**Submission No 11**

# FOOD PRODUCTION AND SUPPLY IN NSW

**Name:** Mr Benjamin Cronshaw

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This Inquiry has a great opportunity to consider many aspects of the food production and supply in New South Wales, and how we can work for a better food system. There is an important role to be played by all levels of government, cooperating with businesses and farmers, to build sustainable and equitable food systems. There are also good opportunities in promoting urban food security. This includes urban food systems, as well as promoting urban-rural linkages. People want affordable, high quality food while farmers want to earn a living to support themselves and their families.

In one of my favourite books, Kate Raworth presents a vision of Doughnut Economics to meet human needs while living within planetary boundaries – noting that the two are interconnected. As she writes, we need "a future that can provide for every person's needs while safeguarding the living world on which we all depend," getting to a place that is "both ecologically safe and socially just space for humanity" (Raworth 2017, p.45). She uses the image of a Doughnut to conceptualise a space to meet human needs (not leaving people in the doughnut hole, as it were) and without expanding too much into surrounding environmental boundaries. Currently there is deprivation where people do not have essentials such as food, healthcare and education. There is also have environmental degradation where we are living beyond planetary boundaries, such as "climate change, ocean acidification and chemical pollution" (Raworth 2017, p.45). An ideal food system would ensure that food is provided equitably (ensuring that all people have sufficient healthy food) and sustainably (not burdening the environment or using up resources).

Unfortunately, many people even in New South Wales (and elsewhere in Australia) do not have enough to meet their basic needs, including sufficient and nutritious food. It is tragic to think in such a wealthy country as Australia, in which we are a net-exporter of food, that anyone would go hungry or not have enough nutritious food for a healthy diet. The impact on children from hunger or lack of nutrition is especially concerning, with an impact on their education and making it harder to pay attention or learn in class, with their physical development and even the social stigma of e.g. not being able to eat lunch with their friends. There are also many remote or Indigenous communities that struggle with getting enough food or, indeed, they have food but not enough nutritious food. At the same time, we are also breaching

many of the planetary boundaries - the key indicators for a healthy and stable planet on which we rely, including for the very food that we eat. That threatens not only the environment, but the food security of our society in the future.

However, it does not have to be this way. The food system can have positive or negative impacts on humans or the environment, depending on the choices we make. The food industry is a key area to consider how we can make society more equitable and sustainable. This includes delivering on the food and nutrition of all Australians in an affordable way. It also means living within the sustainable limits of our environment and, indeed, with the opportunity for agriculture to positively contribute to biodiversity and carbon abatement. It can be a key area in the transition to a low-emissions economy. There are practices that can be done to reduce emissions and, indeed, to draw carbon out of the atmosphere.

There are opportunities for innovation and new thinking with how we produce food, including with urban agriculture. Urban agriculture can provide options to bolster urban food security with new and more nutritious food. Where people can grow their own food, for example, this can especially benefit low-income households. While there may be limited space in household properties, there can be options for community gardens. Scientific and technological advancements can maximise the amount of food that can be produced with a given amount of inputs i.e. land, water fertiliser and so on. There are innovative designs such as hydroponic or aeroponic gardening, including vertical or rooftop gardens in urban areas.

This Inquiry appropriately recognises that there will be impacts of climate change on our food system. Climate change involves temperatures rising on average, along with more frequent and more damaging extreme weather and natural disasters. There will be more drought, floods and bushfires - all of which can dramatically impact on our crops, fishing and livestock. The issue of water, already under immense and complex pressure from agricultural, commercial, social and environmental needs, will become even harder to effectively manage. Hence climate change will have a severe impact on food security, exacerbating vulnerabilities in a range of food sources (Romm 2016, 73, 123). Indeed, as climate author Romm states, the need to secure “food (and water) for 9 billion or more people by mid-century in a world of rapid climate change is going to be the greatest challenge humanity has ever faced.” The task of feeding humanity, in a period in which environmental challenges will be even more extreme, will

demand a range of expertise in “sustainable agriculture, marine biology, agronomy, hydrology and on and on” (Romm 2016, p.257).

Some one third of global food is wasted, including with inefficient transport and storage (a big problem in developing countries, but also occurs in Australia). In Australia, wastage can also occur because of fresh food being left on the farm for not meeting supermarket specifications or being thrown out from households. This is lamentable given the food insecurity and hunger that goes on, including in Australia, and contributes to climate change through food waste emissions.

