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## Predicting Cs-137 Distribution Patterns from Soil Samples - The Relationships Between Topographic Parameters, Soil Properties, and Cs-137 Concentration Levels

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Forests provide valuable water and nutrient resources to farming activities as well as places for various leisure activities. However, decontaminating forests in the aftermath of a massive radionuclide contamination event presents challenges because of the topography and the difficulty of collecting a large number of field samples. Achieving accurate remote measurements also can be hindered by the canopy cover. In Fukushima, Japan, where elevated radioactive fallout occurred following the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident in March 2011, about 70 percent of the land is covered with forests. Soil samples collected in a forest in Iitate Village, Fukushima, beginning in 2016 through 2018 still contained an average 98200 Bq/kg of Cs-137 in the top 4 cm depth (std. dev. 114100 Bq/kg). Thus, decontamination and identification of Cs-137 distribution patterns in those forests is still a pressing issue. However, soil types in that region, 1000 mm annual precipitation with intense rain during typhoons, and microtopography have presented challenges to understanding how Cs-137 behaves in those forests. In this study, six topographic parameters were computed from 1-m and 10-m resolution DEMs and the relationships between those parameters and soil water content and bulk density were systematically analyzed for their effects on Cs-137 concentration levels. As the first analytical step, correlation indices and the generalized additive models (GAM) analysis were conducted on those parameters. The results show that not all topographic effects are apparent in the correlation analysis, yet the results can be improved when mixed with other parameters in GAM models. Overall the effect of topographic parameters on Cs-137 levels is DEM resolution-dependent while individual soil properties indicate a strong relationship. Also, it was found that depending on the analysis depth, correlation levels and significance of those parameters in GAM models fluctuate. As the second step, Cs-137 levels were extrapolated to a larger area in the study site to understand further the connections between topography and soil properties. The results, including the limitations and proposals for future forest decontamination, will be presented in the session. Understanding how Cs-137 moves and accumulates in forests, especially immediately after contamination, is critical to avoiding the negative impacts on the environment by decontamination measures and to protecting lowlands from harmful radioactivity levels. This study contributes to the radionuclide research field by presenting an example of data analysis processes using field sampled data.

