

**ESYS 10: Introduction to Environmental Systems**  
**Winter 2008**  
**Problem Set #2 (Week #4)**

(This is an adaptation of problem 1 from Chapter 16 in your textbook).

**1. a.** The present atmosphere contains approximately 700 Gton(C) in the form of CO<sub>2</sub>. Earth's total recoverable fossil fuel reserves contain at least 4200 Gton(C), mostly in the form of coal. (We shall use the value 4200 Gton(C) to be specific.) At present, about half the CO<sub>2</sub> produced by the burning of fossil fuels stays in the atmosphere. The other half dissolves in the oceans or is taken up by the terrestrial biosphere. If this ratio remained constant and we burned up all of our fossil fuels instantaneously, by how much would atmospheric CO<sub>2</sub> concentrations rise? (Express your answer in terms of the new CO<sub>2</sub> level divided by the old one.)

**b.** The actual problem of global warming could be more severe than we have just calculated. Forests and soils together contain an additional 2100 Gton(C) of carbon that might go into the atmosphere if deforestation is not prevented. The ocean becomes more acidic as it absorbs CO<sub>2</sub>, so it might not be able to continue taking up as much CO<sub>2</sub> as it has been until now. If we burned up all our fossil fuels and deforested one-third of the globe without losing any CO<sub>2</sub> to the ocean (or to CO<sub>2</sub> fertilization) by how much would atmospheric CO<sub>2</sub> increase?

**c.** Several leading candidates for U.S. President have proposed reducing the U.S. emissions of carbon dioxide by 80% of their present level by the year 2050. If there are no other changes to global emissions, calculate the effect that enacting these measures would have on the atmospheric CO<sub>2</sub> level in 2050.

Assume that global emissions reach 8 Gton(C) per year by the end of 2008. Also assume that the ocean will take up a constant 2 Gton(C) per year and that the net effect of the terrestrial biosphere is zero (deforestation and uptake by "regrowth" cancel each other out). The U.S. presently accounts for about 25% of all fossil fuel emissions worldwide.