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Ecosystem respiration and its controlling factors in northern wetlands differing in vegetation type

Isabell Kiepe, Thomas Friborg, Mathias Herbst, Torbjörn Johansson, and Henrik Søgaard

Department of Geography & Geology, University of Copenhagen, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark (ik@geo.ku.dk)

Ecosystem respiration, which consists of soil and plant respiration, is an important part of the global carbon cycle and changes in either component may have strong influence on the net carbon uptake from the atmosphere.

For the determination of the present and predicting future carbon budgets the ecosystem respiration plays a major role, not only with respect to magnitude but also to environmental dependence. While there is an increasing agreement, that the temperature dependency can be expressed through an Arrhenius type of exponential function, the influence of leaf area and leaf phenology, soil organic matter content, soil moisture, active layer depth, litter quality is under ongoing investigation.

Due to the close relationship of respiration and temperature, higher effluxes can be expected under warmer temperatures. With regard to this fact, the boreal and arctic zone is attracting special attention. Most climate models predict that the temperature rise is especially pronounced in the northern latitudes, which might cause a rapid decrease in permafrost area. Taking into account that estimated up to 30 % of the world's carbon pool is stored in that zone, a temperature rise might lead to enhanced decomposition and higher respiration rates.

In this study we compare the ecosystem respiration derived by eddy covariance and chamber technique of different wetlands in the temperate, boreal and arctic zone in Europe and Northern Russia. The compared ecosystems show similarity in temperature dependence, but distinct differences in the magnitude of effluxes. The respiration rate at a reference temperature of 10 °C, the R_{10} value, is highest in the tundra ecosystem with 3.2 μmol m^{-2} s^{-1}. The lowest R_{10} value, 2.3 μmol m^{-2} s^{-1},was found in the temperate wet grassland, while the boreal peatland shows an intermediate value of 2.6 μmol m^{-2} s^{-1}. With respect to vegetation influence the analysis includes measurements from North-eastern Greenland in order to show the influence of LAI as a proxy for soil carbon on the R_{10} value. Furthermore our data shows that soil respiration is suppressed in anaerobic soil as well as during drought, indicating an optimum soil moisture range for the release of carbon dioxide from the soil.

In more general sense it will be discussed, which of the named controlling factors play the most important role in describing ecosystem respiration.