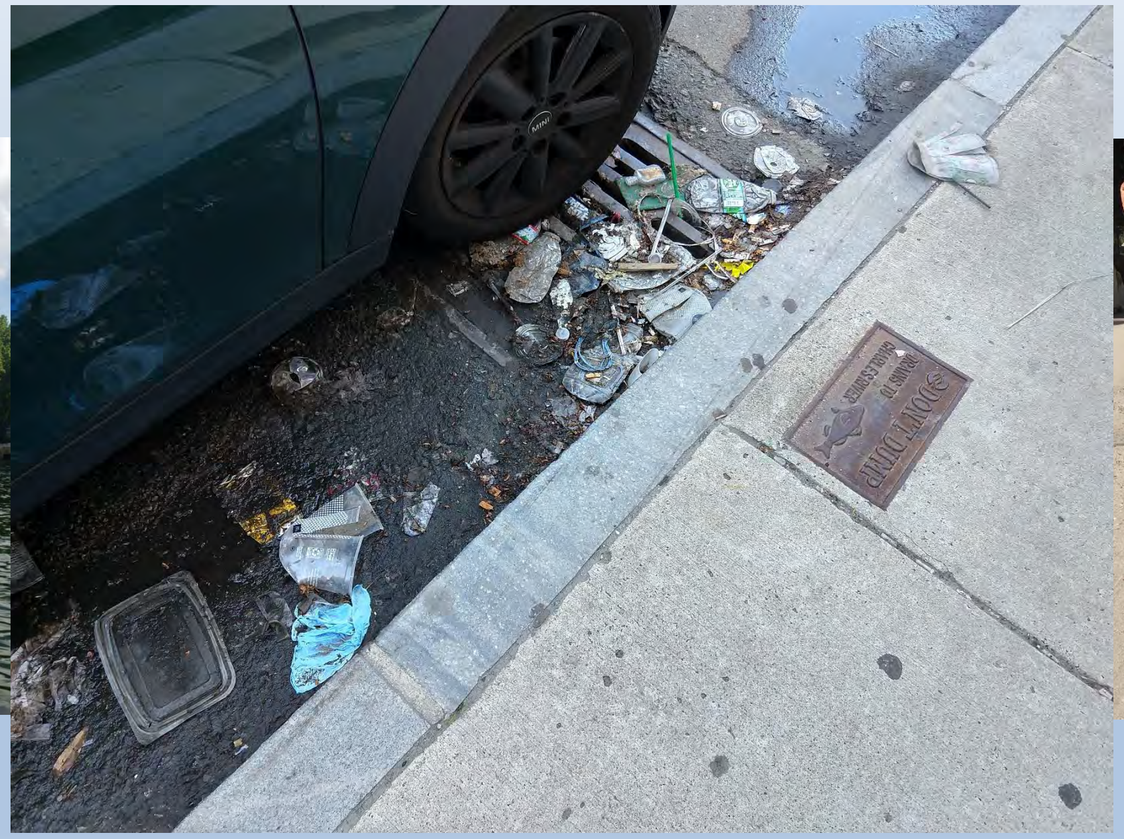
Global Challenges of Plastic Pollution

Stories of Plastics, Cities and the Circular Economy



Jenna Jambeck, PhD

Georgia Athletic Association Distinguished Professor of Environmental Engineering, University of Georgia

2022 MacArthur Fellow, National Geographic Explorer (2018-2021)

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

2015

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

26B 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?

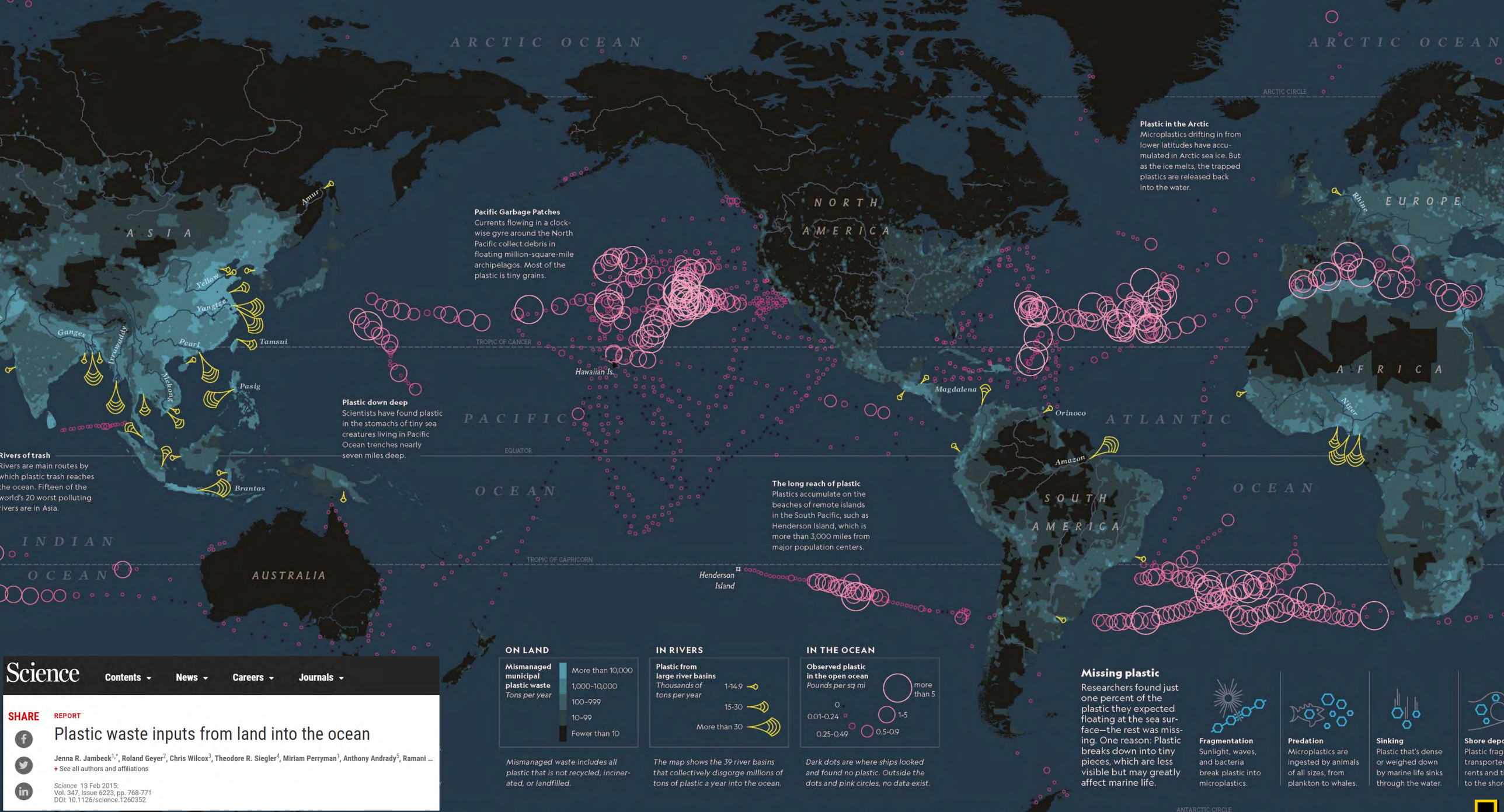
1 million metric tons (Mt) = 1.1 million tons

