Influence of constructed wetlands on global warming

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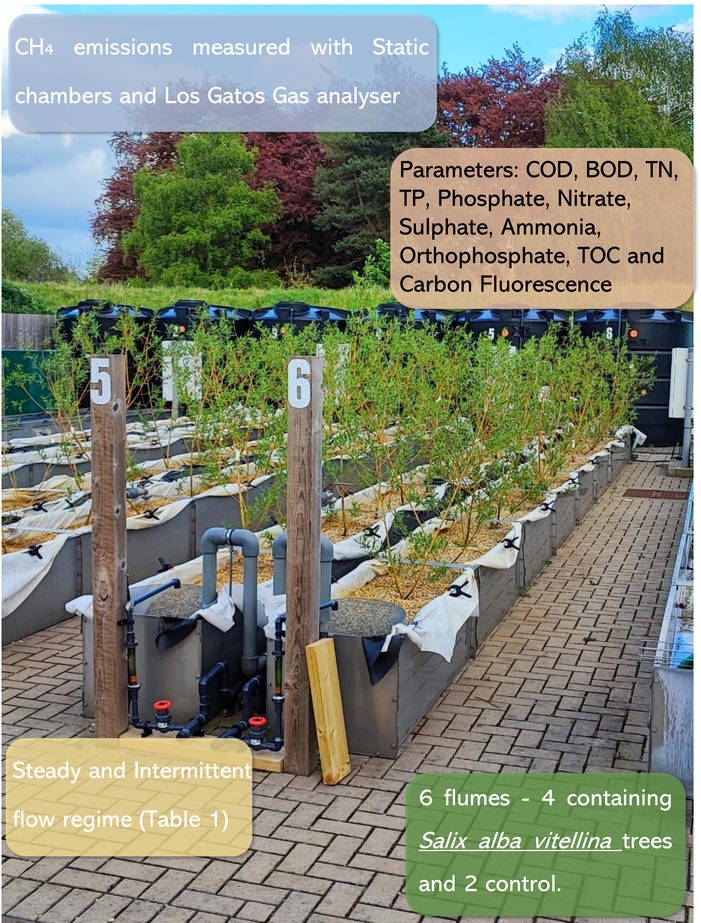
1. Introduction

- 2.3 billion people does not have access to sanitation. In developing countries sanitation coverage is below 50% in many countries in Southern Asia and Sub-Saharan Africa;
- Such countries require simple and low-cost solutions for wastewater treatment to support effective sanitation;
- In this scenario, constructed wetlands are considered an economical and efficient option for wastewater treatment systems, since a great range of effluents can be used in this system, as well as different kind of vegetation to achieve satisfactory results.
- Woody species: good adaptation to wetlands, high organic matter removal, high nutrient accumulation and can work as a sink for CO2.



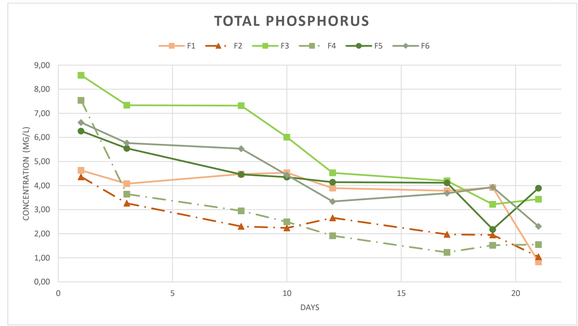
2. Objectives

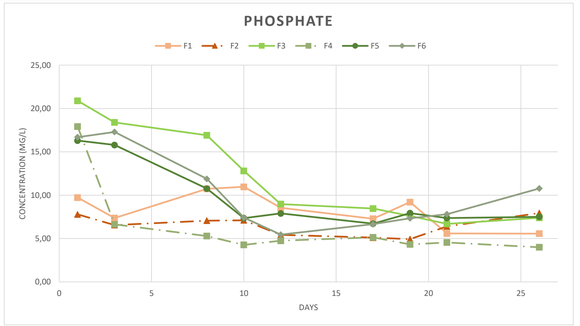
- Quantify removal of common pollutants such as nitrogen and phosphate from a synthetic secondary wastewater;
- Quantify carbon sequestration and biomass gains;
- Measure methane emission by the different parts of the mesocosm: trees and soil.

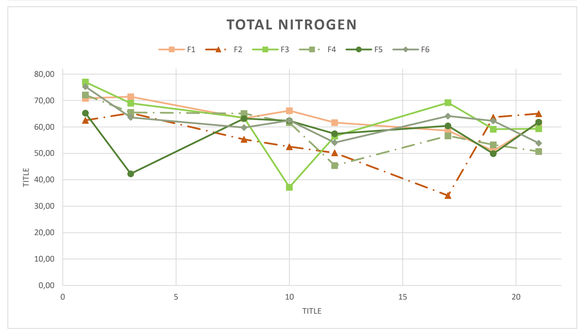
Table 1. Flume Map

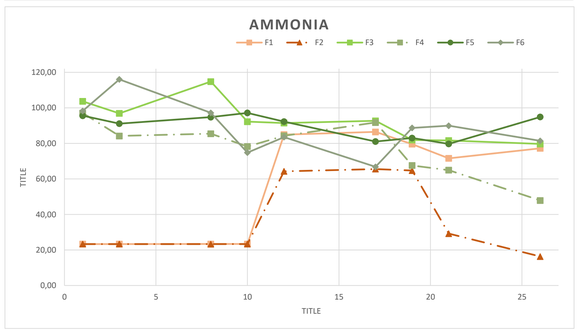
Flume no.	Flood Regime	Flood:Dry (Days)	Planted/Control
1	Intermittent	2:1	Control
2	Steady	-	Control
3	Intermittent	2:1	Planted
4	Steady	-	Planted
5	Intermittent	1:2	Planted
6	Intermittent	2:2	Planted

3. Early Results









4. Discussion – Wastewater treatment

- TP was best removed on Flume 4: 85.49% of removal so far; Steady flow flumes showed best removal of TP;
- Phosphate removal: 77 to 35%. Planted flumes shows better removal efficiency. Control flumes shows a lot of fluctuations on phosphate concentration;
- TN removal efficiency is low due to the aeration of the system (compromising the nitrification – denitrification process);
- Ammonia is efficiently removed in steady flow CW. Flume 2 has the best removal (95%) followed by Flume 4 (57,82%).

5. Discussion – Methane Emissions

- Early results show that Steady flow wetlands emits less methane than the intermittent flow ones (Table 2). This is due the incomplete methanogenesis: steady flow CW creates an aerobic environment, breaking the anaerobic methanogenesis process. Table 2 shows the first results of the total emission of CH_4 from each flume.

Table 2. Methane Flux

Flume	Measured part	CH_4 Flux ($mg.m^{-2}.d^{-1}$)
1	Soil	4.03
2	Soil	-0.21
3	Soil and Trees	22.27
4	Soil and Trees	-2.25
5	Soil and Trees	13.21
6	Soil and Trees	0.06

6. Conclusion and future work

- Steady flow showed better performance on removing pollutants like Ammonia, Phosphate and Total Phosphorus, while Total Nitrogen on intermittent flow (removal efficiency is not as high when compared to the other parameters).
- Excluding Ammonia, all the other nutrients were removed in the presence of trees.
- CH_4 emissions are also lower in the steady flumes because of the aeration of water (not allowing the occurrence of methanogenesis).
- For future work, continuous monitoring of wastewater and more parameters should be analysed (i.e. COD, BOD, TOC…). For Green House Gases, verify the different emission on different seasons and check the percentage of methane coming from the different parts of the CW (trees and soil).