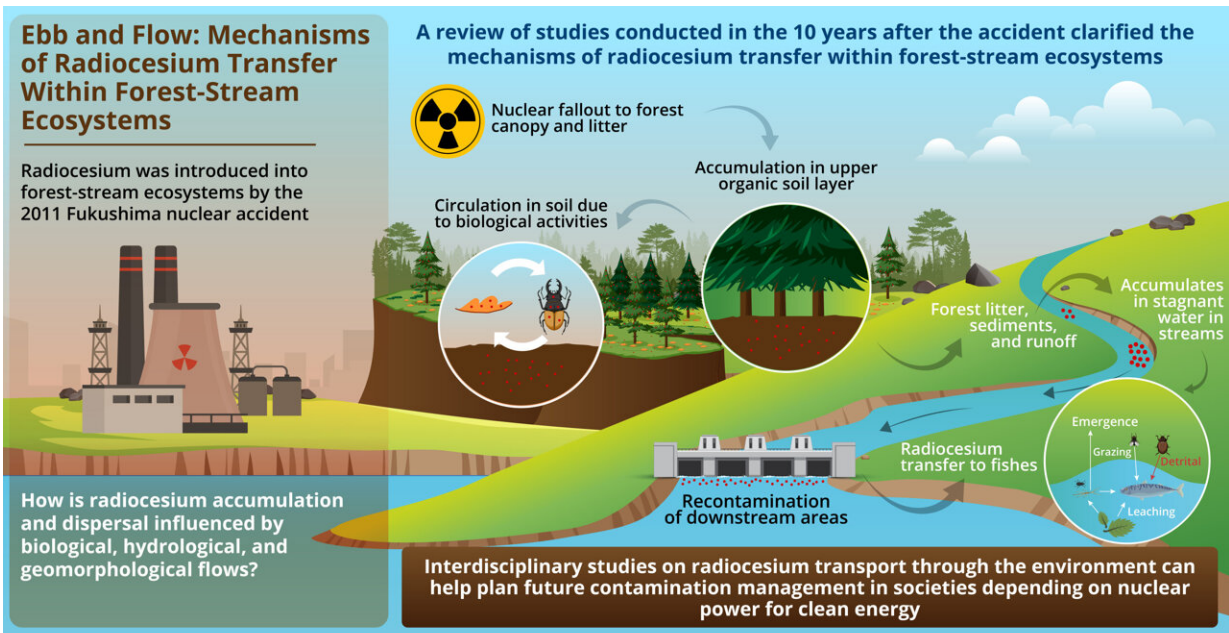


Scientists trace the path of radioactive cesium in the ecosystem of Fukushima

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Untangling radiocesium dynamics of forest-stream ecosystems: A review of Fukushima studies in the decade after the accident
Sakai et al. (2021) | *Environmental Pollution* | 10.1016/j.envpol.2021.117744



Interdisciplinary studies on radiocesium transport through the environment can help plan future contamination management in societies depending on nuclear power for clean energy. Credit: NIES

In 2011, the nuclear accident at Fukushima, Japan, resulted in the deposit of radioactive cesium (radiocesium) into habitats in the vicinity. A decade after the accident, researchers from the National Institute of Environmental Studies, Japan, have collated the complicated dynamics

of radiocesium within forest-stream ecosystems. Understanding radiocesium flow in the environment could help mitigate contamination and inform future containment strategies.

In the aftermath of the Fukushima [nuclear accident](#), the Japanese government performed intensive decontamination in the human-occupied parts of the affected area by removing soil surface layers. But a major affected region consists of dense, uninhabited forests, where such decontamination strategies are not feasible. So, finding ways to avoid the spread of radioactive [contaminants](#) like radiocesium to areas of human activity that lie downstream to these contaminated forests is crucial.

The first step to this is to understand the dynamics of radiocesium flow through forest-stream ecosystems. In the decade since the accident, a vast body of research has been dedicated to doing just that. Scientists from the National Institute of Environmental Studies, Japan, sifted through the data and detangled the threads of individual radiocesium transport processes in forest-stream ecosystems. "We identified that radiocesium accumulates primarily in the organic soil layer in forests and in stagnant water in streams, thereby making them potent sources for contaminating organisms. Contamination management in these habitats is crucial to provisioning services in forest-stream ecosystems," says Dr. Masaru Sakai, who led the study. The findings of this study was made available online on 6 July 2021 and published in volume 288 of the journal *Environmental Pollution* on 1st November 2021.

The research team reviewed a broad range of scientific research on radiocesium in forests and streams to identify regions of radiocesium accumulation and storage. After the accident, radiocesium was primarily deposited onto the forest canopy and forest floor. This radiocesium reaches the earth eventually—through rainfall and falling leaves—where it builds up in the upper layers of the soil. Biological activities, such as those of detritivores (insects and fungi that live off leaf debris etc.)

ensure that radiocesium is circulated through the upper layers of the soil and subsequently incorporated into plants and fungi. This allows radiocesium to enter the food web, eventually making its way into higher organisms. Radiocesium is chemically similar to potassium, an essential mineral in living organisms, contributing to its uptake in plants and animals. "Fertilizing" contaminated areas with an excess of potassium provides an effective strategy to suppress the biological absorption of radiocesium.

Streams and water bodies in the surrounding area get their share of radiocesium from runoff and fallen leaves. Most radiocesium in streams is likely to be captured by the clay minerals on stream beds, but a small part dissolves in the water. Unfortunately, there is little information on the relationship between dissolved radiocesium and aquatic organisms, like fish, which could be important to the formulation of contamination management strategies. Radiocesium in streams also accumulates in headwater valleys, pools, and other areas of stagnant water. Constructions such as reservoir dams provide a way to effectively trap radiocesium but steady leaching from the reservoir sediments causes re-contamination downstream.

This complicated web of radiocesium transport is hard to trace, making the development of a one-stop solution to radiocesium contamination impossible. Dr. Sakai and team recommend interdisciplinary studies to accelerate a full understanding of radiocesium pathways in forest-stream ecosystems so that measures can be developed to reduce future contamination. "This review can serve as basal knowledge for exploring future contamination management strategies. The tangled radiocesium pathways documented here may also imply the difficulties of creating successful radiation contamination management strategies after unwished-for nuclear accidents," explains Dr. Sakai.

Nuclear power is often touted as a solution to the [energy crisis](#), but it is

important to plan response measures to unpredictable contamination events. To address the essential need for clean energy in view of the climate crisis, contamination management in societies depending on nuclear power is integral. Fully understanding the behavior of radiocesium in ecosystems can not only lead to the successful management of existing contamination but can also ensure the swift containment of potential future accidents.

More information: Masaru Sakai et al, Untangling radiocesium dynamics of forest-stream ecosystems: A review of Fukushima studies in the decade after the accident, *Environmental Pollution* (2021). [DOI: 10.1016/j.envpol.2021.117744](https://doi.org/10.1016/j.envpol.2021.117744)

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