



What's Really in Your Waste Stream?

Developing new tools for data-driven decision making

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CONSULTANT | RESOURCE RECYCLING SYSTEMS



OUR QUESTION



WHAT'S IN THERE...





...AND HOW MUCH?



OR

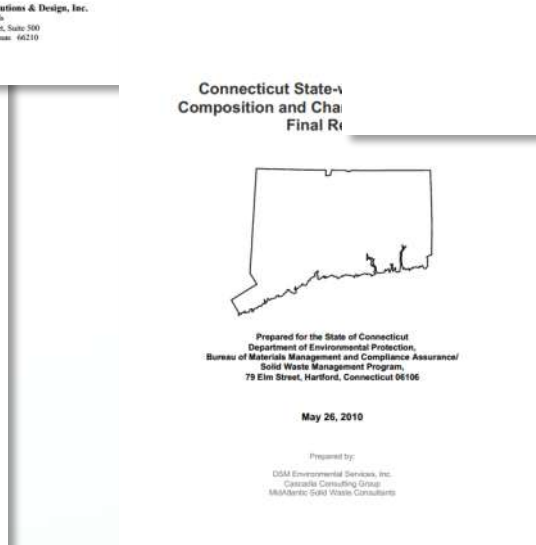
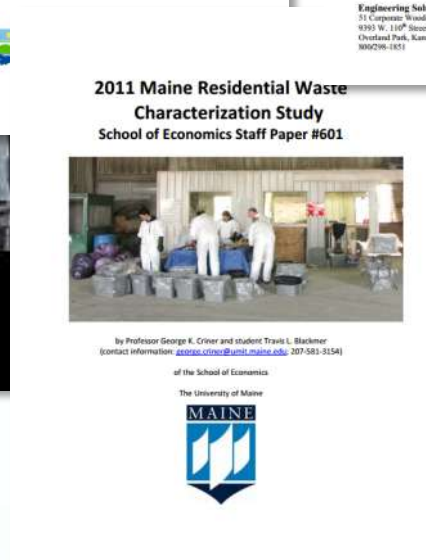
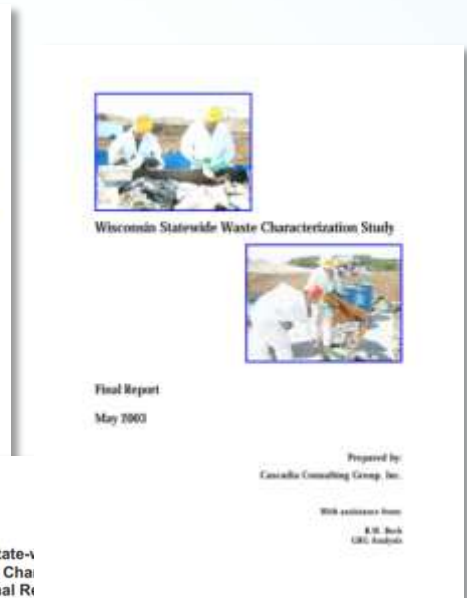
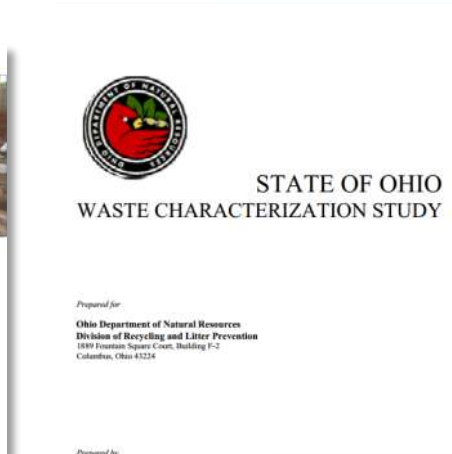
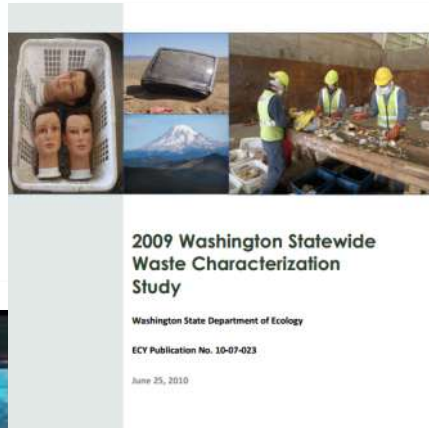




SOME ANSWERS...



STATE/LOCAL LEVEL - WASTE CHARACTERIZATION STUDIES





NATIONAL LEVEL - BIOCYCLE

17th NATIONWIDE SURVEY OF MSW MANAGEMENT IN THE U.S.

THE STATE OF GARBAGE IN AMERICA

Latest national data on municipal solid waste management find estimated generation is 389.5 million tons in 2008 — 69 percent landfilled, 24 percent recycled and composted, and 7 percent combusted via waste-to-energy.

