

Planting Stormwater Ponds: Determining the Benefits and Best Management Practices for Ornamental Plants in an Underutilized Portion of Residential Landscapes

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ABSTRACT

The community of Lakewood Ranch (LWR), FL has over 300 stormwater ponds (SWPs) that residents consider aesthetic amenities. However, these SWPs often contain large amounts of unsightly algae, exhibit low water clarity, and experience bank erosion that encroaches on homeowner properties, presents safety risks, and degrades water quality. Our project is a collaboration among UF/IFAS, LWR and pond and landscaping companies aimed at determining if incorporating ornamental plantings into SWPs could help to alleviate water quality and bank erosion issues. To do so, we selected six SWP pairs (N = 12). One SWP from each pair was planted and the other was not. This paired design allows us to make comparisons between planted and non-planted SWPs in water quality and bank

erosion over time. We also hosted workshops to identify collaborator goals and to devise management strategies for SWP plantings. Plantings were completed in August 2018. Plant material and labor was donated by LWR. Analyses of baseline data revealed no apparent differences in water quality or extent of bank erosion between planted and non-planted SWPs prior to planting. This lack of difference provides evidence that any variability between planted and non-planted SWPs detected in the future is not due to pre-existing conditions. Our plantings have also created public interests in the form of requests to plant more SWPs and a local news story. Future work includes workshops to devise management strategies and continued monitoring of water quality.

OBJECTIVES

Stormwater ponds (SWPs) occur in nearly all residential areas of Florida. While the intended function of these engineered ecosystems includes flood control and pollutant removal from stormwater runoff, SWPs can also enhance the aesthetics of residential landscapes. The community of Lakewood Ranch (LWR), FL has over 300 SWPs that residents consider aesthetic amenities. However, these SWPs often contain large areas of unsightly algal growth, exhibit low water clarity, and experience bank erosion that encroaches on homeowner properties, presents safety risks, and degrades water quality. Incorporating plants within and around SWPs may be a logistically and economically feasible strategy for alleviating these challenges. However, this potential solution has two key barriers to implementation. First, there is conflict among landscaping and pond management companies as to who is responsible for maintaining SWP plantings. Second, residents perceive plants in and around SWPs unfavorably, as they can block their view of the water. Designing SWP plantings to use aesthetically appealing ornamental plants may alleviate this latter barrier and provide economic opportunity for nursery growers and landscaping companies.

Our team collaborated with the LWR IDA, Altec Lakes and Natural Areas (Altec), and the Down to Earth Landscaping (Down2Earth) to overcome these barriers by: **1) quantifying the degree to which ornamental plants stabilize SWP banks, help to reduce unsightly algal blooms, and help to decrease pollutants that degrade water quality (i.e., nitrate, ammonium, total organic nitrogen, total nitrogen, phosphate, and total phosphorus), and 2) devising best management practices for the maintenance of ornamental SWP plantings.**

METHODS

To meet these objectives, our team is leading a field study and hosting multiple workshops. For the field study, our team worked with our collaborators to select six SWP pairs. One SWP from each pair was planted and the other was left as an unplanted reference (N =12 SWPs). Suitable pairings were identified using a cluster analysis of a prior dataset on SWP morphology and chemistry collected at LWR in 2014. The SWP from each pair that was most visible to the public was chosen for planting, as these plantings are intended to serve as demonstration sites aimed at communicating the aesthetic potential of SWP plantings. SWP plantings were completed in August 2018.

LWR IDA donated over \$16,000 to cover planting costs. Prior to planting, our team quantified concentrations of inorganic and organic nutrients, water clarity, and the amount of bank erosion for all 12 studied SWPs (Fig. 1). We will sample one more time prior to October 2018 and once during the winter of 2018-2019. We will begin more frequent sampling after plant establishment during the spring/summer of 2019. We are more likely to detect effects of plants on water quality and bank stabilization after this establishment period.

Thus far we have hosted two workshops. The first workshop involved 14 attendees from UF/IFAS, LWR, Altec, and Down2Earth. The aim of this workshop was to ensure that all collaborators understood why all other collaborators were contributing to this project. The second workshop was held to communicate our statistical approaches for SWP selection and to finalize the list of SWPs currently included in our field study. Future workshops will focus on developing management strategies for SWP plantings that work across often conflicting pond and landscaping management companies. In addition, members of our team will lead focus groups to learn resident perceptions of ornamental SWP plantings given their potential benefits. These efforts will occur after plant establishment.

RESULTS

Statistical analysis of baseline data (i.e., data collected prior to planting) on water chemistry, water clarity, and amount of bank erosion revealed no detectable differences between planted and non-planted SWPs, nor between individual SWP pairs. Table 1 summarizes these findings across all planted and non-planted SWPs. This lack of detectable differences supports the suitability of our study design. That is, we can state with greater certainty that any differences we detect in the future between planted and non-planted SWPs are not due to pre-existing conditions.

