

The Design Challenge

*interviewing critical geographic pedagogy, visual storytelling,
and big data visualization in a day-long mapping workshop!*



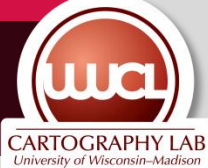
**Robert E. Roth, Sarah A. Moore, Tanya M.A Buckingham
Heather Rosenfeld, Eric Nost, Kristen Vincent, & Rafi Arefin**

University of Wisconsin Cartography Lab &
University of Wisconsin–Madison, Department of Geography

2017 AAG Annual Meeting

ICA Sessions on Cognition, Behavior, & Design
Sponsored by the AAG Cartography Specialty Group
Boston, MA | April 6

#uwcart



CARTOGRAPHY LAB
University of Wisconsin-Madison



2015 Cart Lab Design Challenge

Mapping the transnational hazardous waste trade

Interested in environmental justice? Have a little mapping experience? Be the first to look for patterns and stories in our dataset. Add a new map to your portfolio and compete for prizes in our one day design event!

Over **one million tons** of hazardous waste are traded among the United States, Canada, and Mexico each year. What kinds of waste are traded, and where do they go? What happens to it upon arriving at its destination? What does it mean for communities that are major hazardous waste importers?

In this design challenge, UW-Madison students are invited to participate in a mapping competition to begin to answer these questions. **Participants will be the first to look at a previously unreleased dataset** assembled from two Freedom of Information Act Requests to the U.S. Environmental Protection Agency on U.S. hazardous waste imports.

To participate, you must:

- Be a student
- Register by **5pm February 6th** via the form at bit.ly/1yGSwWj. More details and the dataset will be sent after registration
- Have taken Geog 370 or possess equivalent experience
- Work individually or in groups of two
- Work in any medium (e.g., hand drawn, print, or interactive), but maps must be visible on powerpoint slides or work in browser

\$800

in prizes!
(\$500 top prize)

Meals provided to participants

Saturday Feb. 14, 9am-7pm

Cartography Lab, Science Hall
M390, 550 N. Park St

Register by 5pm February 6th at bit.ly/1yGSwWj
Questions? Contact [Robert Roth](mailto:Robert.Roth@wisc.edu) at Robert.Roth@wisc.edu

environmental justice

VISUALIZE SPACIO-TEMPORAL FOSSIL DATA
WORK IN A TEAM ON RECENT CLIMATE RESEARCH
SIGN UP: BIT.LY/DESIGNCHALLENGE2017

Sat. Feb 20
Design 9:30am-5pm
Meals provided

UW Cartography Lab
Meals provided

Presentations
6pm, Map Library
Open to the public

DESIGN CHALLENGE

climate change

2017 DESIGN CHALLENGE

hosted by the UW-Madison Cartography Lab

March 4, 2017 • 9am-8pm • UW-Madison Cartography Lab

MEANINGFUL WORK FOR YOUR CITY

Maps are powerful and persuasive visuals for tackling local needs. The 2017 Design Challenge will focus on mapping and community needs in Madison!

Participants will create a comprehensive plan for Madison focused on community services (where are the services and who is being served), and create a focused map analysis of Bridge Lake Point Waunona Community Center (what does the center provide, and who's being served). The goal is to put our plans into action to make a difference within our community!

Join us in the cart lab if you have taken 305, 370, 377, or have expertise in city planning and you want to...

- improve your design skills
- work on a meaningful, real-world project
- meet more people in the department

WATCH HERE FOR AN ANNOUNCEMENT ABOUT SPECIAL GUEST CARTOGRAPHER!