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)



Mismanaged waste includes all plastic that is not recycled, incinerated, or landfilled.

The map shows the 39 river basins that collectively disgorge millions of tons of plastic a year into the ocean.

Dark dots are where ships looked and found no plastic. Outside the dots and pink circles, no data exist.

Missing plastic

Researchers found just one percent of the plastic they expected floating at the sea surface—the rest was missing. One reason: Plastic breaks down into tiny pieces, which are less visible but may greatly affect marine life.

Fragmentation
Sunlight, waves, and bacteria break plastic into microplastics.

Predation
Microplastics are ingested by animals of all sizes, from plankton to whales.

Sinking
Plastic that's dense or weighed down by marine life sinks through the water.

Shore dep
Plastic frag
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eXXpedition, 2014

Strategic Intervention Framework to Reduce Plastic Pollution

REDUCE PLASTIC PRODUCTION

Industry led or reduce demand

INNOVATIVE MATERIALS & PRODUCT DESIGN

Green engineering, circular economy

REDUCE WASTE GENERATION

Reusable items, sharing / collaborative economy

IMPROVE GLOBAL WASTE MANAGEMENT

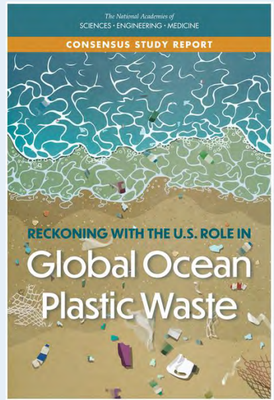
Context-sensitive Solid Waste management infrastructure

IMPROVE LITTER CAPTURE

Litter capture and clean-up

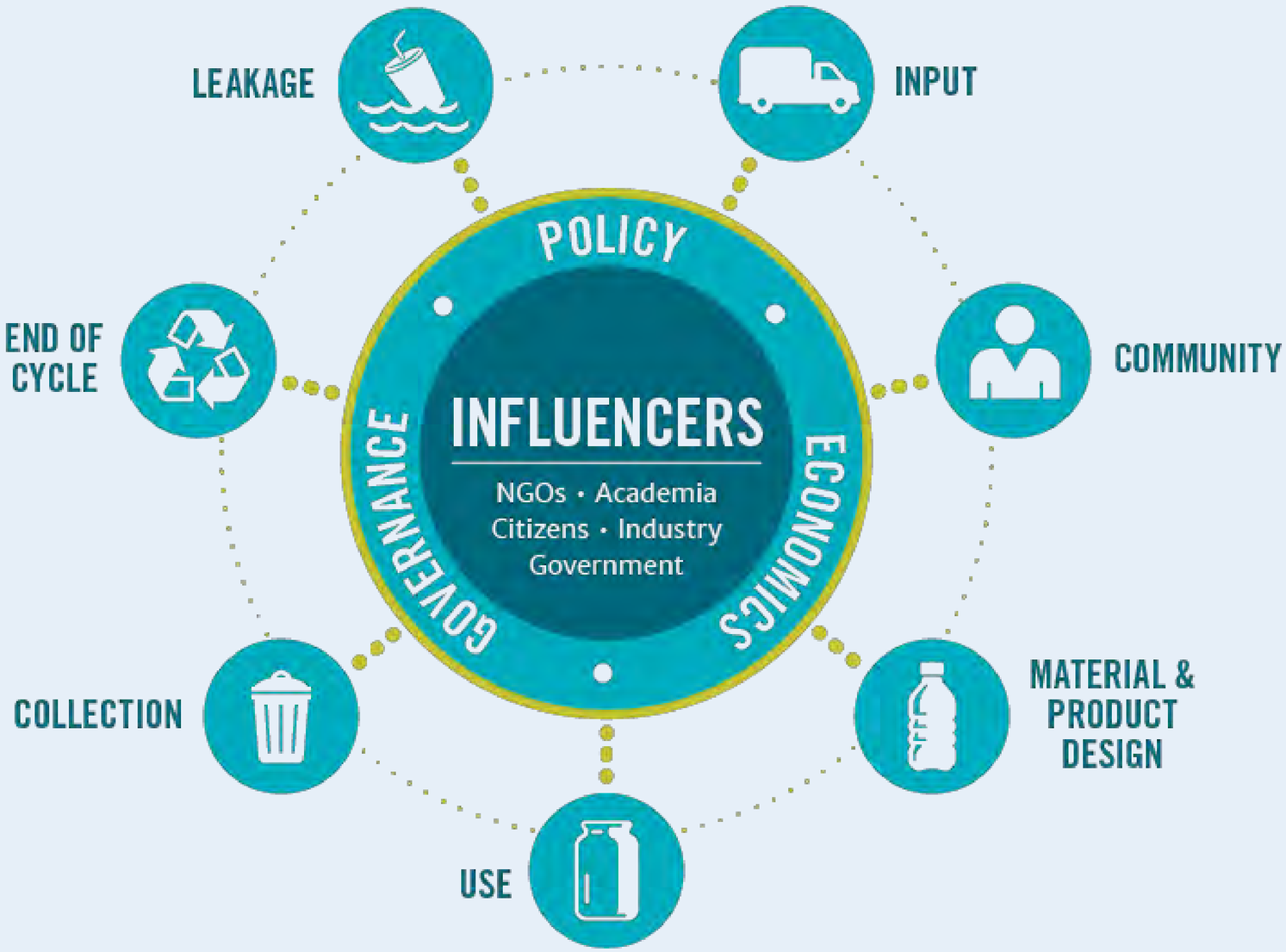
REDUCE INPUT CONCENTRATIONS (ZERO GOAL)

