Key to Quiz Questions—Week 4

Forests Through Time and Space, W05

1. *The two readings for Wed, Jan 25 (Beedlow et al and "Carbon sequestration") take opposing views of the influence of rising carbon dioxide levels on the rates and levels of carbon sequestration in the world's forests. They both use peer-reviewed references. Which of these papers do you find more compelling? Why? Be specific and compare and contrast statements/ evidence from both, followed by your assessment of the validity of the arguments. Develop your thoughts and demonstrate critical analysis of the positions.* *(20 pts)*

To receive full credit for this question, you needed to address all the aspects of the question: 1. take a position and supporting your position by, 2. comparing and contrasting statement from both, and 3. assessing the validity of the arguments based on your knowledge. This is one possible sample answer.

Beedlow is more compelling for a variety of reasons. To begin with, Beedlow is a peer-reviewed paper on its own, while the CO_2 science paper uses peer-reviewed references, it was not published in a peer-reviewed journal. A comparison of the references used by both papers reveals very little overlap (two papers). In general, Beedlow represents the uncertainty inherent in the scientific process and presents both supporting and contrary results, while CO_2 science presents only the data that "supports" their point of view and presents it as though it were absolute.

Some specific comparisons between the two follow. CO_2 science uses Pregitzer's results on CO_2 increasing fine root biomass to support the idea that increase sequestration will happen, while Beedlow points out that fine roots turnover every year, the MRT is too short for sequestration. Most of the papers cited in CO_2 science to support the increase in photosynthesis with increasing CO_2 levels are growth chamber studies. Beedlow cites several *in situ* studies (in the out-of-doors) that didn't find long-term increases in growth rate due to higher CO_2 levels. Many greenhouse experiments are carefully controlled experiments, whereas we know that increasing CO_2 will carry with it several additional changes, which Beedlow et al addresses, but CO_2 science doesn't.

CO_2 science asserts that in areas where N limits forest growth, pollution will supply increased N, thereby increasing growth and sequestration. Beedlow analyzes this situation more thoroughly and points out that "In areas where N is deficient (limiting), C sequestration is not likely to increase with rising levels of CO_2." That is, only in the NE, upper midwest, and PNW, where there is ample N in the soils, is there much chance at all that C is limiting growth. If C isn't limiting growth, then increasing CO_2 levels won't increase growth. (p318 and fig 4). In addition, pollution from fertilizers could increase N-compounds in soil, potentially increasing growth (as asserted by CO_2 science). But many N-compounds bind with micronutrient molecules in the soil (e.g. calcium and magnesium), thus reducing their concentration, potentially making them the limiting nutrients where they were once in abundance. So adding N through fertilizer runoff has other potentially cascading effects. (top of p319). In addition, pollution has numerous effects that could impact tree growth which Beedlow examines and CO_2 science ignores. For example, there is a positive feedback caused by ozone. ozone created by warmer temps, ozone prevalence in atmosphere then creates warmer world, etc. Presence of ozone reduces ability of trees to use CO_2—reduces both C sequestration by trees, and by soils (p319)

There were a number of logical flaws in the CO_2 science paper. There was a huge logical leap by asserting that increased photosynthesis in needles equals increased sequestration. Reducing respiration rates means that plants are metabolizing more slowly, hence growing more slowly…which will slow sequestration, not increase it (as asserted in the fifth paragraph).