INFO & REGISTRATION: bit.ly/DesignChallenge2017

BREAKFAST, LUNCH, & DINNER WILL BE SERVED TO PARTICIPANTS

community organization

pedagogy

active learning

real-world problems

service learning

portfolio building

expert feedback

self management

self assessment



innovation

process over product

mixed methods

hybridized epistemologies

spontaneous insights

maps that matter

broader impacts

design + critique





community

social engineering

peer-to-peer learning

capacity building

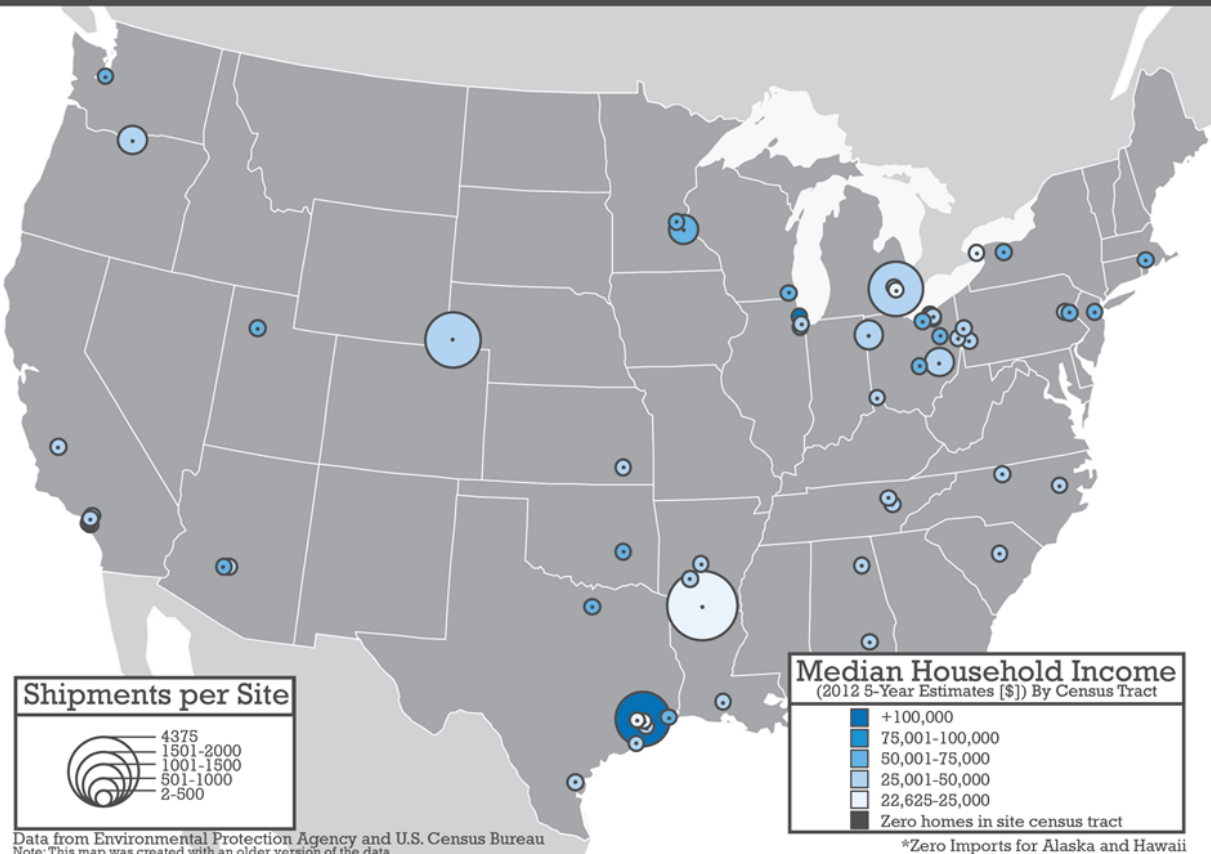
outreach

cartographic stewardship

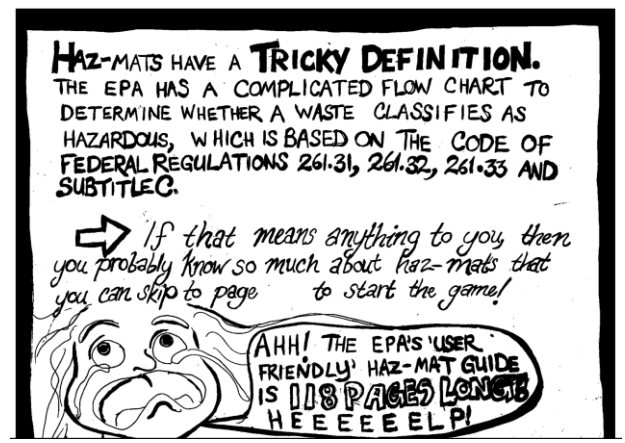
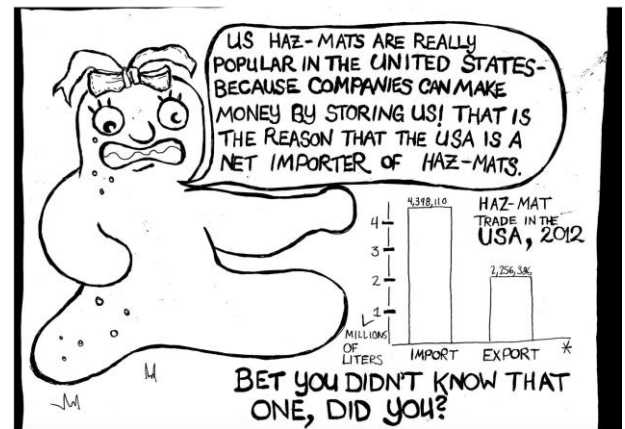
leveling hierarchies

undisciplining geography

Hazardous Waste Imports: 2007, 2009-2012



Data from Environmental Protection Agency and U.S. Census Bureau
 Note: This map was created with an older version of the data.



#DC2015

Kristen Vincent (left) Chelsea Nestel (right)

Search for a chemical (e.g. lead) or a description (e.g. radioactive)

