(Attachment 2)

[Survey 2] Results of FY2020 Survey on Radioactive Cesium in Forests in Difficult-to-Return and Adjacent Areas

1. Purpose of Survey

Earlier studies on radioactive cesium suggest that total quantities that have accumulated in forests have not changed more than its physical decay, and that the amount of its release via mountain steam water is infinitesimal. As the bulk of radioactive cesium that settled in forest ecosystems remains, investigations of its dynamics need to be conducted continuously from a long-term viewpoint. In consideration of the restrictions on entry into areas with extremely high air dose, in 2017, the Forestry Agency instigated surveys to understand the dynamics of radioactive cesium in forests in difficult-to-return-to and adjacent areas. The results of the FY2020 survey (fourth year) are shown below.

Photo 1 Measuring air dose rates

Photo 2 Sampling trunk xylem

2. Survey Method

The survey was conducted at nine sites, one site more than the previous year (Figure 1; a landslide caused by Typhoon 19 (Hagibis) prevented access to one site. In place of that site, a new survey site was established). Many of the monitoring sites were selected from Fukushima Prefecture that were used for surveying radioactive cesium contained in male flowers of cedar in FY2019. At each monitoring site, from September to October 2020, air dose rates were measured at a height of 1 m above the ground, and samples of cedar leaves, branches, bark, and trunk (sapwood, heartwood) were collected. For the litter layer and soil, samples were collected in June 2020.

Samples were treated indoors after collection, and subjected to gamma-ray spectrometry using a germanium semiconductor detector to measure radioactive cesium (Cs-134 and Cs-137) concentrations. This year's measurements were normalized to September 1, 2020.

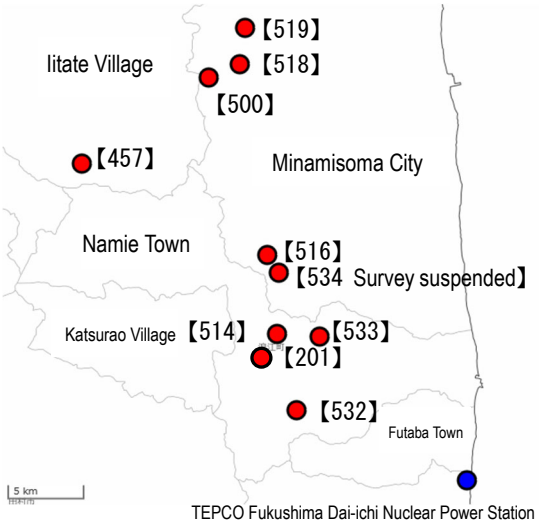


Figure 1 Location of Monitoring Sites (Numbers in parentheses indicate site IDs. Created using GSI tiles.)

Table 1 Air Dose Rate at Monitoring Sites (μSv/h)

Site ID	FY2020	FY2019	FY2018	FY2017
201	8.09			
457	2.23	2.30	2.83	2.87
500	1.30	1.36	1.60	1.68
514	7.14	7.12	8.83	9.07
516	2.29	2.30	3.01	3.05
518	0.60	0.56	0.74	0.77
519	0.48	0.48	0.63	0.70
532	2.38	2.48	2.95	2.65
533	2.29	2.26	2.90	3.25

*Air dose rates for FY2018 and FY2019 were incorrect and corrected in this report.

3. Results

The air dose rates at seven of the eight sites, excluding the new site, were 96-101% of the previous year's levels (Table 1). In addition to the physical decay, this result is likely attributable to the heavy rain caused by Typhoon 19 (Hagibis) that hit just before the survey, resulting in a greater amount of moisture. The radioactive cesium concentrations (sum of Cs-134 and Cs-137) in trees and the soil were, similar to previous surveys, high in the litter layer and surface soil, and low in the sections of trees (Figure 2 - Figure 6).
The quantities of radioactive cesium accumulated in the litter layer and surface soil (underground) continue to be larger at higher air dose rate locations (Figure 7). However, as shown in the quantities of radioactive cesium accumulated at site ID 514 in FY2019, it should be noted that the quantities may deviate from a straight line. The amount of radioactive cesium accumulated includes a certain amount of variability, and change trends in quantities of radioactive cesium accumulated underground require continued monitoring and careful consideration.

