Radiocesium concentrations in edible wild mushrooms in eastern Japan

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Wild mushrooms tend to absorb large amounts of radioactive cesium. The commercial shipping of wild mushrooms has been restricted across eastern Japan (spanning across more than one hundred municipalities) as a result of the Fukushima Daiichi Nuclear Power Plant accident. The concentrations of radioactive cesium in wild mushroom species after the Chernobyl accident have been shown to vary greatly, depending on the species. Detailed information on these concentrations could be very important when considering the criteria for safe collection. However, the absorption concentrations for each species in Japan have not been investigated thoroughly. Therefore, we analyzed the data from radioactivity monitoring of wild edible mushrooms that were collected by the local governments in eastern Japan. In the analysis, the radioactivity deposition data from aircraft monitoring was used to standardize the mushroom radiocesium concentrations with the contamination levels of the sampled area. Our results showed that there was a large difference of up to 100 times within each species. As in previous studies, the concentration of mycorrhizal species tended to have higher concentrations of radiocesium. Some saprophytic species also had high concentrations. For the mushroom species that were also evaluated in the post-Chernobyl studies, we found that the same species had similar levels of absorption and a positive correlation was found. Moreover, the estimation of radiocesium concentration was much improved by the use of information from the municipalities of mushroom collection. We observed regional bias from the municipality effect.

Temporal changes in spatial distributions of radiocesium in forest floors in Fukushima, Japan

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Due to the Fukushima Dai-ichi Nuclear Power Plant accident, the majority of areas of East Japan forests were contaminated by radiocesium. Estimation of the spatial distributions of radiocesium within the forest would help in devising strategies both for reducing exposure for forest workers and for decontamination in the forest. In this study, the spatial distribution of radiocesium and its temporal change were estimated at both observed plot (2 m × 2 m) and forest (0.12–0.24 ha) scales. Radiocesium inventories of the litter and mineral soil layers (0–5 cm) were collected in 12 observed plots in each of four forest with various topographies in Fukushima Prefecture. The ambient dose rate at a height of 10 cm was measured in 20–36 points in the same forests. These observations were conducted in summer from 2012 to 2016. Results showed temporal change in the radiocesium inventories accumulated in the litter and mineral soil layers collected at the observed plot scale. However, the distribution pattern of the ambient dose rate did not change significantly over time at the forest scale. These findings suggested that the spatial variation at the observed plot scale could be affected by the initial distribution or local migration of radiocesium in the litter and mineral soil layers. However, there was no significant migration of radiocesium that could affect the ambient dose rate in the forest. This study also indicated that topographic characteristics had no effect on the spatial distributions of the ambient dose rate.

A rechargeable increment borer for radiocesium monitoring

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Radioactive cesium analysis requires large amount of wood (Kagawa *et al*; 2002, Journal of Environmental Quality 31(6):2001-2007). Initially, in our Fukushima project, we have felled trees to obtain stem disks for the analysis. In recent years, we have explored the possibility of using increment cores (12-mm diameter) for radio-cesium analysis as a substitute of wood disks. Increment core sampling has advantages over disk sampling because it does not kill the trees and therefore enables continual monitoring of radio-cesium levels within an individual tree over many years. Disk sampling may cause significant disturbance that may affect dynamics of radio-cesium movement within a forest ecosystem. We developed an automated increment-core sampling device, "Smartborer", to increase the sample throughput (Kagawa and Fujiwara 2018, Journal of Wood Science 64(1):52-58; www.smartborer.com). The lightweight, portable device employs a battery-powered electric wrench and the complete system to drive the boring operation weighs less than 10 kg. It is capable of taking both 5- and 12-mm diameter cores of more than 800-mm length, even from hardwood. Compared to equipment used in previously published articles, Smartborer enables more rapid sampling and demonstrates a superior torque output/total weight ratio. Overall, averaged radio-cesium concentrations over the two increment cores sampled from two opposing directions of a stem showed a good match to the values obtained from the stem disk. However, the radio-cesium concentrations of heartwood based on increment-core measurement showed a little less accuracy than those based on disk measurement.

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Dendrometric aspects of the biochar application in *Eucalyptus urograndis*

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Biochar application aims to improve the soil properties and increase its carbon stable reservoir. The aim was to evaluate the effect of the use of biochar in soils with Eucalyptus *urograndis*, under different fertilization rates in tree growth. The experiment is in São Jerônimo da Serra (Paraná, Brazil), in a Red-Yellow Latosol, as a factorial in 4 randomized blocks with subdivided plots, with and without biochar in plots, and 3 fertilization rates in subplots. The treatments were: T1 - without biochar and without fertilizer; T2 - without biochar and fertilizer rate reduced by 20%; T3 - without biochar and commercial fertilizer rate; T4 - with biochar and without fertilizer; T5 - with biochar and fertilizer rate reduced by 20%; and T6 - with biochar and commercial fertilizer rate. Each plot comprised of 36 trees spaced of 3 m × 3 m. It was applied 9 kg of biochar (1 kg/tree or 3.21 t ha^{-1}) in strip with 1 m of width and incorporated 15 cm with a grid. The commercial fertilization (NPK at planting 4:42:6 and second dose 15:05:30) were of 166 g/tree. The tree height (AP) and stem basal diameter (DC) were measured in 20 trees/plot at the 3, 6, 9, 12 and 18 months age. The AP and DC at each age varied between treatments with and without fertilization. However, there were no effect reducing the fertilizer rate neither with the biochar application until 18 months old. The effect of biochar on soil quality attributes and carbon storage are being evaluated.