



Net ecosystem productivity of temperate and boreal forests after clearcutting – a Fluxnet-Canada measurement and modelling synthesis

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Clearcutting strongly affects subsequent forest net ecosystem productivity (NEP). Hypotheses for ecological controls on NEP in the ecosystem model ecosys were tested with CO₂ fluxes measured by eddy covariance (EC) in three post-clearcut conifer chronosequences. An algorithm for microbial colonization of fine and woody debris allowed the model to reproduce sigmoidal declines in debris observed after clearcutting. In the model, Rh drove debris decomposition that drove microbial growth, N mineralization and asymbiotic N₂ fixation. These processes controlled root N uptake, and thereby CO₂ fixation in regrowing vegetation. Interactions among soil and plant processes allowed the model to simulate hourly CO₂ fluxes and annual NEP within the uncertainty of EC measurements from 2003 through 2007 over forest stands from 1 to 80 years of age in all three chronosequences without site- or species-specific parameterization. The model was then used to study the impacts of increasing harvest removals on subsequent C stocks at one of the chronosequence sites. Model results indicated that increasing harvest removals would hasten recovery of NEP during the first 30 years after clearcutting, but would reduce ecosystem C stocks by about 15% of the increased removals at the end of an 80 year harvest cycle.