Rob van Haaren,
Nikolas Themelis and
Nora Goldstein

A joint study by BioCycle and the Earth Engineering Center of Columbia University

BIOCYCLE, in collaboration with the Earth Engineering Center (EEC) of Columbia University, conducts the biennial State of Garbage in America survey on the generation and management of municipal solid waste (MSW) in the United States. The State of Garbage in America Report, launched by BioCycle in 1999, is unique in that actual tonnage data is collected from each individual state, with waste characterization studies solely used for validation of the numbers. This is the 17th nationwide survey, reporting data from calendar year 2008.

The data was gathered during the spring of 2010, using an Excel form that was e-mailed to the solid waste management departments in all 50 states and the District of Columbia. All entries were checked and validated using results of former State of Garbage in America reports, EPA waste characterization studies, and also a survey of Materials Recovery Facilities (MRF) carried out by Kileen Beroony of Government Advisory Associates (GAA). We greatly appreciate the time spent and the contributions made by the solid waste and recycling officials listed at the end of this report. Thanks to their help and expertise, we can present the 2010 edition of "The State of Garbage in America." All tonnages are reported in U.S. tons (1 U.S. ton = 1 metric ton).

SURVEY METHODOLOGY

In 2004, the EEC was invited by BioCycle to collaborate on a science-based version of the State of Garbage survey. The State of Garbage methodology uses the principle of mass balance: all MSW generated is equal to the MSW landfilled, combusted in waste-to-energy (WTE) plants, composted and/or recycled. This relies on the assumption that all management methods employed for municipal solid waste are quantified/tracked and reported to the state agencies. According to our survey results, at least 15 states require waste management companies and local government agencies to report annual tonnages. Nineteen states reported that there was an

each requirement and another 12 states did not respond to this question. Only five states did not complete the 2010 State of Garbage survey. For states where companies and local agencies are not required to report to the state, disposal data can and, in most cases, are still collected from waste management facilities. This is especially true for landfills and waste-to-energy

residential and commercial wastes like paper, plastic packaging, bottles and cans, tires, yard trimmings, batteries, furniture, appliances, etc. Typical "non-MSW" materials are: industrial and agricultural wastes, construction and demolition (C&D) debris, automobile scrap and sludge from wastewater treatment plants. To account for these non-MSW materials, survey respondents were asked to provide a more specific breakdown of the waste streams being reported. This was done either by estimate or from measured tonnages. The non-MSW tonnages were automatically subtracted in the Excel spreadsheet from the total generation reported.

Over the past six years (with the survey conducted every two years), the methodology developed by EEC has been further refined. In the 2008 State of Garbage in America Report (December 2008), MSW

reported tonnages are reported in separate columns in Table 2. It is quite likely that some smaller composting operations have, inadvertently, not been included and, therefore, the total MSW composted may be somewhat higher than reported.

In the 2010 survey, an additional "filter" on the reported composting/recycling rates for different materials was introduced. The total amount of MSW generated was estimated using the 2008 State of Garbage national number of per capita generation (1.28 ton/capita, 2006 data) and the population of the state. EEC then used EPA's MSW Facts And Figures waste characterization report (EPA, 2008) of the average (U.S.) percent composition of MSW times the population of the state to estimate how many tons of each material were generated in the state. On the basis of this information, we were able to "filter out" reported recycling tonnages that were "through the roof," most likely due to the inclusion of non-MSW materials (e.g., automobile scrap). Reported recycling tonnages that were higher than the estimated waste generation of a particular material were decreased to 100 percent of the estimated waste generation.

PROTOCOL USED FOR RECYCLING TONNAGES

For a consistent determination of the tonnages to report in the survey, the following protocol was established. We reported tonnage unless any of the following factors were evident:

1. States did not report a recycled material tonnage. The GAA MRF survey reports of MRF-processed tonnages that in general were one half of the recycling tonnage reported by the states. Therefore, EEC concluded that approximately 50 percent of all



plants, since they track all of the disposed waste by simply weighing incoming and outgoing trucks. Composting and materials recycling facilities, however, may not have scales and/or are commercial or public enterprises that are not obligated to report tonnages received and processed to local or state government agencies. An important part of MSW accounting in the State of Garbage survey is "filtering out" non-MSW materials that may be included in the states' responses. The BioCycle/EEC survey uses the US EPA definition of Municipal Solid Waste, which includes:

management was divided into three main categories: Landfilling, Waste-to-Energy and Recycling. After such discussion and with input from survey participants, it was decided to divide the "recycling" category into materials recycling (i.e., recovery of paper, metals, glass, plastics) and organic recycling via composting (which includes such products). The tonnage sent to composting facilities appears to be tracked in many states, and EEC believes that it is useful to distinguish composting and mulching from other material recovery methods. As a result, recycled and non-

An important part of MSW accounting in the State of Garbage is filtering out non-MSW materials that may be included in the states' responses.

National estimated MSW generation dropped between 2006 and 2008, from 413 million tons to 389.5 million tons.

