Life Cycle Analysis for Evaluating Sustainability of Stormwater Streetscape Designs

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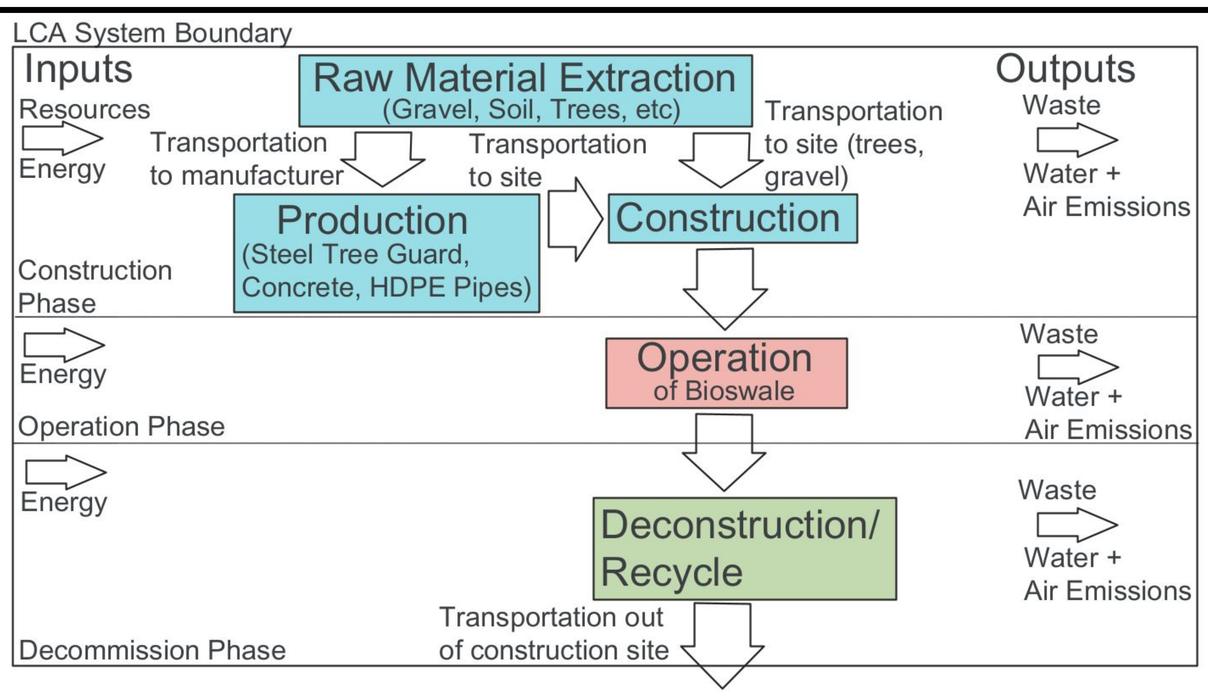
Introduction

- There is limited research on the efficiency and sustainability of different bioswale designs.
- Life Cycle Analysis (LCA): is often used to compare the impacts of products and processes.
- Two different bioswale designs in Brooklyn, NY compared to a standard NYC bioswales



Object	Number
Curb Cut Inlet	1
Curb Cut Outlet	2
Concrete Culvert	3
HDPE Riser	4
Connection	5
Stormwater Inlet	6
Curb Cut H-flume inlet	7
Tree	8