Show type: Solids Liquids

Measured as: Weight (kg) Volume (l) # of Shipments

Aggregate by: Sites States

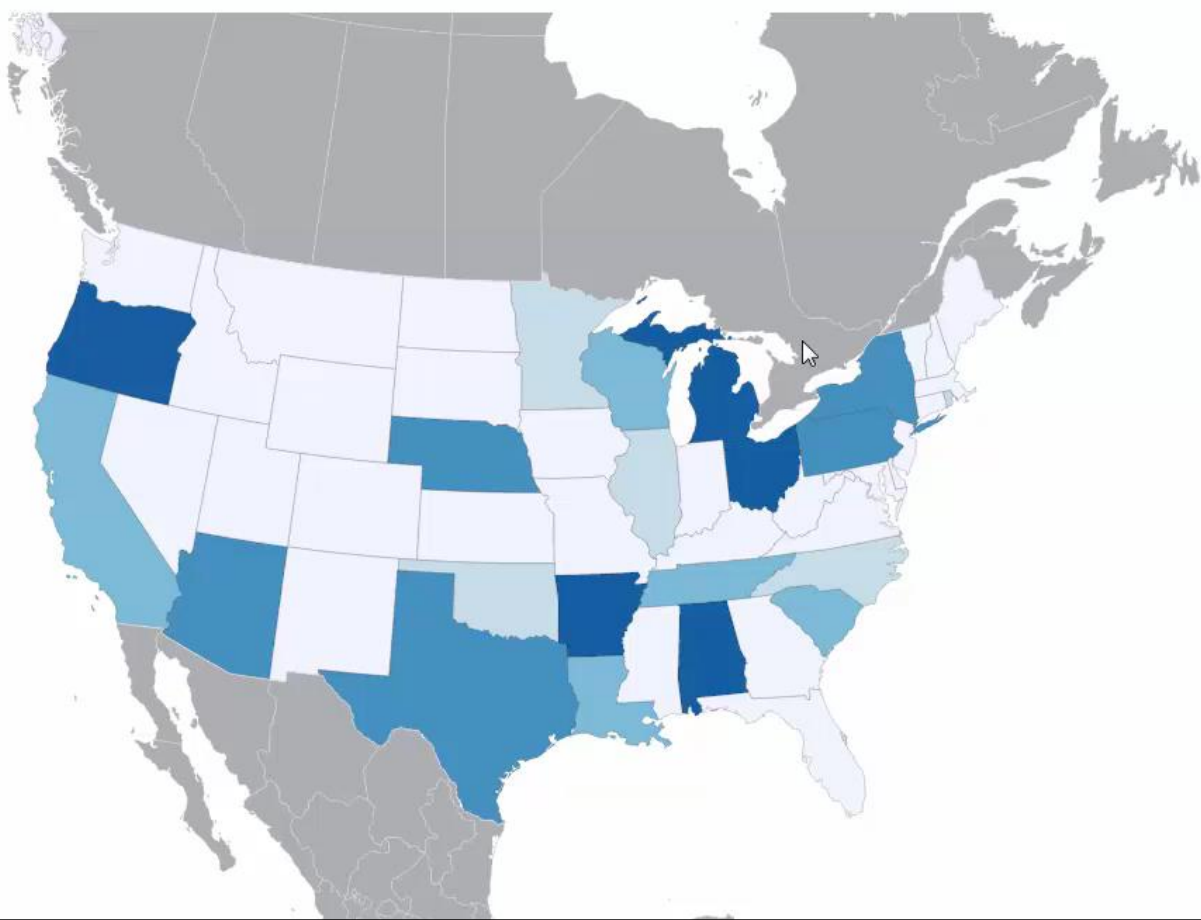
Filter year(s): 2007 2008 2009 2010 2011 2012

Overlay correlates: None Poverty Race

Overlay context: None EPA Regions All TSDFs



Percent of total waste flow.... By state, for the selected years. Hover over a state to see total imports and # of sites.



Need to submit form

UNIFORM HAZARDOUS WASTE MANIFEST 1. Generator ID Number ~~550988~~ A0048743192 2. Page 1 of 3 3. Emergency Response Phone ~~31~~ (800)483-3718 4. Manifest Tracking Number 003896230 FLE

5. Generator's Name and Mailing Address Clean Harbors Canada Inc. 7842 Progress Way Delta, BC V4B 3M4 Generator's Phone (804)940-0694 Exporter name and address 81: CLEAN HARBORS 309 Ave. E. 00000 Manifest number

6. Transporter 1 Company Name Alchemat Transport Inc (USA) 2560/47/11 U.S. EPA ID Number ARD000007954 CANADA

7. Transporter 2 Company Name Clean Harbors Environmental Services U.S. EPA ID Number Importer EPA ID

8. Designated Facility Name and Site Address Clean Harbors El Dorado LLC 309 American Circle El Dorado, AR 71730 Importer name and address ARD089748192 Facility's Phone (870)863-7173 # of containers Container type

10. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	11. Containers		12. Unit Wt./Vol.	13. Waste Codes	
	a. No.	b. Type		1. UN	2. EPA
UN1391, WASTE ALKALI METAL DISPERSIONS, 4.3, PG I	001	D M	00097	P	D001 D003
UN1391, WASTE ALKALI METAL DISPERSIONS, 4.3, PG I	005	D F	02088	P	D001 D003
			Quantity		EPA waste code
			Quantity unit		

14. Special Handling Instructions and Additional Information 1. E1-CE487251 ERG#138 1X55 2. E1-CE487251 ERG#138 5X85

15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 262.22(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true. Year 08/26/11

16. International Shipments [X] Import to U.S. [] Export from U.S. Port of entry: BLANCO, WA Port of entry Date leaving U.S. 09/27/11

17. Transporter Acknowledgment of Receipt of Materials Transporter 1 Printed/typed Name Signature Date Month Day Year 09/27/11 Transporter 2 Printed/typed Name Signature Date Month Day Year 09/27/11

18. Discrepancy 18a. Discrepancy Indication Space [] Quantity [] Type [] Residue [] Partial Rejection [] Full Rejection Manifest Reference Number U.S. EPA ID Number

18b. Alternate Facility (or Generator) Facility's Phone Month Day Year 18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Expected management method H040 H040 3. 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a. Month Day Year 11/07/11