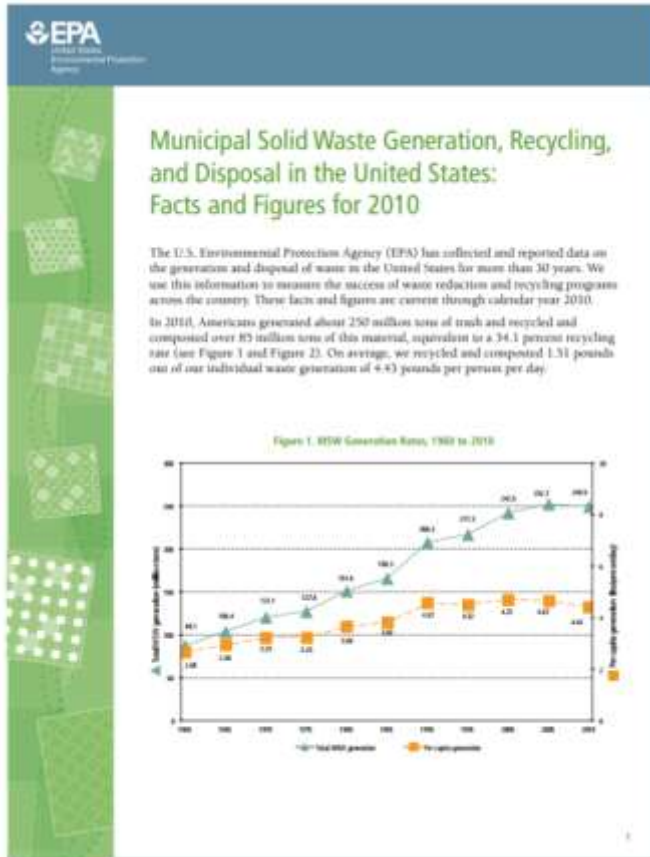
Table 1. State of Garbage in America survey data 1999-2008: Reported and estimated MSW generation and rates of MSW recycling, waste-to-energy and landfilling*

Year	Reported MSW Generation† (tonnes)	Estimated MSW Generation† (tonnes)	MSW Recycled† (%)	MSW Waste-to-Energy† (%)	MSW Landfilling† (%)
1999	300,000,000	4.0	8.0	8.0	84.0
2000	302,612,000	11.5	11.5	11.0	77.0
2001	292,670,000	14.9	14.9	10.0	75.0
2002	301,477,000	19.0	11.0	11.0	77.0
2003	306,894,000	19.0	10.0	10.0	71.0
2004	322,470,000	23.0	10.0	10.0	82.0
2005	326,700,000	27.0	10.0	10.0	80.0
2006	327,460,000	38.0	10.0	10.0	82.0
2007	340,460,000	39.0	8.0	8.0	81.0
2008	379,020,000	31.0	7.5	7.5	81.0
2009	387,500,000	33.0	7.0	7.0	86.0
2008	406,020,000	32.0	7.8	7.8	81.0
2005	-	303,387,411	28.7	7.7	63.6
2006	-	307,353,461	28.5	7.4	64.1
2006	-	413,014,732	28.6	8.0	64.5
2008	-	389,468,020	24.1	8.7	68.3

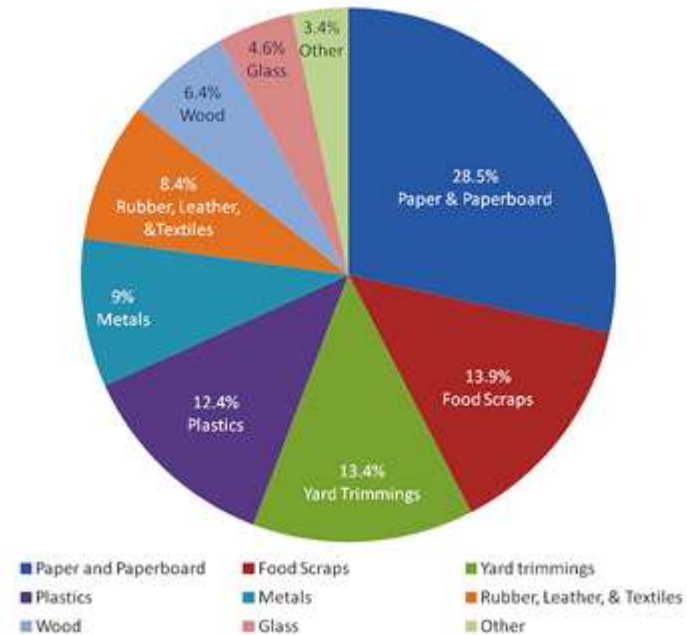
*2002, 2004, 2006 and 2008 estimated MSW Generation, MSW Recycled, WTE and Landfilling have been adjusted to exclude non-MSW. †Reported MSW Generation is reported values calculated by BioCycle prior to collaboration with Columbia University and use of current methodology. ‡Estimated MSW Generation is sum of MSW Recycled, WTE and Landfilling. †MSW Recycled includes composting and recycling.



