Assessing Scope 3 Emissions Within a University Department: Using a Life Cycle Assessment and Supply Chain Case Studies

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Climate Change and the University of Richmond, Spring 2014

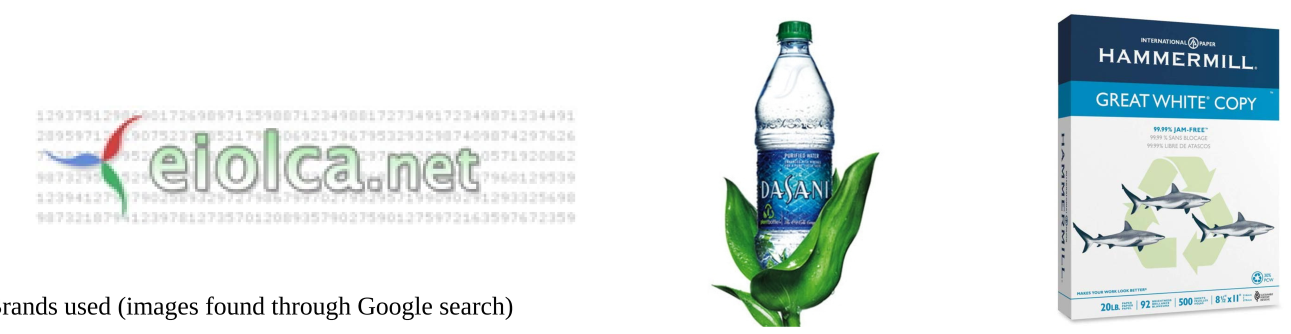
Introduction

In a society built on consumerism, companies across all industries are constantly analyzing how to increase consumption of a good or service. The drive to consume has exacerbated anthropogenic climate change impacts through increased production and consumption. (EIA, 2014) The average consumer does not think about hidden costs associated with the goods he or she comes in contact with each day, such as materials extraction, transportation, and disposal. As the data on climate change impacts improves, producers and consumers alike are paying more attention to the methods of production and the life cycle costs of a product. This project seeks to make a contribution by quantifying the environmental impacts associated with University procurement.

The University of Richmond's Climate Action Plan (CAP) outlines a strategy to reach carbon neutrality by 2050. The CAP includes the University's greenhouse gas (GHG) inventory, which includes the breakdown of emissions by activity. The inventory only includes Scope 1 and 2 emissions, which are those emissions the University is responsible for through the campus fleet, buildings, purchased electricity, steam, and heating and cooling. Scope 3 emissions, those which the University is indirectly responsible for, are caused from travel, investments, and the production and disposal of goods (GHG Protocol, 2012). While UR's GHG inventory excludes Scope 3 emissions, we believe procurement strategies should not be overlooked as a means for the University to reduce its impacts to climate change. This project features a two-part analysis, a life cycle assessment and two supply chain case studies, that highlight opportunities for the University to reduce consumption and minimize emissions. The life cycle assessment uses the Economic Input Output Life Cycle Assessment tool from the Carnegie Mellon University Green Design Institute to analyze UR's Department of Geography and the Environment. The supply chain case studies analyze the life cycle costs of two specific products, bottled water and paper, using a literature review and graphics to recognize the global dimensions of local consumption on UR's campus.

Objectives

The purpose of this project is to identify opportunities to reduce Scope 3 emissions associated with University operations. While the scope of this report is limited, analysis of the department case study and the two selected products suggest the University should conduct a larger, more comprehensive supply chain assessment in the future to identify methods for emissions and cost reductions from altered purchasing practices. By sharing the information from this report, we hope to encourage the University to pursue more sustainable consumption practices.