The production of food is intimately connected to our natural environment. This should compel us to do everything we can to operate sustainably, so that we do not impinge on the environment and that the food system can last for the future. This is clear with examples such as overfishing, with fishing around the world far exceeding the sustainable limits of fish species. This can only mean that the population will go on a downward trend, potentially reaching a critical point where their populations collapse. Overfishing provides an existential risk to the fish industry itself and to having access to wild fish for our diets. While it may take some sacrifice and adjustment to bring fishing back under sustainable levels, not doing so is wilful ignorance that will only lead to a worse and more permanent outcome within the next few decades. There are many other sustainability issues, including soil fertility, with modern agriculture degrading the health of the soil on which it lies (Hawken 2010, 90, 177). All these issues need to be considered honestly and seriously. I believe we have an intergenerational responsibility to take seriously the natural environment that we are blessed with, from which we can get our food, and need to steward for the sake of upcoming generations.

There are good lessons to be drawn from Indigenous food and land management practices. Indigenous people across Australia, including in New South Wales, have a wealth of knowledge gained from living and adapting to the natural conditions of this country over thousands of years. Indeed, they know better about how to effectively and sustainably use the land for food than the European-style practices that were imported and imposed only some 200 years ago - including clearing native vegetation and imposing large-scale agriculture (Gergis 2018, 174). As in the book Sunburnt Country, Indigenous Australians have an intimate knowledge of the Australian landscape:

> “The First Australians have followed intricate seasonal cycles of plant and animal cues for over

40,000 years, passing them down from generation to generation through stories like these. The ability to adapt to extremely harsh weather conditions has allowed countless generations of Aboriginal people to survive. An intimate knowledge of the environment was literally a matter of life and death: it was used for practical purposes like tracking hunting grounds or identifying safe travelling routes as the seasons began to change" (Gergis 2018, 116).

Moreover:

"They respected the limits of the land, and developed ways of managing its health and productivity. They used practices like fire stick farming to encourage trees to seed and prevent fuel loads building up to the dangerous levels of capable of producing ferocious wildfires that could annihilate their country and people" (Gergis 2018, 174).

We should also ensure that we consider the wellbeing of our farmers. Farmers in the dairy industry, for example, have been especially pressured by the milk price war with $1 litre milk. This does not adequately compensate them for their work and the costs they endure in producing the milk for us, nor does it appreciate them or the value of our domestic dairy industry. We cannot expect farmers to undertake a lot of work and stress and to remain in the industry, or for their children to take over the family farm, for such poor compensation. Amidst the other pressures like rural isolation, drought and other natural disasters, this can have a serious negative impact on the mental health of farmers. Hence, from an ethical perspective and in wanting a viable domestic dairy industry to continue (including family farms) we should ensure that we are adequately valuing the farm produce that we purchase. It is understandable that consumers want affordable food, and some will feel financial pressure to buy the cheapest milk. To reach a better balance, we should find ways to have an equitable food system that delivers affordable fresh food and compensates farmers fairly. I believe consumers would be happy to support farmers (even with a slightly higher price), if they had a way of determining which brands were better for farmers. The opacity of different milk brands makes it difficult for consumers to know where their milk is coming from, and which brands support farmers more or have an adequate farm-gate price. Perhaps having a mandatory labelling of what the farm-gate price for each milk or other products could enable consumers to compare brands. This could encourage a race to the top amongst brands and supermarkets, competing to have the best relationship with farmers, rather than racing to the bottom to provide the cheapest milk.

I commend the opening of this Inquiry and look forward to hearing more about what can be done for a better, more productive, equitable and sustainable food system in New South Wales.

Thank you for considering my submission.

Kind Regards.

Benjamin Cronshaw.

Appendix 1: I have attached a paper I wrote on urban food systems for a University of Melbourne subject Environmental Policy (ENST90005). The paper goes has more research about the challenges and potential programs for sustainably and equitably meeting urban food demand.

**References**

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# Environmental Policy: The Sustainability and Social Challenges of Meeting Urban Food Demand

## Introduction

There are major challenges to meet urban food demand across the cities of the globe. Food should be provided equitably (ensuring that all people have sufficient healthy food) and sustainably (not burdening the environment or using up resources). Urban populations tend to source their food from rural areas, which opens opportunities to diversity with more urban agriculture, while also improving urban-rural linkages. This will require innovation and creative thinking, including opening the way we produce or eat food to new ideas and methods. It will require planning and implementation of various strategies by governments and businesses to adopt the principals that have been discussed in declarations and emerging literature on the issue of urban food demand. This essay will include a case study on Lima, Peru, though there are many examples of innovation and planning that have promoted more sustainable food options in cities around the world. Meeting urban food demand in a climate impacted future will require effective planning to address food insecurity and improve sustainability.