Jambeck, US Senate Testimony, 2016 –> National Academies, 2021

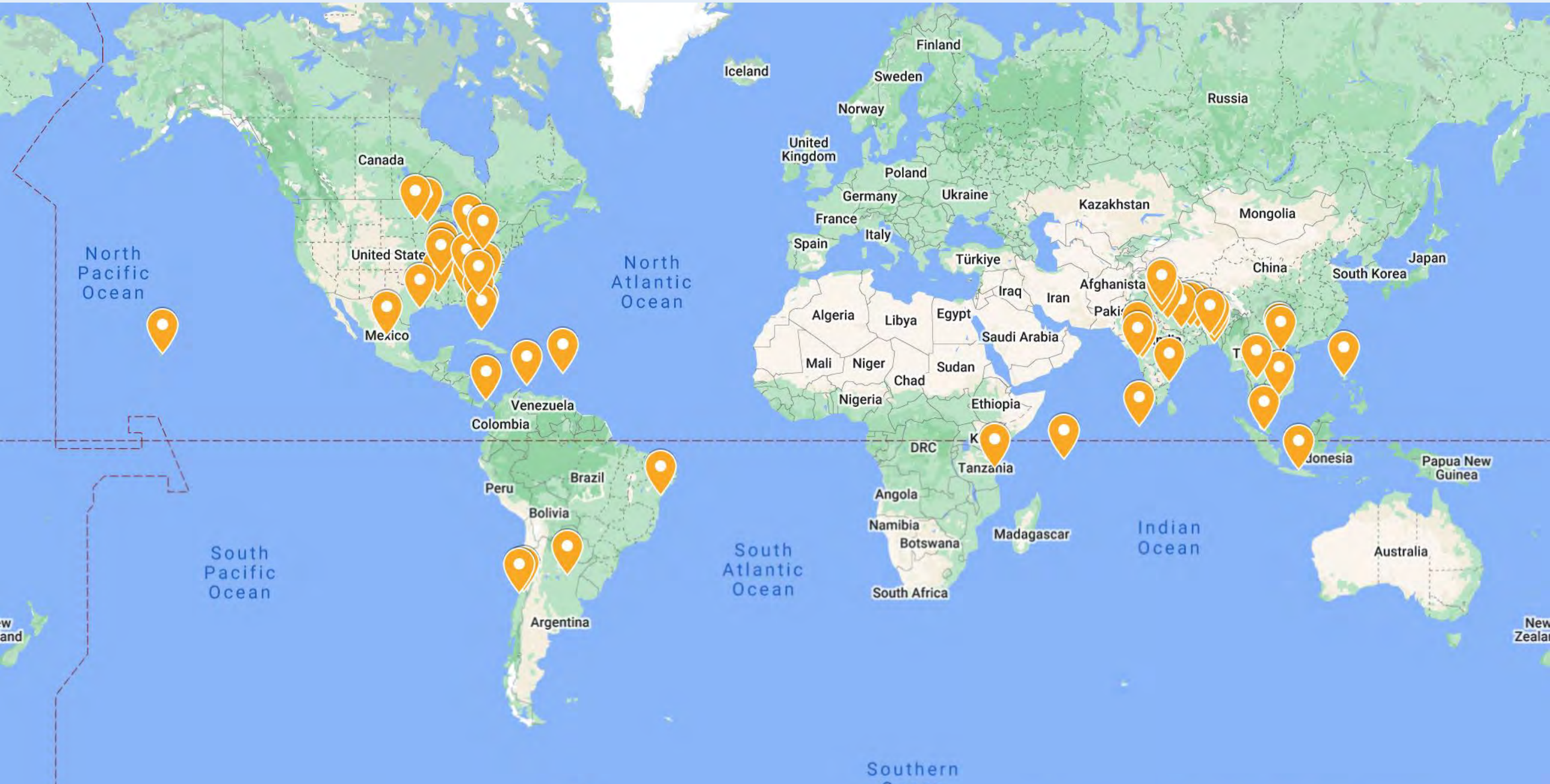


The Circularity Assessment Protocol (CAP)

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.