Brands used (images found through Google search)

Methods

As a two part project, we pursued separate methodologies for each section. For the life cycle assessment, we selected the Economic Input-Output Life Cycle Assessment (EIO-LCA) tool based on two factors. First, the tool has proven successful in many other case studies (Stanforth, 2013). Second, the tool is the most comprehensive, free tool available for life cycle assessments. The EIO-LCA tool has been used for student and research projects in other institutions (Green Design Institute, 2008). The tool is available online at www.eiolca.net. While the EIO-LCA tool was the best option for the purpose of our research, the method is not without limitations, which are addressed separately and specifically to the right.

Given the allotted time and resources for our project, we chose to analyze the purchasing data for one department from the three most recent years, 2011-2013. We selected the Department of Geography and the Environment because it is the home department of our major with a manageable volume of data due the department's relatively small size. The EIO-LCA tool requires extensive purchasing data and analyzes emissions from 17 categories, including: chemicals, classroom supplies, computer and telephone software and licensing, computers and electronics, construction, food services, furniture/fixtures/minor equipment, grounds, maintenance and repairs, office supplies, paper, postage and shipping and receiving, printing services, professional services, real estate, travel and water. Once we received the purchasing data, we developed a legend of relevant account codes that corresponds with the 17 categories evaluated in the EIO-LCA tool. Some of the categories in the tool are not part of the department's budget and were therefore excluded from the assessment. These categories are: real estate, grounds, computer software and licensing, computers and electronics, furniture/fixtures, construction, maintenance and repairs, and professional services. We entered the data into Excel, adjusted the prices for inflation according to the US Inflation Calculator (Coin News, 2014), and plugged our information into the EIO-LCA tool (Fig. 3). Using the results of the tool, we developed Figures 1 and 2.