Need Consent Form

#DC2015

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: **AC004773192**

2. Page 1 of 3

3. Emergency Response Phone: **(800)483-3718**

4. Manifest Tracking Number: **003896230 FLE**

5. Generator's Name and Mailing Address: **Clean Harbors Canada Inc. 7842 Progress Way Delta, BC V4B 3M4**

6. Exporter name and address: **Clean Harbors Canada Inc. 7842 Progress Way Delta, BC V4B 3M4**

7. Manifest number: **003896230 FLE**

8. Transporter 1 Company Name: **Alchemat Transport Inc (USA)**

9. U.S. EPA ID Number: **AKC000007954**

10. Importer name and address: **Clean Harbors Environmental Services Inc. 309 American Circle El Dorado, AR 71730**

11. Importer EPA ID: **ARD089748192**

12. Designated Facility Name and Site Address: **Clean Harbors El Dorado LLC 309 American Circle El Dorado, AR 71730**

13. # of containers: **001** Container type: **DM**

14. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	15. Containers	16. Type	17. Total Quantity	18. Unit W/L No.	19. Waste Codes
UN1391, WASTE ALKALI METAL DISPERSIONS, 4.3, PG I	001	DM	0097		D001, D003
UN1391, WASTE ALKALI METAL DISPERSIONS, 4.3, PG I	005	DF	2088		D001, D003

14. Special Handling Instructions and Additional Information:

1. E1 - CH487251 ERG#139 1X55

2. E1 - CE487251 ERG#139 5X95

15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. I export shipment and I am the Primary Exporter. I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.

16. International Shipments: Import to U.S. Export from U.S. Port of entry: **BLANCO, WA**

17. Transporter Acknowledgment of Receipt of Materials: Transporter 1 Printed Name: **D** Signature: **D** Month: **02** Day: **14** Year: **11**

18. Discrepancy: 18a. Discrepancy Indication Space: Quantity Type Residue Partial Rejection Full Rejection

19. Hazardous Waste: **H040**

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in item 18a. Signature: **11/27/11**

Data: EPA Scanned Manifests

- 21,184 import/export shipments (27% of total FOIA)
- imports: 41 unique attributes (3370 unique entries)
- exports: 29 unique attributes (3570 unique entries)

Participants (25 DCers)

- 17 students: 2 PhD, 4 MS, 6 cert, 5 undergrad
- 8 helpers: 2 faculty, 2 staff, 2 visitors, 2 PAs

The Challenge

"visualize unique stories in the dataset"

Logistics (February 14th, 2015)

- dataset curated by Cart Lab PA (~two weeks)
- dataset sent to participants one week in advance
- 8 hours to design + 90 minutes of presentation
- \$900 in prizes + \$600 for three meals

Interviews (Spring 2015)

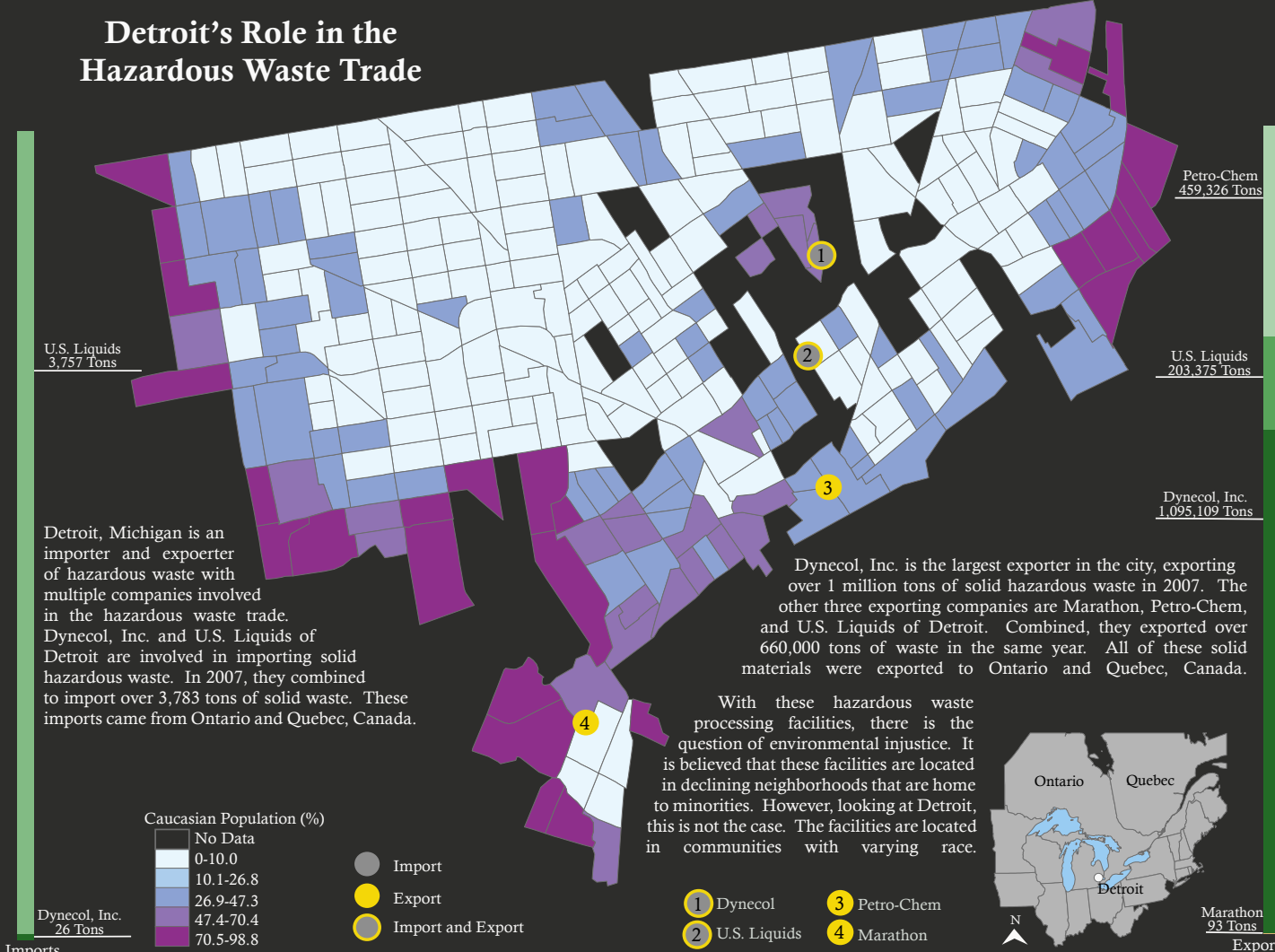
- 14/17 participants reflected on lasting impressions

