

# Regionalization of urban food systems and its climate benefits

Global urban food transport emission would reduce by half or more by regionalization of food systems. To enable regionalized food systems would additionally require closing yield gaps, food waste reduction, and a shift towards diversified farming.

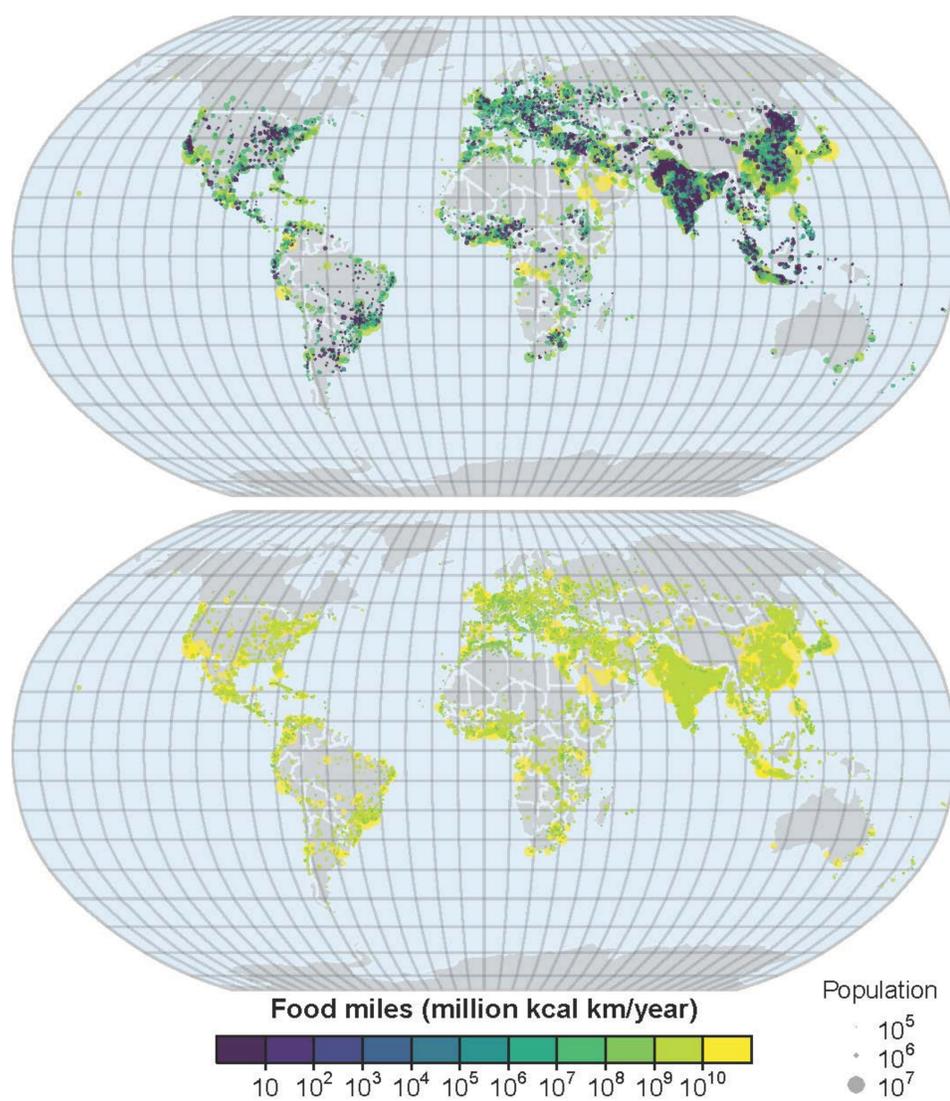
Prajal Pradhan<sup>1</sup>, Steffen Kriewald<sup>1</sup>, Luis Costa<sup>1</sup>, Diego Rybski<sup>1</sup>, Günther Fischer<sup>2</sup>, and Jürgen P. Kropp<sup>1</sup>

<sup>1</sup>PIK RD II Climate Impacts & Vulnerabilities

<sup>2</sup>International Institute for Applied Systems Analysis (IIASA)

## INTRODUCTION

A global challenge is to sustainably nourish the growing population. By 2050 the share of urban population may grow up to 70%. Thus, sustainable urban food systems based on regionalization is a potential solution to address the global challenge. Regionalization of the food systems also contribute to lower carbon emissions from food transport by reducing food-miles. However, this requires an understanding of interdependency between hinterlands and urban areas in food production and consumption, which we consider as urban foodshed.