## Urban Planning and Food

Urban food security has only recently been given the attention the topic deserves. Tacoli notes that urban food security will need greater focus with "climate change, rising food prices and growing urban populations," particularly for poorer communities (Tacoli 2013, 1). Food is steadily becoming more prominent in urban planning literature (Cabannes 2018, 18-19). Food security is also being focused more on the individual rather than national level, a distinction seen in South Africa being nationally food secure but with 1/4 households being food insecure (Bohle 1994, 248; Battersby 2018 189). Urban agriculture has traditionally been overlooked by "modernist urban planning ideologies" that the city and rural should be separate. It is typically ignored in government planning, and sometimes illegal but at least "ambiguous and difficult," despite urban areas being critical to meeting food demand (Koscica 2014, 180-184). There are some historical precedents; the 1900s saw the "Garden City" movement to bring food "production, distribution, consumption and waste recycling as an integral part of the city"

(Cabannes 2018, 19). Food has only re-emerged in the urban planning focus recently. Local governments are also beginning to focus much more on food planning as a priority (Cabannes 2018, 19-20). Thus far, policy-makers have generally been unable to envision and implement "environmentally sound and socially just strategies for sustainable urban development" (Bohle 1994, 245). Urban planners have sometimes been distracted by housing or sanitation problems to think about food planning, but are increasingly thinking about food and sustainability (Battersby 2012, 142; Biel 2016, 91).

There can be better visions. A food movement calls for quality, sustainable and safe food (Holt 2011, 85). Kate Raworth presents a vision of Doughnut Economics to meet human needs while living within planetary boundaries – noting that the two are interconnected **(**Raworth 2018). There is growing international support and declarations, such as the New Urban Agenda encouraging better food system planning and use of public spaces to bolster "food security and nutrition" (Cabannes 2018, 19-22). Food charters from the 2000s onwards represent the "vision and the principles about the food that a county, a city or a region consider most important" (Cabannes 2018, 44). Urban food planning should encourage "locally-owned sustainable food enterprises" for both environmental and economic reasons (Harvey 2009, 75). Cabannes has an optimistic note that we have a "time of opportunity" for food to become an "integral part of urban planning" at various scales (Cabannes 2018, 22).

We need to build on these "good intentions" and upscale the small innovations into "full city scale" and more deeply in planning practices (Cabannes 2018, 23). It will take time for urban food projects to be built up, with South Milan's agricultural lands taking some 15-20 years to develop (Cabannes 2018, 32). With cities having limited vacant space, there will be challenges about whether they can find or convert local space back to food production. City and regional planners have an important role in the process by cooperating with civil society and business stakeholders committed to sustainable food systems (Cabannes 2018, 28). For example, Vancouver endeavoured to create a "just and sustainable food system" with food as a human right (Cabannes 2018, 45). Sustainability does not require food to be produced within urban limits, but could come from better urban-rural linkages (Cabannes 2018, 27).

