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The carbon sequestration by Russian fallows

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The aim of this work was to estimate the value of carbon sequestration by Russian fallows. The major objectives of the work were as follows:
• to analyze the long-term dynamics of agricultural lands and their structure in Russian regions in the 20th century, before the crisis of the 1990s (1897–1960, 1961-1990) and during the crisis (1990–2007), and on the base of this data to calculate the area of abandoned agricultural lands and fallows in Russian regions;
• to study the process of restoration of natural ecosystems on fallows in different natural zones of European Russia and to study the sequestration of carbon in the soil and plant covers of fallows in the course of postagrogenic successions in different natural zones of European Russia;
• on the base of these data to estimate the total value of carbon sequestration by all Russian fallows.
The investigation showed that about 70 million ha of agricultural land was removed from crop production in Russia during the century. About 63% of this loss took place during the last crisis period (1990-2007), and 37% during the entire pre-crisis period (1897-1990). The major reduction of agricultural land (60%) occurred in the European Russia; 17% and 23% were found for the Asian Russia and the Urals, respectively. On the basis of the estimated agricultural land areas occupied by growing settlements, industrial and infrastructure projects, water reservoirs, etc., the areas of fallow lands (i.e., natural ecosystems developed in place of agricultural lands) in different regions of Russia were calculated. The total fallow (abandoned agricultural) land area is about 65 million ha (it is a little more than the total area of France). Most of the fallows occur in the Northwestern and Central regions, where old and medium-aged fallows play an important role, and in the Volga region, where young fallows predominate.
The stock of carbon in soils and plants covers of fallows was investigated in 8 regions of European Russia (from mid taiga to semi-desert ecoregions) on fallows of different ages (from 1 to 180 years). Abandoned lands are capacious accumulators of atmospheric carbon. However, our data show that the dynamics of carbon accumulation in the fallows differ between the steppe and forest zones. In the steppes and forest-steppes, its active accumulation occurs during the first 10 years (+0.1 to +0.2 kg/m2 per year), while in the forest zone, on the contrary, its emission is observed at a rate of –0.1 to –0.3 kg/m2 per year. Later on, the accumulation of carbon decreases abruptly in the steppe fallows (although remains positive) and increases to +0.1 to +0.2 kg/m2 per year in the forest fallows. In the ecosystems forming on the abandoned agricultural lands, the accumulation of carbon (soil + vegetation) increases from the north to the south, reaches a maximum value in the zone of hardwood forests, and decreases again to a minimum level in the semidesert zone.
In Russia, the fallows presently accumulate about 64 million tons carbon annually (16% of the total current industrial emission of carbon in our country), first of all in south taiga region (34 mln. tons). However, already in $\sim$10 years, when most of the young forest fallows will pass the emission stage of development, this value will reach 105–110 million tons C annually, which are more than one-fourth of the total current industrial emission of carbon in our country.