Campus' Contribution to Circularity in Cities: The Circularity Assessment Protocol

Jenna Jambeck, PhD

UMCS Conference

September 23, 2023

New Materials Institute
UNIVERSITY OF GEORGIA

Jambeck Research Group

Circularity Informatics Lab

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GLOBAL PLASTIC PRODUCED

Humans have created about 8.3 billion metric tons of plastics, outgrowing all man-made materials other than steel and cement.

2M METRIC TONS

1950

8.3B METRIC TONS

2017

2000

34B PROJECTED METRIC TONS

2050

PLASTIC WASTE

Plastic waste can be recycled, incinerated or discarded where it accumulates in landfills and the natural environment.

2015

6.3B METRIC TONS

12B PROJECTED METRIC TONS

9% Recycled

12% Incinerated

79% Accumulated in landfills & natural environment

Geyer, Jambeck and Law, Science Advances 2017

HOW HEAVY IS 8.3 BILLION METRIC TONS?

1 million metric tons (Mt) = 1.1 million tons

1,000,000,000 X ELEPHANTS (7.5 tons)

80,000,000 X BLUE WHALE (104.5 tons)

800,000 X THE EIFFEL TOWER (20,000 tons)

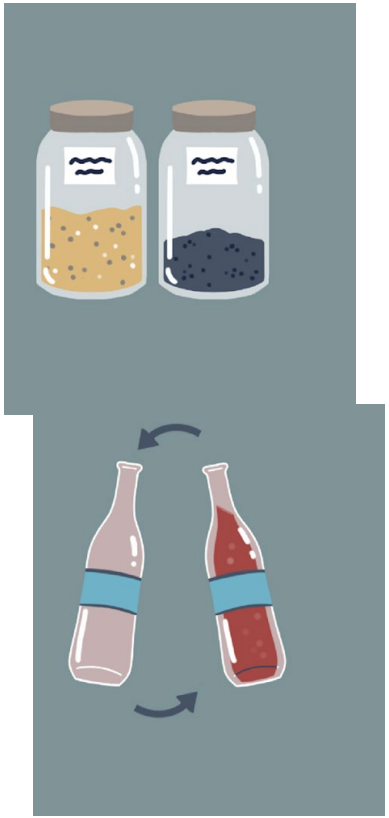
25,000 X EMPIRE STATE BUILDING (331,000 tons)

NEWS | ENVIRONMENT

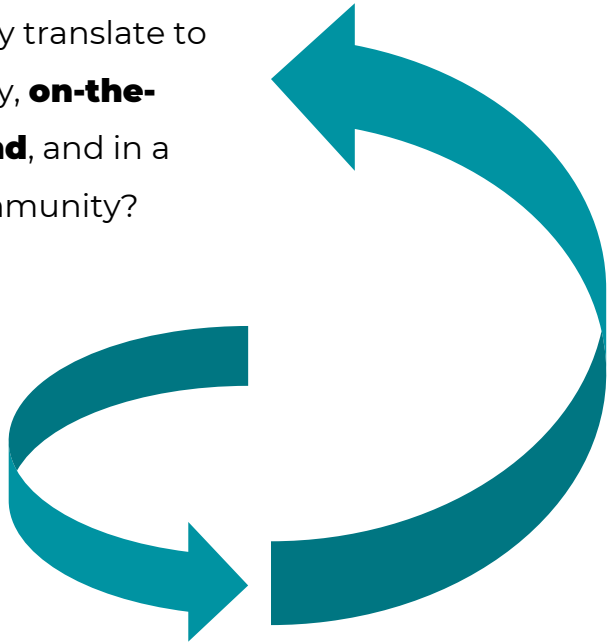
World's nations start to hammer out first global treaty on plastic pollution

"Ambitious" efforts could set waste reduction targets, establish scientific advisory body

23 FEB 2022 · 12:55 PM · BY ERIK STOKSTAD



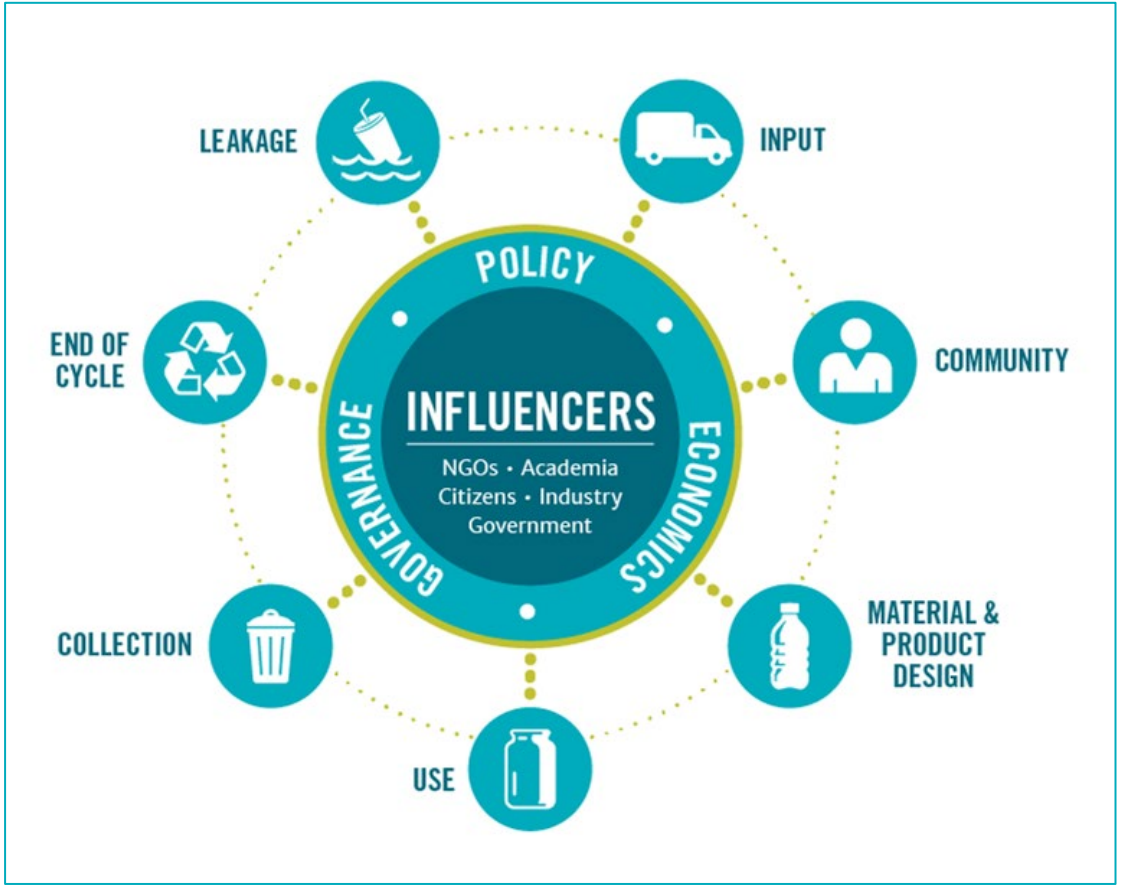
How does the circular economy translate to reality, **on-the-ground**, and in a community?