Clean Harbors has the appropriate permits for and will accept the waste this generator is shipping.

#	Title	Story Theme
1	Burying Hazardous Waste: Continental Imports to United States Landfills from 2007–2012	Flows (Transboundary)
2	Choose Your Own HazMat Adventure Game	Political Economics
3	Detroit's Role in the Hazardous Waste Trade	Uneven Risk (City)
4	Hazardous Waste Import Locations by Packing Group	Uneven Risk (Country)
5	Hazardous Waste Treatment Facilities: The Communities	Political Economics, Uneven Risk (Country)
6	How One Line on a Map Explains 9% of the US–Mexico Hazardous Waste Trade	Flows (Transnational), Political Economics
7	One Company and the North American Hazardous Waste Trade	Flows (Transnational), Political Economics
8	Solid Lead from Canada to the United States from 2007–2009	Flows (Regional)
9	Untitled	Uneven Risk (State)
10	Ways We Eliminate Waste	Uneven Risk (Country)

Detroit's Role in the Hazardous Waste Trade

uneven risk
local disparity



Detroit, Michigan is an importer and exporter of hazardous waste with multiple companies involved in the hazardous waste trade. Dynecol, Inc. and U.S. Liquids of Detroit are involved in importing solid hazardous waste. In 2007, they combined to import over 3,783 tons of solid waste. These imports came from Ontario and Quebec, Canada.

Dynecol, Inc. is the largest exporter in the city, exporting over 1 million tons of solid hazardous waste in 2007. The other three exporting companies are Marathon, Petro-Chem, and U.S. Liquids of Detroit. Combined, they exported over 660,000 tons of waste in the same year. All of these solid materials were exported to Ontario and Quebec, Canada.

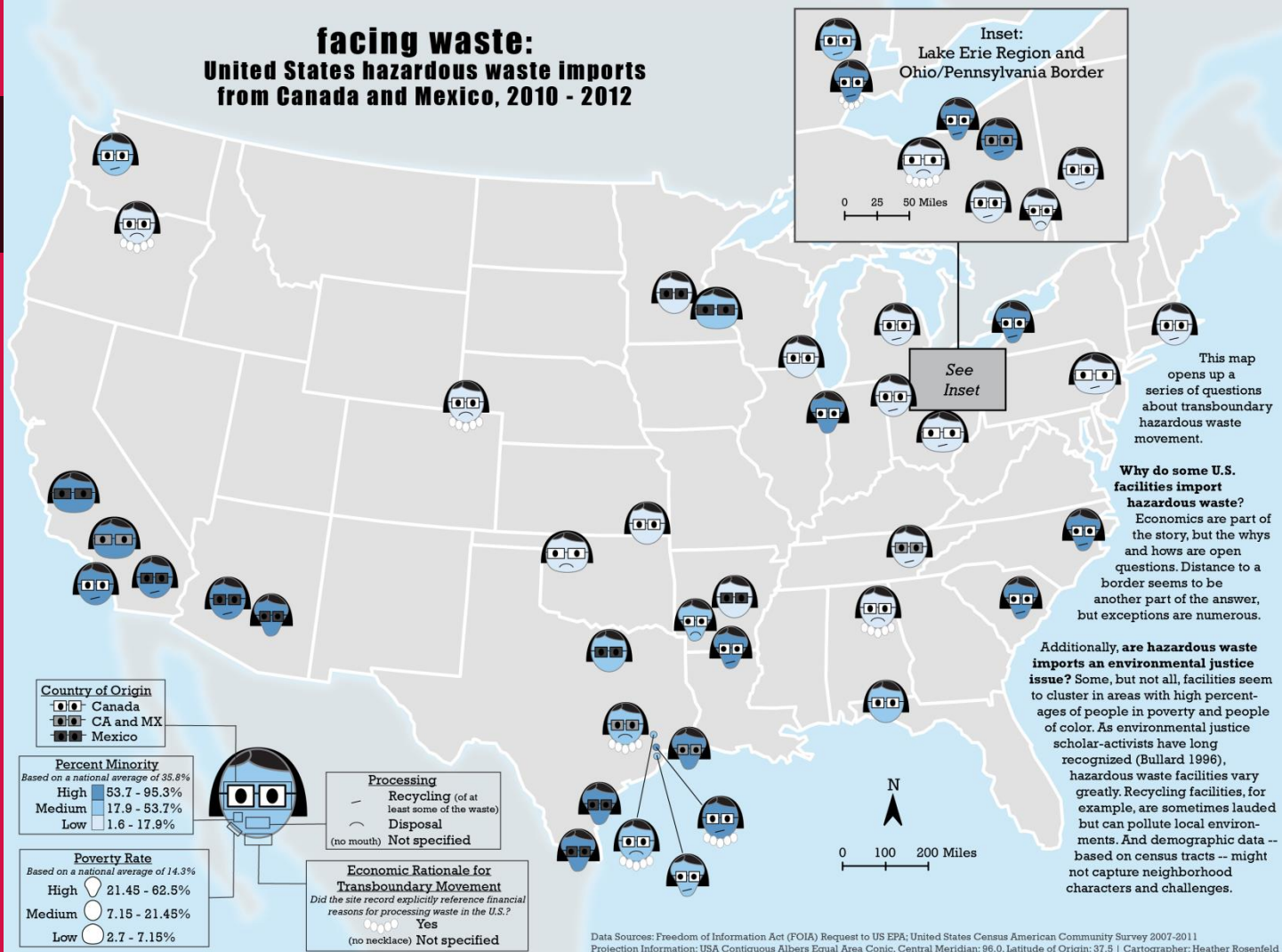
With these hazardous waste processing facilities, there is the question of environmental injustice. It is believed that these facilities are located in declining neighborhoods that are home to minorities. However, looking at Detroit, this is not the case. The facilities are located in communities with varying race.