Comparing within the same site, similar to the past survey results, the radioactive cesium concentrations in heartwood were slightly higher than those in sapwood (Figure 8). This trend has been observed for cedar in past studies, except for immediately after the accident, and therefore it may be a characteristic common in cedar.

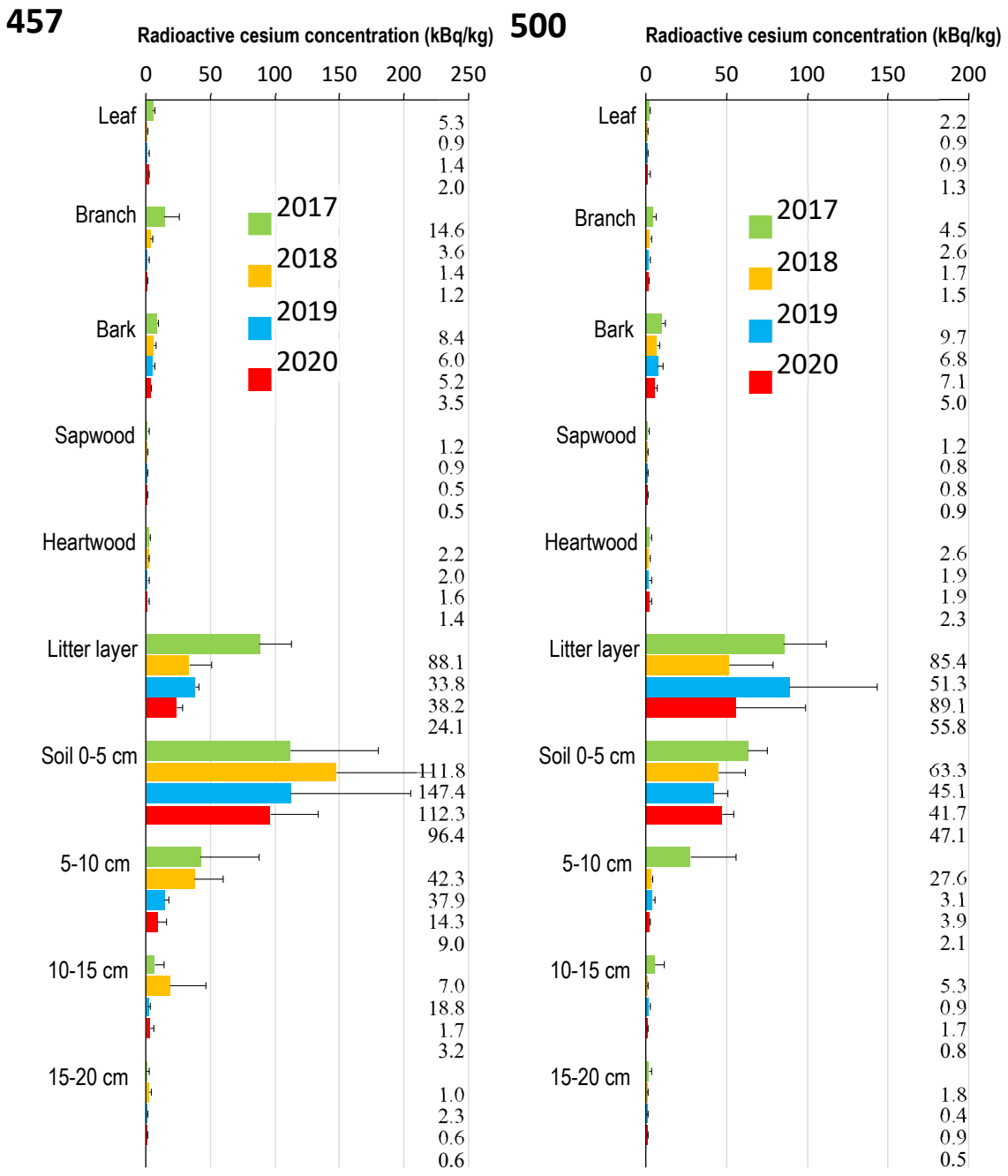


Figure 2 Radioactive Cesium Concentrations in Forest at Site IDs 457 and 500

(Data points and error bars indicate average and standard deviation of radioactive cesium concentration, respectively, at each section. The numbers shown at the right of each data set are average radioactive cesium concentrations (in kBq/kg) at each section in each FY.)

