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Soil Organic Matter in Forest Ecosystems of the Forest-tundra zone of Central Siberia

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Our study was conducted on 17 forest sample plots in the forest-tundra zone of Central Siberia, Krasnoyarsk region, Russia. They were covered by larch/feather moss/shrub and larch/grass forest types growing on cryozems and podburs (Cryosols).
The investigation was aimed at estimating soil organic matter storage and structure in forest ecosystems growing along the northern tree line. Such ecosystems have low rates of exchange processes and biological productivity. Estimating soil carbon in these forest types is important for a deeper understanding of their role in biogeochemical cycles and forecasting consequences of climate changes.
Soil organic matter was divided into pools by biodegradation resistance level and, hence, different roles of these pools in biological cycles. The soil organic matter was divided into an easily mineralizable (LMOM) fraction, which includes labile (insoluble) (LOM) and mobile (soluble) (MOM) organic compounds, and a stable organic matter fraction that is humus substances bound with soil matrix.
The forest-tundra soil carbon was found to total 30.9 to 125.9 tons/ha. Plant residues were the main part of the soil easily mineralizable organic matter and contained from 13.3 to 62.4% of this carbon. Plant residue carbon was mainly allocated on the soil surface, in the forest litter. Plant residues in the soil (dead roots + other "mortmass") were calculated to contribute 10-30% of the plant residues carbon, or 2.5-15.1% of the total soil carbon. Soil surface and in-soil dead plant material included 60-95% of heavily decomposed residues that made up a forest litter fermentation subhorizon and an "other mortmass" fraction of the root detritus.
Mobile organic matter (substances dissolved in water and 0.1N NaOH) of plant residues was found to allocate 15-25% of carbon. In soil humus, MOM contribution ranged 14 to 64%.
Easily mineralizable organic matter carbon appeared to generally dominate forest-tundra soil carbon pool. It was measured to contribute 57% of the total soil carbon on average, stable humus hence containing only 43% (from 13 to 63%) of the total carbon.
This ratio between the main forest-tundra soil carbon pools might be attributed to a small soil depth of thawing and a low rate of plant residue decomposition that enhance easily mineralizable organic matter accumulation. Ecosystems of taiga zones showed different ratios between easily mineralizable and stable organic matter carbon: 53 and 47% in northern taiga (cryogenic soils), 49 and 51 % in central taiga, and 45 and 55 % in southern taiga, respectively.
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