

Effect of clear fell harvesting on soil GHG fluxes from an upland Sitka spruce forest in England

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Forest harvest, particularly by clear fell alters many factors that may influence greenhouse gas (GHG) fluxes, such as soil N content, organic C input, decomposition of organic matter, soil water content, water table depth, and soil temperature. Whilst there has been some research on the influence of harvest on soil CO₂ effluxes there is much less literature for CH₄ and N₂O fluxes, both of which can also be significant components of the GHG balance. We present results from a three year experiment to quantify soil GHG fluxes from two areas of a mature Sitka spruce forest on a peaty gley organo-mineral soil with similar previous management history where one area was harvested after one year. GHG fluxes were measured monthly by closed chamber method (8 replicated chambers per site) and analysis of CO₂, CH₄ and N₂O changes in collected gas samples by gas chromatography. Each flux measurement were accompanied by simultaneous soil temperature and moisture measurements to help elucidate drivers of flux differences.

In the first year before harvesting there were similar CO₂, CH₄ and N₂O mean soil fluxes from both areas of the forest. However, in the two consecutive years after harvest CO₂ effluxes reduced substantially in the harvested area presumably due to lower autotrophic respiration from lower root activity. CH₄ effluxes changed so that the soil turned from a small sink before harvest to a net source because of the increase in soil moisture. N₂O fluxes were increased by felling and seemed to respond to increase in both soil temperature and moisture. This study shows the significant effect of changes in soil biotic and abiotic factors due to clear fell harvest on GHG fluxes and the need to measure all GHGs to enable a robust estimate of the effect on net GHG balance.