15+ Countries – 60+ Cities



ENVIRONMENTAL RESEARCH COMMUNICATIONS

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PAPER • OPEN ACCESS

Advancing local circular economy of plastics from the ground up: a case study in Athens, Georgia, USA

Amy L Brooks*, Taylor Maddalene, Madison Werner, Kathryn Youngblood, Suki Janssen, Evan M White, Jason Locklin, Melissa M Bilec and Jenna R Jambeck

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Environmental Research Communications, Volume 8, Number 1

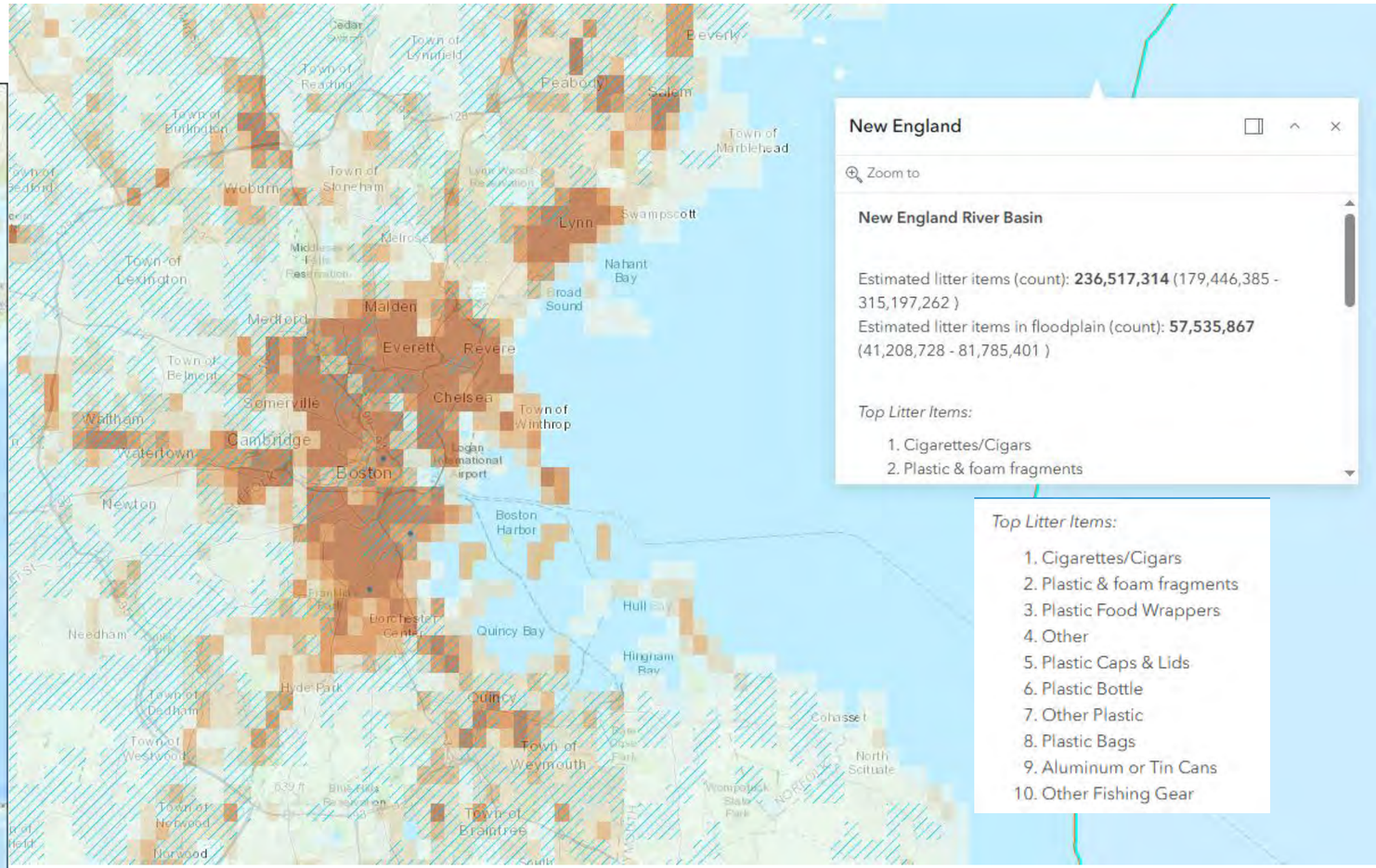
Focus on Our Plastic Planet: from Problems to Solutions

Citation Amy L Brooks *et al* 2026 *Environ. Res. Commun.* **8** 015015

DOI 10.1088/2515-7620/ae207f

Trash-Free Waters

Escaped Trash Risk Map



Cities and community members have the right to optimize their own circularity

This material is based upon work supported by the National Science Foundation under Grant No. 2345080


Monogram


COMPOST
COMMINGLED RECYCLING
COMPOSTING
TRASH ONLY


BACE


Ripples
DUTCH CRUNCH
Original

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.

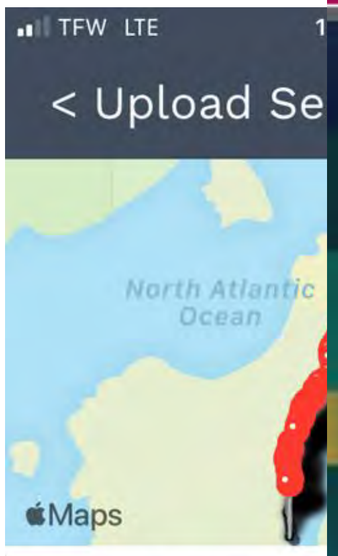
DATA ANALYTICS

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.