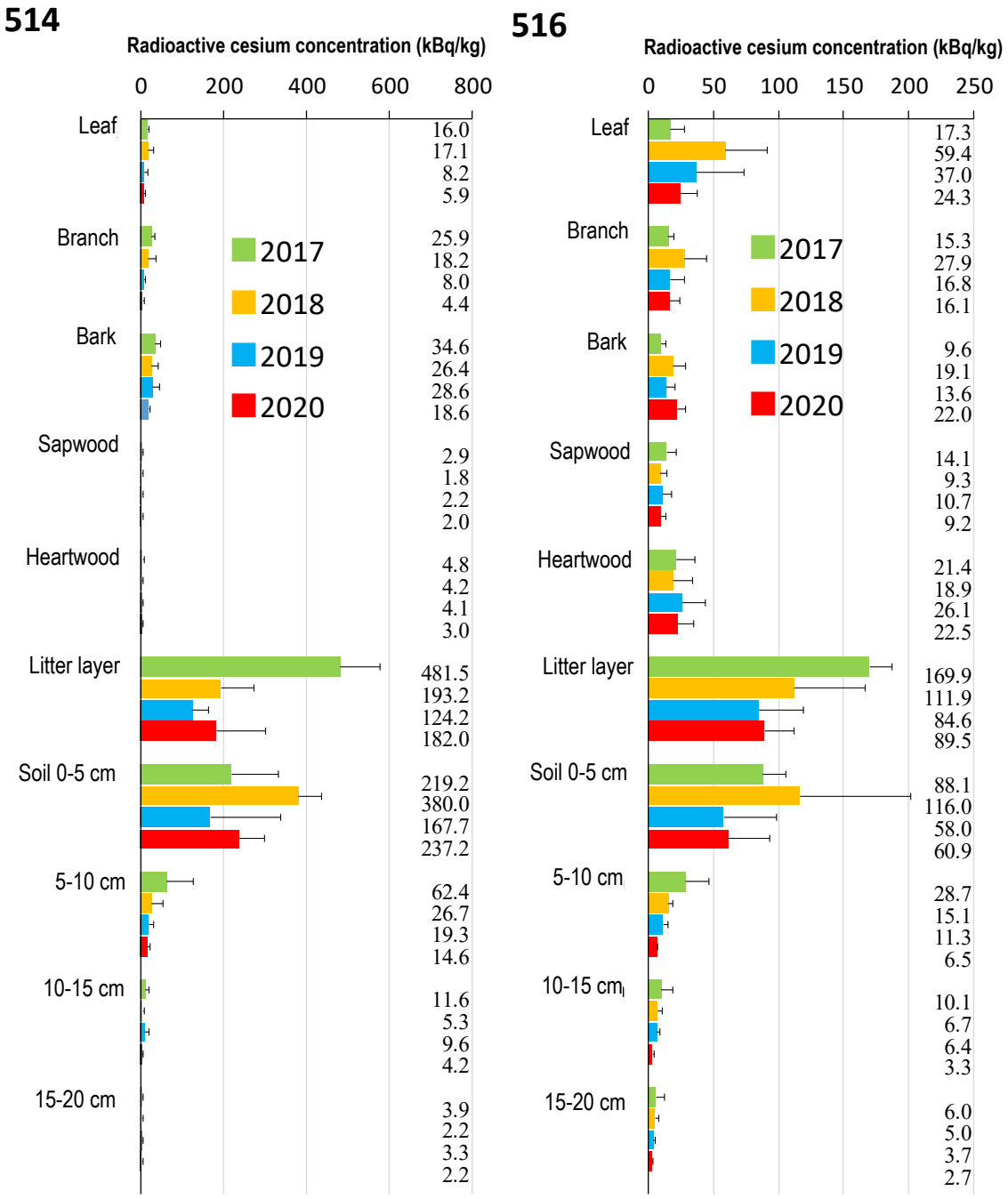


Figure 3 Radioactive Cesium Concentrations in Forest at Site IDs 514 and 516
（Data points and error bars indicate average and standard deviation of radioactive

cesium concentration, respectively, at each section. The numbers shown to the right of each data set are average radioactive cesium concentrations (in kBq/kg) at each section in each FY.)

