

A nitrogen footprint tool (NFT) for communities: A case study in Baltimore, Maryland US

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Introduction and Objectives

Nitrogen footprint tools (NFTs) allow entities to determine the amount of reactive nitrogen lost to the environment as a result of the entities resource use. The community NFT model estimates these losses for census block groups within a given area and for this study Baltimore City, MD. The objectives of this study were to: 1) calculate and map the N footprint of Baltimore City, 2) present potential reduction scenarios to reduce this footprint, 3) determine the impact of income on N footprints in Baltimore City, and 4) provide a methodology for additional communities to calculate their N footprints.

Baltimore City, MD, USA



Baltimore City, MD, is located on the East Coast of the US and drains into the Chesapeake Bay

Methodology

- System bounds include all activities occurring within the city and associated upstream losses (food purchased by residents, miles traveled within city limits)
- N emissions calculated from food, energy use, wastewater, fertilizer, and pets
- Publicly available datasets used for US communities in Excel-based tool to calculate block-group-specific footprints and display in ArcGIS

Results of the Baltimore City N Footprint

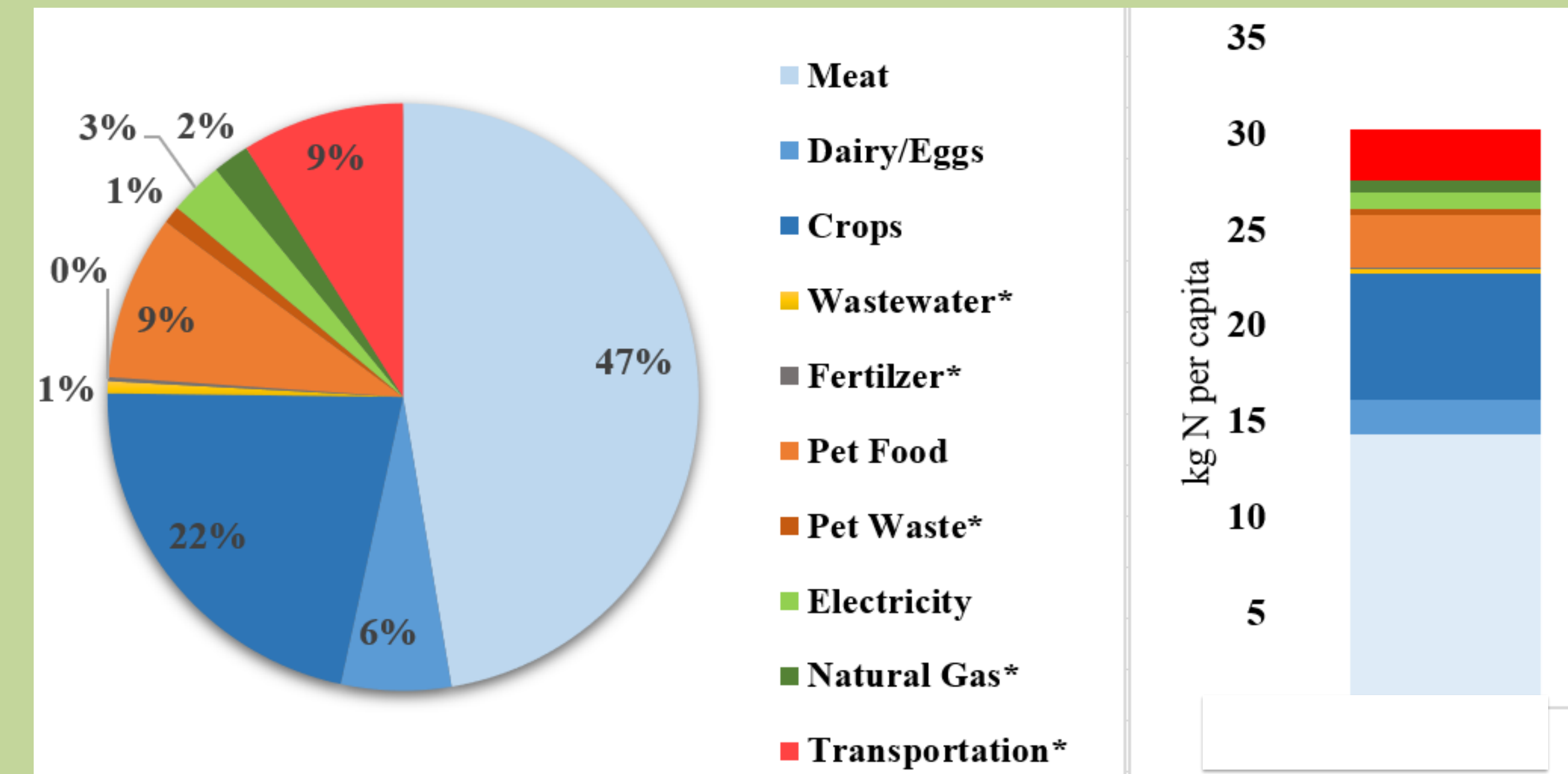


Figure 1 (above): The average components of a) the total nitrogen footprint of Baltimore City and b) average per capita nitrogen footprint for an average Baltimore City resident. The starred sectors indicate N losses occurring in Baltimore City directly while unstarred sectors indicates emissions outside of Baltimore.

