Organic Waste Collection

for Renewable Energy Development in Boston, MA

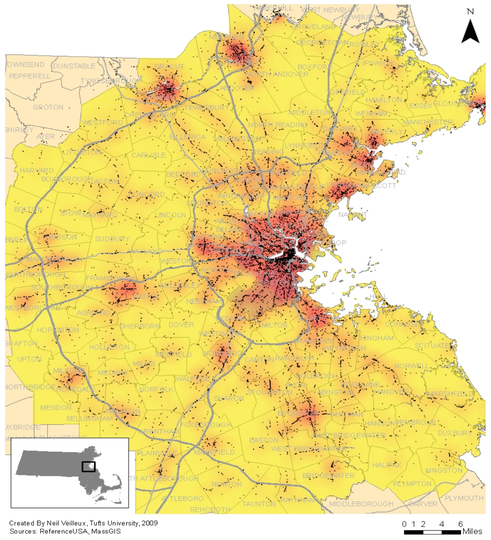

Figure 1: Density of organic waste generators in Boston & surrounding region. Note high concentrations (in red) of generators in Boston, Cambridge, Lawrence & Lowell.

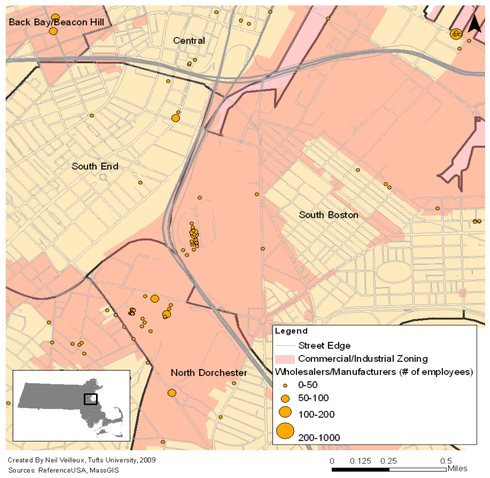

Figure 2: Food Wholesalers and Manufacturers in Newmarket.

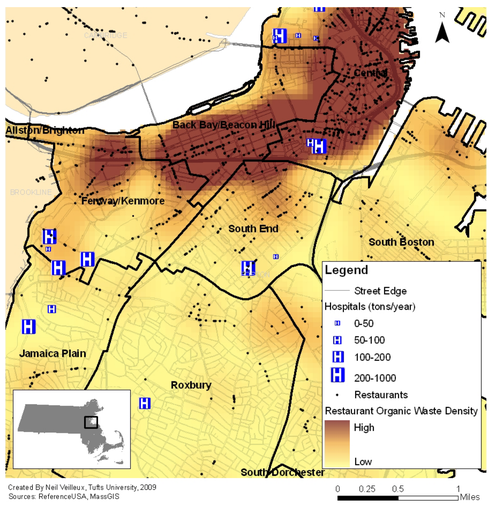

Figure 3: a) Hospital organic waste production & b) density of restaurant organic waste in Boston.

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UEP Urban + Environmental Policy + Planning
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Project Description & Introduction

The City of Boston mayor's office is interested in encouraging development of an urban anaerobic digestion (AD) facility. Anaerobic digesters break down organic waste (i.e. food, cardboard, paper, etc.) and, in the process, sequester methane – a greenhouse gas (GHG) 25 times more potent that carbon dioxide. Methane may then be combusted (and destroyed) to produce "green" electricity. To help meet its renewable energy and GHG reduction goals, the mayor's office would like to locate an AD project in the city.

A necessary step in developing an urban AD facility is analyzing the distribution and size of Boston's organic waste generators, which are needed to provide feedstock (fuel). Waste generators encompass a variety of entities: restaurants, universities, hospitals, food processors, homeowners, landscapers, schools, and so forth. Obviously, some generators produce more (and more consistent) waste than others, and thus, are more valuable as feedstock providers. The goal of this project is to analyze and map generators – looking especially for "hot spots" of large generators in close proximity of one another. Proximity and size are important in order to reduce fuel, logistical, and environmental costs associated with transporting organics.

Methodology

Using a methodology based on a 2002 report by Draper/Lennon consultants for the Massachusetts Department of Environmental Protection, organic waste production was estimated for different industries and categorized by NAICS code. The methodology and analysis are described below.

From ReferenceUSA, organic waste generators within a 30 mile radius of Boston were compiled into a database and sorted by industry. A sample of data collected from ReferenceUSA for correctional facilities are in Table 1.

