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Greenhouse gas emissions from freshly logged wood

Antti Laihonen and Marja Tiirola
University of Jyväskylä, Department of Biological and Environmental Science, Jyväskylä, Finland

Trees are known to be sources of greenhouse gases carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), but less is known of the emissions from logged wood. Wood is widely used as a fuel for energy production on industrial and residential scale. During the storage period, logged wood is known to lose up to 1.5 % of its dry weight per month, causing concerns of economic losses. Environmental effects of the dry matter losses have been less studied. For example, in Finland alone, every year several million tonnes of wood is logged for use in energy production. Before actual combustion, this wood logged for energy production is a potential source of greenhouse gases. We hypothesized that logged wood is not just a static part of the environment, but actively emit greenhouse gases into the atmosphere throughout the storage period.

We studied greenhouse gas emissions of freshly logged wood from birch and pine, and also from spruce logging residue during storage period, by incubating plant material for 13 weeks in controlled environmental conditions. In all studied plant material, CO_2 was observed to be the main emitted greenhouse gas, likely originating from the cellular respiration. Emissions of CH_4 and N_2O were observed from spruce logging residue in the later stage of the incubation period. We also measured respiratory quotient (RQ) of the plant material, i.e. the ratio of CO_2 efflux to O_2 influx, and found it to be in the range of 0.31 – 0.66, with average value of 0.53, which agrees well with values from previous studies. As carbohydrates are the main substrate for plant respiration, RQ is expected to be 1.0, which is much higher than observed by us and previous studies. Thus, RQ may be affected by other biochemical processes than cellular respiration. Our study is an important step in understanding how logs can affect greenhouse gas exchange. CH_4 and N_2O production may become more significant in older logs along with enhanced microbial degradation, especially as earlier finding of methanotrophic bacteria in decaying spruce logs refers to elevated CH_4 concentrations.