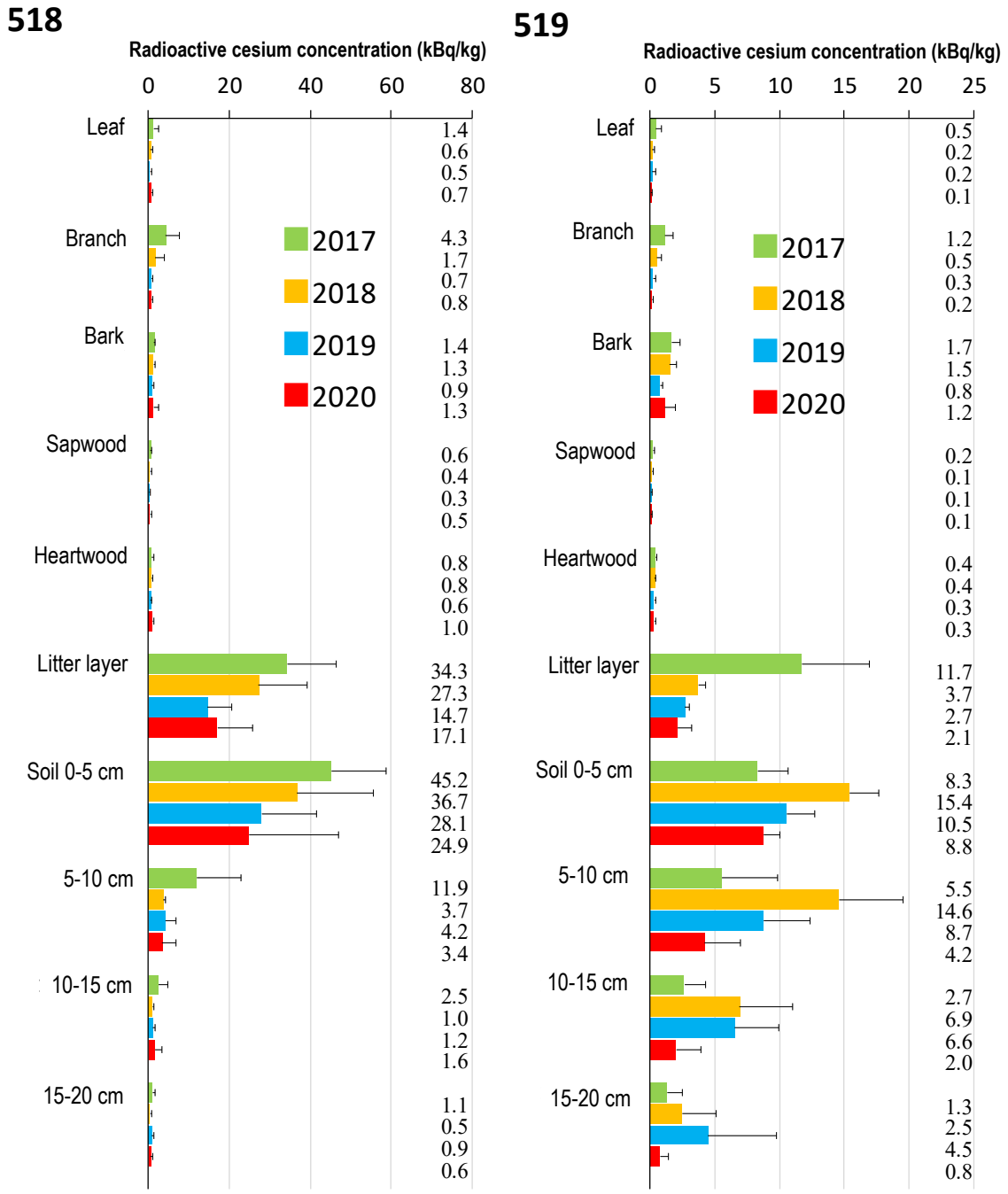


Figure 4 Radioactive Cesium Concentrations in Forest at Site IDs 518 and 519
(Data points and error bars indicate average and standard deviation of radioactive cesium

concentration, respectively, at each section. The numbers shown to the right of each data set are average radioactive cesium concentrations (in kBq/kg) at each section in each FY.)

