NUTRIENT MANAGEMENT AND OPTIMIZATION FOR ALGAE BLOOM REDUCTION IN LAKE OKEECHOBEE

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Best Management Practices (BMPs) are typically implemented in agricultural and urban landscapes to reduce nutrient losses at individual parcels. However, BMPs effectiveness at reducing watershed-wide regions remains an open question. This study aims to evaluate the effectiveness of parcel-based agricultural and urban BMP implementations in reducing watershed-wide phosphorus (P) and nitrogen (N) loads. The Lake Okeechobee watershed, covering 10,600 km^2 of mixed agricultural and urban land use, is used as a case study. Hydrological and nutrient transport processes in the watershed were simulated using the Watershed Assessment Model (WAM). The model was calibrated and validated for river discharge and nutrients for each of the six sub-watersheds, with R^2 values ranging from 0.43 to 0.80 for flows and 0.24 to 0.85 for nutrients. Four what-if scenarios were simulated representing different regional BMP implementations and their annual costs were addressed: Baseline (no BMPs implemented), current conditions (1032 km^2 area influenced), maximum potential scenario (5923 km^2 area influenced), and optimal BMP placement. Simulations indicated that the currently implemented BMPs could be reducing P loads from 482 to 468 tons/year (-3%; $9 million/P ton) and N loads from 4384 to 3796 tons/year (-13%; $0.22 million/N ton). Further implementation of potential BMPs could reduce P to 307 tons/year (-37%; $3.25 million/P ton) and N to 3036 tons/year (-31%; $0.42 million/N ton). Dividing the watershed into finer spatial units with different land use distributions illustrated that BMPs in Taylor Creek-Nubbin Slough (50% agriculture) have the potential to reduce P by 55%, and in Upper Kissimmee (23.5% urban) BMPs have the potential to reduce N by 42%. In addition, we evaluated the effect that these nutrient reductions could have on algal blooms using the Lake Okeechobee Optimization of Nutrient Exports model and determined that combining watershed nutrient management with lake operations could be even more effective at decreasing algal blooms.

PRESENTER BIO: Dr. Arias is an Associate Professor at the University of South Florida, where he is the Principal Investigator of the Watershed Sustainability Lab (www.watershedsustainability.org). Areas of research include surface water quantity/quality prediction and Ecological Engineering, with emphasis on tropical and subtropical watersheds. He became a Gulf Research Program Early Career Fellow in 2021 and received USF's 2023 Outstanding Research Achievement Award.