TEMPERATURE AND EARTHWORM EFFECTS ON C AND N DYNAMICS IN OAK STANDS ALONG AN URBAN-RURAL LAND USE GRADIENT

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In previous studies of an urban-rural land use gradient in the New York City metropolitan area, urban forest soils had higher heavy metal concentrations, soil temperatures, and abundances of earthworms than rural soils, while rural soils had higher abundances of fungi. Leaf litter collected along the gradient had higher concentrations of lignin in urban than in rural stands. The effects of site (soil organisms, soil temperature) and substrate quality (lignin) on decomposition and N dynamics was tested by transplanting litter and soil between urban and rural stands. Rural derived litter decomposed more rapidly than urban derived litter regardless of site conditions and the urban sites exhibited higher decomposition rates regardless of litter type. In a laboratory experiment, initial lignin concentrations of leaf litter explained 50% of the variation measured in decomposition rate. Similar to the site effect on litter decomposition, net N mineralization rates were higher in urban than in rural stands regardless of soil type. Nitrification rates increased in urban stands; however, rate increases were only measured in urban soil cores. In contrast to litter decomposition rates, urban soil had higher N mineralization rates than rural soil, regardless of site conditions. An earthworm microcosm study was conducted to test whether earthworm activity explains the increased N transformation rate in the urban forest soils. N mineralization rates were significantly higher in urban soil with earthworms (0.15 mg N kg^{-1} d^{-1}) than in urban soil without earthworms. Rural soil with earthworms (0.57 mg kg^{-1} d^{-1}) had significantly higher rates than urban soil with earthworms and rural soil without earthworms (0.28 mg kg^{-1} d^{-1}). Net nitrification rates were 2 to 3 times higher in urban soil with earthworms than in the other treatments. These results suggest that earthworms may explain the relatively high N transformation rates in the urban stands despite the input of poorer quality litter.

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