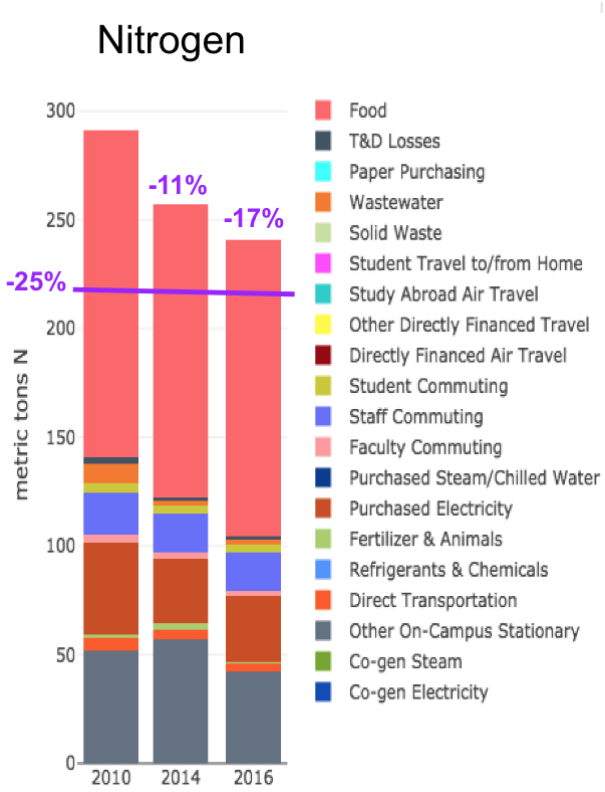
The University of Virginia Institutional Nitrogen Footprint Project

Rachel McGill, Alicia Zheng, Elizabeth Dukes, Andrew Pettit

The University of Virginia has a Board of Visitors approved sustainability goal to reduce reactive nitrogen emissions by 25% below 2010 baseline levels by the year 2025. UVA's Institutional Nitrogen Footprint Project works towards this goal through the following objectives:

1) Track UVA's nitrogen footprint over time and calculate projected emissions to 2025
2) Collaborate with stakeholders to develop reduction scenarios to reach the 25% goal by 2025
3) Publish a Nitrogen Action Plan to outline how UVA will reach this goal and ensure its success



Our team has successfully calculated nitrogen footprints for 2010, 2014, and 2016 thus far (figure on the right). Current reductions are observed to be 17%, driven by transitions from coal and oil to natural gas as energy sources, decreased meat purchasing, and the City of Charlottesville's adoption of tertiary water treatment. By working with stakeholders including UVA Dining, the UVA Health System Dining, and Facilities Management, our team has developed over 30 reduction scenarios related to energy and food that will allow UVA to reach 25% nitrogen emission reductions by 2025. These scenarios have been integrated into a Nitrogen Action Plan that was published in April 2019.

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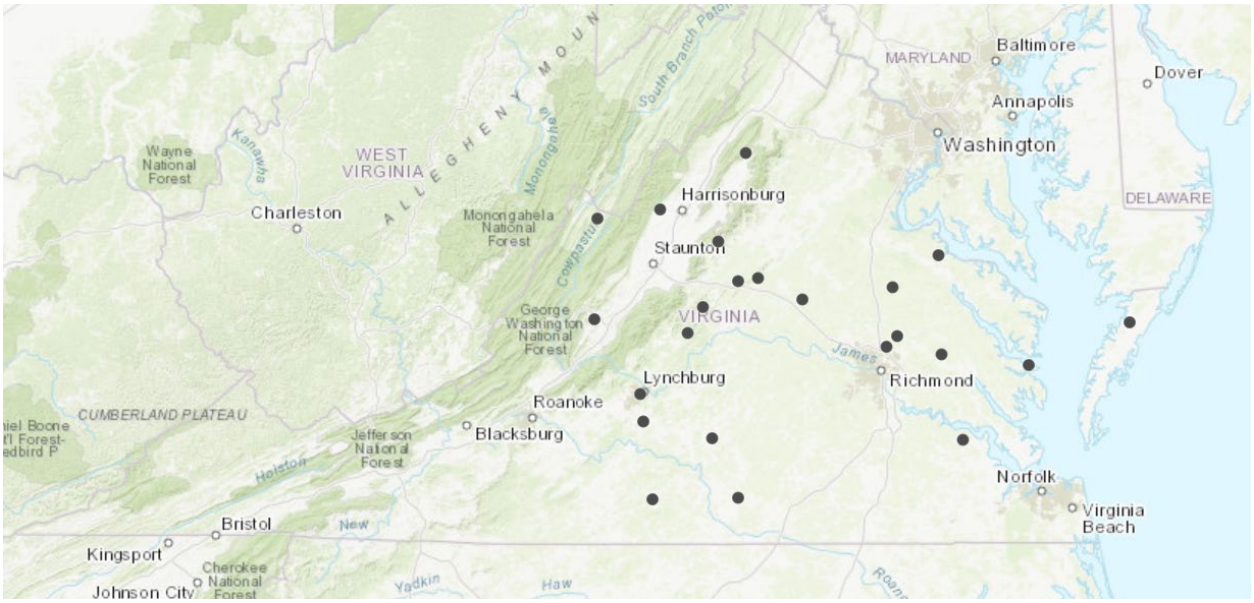
The Local Food Project