Figures

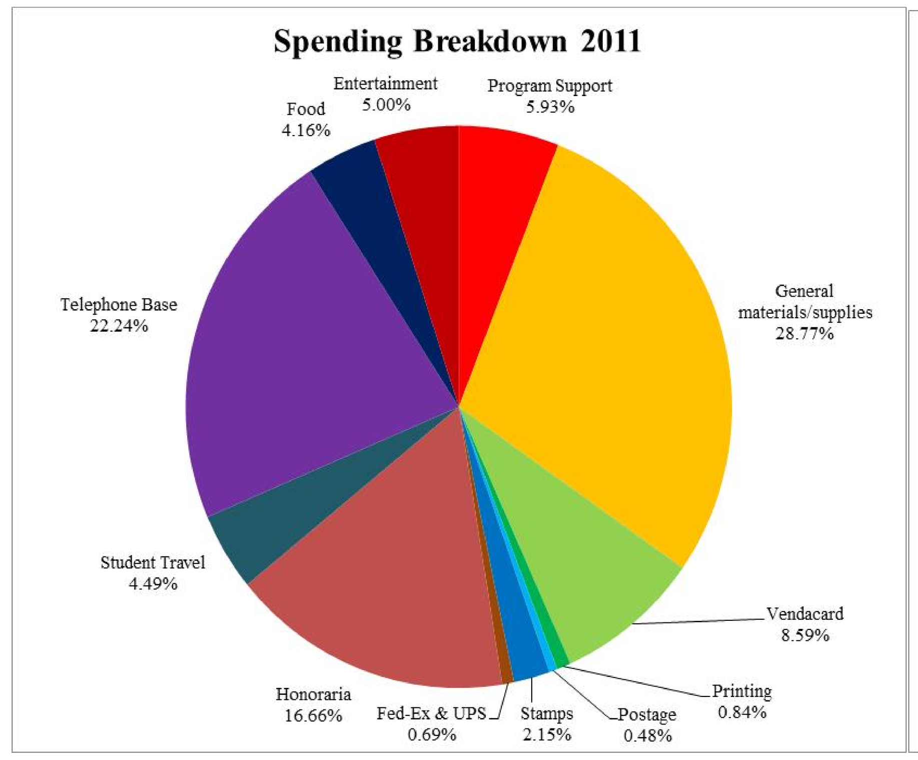


Figure 1a

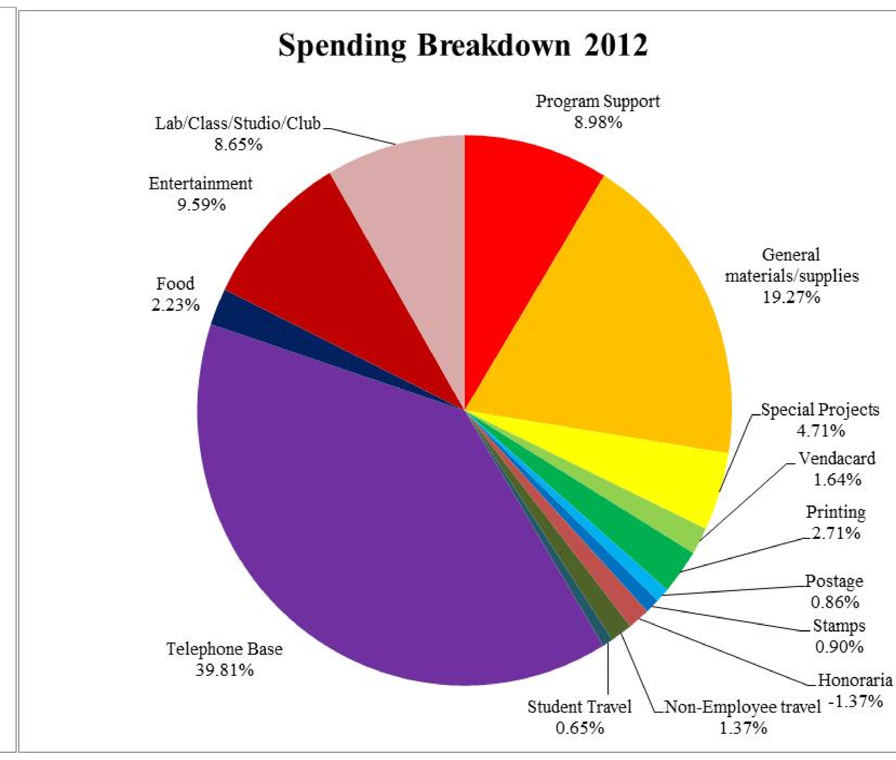


Figure 1b

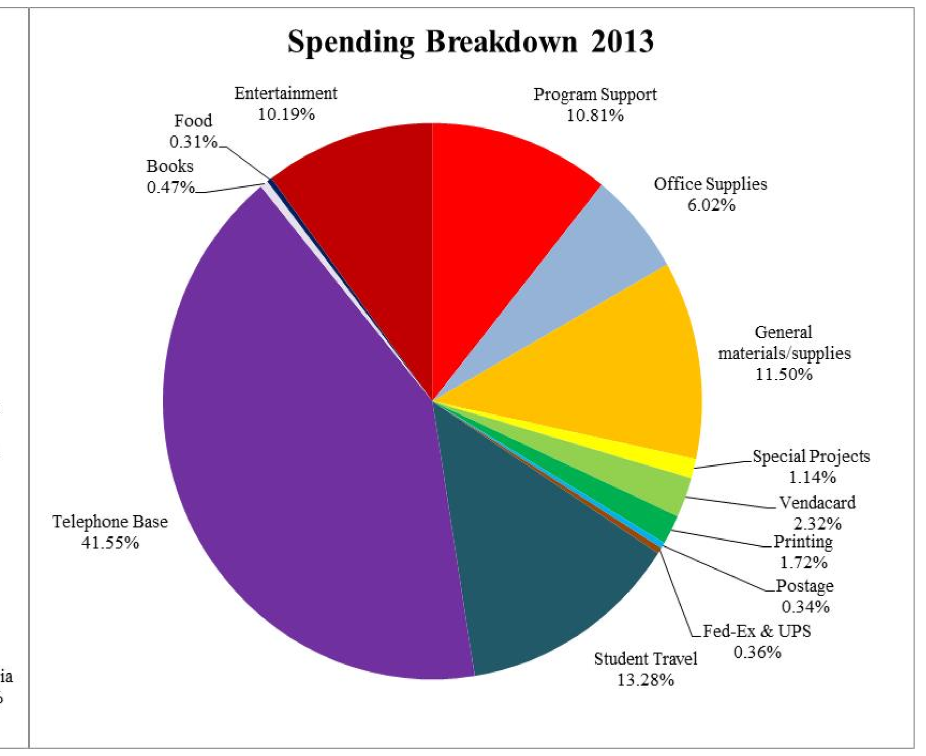


Figure 1c

Figures 1a,b,c: These figures show the breakdown of spending per category for each individual calendar year, 2011-2013.

