

MIT OpenCourseWare
<http://ocw.mit.edu>

12.085 Seminar in Environmental Science
Spring 2008

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.

Week 7

For this week's readings, I started with reading a couple more contributions to the special publication that I read articles from for last week, the Soil Science Society of America's special publication *Soil Carbon Sequestration and the Greenhouse Effect*. The first article I read was by Lal, and it dealt with what happens to the carbon in the soil which is eroded. The essence of the conclusion was that we don't really know enough about that aspect yet. However, it discussed the process which soil goes through as it is eroded, and what the suspected effect on the organic carbon is at each stage. There is significant erosion of the organic portion of soil when land is transitioned from the natural environment to cropland. The first stage of erosion is breakup of soil aggregates by kinetic movement by wind or water. Soil aggregates are composed of clay, organic matter, and polyvalent cations. The next step is transport of detached and entrained particles by fluids, and finally deposition of the material in the new locations. There are three main places where the eroded material can end up. It can end up being redistributed over the land surface, which leads to decomposition of organic matter, and probably a net emission of carbon, estimated at 1.14 PgC/yr. The carbon that is transported by rivers is not well understood, but it is thought that this ends up decomposing as well, one estimate is that European rivers emit 30-60 TgC/yr, 5-10% of Europe's total carbon emissions. Soils can also end up being buried in depressions, which is thought to enhance aggregation and storage, it is estimated that 0.57-1 PgC/yr is stored this way. However if

conditions are anerobic, burial can lead to the production of methane and the realease of N₂O.

The second article I read from the SSSA volume was by Schuman et al, and it was called “Carbon Dynamics and Sequestration of Mixed-Grass Praries as Influenced by Grazing”. This article was fairly dense, and I did not read the whole thing, but the general goal was to study whether lands used for grazing effected the carbon sequestration in comparison with regular grassland. Their conclusion was that the use as rangeland did change some characteristics of the soil and where the carbon was stored, but it generally did not affect the overall sequestration, so rangelands could be used for carbon sequestration by changing other practices.

The final article I read was by De Deyn et al (2008) entitled “Plant Functional Traits and Soil Carbon Sequestration in Contrasting Biomes”. It discussed the effects that plants have on soil carbon sequestration. They showed that different traits are more valuable for increasing soil sequestration depending on the biome in which the plant resides. They bring up the issue that rapidly changing climate could change the biome in a specific location, and have effects on the carbon stored in these ecosystems. There are two methods of enhancing carbon storage, first by fast input through high primary productivity, and second by slow output by slow decomposition. De Deyn et al. find that in ecosystems where soil nutrients are the limiting factor, slow growth and long litter residence time tend to dominate, while in rich-soil ecosystem where light is the limiting factor the opposite is true. They end the article with a list of seven areas for further research. I thought this aspect was interesting because it shows how complicated soil sequestration is, and that it is still not very well understood.

References:

- De Deyn, Gerlinde B., Johannes H. C. Cornelissen, Richard D. Bardgett. 2008. Plant functional traits and soil carbon sequestration in contrasting biomes. *Ecology Letters*. 11:xxx-xxx.
- Lal, R. 2001. Fate of eroded soil carbon: emission or sequestration. In *Soil Carbon Sequestration and the Greenhouse Effect* ed. by Rattan Lal. SSSA Special Publication number 57.
- Schuman, G. E., D. E. LeCain, J. D. Reeder, J.A. Morgan. 2001. Carbon Dynamics and Sequestration of a Mixed-Grass Prairie as Influenced by Grazing. In *Soil Carbon Sequestration and the Greenhouse Effect* ed. by Rattan Lal. SSSA Special Publication number 57.