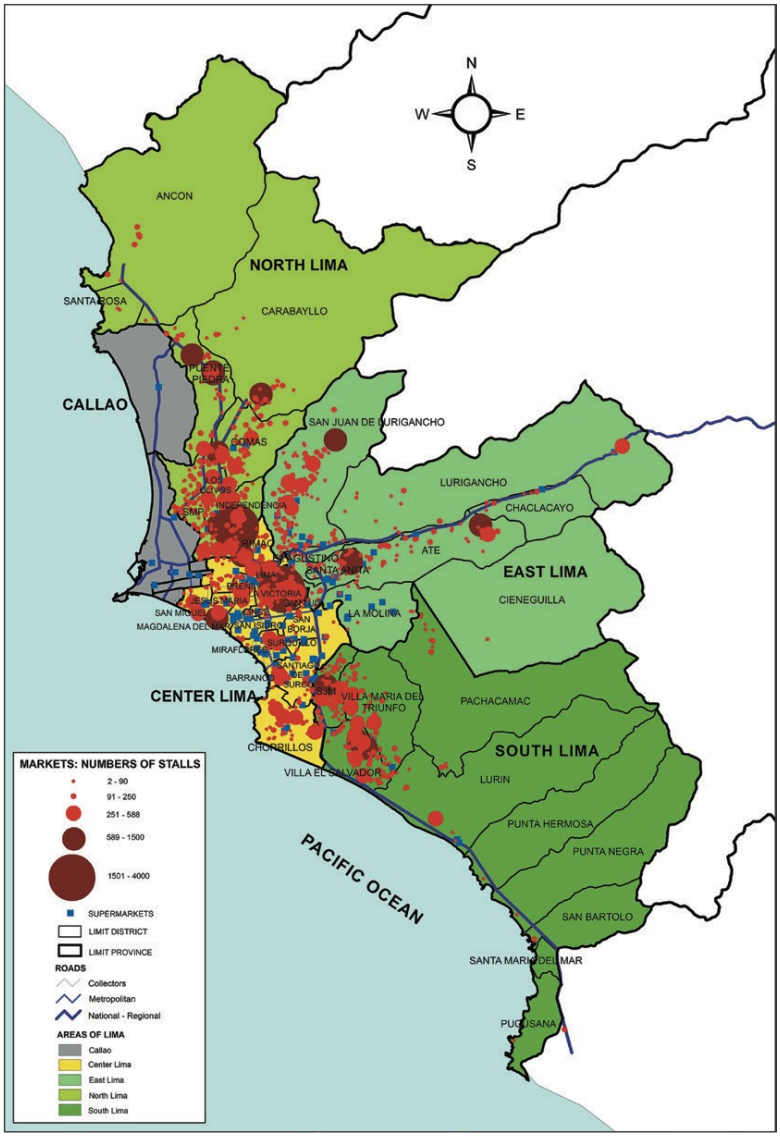
Along with government, it is also critical to involve the people. Food councils play an important role in democratically generating food plans and implementing them in a community way (Cabannes 2018, 47). We need “engaged citizens and committed decision-makers” to bring greater “food sovereignty” in cities (Cabannes 2018, 56). There are democratic opportunities to create “food charters and strategic plans” for the city (Cabannes 2018, 29). Gardeners can form groups and "actively take part in local political decision-making processes” (Certoma 2015, 13). This involves government, businesses and urban and rural residents to equitably and sustainably meet urban food demand.

**Peru**

An interesting example for urban food demand is the city of Peru, Lima. Lima is the 2nd largest desert city in the world, with only “25–100 mm of rain per year” and “only 3.7 m2 of green area per inhabitant.” As a desert city, Lima faces severe environmental problems, including major water constraints. The city mainly gets water from the Rimac River, including for food grown on the edge of the city (Santandreu 2018, 117). Urban poverty in Lima declined from around 45% to 11% across 2004-2014, which bolstered the ability of the former urban poor to buy food (including from supermarkets), but also led to more demand (Santandreu 2018, 119, see figure 1). Urban food production was previously taken for granted and unregulated, but gained greater focus and encouragement under the Mayorship of Mayor Susana Villaran (2011–14). The program "Chacrita Productiva” encouraged urban agriculture for food, economic, social and environmental reasons including through the creation of allotments. Unfortunately, the vision of Villaran has been lost somewhat by her successors, but the legacy has been carried by independent growers and community groups (Santandrue 120-124). Quispe notes that agriculture continues to be “neglected by the state,” with various challenges faced by rural farmers and upholding their livelihoods (Quispe 2021). Santandreu describes Lima as a “mega-city facing mega-problems,” hence the city will need effective food planning and agricultural programs to meet urban food demand and balance against other needs (Santandreu 2018, 119). Historically, farming has always been part of Lima (Santandreu 2018, 121). In developing countries, many 1st generation migrants to the city have farming skills from their rural agricultural background, including in Peru (Cabannes 2018, 33; Santandreu 2018, 121). There are limitations to how much urban agriculture can solve Peru’s food needs, but can nonetheless make "significant

contributions to a more sustainable urban environment, more equitable land use and more diverse and nutritional diet" along with social benefits (Santandreu 2018, 123).

Figure 1. Lima with red circles indicating the number of market stalls and blue dots being supermarkets (Santandreu 2018, 118).




