On the Trail of Our Trash

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EVS 300 Smith
Final Project
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Abstract:
The objective of this project is to learn about the solid waste stream at Smith College and about how the Northampton landfill operates. I conducted interviews with Bob Dombkowski, Karen Bouquillon, and David Veleta and had a tour of the Northampton landfill. I learned that Smith produced 960 tons of waste in 2006 (713 lbs/student). Smith garbage is composed of 25% compost and some recyclable materials. The heaviest component of our trash is organic material. Smith garbage is hauled daily to the Northampton Regional Sanitary Landfill by a Smith garbage truck. About four tons of solid waste is hauled weekly costing $300 per week.

Northampton Regional Sanitary Landfill serves 44 communities and is located about five miles away from campus on Glendale Road off Rt. 66. The permitted annual capacity is fifty thousand tons and the current contract ends in 2011 when the existing landfill will be capped. The city is seeking approval for horizontal expansion of the landfill. The Northampton Landfill has contracted a company called Amaresco to purify methane from landfill gas emissions and generate electricity, which could begin as early as August 2007. The old portion of the landfill remains unlined and could potentially release leachate into the groundwater, but was capped so as to minimize the amount of leachate generated.

Smith has both economic and publicity incentives to reduce our solid waste stream. This could be done by eliminating the Grab’n’Go theme in dining halls, decreasing disposal of food waste, and employing a dependable composting program on campus.

Introduction: The State of the Nation

Americans are reputed to be the greatest producers of trash in the global community. In 2005 the U.S. generated nearly 246 million tons of municipal solid waste (Smith, 2006). The national scale of municipal solid waste has tripled since 1960, peaking at 369 million tons in 2002 (Royte 2005). In fact, Americans discard 4.3 pounds of trash daily per person, making us truly the greatest trash producers globally.

On the state scale, Massachusetts generates 8 million tons annually, 15.5% of which is exported out of the state (1.06 million tons) (Repa, 2005). That waste may be going to any of our neighbors’ back yards or as far as South Carolina or west to Ohio. Do you know where your trash goes?
In order to be an environmentally conscious member of this planet one must have an awareness of the consequences of one’s actions. As citizens in a consumer society it is important to know where one’s purchased products come from and where one’s waste goes. As Frey says regarding hazardous waste: “those who create . . . waste and benefit from its production should bear the costs associated with its disposal” (Frey, 2001). Many people are clueless about where their trash actually goes after the garbage can.

Elizabeth Royte is one American citizen who took responsibility for her trash and went on an adventure following her garbage from her kitchen trashcan to the landfill. Smith College is an institution that does in fact profit by catering to student’s convenience in a manner that yields a huge amount of waste. For my final project I use Royte’s example and trace my trash from the dumpster across from my house on campus to it’s ultimate destination. Through this report I would like to challenge other members of the Smith community, students, staff, and faculty alike, to take initiative and learn where their trash goes.

Methods:

My exploration of the waste stream began upon my visit to the municipal waste facility, the Northampton Regional Sanitary Landfill, where I met David Veleta, who is an engineer at the Northampton Department of Public Works, and David Lucey, Landfill Supervisor. I got an extensive tour of the landfill including a brief history and an explanation of the engineering of a landfill and how it operates. It is a much more complex system than I realized!
I conducted several interviews with individuals both at Smith College and City of Northampton Department of Public Works. I talked with Karen Bouquillon, Solid Waste Management Supervisor, as well as Bob Dombkowski, Grounds Supervisor at Smith College. I talked with Ms. Bouquillon on the phone and with Mr. Dombkowski in person.

This project also involved a research component. In choosing a paper topic, I visited the Environmental Science Resource Room to explore past year’s seminar papers. A few of these papers were relevant to aspects of my topic (Wraight 2003 and Torres-Leon 2005). I also visited David Veleta at his office to pick up some documents regarding the landfill. Finally, I conducted research of city and EPA documents online.