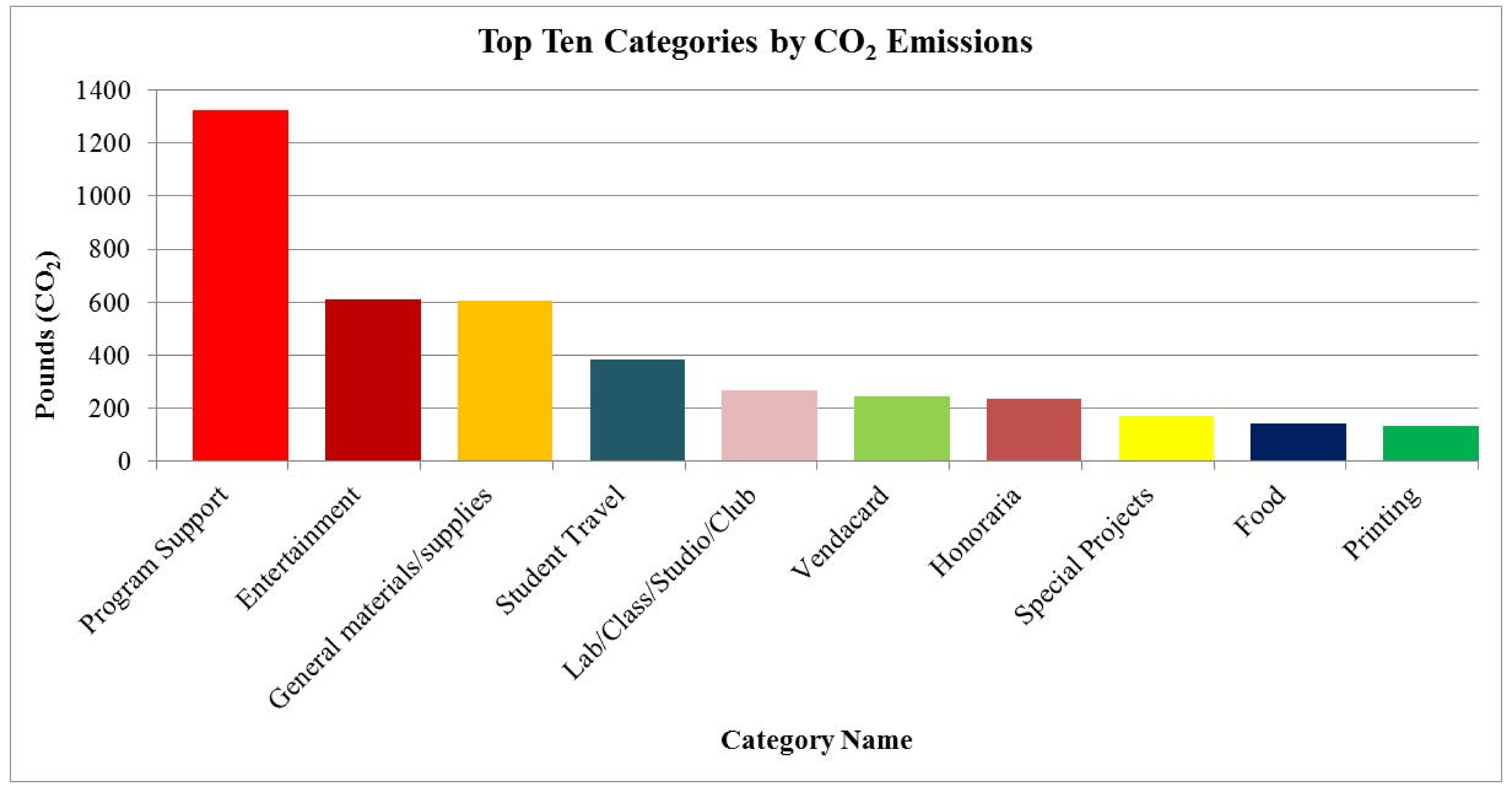


Figure 2: The top ten categories associated with the highest CO_2 emissions. Telephone base is eliminated from this graph based on that