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12.085 Seminar in Environmental Science
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Homework #1

Keith (2000) gave a good overview of the history of climate/geoengineering. I was most interested in the section on fertilizing the oceans. In theory, the idea seems perfect: iron is a major limiting nutrient in the oceans, and its ratio with carbon is 1:10,000 in the deep oceans. So the addition of extra iron would be very effective in burying extra carbon in the short term (Keith, 2000). The idea has already gone beyond theory: small scale experiments have been conducted in the open ocean and scientists have noted increased phytoplankton activity over a period of days or weeks. Several commercial companies have expressed interest in conducting larger demonstration projects; the companies are largely drawn by the potential to use ocean fertilization as global carbon credits (Chisolm et al., 2001).

Chisolm et al. (2001) argues strongly against using ocean fertilization for carbon credits. The article is clearly biased and mentions only the negative consequences, but I think its most compelling argument is that we can't predict the long-term consequences of large-scale ocean fertilization. There are researchers who spend their lives modeling plankton and bacteria behavior; we simply don't know what will happen if we perturb the ocean's biogeochemical cycles. One serious side effect is the deoxygenation of the deep oceans, which would kill off many organisms including fish. Some proponents believe Fe fertilization will help the fishing industry (Keith, 2000), but eutrophication would do the opposite. Another possible consequence is the increase of organisms that release CH₄ or NO₂. Both are greenhouse gases that warm the atmosphere more effectively than CO₂, so

ocean fertilization could actually increase global warming. Lastly, there is the danger that financial incentives will outweigh the science. If ocean fertilization becomes commercially profitable for carbon credits, everyone will want to try it, regardless of the environmental consequences (Chisolm et al., 2000). Just like global warming, ocean fertilization could turn into a situation where science has little power over economic forces.

References:

Chisolm, S.W. et al. (2001), Oceans: Dis-Crediting Ocean Fertilization, *Science* 294:5541, 309-310.

Keith, D. (2000), Geoengineering the Climate: History and Prospect, *Annu. Rev. Energy Environ.* 2000. 25:245–84.