Results:

Smith Trash:

Although Smithies witness the garbage truck emptying dumpsters on a daily basis, the great majority of the Smith College community it unaware of where our trash goes. Our trash is in fact picked up daily all over campus by one garbage truck driven by Chester Saltis and delivered to Northampton Regional Sanitary Landfill, located roughly five miles from campus.

In my interview with Bob Dombkowski, I learned that Smith produced 959 tons of solid waste in 2006 alone. This figure works out to about 713 pounds of trash per student. Between three and four tons of solid waste are hauled weekly at a cost of $300 per week.

Furthermore, in 2006, 301 tons of recyclable material or 223 pounds per student were produced on campus. Domkowski says that there is not much paper in the waste
stream and what is there is contaminated. He thinks that the amount of recyclable waste in the waste stream has decreased significantly as the recycling program on campus has improved over the past few years. Several years ago when the recyclable content was higher the amount of annual waste was exceeding 1,000 tons per year, Domkowski says.

The heaviest component of our trash is food waste. Since the consolidation of dining halls, Dombkowski claims that the amount of food waste has increased. When asked his opinion on the pilot composting program, Domkowski had negative feedback. He doesn’t believe that a composting program at Smith will be successful unless it is integrated with the solid waste system on campus. He thinks the current system of having a truck from off campus haul compost far away (to Hatfield) is inefficient. He envisions a system where pulpers are installed in the dining halls that chop the compost into a pulp and stored in bags. Those bags could then be hauled to Fort Hill by our garbage truck. Brush, or organic material from outdoor work, is currently hauled to Fort Hill and added to the compost pile.

In her report “Wasting Away,” Karen Wraight determined the composition of trash on campus in 2003 (Figure 1).

![Figure 1: Composition of Smith Trash](image-url)
From this pie chart you can see that organic matter (25%) is the next greatest component after general trash (35%) and that paper comes next (14%). Thus, composting would contribute considerably to decreasing our food waste.

Surely the transition to consolidated dining hasn’t decreased our trash production from dining halls. The number of students expected for each meal is less predictable, so the dining hall has to produce more food. This is a less efficient system since it produces more food waste.

Furthermore, the new Grab’n’Go themed dining halls, are producing more waste than ever. In a 2005 seminar project, Torres-Leon and Turki-Judeh compared the amount of waste produced in two Grab’n’Go dining halls (Chapin and Hubbard) versus two traditional dining halls (Tyler and Cushing). The results indicate that Grab’n’Go dining halls produce more waste than traditional dining halls, but the difference between Hubbard, Tyler, and Cushing is very small (Figure 2). Chapin has very high traffic at lunch due to its location in the center of campus, and thus produces dramatically more waste than the other three dining areas.

The greatest contribution to trash volume in Grab’n’Go dining halls is from water bottles, plastic food packaging containers, and paper bags. This is another area where the amount of waste generated on campus could be decreased.
The Landfill:

Northampton Regional Sanitary Landfill serves forty-four communities, reaching the northern Massachusetts border, east to New Salem, west to Worthington, and south to Southampton (Appendix 1) (Draft Environmental Impact Report). The town landfill is located on 170 Glendale Road in Florence, MA off Rt. 66 (Appendix 2). This landfill is a fifty-two acre site including twenty-one acres of the original unlined landfill that began accepting waste in 1969 before environmental legislation required lining. The old portion was closed in 1990 and capped in 1995. The four lined cells (Phases 1-4) lie east of the old, unlined landfill. The new, lined Phase 3 was opened for dumping waste in 1990 (Appendix 3).

I was quite fascinated by the amount of engineering that goes into containing the waste and extracting the hazardous materials (leachate and gases) in a controlled manner. Underlying the waste is a layer of sand, two flexible, 60 mm, plastic membrane layers with a leak detection zone in between and at the very bottom is a layer of compacted clay (Appendix 4). Within this layer is a leachate collection system that collects all of the liquid which leaches from solid waste, called “leachate,” through a system of pipes that drain into a centralized reservoir (Appendix 5). Liquid from the leachate is pumped to wastewater treatment facilities and the residual sludge is incinerated elsewhere.