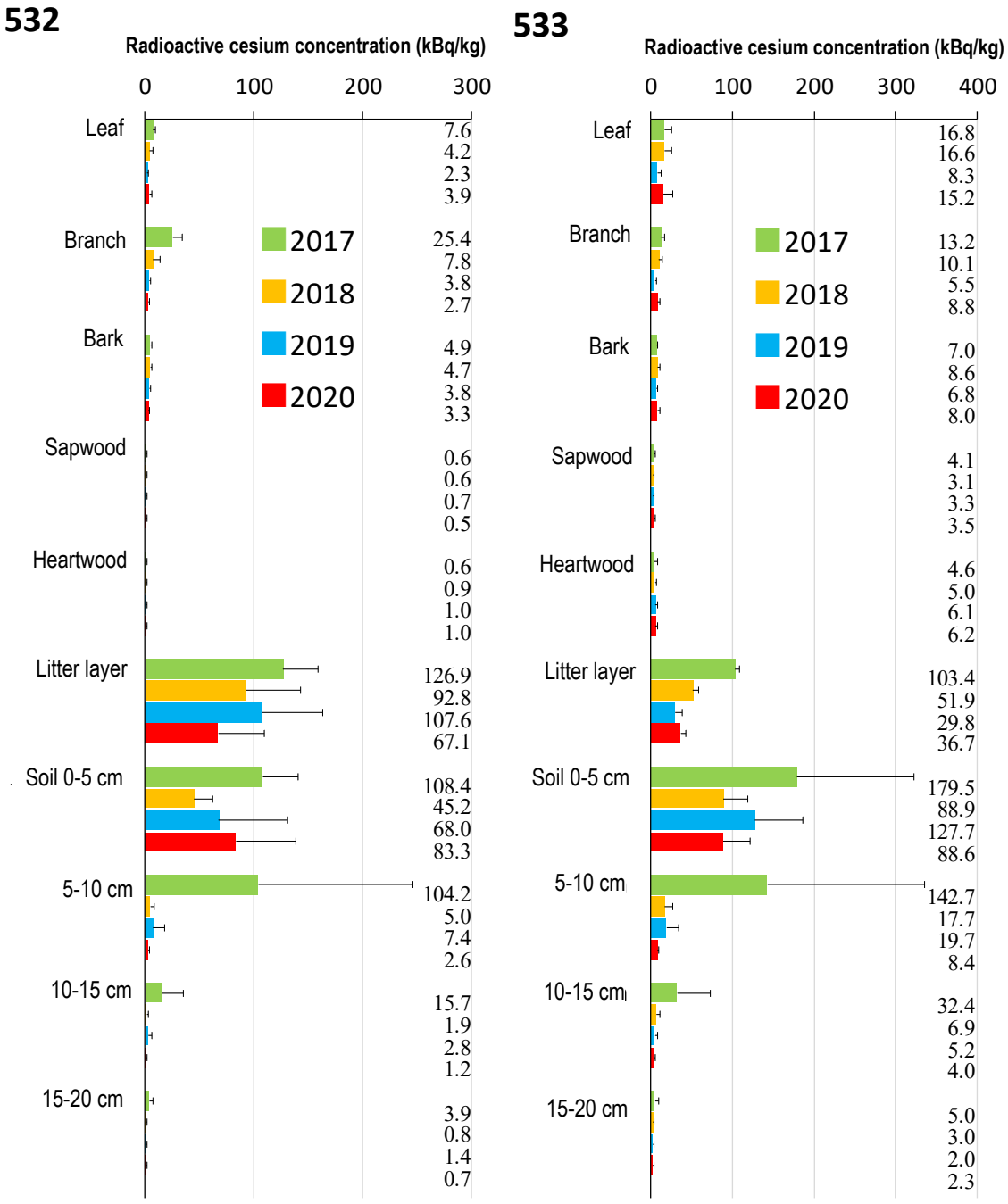


Figure 5 Radioactive Cesium Concentrations in Forest at Site IDs 532 and 533
(Data points and error bars indicate average and standard deviation of radioactive cesium concentration, respectively, at