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The Carbon Cycle at the Nile Headwaters

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River systems play an integral role in the global carbon cycle by connecting the terrestrial biosphere, the atmosphere and the oceans. Extensive wetland systems, such as those found in the Amazon region, have been shown to export significant amounts of carbon to river waters as dissolved carbon dioxide (CO_2) that can be transported and emitted hundreds of km downstream. The assessment of both regional and global carbon budgets could therefore be improved by quantifying these lateral carbon fluxes, especially from highly productive temporarily or permanently flooded areas where substantial CO_2 evasion from inland waters can occur.
The Nile is the longest river in the world and the headwaters are located in the extensive Papyrus dominated wetlands in central Africa that are associated with Lake Victoria. From its source the White Nile flows northwards through wetlands in Uganda and Sudan before it joins the Blue Nile. Papyrus wetlands have been shown to be some of the most productive global ecosystems, with recorded rates of aerial net primary productivity of up to 3.09 kg C m-2 yr-1. In addition, where anaerobic conditions occur they also accumulate large amounts of carbon in the form of peat, and under these circumstances they represent a significant carbon sink. However, as water moves through these wetlands and is exchanged with surrounding rivers and lakes significant quantities of dissolved organic and inorganic carbon as well as suspended particulate organic matter are exported, which are either released further downstream by degassing, decomposition or deposition. Information on such losses from these wetland ecosystems is extremely sparse but in order to better constrain ecosystem scale carbon dynamics more accurate regional carbon budget estimates are required for constructing the full carbon budgets of these regions. Here we construct a carbon budget for this region scaled from plot-based measurements of carbon pools and fluxes and we make the first estimates of carbon export from the headwaters into the Nile river as it flows northwards to Sudan.