GHG inventory for local urban farm shows promise for carbon sink capabilities

Theresa Isemann
Advisor: **Dr. Kevin Hallinan, Ph. D**
Co-Advisor: **Dr. Felix Fernando, Ph. D**

Acknowledgments: **Stephen Mackell** and **Michael Schulz** of Mission of Mary Cooperative

Research Objective: To begin quantifying the significant greenhouse gas emissions associated with a local urban farm to understand its role as a net carbon sink or source.

Introduction

- To meet the IPCC's global warming limit of 2ºC, humans will need to rethink how to transform the carbon intensive agricultural system currently in place
- Urban farms are a popular strategy hedging against food insecurity
- However research is limited on using urban farms also as a net sink of carbon emissions
- With proper soil and land management, while mitigating energy sources from fossil fuels, urban farms have the potential to store more carbon than used

Case Study

- Mission of Mary Cooperative, an urban farm in Dayton, was identified as a potential low or no carbon organization due to various site characteristics from their decision to intentionally design their operations for low environmental impact
  - *Geothermal for heating and cooling*
  - *Solar photovoltaics for electricity*
  - *Various energy efficiency measures*
  - *Regenerative farming techniques*

Methodology

1. Identify sources and sinks at MMC by emissions type and operational use
2. Assign carbon equivalent emission
3. Determine overall carbon footprint

Limitations

- Considered Scope 1 (on-site combustion) and Scope 2 (purchased electricity) sources
- Scope 3 (upstream and downstream) sources excluded due to limited data

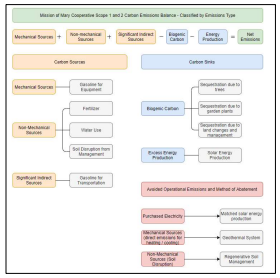

Fig. 1: Emissions Balance - Type

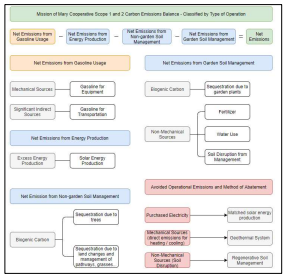

Fig. 2: Emissions Balance - Operation

Results

Gasoline was the single operational type emission with a net source.

	Net (lbs CO2)	Abated (lbs CO2)
Gasoline Usage	7473	0
Energy Production	-133	23735
Non-garden Soil Management	-4216	0
Garden Soil Management	-3291	0
Total	1166	23735

Fig. 3: Simplified GHG Emissions by Operation Type in terms of Carbon Equivalency

Discussion

From this high-level emissions balance, Mission of Mary Cooperative appears to store more carbon than they use. This is largely due to abating emissions from their energy use, which would have caused an estimated 23,735 pounds of carbon dioxide increase in their footprint if they had used energy from the grid. The role of renewable energy in unlocking carbon sink potential is significant.

The carbon storage from the land management was largely from transforming areas that used to be vacant lots into a community garden with native plants and new trees planted each year.

Conclusion

This research utilizes a local case study to understand the carbon emissions balance for an urban farm. A GHG inventory sets the foundation for further analysis with more robust calculation methods. This research can be used to optimize carbon storage of urban farms and understand how to scale urban agriculture as a carbon sink.