each section. The numbers shown to the right of each data

set are average radioactive cesium concentrations (in kBq/kg) at each section in each FY.)

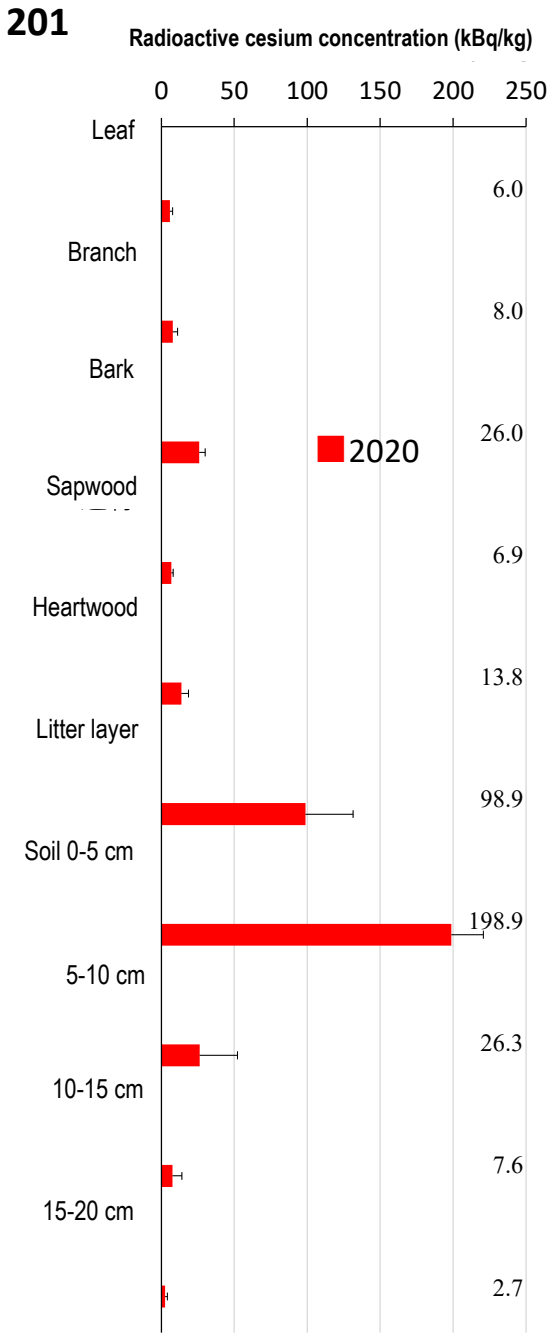
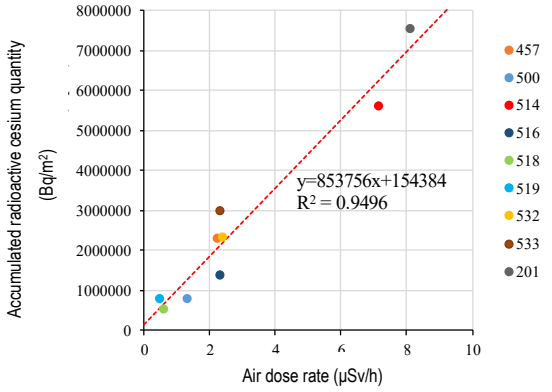