The Circularity Assessment Protocol (CAP)

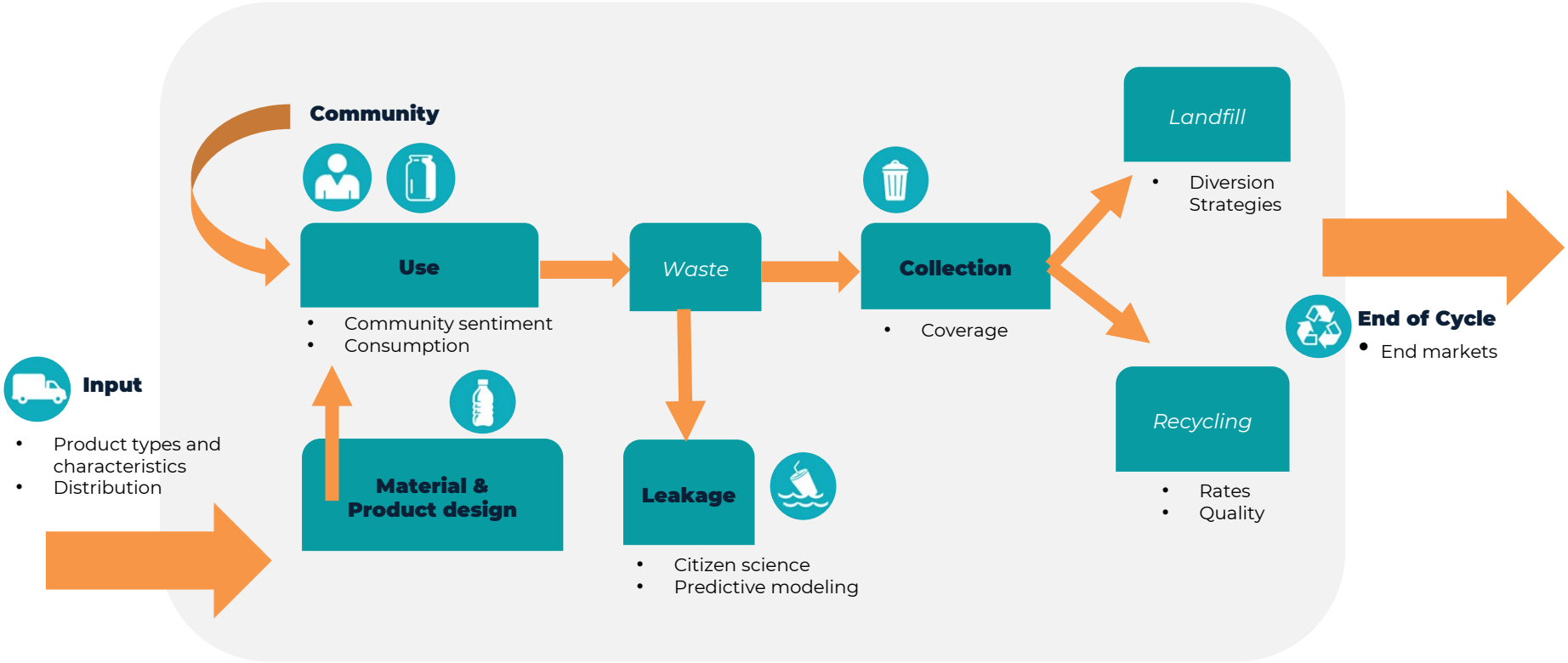
The Circularity Assessment Protocol (CAP) is a hub and spoke model that provides a snapshot of a city's circularity that can provide data for local, regional, or national decision-making to reduce leakage of waste (e.g., single-use plastic) into the environment and increase circular materials management.

51 cities in 14 countries



https://www.circularityinformatics.org/

Material Flow Analysis



What do the components look at?

INPUT
What products are sold in the community and where do they originate?

COMMUNITY
What conversations are happening and what are the stakeholders' attitudes and perceptions?

PRODUCT DESIGN
What materials, formats, and innovations are found in products, particularly packaging?

USE
What are the community trends around use and reuse of product types?

COLLECTION
How much waste is generated, what does it comprise, how is it disposed? How much is collected and what infrastructure exists?

END OF CYCLE
What is the fate of waste once it is properly discarded? How is it treated?

LEAKAGE
What waste ends up in the environment? Why and how is it getting there?

Reduce plastic **production**

Innovative materials & product **design**

Reduce waste generation

Improve global **waste management**

Improve **litter capture**

Reduce input concentrations (zero goal)

Strategic Intervention Framework to Reduce Plastic Pollution

Jambeck, US Senate Testimony, 2016

INFORMATION SHARING

The local community's knowledge and expertise is honored. Partners and teams build capacity through learning methods and collaboration. **Debris Tracker** is an important tool that is used by researchers and the community alike. Open data is important to the process.

DATA ANALYTICS

Data for each city's CAP is analyzed and co-owned by the researchers, city and sponsors. Trends across cities, countries and regions can illuminate global narratives and influencing factors.

