BIOL 303, Ecology

Study guide for Exam1, Spring 2011

1. The sun is so far from the earth that its energy strikes the earth as waves that are essentially parallel. Given this, why is the equator warmer than the poles? There are two mechanisms involved.
2. Explain Hadley cells. Why do they exist? How do they create the observed global patterns of wind along the North-South axis? How does this produce the observed global distribution of wet and dry climates along the North-South axis?
3. Given the global patterns of North-South winds from the previous question, what explains the observed global patterns of wind along the East-West axis.
4. What explains seasonal variation in the basic patterns of climate discussed above?
5. Why are some gasses, such as methane (CH_4), carbon dioxide (CO_2) and water (H_20) greenhouse gasses, while others are not (such as nitrogen, N_2, and oxygen, O_2)?
6. What is the current atmospheric concentration of $C0_2$? How does this compare to measurements of past CO_2 from ice cores? From direct measurements like the 'Keeling curve'? What time scales do these data sets cover?
7. What is 'hindcasting'? How is it used to evaluate climate change models (Global Circulation Models or GCMS)? What do hindcasting results suggest about natural and human-caused (anthropogenic) effects on climate since the industrial revolution?
8. Examine the overhead that we discussed in class that shows the spectrum of energy emitted from earth back to space, for three scenarios: no CO2, CO2 added, and after global temperature responds to the addition of CO2. Understand this figure **thoroughly,** because it is the basic explanation of how greenhouse gasses cause climate change.
9. What are some of the observed ecological responses to climate change? What is meant by a 'globally coherent fingerprint' of ecological responses to climate change?
10. Define evolution. Understand each of the evolutionary forces. Understand the distinction between adaptive evolution and other types. Understand the distinction between convergent (analogous traits) and divergent evolution (homologous traits).
11. Review the Generation X model of evolutionary responses to variation in population size, natural selection, and dispersal among populations. How does the population evolve in response to each of these (think about the mean and variance of allele frequency). Understand what each type of output plot from the model shows.
12. Understand the distinctions between directional, stabilizing and disruptive selection. How does each one affect the mean and variance of the frequency distribution for the phenotypic trait being considered? Understand the examples we discussed in class, for example Andersson's study of tail length in widow birds, or changes in body size and growth rate of salmon in response to selective harvesting.
13. What is heritability? Understand the two methods to measure heritability (parent-offspring regression, and selection-response experiments).
14. Understand what is measured by each of the major variables in a demographic life table. There will be some questions that require you to complete parts of a table: you should be prepared to calculate numeric values for l_x, s_x, l_xm_x, R_0 & gross reproductive rate for a table with nice round numbers (so no calculator is needed). For variables that are more complex to calculate, I expect you to understand their definitions and their use, but will not ask you calculate numeric values

(generation time, intrinsic rate of increase, reproductive value, residual reproductive value, life expectancy).

15. What is the relationship between the two measures of population growth R_0 and r?
16. What is reproductive value? Residual reproductive value? How can a plot of residual reproductive value vs current reproductive effort (fecundity) be used to examine reproductive strategies (iteroparity vs semelparity).
17. Explain the simple graphical model of offspring quality vs offspring quantity.

Here is an example question:

CO_2 is a greenhouse gas, but nitrogen (N_2) is not. Why?

a. N_2 is better at absorbing outgoing infrared energy from the earth to space
b. N_2 is better at absorbing incoming solar radiation
c. CO_2 is better at absorbing outgoing infrared energy from the earth to space
d. CO_2 is better at absorbing incoming solar radiation
e. Both c & d are correct

(The answer is 'c').

There will be questions that include graphs, asking you to interpret them.