the department does not have control over this category.

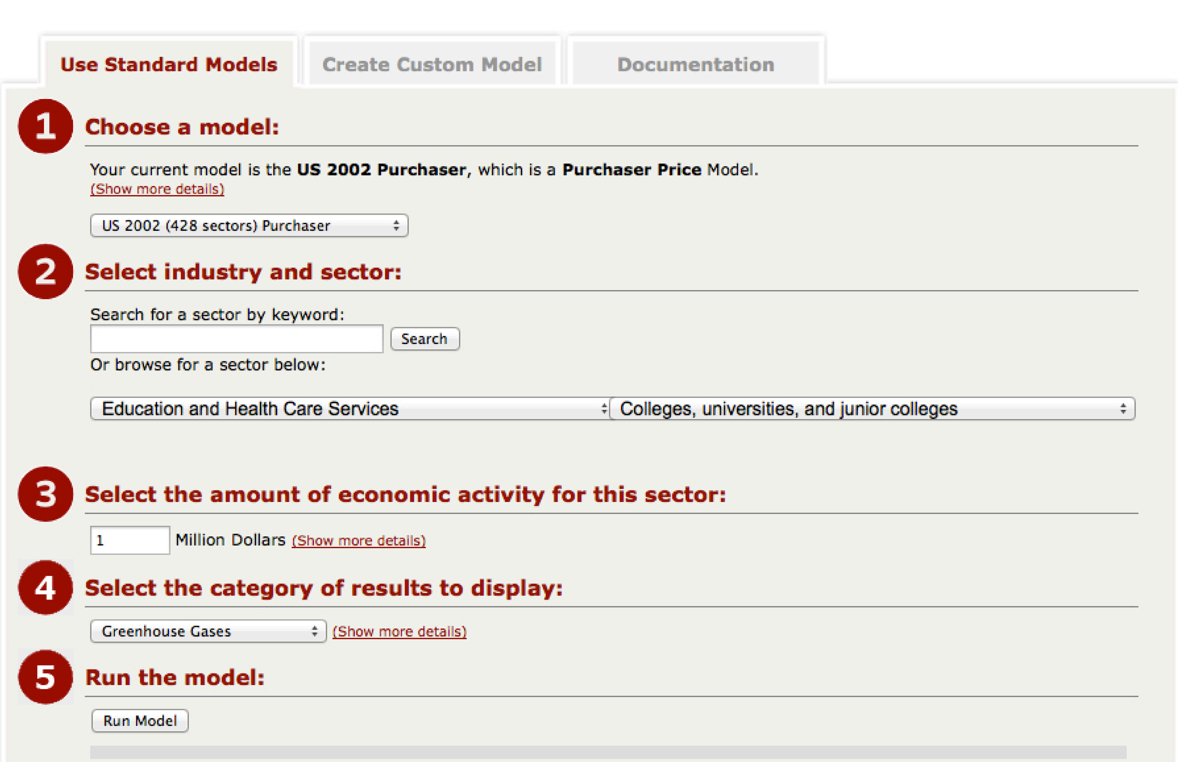


Figure 3: A screenshot of the EIO-LCA tool used to generate the emissions data.

