

Major and trace elements behavior in two forest watersheds in the Kanto region

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Atmospheric deposition supplies some nutrients to forest ecosystem, serving as a source of reactive nitrogen, sulfur and the toxic metals. Although nitrogen and sulfur have been deposited in Japan as well as in Europe and North America, the impacts of the deposition of reactive N and S such as acidification of surface water and forest decline have not been reported yet. Itoh et al. (2004) reported high nitrate concentrations in stream waters mostly on the periphery of metropolitan Tokyo in Japan. In these forest watersheds, a high level of reactive nitrogen deposition may enhance the nitrification process and thereby acidify the forest soils. In turn, soil acidification can cause increased solubility of metals in the forest soil. In the surface forest soil layer, heavy metals derived from the atmosphere and mainly anthropogenic sources have been accumulating for long time in Japan (Itoh et al., 2007). The increasing mobility of the metals could pollute stream water or ground water, and thus damage the forest ecosystems in the future.

The objective of this study was to compare the behavior of potentially toxic metals in forest soil profiles in two forest sites: the Tsukuba experimental forest watershed and the Katsura experimental forest watershed. Two soil profiles were studied at Tsukuba and one soil profile at Katsura. Soil solution was collected from suction cups (PTFE) installed at each plot at depths from 10 cm to 100 cm. Concentrations of metals were determined using an inductively coupled plasma mass spectrometer (Agilent 7500). The soil solutions were acidic at Tsukuba. The pH values of soil solution did not increase from the surface soil layer to deeper layers (< pH 4.5). Elevated nitrate leaching from the rooting zone was also observed. At Tsukuba, the concentrations of metals (Al, Pb, Cd, Cu, and Zn) were significantly higher than those at Katsura. Higher N deposition loads from the atmosphere and higher nitrification rate in the soils were also observed at Tsukuba. Therefore, the acidification of soil resulting from nitrate leaching may increase the mobility of metals in the soils. However, surface water acidification and high losses of metals from forest ecosystems have not been detected yet.