

1. Diagram and explain the major carbon pools and fluxes in the natural global carbon cycle. Explain the additional influence of anthropogenic CO₂ emissions. Quantitatively, how much carbon is added to the atmosphere annually by human activities? How much is the atmospheric CO₂ pool increasing annually? What explains the difference? Quantitatively, what do these patterns suggest about the time over which atmospheric CO₂ will double with 'business as usual'?
2. Explain the greenhouse effect of atmospheric CO₂, including a graphical explanation that shows how an increase in atmospheric CO₂ affects outgoing energy from the earth, and how this drives an increase in temperature. What about this is affected by the 'lapse rate' (the temperature gradient from the Earth's surface to the tropopause)? What about this is affected by 'band saturation' within the set of wavelengths absorbed by CO₂?
3. Explain two feedback loops (such as the effect of changes in albedo) that affect the magnitude of climate change.
4. List and briefly explain (with examples if possible) three primary ecological responses to climate change and two secondary responses that arise from the primary responses.
5. Describe two empirical results from class and/or the reading that quantify recent changes in phenology. Include a description of the methods used for at least one example. What is 'phenological mismatch' and why is it a conservation concern?
6. Describe, including a description of the methods used, the way in which Reusch et al. used climate envelope modelling to predict ecological responses of three trout species to climate change.
7. Describe and explain the results of Burkle et al.'s study of changes over a period of 120 years in plant-pollinator interactions.
8. Graphically, algebraically and verbally explain how a least-squares regression line is fit by minimizing the sum of the squared residuals. What must you consider when choosing whether to use ordinary least squares regression (with the `lm()` function in R) or a generalized linear model (with the `glm()` function)? Understand how to interpret the output from an R summary for a regression model.