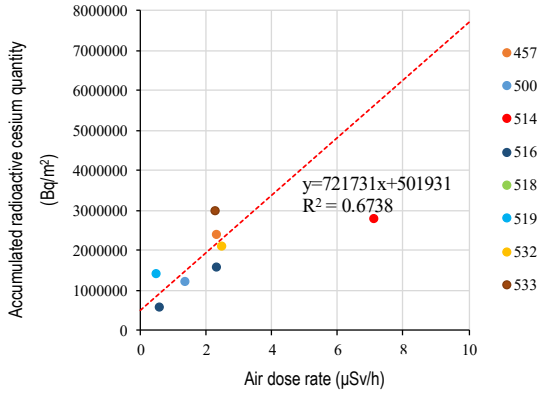
Figure 6 Radioactive Cesium Concentrations in Forest at Site ID 201
(Data points and error bars indicate average and standard deviation of radioactive cesium concentration, respectively, at each section. The numbers shown to the right of each data

set are average radioactive cesium concentrations (in kBq/kg) at each section in each FY.)

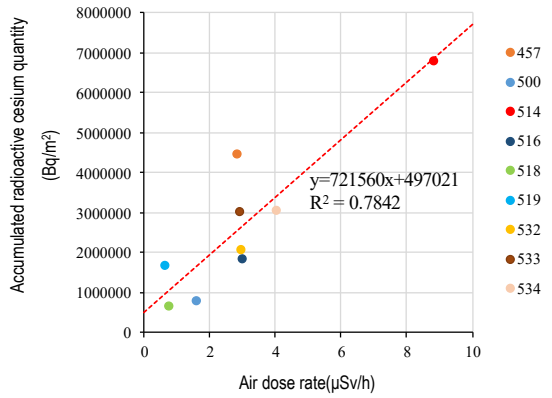
FY2020



FY2019



FY2018



FY2017

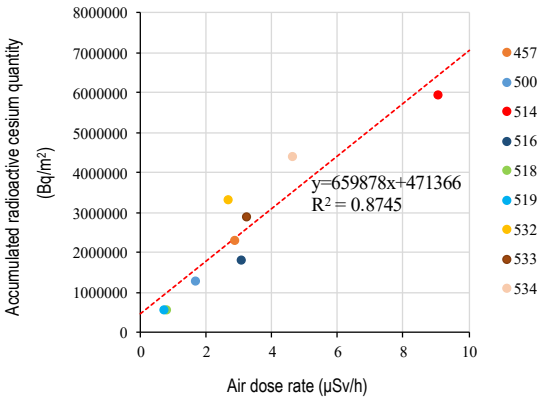


Figure 7 Correlation between Air Dose Rates and Quantities of Radioactive Cesium Accumulated Underground

(Dotted line indicates the regression line. The regression line for FY2019 is derived with omitting the site ID 514.)