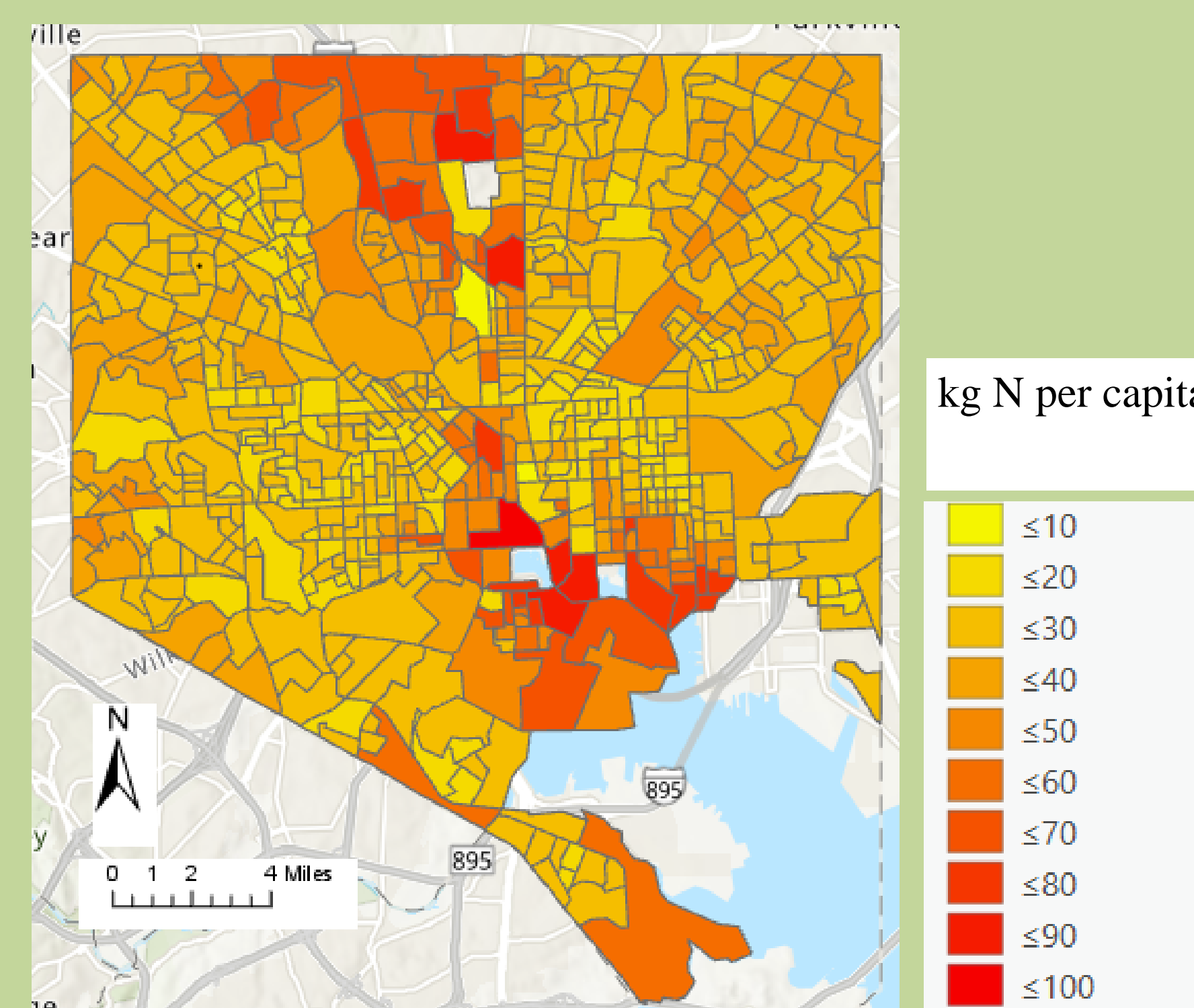


Figure 2 (left): The N footprint of census block groups per capita within Baltimore City in 2016. The average value is 30 kg N per capita. Values lower than the average are colored in shades of yellow and values higher than the median are colored in shades of red.

Correlation with Income

The Baltimore City N footprint was positively correlated with household income ($p > 0.01$). As a census block groups' household income increased, so did the per capita N footprint

Reduction Scenarios

All energy scenarios (-1.5%):

- Reduce energy consumption by 10%
- Reduce single passenger car use by 10%
- Increase public transport by 10%
- Increase renewable 20%

All food scenarios (-9.5%):

- Make 15% of fast food meals vegetarian
- Reduce beef consumption in over-consuming block groups
- Replace 25% of beef purchased with beans

Conclusion: The N footprint of the average person would decrease 11% if the strategies were implemented