When a phase of the landfill has reached the desired elevation, it is capped with a layer of soil, a gas venting layer composed of crushed glass or sand, a 40 mm flexible plastic liner, a foot of sand, a layer of top soil, and finally is planted with grass seed (Appendix 6). The gas is vented through gas wells that feed into a system of pipes and is burned off through a flare (Appendix 7).
The landfill is bordered by residential neighborhoods to the south and west (Draft Environmental Impact Report). A former gravel pit lies to the north and forested wetland lies east of the landfill. The land to the north was purchased by the City of Northampton as conservation land and as a buffer zone.

At first I cringed when I saw the close proximity of the neighborhood to the landfill edges. However, Mr. Veleta was sure to point out the ten-foot-tall plastic mesh barrier that borders the perimeter of the open phase in order to prevent the wind from carrying trash off site. At the end of each day, the workers cover up the open site, with a heavy rubber barrier or with a layer of loam. There are also gas and water monitoring stations around the entire perimeter of the landfill that sample the air and groundwater to ensure that leachate isn’t leaching into the groundwater and that gas pipes aren’t leaking (Appendix 8).

The old portion remains unlined and doesn’t have a contained system for extracting leachate. It is likely that the leachate entered the groundwater prior to capping. The landfill property is included in the watershed that supplies the backup drinking water well for Easthampton (aka the Maloney Well). This well isn’t being used since it has a high concentration of iron and manganese, which aren’t harmful, but make the water unpleasant to use (staining and smelly). The monitoring wells indicate that there has been very little seepage from the landfill over the past ten years.

I was also impressed at the resourcefulness of the operation. Veleta showed me how they are using brick debris from the old State Hospital to build temporary roads on the side of the open site. This rubble will later be smoothed over when that phase is
capped. Also, on the northern border of the landfill, there is a pile of crushed glass that is used as the gas-venting layer, below the top liner, when the landfill is capped.

This landfill serves strictly for concealing waste; incineration does not take place at this site (Bouquillon). The facilities are permitted to accept fifty thousand tons annually and they try to accept as near to this limit as possible in order to maximize profit. The permitted capacity will end in the year 2011 when that portion of the landfill will be capped. The city is currently seeking approval for horizontal expansion of the landfill. The new contract would expire in 2025.

None of our trash is exported to other states. My guess is that the 1.06 million tons that are exported from Massachusetts annually (Repa, 2005) come from the eastern portion of the state, where the population density is much higher and there is less land available for disposing of waste.

**Methane Emissions:**

Methane constitutes about half of gaseous landfill emissions, which is of concern since methane is known to be a greenhouse gas. Landfills are the primary source of American methane emissions (Figure 3).
There are three stages of solid waste decomposition in a capped landfill: the aerobic stage, the anaerobic acid phase, and the anaerobic stage (Baird 2005). In the first stage, organic material is oxidized in the presence of oxygen to form carbon dioxide, water and heat. In the anaerobic acid stage, acidic fermentation produces ammonia, hydrogen gas, and carbon dioxide in the absence of oxygen, creating a very acidic environment. Finally, in the last stage beginning half a year to a year after the landfill was capped, anaerobic bacteria degrade organic acids and hydrogen generating carbon dioxide and methane.

Gas emissions are currently collected via a system of pipes and burned in a flare at the Northampton landfill since gas accumulation is a fire safety hazard. Efforts are underway to utilize methane emissions as a means of generating energy in the near future. A company called Ameresco has been contracted to purify and generate electricity from methane emissions. The station is already installed at the landfill (Appendix 9). Ameresco will soon submit an Operations and Maintenance report to the DEP that needs approval before the facilities can operate. At the earliest, the landfill will be generating electricity that will contribute to the power grid by August of 2007.

After the landfill is capped, the rate of decomposition tends to decrease and so methane emissions decrease over time. For this reason, the city is contemplating accelerating the rate of decomposition (called biostabilization) by adding sewage. This would have the effect of increasing the methane emissions as well as the potential to produce electricity.
Discussion:

The new portion of Northampton Landfill is for the most part an environmentally friendly operation and is seeking to be even more efficient by installing the methane power generation system. However, the old section made me a little weary. Leachate is formed mostly from rainwater seeping into the landfill and leaching out of the bottom with dissolved water-soluble contaminants. Therefore, when the old landfill was capped in 1995, making it impervious to water, the amount of leachate produced decreased substantially.

