Linking Phosphorus Storage Mechanisms with Removal Performance in Everglades Stormwater Treatment Wetlands

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Constructed wetlands (CWs) have been applied all over the world to reduce excess phosphorus (P) from nonpoint source nutrient pollution. However, the relationship between the function of CWs and the biotic and abiotic mechanisms that drive P storage has not been widely studied. This study seeks to better understand the biotic and abiotic mechanisms that contribute to P storage in a study of six Everglades Stormwater Treatment Area (STA) CWs representing a range of performance designations (i.e., well- vs under-performing). A principal component analysis (PCA) was conducted on accreted soil (i.e., floc and recently accreted soil layers) P fractionation data from STA-1E EFW, STA-1E CFW, STA-2 FW3, STA-2 FW4, STA-3/4 CFW, and STA-5/6 FW1. The results of this study found that there are four P storage mechanisms present in the STAs: (1) microbially driven biotic, (2) abiotic driven by carbonate formation, (3) abiotic driven by iron (Fe), and (4) abiotic driven by aluminum (Al) and potassium (K). Well-performing FWs stored the majority of P via the abiotic mechanisms driven by carbonate formation as well as Al and K. Under-performing FWs stored the majority of P via the microbially driven biotic mechanism and abiotic mechanism driven by Fe. The results of this study point to various management strategies to improve P storage and P removal performance, such as submerged aquatic vegetation management and better understanding of the exact mechanisms behind the abiotic mechanisms driven by Al, Fe, and K.