NATIONAL LEVEL - EPA



**2010 Total MSW Generation (by Material)
250 Million Tons (Before Recycling)**





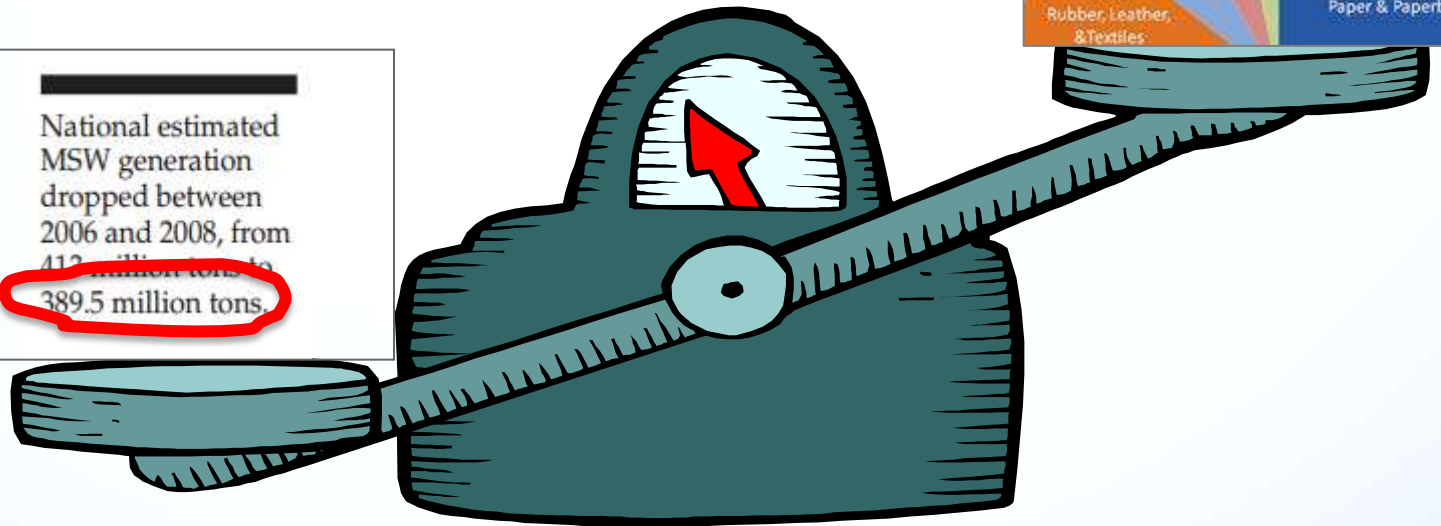
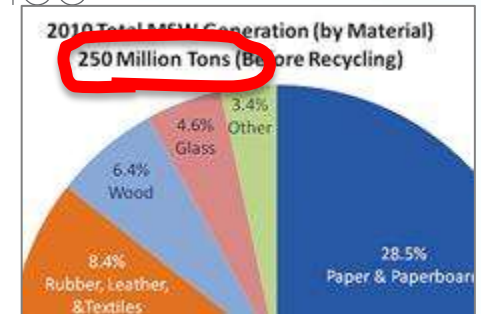
...BUT MORE QUESTIONS



DATA REALITY CHECK

- » Different methods → Very different results
- » National estimates vs local experience

National estimated MSW generation dropped between 2006 and 2008, from 412 million tons to 389.5 million tons.





IS EVERYTHING BEING COUNTED?

- » EPA/Mass Balance:
 - » Imports & exports
 - » Materials flow methodology and assumptions around product usage
- » Self Reported Data
 - » Commercial
 - » Self Haul



