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# Biogenic silicon pools in terrestrial biogeosystems and their significance for silicon cycling

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On a global scale the biogeochemical cycles of silicon (Si) and carbon are connected by weathering processes and fluxes of dissolved Si from terrestrial to aquatic ecosystems. Various pro- and eukaryotic organisms are evolutionarily adapted to synthesize amorphous siliceous structures (biosilicification). In soils these siliceous structures can accumulate and form biogenic Si (BSi) pools, whereat it can be differentiated between phytogenic (BSi synthesized by plants), zoogenic (BSi synthesized by sponges), microbial (BSi synthesized by bacteria and fungi) and protistic (BSi synthesized by unicellular organisms) pools. Accumulation and recycling of BSi in terrestrial biogeosystems influence fluxes of dissolved Si from the continents to the oceans, thus act as a filter in the global Si cycle. As research has primarily been focused on the role of phytogenic Si pools until now there is only little information available on the other BSi pools in soils. In order to fill this knowledge gap we examined different BSi pools in soils of initial and forested terrestrial biogeosystems using modern microscopical methods (laser scanning and scanning electron microscopy). In forested biogeosystems we further analyzed abiotic (e.g. soil pH) and biotic (earthworm biomasses) influencing factors on BSi pool size, while samples of initial biogeosystems were used to analyze spatiotemporal BSi pool dynamics. We found that especially biotic interactions are important factors for protistic BSi pools (represented by testate amoebae) and that phytogenic Si pools are about several 100-times bigger than protistic (testate amoebae) Si pools (0.2-4.7 kg Si ha-1). However, annual biosilicification rates of testate amoebae (up to 80 kg Si ha-1) are comparable to or even can exceed annual silicon uptake by trees. Our studies of initial biogeosystems revealed that BSi pool sizes increased markedly within a relatively short time span (<10 years) of ecosystem development. Differences in quantities, dynamics and resistibility against dissolution of various BSi pools indicated their possibility to influence biogeochemical Si cycling relatively rapid (protistic Si pools) or slow (zoogenic Si pools). In conclusion, our results are crucial for a detailed understanding and a more precise modeling of Si fluxes from terrestrial to aquatic ecosystems.