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Influence of vegetation and cryogenic processes on the Microbial Respiration of permafrost peatland soils.

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The knowledge about the contribution of different sources of the soil respiration is an essential element in the simulation of the carbon cycle. That must be taken into account in projecting of change in intensity of the CO_2release from the soil surface and in development and carrying out activities to reduce the concentration of greenhouse gases in the atmosphere. 65% of the Russian territory are in permafrost zone. And permafrost-affected soils are one of the major sources of CO_2pool. For example, northern peatlands contain between 270 and 370 Gt of carbon. The relevance of the topic is also connected with the Paris climate agreement.

Each component of soil respiration has the different sensitivity to changing of biotic and abiotic factors, such as temperature, moisture, content and composition of biophilic elements in soils and substrate availability. Contribution of microbial respiration depends on method of determination, type of soils or ecosystems, and it can vary widely.

Five main sources of the contribution to the total soil CO_2efflux are allocated: 1) growth and respiration maintenance by roots (true root respiration), 2) rhizomicrobial respiration (microbial decomposition of rhizodeposits of living roots) 3) priming of soil organic matter decomposition by recent input of rhizodeposits, fresh plant residues, 4) decomposition of old soil organic matter (basal respiration (BSR)), 5) microbial decomposition of dead plant remains.

The purpose of the study was to estimate the contribution of individual components to the total respiration of permafrost peatland soil and assess the effect of vegetation and cryogenic processes on microbial activity.

The study area was located in the north of West Siberia (Russia) in discontinuous permafrost zone. The object of the study was peat soils under tundra vegetation and soils of peat spots without any vegetation cover for a long period (decades).

Two primary methods have been used to distinguish components of soil respiration: the comparison of vegetated and bared soils (without vegetation and living roots); the component integration method. The first method consists of comparison of the CO_2 emission values in two closely located areas: peat spots and soils under herbaceous vegetation and reindeer lichen. According to this method the contribution of soil microbial respiration (only BSR) to the total soil respiration was 56%.

We separately measured the root respiration of vascular plants (roots were washed to remove adhering humus) and the BSR. Input of each component was estimated as part of total respiration by means of the second method. The input of microbial respiration was 82%.

For bared peat spots and soils under vegetation some indicators of microbial activity were evaluated: labile soil carbon (C_{lab}), microbial carbon (C_{mic}) and (BSR). The BSR and $C_{mic}$are three times less for soil of peat spots, than for soil under vegetation, $C_{lab}$is approximately the same for both soils. This ratio can be caused by the impact of plants on the activity of biota. It's connected with root exudates and fresh plant residues. Furthermore, lower values for peat spots may be related to the cryogenic turbation.