Amelia Lindsay and Elizabeth Dukes

The Local Food Project is a research endeavor started by UVA graduate Gabi Freckmann, with a focus on local food within UVA Dining. In the beginning of the project, Gabi spent a lot of time gathering information on where UVA buys its local food. She researched which foods we buy locally, which farms they come from, and used the data she found put together an interactive map to show students what she found. This map features farms throughout Virginia that provide local food to our very own dining halls. Currently, the Local Food Project is led by second-year Amelia Lindsey. Her focus for the project is to track non-local food purchases by UVA dining and use this research to see how much farther food travels when it isn't bought locally. For more information on the Local Food Project and how to eat locally as a student, you can visit the Local Food Project website which is in development!

This is the interactive Local Food Map. It shows the farms from which UVA sources local produce, meat, honey, and jam for its dining halls. Many of the farms have websites linked, which outline their agricultural practices and backgrounds.



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The Food Labeling Project

Christine DeRieux, Archana Shekharan, Hannah Piester, Elizabeth Dukes

The Food Labeling Research Team studies how labeling and marketing campaigns can effectively shift individual preferences, lowering both individual and institutional environmental footprints. Many college Dining operations rely on student preferences and demand to determine the types of foods that are purchased and served. Thus, if student preferences shift towards more sustainable food items, University Dining may be more inclined to serve more sustainable food options, and ultimately, contribute to a reduced environmental impact of the institution at large.

Our overall findings are reported below:

- Fall 2017 study, *In the Nood Café*, we found that female participants purchased significantly more sustainable food items after they were presented with environmental impact labels on food items listed on the menu. The same study revealed that male participants needed more information to make the same decision.
- Survey data collected from the Spring 2018 at *In the Nood Café* study indicated that students' decisions about food are most heavily influenced by perceptions about tastiness of food items, whereas environmental concerns have the smallest degree of influence in these decisions.
- In our Fall 2018 study at *West Range Café*, we decided to test the relative impact of labels identifying menu items as a) tasty, b) sustainable, and c) tasty and sustainable.
    - Female participants who saw either the taste or sustainability label were more likely to buy a veggie burger and those who saw either the tasty or sustainable label for the veggie burger were also more likely to buy vegetarian options other than the veggie burger.
    - Male participants were not significantly impacted by the presence of either type of label.

Please contact Archana Shekharan (ars3ff@virginia.edu) for more information.

The Hydroponic Project

Neha Awasthi, Selina Cheng, Elizabeth Dukes

Nitrogen is necessary for the growth of plants. However, a large amount of nitrogen is wasted through excess fertilizer and leads to negative effects on the environment. The goal of this study was to compare the nitrogen usage and efficiency of a hydroponics system to the efficiency of conventional farming. In this study, a hydroponic system was set up by Babylon Micro-Farms in the Fresh Food Company Dining Hall at the University of Virginia. The system contained eight trays of lettuce which were monitored throughout the semester and the amount of nutrients entered into the system was recorded.

