Application of Soil Radioactivity Data to Environmental Contamination Recovery

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Response to an environmental disaster consists of three domains: Human perception of the event, the concerned environmental processes, and the data and analytical tools. Human perception of the event (cause, effect, future prediction) would affect the disaster recovery and mitigation planning. Building a proper plan requires an understanding of the physical landscape processes. To understand the landscape processes, filed data and data analysis tools are utilized. Together, these three domains combine to present a whole aspect of the disaster situation which needs to be tackled.

During the summer of 2016, soil samples were collected in a village in Fukushima, Japan for radioactivity level assessment. Following the nuclear plant accident in 2011, environmental decontamination efforts, including surface soil scraping, have been taken place in the areas affected by the radioactive fallout. In this study, based on the collected soil radiation data, the relationship among the three domains (human perception, landscape processes, and data) in case of Fukushima is analyzed.

The challenge, which soil data presents, is the inherent geological and landscape heterogeneity, movability, and its three-dimensionality. The land types of the sampling site include natural forests on hills, the foot of the forests where the ground surface was decontaminated, and a rice paddy in the lowlands whose surface soil was replaced. In an effort to identify the storage and the subsurface movement patterns of radioactivity, numerical statistical analysis and two- and three- dimensional visualization analysis are attempted.

The preliminary results indicate a few issues in the three-domain model. With regard to human perception, decision makers' perception about the land processes pose enormous effects on the later implementation of recovery measures. Physical process modeling indicates that the forests are acting as a natural storage for elevated radioactivity, although the natural storage would work differently compared with a man-made storage. As for data handling, horizontally and vertically distributed soil samples impose challenges in visualization. Still, visualization attempts show the certain radiation 'sink' areas in the landscape.

Addressing shortcomings in each domain and filling gaps in the interconnection among them would present an insight which is relevant to disaster response and recovery in general.

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