Total Emissions Equivalences

The emissions equivalences shown below reflect additional ways to understand the total amount of CO_2 associated with all categories within the Department of Geography and the Environment.

2,245 pounds of waste sent to landfill

6,693 pounds of carbon sequestered; equal to 2.6 acres of US forests in one year

354 gallons of gasoline consumed

From: EPA's equivalency calculator

Limitations

The EIO-LCA method successfully generates the sector's emissions based on financial data, but there are inherent limitations with the tool. As with any model, there are assumptions and uncertainties with the data used to create the tool. The EIO-LCA model is linear and aggregates the US production facilities into 500 sectors (Green Design Institute, 2002). The main limitation of the instrument for our project has been that the results from the tool suggest that decreasing spending is the only means to reduce emissions associated with the life cycle of products. The model cannot take into account an item purchased locally or a product made from recycled materials, for example. For this reason, the emissions results from the tool are more representative of a baseline for understanding and decision-making. While selecting a more sustainable product option might not quantitatively bring down emissions levels based on the EIO-LCA, the results offer insight into the purchasing habits of the entity analyzed, in this case the Department of Geography and the Environment. The results make it easy to recognize areas where spending is significantly higher than the average sector, which offers a meaningful starting point for recommendations in changing purchasing habits. At the university scale, departments with high spending could be flagged and observed more comprehensively to see how investing in sustainable products could bring down costs as well as emissions. At the department scale, account codes associated with high spending stand out as opportunities for savings and CO_2 reduction.

Supply Chain Case Studies

The specific supply chain case studies were chosen to supplement the results of the life cycle assessment. The case studies are based on a literature review of information pertaining to each product: Hammermill paper and Coca-Cola's Dasani *PlantBottles*.

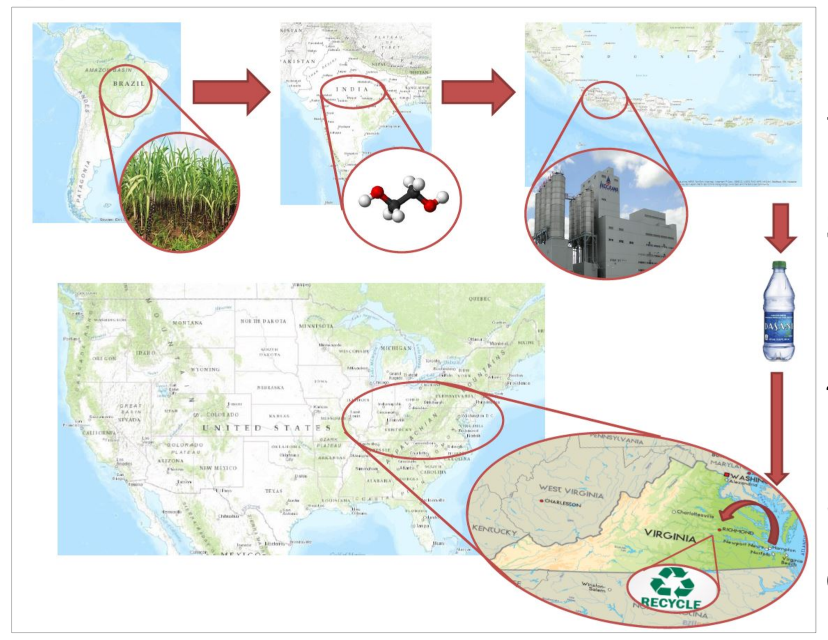


Figure 4: Infographic of supply chain for Coca-Cola's *PlantBottle* water bottle. The *PlantBottle* is currently made from 30% sugar-based MEG (monoethylene glycol) and 70% PTA (purified terephthalic acid) by weight. Images found using Google search.

