Workshop Report: Regulation of Organic Matter Preservation in Soils and Sediments
All Scientists Meeting, August 1-11, 2000, Snowbird, Utah

This workshop was moderated by James Morris (PIE) and attended by a diverse group of LTER and ILTER scientists and students (list appended). Wide participation in the workshop by representatives from PIE, VCR, GCE, FCE, SBC, ARC, KBS, and NTL stemmed from a shared interest in the regulation of organic matter (OM) accumulation and preservation in wetland sediments. Wetlands, including arctic tundra and boreal forest, display radically different tendencies to preserve sediment organic matter. There are also great differences in soil organic content, ranging from systems dominated by mineral soils and sediments to those characterized as peat. Trends in organic content along latitudinal gradients, suggest control by temperature. This was demonstrated by data presented at the workshop by Chris Craft (GCE). However, there are exceptions to this trend and many unanswered questions that warrant further examination. Temperature control of decomposition rate per se may not explain differences in organic matter accumulation and preservation.

Organic matter accumulation and the fraction of production preserved in soils and sediments results from a balance among influx, primary production, net export, and respiration. Numerous factors influence this balance including temperature, quantity and chemical composition of the OM, hydrology, pH, redox potential, nutrient availability, presence of alternate electron acceptors, sedimentation rate, faunal activity, and physical properties of the soil/sediment matrix (e.g. bulk density, porosity, hydraulic conductivity) (Fig. 1). The consensus of the group was that within-site variation in organic matter accumulation is greatly influenced by variation in primary production, particularly belowground production. In contrast, between-site variation in organic matter accumulation is largely a consequence of variation in organic matter preservation. This characterization of organic matter as labile or refractory is a function of the chemical properties of the material and the physicochemical environment. Primary producers are not the primary synthesizers of the refractory organic compounds that are preserved in sediments. Much variation among sites is probably due to the poorly understood process of organic matter diagenesis or humification by which compounds synthesized by plants are converted in the sediment into stable end-products.

Our group plans to further investigate questions of soil organic matter preservation through a combination of workshops, data compilations, and comparative field and laboratory experimentation. We are planning an experiment that involves reciprocal transplants of sediment cores in combination with a controlled laboratory study. A time-series of common measurements will be made at all sites. These likely will include CO_2 and CH_4 flux (and possibly O_2 consumption), DOC, chemical composition of organic matter, and root ingrowth into cores-depending on the design of the cores. Some measurements, like biogenic gas flux, will be done by a traveling technician, while others (pyrolysis-GCMS analysis of organic matter) will be done by a single lab. Preliminary data were identified that are necessary to characterize participating sites. These included the range of percent organic matter in sediments, the hydroperiod, sediment bulk density, total sediment CNP content and concentration, salinity, temperature, pH, primary productivity, and presence or absence of important detritivores, leaf shredders, etc. Jim Morris (PIE) volunteered to establish a web site with a discussion board and

where the background data necessary for designing an intersite comparison could be entered into a table.

Our plans are to request additional funding from the LTER Executive Office to fund a workshop for further comparison of existing data and to prepare a proposal for conducting the comparative research program. A subgroup will meet again on Sunday, 11 February, preceding the next ASLO meeting in Albuquerque to plan the next workshop. Mandy Joye (GCE) volunteered to contact the ASLO organizers to arrange for a room. Numerous details of the experimental design need to be decided before a proposal is crafted, and this will be the subject of a subsequent workshop where the objective will be to prepare the outline of an intersite proposal. Iris Anderson (VCR) volunteered to host such a workshop at VIMS.

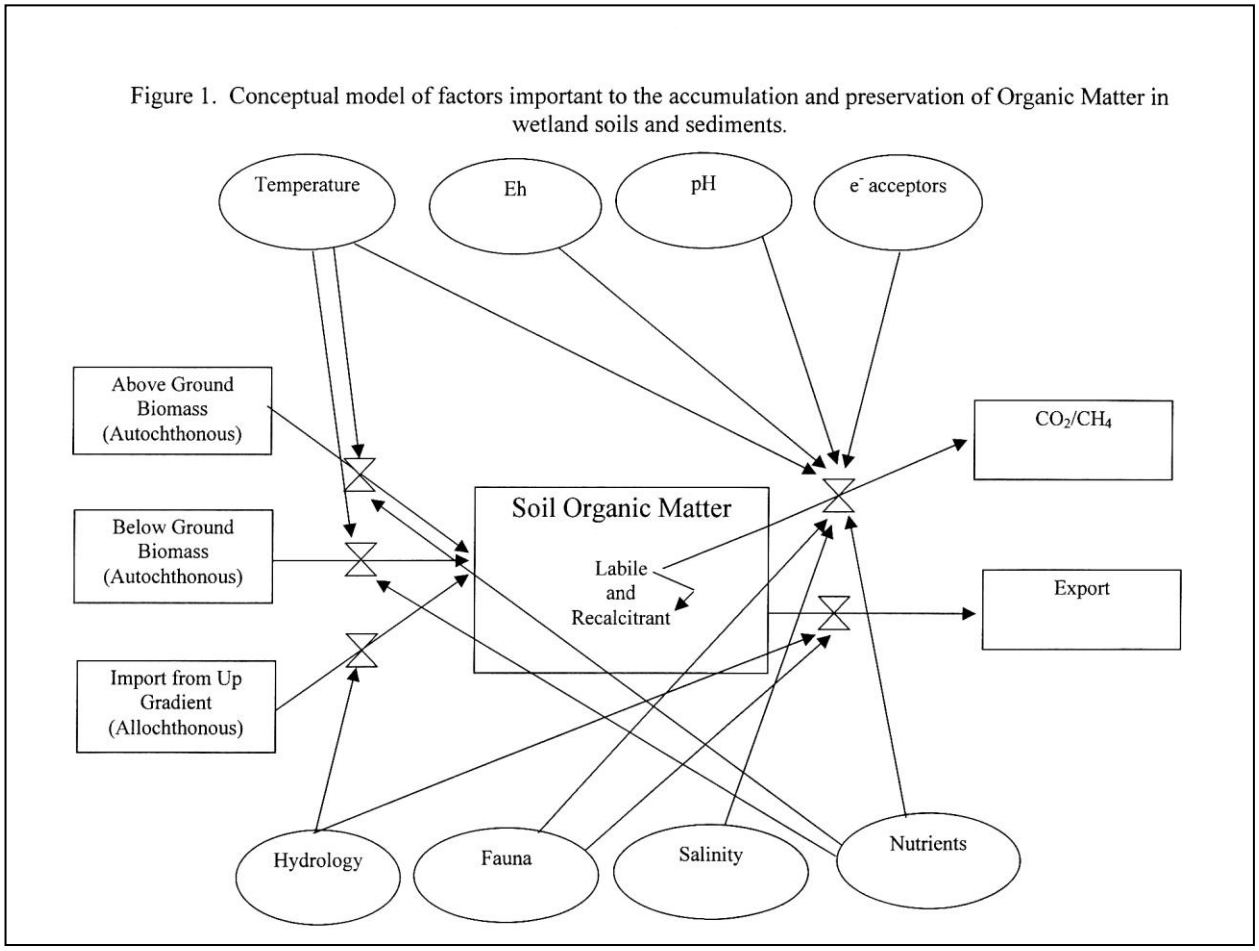

Figure 1. Conceptual model of factors important to the accumulation and preservation of Organic Matter in wetland soils and sediments.

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