Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AGE04-P19 Room:Convention Hall Time:May 20 17:15-18:30

Evaluation of management practices in agricultural and forest lands by the multiple-frequency electromagnetic surveying

MIYAMOTO, Tamami[1*], MORI, Yasushi[2], Hiroaki Somura[1], IDE, Jun'ichiro[3], SUETSUGU, Atsushi[2]

[1]Graduate School of Life and Environmental Science, Shimane University., [2]Graduate School of Environmental Science, Okayama University., [3]Finnish Forest Research Institute, Finland

1. Introduction

Agricultural and forest lands are the possible sources of pollutant load to aquatic environments, because those lands account for large proportion of basin areas. We had successfully evaluated pollutant load from non-point sources by sampling and analyzing river water or subsurface drainage. If a large-scale soil survey is also possible, the estimation of pollutant load could be confirmed by elucidating the processes relevant to the pollution. However, the cost in time and labor for soil survey restricts opportunities of surveying large areas. The multiple-frequency electromagnetic surveying system (MFEM) enables non-destructive measurements of soil electrical conductivity profiles. The purpose of this study is to develop a procedure for efficient soil survey with the MFEM. We applied this technique to evaluate the effects of management practices in agricultural and forest lands on the soil properties. The main test sites were at Oki-islands in Shimane Prefecture, Japan. Most of the island surfaces are covered with forests, and the forests are considered as an important watershed protection area.

2. Experimental methods

We investigated nine sites at Oki-islands with a MFEM system (GEM-2, Geophex, US) on 30, 31 August, 2010. The scanned data were mapped by referring location data from a GPS device. The frequencies of the MFEM measurement were 47970, 24510, 7950, 3870 and 2310 Hz. Destructive analysis on soil moisture, electrical conductivity and soil temperature were also conducted by using a soil sensor (Stevens Water Monitoring Systems, Inc., US) at several plots in each site. Total carbon content of the surface soils were also measured by the dry combustion method.

3. Results and discussion

We could distinguish the sites by referring electrical conductivity data around surface of the soils. Electrical conductivity data at surface soils obtained by the MFEM were well correlated with those by the conventional sensor. The data were not perturbed by total organic carbon of the soils. Therefore, in this study, soluble salts could be selectively measured by the MFEM system.

By considering management practices in the investigated sites, we found higher electrical conductivity at the sites with delayed tree thinning. The delayed tree thinning had reduced understory vegetation, hydraulic conductivity of surface soil, and thickness of organic layer. The reduced understory vegetation and soil permeability would have remained soluble salts at the soil surfaces. It was also found that some of the forest sites that have been used as farmlands remained greater amount of soluble salts in the soils.

4. Summary

The MFEM system could evaluate vertical and horizontal distribution of soil electrical conductivity efficiently. By comparing the mapped data, the effects of management practices and land use history on the surface soils could be found. It was confirmed that the immediacy of MFEM technique are useful in the preliminary investigation for large areas.

Keywords: Electromagnetic sounding, land management, forest