## Water

Water allocation poses a big challenge to urban food planning, particularly in arid environments such as Lima. Water is essential for supporting agricultural production and communities that are critical to "provide food to growing larger and larger cities" (Lazarus 2010, 12; Postel 1998,

635). Water is contested from domestic, industrial and agricultural sectors (Koscica 2014, 181; Lazarus 2010, 13). Water shortages or higher oil prices will place challenges on the agricultural community to "produce more food on less land with less water and higher input costs" (Lazarus 2010, 12-14). There is competition between "cities and the agricultural communities that supply food to urban dwellers" (Lazarus 2010, 13). There is a need for cooperation instead, such as finding a way to share or exchange water resources, as they are mutually interdependent. As Lazarus notes, people want "inexpensive, high quality food" whereas farmers want to "support their families, make a living, maintain the productivity of their farm lands, and maintain a sustainable water supply" (Lazarus 2010, 12). Moreover, our "future as a global community" relies upon efficiently meeting those interdependent aims (Lazarus 2010, 12). There are various options for improving water use, including education or recycling (Lazarus 2010, 14). With closed-loop waste treatment systems, cities can use and reuse water. Water management systems can also reduce water usage, such as Beijing's rainwater collection replacing some 90% of their groundwater usage (Koscica 2014, 182). Using reused water can help meet competing needs including food production that improves food security (Koscica 2014, 182). Meeting urban food demand or agricultural production, including in cities such as Lima, will require being careful and innovative with the use and recycling of water to meet various demands.

**Food production**

Urban farming involves growing crops and animal breeding on urban or adjacent areas based on available land and interest (Certoma 2015, 14). Urban agriculture is a compelling system. It is more than simply backyard gardens. It is an industry on the fringe of a city or town producing food and related products, not only "intra-urban" but "Peri-urban" (Cabannes 2018, 33). In developing countries, some 30% of families participate in urban agriculture for some 15-20% of world's food in total (Koscica 2014, 179; Certoma 2015, 15). Urban agriculture provides both "greater food availability and accessibility" underpinning better food security for low-income households (Koscica 2014, 179). Urban cultivation can include "horticulture, floriculture, forestry, aquaculture and livestock" leading to "crops as plantain, rice, potatoes, peppers, tomatoes, mushrooms and leafy vegetables, as well as livestock products like eggs, milk and meat" (Koscica 2014, 179; Cabannes 2018, 23). Urban agriculture can thus provide fresh, perishable and nutritious foods to low-income households, that might otherwise be too

expensive, including fruit and vegetables (Koscica 2014, 179; Dimitri 2014, 19). Urban agriculture can provide an important source of income, either from saving money otherwise spent on food, or by selling food (Koscica 2014, 179-180). There are movements to reclaim public spaces for gardens and “right to produce local food" (Certoma 2015, 13). There are "vegetable gardens … blossoming in city spaces worldwide” on the walls or roofs of buildings (Certoma 2015, 13). Eco-friendly architects can place garden-beds on the roof for residents, who can enjoy nature and produce food (Certoma 2015, 13). Critical urban gardening is a movement that encourages taking public space for flowers and vegetables to “demonstrate an alternative to the current conventional use of space” (Certoma 2015, 13). There are various benefits including self-sufficiency, dealing with climate change, and reconnecting with nature (Certoma 2015, 14).

In our globalised economy, food is increasingly part of a corporate food regime, including "agrifood corporations, globalized grain-fed meat production, giant retail" (Holt-Gimeenez 2011, 91). Most food in the United States comes from large-scale domestic or foreign farms with huge amount of fertiliser, energy and transportation costs (Lazarus 2010, 12). Large scale farms are pushing out smaller farms while also causing environmental and climate harm and “perpetuating food instability.” Harvey suggests reducing the size and increasing the number of (smaller) farms to reduce emissions in producing and transporting food crops (Harvey 2009, 76). Cities source their food from a variety of sources, thus having a hybrid food system. Cities can be relatively self-reliant with their surrounding hinterland, or be more reliant on exports and longer supply chains (Cabannes 2018, 26). Agricultural policies have historically encouraged “cash crops for export,” which are traded for imports of staple foods. Along with land degradation and climate events, many rural residents have turned into “net food buyers” (Tacoli 2013, 2). This has been a concern in Peru, with President Castillo promising to restore the balance between agro-exporters getting more benefits than farmers producing for domestic consumption (Quispe 2021). Only some 2.2% of Lima’s food demand is produced within the city territory, which makes Lima vulnerable to outside factors (Santandreu 119). Peri-urban agricultural production can be captured by richer domestic or export markets, which can promote tension between corporatist aims and local food demands (including market sellers and buyers). The ideal would be a hybrid system that does not impact negatively on local production or markets (Cabannes 2018, 27). Food deserts are low-income areas with less food access, with time or transport constraints in