Even if leachate is now minimal, it is likely that the soil remains contaminated with some undesirable substances. Especially considering the limited regulations pertaining to disposal of solid waste when the old landfill was first opened in 1969, it is probable that there were some hazardous chemicals such as battery acid, heavy metals, and organochlorines leaching from the landfill and contaminating the soil.

Clearly it is not feasible to dig up the old landfill, remediate the soil, and install a liner or I’m sure this would have been done already. Capping the landfill decreased leachate production and gas wells were installed to collect the gas emissions. There are a few options that can be taken to filter the groundwater and remediate the soil in situ.

One option of groundwater decontamination involves installing a vertical, permeable wall “downstream” of the chemical source (Baird 2005). The wall is composed of a sand bed with iron filings that act as a reducing agent and degrade some chlorine-containing compounds (Baird 2005). Although this method would have ideally been employed when the landfill became active, it could still be effective in degrading
any leachate that is currently produced. Lateral cut off walls could also serve to prevent the lateral spread of contaminants (Baird 2005).

The soil underlying the landfill could also be remediated so that groundwater isn’t contaminated with harmful chemicals that leached into the soil in the past. The most appropriate in situ method of soil remediation for this situation is soil washing. This method involves injecting liquids (water, oxidizing agents, or chelating agents to remove metals) into the subsurface soil and collecting liquids with contaminants in another well (Baird 2005). Bioremediation is another option of remediating the soil that involves introducing or stimulating microorganisms that are capable of degrading contaminants (Baird 2005).

Learning about our solid waste stream could be incorporated into academics at Smith College in several manners. A tour of the landfill could be included in the EVS 300 seminar. I think that this is a more tangible illustration of what becomes of our waste than the wastewater and sewage treatment plants. It would also be neat to have a landfill tour be part of Katya Erlij’s orientation program for incoming students. Furthermore, we have a blossoming engineering program here that could be introduced to the landfill, since there is much engineering that goes into planning the continuation of the landfill as well as improving the containment of the old phase.

Although it is more difficult to have control or influence on where your waste goes as a member of an institution like Smith, an institutional system is a great opportunity to change the American plague of excessive waste on a larger scale than the individual. Smith has improved recycling efforts substantially over the past few years, however there is plenty of room for reduction of our waste stream.
A spreadsheet that Roger Guzowski, Five College Recycling Coordinator compiled comparing Hampshire, Amherst, Mount Holyoke and Smith indicates that Smith is by far the greatest producer of trash among the four colleges. Hampshire produced the least solid waste in 2006. This is expected with their exceptional composting system. Compost collection is centralized in one dining hall and they dump it on campus so that it can be utilized for the farm. Mount Holyoke also has a composting program with the same company contracted as has been hauling compost from Cutter-Ziskind and Chase-Duckett dining halls at Smith. I was requested not to include specific statistics for the other colleges as a comparison with the scale of Smith waste production.

I think that the fact that staff is unable to release statistical figures on our waste production in relation to other colleges is in itself a powerful statement about Smith. While the college is projecting a facade of sustainability, we are not in fact living up to this image, but most importantly we can’t even admit that we produce more solid waste than other colleges of comparable size in the immediate area. In my opinion, it is more effective to acknowledge our shortcomings and commit to new standards in the public sphere than to silence the facts.

Smith College has multiple incentives to reduce our solid waste stream. First and foremost is our highly cherished reputation and the burgeoning image of the college as a sustainable institution. Positive publicity is a strong motivator for the institution and being able to tout a small ecological footprint would certainly work wonders for recruitment of prospective students and courting their parents. Furthermore, there are economic incentives to decrease trash generation on campus. It is expensive to dispose of trash and producing less trash could potentially save money.
The amount of waste that we produce could undoubtedly be improved by discouraging to-go dining and converting the Grab’n’Go themed dining halls back to traditional dining style with dinnerware and silverware. Dining Services is making an avid attempt to better predict the number of students attending each meal and decrease the food waste in this manner. However, this is a difficult task and avoiding dining hall consolidation in the future would probably be the best option to preventing an increase in the scale of food disposal.

