

Effects of thinning on carbon dioxide exchanges in a mixed boreal forest

Anders Lindroth (1), Michal Heliasz (2), Jutta Holst (1), Meelis Mölder (1), Patrik Vestin (1), Fredrik Lagergren (1), Tobias Biermann (2), and Elin Sundqvist (1)

(1) Lund University, Department of Physical Geography and Ecosystems Sciences, Lund, Sweden
(anders.lindroth@nateko.lu.se), (2) Lund University, Center for Environmental and Climate Research, Lund, Sweden

We used eddy covariance measurements of net ecosystem exchange (NEE) above (2007-2016) to assess the effects of thinning on the fluxes in the Norunda forest in central Sweden. The thinning was performed in a half-circle sector from the mast extending 200 m outwards. The thinning operation that was made in winter 2008/2009 harvested about 25% of the volume in the ca. 110 years mixed pine and spruce stand. Thus, for above canopy fluxes we had two years before the thinning and eight years after the thinning. We focused the analyses on the main part of the growing season May-August during which most of the exchanges take place.

One of the problems with a 'change' study like this is the large temporal variability in the fluxes caused by the variability in the drivers. We therefore created a normalized NEE besides the actual values in order to try to assess statistically if observed differences were 'real' or caused by differences in drivers. Daytime NEE was normalized by dividing each half-hour value with the corresponding value from an average light response curve. We also used simple models of daytime NEE (light response curve) and night time NEE during well mixed conditions (temperature driven respiration model) were the model parameters were fitted to the whole dataset thus representing 'average' responses to those drivers involved.

The main result was that the actual NEE during the first years after the thinning was reduced by about 40% but because of the large inter-annual variability even after normalization, it could not be concluded statistically that these differences were caused by the thinning. However, there was a clear trend with increasing NEE (more negative) with time after thinning and decreasing respiration. Models did not show any trends so the conclusion was that the trends were caused by the thinning.