EMPOWERING COMMUNITIES

Communities are empowered by local and global CAP data to inform their decisions about what is working - or where and how to intervene to increase circularity. Communities that participate in CAP can better define resource needs and participate in knowledge exchange.

SYSTEMS CHANGE

conducted fieldwork in Melaka, Malaysia. The CAP was conducted with support from the city's local government, the Chief Resilience Officer (a top-level advisor in the city that is responsible for leading, coordinating and developing a city's resilience strategy and policy), and the larger Urban Ocean team.

University, with guidance and support from the Circularity Informatics Lab, conducted fieldwork in the city of Semarang, Indonesia. The CAP was conducted with support from the city's local government, Resilience Officers, and the larger Urban Ocean team.

Can Tho, Vietnam

Between October 2020 and January 2021, a team from the DRAGON Institute at Can Tho University, with guidance and support from the Circularity Informatics Lab, conducted fieldwork in the city of Can Tho, Vietnam. The CAP was conducted with support from the city's local government, Resilience Officers, and the larger Urban Ocean team.

DOWNLOAD THE VIETNAMESE VERSION

Chennai, India

Between September 2021 and December 2021, a team from Okapi Advisory Services (Okapi), with guidance and support from the Circularity Informatics Lab, conducted fieldwork in the city of Chennai, India. The CAP was conducted with support from the city's local government, the Chief Resilience Officer (a top-level advisor in the city that is responsible for leading, coordinating and developing a city's resilience strategy and policy), and the larger Urban Ocean team.

Hanoi, Vietnam

Between February 2021 and March 2021, a team from the Center for Marine Life Conservation and Community Development (MCD), with guidance and support from CIL, conducted fieldwork in the city of Hanoi, Vietnam. The CAP was conducted with support from the city's local government and the Ocean Conservancy (OC).

https://www.circularityinformatics.org/

Miami, Florida

In May 2021, a team from CIL conducted fieldwork in the City of Miami, FL, with support from graduate students at Florida International University (FIU). The CAP was conducted with support from the City of Miami's local government and the Ocean Conservancy (OC).

DOWNLAOD THE SPANISH VERSION
DOWNLOAD THE HAITIAN-CREOLE VERSION

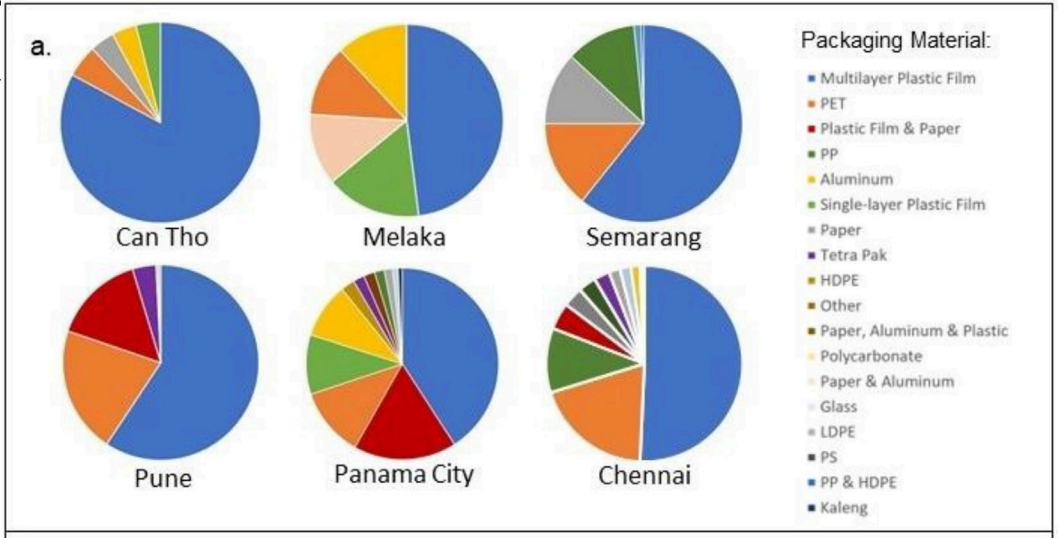
Resources, Conservation and Recycling
Volume 198, November 2023, 107156

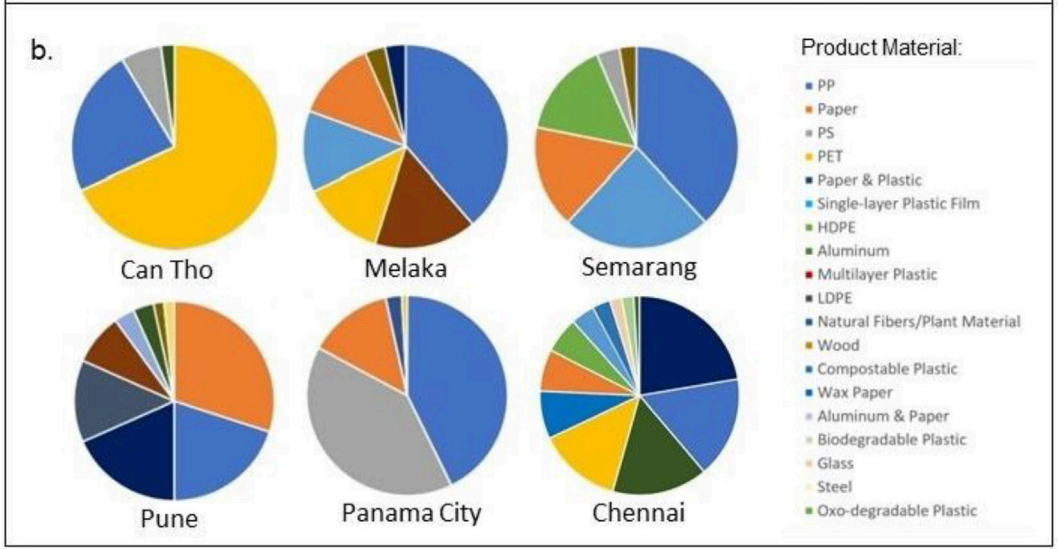
Full length article

Circularity in cities: A comparative tool to inform prevention of plastic pollution