The Smith waste stream could also be decreased by the installation of a campus-wide composting system at Smith. This is complicated by lack of space on campus and the reluctance of the administration to commit the budget that will be necessary to haul it. However, Dombkowski’s suggestion of hauling compost with the Smith trash truck is one to consider if the dumping site were located near campus (such as Fort Hill).

The suggestions of this report require that the administration, dining services, physical plant, and the recycling program work together to think creatively and provide the infrastructure for an improved waste system. This requires willingness and infrastructure for the administration, staff, and student body to network, which I believe we are still sorely lacking. Numerous times during my career at Smith working toward more sustainable options, I have drawn up a flow chart illustrating the relation of these components in the Smith network and attempted to determine the missing connections. I even submitted such a flow chart to the Sustainability Committee once to see if they could develop it. However, it is very difficult to decide what crucial networking connections are missing.
I think that these changes could be best reinforced by student organizations such as Gaia that focus on issues specifically on campus. They also require commitment by the student body to reduce the amount of waste produced per student.

In an attempt to encourage different parties at Smith to collaborate on this issue, I will email this report to the Sustainability Committee, Kathy Zieja from Dining Services, Roger Guzowski from the Recycling Program, and Bob Dombkowski from Physical Plant as well as Rebecca Staples-Moore who will be returning next year to continue leadership of Gaia.

Possessing awareness of the source of one’s products and the ultimate destination of one’s waste are important aspects of developing a sense of place and being aware of one’s environmental impact. I think that it is crucial that every citizen of the local and global community is aware of how much trash they produce and its final destination.
References:


Interview with Bob Dombkowski. 4/27/07.

Interview and tour of Northampton Regional Sanitary Landfill with David Veleta, Northampton Department of Public Works. 4/4/07.

Interview with Jim Laurila, City Engineer, Dept Public Works.

Interview with Karen Bouquillon, Solid Waste Management Supervisor for Northampton.


Appendix 1: Regions that dump at Northampton Landfill
Appendix 2: Local Map of Landfill Location

Appendix 3: Picture of Phase 3 (active section of landfill)
Appendix 4: Detail of Bottom Liner of Landfill

- 2% MIN. SLOPE
- 12" OF 1X10⁻² CM/S SAND + 6" OF 1X10⁻³ SAND
  OR
  GEONET + 18" OF 1X10⁻³ CM/S SAND
- 12" OF 1X10⁻³ CM/S SAND
  OR
  GEONET
  (LEAK DETECTION ZONE)
- 24" OF CCL OR 12" OF CCL + GCL

NOTES:
CCL: COMPACTED CLAY LINER: LOW PERMEABILITY SOIL OR ADJUNCT LAYER; MAXIMUM IN-PLACE SATURATED HYDRAULIC CONDUCTIVITY OF 1X10⁻⁷ CM/S.
FML: FLEXIBLE MEMBRANE LINER.
GEO-NET: SYNTHETIC DRAINAGE MATERIAL.
GCL: GEOSYNTHETIC CLAY LINER.
SAND: DRAINAGE/PROTECTION MATERIAL; MINIMUM IN-PLACE HYDRAULIC CONDUCTIVITY AS NOTED.

NORTHAMPTON SANITARY LANDFILL
PHASE 5 EXPANSION-DEIR
FIGURE 2-1
LINER DETAIL
NEW LANDFILL AREAS

DH
Norhampton, Massachusetts
Tel: (413) 581-0716
www.dufresne-henry.com

Project No. 9240015
Proj. Mgr. JRL
Scale NONE
Date 9/05
Appendix 5: Leachate Collection System
Appendix 6: Detail of Top Liner of Landfill
Appendix 7: Gas Collection System Map
Appendix 8: Picture of Monitoring Station

Appendix 9: Picture of Amaresco Methane Processing Plant