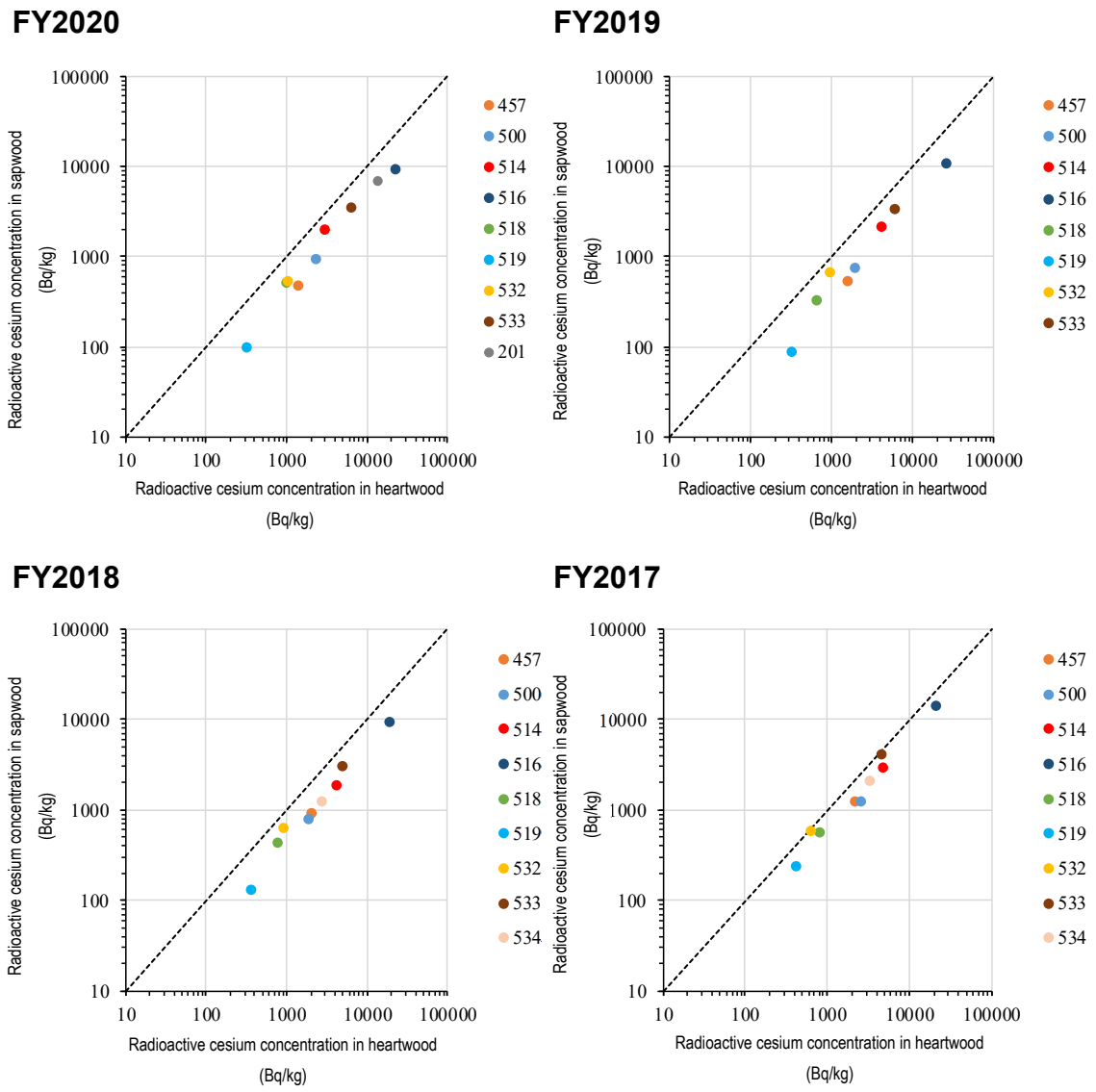


Figure 8 Correlation between Radioactive Cesium Concentrations in Heartwood and Sapwood of Cedar

(Dotted line is the 1:1 line.)