

**STUDYING THE IMPACTS OF FULL-TREE HARVESTING
ON LONG-TERM SITE PRODUCTIVITY OF BLACK SPRUCE ECOSYSTEMS:
A Project Overview**

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ABSTRACT.—A project is currently underway in Northwestern Ontario to quantify the disruption and restoration of ecosystem function caused by timber harvest, with specific reference to full-tree harvesting. This 20-year project was begun in 1992 to provide information that will enable the prediction of the impacts of various harvesting systems on the long-term site productivity of black spruce ecosystems occurring on different land types, and the constraints imposed by nutrient budgets on harvesting methods and rotation ages.

The sampling approach adopted for this project was to select a limited number of sites (three) to be intensively studied and a series of satellite sites (six) covering a range of site conditions and productivity levels. The site types targeted for study included: (1) fresh to moist, upland black spruce/feathermoss associations, (2) moderately deep to shallow sites occupied by black spruce/feathermoss/lichen associations, and (3) moist to wet, organic sites dominated by black spruce/sphagnum associations. The intensively studied sites are being used to describe, in continuous detail, the processes and inherent annual fluctuations involved in recovery dynamics, and more importantly, changes to these processes as a result of different harvesting regimes. Periodic sampling of nutrient pools will be conducted on the satellite sites and the data used to compare recovery rates with that of the intensively studied sites.

In order to assess the significance of the impacts on site productivity caused by full-tree harvesting one needs to compare post-harvest recovery along a continuum of biomass removal. Therefore, all of the nine study sites have been subjected to replicated, controlled levels of biomass removal that approximate the following harvesting systems: tree length, full-tree, whole-tree, full-tree chipping, and a control (uncut). Three of the sites were harvested in 1994 and the remaining six in 1995. On all sites, preharvest measurements included: (1) a detailed assessment of the community structure, (2) parameters to estimate productivity (NPP), and (3) an inventory/allocation of current pools of carbon and nutrients. Measurements of fluxes (precipitation partitioned into stemflow and throughfall, soil horizon infiltration, litterfall, decomposition and N-mineralization rates) have been carried out on the intensively studied sites only. The expectation is that the information generated from these studies (e.g., a gradient of process rates linked to key regulatory factors) would be applied, in a modelling context, to the other site types and stand conditions included in this project. For the most part, post-harvest studies represent "companions" to the preharvest studies with the principal focus, and corresponding experimental design and sampling scheme, being to isolate the harvest treatment effects on the restoration (recovery) of ecosystem function and, ultimately, site productivity. In addition, the site array included in this project permits the examination/detection of any differential effects related to site (i.e., site type x harvest treatment interactions).

It is anticipated that the results from this project will be incorporated into the calibration of an existing ecosystem, process-based growth model which, in turn, can be used by forest managers to evaluate the potential impacts of current and alternative management options for particular site/species combinations resulting in ecosystem-level management and progress towards sustainable forestry.

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