

# 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

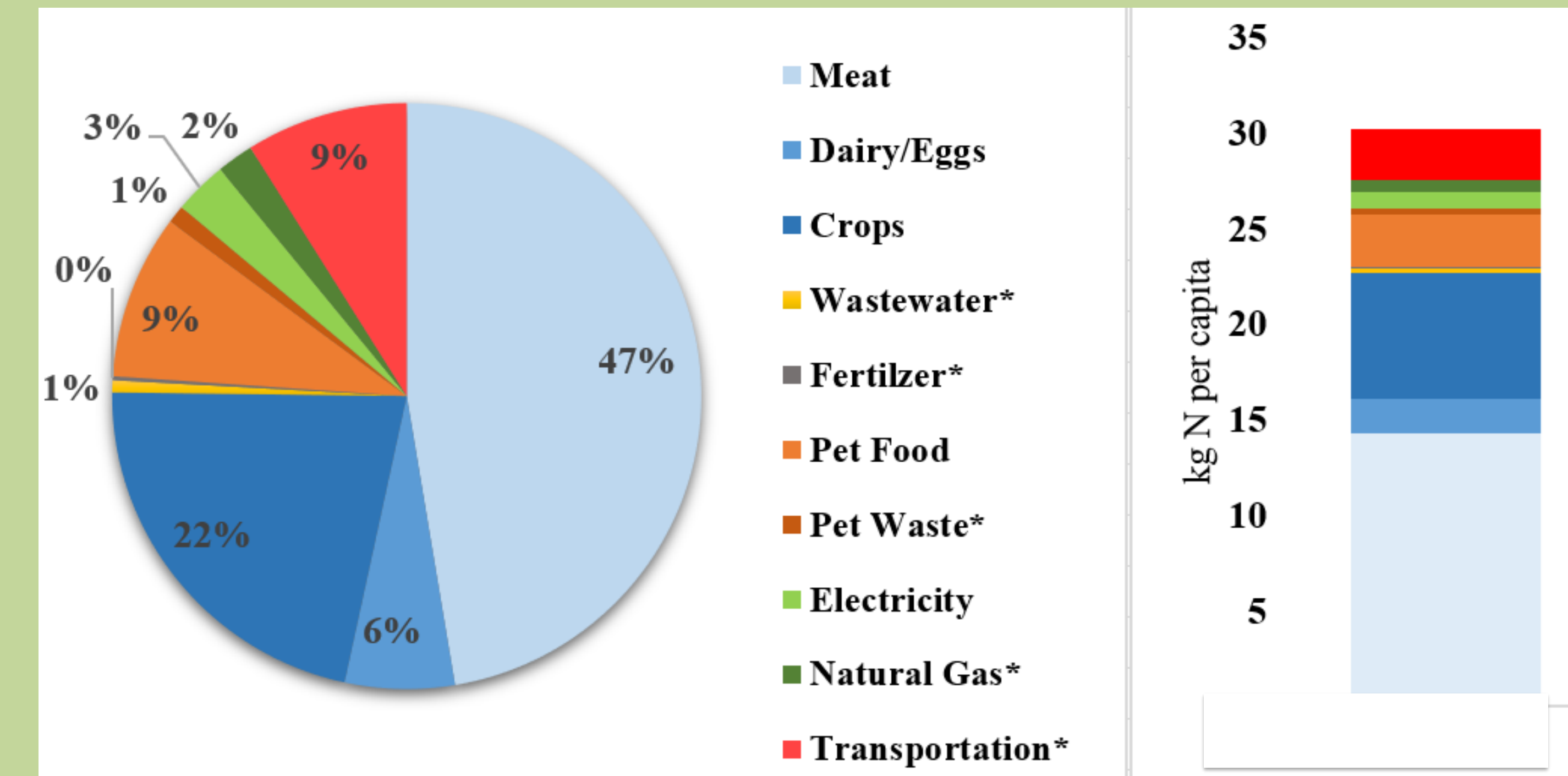


Baltimore City, MD, is located on the East Coast of the US and drains into the Chesapeake Bay