Taylor Maddalene [a], Kathryn Youngblood [a], Azlan Abas [h], Keri Browder [b], Edith Cecchini [b], Sheridan Finder [a], Saurabh Gaidhani [c], Wiwandari Handayani [e], Nguyen Xuan Hoang [f], Kunal Jaiswal [i], Ellen Martin [d], Sanskriti Menon [i], Quinn O'Brien [a], Parama Roy [j], Bintang Septiarani [e], Nguyen Hieu Trung [k], Chever Voltmer [b], Madison Werner [a], Ricardo Wong [g], Jenna R. Jambeck [a]

https://doi.org/10.1016/j.resconrec.2023.107156





Marine Debris Tracker
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Debris Tracker

An open data citizen scientist movement

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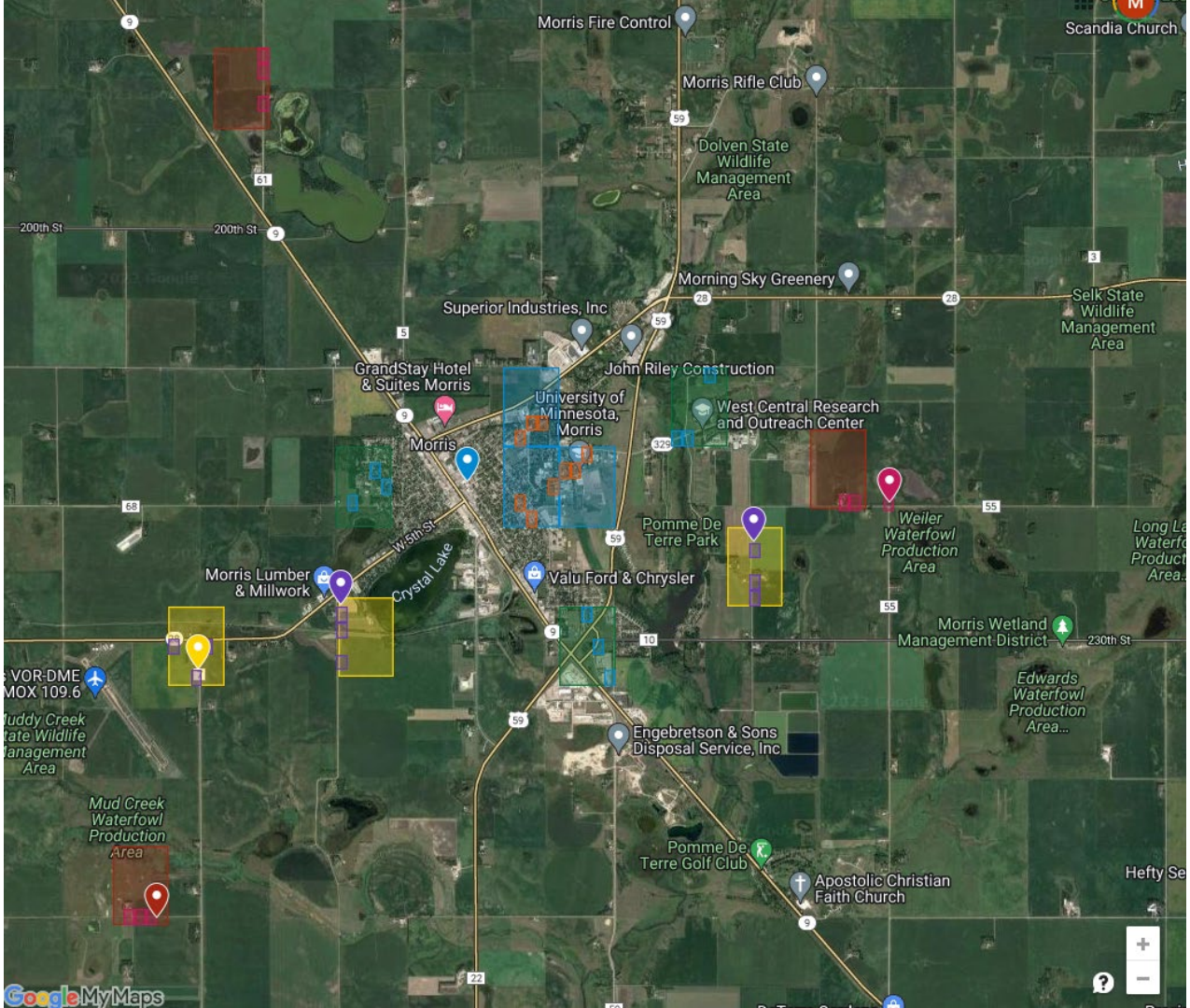
MORRIS



