SOIL, WATER, AND CLIMATE
MS DEFENSE SEMINAR

Influence of non-native invasive earthworms on soil inorganic biogeochemical cycles: an example from a northern hardwood sugar maple forest in Minnesota

BY

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Friday, May 3, 2013
9:00 AM
S415 Soil Science Building

Abstract:

The hardwood forests of the Great Lakes Region have evolved without the presence of native earthworms since the Last Glacial Maximum but are now facing the invasion of exotic earthworms due to fishing, logging, and recreational activities. Exotic earthworms are known to increase soil mixing and dramatically alter soil morphology. However, how such a physical disturbance interferes with soil biogeochemical processes remains largely unknown. This study uses a geochemical mass balance model to examine the biogeochemical responses to exotic earthworms along an earthworm invasion chronosequence in a Northern Minnesota sugar maple forest. Fractional and absolute mass changes of biologically important elements such as Ca, P, K, Fe, and Si relative to the parent material are greatly altered by invasive earthworm species. In the relatively pristine soils with only litter dwelling epigeic species, Si as well as nutrient elements Ca, P, and K are greatly enriched in the A horizons. The subsequent invasion wave of epi-endogeic and epi-anecic earthworms results in further fractional and total mass enrichments by incorporating the leaf organic matter, into the shallow horizons. However, the arrival of endogeic earthworms, in the second invasion stage, dramatically reduces the level of elemental enrichments. The loss of elemental enrichment is likely derived from the loss of particulate organic matter due to endogeic consumption, which leads to the mineralization of Ca, P, K. The dramatic loss of enrichment also suggests that the newly released nutrients are in excess of the nutrient demand from understory plants. Our results indicate the significant and potentially negative impacts of invasive earthworms on the soil nutrient cycling and subsequently the sustainability of the hardwood forests in the Great Lakes Region.