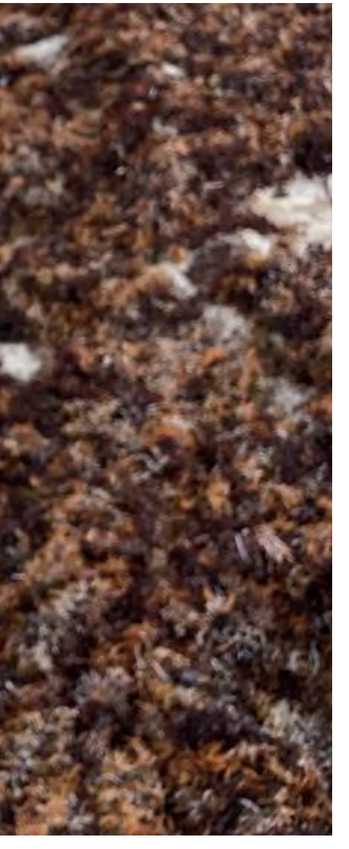
EMPOWERING COMMUNITIES

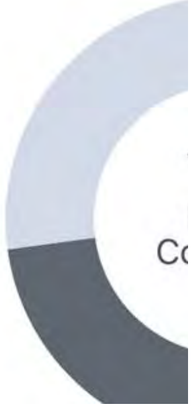
Communities are empowered by local and global CAP data to inform their decisions about what is working - or where and how to intervene to increase circularity. Communities that participate in CAP can better define resource needs and participate in knowledge exchange.

SYSTEMS CHANGE



ists and volunteers
data to our public





Citizen-Based Litter and Marine Debris Data Collection and Mapping

Jenna R. Jambeck and Kyle Johnsen | University of Georgia, Athens

The monitoring of litter and debris is challenging at the global scale because of disconnected local organizations and the use of paper and pen for documentation. The Marine Debris Tracker mobile app and citizen science program allows for the collection of global standardized data at a scale, speed, and efficiency that wasn't previously possible.

Since 2011, Debris Tracker volunteers have logged more than **10 million items** in 90+

Debris Tracker Data Dashboard

1. What is it?

2. How did it get here?

3. What can “we” do about it?

Data is powerful if it’s open

CAP Cities

Explore the global footprint of CAP data collection. Click a city dot to filter all charts below, or use the filters above. Grey dots are outside the current filter.

Currently viewing: **All locations**

DATA IN CURRENT SELECTION

46	814	3,763	1,278	3,106	158,795
CITIES	STORES SURVEYED	FOOD VENDOR ITEMS	ALTERNATIVES FOUND	UNIQUE BRANDS	LITTER ITEMS COUNTED
	354 convenience · 397 grocery				

Materials Used for Food Vendor Products

All locations

Select a product and/or food vendor type to see which materials are most commonly used. All results reflect the city type and location filters above.

Select product: All Select food vendor: All

Hard Plastic | Paper / Paperboard | Foam | Item not present | Other | Compostable Plastic | Film Plastic | Wood / Natural Materials | Aluminum

Litter Survey Results

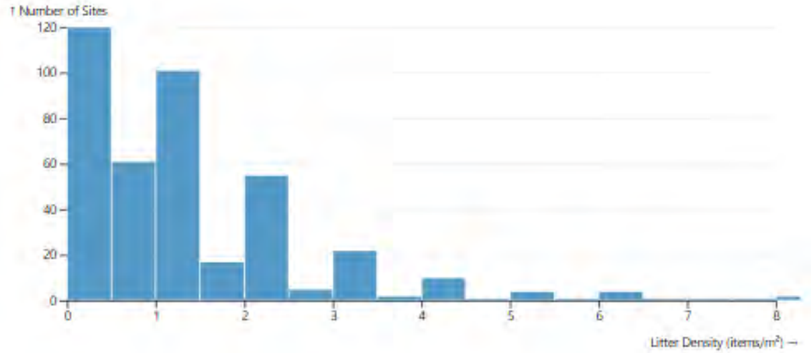
All locations

Litter density measured across 100m transects using a stratified random sampling protocol. Sites are classified by ambient population density (Low, Medium, High) using LandScan data.

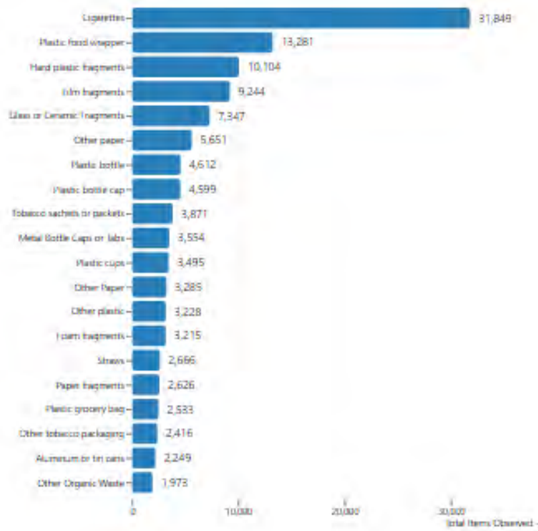
Overall Density

Density Histogram

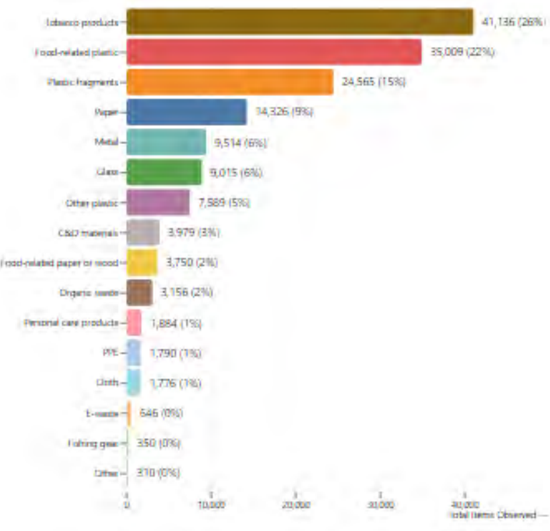
Distribution of litter density across all sites. Most sites have low density; a small number of hotspots drive the mean upward.



