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Soil microbial carbon sources and Contribution of different microbial groups in soil carbon cycling

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Soils are known as important terrestrial carbon pools and soil organic matter (SOM) as dynamic reservoir plays a central role in the global carbon cycle. As transformation of carbon in soils is mainly driven by microbial activity, isotope analysis of microbial biomarker such as phospholipid fatty acids (PLFA) provides great information about soil microbial carbon sources and the role of microorganisms in soil carbon cycling. Radiocarbon analysis ($\Delta^{14}C$) of PLFA is a novel tool to determine between recent and retained SOM-carbon as microbial carbon sources. It is also a valuable technique to identify further carbon sources originating from anthropogenic inputs to the soil such as carbon very low in $\Delta^{14}C$, e.g. from fossil fuels, or carbon very high in $\Delta^{14}C$, e.g. from incinerated waste materials.

We used soil samples from a temperate forest that was exposed to a whole-ecosystem ^{14}C-label originating from a nearby incinerator. This ^{14}C release was incorporated into plants via photosynthesis and thereby it entered all elements of this ecosystem. The purpose of our study was to trace this label within the soil ecosystem in order to determine microbial carbon sources but also to identify different microbial groups responsible for biodegradation of specific carbon substrates.

Extracted phospholipids were subjected to several separation procedures and analyzed by gas chromatography-mass-spectrometry. Individual compounds were isolated by preparative capillary gas chromatography and graphitized for radiocarbon analysis.

Our results show that soil organic matter is labelled to a much lesser extent than plants or plant debris but still represents a ^{14}C-content higher than the averaged atmospheric

level. Furthermore, microbial carbon is labelled more with ^{14}C than soil organic matter. However, individual PLFA show different incorporation of the label into their cell membranes which clearly demonstrates the use of distinct carbon sources by specific microbial groups. Our results give insight into functioning of different soil microorganisms during degradation of soil organic matter and cycling of soil organic carbon.