Quantifying Urban Foodprints and Mitigation Opportunities

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Introduction

As centers of wealth and population, cities are and will continue to be the major driving force of anthropogenic environmental impacts. Overviews of urban transport [1], building energy [2] and water consumption [3] have shown the importance of these activities in influencing urban environmental integrity. Urban food consumption has not received a similar treatment despite its large contributions to global climate change [4], non-renewable resource consumption [5] and other ecological challenges. This study attempts to fill that gap by asking:

> What is food consumption's role in a city's environmental profile (the 'foodprint') and how can urban designers re-imagine cities to mitigate it?

Methods

Comprehensive review of urban metabolism and related literature to find quantified urban foodprints in terms of:

- Urban food demand (tons/cap/a) - *MFA*
- Ecological footprint (global ha/cap/a) - *EF*
- Carbon footprint (tons CO_2 eq./cap/a) - *CF*

'urban metabolism'
'nutrient balance'
etc.

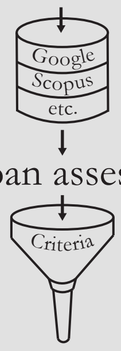

Fig 1: Overview of research methods

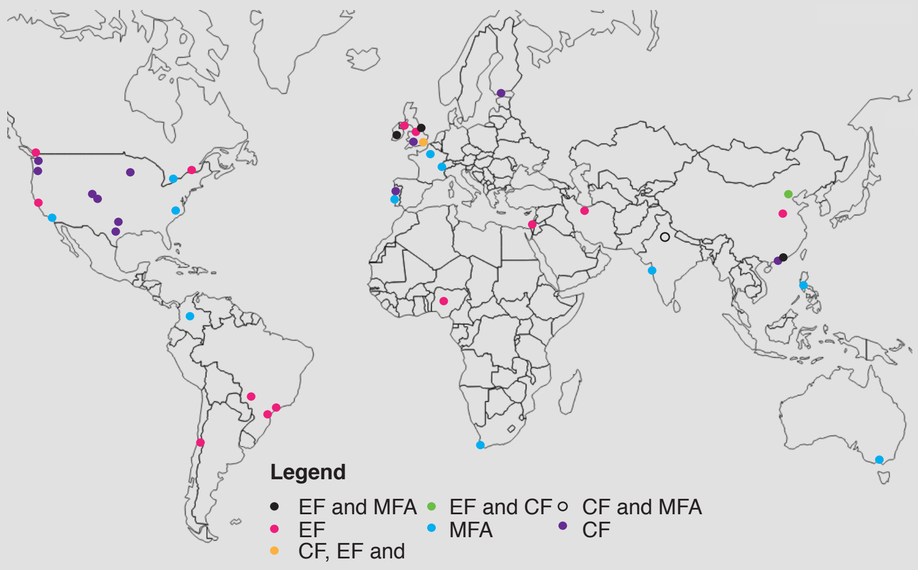

Fig 2: Map showing the locations of foodprint studies included in the review

Results

The urban foodprint is a significant driver of the reviewed cities' overall environmental pressures at (figure 3):

- 1 ton food/cap/a (figure 4a)
- 1.2 global hectare/cap/a (figure 4b)
- 1.9 tons CO_2 eq./cap/a (figure 4c)

Plotting against per capita GDP shows moderate positive correlation with foodprint and food waste hinting at consumption patterns that will increase in terms of embodied impacts (more animal products intake) and wastefulness with future urbanization [6] (figure 4d).

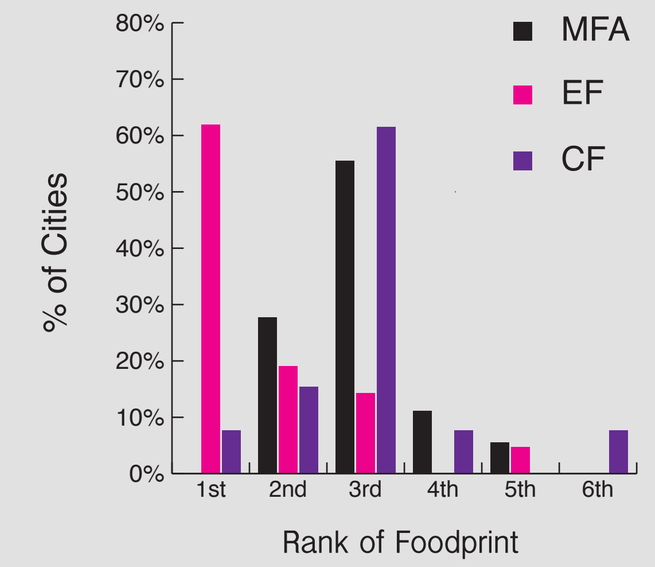

Fig 3: Rank of foodprint relative to other major urban metabolic drivers (e.g. tansport, building energy, etc.)

