Ecological Controls on Carbon Dynamics in Fire-Disturbed Boreal Forests: Are Northern Soils a net Source of Carbon after Disturbance? (S05-oneill150029-Oral)

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Abstract:

Post-fire changes in the local energy balance and soil chemistry may significantly alter rates of carbon turnover in organic-rich boreal forest soils. This study combines field measurements of soil C exchange along a 140 yr age-sequence of burned black spruce stands with microbial incubation studies and moss cover/photosynthesis measurements to evaluate the ecological controls on these disturbance effects and the time scales over which they operate. During the first 140 years after disturbance, soil CO2 flux increased as a function of stand age at a mean rate of 0.12 Mg C ha/yr2 while organic soil horizons sequestered C at rates of 0.28 to 0.54 Mg C/ha/yr. Mass-balance models based on field and laboratory measurements suggest that temperature and moisture-mediated changes in root, microbial, and moss respiration caused these soils to function as a net source of carbon for 7-15 years before feedback mechanisms reestablished them as a net C sink. Estimated post-fire carbon releases were on the same order of magnitude as C losses during combustion itself and suggest that current models may underestimate the effect of fire on C emissions by a factor of two.

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