Urban Food Print: a tool to calculate the land needed to feed Dutch cities

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Introduction

Urban areas almost entirely rely on the import of food and food related goods. This import doesn't necessarily come from the cities' hinterlands, since our urban food system is globally organised (Grewal and Grewal, 2012). As a counterweight to this global food system but driven by different causes, many cities in the global North have developed food policies to foster local food initiatives. One basic assumption related to these policies is that local food production will improve the urban system as a whole, economically, environmentally as well as socially (Morgan, 2009). Albeit the debate if local food production is more economically and environmentally efficient just started, a more fundamental question is how much land we actually need to feed the city. What is the needed size of the hinterland to fill the city's foodshed? If we know what the city's needs are and what the different needs require in terms of production area, a more focussed food policy could be developed based on what is reasonable to produce locally.

Rood *et al.* (2004) calculated that the overall land use of agricultural production is 0.31 ha per person. This Dutch *foodprint* is based on our overall consumption, including imported produce like cacao, rice, coffee and plant based oils and also on non-food products like cotton and pet fodder. This figure is a starting point but the principles behind it are too comprehensive to start a discussion on what is reasonable to produce locally under Dutch conditions. In order to plan for local produced food we developed an internet based tool to estimate the amount of hectares needed to feed a specified amount of people.

Approach

Based on the average Dutch diet on the one hand and the average agricultural production on the other hand we developed an internet based tool (www.stedelijkefoodprint.nl). The tool is grossly simplified, which means that the outcomes are only an approximation of reality. It takes the following produce into account: vegetables, fruit, potatoes, wheat, sugar, meat, milk and eggs (plus the necessary fodder required to feed the livestock).

Briefly summarized, this tool:

1. Is based on the yearly average diet of a Dutch person between 19-30 years in the year 2003.
2. Does not calculate the complete diet, but only the produce that can be cultivated under Dutch circumstances (livestock, horticulture and arable farming). Consumption of exotic products like coffee, fruits and rice are not covered by this tool.
3. Does not take into account the acreage needed to produce the plant based oils in our diet, like soy oil in margarine.
4. Calculates with so called model crops. One model crop symbolizes a certain group of produce. For example: the model crop for the produce group of fruits is apple. Production and consumption data of all other fruits are converted to the production and consumption data of apple.
5. Works with average Dutch production data based on conventional agricultural production methods.

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6. Functions with processed food that is traced back on one ingredient, like cheese (milk), chips (potato) or bread (grain). Not taken into account are the complex multi-ingredient part of our diet like pizza or cakes.

7. Takes the loss of produce within the food chain (to a certain degree) into account.

8. Takes the necessary concentrate to feed the livestock partly (approximately 60%) into account.

The tool is based on the databases created and described in Jansma *et al.* (2012) and uses the consumption figures of Hulshof *et al.* (2004).

Results and conclusions

The tool estimates that to feed 18 persons one ha of agricultural production is needed. So a city of 100,000 dwellers needs 5,645 ha to be fed. This figure is an under estimation of the reality because of the assumptions made. Rood *et al.* (2004) come with an overall figure of 0.31 ha per person (or three persons per ha). The big gap between both figures can be explained by the fact that Rood *et al.* (2004) based their figure on the complete diet, including all imported products and non-food products. Moreover, the agricultural production per ha in the Netherlands belongs to the global top (Worldbank, 2013). In the tool we converted some of the imported products to Dutch conditions and in that way we 'lost' ha.

We see the tool as a starting point in the debate on what could be produced locally. It could help to underpin and plan for a local food provision area for the city. The tool shows that the production of fresh produce (vegetables and fruits) is less land consuming than the production of grains and animal based proteins. This evokes a more focused discussion on the various types of flows structuring the urban food system. Van der Schans and Wiskerke (2012) introduce the 19th century *Von Thunen model*, in which the pattern of agricultural land use changes with the distance to the urban center. In this model fresh, perishable, high volume and thus less transportable and storable products filled the pattern in the city's fringe. The *Von Thunen model* reconsidered could help to plan the metropolitan landscape of the 21th century as Van der Schans and Wiskerke (2012) argue.

The tool also underlines the discussion on the diet of the global North. Nearly three of a quarter of the land is needed to produce the animal based protein in our diet. Jansma *et al.* (2012) argue that more of the daily food basket could be produced locally if consumers behavior changes towards less meat consumption and more in season products.

The tool isn't finished yet. We would like to add different diets (vegetarian) and production conditions (organic or high yielding hydroponic production) in the model. The model could also be adjusted for non-Dutch conditions, like different climate zones or diets.

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