

The global potential of local peri-urban food production

Authors: Steffen Kriewald, Anselmo Garcia Cantu Ros, Till Sterzel, and Jürgen P. Kropp

One big challenge for the rest of the 21st century will be massive urbanisation. It is expected that more than 7 out of 10 people will live in a city by 2050. Crucial developments towards a sustainable future will therefore take place in cities. One important approach for sustainable city development is to re-localize food production and to close urban nutrient cycles through better waste management. Although urban and peri-urban agriculture can be found in many cities worldwide and already contributes substantially to food supply, it has not yet been researched comprehensively. We combine several worldwide data sets to determine the food consumption demand of 2,838 cities and the fraction which can be met with regional production. Regional is defined as production that occurs very close to the consumption within the peri-urban area. With regard to local circumstances, the results of potential worldwide peri-urban agriculture emphasize the ongoing investigation of sustainable transitions of the socio-ecologic system. Identifying areas that can increase food production while ensuring the sustainability of natural resources and maintaining urban needs will be a major task for cities in future.

Methods:

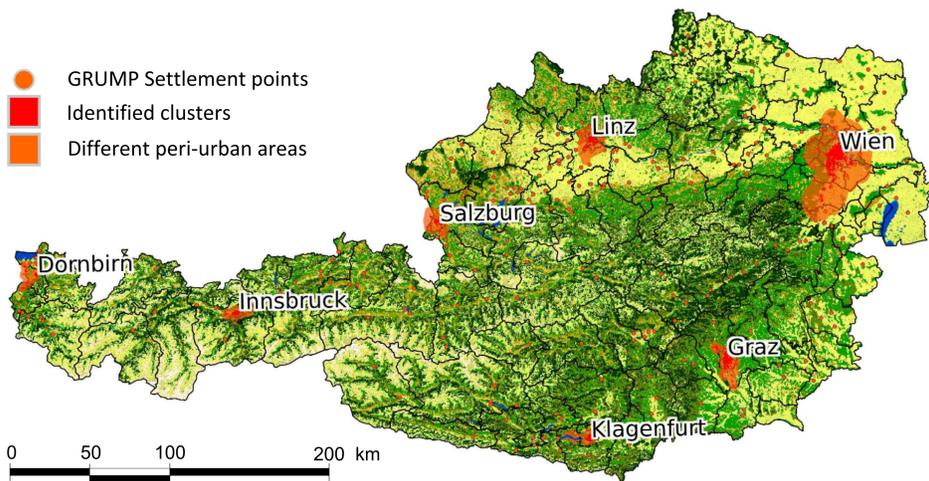
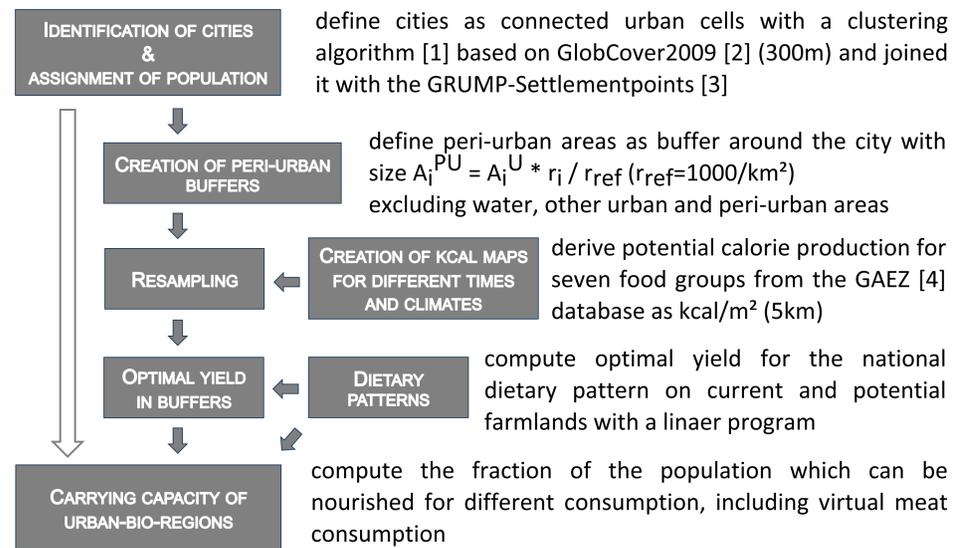


Figure 1: Identified urban clusters and defined peri-urban areas for Austria

Results:

It is possible to feed cities by products grown in their peri-urban area. For a maximum yield scenario on today's already existing agricultural areas, 867 of the observed 2,838 UBRs are capable of supplying their entire population with today's calories consumption. Even for a minimum possible yield scenario, 76 UBRs reach full supply. High carrying capacities result mainly from high agricultural productivity in the peri-urban area.

The fraction of the global urban population, which can be fed by peri-urban agriculture, varies between 15 and 70 %. These numbers are based on today's harvested areas and the actual consumption for the minimum and the maximum potential yield. This also indicates the need to close the yield gap.