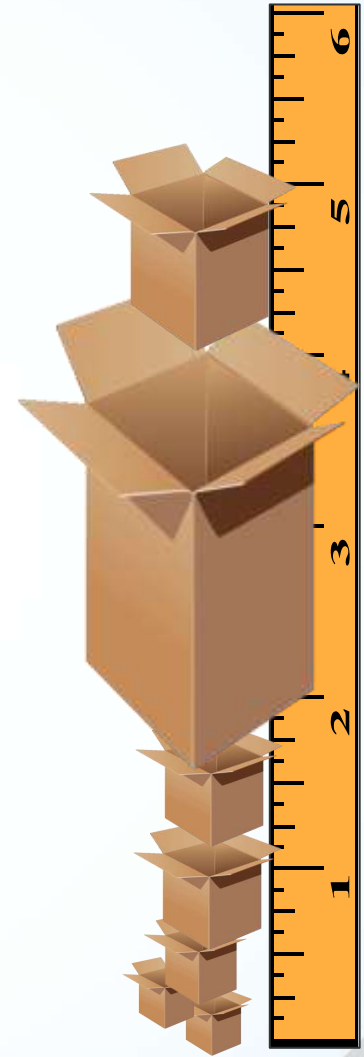
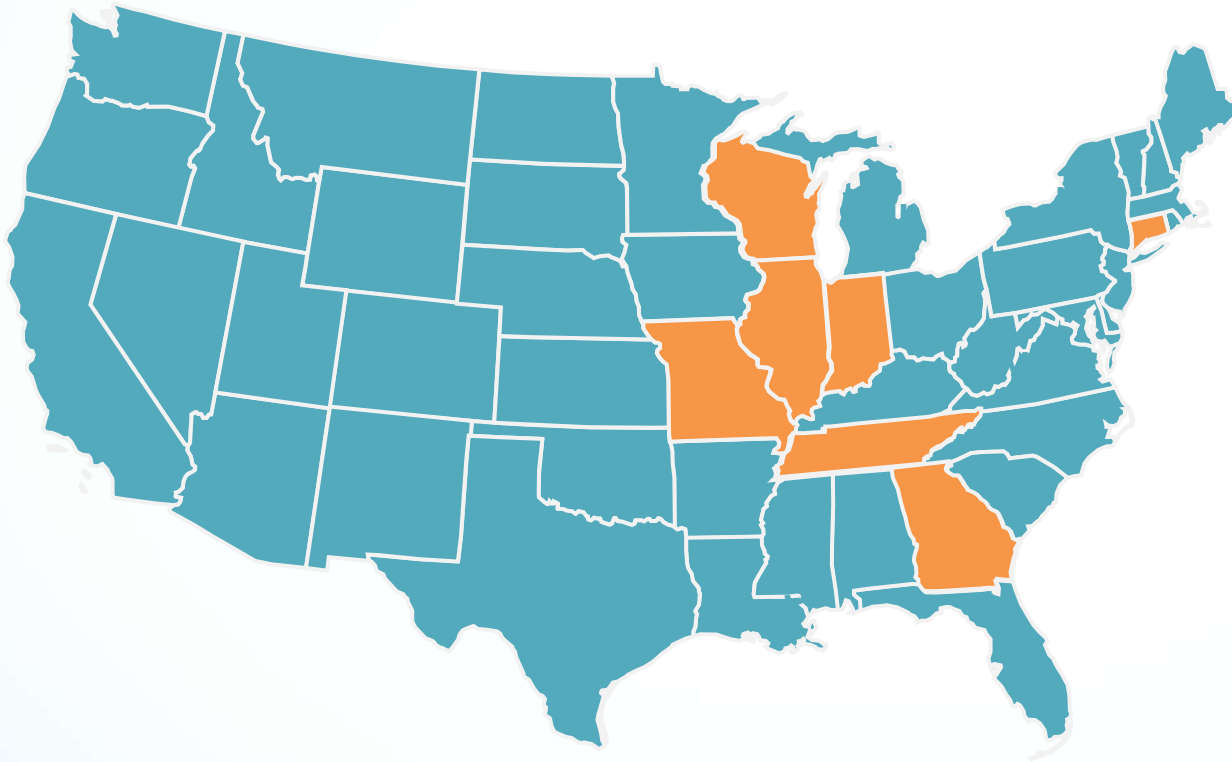


EXAMPLE - OCC





EXAMPLE - OCC





IS TOO MUCH BEING COUNTED?

- » Self-Reported Data
 - » C&D, Industrial included in MSW
 - » Industrial scrap, etc included in municipal recycling





IS THE COUNT ACCURATE?

- » Waste Characterization Studies
 - » Scientific sample
 - » Still limited by sample location, timing, etc.
- » Self Reported Data
 - » Data entry errors
 - » User confusion/inconsistencies
 - » Etc...





IS IT FEASIBLE?

- » Time
- » Money
- » Information available
- » How long does information stay useful?



