Geophysical Research Abstracts
Vol. 16, EGU2014-4070, 2014
EGU General Assembly 2014

Assessing Actual and Potential Organic Carbon Pools in Southern Taiga and Forest-Steppe Ecosystems of Russia

Olga Chernova (1), Irina Ryzhova (2), and Marina Podvezennaya (3)

(1) Severtsov Institute of Ecology and Evolution Russian Academy of Sciences, Moscow, Russian Federation (ovcher@mail.ru), (2) Moscow Lomonosov State University Soil Science Faculty, Moscow, Russian Federation (iryzhova@mail.ru), (3) Moscow Lomonosov State University Soil Science Faculty, Moscow, Russian Federation (podvezennaya@yandex.ru)

Recent debates on climate changes showed the importance of maintaining natural cycles of nutrients and preserving extensive areas of natural ecosystems to ensure sustainability of the biosphere. The size and distribution of nutrient pools within ecosystems are the key characteristics of the biological cycle reflecting changes in the functioning of natural systems.

Carbon pools assessed in similar land-use types by different researchers are often poorly comparable due to various calculation algorithms, sampling techniques and sets of field data used. Model-based assessments often yield results that significantly depart from calculations based on actual field data.

We estimated the actual and potential natural carbon pools using potential natural vegetation maps, soil maps, up-to-date statistics and results of regional studies. Organic carbon pools in biomass, forest litter, peat and soil were calculated for most typical natural (ecosystems, which experienced the least effect of historic land use) and modern ecosystems for two administrative regions of Russia:

1. Kursk region characterized by high productive natural steppe vegetation with predominance of chernozems – the country's most fertile soils, which were extensively transformed by agricultural activity;
2. Kostroma region, sparsely populated area with still abundant southern taiga forests.

The average characteristics of vegetation productivity for natural and some human-modified ecosystems such as coniferous (pine, spruce) and noble broadleaf (oak, linden) forests, swamps, bogs, steppes, bottomland meadows, secondary forests, hayfields, pastures were calculated using the Database on the Productivity of Ecosystems in North Eurasia. The biological productivity of present-day forests and carbon pools in biomass were calculated using the program for assessing forest carbon budget (ROBUL model). Similar characteristics were used for agricultural areas. They were averaged according to crop rotations and recalculated to match the latest data on the structure of agricultural lands. The nonlinear dynamics model of the carbon cycle NAMSOM was used to calculate carbon pools in most typical soils. When calculating carbon pools, we took into account the net primary productivity of natural ecosystems and soil texture.

The actual and potential natural total organic carbon pool and specific carbon pools were assessed and a series of relevant thematic maps were prepared for the two regions.

In the both regions, actual carbon pools are less than potential natural ones. In southern taiga, the phytomass carbon pool significant lower (40%) due to active use of forest resources, while the soil carbon pool slightly lower (by 10%) due to weak agricultural development in the area. In forest-steppe, the actual phytomass and soil carbon pools are much lower than potential natural ones (by 80% and 25%, respectively).

A conversion of croplands and hayfields to abandoned lands can slightly increase the biomass carbon pool, but cannot sufficiently fast compensate the loss of soil humus as a result of erosion and poor historic agricultural practices.