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Executive Summary
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Impacts of Biomass Removal on Carbon and Nutrient Pools in Wisconsin Northern Hardwood Forests: Establishment of a Long-Term Study

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Executive Summary

Background

A better understanding of the environmental impacts of harvesting forest biomass has become a priority because of the recent emphasis on renewable, alternative energy sources. Though

removing additional biomass from our forests may reduce the use of fossil fuels, improve aesthetic appearance and stimulate job creation, there may be detrimental impacts on the forest ecosystem. Woody debris is a critical structural and functional component of forests, yet its influence on fundamental questions like carbon exchange and storage remain poorly understood. *Our overall research question is: how will the removal of all biomass during single tree to small group selection harvests alter carbon and nutrient storage in forest soils over the long-term?* Understanding how forest management affects longer term storage and turnover rates of soil nutrients is critical to evaluate the sustainability of possible management alternatives for biomass energy production – especially in the context of increasing atmospheric CO_2 and deposition of anthropogenic nitrogen.

Research Objective

This study focuses on the effects of biomass harvest and removal on key nutrients in Wisconsin northern hardwood forests, including nitrogen, phosphorus, calcium, and potassium. Our objectives were to (1) measure above- and belowground nutrient pools in a second-growth northern hardwood forest and (2) predict how intensive utilization and removal of aboveground biomass will alter the belowground nutrient status.

Methods

We have established baseline conditions of soil nutrient status in long-term permanent plots where woody debris levels have been augmented or left unaltered following single-tree to small group selection harvests. To estimate the site nutrients removed during harvests, we analyzed tree components for site and species specific nutrient concentrations. We used fine-scale sampling near woody debris of varied decay stages to assess if belowground nutrient storage may be altered over time following woody debris removal.

Results and Conclusions

The majority of the forest's nutrient capital is contained in the living aboveground biomass as opposed to the woody debris or forest floor strata. The experimental group selection cuts removed approximately 4-5% of total aboveground N, K and Ca pools. Where the harvested wood was left in place following cutting, the woody debris nutrient pool increased to over four times the reference conditions. The largest pool of N is in the mineral soil and was not observed to differ between experimental treatments after two years.

The nutrient content of the forest floor appeared higher near woody debris of any type. Potassium in the forest floor was significantly greater beneath coarse and fine woody debris than at greater distances away from the debris. Soil nutrient pools beneath debris were similar to those estimated away from debris with few exceptions.

These results establish the initial conditions of the forest before and immediately following forest harvest. Repeated sampling in future years will allow us to study the impacts of intensive harvests to evaluate the sustainability of this management practice.