finding healthy food (Alviola 2013, 106; Holt- Gimeenez 2011, 84; Battersby 2012, 147; Hillier 2016, 74-76). Supermarkets are economically motivated in their placement and operation (Dimitri 2014, 21; Hillier 2016, 77). The terminology can overlook community gardens and provide the simplistic solution 'to get a supermarket,' which may not be feasible or the most beneficial policy (Hillier 2016, 77). Where they do operate, supermarkets can outcompete local food markets, including with state support (Cabannes 2018, 36). Partnering with markets and organic producers can be even better to deliver "nutritious food for all," connect food to local restaurants and keep prices affordable (Cabannes 2018, 37).

Comparatively, informal outlets such as food carts can provide an "innovative solution to increase access to fresh food in underserved areas," such as Green Food Carts providing fruit and vegetables to New York city (Cabannes 2018, 38). The informal food sector is a big source of food for low socio-economic people (Battersby 2018, 186). Informal food retailers are highly flexible and mobile and are able to occupy the spaces that have no supermarkets" (Battersby 2018, 188). Lukaka, Zambia is unusual in intentionally supporting the informal food sector (Battersby 2018, 188). Many street vendors and markets have an important role in delivering affordable food in underserved areas in cities, bolstering the "local economy but also to food security and nutrition in urban areas" (Cabannes 2018, 55-56). There are some 1200 informal food markets meeting the needs of poorer communities in Lima (Santandreu 2018, 119). Street vendors face challenges such as "limited storage facilities, inadequate water and sanitation infrastructure, and lack of solid waste collection." Long transport distances also reduce ability to sell fresh food (Tacoli 2013, 3-4). This waste translates to less available (and more expensive) food for urban residents (Tacoli 2013, 2). Extreme weather events under climate change are projected to worsen problems with floods, temperature and humidity affecting transport and storage (Tacoli 2013, 2). Urban expansion takes up agricultural land, and often leads to poor people taking up informal settlements (Tacoli 2013, 3). However, official planning tends to overlook the people and priorities of informal settlements (Including informal food vendors) (Tacoli 2013, 3). Urban food planning generally affects food vendors with "food safety and relocation owing to road congestion, hazardous location and re-zoning" but rarely encourages them (Cabannes 2018, 56). This can affect a major source of food for people on low-incomes or living in informal settlements, who have limited income, time or cooking facilities to cook for

themselves (Tacoli 2013, 3). Some settlement resident federations made their own initiatives such as better planning for environmental hazards and where food is sold along with other infrastructure e.g. waste bins (Tacoli 2013, 3). Thus, informal food outlets can address equity and be an efficient way of meeting urban food demand.

**Resources**

Urban stakeholders have fierce competition for land and water resources, which can inhibit food production. Land, water and health are three constraints (Koscica 2014, 178). There are concerns, such as a competition for land, water, time or energy and the negative effects of gardening, such as smell, noise and water pollution (Certoma 2015, 15). Food planning is endeavouring to achieve healthier and sustainable system (Cabannes 2018, 25). Harvey notes how our environmental resources from “land, water, and farming” are essential for addressing climate change and creating an “equitable green economy” (Harvey 2009, 75). The challenge "demands better connections among cities and towns and between them and their rural surroundings” (Cabannes 2018, 27). City Region Food Systems (CRFS) aim to create more sustainable and effective food systems through linking urban and rural stakeholders (Cabannes 2018, 19-20). Food also takes up energy in the process, including in the stages of production and transportation. Sustainable food can have economic benefits while reducing transportation miles; “from farmer to plate” (Harvey 2009, 76). The Mandela Foods Cooperative is a good example of this in action (Harvey 2009, 76). Biofuels are one suggestion, though they have ethical problems (Lazarus 2010, 13). Producing food as close to the city as possible helps to reduce fuel costs and emissions. Planning is essential at every step, for example with transport infrastructure to quickly deliver perishable food to markets. 30-40% of global food is wasted, especially in lower-income countries from “inefficient harvesting, transport and storage” (Tacoli 2013, 2). There is a need for effective planning to oversee and manage these problems. There needs to be cooperation between municipal authorities and urban farmers to optimise land and resources for sustainable agriculture (Certoma 2015, 16). Positively, the current Peruvian President Pedro Castillo campaigned on helping smaller farmers, including helping farmers with irrigation, transportation and other technology to deliver their food to the cities (Quispe 2021). For another example, Food Hubs “actively connect the food supply side and demand side” (Cabannes 2018, 54). The food hub in Parma has electric vehicles to deliver local and fresh food, while reducing emissions

(Cabannes 2018, 54). Therefore, focusing on the sustainable ways of reducing the distance food is transported, and ensuring adequate storing facilities can help to meet urban food demands.