Morris, MN Transect and Sampling Map


TRASH ONLY
COMMINGLED RECYCLING

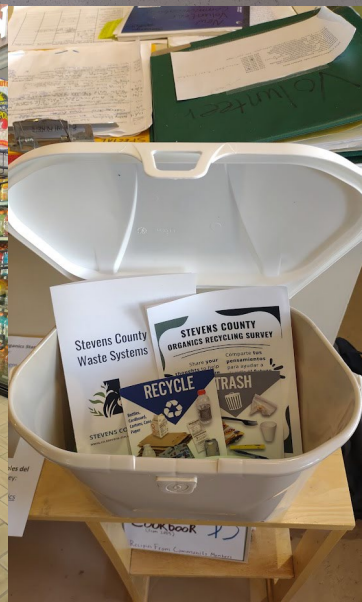

THANKS FOR RECYCLING AT UMM


COMPOST
COMMINGLED RECYCLING
COMPOSTING
TRASH ONLY


BACE
4x4


GOOD EATS
AMERICAN EXPRESS
We Organics Recycle!
co.stevens.mn.us/organics


Ripples
DUTCH CRUNCH

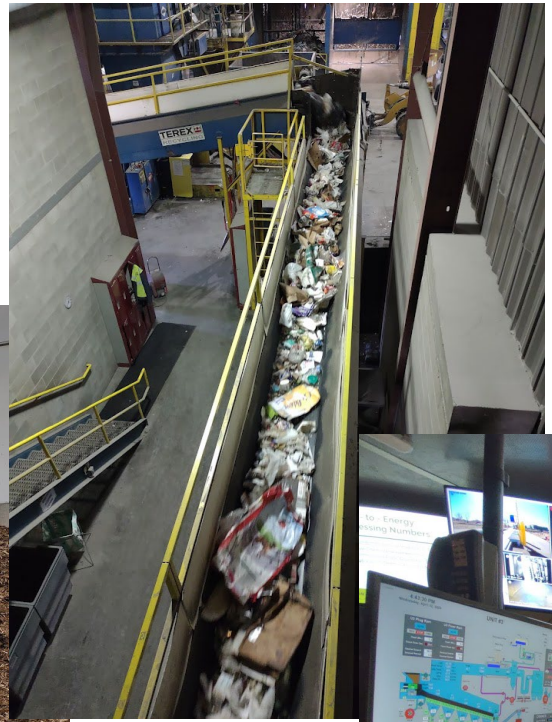

Stevens County Waste Systems
STEVENS COUNTY
ORGANICS RECYCLING SURVEY
RECYCLE
TRASH

	Pomme de Terre (Co-Op)	Willies (Supermarket)	Family Dollar
Beverages	90% Glass, 7% Aluminum, 3% Plastic	65% Plastic, 25% Aluminum, 10% Glass,	80% Plastic, 20% Aluminum
Snacks	No single serve chips/snacks	100% Film or Multi-layer Film	95% Film or Multi-layer Film, 5% Paperboard/Plastic/Metal
Candy	100% Multi-layer film	90% Film or Multi-layer Film, 10% Hard plastic/other	85% Film or Multi-layer Film, 15% Paperboard
Rice	100% Bulk (6 kinds)	30% Paperboard, 25% Film, 15% with flavor pouch, 15% Standup pouch, 15% Plastic Cups,	45% Paperboard, 45% Film, 10% Standup pouch
Sugar	33% standup pouch (plastic), 66% Bulk	50% Paper, 50% Plastic film	100% Paper
Milk	100% Carton w/plastic cap	100% Plastic	None observed
Eggs	All reused, 75% paperboard, 25% foam	70% Foam, 30% Paperboard	None
Oil	84% Glass, 8% Metal, 8% Bulk	85% Plastic, 10% Metal, 5% Glass	65% Plastic, 30% Metal,5% Glass
Greens	Local Lettuce, clear plastic bag	90% Film plastic, 10% Hard plastic	None
Laundry Detergent	100% Plastic (Seventh Generation)	80% Hard plastic, 15% Standup pouch, 5% Paperboard	70% Hard plastic, 30% Standup pouch (film)