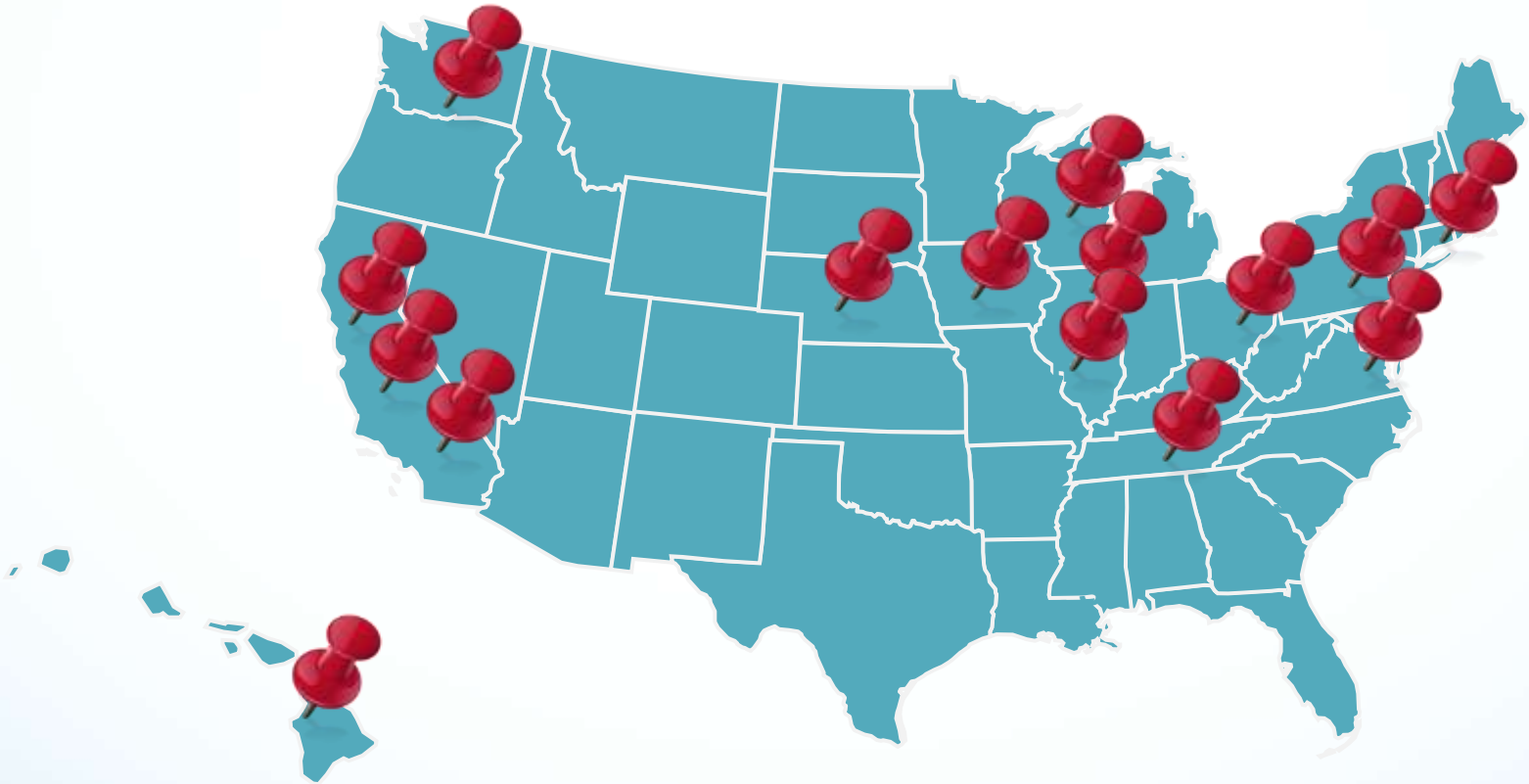


OUR APPROACH



SOURCE DATA

- » 27 waste characterization studies from last 10 years
- » Residential and commercial waste streams





FOCUS MATERIALS - PACKAGING, PRINTING & WRITING PAPER

High Grade Office	Mixed Office	Low Grade – General & Other Recyclable	ONP	Magazines & Catalogs
Paper Bags	Phonebooks and Directories	Hard Bound Books	OCC	Paperboard/ Boxboard
Aseptic/ Cartons	Polycoated Paper	PET Bottles	PET Containers Non Bottles	HDPE Bottles
3-7 Rigid Plastics	Aluminum Cans	Tin/Steel Cans	Glass Bottles/ Jars	



REVIEW OF PREVIOUS STUDY RESULTS





VARIATION BETWEEN STUDIES

Less Important

More Important

State By State Variation

Regional Variation

Residential – Commercial Mix

Diversion Rate



TREND ANALYSIS

Less Waste
Per Capita

More Waste
Per Capita



High Diversion Areas
More "Other" waste
Few common recyclables
(OCC, newspaper, office
paper, bottles and cans...

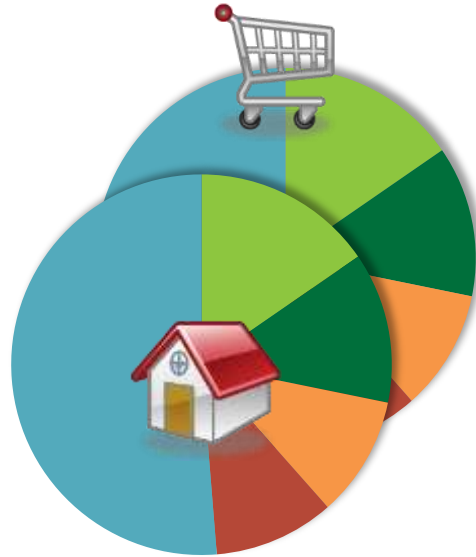
Low Diversion Areas
Lots of common recyclables
Less "Other" waste