**Health**

Health is another consideration for urban food. While providing fresh local food can improve health and nutrition, there are also concerns. There can be contamination on the food from industrial metals in the soil or water, competition for space, pollution from traffic, increasing rodents (and disease), or agriculture run-off leading to water contamination (Certoma 16; Bohle 1994, 245; Tacoli 2013, 2). Using untreated wastewater for food production has been a concern in Lima (Santandreu 2018, 121). Waste can also lead to food contamination or health problems, including for children (Tacoli 2013, 2; Tacoli 2013b, 11). Strategies can minimise risk, such as growing away from roads or washing food (Koscica 2014, 183). Local government can play a critical role in improving water and sanitation, transport and storage to improve health and reduce waste (Tacoli 2013, 4). Equitable access to food is important, however should not be overlooked in the consideration of equitable access to health, including as it relates to diet and the possible contaminants presented from urban agricultural produce. Urban farming helps deliver nutritious food, connect urban and rural areas and encourage agriculture becoming more sustainable (Certoma 2015, 15). There are health benefits from urban agriculture, with community gardening, for example, giving families access to fresh and culturally relevant food (Buckingham 2005, 171). Low income women want to bolster their families diet, whereas higher income women seek gardens for environmental reasons or about the quality of food (Buckingham 2005, 178; Koscica 2014, 179). In developed countries, gardening is often citizen-led for free vegetables, community and reclaiming public space such as with allotments in the United Kingdom (Certoma 2015, 17; Buckingham 2005, 178). Hence, food production in cities can contribute to a healthier diet and better quality of life, though should be carefully managed with potential negative health impacts.

**Productivity and innovation**

The advances achieved through science and technology can boost the productivity and amount of food that can be grown in a small amount of land i.e. that which is suitable for an urban setting (Postel 1998, 629). Lack of land is the most prominent argument against urban agriculture and

the potential to bolster food security (Koscica 2014, 180). However, urban farmers demonstrate great resourcefulness in producing crops and livestock foods in diverse and challenging conditions. Various infrastructure can contribute to food security by encouraging greater production of food locally. Food can be delivered to people through various ways, such as fairs, supermarkets, food hubs, wholesale markets or delivered (Cabannes 2018, 29). Production areas are extremely varied from windows, rooftops, basements, community gardens, alongside roads or railway tracks. It also includes houses with backyard or frontward gardens, apartments with green roofs, food along the streets, larger parks or cultivated gardens. Hence Koscica notes that urban agriculture "integrates well within the existing city structure" and even effectively utilises underused spaces (Koscica 2014, 181; Cabannes 2018, 29). This was seen in Lima, with the Municipal Ordinance No. 1629 dedicating various unused spaces for urban agriculture, such as parks, school and community gardens and rooftops (Santandrue 120-124). It is not about the "size" but the "techniques" to gain the greatest productivity (Koscica 2014, 181). The success of urban agriculture comes from the challenges they face with "unrelenting competition for resources" forcing urban farmers to become more innovative and adaptive (Koscica 2014, 184).

Furthermore, hydroponics and water recycling has enabled farming to become better integrated with the urban ecosystem (Koscica 2014, 184). Hydroponic rooftop gardening can contribute 14 times conventional agriculture. Hydroponic production already produces some 60% of vegetables for some developing cities (Koscica 2014, 181). Adding food production to a city can often stress water resources, yet hydroponics allows the reuse of water, and is 70% less water intensive than soil farming (Koscica 2014, 182). Further, aeroponics, the growing of plants in the air and only watering the roots, is 70% less intensive again than hydroponics (Koscica 2014, 182). Additionally, vertical gardening is an innovative new approach, with a 30-story building potentially feeding some 10,000 a year. These could yield as much as 10-20 acres depending on food used. The main constraint is design and manufacture cost (Koscica 2014, 183). Singapore has a Sky Greens vertical farm (Koscica 2014, 184). Through emerging innovations and the increased productivity that can be produced, urban food demands can be met when applied through sustainable-driven approaches. The use of less water intensive methods such as hydroponics and aeroponics can dramatically increase productivity with limited water and space, ideal for arid environments such as Lima and other cities.

