The whole-tree harvesting issue: How do harvesting methods compare with natural disturbances?

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An important tenet of the natural disturbance paradigm as a basis for Sustainable Forest Management (SFM) is that impacts of interventions fall within the range of natural variation observed for the natural disturbance in question. In the present study, we evaluate differences in soil nutrients, acid-base status, as well as tree nutrition between whole-tree harvesting, stem-only harvesting, and wildfire disturbances, and assess whether these harvesting methods have biogeochemical impacts that are within the natural range of variation caused by wildfires in boreal coniferous ecosystems of Quebec, Canada. Forest floor and upper podzolic B horizon samples were collected at sites that were disturbed 20 years ago either by wildfire, WTH or SOH. We observed that exchangeable base cation status in the forest floor following harvesting fell below the natural range of conditions present in the wildfire sites: values for cation exchange capacity and base saturation in the clearcut sites were respectively 15% and 41% lower than the minimum value of the wildfire range. Harvesting also drove organic C and total N concentrations below the conditions measured for wildfire by 18% and 12%, respectively. Little or no difference among disturbance types was observed in the B horizon. We hypothesize that the differences observed in the forest floor are due to the incorporation of ash and charcoal after wildfire. Ash is characterized by high soluble nutrient content and hydrophobic organic matter, whereas charcoal has high affinity for base cations. In the ecosystems studied, harvesting altered biogeochemical cycling in ways that do not mimic wildfires, and these differences can be observed for at least 20 years.

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