

Influence of forest stands on soil and ecosystem carbon stocks in the conditions of the European part of Russia

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Forest stands are one of the most important components of ecosystems, both in Russia and around the world and at the same time forest vegetation is able to provide environment-modifying effect on the occupied landscape and, in particular, on the soil cover. Currently, due to the large interest in the carbon cycle, there is a question about the influence of forest vegetation on carbon stocks in ecosystems and in particular in the soil cover.

To perform the study we selected 9 objects located in the European part of Russia from the area of the southern taiga to the semi-desert zone: Novgorod region, Kostroma region, Moscow region (2 objects), Penza region, Voronezh region, Volgograd region (2 objects) and Astrakhan region. For studying the influence of forest vegetation on the soil's carbon, we organized the following experiment scheme: in each of the objects two key sites were selected, so that they originally were in the same soil conditions and the difference between them was only in a course development of vegetation - forest or grass. One part of the experimental sites, presenting forest vegetation, were the restored forests on abandoned lands with the age of 70-200 years. The second part of the experimental sites were artificial forest plantations aged from 60 to 112 years planted on the originally treeless forest-steppe or steppe landscapes. Perennial hayfields, perennial abandoned agricultural landscapes and virgin steppe areas were used as reference sites with grass vegetation. For each forest site we estimated the major carbon pools: phytomass, mortmass (dead wood, dry grass), debris, litter and soil. All data were recalculated using the conversion factors in carbon stocks in t C ha⁻¹. We collected soil samples every 10 cm until the depth of 50 cm, and then at 50-75 and 75-100 cm soil layers. Bulk density and total organic carbon were determined by CHN analyzer. As a result, the soil's carbon was also calculated into t C ha⁻¹.

We found out that the total carbon stocks were higher for the forestry vegetation than for the reference plots for all studied sites. Maximal values of carbon stocks (779 ± 2 t C ha⁻¹) were observed in forest sites of the forest-steppe zone (Voronezh region). These values decreased while moving both north and south and amounted for 236 ± 1 t C ha⁻¹ in south taiga (Novgorod region) and $104,5 \pm 7,4$ t C ha⁻¹ in semi-desert areas (Astrakhan region). The stock of total soil carbon significantly increased in 0-10 cm soil layer and decreased in 50-100 cm layer in the forest stands compared to the grass vegetation (T-test at significance level of 0.05). However, when considering the entire 100-cm layer of soil, there is no statistically significant difference in total carbon stock between forest and grass vegetation.