**Urbanisation**

The challenge of meeting urban food demand will only increase with rising urban populations. Within a few decades, between 50-70% of the world population (around 10 billion) will live in cities (Koscica 2014, 177; Lazarus 2010, 12). Food supply is taken for granted as a routine function by those "not directly involved," unless there are disruptions (Bohle 1994, 246). Urban migration includes many poor people seeking work, who are vulnerable to food insecurity (Battersby 2012, 141; Certoma 2015, 15). Urban expansion can take up arable farming land, which can reduce food production even while the population (and food demand) becomes greater (Cabannes 2018, 22). The aim of an equitable food system is for everyone to have food security, where they have enough "safe and nutritious food" to meet their diet and maintain an "active healthy life" (Battersby 2012, 142; Bohle 1994, 249). It is important since "food acquisition is fundamental to everyday life and health" (Hillier 2016 84). Conversely, people can suffer food insecurity where they have not enough food or even not enough healthy or varied food (Dimitri 2014, 19). Vulnerable people are those most exposed to and likely to suffer the most from disruptive shocks (Bohle 1994, 249). This can be mapped out, with Brazil developing a hunger map surveying urban residents how often they were hungry in the past months (Cabannes 2018, 41). Poverty is the main driver of urban food insecurity, as they need to buy (with limited ability to produce) food. Thus, if poverty in urban populations is decreased, there is a greater capacity for urban populations to produce food rather than relying on rural supply chains. In lower income countries, most urban residents have irregular incomes (Tacoli 2013, 1; Harvey 2009, 76). Food access can be disrupted by events occurring elsewhere (even from foreign countries), particularly for communities relying on distant imports (Tacoli 2013, 2). Food access can also be disrupted by personal circumstances (e.g. losing employment) (Tacoli 2013, 14B). The supply side of food requires effective food systems, from production to storage to distribution while the demand side relies upon "accessible markets and adequate incomes" (Tacoli 2013, 1). Focusing on equity and poverty-reduction can empower people to become more food secure.

**Benefits and Limitations**

There are some but limited opportunities for urban-produced food, but urban planning can

nonetheless bolster food security through "effective transport links, food storage facilities, adequate water and sanitation infrastructure and waste management" (Tacoli 2013, 1). Local government can support community initiatives to improve food access and security, bolstering resilience against climate change (Tacoli 2013, 1). Low income residents are also time-poor from work or commuting, leaving little time for potential food production (Tacoli 2013, 2). Food planning literature can focus on rural development, but this overlooks the opportunity for urban agriculture (Battersby 2012, 141). While urban agriculture can supplement diets with various foods, food security typically still depends on staples from rural areas (Tacoli 2013, 2). Food insecurity is a big and worsening problem, including in developed countries such as the United States (Gundersen 2011, 281, 289; Holt- Gimeenez 2011, 83). There is an increasing realisation that food systems need to be involved in urban planning, not merely rural planning (Battersby 2018, 186). Support for urban agriculture is a common proposal to address food insecurity (Battersby 2018, 186; Certoma 2015, 14). While there are debates about food production in cities, there is limited land for agriculture (particularly in expanding cities) (Tacoli 2013, 1). Urban agriculture is not a "silver bullet" for all food needs, but it can be one important tool to increase food security for the urban poor (Koscica 2014, 184). Urban agriculture addresses the equity and sustainability-based approaches to meeting food demands, and initiatives such as informal food outlets can contribute to meeting the needs of low socio-economic populations in a direct way.

**Conclusion**

The challenge of feeding a rising global urban population into the future will require a greater linkage between food and urban planning, along with a focus on equitability and sustainability. Food production comes up against resource constraints of land, water and energy, particularly when considering the development of urban agriculture. There are lessons we can gain from the city of Lima, Peru, with their advances and challenges in placing a greater focus on food in their urban planning. Lima can also benefit from learning from other examples and theories from around the world, such as advancing water recycling or developing hydroponics. As we proceed into an era of increased urban migration along with the impacts of climate change and other environmental threats, we will need much more planning, innovation and cooperation in how we design our food systems and ensure that everyone gets enough food.

Benjamin Cronshaw.

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Figure 1. FAO Proyecto NADHALI. 2016–18. “Location of popular markets and supermarkets according to the number of establishments.” In Yves Cabannes and Cecilia Marocchino (eds). 2018. *Integrating Food into Urban Planning*. London: UCL Press.