There are regional differences in production capabilities for peri-urban agriculture. These differences result from differences of the fraction of the harvested area within the peri-urban area and in general from the agricultural capabilities given by soil quality and farming techniques. North America has a high potential to increase its production capabilities by increasing the fraction of harvested areas in the surroundings. India for example has with a few exceptions agricultural dominated peri-urban areas which can additionally use the good soil quality. UBRs in the Indo-Gangetic Plain, the Yangtze Plain, along the Nile-River and in the Danube Delta have above average carrying capacities.

The nourished population can be reduced by half by changing dietary patterns. This may be observed by comparing a minimum required calorie diet based on 2,100 kcal with a high calorie diet based on 3,500 kcal, which is typical for western countries. Assuming a norm diet for all people based on 2,800 kcal, 15% of the global urban population can be nourished. This is equal to today's regional different diets.

	P min yield [10 ⁹]	P min yield [%]	P max yield [10 ⁹]	P max yield [%]
actual dietary	0.42	14.70	1.96	69.10
min dietary	0.62	21.90	3.14	110.50
norm dietary	0.41	14.40	2.07	72.70
max dietary	0.28	10.00	1.43	50.20
crop consum	0.71	24.90	3.53	124.40

Table 1: Total population in billions and percent of the urban world population, which can be fed by peri-urban agriculture. The numbers are given for the potential maximum and minimum yield and for different dietary patterns.

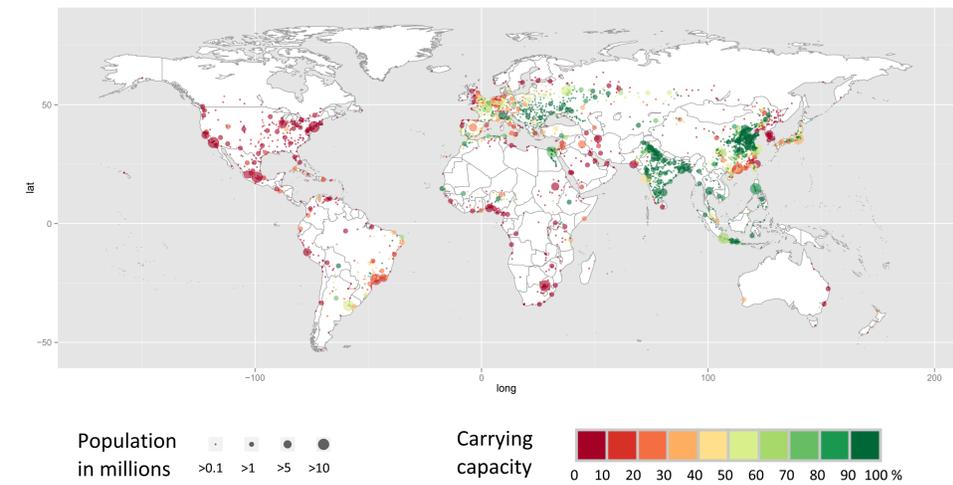


Figure 2: Global carrying capacity for today's agricultural areas and a maximum yield scenario (high input of fertilizer and most productive crop)

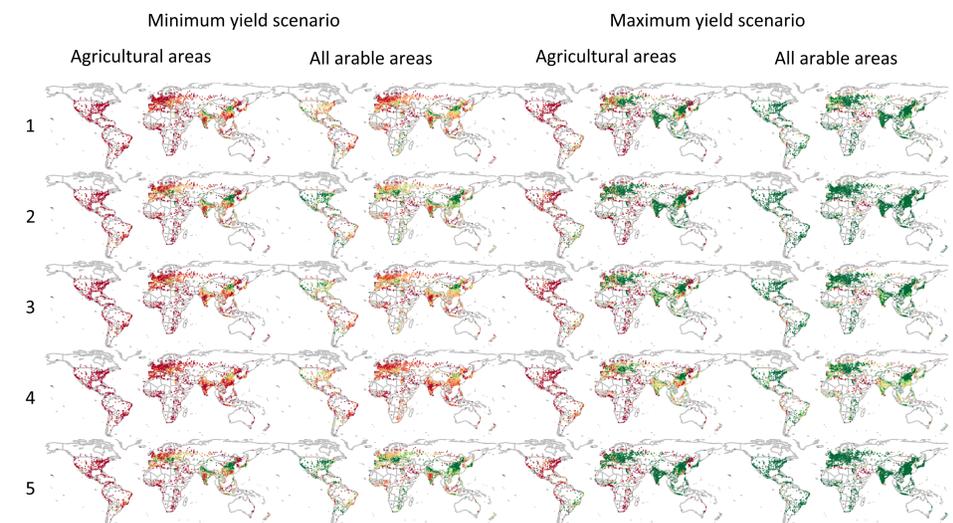


Figure 3: Carrying capacity for different yield, area and dietary scenarios:

- 1 actual dietary on national level
- 2 minimum dietary (2,100 kcal with 200 kcal of animal products)
- 3 norm dietary (2,800 kcal with 500 kcal of animal products)
- 4 maximum dietary (3,500 kcal with 1,000 kcal of animal products)
- 5 crop dietary describe only the vegetarian part of the today's dietary

References:

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