Top 20 Litter Items

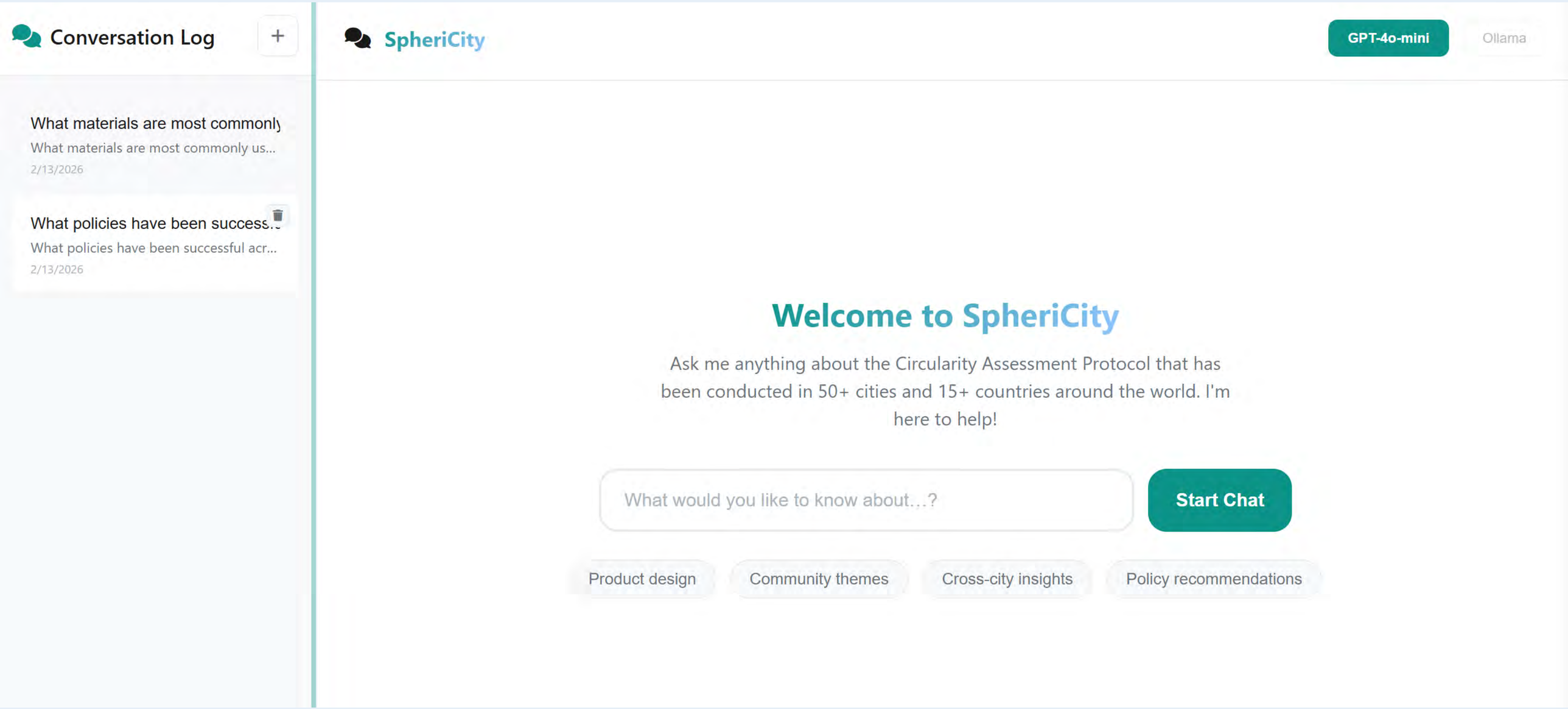


Litter Characterization



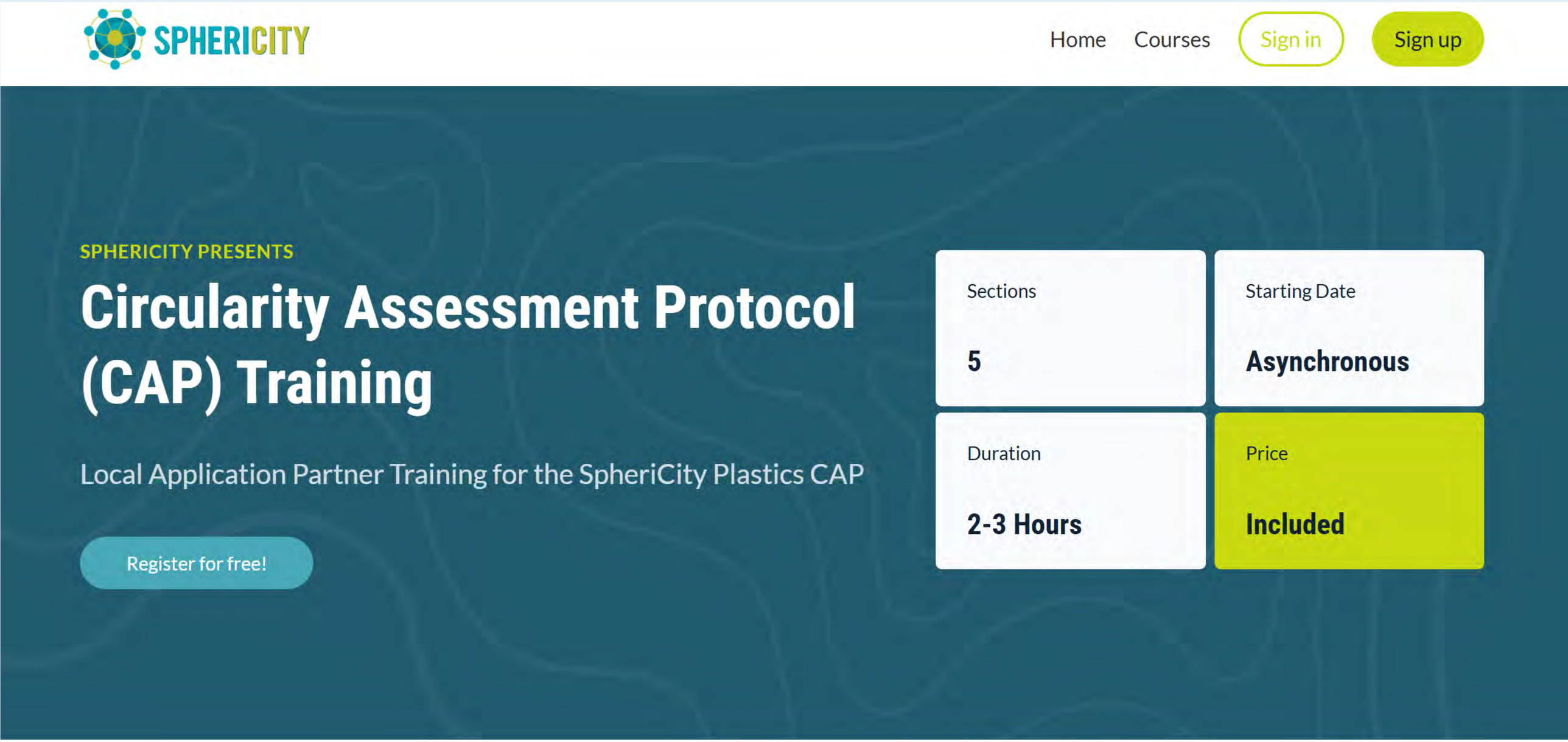
Data is powerful if it’s open

Data is powerful if it’s usable

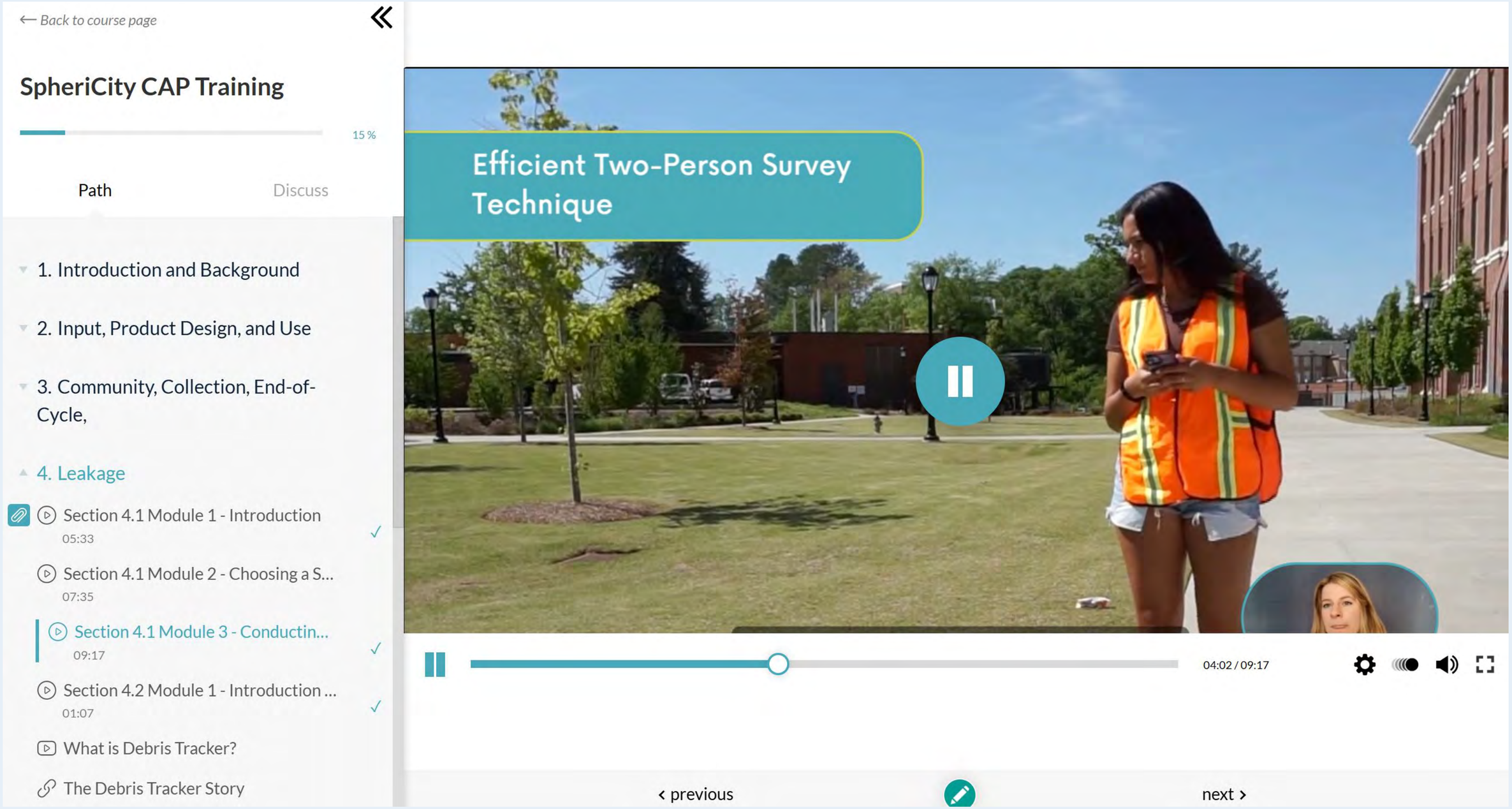


