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Ecological and geochemical impacts of exotic earthworm dispersal in forest ecosystems of Eastern Canada

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In Eastern Canada, native earthworm species did not survive the Wisconsin glaciation, which ended over 11,000 years ago. Accordingly, the 17 known Lumbricidae species in the province of Québec were introduced in recent centuries by European settlers. Given that natural migration rates are no more than 5–10 m yr^{-1}, exotic earthworm dispersal across the landscape is presumed to be mediated by human activities, although this assertion needs further validation. In agroecosystems, earthworms have traditionally been considered beneficial soil organisms that facilitate litter decomposition, increase nutrient availability and improve soil structure. However, earthworm activities could also increase soil nutrient leaching and CO_2 emissions. Furthermore, in natural forest ecosystems, exotic earthworms may reduce organic forest floors provoking changes in watershed hydrology and loss of habitat for some faunal species. Over the past decade, studies have also suggested a negative effect of exotic earthworms on understory plant diversity, but the underlying mechanisms remain elusive. Finally, there are no studies to our knowledge that have tested the effects of Lumbricidae species on the production of N_2O (an important greenhouse gas) in forest ecosystems. We report on a series of field, greenhouse and laboratory studies on the human activities responsible for the dispersal of exotic earthworms, and on their ecological / geochemical impacts in natural forest ecosystems. Our results show: (1) Car tire treads and bait discarded by fishermen are important human vectors driving the dispersal of earthworms into northern temperate forests; (2) Exotic earthworms significantly modify soil physicochemical properties, nutrient cycling, microbial community structure and biomass; (3) Earthworm abundances in the field correlate with a decrease in understory plant diversity; (4) *Lumbricus terrestris*, an anecic earthworm species and favorite bait of fishermen, reduces seed germination and seedling survival of some temperate and boreal trees species; (5) The abundance of L. *terrestris* correlates with higher potential rates of N_2O production. Taken collectively, our data provide scientific evidence that earthworm dispersal mitigation strategies are required to conserve the ecological integrity of forest ecosystems in Eastern Canada.