



Tree leftovers are good for forest productivity

Forestry harvesting methods that completely remove all of the tree, instead of leaving branches and leaves behind on the forest floor, can lead to smaller trees and reduced productivity in subsequent crops, according to long-term research.

Wood, used efficiently, is viewed as an important renewable energy source. However, demand has led to an increase in the practice of whole tree harvesting (WTH) of all above-ground parts of the tree, including parts previously left behind, such as branches and leaves. Production of wood chips from forest residues increased 22-fold in Finland between 1995 and 2003, and by 5-fold in Sweden between 2002 and 2005. However, major concerns have been raised about the sustainability of the practice including its impacts on the growth of subsequent tree crops and the long-term health of soil.

The research team measured the height, diameter at breast height and density of second rotation Sitka spruce trees planted in an upland infertile area of the UK. Some trees had been planted after WTH and some after conventional harvesting (of the tree trunks only) of the first rotation crop. The EU-supported study¹ found that conifers planted 23 years ago following WTH were 10 per cent smaller in diameter than those replacing conventionally harvested trees. WTH also resulted in an 8 per cent reduction in tree height. This negative effect of WTH on tree growth was found to be greater on sites more exposed to sun and wind, than on more sheltered sites.

WTH of the first rotation crop removed 3-4 times more of the nutrients nitrogen, phosphorus and potassium in the harvested biomass than did conventional harvesting. Whereas, following conventional harvesting, the remaining tree branch residues return these nutrients to the soil, making them available to future crops. After 23 years of the second rotation concentrations of potassium and sodium in the soil were lower following WTH than conventional harvesting.

WTH also results in greater competition from other plants during the early stages of the second rotation. Under conventional harvesting, the tree residues suppress weeds, thus helping the planted second rotation tree seedlings to grow. Under WTH, it is easier for weeds to grow, diverting resources from the trees.

Afforestation greatly changes plant composition and nutrient distribution on upland sites, with between 7 and 15 times more nutrients held above ground under plantation forestry than in typical moorland ecosystems. The research therefore concludes that on nutrient poor soils WTH is only sustainable when measures are taken to overcome shortage of nutrients (e.g. through the application of wood ash) and high levels of competition from vegetation.

1. This study was partially supported by the European Social Fund: http://ec.europa.eu/employment_social/esf/index_en.htm. It was also guided with advice from Forestry Commission Wales: www.forestry.gov.uk/wales

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