Kristen Vincent

uneven risk
national disparity

facing waste: United States hazardous waste imports from Canada and Mexico, 2010 - 2012



Heather Rosenfeld

Data Sources: Freedom of Information Act (FOIA) Request to US EPA; United States Census American Community Survey 2007-2011
Projection Information: USA Contiguous Albers Equal Area Conic, Central Meridian: 96.0, Latitude of Origin: 37.5 | Cartographer: Heather Rosenfeld

Solid Lead from Canada to the United States from 2007-2009

flows
specific materials

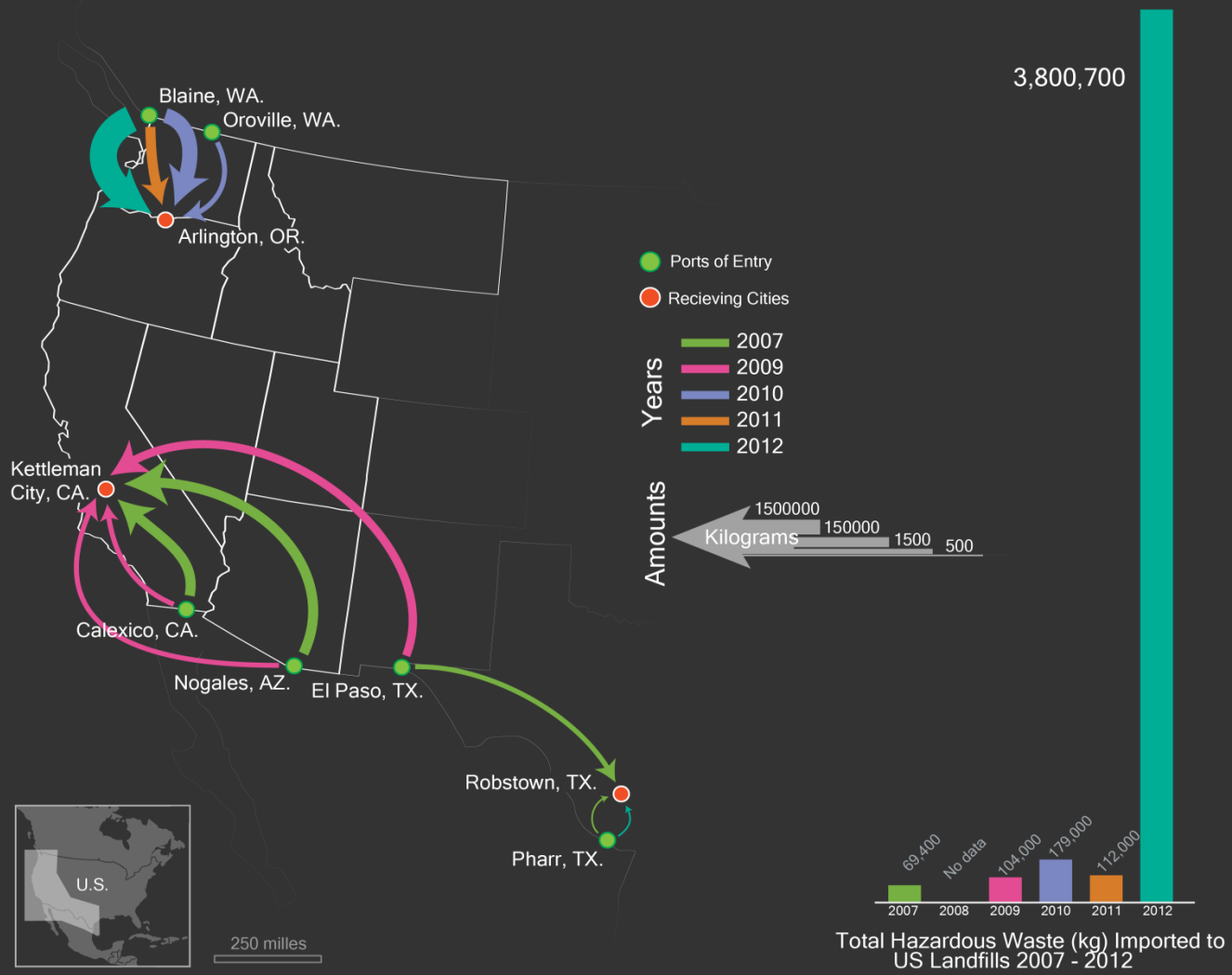


The Health Effects of Lead

There are many serious health problems caused by the accumulation of lead in a body. For children, lead can lead to slowed growth, lower IQ, behavior problems, hearing problems, hyperactivity, and anemia. For pregnant women, lead in the body can reduce growth of the fetus and lead to premature birth.

