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The biological control on Si cycling in the Okavango Delta

Eric Struyf (1), Keotshepile Mosimane (2), Dimitri Van Pelt (1), Mike Murray-Hudson (2), Patrick Meire (1), Patrick Frings (3), Jonas Schoelynck (1), Mangaliso Gondwé (2), Piotr Wolski (2), and Daniel Conley (3)

(1) University of Antwerp, Department of Biology, Ecosystem Management. Universiteitsplein 1C, 2610 Wilrijk, Belgium, (2) University of Botswana, Okavango Research Institute, Private Bag 285, Maun, Botswana, (3) Lund University, Department of Geology, Sölvegatan 12, 22362 Lund, Sweden

We assessed the role of vegetation and hydrology in the Si cycle in the Okavango Delta (Botswana). Our results show a large storage of biogenic Si (BSi) in vegetation and the sediments. The biological storage is among the highest observed so far for any ecosystem worldwide. Floodplain vegetation accumulates similar amounts of BSi in both the temporary floodplains and the permanent floodplains, with most values observed between 20-100 g Si m-2. This vegetation Si, after litterfall, contributes to a large biogenic Si storage in the sediments. In temporary floodplains, sediments contain less BSi (375 -1950 g Si m-2 in the top 5 cm) than in the permanent floodplains (1950 - 3600 g Si m-2 in the top 5 cm). BSi concentrations in the floodplain sediments decline exponentially indicating rapid dissolution. In the occasional and seasonal floodplains, unidirectional solute transfer from floodplains to tree covered islands removes Si from the riverine systems.

The hydrology of many tropical wetlands is undergoing major changes due to human alteration of river morphology and watersheds. Model predictions also project substantial future changes in hydrology and climate . This will have implications for flooding extent and seasonality, factors that may induce changes in Si storage in the Okavango Delta. Recently, annual BSi uptake in global vegetation was estimated at about 85 Tmole. Of this, the total surface of wetlands worldwide contributes approximately 4.16 Tmole a-1. Our conservative vegetation BSi production estimate of 0.02 Tmole of Si a-1 would represent about 0.4% of total annual uptake in wetland vegetation worldwide within the Okavango Delta alone, despite it covering only about 0.1% of global wetland area. Tropical rivers deliver about 70-80% of the global Si load into the ocean , implying it is crucial to assess environmental factors that can influence its transport. Our data and the limited available literature data available clearly show that wetlands and floodplains are an important yet understudied component.