

Fire and soil erosion in temperate and boreal forests: long-term sedimentological record in east Canada

Christopher Carcaillet ^{1,2}, Pierre J. H. Richard ², Hans Asnong ², Lidia Capece ²

1) Institut de Botanique, École Pratique des Hautes Études, 163 rue Broussonet, F-34090 Montpellier, France.

2) Département de Géographie, Université de Montréal, CP 6128 Centre-Ville, Montréal (Qc) H3C 3J7, Canada

Abstract

Among processes that increase the risk of erosion, fire also plays a role on the carbon dynamics toward the atmosphere by mineralisation of organic matter from aboveground biomass and soil.

Here we report long-term high-resolution sedimentological data from seven lakes located in temperate and boreal forests in east Canada (Ontario and Quebec). Fire activity is deduced from charcoal accumulation rate, and soil erosion process is inferred from inorganic sediment concentration and magnetic susceptibility. Sites from temperate mixed-deciduous forest display thin and dry humus layer, and sites from the closed-crown coniferous boreal forest show thick (>50 cm) humus layer. Temperate sites are highly susceptible to a total mineralisation of humus layer and then to soil erosion.

Results show no relationship between fire events and inorganic sediment concentration or magnetic susceptibility. Furthermore, the fire frequencies that have increased several times at each site during the Postglacial associated to changes in climate do not show any long-term increase in inorganic sediment concentration or magnetic susceptibility.

The total lack of relationship between fire activity and soil erosion proxies strongly suggests that soil from lake catchment areas were not eroded whatever the type of forest composition and structure, humus layer and fire frequency. We thus suggest that fire in mixed-deciduous temperate and coniferous boreal forests is not a significant process of soil erosion. Current global climatic change that modifies the fire regime would not affect the soil erosion in east Canada.

Keywords: Fire, Sedimentological data, Magnetic susceptibility, Soil erosion, Canada, Postglacial

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Contact Bulletin du RESEAU EROSION : beep@ird.fr