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‘Soil Science in a Changing World’

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ASSESSING CHANGES IN SOIL NUTRIENT STATUS IN RESPONSE TO DIFFERENT FOREST HARVESTING PRACTICES

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The substitution of biomass for fossil fuels in energy consumption is a measure to decrease the emission of greenhouse gases and thereby mitigate global warming. Over recent years, this has led to an increasing interest to use tree harvest residues as feedstock for bioenergy. An important concern related to removal of harvesting residues is, however, the potential adverse effects on soil fertility caused by an increased nutrient removal, relative to conventional stem-only harvesting. In the Netherlands this is a major concern, because we have many forests on nutrient poor sandy soils.

Here we report the results of a soil balance modelling approach assessing the change in forest soil nutrient status by comparing inputs of the nutrients phosphorus (P), calcium (Ca), magnesium (Mg) and potassium (K) by deposition and weathering with the outputs of those nutrients by tree harvesting and leaching, distinguishing stem-only harvesting and additional removal of tree tops and branches. Results are given for the whole of the Netherlands, distinguishing seven major tree species, seven soil types (various forms of sand, loam, clay and peat soils) and nine regions, with variations in atmospheric deposition of the nutrients. For each region-tree-soil combination we calculated the maximum amounts that can be harvested such that the output of the nutrients P, Ca, Mg and K is balanced with the inputs.

Results showed that at current harvesting rates, a negative nutrient balance is hardly calculated for the loamy to clayey soil types except for K, since K weathering in clay soils is generally limited and comparable to that in sandy soils. Nutrient depletion, however, mainly occurs in the sandy soils, particularly in P and K. Compared to K, the available P pool is, however, much larger and depletion of the P pool takes many rotations, even in case of harvesting stems, tree tops and branches on poor sandy soils.

We discuss the uncertainties when translating the results to an advisory system for forest harvesting.