1. Standard Bioswale
2. Cluster A
3. Cluster F

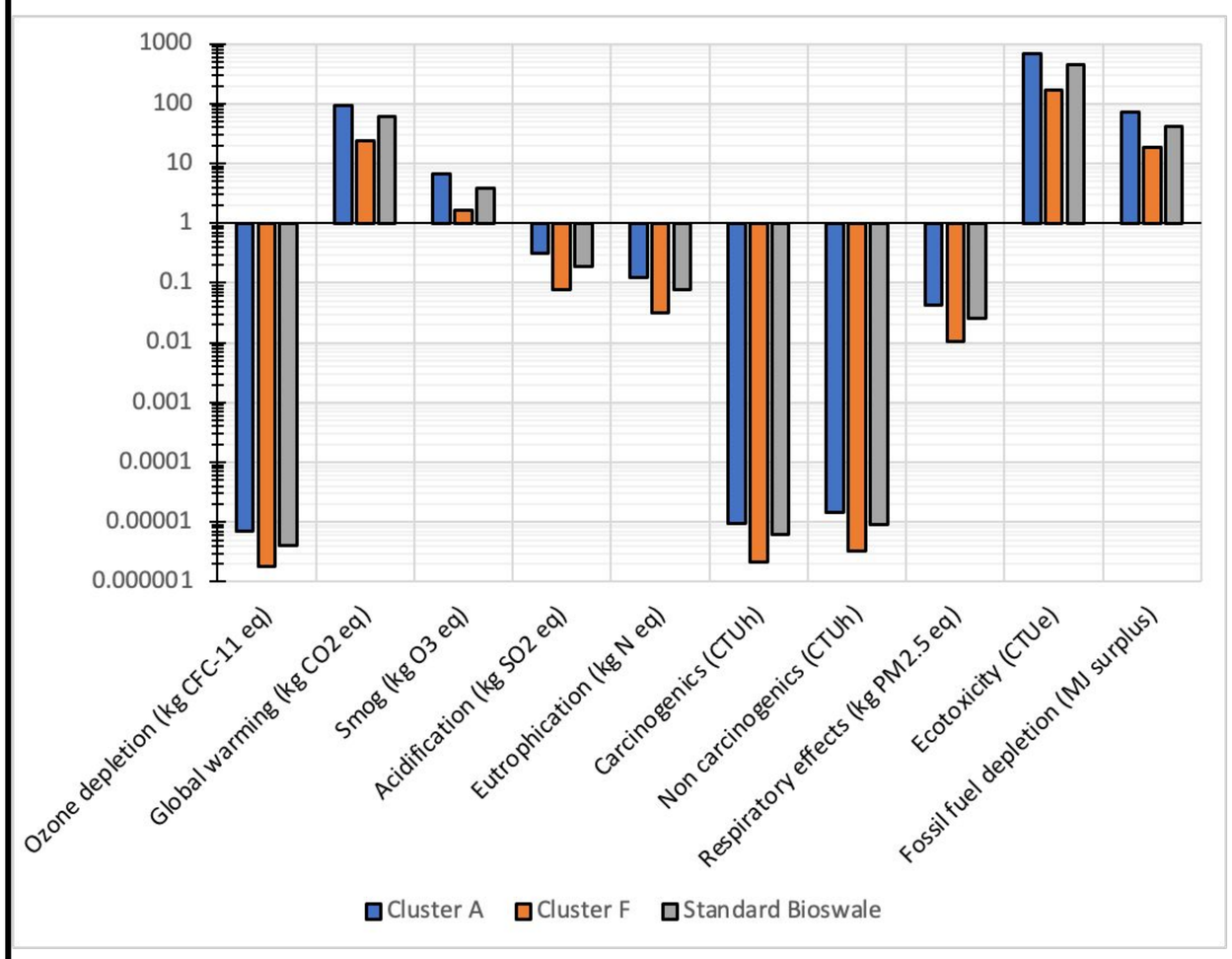
1.

2.

3.

Results

Weight of Material (kg)	Cluster A	Cluster F	Standard Bioswale
Concrete	3790	9600	2331
Gravel	9830	26485	10330
Steel	1300	2280	550
Cast Iron	98	0	0
HDPE	87	87	0
Jute	0	1.3	0
Static Capacity (m^3 water retained)	6.13	24.47	5.48



- Logarithmic Scaled Graph of TRACI impacts per $1m^3$ of water retained by the bioswale
- The construction and transportation of materials for each respective bioswale resulted in a large adverse effect on:
  - global warming (kg CO2)
  - ecotoxicity (CTUe)
  - Fossil Fuel Depletion (MJ surplus)

Methodology

- Created a material list from the construction drawings of each bioswale design.
- Conducted the life cycle inventory analysis using LCA software called SimaPro to evaluate environmental impacts.
- Used the Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI) method to complete life cycle inventory
- TRACI measures: ozone depletion, climate change, acidification, eutrophication, smog formation, human health impacts, and ecotoxicity.
- Used $1m^3$ of water retained by the bioswale as a functional unit to normalize the results that can be utilized to compare these different bioswale designs.

Conclusions and Future Work

- Comparing total adverse environmental Impacts for each design:
  - Cluster F < Standard Bioswale < Cluster A
- Future work will incorporate the life cycle cost analysis to further determine the most sustainable and efficient bioswale design.

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