



Soil greenhouse gases fluxes in forest – fallow succession at the Central Forest Reserve in European Russia

Tatiana Komarova and Ivan Vasenev

Russian Timiryazev State Agricultural University, Department of Ecology & LAMP, Moscow, Russian Federation
(ivvasenev@gmail.com)

One of the principal factors influencing the current level of the greenhouse fluxes are land-use changes, including the forest restoration in fallow lands, which is widespread at the Central Region of Russia. The comprehensive environmental studies of soil greenhouse fluxes have been done in comparable sites with different stages of the forest-fallow successions in the southern part of the Central Forest Reserve with spruce domination in the mature forest - representative southern-taiga ecosystems. Seasonal and diurnal dynamics CO₂ fluxes measurements were carried out in situ using a mobile gas analyzer Li-820 with soil exposure chambers and parallel observation of air temperature, soil temperature and moisture. Also, every ten days the soil air has been sampled in the vials for further CO₂, CH₄ and N₂O flux measurements by the stationary gas chromatograph. Within forest-fallow successions there are shown the litter gradual development, humus-accumulative horizon differentiation, soil acidity and bulk density increasing. At the same time there is enough obvious in the down part of past-arable horizon gradual restoration of the podzolic horizon.

The monitoring results have shown the essential decreasing of soil CO₂ fluxes (in 2 times) in frame of successions. The maximum CO₂ fluxes have been fixed in July with optimal soil temperature/moisture ratio. In the middle of July the maximum CO₂ emission is observed in fallow grassland (34,1 g CO₂ / m²day), that is almost in 2-times more than in spruce-forest after fallow stage of 120-150 years. It is important that soil CO₂ fluxes essentially increase with soil temperature rise (with up to R = 0,75) and drop soil moisture (with up to R = - 0,66).

During the day, the most intense soil CO₂ fluxes have been observed from case of 12:00 to 18:00. The maximum CO₂ flux has been recorded at 15:00 in the fallow grassland (23 g CO₂ / m² day). In the forest-fallow stage of 10-15 years the maximum soil CO₂ flux observed at 12 hours was (16 - 17 g CO₂ / m² day). There were not strong differences in soil CO₂ fluxes of these two investigated sites in the night time from 21:00 to 9:00. The essential daily dynamics must be taken into attention for assessment the seasonal fluxes of greenhouse gases and carbon balance.

The maximum CH₄ flux has been fixed in the fallow grassland and forest-fallow stage of 10 - 15 years – in contrast to stable soil sink CH₄ in the spruce-forest after forest-fallow older than 120 years. In the fallow meadow grassland there are observed CH₄ emission in July and sink in June and August, with a maximum flux in early July. The level of N₂O fluxes usually does not exceed 0,2 mg N₂O /m²*day with the maximum flux in mid-August and light sink in early June.