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Megafauna and frozen soil: the drivers of atmospheric CH4 and CO2 dynamics
Megafauna and frozen soil: the drivers of atmospheric CH4 and CO2 dynamics

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In the late Pleistocene grass-herb communities dominated on the planet. Resting on permafrost Mammoth steppe was the biggest biome. It was a high productive ecosystem. Analyses of skeleton density in the permafrost of Northern Siberia have indicated that in Mammoth steppe animals biomass was ˜10 ton/km2 ? same as in African savannah. Soils of this ecosystem are rich with carbon.

Analysis of global 14C data for basal peat and modeling of the atmospheric methane isotope composition allowed us to reconstruct the dynamics of main global methane sources from late Pleistocene to present day. Only in the Holocene wetlands were the largest methane source .While during the glacial the largest source was mega herbivores whose total biomass exceeded the biomass of present-day humans and domestic animals. During deglaciation the largest methane emission was from degrading frozen soils of mammoth steppe biome. Besides methane these soils released ˜2500 Pg of carbon as CO2. Roughly 1,100 Pg of this carbon was taken up by forests and peatlands, while the oceans DIC and bottom sediments reservoirs consumed ˜1200 Gt. This reduced average carbonate ion concentration in the ocean by ˜20 mmol/kg. Ocean level rise during deglaciation led to increase of pressure in bottom sediments, this terminated carbon emissions from strongly 13C-depleted gas clathrates reservoir.

Pasture ecosystems have high albedo (especially in the snow season) and cool soils. Restoration of pasture ecosystems would slow thawing of permafrost and moderate climate warming.

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