

Integrated assessment of watershed ecosystems by the use of stable isotope ratios

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The goal of my talk is to review the basic concept and preliminary results of our on-going project regarding stable isotope indicators of the health and sustainability of watershed ecosystems (sponsored by the CREST program of Japan Science and Technology Agency). The primary purpose of this project is to establish an effective tool (a set of stable isotope indicators) that facilitates planning and decision making toward effective watershed management and restoration. Although the “health” of watershed is difficult to define, some of the anthropogenic perturbations alter the biogeochemical and ecological state of ecosystems as a consequence of complex interactions among biotic communities and physico-chemical forces. The prompt diagnosis of this “state of ecosystems” is critical not only to deliver the information to public and decision makers who evaluate the risk of perturbations but also to provide clear “target images” that may guide conservation and restoration practices. Recent studies have shown that the use of multiple stable isotope ratios of watershed components can help improve the conventional ecosystem assessments regarding water quality and biotic communities. The strategy of our project is to organize a multidisciplinary team consisting of hydrologists, geochemists, and ecologists in order to decipher detailed structure of “isotopically ordered watershed” and its responses to anthropogenic impacts. We expect that a carefully coordinated monitoring of multiple stable isotope ratios in a given watershed can provide comprehensive information regarding 1) sources and flow paths of water and nutrients, 2) various metabolic parameters of ecosystems, and 3) energy base and food web structure of aquatic communities, depending on the type and scale of the watershed.