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Soil CO_2 and CH4 fluxes under different land cover types of a university campus area in Vladivostok (Russia)

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The temporal dynamic of soil CO_2 and CH_4 fluxes was monitored from spring to fall 2017 over five target areas differing by land cover type and degree of artificiality within the recreation zone of the Far Eastern Federal University campus which extends over 93 hectares as the result of the recent urbanization of Russky Island, in the municipality of Vladivostok

Experimental plots were established over forest (natural forest/forest park), grassland (semi natural meadow/lawn), and wetland (pond) environments and chamber flux measurements were carried out on a ten day average basis with a portable laser spectrometer along with the monitoring of soil temperature and water content. Collected data included a physicochemical characterization of plots soils, including soil organic carbon stocks, to evaluate the effect of land cover transformation following the establishment of the university campus.

Grasslands showed the largest CO_2 emission rates, (up to 7-8 μmolCO_2 m^{-2} s^{-1}), only partly explained by the consistently warmer soil conditions. Soil respiration in forest land covers exhibited however the largest temperature sensitivity (Q10=2.03$\pm$0.16) compared to grasslands (1.53$\pm$0.18) and wetland (1.73) types. Air temperature was found the most important predictor of soil respiration and together with soil organic carbon and fine root biomass stocks best explained the observed spatial and temporal variability (R^2=0.66).

We detected methanotrophic activity which was most intense in natural forest soils (up to -1.7 nmol CH_4 m^{-2} s^{-1}) and twofold smaller over the semi natural meadow. Methane emissions, although weak (0.5 nmol CH_4 m^{-2} s^{-1}), were only observed along the banks of the pond in combination with the warmest seasonal temperature records.