Gillian Cooper,
Claire Trainor

flows
specific sites



Constanza Bravo,
 Michelle Hu



250 miles

political economy transnational?

One Company AND THE North American Hazardous Waste Trade

The movement and disposal of hazardous waste in North America is a profit-driven industry, an international trade, like clothing or fruit. The United States is a **NET IMPORTER** of hazardous waste.

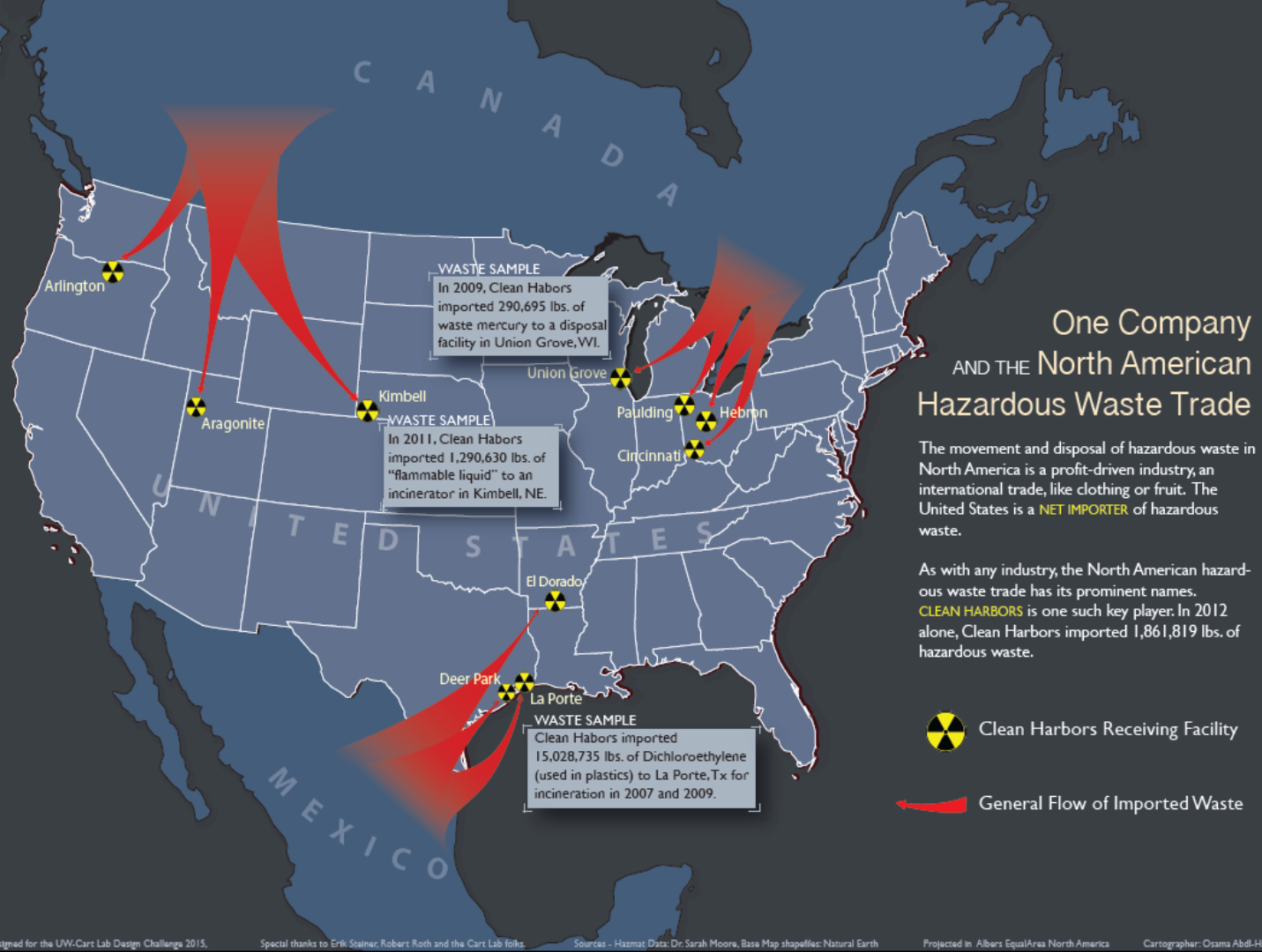
As with any industry, the North American hazardous waste trade has its prominent names. **CLEAN HARBORS** is one such key player. In 2012 alone, Clean Harbors imported 1,861,819 lbs. of hazardous waste.



Clean Harbors Receiving Facility



General Flow of Imported Waste



How one line on a map explains 9% of the U.S.-Mexico hazardous waste trade

By Evan Applegate & Eric Nost

1

Let's talk about



a company that appears in 1/3 of the rows in the "waste importer" dataset. Its ubiquity isn't so surprising: they had **\$1 billion** in waste disposal revenues last year, and according to them most of the hazardous waste incinerated in North America goes through one of their facilities.

Most of the waste they import is leftovers from the manufacture of **vinyl chloride**, the stuff you need to make PVC pipes.