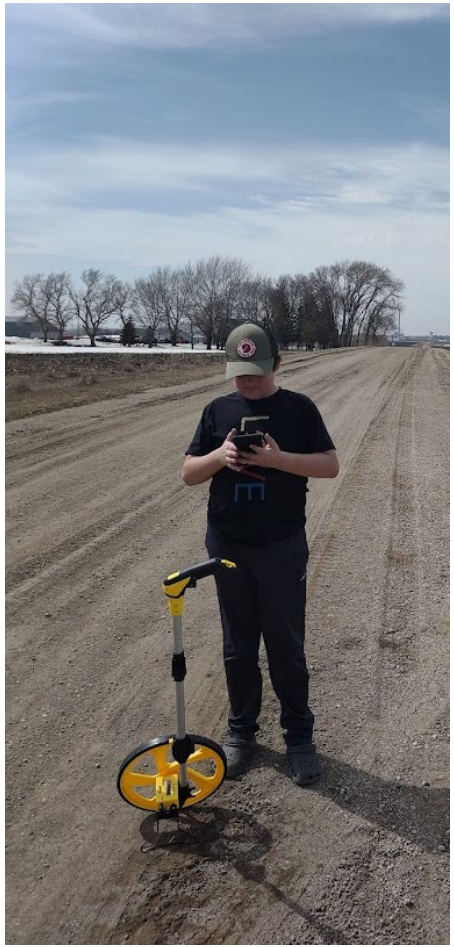
Food Ven-dors

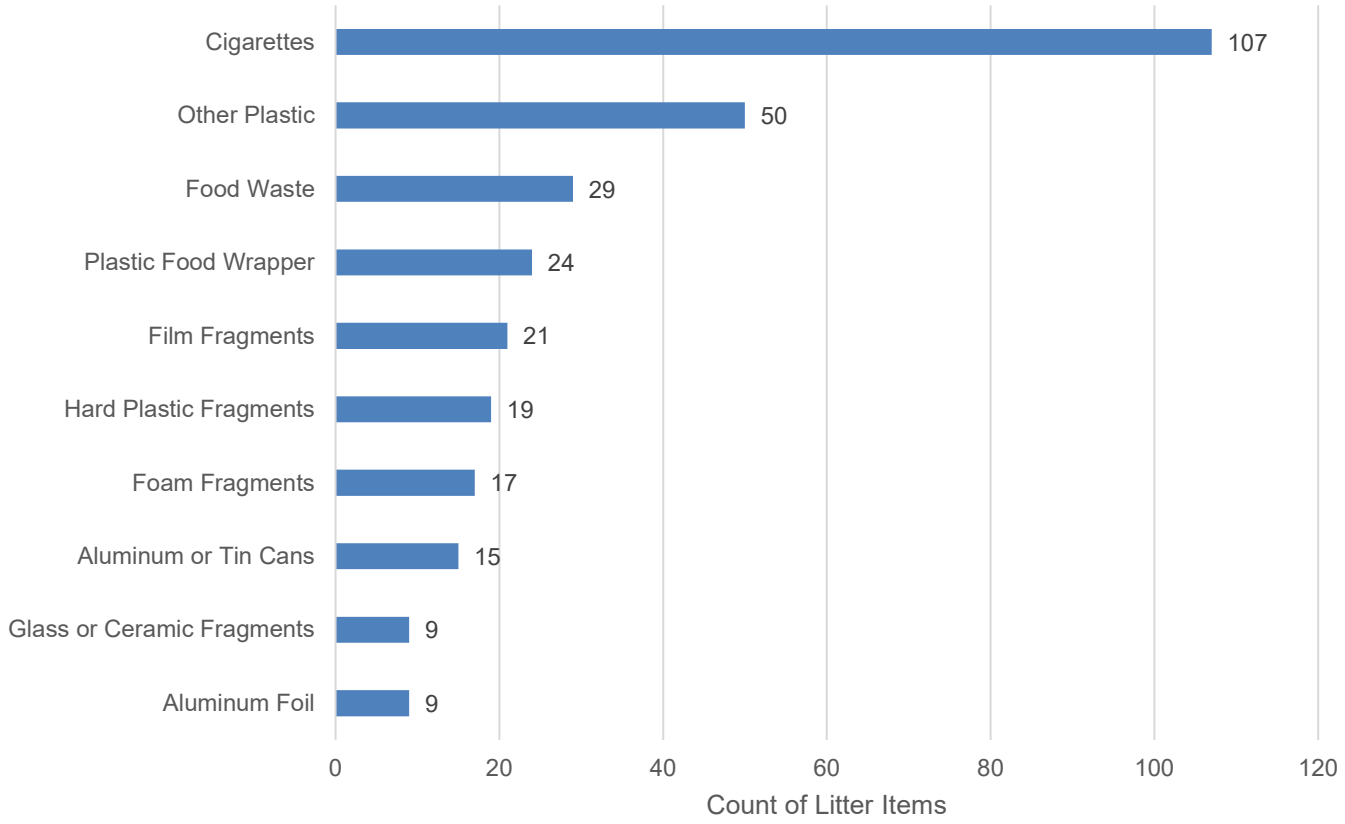
Food Vendor Name	Food Vendor Tyoe	Product	Material	Label Designation	Brand (mainly for compostables)	Manufacturer	Manufacturing Location	Notes
Higbies	Coffee Shop at UMM	Cold Drink Coffe	PLA	PLA, #7	Greenware	FK	USA	"Made in USA, Cold Drinks Only, Made from Plants"
		Cold Drink Dome	PLA		Greenware	FK	USA	"Made in USA"
		Straw	PLA		Greenware			
		Straw	Conventional (PP	None				
		Coffee Cup						
		Coffee Cup Lid						
		Cookie Holder						
		Boxed lunch box	Paperboard					
Old No. 1	Sit-down restaurant	To-Go Food Cari	EPS	PS, #6	Sysco			
		Cup for cold drin	Paperboard, coated		Pepsi branded			
		Cup lid	PS	#6	Graphic Packaging			
		Straw	Conventional (PP likely)					
Taco Johns	Fast Food	Cup	Paperboard, coated					
		Cup lid	PS	#6	Graphic Packaging			
		Straw	Conventional (PP likely, red)					
		Container for pol	Paperboard, coated					12 oz
		Sauce Packet	Plastic Sachet					
		Ketchup Packet	Plastic Sachet					
		Taco Wrapper	Paper, coated					
		Utensils	Black, rigid plastic, each individually wrapped					
		Bag	Paper	100% Recycled, 60% Post-Consumer Recycled Content, FSC				"Please Reuse and Recycle this Bag"
Common Cup		Coffee Cup	PLA	Compostable, BPI Certified				"Facilities may not exist in your area"
		Coffee Cup Lid	PLA	Compostable				
		Clamshell (large	Paperboard (brown)					
		Clamshell (small	Paperboard (brown)					
		Clamshell (clear	PS	PS, #6				
		Straw	Conventional, wrapped in paper					
		Cold Drink Cup	PLA	PLA, #7, Cold D	Monogram Susta	Natureworks		"Can not be recycled with other clear plastics"
Coffee Shop Notes: Have compost, recycle and trash bin in the shop. Sugar/sweetener packets (paper), honey packets (plastic sachets), water refill station with reusable plastic cups								
Photos: https://photos.app.goo.gl/KZtRUc9BDhPTaEw67								
Prime Steakhouse	Sit-down Restaurant	To-Go Food Cari	Paperboard, coate	Earth Plus	Sysco	http://www.innopak.com/wp-conte		https://foodie.sysco.com/wp-content/uploads/2020/04/EarthPlu
		Food wrap/paper	Paper, coated, brown		Sysco			Notes from above: made from 100% recycled paperboard. Say
		Soup Cup	Paper, coated, wh	None	None available			
		Soup Cup Lid	Plastic, white	None	None available			

End of Cycle - Management



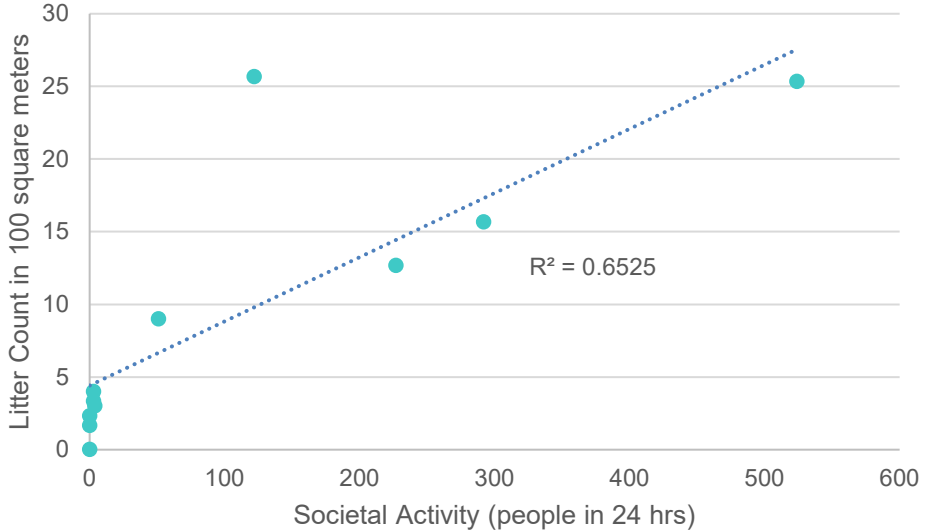
Top Items (n = 372)





