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# Biogeochemical Controls on CH4, N2O and CO2 Fluxes from Deciduous and Boreal Forests Soils in Eastern Canada

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The exchange of the important trace gases, methane (CH4), nitrous oxide (N2O) and carbon dioxide (CO2), between forested soils and the atmosphere can show great temporal and spatial variability. We investigated the fluxes of CH4, N2O, and CO2 from deciduous and boreal forest soils in eastern Canada in 20 forest plots representative of different soil drainage classes, management schemes and natural disturbance from 2006 to 2008.Well-drained soils consumed atmospheric CH4, while poorly drained soils embedded in low-elevation depressions of the both boreal and deciduous forests were a source. CH4 fluxes could be predicted primarily by temperature and moisture, and tree cover exerted an influence mainly through the creation of large soil porosity, leading to increased consumption rates. In contrast, there were very poor relationships between N2O fluxes and environmental variables, reflecting the complex microbial, edpahic and N cycling processes, such as nitrification in well-drained soils and denitrification in poorly drained soils, which lead to N2O production (or consumption) in soils. At the broad temporal and spatial scale, however, soil C:N ratio was a good predictor of N2O emission rates, through its influence upon N cycling processes. Soil CO2 emission rates showed less spatial and temporal variability, and were controlled by temperature and moisture. Soil drainage class integrates many of the biogeochemical processes controlling the flux of these gases and provides a framework for extrapolating results spatially and identifying ‘hot spots’ and ‘hot moments’ and to account for the fluxes of poorly drained soils in the overall global warming potential of the different forest types at watershed scale.