

Biogeochemistry of Si and soil ecosystems services : emerging issues

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It is well documented that the global cycle of Si is strongly intertwined with the cycling of other major elements such as carbon and nitrogen. Terrestrial ecosystems play an important role in the global cycle of Si by delivering the reactive Si (RSi) to the ocean through the riverine transportation of dissolved silica (DSi) and soluble/available biogenic silica (BSi). Here we present some evidences that the biogeochemistry of Si is intimately linked to ecosystem services such as food provisioning, nutrient cycling or water regulation under changing climate conditions. In agriculture, the benefits of Si for the development of crops has become significantly documented for the last 2 decades but the mechanisms behind the benefits are still debated. In cultivated soils the status of Si has to be more carefully evaluated because the fraction that is bioavailable may constitute a possible limiting factor for major crops such as rice or sugarcane. The search for a simple and rapid plant available indicator (PAS) is a challenging issue that depends on the knowledge of the reactivity of the Si pools and that we want to address. Silicon isotopes have recently been applied to a few cultivated fields and we show that they are useful to decipher the effect of Si uptake by plant and to trace the source of Si for crops. In plants, the role of Si can be better assessed using in-situ recent technology. For example, using X-ray imaging, we showed that accumulation of phytoliths over the veins provides better support to the leaf when water stress is applied. This communication benefits from the financial support of the BIOSiSOI projet ANR-14-CE01-0002.