The lettuce incurred nitrogen losses to the environment from the nitrate used in the solution and the nitrogen emitted through fossil fuel combustion to provide the electricity powering the system. The total nitrogen used to grow the lettuce was 13.5 grams (10 g from the growth solution and 3.5 g from the light emission). There was 3.5 grams of nitrogen in the harvested lettuce and a virtual nitrogen factor (VNF) of 2.9 was calculated. Conventional farming on the other hand has a VNF of 5.1, almost double the VNF of the hydroponic system. That means that for every gram of nitrogen in the lettuce consumed, 2.9 grams of nitrogen were lost to the environment in a hydroponic system while 5.1 grams of N were lost to the environment in conventional farming.

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The Scope 3 Project

Sam Mogen and Elizabeth Dukes

The Nitrogen Working Group is now working on the final and most challenging level of institutional nitrogen emission accounting - Scope 3. Future nitrogen footprint calculation will include emissions defined under Scope 3 that are not currently included in the UVA Nitrogen Footprint. Scope 3 emissions include purchased goods (paper, plastics, etc.), upstream and downstream emissions, and investments made by the University. Currently, the Nitrogen Working Group is working to develop an institutional model for measuring Scope 3 emissions. A methodology is being developed by working in Clark Hall, but will eventually be expanded to other buildings and sectors of the University.

Upstream or downstream	Scope 3 category
Upstream scope 3 emissions	1. Purchased goods and services 2. Capital goods 3. Fuel- and energy-related activities (not included in scope 1 or scope 2) 4. Upstream transportation and distribution 5. Waste generated in operations 6. Business travel 7. Employee commuting 8. Upstream leased assets
Downstream scope 3 emissions	9. Downstream transportation and distribution 10. Processing of sold products 11. Use of sold products 12. End-of-life treatment of sold products 13. Downstream leased assets 14. Franchises 15. Investments

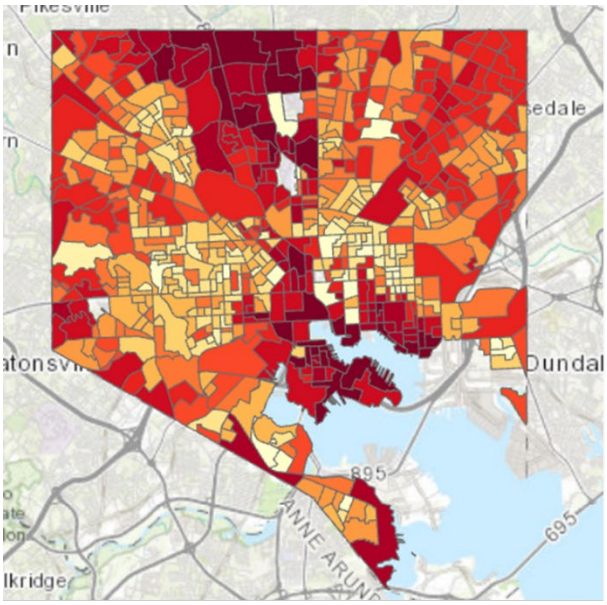
The graphic is from the Corporate Value Chain (Scope 3) Accounting and Reporting Standard document put out by the Greenhouse Gas Protocol.

Please contact Samuel Mogen (sm5fa@virginia.edu) with any questions.

The Community Nitrogen Footprint Tool Project

Julia Stanganelli and Elizabeth Dukes

The Community Nitrogen (N) Footprint Project is focused on enhancing the newly developed community nitrogen footprint tool (NFT). In its beta form, this tool was used to calculate and evaluate the N footprint of Baltimore City, MD on the census block group scale. The initial Baltimore City footprint calculation included an analysis of the relationship between income and N footprints and suggested strategies to reduce the city's total N footprint (thesis can be accessed here). The focus of this team's work to expand on the Baltimore City study is to: a) transition the beta version of the tool to a version that can be shared broadly and easily used by community stakeholders; b) work to include socio-economic analysis to the tool; and c) work with local (the city of Charlottesville and Albemarle County) stakeholders to calculate the N footprint of these communities. By accomplishing these steps, we hope the community tool can be used to further explore the impact of UVA on the community N sustainability.



The N footprint of census block groups within Baltimore City in 2016. The average value is 30 kg N per capita. Values lower than the average are colored in shades of yellow and values higher than the median are colored in shades of red. Complete data sets were not available for gray census block groups.

For more information, please contact Elizabeth (Milo) Dukes (esm9gq@virginia.edu) and Julia Stanganelli (jas7ua@virginia.edu).