Data is powerful If it’s impactful

Data can create change when scaled



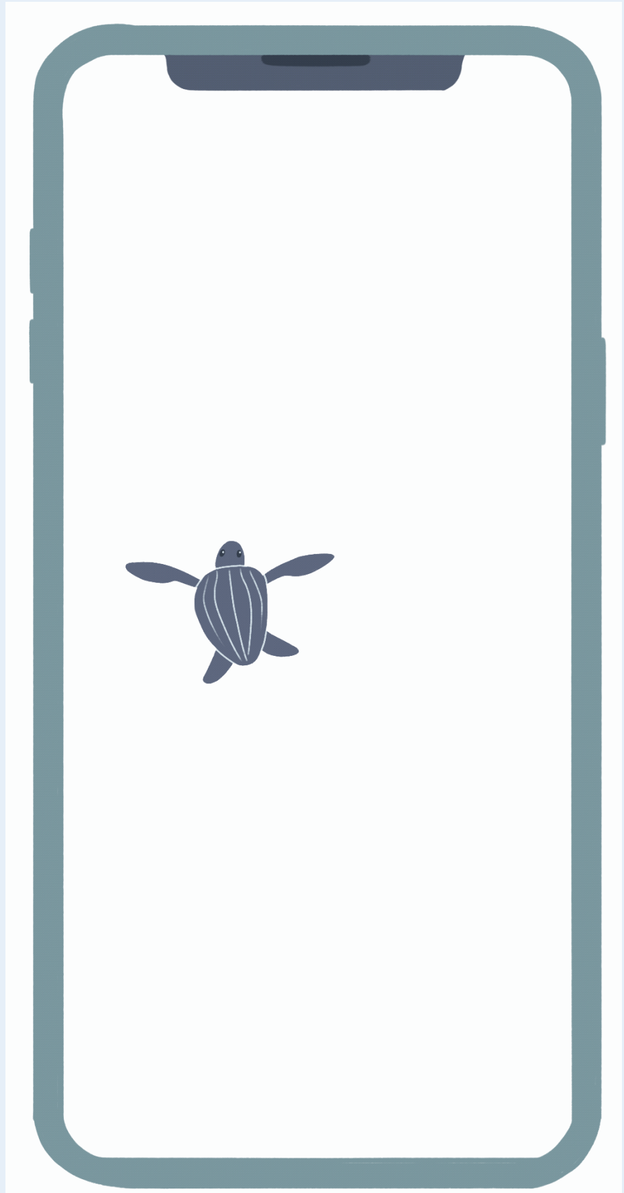
Data can create change when scaled

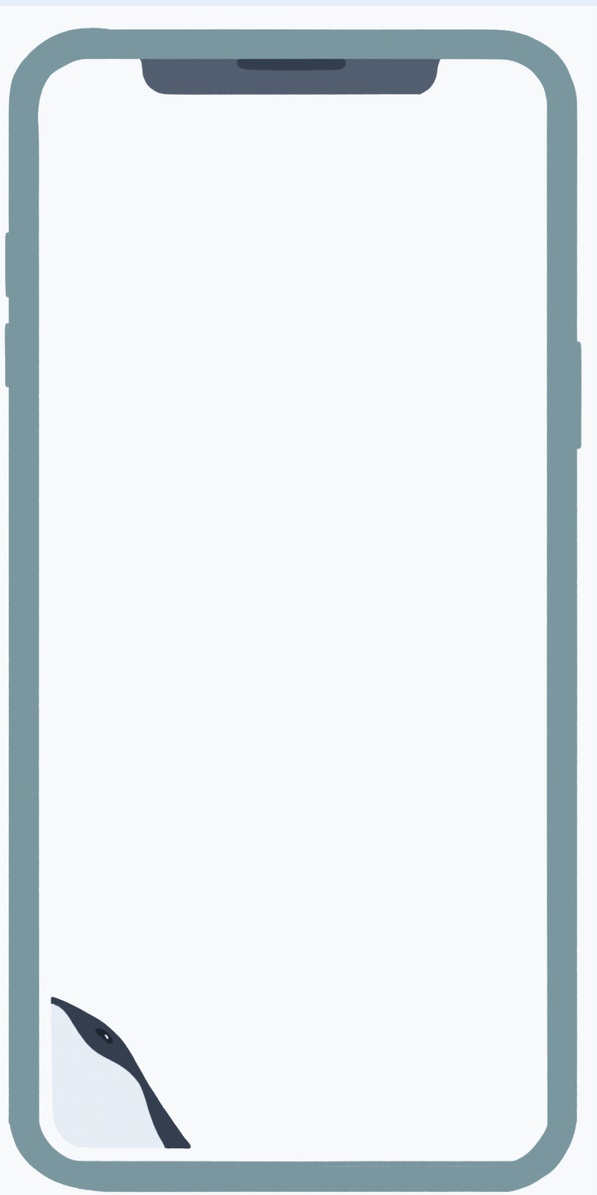


Debris Tracker Jr.

Thanks to Young Futures

We are not going to immediately “solve” plastic pollution, but together we can change the system of what is possible.





Thank You

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