Forest observatory site in Yamakiya

Fukushima observatory sites contaminated by radiocaesium

Fukushima University has established forest observatory sites in Yamakiya, Tsushima and Okuma (Fukushima). The Yamakiya forest observatory site (37º35'20.5"N, 140º42'37.1"E) is located 35 km north-west of the TEPCO* Fukushima Daiichi Nuclear Power Station and has been operational since it was established in 2014.

Photo: H. Tsukada/IER

Forest observatory site in Yamakiya, Fukushima

The site is a cedar-dominant community of approximately 7 ha, with an elevation difference of approximately 100 m. Average temperature is 12.7°C (-9.3-37.1°C) and annual precipitation is 1220 mm ·y^{-1}.

The major soil type is Andosols and it supports a planted Japanese Sugi cedar stand. The ^{137}Cs inventory is 670 ± 400 kBq·m^{-2} (n=6) and ^{137}Cs activity concentration in surface soil (humus + depth of 0-10 cm) is 19 ± 8.3 Bq·g^{-1}. The distributions of ^{137}Cs in exchangeable, bound-to-organic matter and residual fractions in the 0-5 cm soil layer collected in 2015 were 5%, 4% and 91% respectively, with most of the ^{137}Cs in the strongly bound fraction.

No other contamination by heavy metals was observed in the area. Aggregated Transfer Factor (TF) for ^{137}Cs, defined as the concentration of ^{137}Cs in animals (Bq·kg^{-1} FW) divided by soil ^{137}Cs levels (Bq·m^{-2}), has been determined. Tags in earthworm, frog, newt, bee, mouse and boar were 0.0022, 0.0014, 0.00049, 0.00016, 0.012 and 0.0019 respectively.

The mean ^{137}Cs radioactivity concentration in the Montane brown frog collected at the Yamakiya observatory site in 2016 was 1.12 ± 0.81 (n=20) Bq·g^{-1} FW. The range of radioactivity concentration (0.08 - 3.2 Bq·g^{-1} FW) was two orders of magnitude, even in the limited area. The external radiation dose in the frog from radiocaesium ($^{134+137}$Cs) calculated using the ERICA tool was 4.2 µGy·h^{-1}. The internal radiation dose in the frog was 0.2 µGy·h^{-1}, which was 5% of the external dose.

Photo: H. Tsukada/IER

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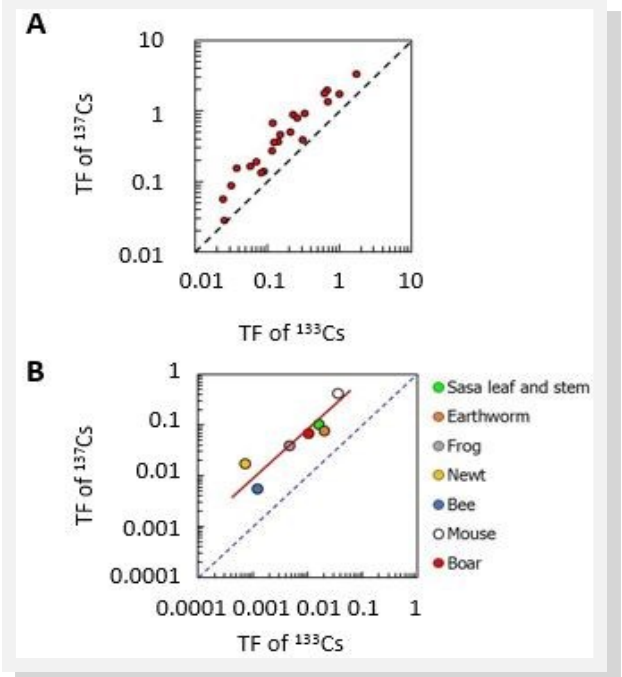
Previously reported TF from substrate to mushroom of ^{137}Cs is well correlated with that of stable ^{133}Cs. This suggests that the transfer of ^{133}Cs from substrate to mushroom is utilised as a natural analogue of radiocaesium. The transfer factors, defined as the concentration of ^{137}Cs in plant and animals divided by that in surface soil, were well correlated with the transfer factor of ^{133}Cs. This indicates that the behaviour of ^{133}Cs can be regarded as a useful analogue for predicting long-term changes of radiocaesium in the forest environment.

*Tokyo Electric Power Company



A) Comparsion of transfer factor of stable ^{133}Cs and ^{137}Cs in mushroom in 1992.

B) Comparsion of transfer factor of stable ^{133}Cs and ^{137}Cs in plants and animals collected in Yamakiya, Fukushima.

Radiocesium distribution and fluxes in the typical *Cryptomeria japonica* forest at the late stage after the accident at Fukushima Dai-Ichi Nuclear Power Plant, Yoschenko V., Takase T., Konoplev A., Nanba K., Onda Y., Kivva S., Zheleznyak M., Sato N., Keitoku K. (2017), J Environ Radioact, 166, 45-55

Transfer of radiocaesium and stable caesium from substrata to mushrooms in a pine forest in Rokkasho-mura, Aomori, Japan, Tsukada H., Shibata H., Sugiyama H. (1998), J Environ Radioact, 39, 149-160

ID Card:

Type of ecosystem contaminated:
Semi-natural forest environment

Compartment of environment contaminated:
Soil, water, sediments, plants, animals

Contamination source:
Radiocaesium, radioiodine and other radionuclides from TEPCO's FDNPS accident

Radioactivity or dosimetric characteristics:
Radiocaesium is the major source of contamination, and Pu, ^{90}Sr et al. are also deposited in the surrounding areas of the FDNPS

Total contaminated area:
953 km^2 (>20 mSv·y^{-1}, 7% of Fukushima Prefecture)

Species exposed/present in the site:
Japanese cedar, pine and broad-leaf trees, bamboo, fern, sasa plant, earthworm, frog, newt, mouse, wild boar, etc.

Authorized related data/ samples:
COMET report, publications

Supporting lab:
Institute of Environmental Radioactivity (IER) at Fukushima University supports sampling, pretreatment and analyses

Access:
Permission from IER is required

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