Dynamics of radioactive and stable cesium in a forest in Fukushima, Japan

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Following the Fukushima Daiichi Nuclear Power Plant accident in 2011, a large quantity of radionuclides contaminated a wide area in the Tohoku and Kanto regions of Japan. Radiocesium, which has a long half-life, was initially trapped mainly in the canopy and litter layer of forests; over time, it has gradually migrated into mineral soil. To evaluate the long-term environmental impact of radiocesium it is necessary to understand the dynamics of radiocesium in forested ecosystems. In this study, we monitored the inventory and transport of radioactive and stable cesium isotopes (Cs-137 and Cs-133) in a coniferous plantation forest in Fukushima. Cs-137 concentrations in litterfall, throughfall, litter leachate, and soil water gradually decreased throughout the monitoring period. Following infiltration, the Cs-137 concentration in soil water rapidly decreased with depth, demonstrating the strong ability of clay minerals to capture radiocesium. In contrast, the Cs-133 concentration in soil water was almost constant with depth. These findings suggest that the supply of Cs-133 from soil material due to weathering is balanced by its capture by clay minerals and leaching by flowing water.

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