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The effect of dam operation on the hydrology and ecology of a tropical riverine floodplain system

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Worldwide, dam operation has been changing the flow regimes of many rivers with significant impact on riverine ecosystems. At the same time, dam management itself provides the key to better control the specifics of this hydraulic alteration and hence to mitigate negative effects of river regulation. In our study we aimed at substantiating the ecological basis for an adapted dam management for the case of a seasonally inundated riverine floodplain system in Zambia, Southern Africa. We quantified dam-induced alterations and investigated the relationship between an altered flow regime and altered ecological conditions in the floodplain.

For this, we adapted the "Indicators of Hydraulic Alterations" to seasonal tropical river systems and used them to analyze both the pristine and the regulated hydrological regime, namely the inflow to the floodplain, water level in the floodplain and modeled flooded area in the ecologically most valuable part of the floodplain. We checked the reliability of the adapted indicators and demonstrated how dam operation reduces the correlation between them, making it undesirable to further reduce the number of indicators. Using the limited ecological data available we then identified critical hydrological situations that put at risk the functioning of the dam-impacted, flood-dependent grazing ecosystem and investigated the potential of an adapted dam operation for managing these situations. We formulated targets for an adapted dam operation and assessed the potential and the limitations for achieving these targets, where possible giving water management and monitoring recommendations.