with these high levels of toxins because each layer of a food web has increased amounts of mercury from eating lower contaminated levels. This is then stored in body fats. We then get a lot of mercury in us from eating tuna. It has possible neurological effects on humans and can lead to defects in fetuses.

6. Describe three ways that dams and reservoirs impact natural lotic ecosystems and the organisms that rely on them. 5

- 1) Creates huge reservoirs that are no longer lotic but lentic, making travel across difficult for organisms, and also blocks upstream travel such as in salmon.
- 2) Lowers the water temperature and reduces turbidity, can have hugely disastrous effect on native populations.
- 3) Effectively stops flooding, reducing sediments reaching once-fertile floodplains, lowering soil productivity.

7. Write (and answer) one question from Rob Robichaux's lecture on Hawaiian Silverswords that you think your instructors would feel is challenging, fair, and worth 5 points. 5

Why is it important to have cross pollination among many different maternal and paternal lines in Silverswords?

When repopulating, especially from such a small number of existing organisms, it is important to get as much genetic diversity as possible, so that the population is variable and resistant to change. Therefore multiple crossings with many individuals will lead to increased diversity in the seedlings and hopefully produce a population that is diverse and can then be viable in the future.

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