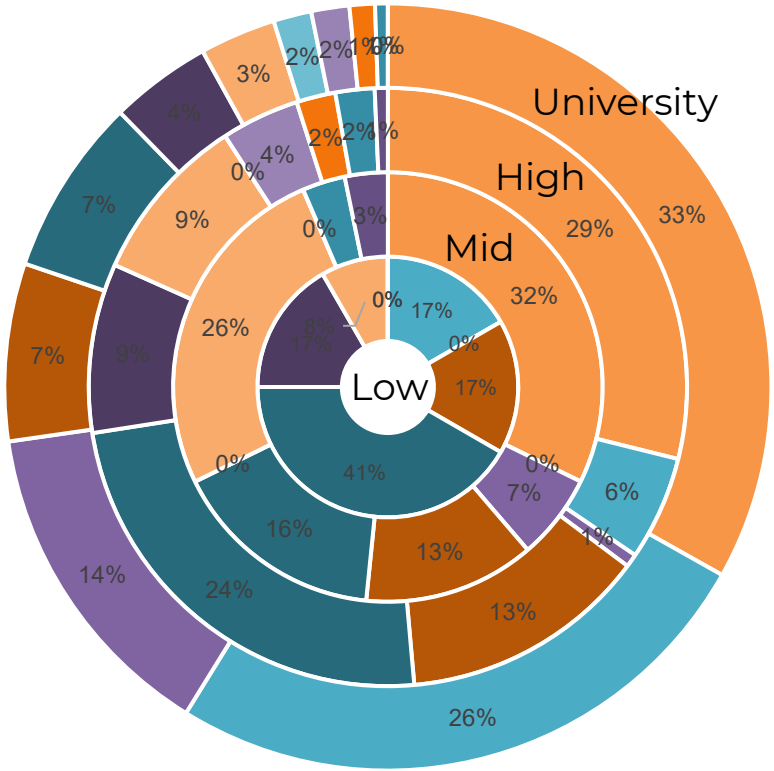
Litter Density

Societal Activity	Litter Density (items/m^2)
University (n= 187)	0.22
High (n= 142)	0.13
Medium (n= 31)	0.03
Low (n= 12)	0.01
Overall (n= 372)	**0.10**



Miami, FL = 2.58; Vicksburg, MS = 1.1; Athens, GA = 1.2; Blytheville, AR = 0.77; Cape Girardeau, MO = 0.55; Minneapolis, MN = 0.68

Morris, MN Transect Composition



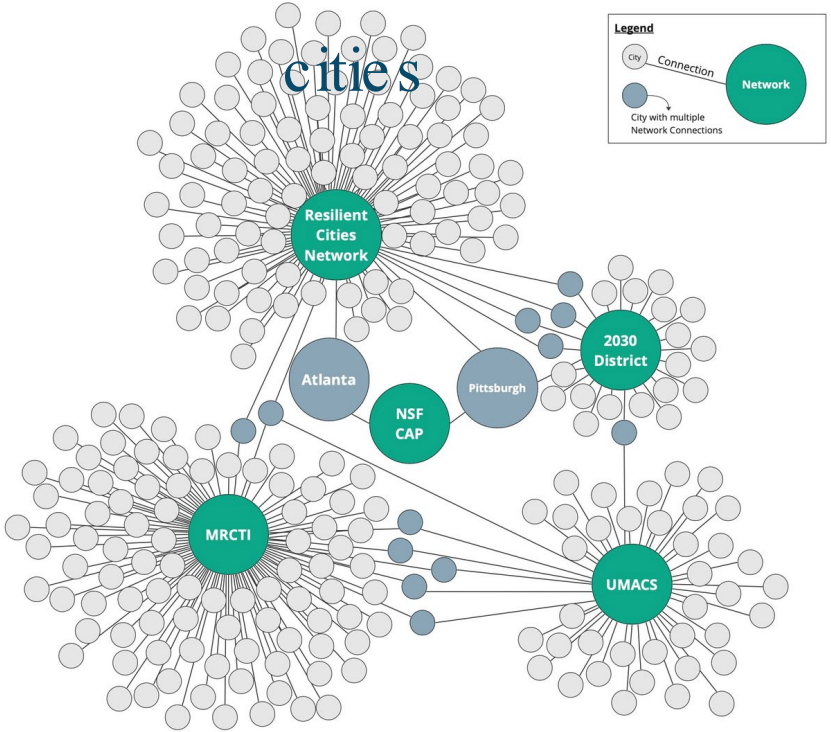
Opportunities

- **Share the amazing work that Morris, UMM, Stevens County are doing! – The Morris Model**
- More stores offer compostable or alternatives to traditional plastics
- More restaurants offer compostable or alternatives to traditional plastics
- Reuse systems?
- Continue to monitor the composting and recycling systems, encourage use, keep the Morris Model active

SPHERICITY

A circularity movement and platform for cities

NSF's Convergence Accelerator



2030 DISTRICTS

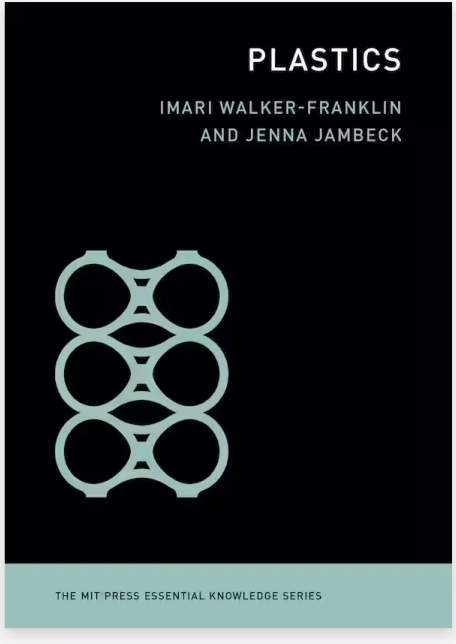
umacs Upper Midwest Association for Campus Sustainability

