



## **Estimation of autotrophic soil respiration in a boreal forest using three different approaches**

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It is generally challenging to separate autotrophic and heterotrophic soil respiration. The reason for these difficulties is connected with the intimate interaction of the key processes in soil. Root-associated microbes practically colonize the whole soil volume while decomposition processes occur in the same matrix. Therefore, autotrophic and heterotrophic processes cannot be separated in natural systems.

However, there are several methods that can be used to better understand the dynamics of these two. A classical method is called 'trenching' where a trench is dug around a known volume of soil and the roots entering the soil are cut from the living trees thus blocking the C flow from them. The second way to separate autotrophic and heterotrophic respiration relies on the difference in the isotopic signature ( $^{13}\text{C}$ ) of plant-derived or decomposition-derived  $\text{CO}_2$ . The third way to separate the sources is to study the differences in the short- and long-term temperature dependencies in  $\text{CO}_2$  soil emissions. This is possible especially in boreal forests where the biological activity has a strong seasonal cycle.

We compared these three methods in an experiment conducted in a southern boreal middle-aged Scots pine stand in Finland. Our data provides a unique possibility to critically evaluate current methods for estimating autotrophic and heterotrophic soil respiration. The knowledge is needed to study further plant physiology and plant-microbe interactions in soil.