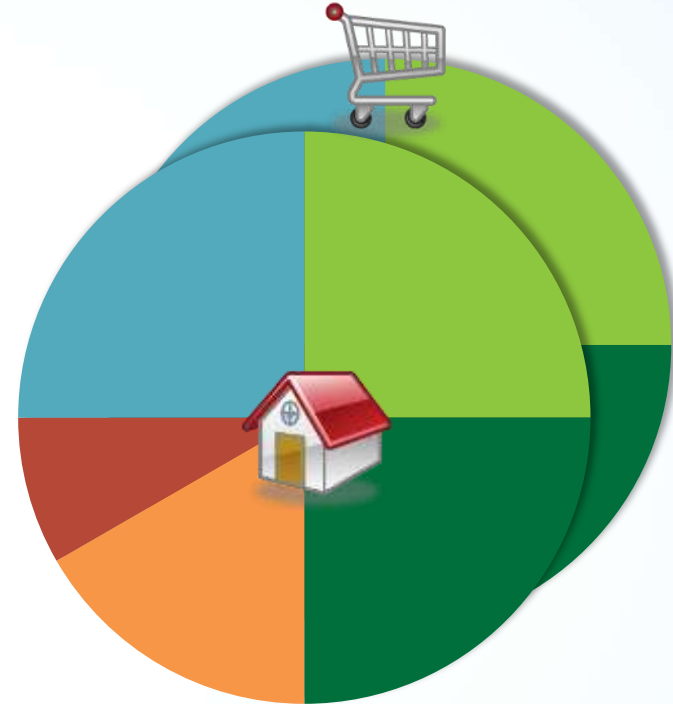
PROFILES - COMMERCIAL AND RESIDENTIAL



Typical High
Diversion Profiles



Typical Medium
Diversion Profiles

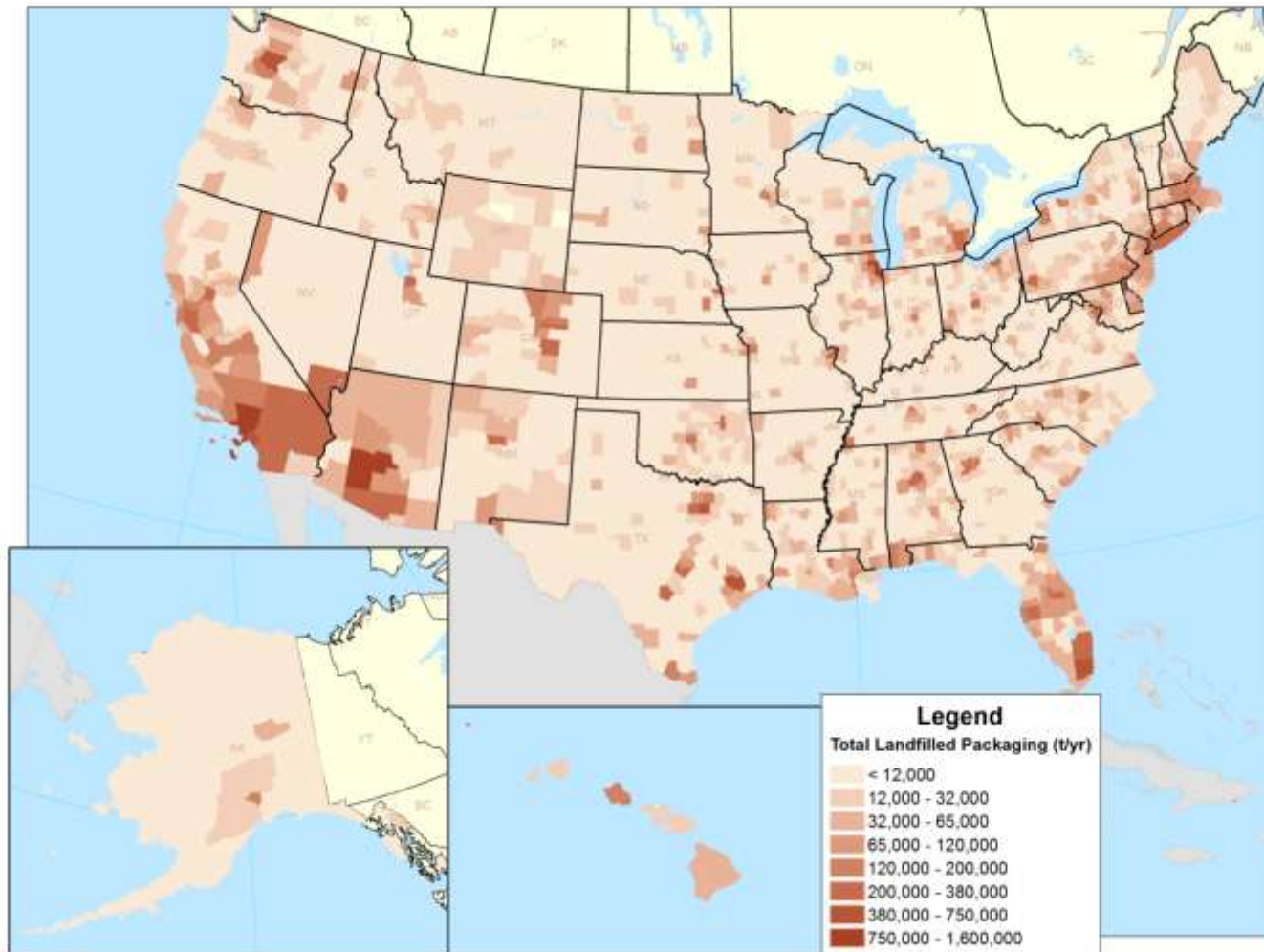


Typical Low
Diversion Profiles

Waste Disposed Per Capita/Per Employee



RESULTS - DATABASE OF LANDFILLED MATERIAL BY COUNTY





APPLICATIONS

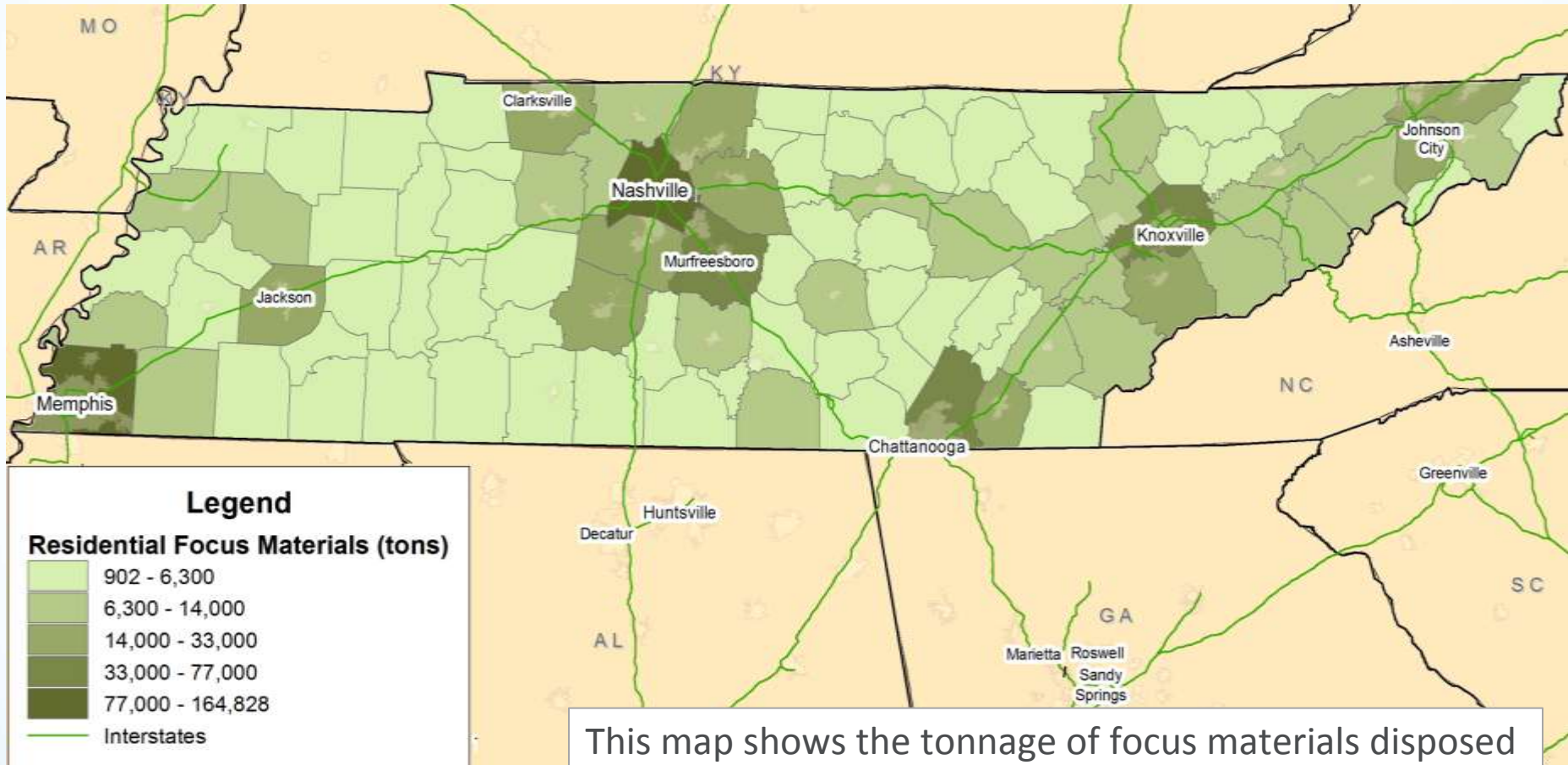


APPLICATIONS

- » Database model applied at local level
- » Fact checked in targeted areas against state and local data sources and known disposed/ recovery volumes



RECYCLING MARKETS DEVELOPMENT



This map shows the tonnage of focus materials disposed county-by-county in the residential waste stream.



VALUE OF POTENTIAL RECYCLING INVESTMENTS

Focus Material	Regional Average (1-year) \$/lb	% of Disposed Waste (state average)	Market Value
Aluminum Cans (Sorted, Baled \$/lb)	\$0.764	0.90%	\$51,482,500
Glass (Mixed)	\$0	4%	\$0
Paper (Soft Mixed Paper)	\$0.043	14%	\$29,743,100
Paper (OCC)	\$0.064	6%	\$24,275,700
Paper (Newsprint)	\$0.029	7%	\$9,861,700
Plastics (PET price)	\$0.273	3.1% (#1 & #2 bottles)	\$61,111,200
Steel Cans (Sorted, Loose Price)	\$0.041	1.70%	\$3,854,600
Total		36.4%	\$180,328,800

Annual residential disposal of 3.3 million tons was converted to pounds. This equals **6.6 billion lbs/year** of residential disposal. The pricing data was calculated using \$/lb averages for 2012. Pricing Data was accessed through *Recycling Data Management Announced Recovered Material Prices*.



OTHER APPLICATIONS

- » Cost curve for recycled vs virgin feedstock
- » Prioritization of pilot areas
- » Opportunities to improve recycling infrastructure and make investments
- » Comparison/backup for self-reported local data



THANK YOU!