

Utilizing green walls for in-situ treatment of greywater for agricultural reuse

UNIVERSITY OF MARYLAND Honors college

Introduction

- 70% of water consumed annually is used on agriculture, equating to ~ 2 quadrillion gallons.^{1,2}
- Expect a 55% increase in global demand for water by 2050 with disadvantaged communities affected the most.³
- Water resources are mismanaged, and water treatment systems are unsustainable, thus continuing to strain resources

Our Solution

- Using an indoor green wall to filter artificial light greywater on-site for recycling
- Green walls have been shown to remove pollutants from stormwater and also have other benefits.⁴
- Greywater accounts for 75% of domestic wastewater and is over treated when it contains substantially less pollutants.⁵
- So our research will address:
 - What role does Maryland native wetland plants play in pollutant removal from greywater filtered through indoor green walls?
 - We hypothesize that both *Juncus effusus* and Carex stricta will have a significant impact on the removal rate of pollutants





Carex stricta⁷

Juncus effusus⁶

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Methodology

- Using artificial light greywater with a recipe developed from Diaper et al. (2008) and Prodanovic et al. (2017) to irrigate the wall.^{8,9}
- Testing for chemical, physical, and biological characteristics of effluent greywater to follow EPA standards for reuse by irrigation purposes¹⁰ Some parameters for water quality tests include: total suspended solids (TSS), biological oxygen demand (BOD), total nitrogen (TN) and pH • Compare the concentration of pollutants in
- collected inflow and outflow water samples
- Perlite and coco coir 1:2 mixture modeled after the 2019 Prodanovic study.¹¹



Fig. 1: configurations modified from Prodanovic et al. (2019) There will be 3 configurations with 1 replicate per trial period. 8 pots per level will mean 24 plants per wall. The unvegetated wall will be a control to determine the role of wetland plants in pollutant removal. LED growing lights will be used.

Fig. 2: Experimental timeline modified from Prodanovic et al. (2017)

During one month establishment phase, all configurations irrigated with tap water. Media configuration will be flushed with tap water twice a day for five days during Week 0. After establishment period, all configurations will be dosed 5 days per week. Inflow and outflow greywater will be sampled weekly every Friday. No dosing during weekends.

Future and Research Goals

- irrigation system

Citations and Acknowledgements

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• Will construct walls this semester and start data collection in the summer for the first trial period • Finish second and third trials by the end of 2023

• Will calculate water loading rate for plant species and wall's size using moisture sensors and a drip

• Will conduct a cost-analysis to determine accessibility to technology and justify use

