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Feeding capitals: Urban food security and self-provisioning in Canberra, Copenhagen and Tokyo



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ABSTRACT

Most people live in cities, but most food system studies and food security issues focus on the rural poor. Urban populations differ from rural populations in their food consumption by being generally wealthier, requiring food trade for their food security, defined as the extent to which people have adequate diets. Cities rarely have the self-provisioning capacity to satisfy their own food supply, understood as the extent to which the food consumed by the city's population is produced from the city's local agro-ecosystems. Almost inevitably, a city's food security is augmented by production from remote landscapes, both internal and external in terms of a state's jurisdiction. We reveal the internal and external food flows necessary for the food security of three wealthy capital cities (Canberra, Australia; Copenhagen, Denmark; Tokyo, Japan). These cities cover two orders of magnitude in population size and three orders of magnitude in population density. From traded volumes of food and their sources into the cities, we calculate the productivity of the city's regional and non-regional ecosystems that provide food for these cities and estimate the overall utilised land area. The three cities exhibit differing degrees of food self-provisioning capacity and exhibit large differences in the areas on which they depend to provide their food. We show that, since 1965, global land area effectively imported to produce food for these cities has increased with their expanding populations, with large reductions in the percentage of demand met by local agro-ecosystems. The physical trading of food commodities embodies ecosystem services, such as water, soil fertility and pollination that are required for land-based food production. This means that the trade in these embodied ecosystem services has become as important for food security as traditional economic mechanisms such as market access and trade. A future policy question, raised by our study, is the degree to which governments will remain committed to open food trade policies in the face of national political unrest caused by food shortages. Our study demonstrates the need to determine the food security and self-provisioning capacity of a wide range of rich and poor cities, taking into account the global location of the ecosystems that are provisioning them.

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1. Introduction

Humanity faces the triple challenge of simultaneously feeding a population estimated to reach nine billion by 2050, in the face of increased global warming, remaining securely within the planet's physical capacity to produce food (Rockström et al., 2009; Rockström et al., 2009; Power and Chapin, 2009; Millennium Ecosystem Assessment, 2005; Ehrlich and Ornstein, 2010) and maintaining the livelihoods generated by agriculture and the associated food industries (Ingram et al., 2010). Whilst much concern over current and future food security focuses on the

situation of the world's rural poor (Campbell, 2009; Hoffmann, 2011), we live in a world where more than half the human population lives in or close to cities (UNFPA, 2007). As well as increasing absolute population and changing demographic distribution, migration to cities is associated with an increase in the relative affluence of city dwellers compared to their rural counterparts (Williamson, 1998). Two general principles linking affluence and food consumption are 'Engel's Law', which states that as incomes grow the percentage spent on food declines, and 'Bennett's Law', which states that as income increases, diets diversify from a narrow range of starch-based staples to a broader range of meat, fruit and vegetables (Timmer et al., 1983; Cirera and Masset, 2010). Urbanisation also typically leads to purchase of pre-prepared foods, which in affluent societies are typically purchased from supermarket chains with national and international food

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system networks (Naylor, 2009). Thus, the question of how humanity increasingly feeds itself moves from the historical situation of predominantly local production feeding a local population (Evans, 1998) to one where food moves large distances, often globally, sourced from many of the planet's farmlands, rivers and oceans to consumers in distant cities. About 15% of total global GHG emissions can be attributed to international trade mostly in food and other biological products (Davis and Caldeira, 2010).

Concerns for issues such as levels of greenhouse gas emissions, looming energy demand and supply and other potential disruptions to food supply have raised the debate about localising urban populations' food production. There are increasing calls for cities to base consumption on their immediate agricultural hinterlands through emerging social activities, such as farmer's markets, local and slow food movements and community based agriculture. Furthermore, cities draw their food from local, national and international sources. Each of these 'sources of food' contains complex nested sets of biophysical, social and jurisdictional issues. For example, at the local scale, issues of localism dominate, as evidenced by calls for increased urban agriculture, regional product labelling, and urban-rural partnerships. Farther afield, but within the nation, concerns for food miles, energy intensity of product and the capacity to close nutrient cycles come into play. Extra-national importation adds another layer via issues of jurisdictional sovereignty, where decisions affecting a landscape's function as a source of food are made by systems of governance outside the international consumers' influence. In this paper, we attempt to document the extent of these food supply and demand scale issues for three wealthy cities.

