

## Ecological Role of Soils upon Radioactive Contamination

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The ecological role of soils upon radioactive contamination is clearly manifested in the system of notions about ecosystems services, i.e. benefits gained by humans from ecosystems and their components, including soils (Millennium Ecosystem Assessment, 2005). For the soils, these services are considered on the basis of soil functions in the biosphere that belong to the protective ecosystem functions within the group of soil functions known under the names of "Buffer and protective biogeocenotic shield" (at the level of particular biogeocenoses) and "Protective shield of the biosphere" (at the global biospheric level) (according to Dobrovolskii & Nikitin, 2005). With respect to radionuclides, this group includes (1) the depositing function, i.e. the accumulation and long-term sequestration of radioactive substances by the soil after atmospheric fallout; (2) the geochemical function, i.e. the regulation of horizontal and vertical fluxes of radionuclides in the system of geochemically conjugated landscapes and in the soil-groundwater and soil-plant systems; and (3) the dose-forming function that is manifested by the shielding capacity of the soil with respect to the external ionizing radiation (lowering of the dose from external radiation) and by the regulation of the migration of radionuclides in the trophic chain (lowering of the dose from internal radiation).

The depositing and geochemical functions of the soils are interrelated, which is seen from quantitative estimates of the dynamics of the fluxes of radionuclides in the considered systems (soil-plant, soil-groundwater, etc.). The downward migration of radionuclides into the lower soil layers proceeds very slowly: for decades, more than 90% of the pool of radionuclides is stored in the topmost 10 cm of the soil profile. In the first 3–5 years after the fallout, the downward migration of radionuclides with infiltrating water flows decreases from several percent to decimals and hundredths of percent from the total density of the soil contamination per year. An analogous role is played by the soil in regulation of the fluxes of radioactive elements in the system of geochemically conjugated landscapes and in the soil-plant system. The shielding capacity of the soil with respect to the ionizing radiation decreases by approximately two times in the same period in dependence of the type of landscape and the depth of penetration of the radionuclides into the soil profile.

The ecological functions of soils upon radioactive contamination greatly depend on the soil texture and become more pronounced in the heavy-textured soils in comparison with sandy soils; in the arable soils, they depend on the intensity of agrogenic pedoturbation.

The shielding capacity of the soils can be considered an integral indicator of the efficiency of its protective functions, because the main threat of the radioactive contamination to humans is controlled by the ionizing radiation and its dose.

The function of "buffer and protective biogeocenotic shield" as the protection from ionizing radiation should be specially valued in the regions subjected to the radioactive contamination or in the regions with the increased risk of radioactive contamination (in places with nuclear power plants, etc.).