Effects of land use and climate change on biosphere-atmosphere exchange of greenhouse gases (CO2, CH4, N2O) in terrestrial ecosystems

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During the last century almost all environmentally important atmospheric trace gases have dramatically increased and there is ample evidence that these changes in atmospheric composition have already resulted in changes of the global climate. Major reasons for this development have been the increasing use of fossil fuel energy and land use/ cover changes e.g. for food and newly for energy production, thereby inducing the mobilisation and volatilisation of soil and plant carbon and nitrogen stocks and increasing the flux of greenhouse gases (GHG), mainly CO_2, CH_4 and N_2O into the atmosphere. The exchange of trace substances between natural and managed ecosystems with the atmosphere and thus the emission of greenhouse gases are also affected by direct feedback of global climate change**.** Increasing temperatures - especially in permafrost regions like the Baikal area - will enhance the mobilisation of soil organic carbon and nitrogen stocks and, thus, the emission of CO_2, CH_4 and N_2O from both, natural and managed ecosystems into the atmosphere.
The responses of terrestrial ecosystems to climate and land use change have many dimensions and are expressed by changes of biogeochemical cycles, such as photosynthesis, respiration, mineralisation, nitrification, denitirifcation, methan oxidation, and methanogenesis, with implications for sustainability, biodiversity, and the provision of ecosystem goods and services.

Within the planned collaboration in the CN cluster "C and N in Terrestrial Ecosystems of Baikal Area", it is intended to study the biosphere-atmosphere exchange of CO_2, CH_4 and N_2O within small catchments being representative for the circum-Baikal region. By analysis of sites differing in land use or representing false time series of e.g. natural forest, clear cutting and agricultural areas, the effects of land use and land use change on GHG emissions in the Baikal region may get assessed. The consequences of changing climate e.g. melting of permafrost, increasing active zone on GHG exchange of different terrestrial ecosystems may get studied by manipulation experiments or by comparison of different altitudinal belts in the surrounding mountain area.
IMK-IFU has long term experience in measuring biosphere-atmosphere exchange processes with automated chamber and eddy covariance systems, also in cold environments e.g. within the DFG MAGIM project in Inner Mongolia. Furthermore, process studies and field measurements are used to (further-)

develop, test and apply mechanistic biogeochemical models (e.g. DNDC) on site scale but also within upscaling procedures on regional/ global scales.