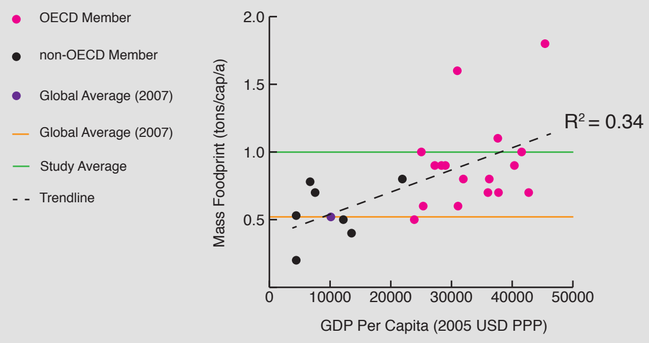

Fig 4a: Per-capita mass foodprint vs. per-capita GDP

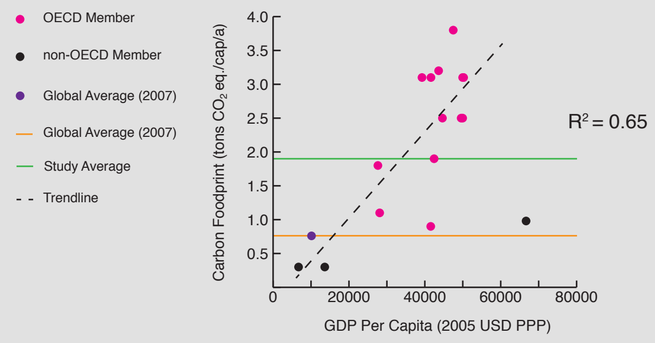

Fig 4b: Per-capita carbon foodprint vs. per-capita GDP

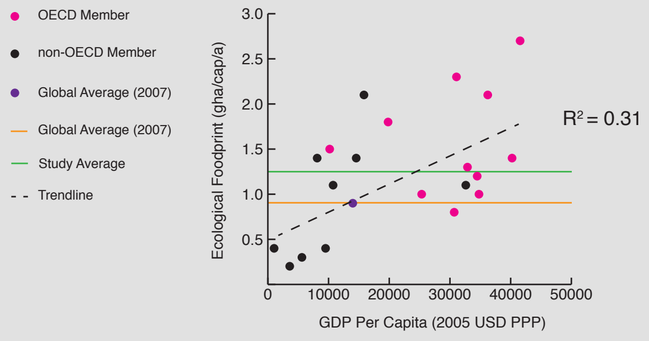

Fig 4c: Per-capita ecological foodprint vs. per-capita GDP

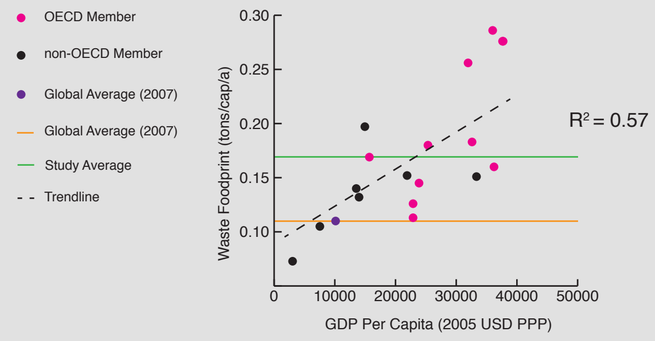

Fig 4d: Per-capita waste foodprint vs. per-capita GDP

Conclusions

The urban foodprint is significant in scale and is poised to grow lockstep with future urbanization. Urban food waste is also set to grow simultaneously, which combined with the current linear metabolism of many cities food systems could result in a significant nutrient exhaust and methane production. These will challenge urban designers and policy makers to explore new infrastructural forms and policies for future cities:

- *Circular metabolic strategies:* wastewater sludge recycling, composting;
- *Behavioral nudging:* food waste attenuation, lower and dairy intake;
- *Alternative food supply-chains:* urban and peri-urban agriculture.

The combined effect of such interventions on the urban foodprint is unknown, making it a ripe question of practical importance for future urban metabolism research.

Acknowledgements

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