RESILIENT CITIES NETWORK

MRCTI

UNIVERSITY OF GEORGIA

University of Pittsburgh



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Plastics

By Imari Walker-Franklin and Jenna Jambeck

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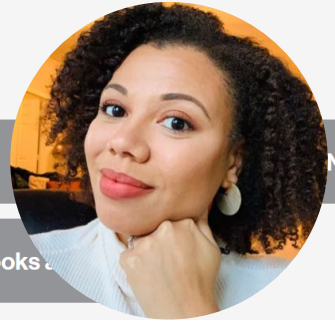

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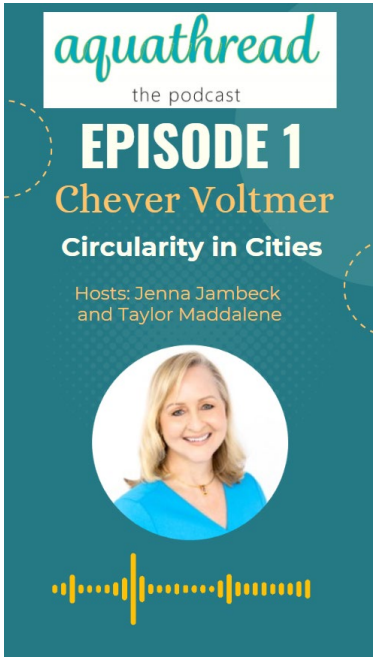

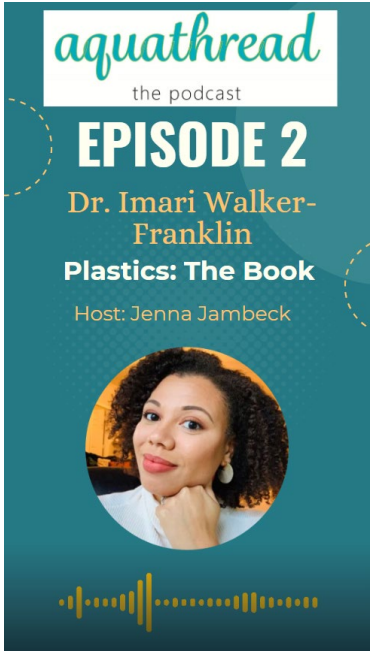

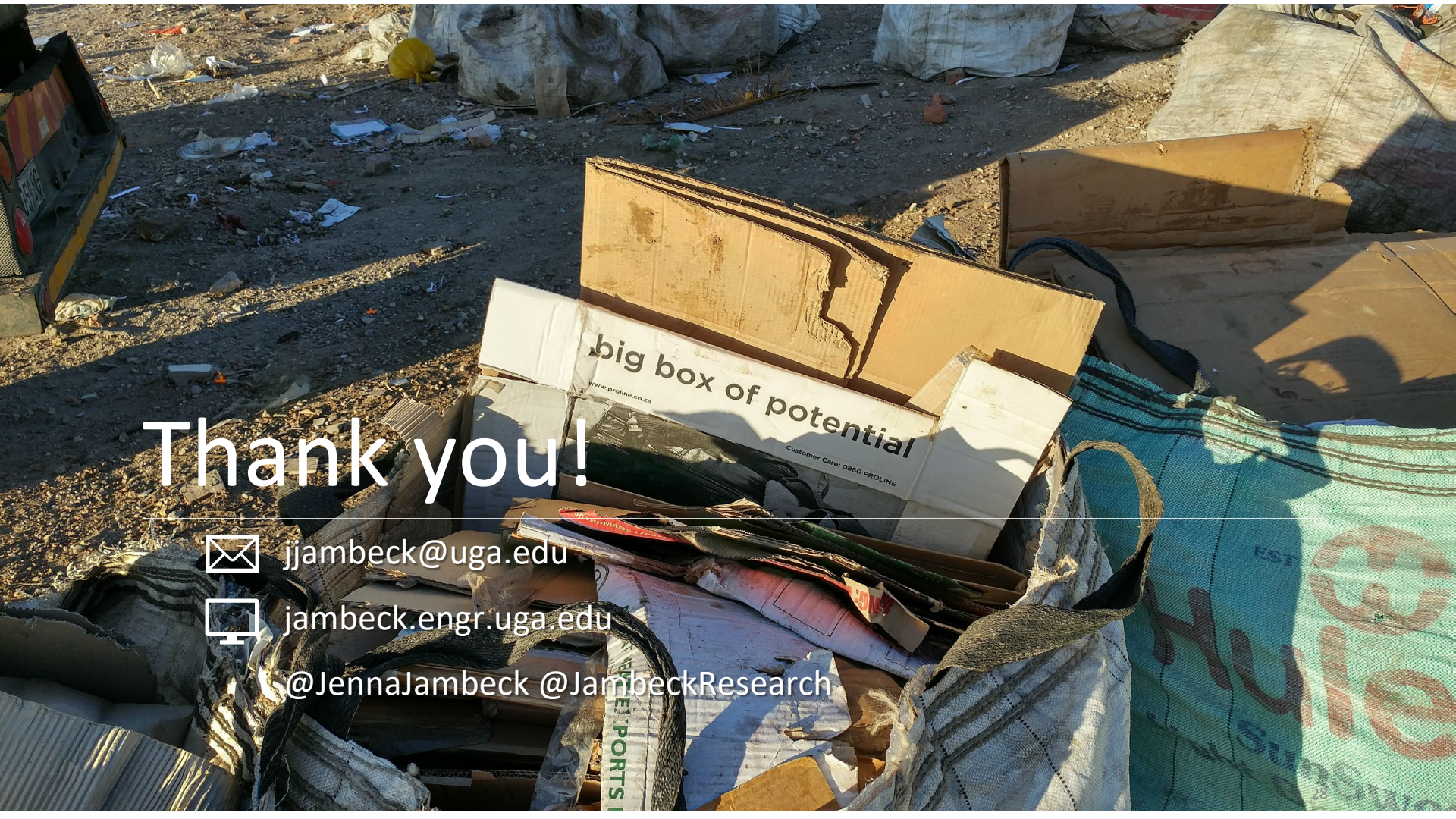

Thank you!

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