Further digging revealed that Clean Harbors imports a lot of this vinyl chloride waste: 11,089 tons from 2007-2012, which adds up to **9% of all hazardous waste imported into the U.S.** that's measured in pounds or kilograms. Where does it all come from?

Clean Harbors Deer Park
La Porte, Texas

3

That one plant is the Deer Park facility in La Porte, Texas. But why's the waste coming to Texas? What's the economic sense of moving waste **800 miles** just to burn it?

MEXICO

U.S.

Pajaritos Petrochemical Complex
Coatzacoalcos, Veracruz, Mexico

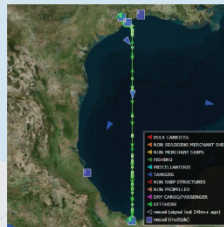
2

All the vinyl chloride waste imported by Clean Harbors comes from a single location in Mexico. And it all ends up at one Clean Harbors plant.

4

The map holds the answer: **both the Deer Park facility and the Pajaritos complex are adjacent to ports on the Gulf of Mexico, and it's a straight shot between them.**

We don't have manifests but public shipping data from IHS maritime confirms ▶ that chemical tankers make regular runs between the two ports, taking on cargo in Mexico and unloading it in Texas.



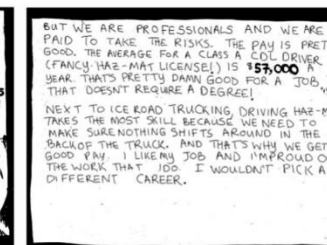
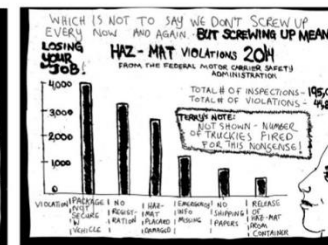
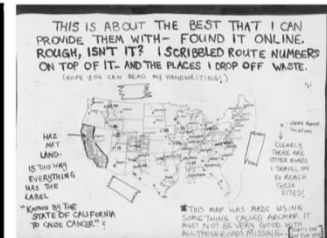
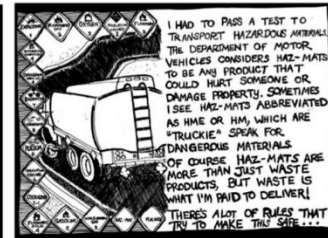
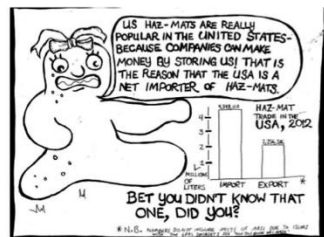
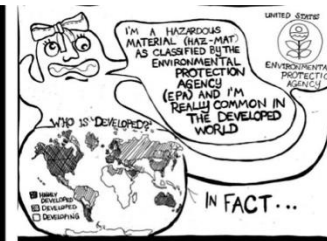
5

It's a simple route, and also a cheap one: moving cargo by ship is far less costly than moving it by rail or road. Add a free trade agreement that smooths international waste transit and the picture becomes clear: **low transport costs plus NAFTA equals a booming trade in hazardous waste between Mexico and the U.S.**

political economy
specific sites

Evan Applegate & Eric Nost

critical quantification storytelling



critical quantification
**can stories tell
themselves?**

"the story is in fact being spun"

"if you go dig around for the numbers that support what you think, you'll probably find them"

directed storytelling

"if I couldn't find the answer from the dataset, I looked for other data"

"it was useful to think in terms of cases rather than exploration"

"it is okay to be subjective and creative, I don't think that subjectivity is always bad"

"as a designer you have to be able to adapt and be able to understand what's in the data"

undirected storyseeking

"whether those stories were appropriate to the data or to the task at hand was up in the air"

"having a big dataset was just inducement to dig out its spurious correlations"

critical quantification
uncertainty

Incompleteness	
missing or underreported shipments	7
missing geocoded coordinates	1
missing units	1
Inconsistency	
inconsistent units	8
inconsistent waste codes/names	5
Inaccuracy	
geocoding errors	3
misspelling	1
Imprecision	
geocoding imprecision	1
aggregation resolution	1
rounding	1
Lineage	
handwriting / transcription issues	3

interviews one year later

critical quantification
collaboration



Dylan Moriarty

- A Design Challenge is a **LOT** of work for everyone, but checks every box on campus while helping us think outside them.
- Big data are **meaningless** but specific stories in them are **powerful**; together, they can reveal their limitations and confront traditional narratives.
- Just as data cannot speak for themselves, **stories cannot tell themselves**. Be creative, critical, and reflexive when seeking and telling.
- Collaboration is essential to learning and understanding. **Everyone** has something to contribute.
- A Design Challenge **starts conversation**, it cannot end one.

The Design Challenge

interviewing critical geographic pedagogy, visual storytelling, and big data visualization in a day-long mapping workshop!

Thx!



Read about the project!

- Nost et al. (2017) HazMatMapper: An online and interactive geographic visualization tool for exploring transnational flows of hazardous waste and environmental justice. *The Journal of Maps*.
- Moore et al. (2017) Undisciplining environmental justice research with visual storytelling. *Geoforum*.
- Project page: www.geography.wisc.edu/hazardouswaste/

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Thanks to our sponsors!

- Andrew W. Mellon Foundation
- National Science Foundation Award #1539712
- The Wisconsin Alumni Research Foundation

Thanks to all participants!

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