The Food and Agriculture Organization of the United Nations defines food security as being when 'all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 1996). Taking this definition, the three cities studied in this paper are all currently 'food secure' in terms of having sufficient volumes of food available for their population's needs, even if not all members have equal access to that food. However, because city consumers source food globally and use agricultural ecosystems worldwide, there are important considerations for food security namely, the balance between levels of regional food production within a city and its hinterland and how this production is augmented through imports or traded via exports. Such trade in food is measured by the physical exchange of food commodities, but which embody ecosystem services, such as water, soil fertility and pollination, that are required for

land-based food production (Porter et al., 2009; Deutsch et al., 2013). We are interested in estimating the land areas required for this trade in food, no matter where on the planet they exist.

Specifically, we analyse the extent to which the food security of three rich capitals are serviced by the productive capacity of landscapes over which the capital city and country has and/or has not national jurisdiction (Pinstrup-Andersen, 2009) and their historical trends. We do not recommend a particular policy for food security in the future. However, we do ask whether increasing and coincidental pressures on global primary food production caused by population increase, projected global warming, changes in consumption and diet, the increasing population density of cities and a decreasing rural agricultural population require a rethink of the means to global food security. This means finding a balance between the economic doctrine of market access and comparative advantage that improve the efficiency of resource use in food production with the need radically to revise the current zero-valuing of ecosystem services by global food markets.

We have chosen three wealthy, food secure cities and their hinterlands (termed 'Capital Regions', CR) for our study; Canberra, Copenhagen and Tokyo. These capital cities and accompanying capital regions or territories have populations that range over two orders of magnitude, situated within different global, climatic and physical locations and socio-economic contexts. Canberra, with the Australian Capital Region (ACR), is located in a huge continent in which 'old-world' food trading partners have given way to partners on the Indian and Pacific Rim. Copenhagen, with the DCR (Danish Capital Region), is part of a European political and trading system that actively supports agriculture and where the food system as a whole is a major employer (ESF/COST, 2009) and Tokyo, with the JCR (Japanese Capital Region), has a food production system that strongly values food traditions and culture.

We assembled data on the production, import and export of a common basket of food commodities consumed in each of the three capital regions and which account for the majority of agricultural land use in the respective regions. Identifying the regional, national and global movements of food needed to feed the three capital cities and the actual land areas required to supply these food flows is an important step in their food systems' analyses (Deutsch and Folke, 2005). For this we identified the food volumes, their sources and land areas used to produce food for the three cities and their populations for four snapshot years from 1965 to 2005 (Porter et al., 2009; Wirsenius, 2003; Hefny et al., 2003), thus attempting to define a bio-historical approach to food systems.

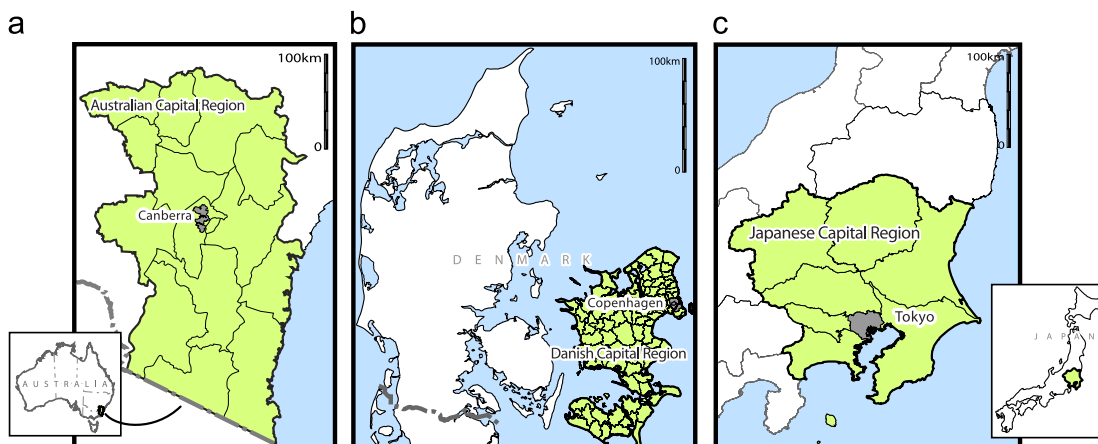


Fig. 1. The three capital regions (CRs) included in the study (a), the Australian Capital Region (ACR); (b), the Danish Capital Region (DCR); and (c), the Japanese Capital Region (JCR).

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