NAME	CITY	ZIP	BEDS	LAT	LONG
Suffolk Jail	Boston	02114	654	42.36	-71.06
Suffolk Cor. Fac.	Boston	02118	1892	42.33	-71.07
Norfolk Cor. Fac.	Dedham	02026	502	42.24	-71.16

Table 1: Sample of data on correctional facilities collected from ReferenceUSA.

Next, using Draper/Lennon formulas, organic waste production was calculated in tons per year per industry. The formulas estimate waste production based on business size (number of employees, beds, etc.) for each industry; the formulas are detailed in Table 2.

Following these calculations, each industry database was then imported into GIS and individual generators were mapped according to the ReferenceUSA coordinates.

INDUSTRY	WASTE GENERATION FORMULA
Restaurants	# emps x 3000 lbs/emp/yr
Supermarkets	# emps x 3000 lbs/emp/yr
Schools	# students x 0.35 lbs/meal x 405 meals/students/yr
Correctional Fac.	# inmates x l.0 lb/inmate/day x 365 days/yr
Hospitals	# beds x 5.7 meals/bed/day x 0.6 lbs/meal x 365 days/yr
Nursing Homes	# beds x 3.0 meals/bed/day x 0.6 lbs/meal x 365 days/yr
Manufacturers	n/a
Wholesalers	n/a

Table 2: Draper/Lennon formulas for organic waste production, by industry.

While the coordinates were accurate enough at the regional scale (see Figure 1), in a few cases it became evident that they were not detailed enough for neighborhood analysis. For example, a few industrial facilities in Chelsea mapped in the middle of Newmarket. As a result, special attention must be given to ensure generator locations map correctly, especially if any detailed (neighborhood) analysis is performed. In Figure 2, for example, industrial facilities were geo-coded by street address (and then individually verified) to attain a more accurate map.

Analysis and Results

Summary statistics are summarized by industry in Table 3. This analysis focuses mainly on four industries providing large quantities of organic waste: 1) Restaurants, 2) Manufacturers, 3) Wholesalers, and 4) Hospitals.

Figure 1 shows the regional concentrations of organic waste generators. Any large scale AD facility in the region will likely require cooperation from Boston industries and businesses to secure feedstock for successful operation. Additionally, Lowell, Lawrence, and other urban centers near Boston could play important roles due to concentration of generators.

Figure 2 shows the locations and size (# of employees) for food manufacturers and wholesalers in Newmarket, an industrial area with high-volume organic waste generation. Assuming each location in Figure 2 generates the industry average of organic waste, this analysis estimates Newmarket industries could provide 31,000 tons of organic waste per year. This is by itself enough feedstock to support an AD facility. However, because industrial processes vary among food wholesalers and manufacturers, it is difficult to estimate organic waste production for a specific generator from industry-level data. As a result, more detailed analysis is required to ascertain the accuracy of this estimate.

Nonetheless, Newmarket is a particularly attractive area for organic waste collection because the district is zoned for commercial/industrial activity. Residential areas are often problematic for waste haulers, because residents do not want garbage trucks rumbling through their neighborhoods. Additionally, Newmarket could provide a suitable spot close to organic waste production to locate an AD facility.

Figure 3 shows the concentration of organic waste from restaurants in the Back Bay, Beacon Hill, and Central districts. Additionally, it shows the location and size of hospitals in the area. Restaurants in these three districts produce approximately 25,000 tons of organic waste, ranging individually from 1.5 to 525 tons. Alternately, hospitals in this area produce approximately 3,124 tons of organic waste, ranging from 16 to 566 tons per generator. Together, these facilities represent a concentrated and potentially attractive option for feedstock collection, though the zoning in these districts – a mix of commercial and residential – is less than ideal.

INDUSTRY	TOTAL (tons/year)	# LOCS	AVG (tons/loc)
Restaurants	212,660	9,435	23
Manufacturers	177,120	270	656
Supermarkets	62,724	1,257	50
Wholesalers	52,773	359	147
Schools	32,014	1,650	19
Correctional Fac.	19,104	201	95
Hospitals	10,883	80	136
Nursing Homes	6,193	167	37
Total	573,471	13,419	145*

Table 3: Summary statistics for organic waste production, by industry. (*average)

Conclusions and Next Steps

This analysis sketches out options for a pilot collection program. Going forward, planners should consider what waste collection contracts currently bind businesses and the ability of generators to separate organic waste from their garbage. Also, city planners should sample waste generators to gauge the accuracy of formula-based estimates. For more, see the following report on the UEP website: *Wind and Waste: Diversifying Boston's Renewable Energies.*

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