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Environmental assessment of bioenergy technologies application in Russia, including their impact on the balance of greenhouse gases

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In recent years, Russia adopted a policy towards increasing of the share of renewable energy in total amount of used energy, albeit with some delay comparing to the EU countries and the USA. It was expected that the use of biofuels over time will reduce significantly the dependency of Russian economy on fossil fuels, increase its competitiveness, and increase Russian contribution to the prevention of global climate changes. Russia has significant bio-energy potential and resources which are characterized by great diversity due to the large extent of the territory, which require systematic studies and environmental assessment of used bio-energy technologies.
Results of research carried at the Laboratory of agroecological monitoring, modeling and prediction of ecosystems RSAU-MTAA demonstrated significant differences in the assessment of the environmental, economic and social effects of biofuel production and use, depending on the species of bio-energy crops, regional soil-ecological and agro-climatic characteristics, applied farming systems and production processes.
The total area of temporarily unused and fallow land, which could be allocated to the active agricultural use in Russia, according to various estimates, ranges from 20 to 33 million hectares, which removes the problem, typical of most European countries, of adverse agro-ecological changes in land use connected with the expansion of bio-energy crops cultivation. However, the expansion of biofuel production through the use of fallow land and conversion of natural lands has as a consequence the problem of greenhouse gas emissions due to land use changes, which, according to FAO, could be even higher than CO_2 emission from fossil fuels for some of bio-energy raw materials and production systems.
Assessment of the total impacts of biofuels on greenhouse gas emissions in the Russian conditions should be based on regionally adapted calculations of flows throughout the entire life cycle of production, taking into account conditions of the particular type of agricultural landscape, possible changes in the characteristics and structure of land use, direct and indirect effects on the ecosystem components and biodiversity. North-Western, Central and Southern regions of the European part of Russia have great potential to produce biofuels. While there is a clearly expressed zonal agroclimatic potential of growing bio-energy crops (1.5 times increase of PAR in the forest-steppe zone in comparison with the area of the southern taiga) and there is a steady trend of further growth with a parallel increase in the amount of rainfall and the amount of active temperatures for the XXI century forecast. Particular attention should be payed to areas with high population density and industrial production with the possibility of combining the cultivation of oilseed rape for the bio-energy purpose with phytoremediation and soil improving effect of the contaminated and unproductive soils.
The increasing potential of atmospheric carbon's temporary binding in the biomass of the bio-energy crops and consequently in the biofuels produced from them can significantly reduce total emissions of greenhouse gases in the conditions of the European part of Russia, but there is the need for more detailed balance calculation for specific soil and climatic conditions and land-use systems.