1. The **sugar cane** grows in Araraquara, Sao Paulo, Brazil. (Guzman, 2012)
2. Ethanol is transported over to India Glycols Ltd., India. Here the sugar cane is converted into **Bio-MEG**. (Guzman, 2012)
3. This chemical is transferred to **Indorama Ventures** in Indonesia, where it is combined with petroleum-based PTA to create plastic water bottles. (Guzman, 2012)
4. These bottles are then shipped to **Norfolk, Virginia** to be filled with filtered tap water. (Pete, 2014)
5. Coca-Cola Bottling Company, Norfolk sends the bottles to **Sandston, VA.** (Pete, 2014)
6. Truck delivers the bottles to the University of Richmond. (Pete, 2014)
7. These 100% recyclable bottles are transported over to the Virginia Waste Services located in **Chester, VA.**

The University purchases Hammermill brand paper, which is owned by International Paper Company. The supply chain is shown in Fig. 5.

- Paper makes up 27% of municipal solid waste, more than any other material discarded by US citizens (EPA, 2012).
- Recycled content paper is made in mills that use recovered papers to make recovered fibers and remove contaminants (EPA, 2012).
- Paper originates from pulp (a mixture of cellulose fibers & water) processed in the **mills**, seen in Fig. 5.
- From the mills, the product is sent to a **conversion facility** or **warehouse** depending on the desired final product.
- The final product is sent to **distribution** facilities before reaching the **consumer** (UR).
- Post-consumption, the material travels to the Virginia Waste Services **disposal site** in Chester, VA.

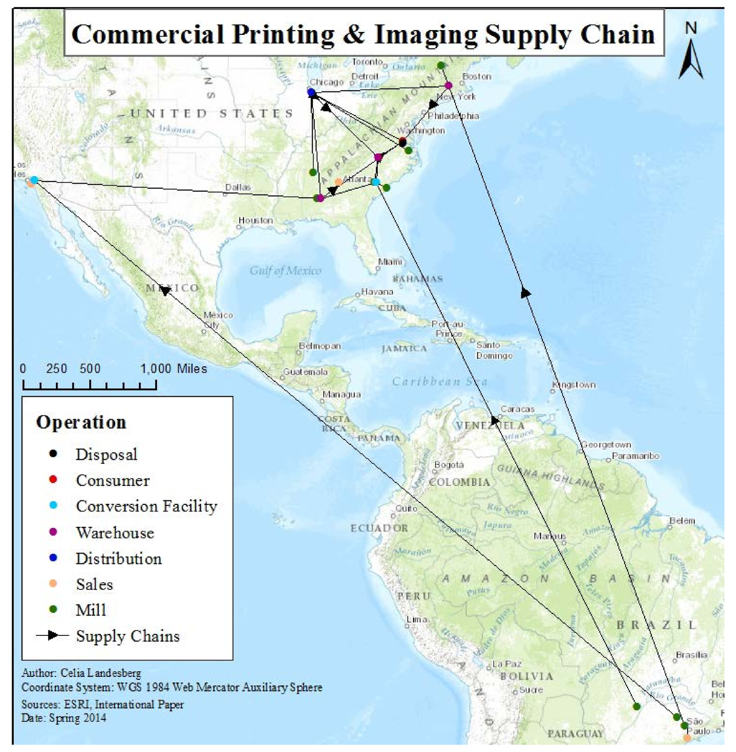


Figure 5: Map of operations and supply chain route for International Paper's Commercial Printing & Imaging business.

Recommendations

- Comprehensive University-wide (all departments and offices) assessment of greenhouse gas (GHG) inventory that includes Scope 3 emissions (indirect)
- The assessment would recognize opportunities to increase purchasing efficiency and decrease total campus GHG emissions
- Database of sustainable purchasing options that takes into account cost and sourcing location to support smarter consumer decisions

Acknowledgements

Thank you to those parties that contributed to our project and provided us with information to make this research possible.

Erin Stanforth, Portland Community College; Nancy Propst, UR Dept. of Geography and the Environment; Megan Zanella-Litke, UR Office for Sustainability; Andrew Pericak, UR Spatial Analysis Lab; Pete, the Coca-Cola delivery man.

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