Table 1. Comparison of baseline mean $\pm$ SD of water chemistry, water clarity (Seki disc reading), and proportion of banks severely eroded in planted and non-planted SWPs. Various statistical analyses revealed no apparent differences.

Parameter	Planted	Non-Planted
NH ₄ -N (mg/L)	0.21 $\pm$ 0.05	0.18 $\pm$ 0.01
NO ₃ -N (mg/L)	0.11 $\pm$ 0.06	0.09 $\pm$ 0.02
Total organic N (mg/L)	0.93 $\pm$ 0.21	1.36 $\pm$ 0.45
Total N (mg/L)	1.25 $\pm$ 0.26	1.64 $\pm$ 0.45
Ortho P (ug/L)	8.07 $\pm$ 4.70	7.51 $\pm$ 3.11
Total P (ug/L)	41.68 $\pm$ 13.30	42.57 $\pm$ 25.15
Seki disc reading (m)	2.00 $\pm$ 0.62	1.54 $\pm$ 0.89
Proportion of bank severely eroded	0.51 $\pm$ 0.35	0.61 $\pm$ 0.37



Fig. 1. Dr. Jariani Mohd-Jani assisting with baseline sampling of LWR SWPs.

Our initial workshop revealed a strong degree of overlap among collaborators in why they are contributing to this project. We are looking for cost-effective strategies to enhance water quality in SWPs. However, all collaborators also have a sincere interest in protecting downstream water resources. They are also interested in using these SWPs as case studies to promote plantings in other SWPs having water quality issues. Lastly this workshop identified a missing stakeholder group- realtors. Altec, Down2Earth, and LWR IDA each stated how realtors sell homes near SWPs as “lake front property”. Homebuyers are, therefore, unaware that SWPs are human-made and are intended as a strategy to manage stormwater. Our collaborators feel this this lack of understanding contributes to homeowners’ unwillingness to use plants to improve water quality. Team members are currently considering how to include realtors, as well as the FNGLA, in future workshops.

Plantings of SWP banks and littoral shelves were completed by mid-August. Again, the costs of the plant materials and installation was provided by LWR IDA. UF/IFAS also provided about 76 hours-worth of labor to these efforts (Fig. 2). As of now, it looks as if plantings are doing well (Fig. 3). Although, some littoral plantings are exhibiting damage and stress from what appears to be some form of herbivory. Altec has agreed to address this concern.

Although SWP plantings at LWR are young, they are attracting attention. This attention has caused us to make minor adjustments to our study design. Residence living on the banks of one of the study’s non-planted SWPs after seeing planted SWPs requested that their SWP be planted. Given the potential for real-world benefit, we accommodated this request. Thus, our plantings have already led to at least some changes in perception regarding plants in SWPs. The local news source, the East County Observer, also reported on our project. We made sure that they mentioned the FNGLA’s generous contribution to this project. The story can be found here: <https://www.yourobserver.com/article/lakewood-ranch-ponds-target-of-water-quality-study>.

CONCLUSION

According to our analyses of baseline data, the SWPs we selected were good candidates, i.e., prior to planting, planted or non-planted SWPs did not differ from one another with regards to water quality and/or bank erosion. We therefore have greater certainty that future differences detected between planted and non-planted SWPs were not pre-existing. Plantings occurred later than anticipated. For this reason, we have delayed more frequent sampling of water quality and bank erosion until after plants establish, i.e., next spring and summer. This delay will help to ensure a better understanding of if and how ornamental plantings affect water quality. Regardless of this delay, we have already learned a lot and have increased interest in the effect of ornamental plantings on water quality and community aesthetics. Specifically, neighbors have requested their ponds be planted and a local news source is spreading the word about the potential benefits of ornamental plants in SWPs. Workshops have enabled all collaborators to understand and define our roles in this project and to better understand the reasoning for our paired pond approach and the statistical methods used to make scientific inferences. Workshops also revealed a new stakeholder - realtors - that we aim to include in future workshops.

Our future efforts will include further sampling of water quality and bank erosion, workshops to devise strategies to manage SWP plantings, and focus groups to document resident perceptions of SWP plantings. We will continue to update the FNGLA on this progress.



Fig. 2. UF/IFAS volunteers who assisted in SWP plantings from left to right: Walsh Nichols, Evangelon James, Dr. Paul Monaghan, Dr. Basil Iannone, Lindsey Kelly, and Mary Szoka.



Fig. 3. Before (A) and after (B) planting images of SWP in LWR illustrating initial improvements in aesthetics. Dr. Eban Bean and Dr. Mary Lusk (from left to right) are shown in A.