

JOURNAL BRIEF: City-level Action to Reduce the Environmental Impact of Food Systems

Sustainable Healthy Cities Journal Brief - 2018, No. 5 - City-level Food System Action

This brief is adapted from the following peer-reviewed journal article: Boyer, D. & A Ramaswami. (2017). "What Is the Contribution of City-Scale Actions to the Overall Food System's Environmental Impacts?: Assessing Water, Greenhouse Gas, and Land Impacts of Future Urban Food Scenarios." *Environmental Science & Technology*, 51, pp. 12035-12045.

Study Intent and Research Question

How do city-level actions related to food production, consumption, and food waste management affect the greenhouse gas (GHG), water and land impacts of the larger food system? Footprints of urban food systems take into account the GHG, land, and water impacts of food consumed by urban residents, encompassing the full supply chain from production, transportation, storage, and retail. Once calculated, urban food system footprints can be used to analyze scenarios that consider policy actions around equity, diet change, urban agriculture, food preparation, and waste management.

Key Background Information

On global and national scales, the food system generates substantial environmental impact, accounting for as much as 85% of global water use and 30% of global GHG emissions (Vermeulen et al, 2012).

Cities are large centers of food demand, but city governments have not traditionally been thought of as key food-system actors (UN Environment, 2016).

Global food organizations, including the United Nations Food and Agriculture Organization's Food for the Cities, C40's Food Systems Network and the Milan Food Pact are all working to mobilize city-scale food system actions (C40, UN Food and Agriculture Organization).

Possible city-level food actions include:

1) Increasing the food intake of undernourished residents
2) Shifting diets to more nutritious and/or environmentally low-impact foods
3) Promoting soil-based or vertical urban agriculture within city boundaries
4) Shifting to cleaner household cooking fuels
5) Composting or anaerobic digestion of organic food waste

Key Findings

In the case of Delhi, India, modeling showed that city-level actions were significant enough to reduce water, GHG and land impacts of the food system as a whole, rivaling the effect of food system actions taken outside of the city-boundary.

City-level food waste management and diet change actions showed particular promise as levers to mitigate the environmental impact of the food system.

Actions to increase diet equity by improving the nutrition of the bottom 50% of the population (increasing the consumption of 8 million people to median consumption levels) results in only a marginal increase of resource impacts.

Increasing the amount of urban agriculture that takes place within a city generates large increases to in-boundary water and land requirements.

There are resource impact tradeoffs between different diet change actions. Multiple diet changes (from rice to wheat, rice to sorghum, and rice to millet) mitigate GHG impact, but also generate an increase in water and/or land impacts.

Vertical farming technology does not generate large aggregate water impact for currently viable crops, given that animal products, grains, and oils—products not currently amenable to vertical farming—dominate the water footprint for Delhi's food consumption.

Policy and Practice Implications

Across diverse cities and diverse food system concerns, the science is lacking to assess the tradeoffs and co-benefits of various city-level actions that affect food policy and food systems. For example, if a city aims to promote a particular diet for improved health, does this complement or conflict with efforts to lessen overall environmental impact?

The methodology presented in this brief helps correct that lack of science and is applicable to any city with the requisite data, regardless of whether it is located in a developing or developed country context. This research helps cities quantitatively understand the impact of potential food-related actions they may take.

It is an encouraging finding that improving the nutrition of the bottom 50% of the population of a large city like Delhi only results in a marginal increase of resource impacts as human development goals are often seen as being at odds with environmental sustainability. The modest increase in environmental impact from the equity scenario could be further mitigated by simultaneous food system actions such as improved food waste management and/or vertical farming.

Promoting urban agriculture may be a challenge for land and/or water scarce cities given its associated increase in land and water requirements.

Food Systems

Co-benefits & Tradeoffs

Policy & Governance

Further Reading and References

-C40. The Food System Network. http://www.c40.org/networks/food_systems (Open Access)
-Food systems and natural resources: a report of the working group on food systems of the International Resource Panel, United Nations Environment Programme: Nairobi, Kenya, 2016. (Open Access)
-United Nations Food and Agriculture Organization. Food for the Cities. http://www.fao.org/fcit/fcit-home/en/ (Open Access)
-Vermeulen, S. J.; Campbell, B. M.; Ingram, J. S. I. Climate Change and Food Systems. Annual Review of Environment and Resources. 2012, 37 (1), 195–222. (Open Access)

Photo Credit

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About the Sustainable Healthy Cities Network

The Sustainable Healthy Cities Network is a U.S. National Science Foundation supported sutainability research network focused on the scientific advancement of integrated urban infrastructure solutions for environmentally sustainable, healthy, and livable cities. We are a network of scientists, industry leaders, and policy partners, committed to building better cities through innovations in infrastructure design, technology and policy. Our network connects across nine research universities, major metropolitan cities in the U.S. and India, as well as infrastructure firms, and policy groups to bridge research and education with concrete action in cities.

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