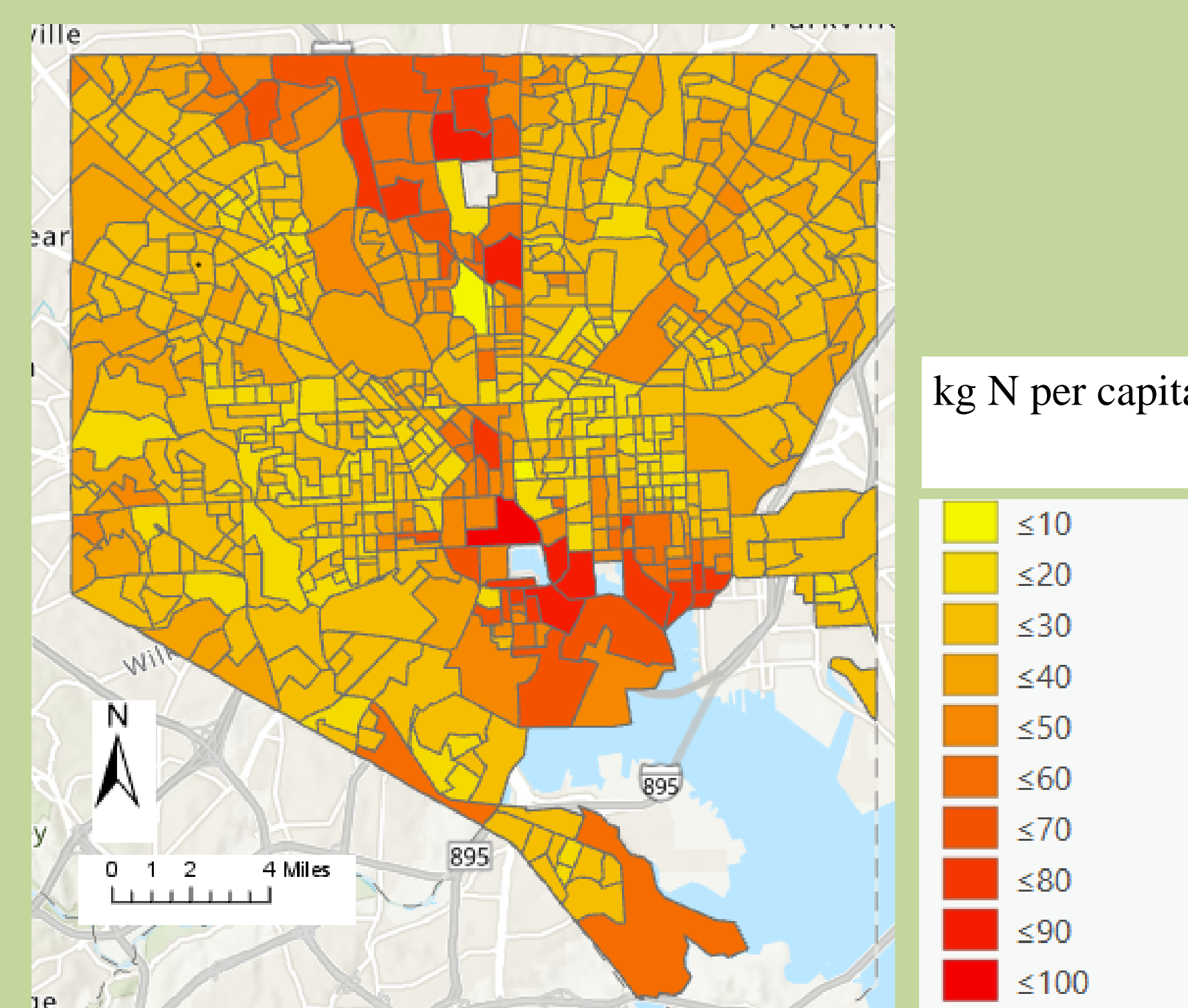
## Methodology

- 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