**Fig. 1** Net food distance also called as food-miles under regionalized (top) and globalized (bottom) food systems in 2010. The bubble's size depicts UAU's population. Food-miles are estimated by summing up the product of distance and food amount transported from each arbitrary or peripheral area (pixel) to fulfill the UAU's food demand. Under regionalized food systems, food-miles are generally larger for big UAUs than for small UAUs. The food-miles are mostly greater under globalized than regionalized systems.

## METHOD AND DATA

We analyze foodshed and food-miles of 7000 urban administrative units (UAUs) globally and estimate carbon emissions related to food transport for 2010 by applying two methods:

- regionalized food systems where the food demands are met from peripheral areas
- extreme globalized food systems where UAUs' food demands are met from arbitrary sites

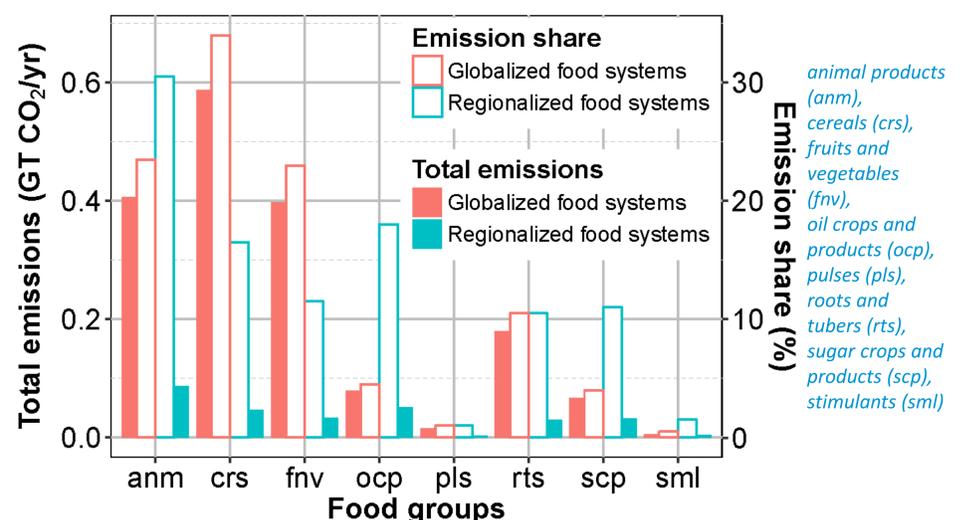
Food systems	Regionalized	Globalized
Baseline	0.150	1.872
Food waste	0.103	1.748
Yield gap	0.089	1.869
Food waste & Yield gap	0.061	1.745
Food groups	0.287	1.738

**Tab. 1** Emissions due to urban food transport (GT CO<sub>2</sub>/yr) under regionalized and globalized food systems in 2010 considering: i) demand and production of total calories (baseline), ii) halving food waste (food waste), iii) closing yield gaps by 75% of potential yields (yield gap), iv) combination of (ii) and (iii) (food waste & yield gap), v) demand and production of the eight major food product categories (food groups). In 2010, the urban food transport emissions were 0.34 GT CO<sub>2</sub>/yr.

## RESULTS

Regionalized urban food systems would halve the current carbon emissions from food transport. However, for this regionalization to occur would require restructuring of the current food system, especially through diversifying cropping to produce a variety of products and shifting diets towards more local and season products. Food miles and associated transport emissions are lower for most UAUs under regionalized rather than under globalized systems. Food waste reduction and closing yield gaps would also result in lower estimates.

By 2050, the emissions due to urban food transport may respectively increase to 0.25–0.92 GT CO<sub>2</sub>/yr and 2.20–3.00 GT CO<sub>2</sub>/yr under regionalized and globalized food systems. The transport emissions are higher under scenarios that only consider increase in food consumption, compared to ones that account for food demand management, such as reducing food waste and improving feed conversion efficiencies.



**Fig. 2** Total urban food transport emissions and their shares for the eight food groups, based on demand in 2010 and modeled globalized or regionalized food systems.

## DISCUSSION

To limit global warming to well below 2°C as agreed at Paris, countries need to follow a deep decarbonization pathway that decreases the global emissions to 5 GT CO<sub>2</sub>/yr by 2050. Regionalized food systems would be an important component of such decarbonization pathway as regionalization has the potential to reduce food transport emissions. Conversely, increasing globalization would increase the emissions considerably. Regionalized food systems also reconnect producers and consumers, leading to responsible production and consumption, strengthening regional economies, and closing nutrient loops.