

The Little Book of LOW CARBON EATING in the city

Valeria De Laurentiis, Dexter Hunt and Chris Rogers

Editors of the Little Books series:

Dr Christopher T. Boyko and Dr Claire Coulton,
ImaginationLancaster, Lancaster University

With design by Roger Whitham, Rachael Hill and Michael Stead,
ImaginationLancaster, Lancaster University



ISBN 978-0-70442-951-2

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Acknowledgements

This book is part of the Liveable Cities project, which is funded by the UK Engineering and Physical Sciences Research Council under grant EP/J017698. Led by Professor Chris Rogers, Liveable Cities was a collaborative effort undertaken by researchers at the University of Birmingham, Lancaster University, University of Southampton and University College London. The contributions of all the members of the research consortium in helping to shape this Little Book are gratefully acknowledged.

Contents

What this little book tells you	4
Introduction	5
Comparing apples and oranges	7
Comparing eating habits	12
Tips for eating a low carbon diet	18
Promoting low carbon diets in cities	21
Summary	25
Notes	26
Resources	28

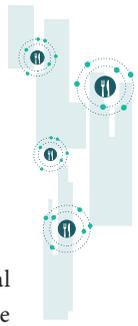
What this little book tells you

This little book presents the main findings of a study carried out as part of the Liveable Cities research project. Through this study, we conclude that:

- When talking about climate change mitigation options, food consumption and diets are often the elephant in the room
- In comparing the carbon footprint of different meals the most crucial thing is what they are made of
- When food is imported from abroad, the way it was transported is what really makes the difference
- Eating less animal based products, avoiding air freighted food and wasting less food are very powerful ways to reduce our carbon footprint
- Cities all over the world have already started to promote the uptake of this type of behaviour through a range of initiatives



Introduction



Since 2008, more than half of the world population has lived in cities. The global urban population is expected to keep growing, and by 2050, 6.4 billion people are expected to live in urban areas. Cities are places of opportunity, wealth creation and employment, where the high concentration of people translates into high levels of resource consumption and both direct and indirect greenhouse gas emissions. Direct emissions are those created within the city, for instance by vehicles and boilers. Indirect emissions are all those embedded in goods and services produced outside the city boundaries for consumption within the city, as their production is driven by the demand occurring in urban areas. This applies to food, a ubiquitous commodity, which needs to be produced elsewhere and then transported and distributed constantly within cities to make sure that supermarket aisles, restaurants and cafes are always fully stocked.

When talking about the causes of climate change, food consumption is often the elephant in the room, even though it has been estimated that between 30 and 35% of human-made greenhouse gas emissions worldwide are caused by agriculture alone (Foley et al., 2011). This applies also to cities. In the few cases where a city's emissions for consumption have been estimated (as opposed to only the emissions produced within the city boundaries), food consumption was found to be responsible for approximately 20% of the total emissions- this value is comparable with the greenhouse gases emitted by household energy use or private transport.¹ This is why a cheap and relatively easy way to reduce a city's contribution to climate change is by encouraging all its citizens to shift to low carbon diets and to reduce the amount of food they waste (as throwing away food is very inefficient from an environmental, social and economic point of view).

Reducing carbon emissions is just one of the reasons why there is a driving need for people in rich countries like ours to change what and how we eat. However, there are a number of other pressing reasons: for example, from an environmental perspective, food production contributes to water scarcity, deforestation, soil erosion and desertification, and represents a threat to biodiversity. Furthermore, from a public health perspective, non-communicable diseases, such as heart disease and diabetes, which are strongly linked to diet and which are commonly related to over- and

mal-consumption of food, are one of the main causes of premature death. As Tim Lang (2017) points out, 65% of the global population lives in countries where being overweight or obese kills more people than being underweight or malnourished. Obviously, all of this adds huge external costs to the economy. Parts of civil society, the academic world and some governments have started to believe that by identifying and promoting the necessary shifts in food consumption, these problems can be addressed together.

This little book tells the story of the research carried out as part of the Liveable Cities project. Liveable Cities is a UK Engineering and Physical Sciences Research Council-funded project involving four universities over 5 years. Our main aim is to transform the engineering of cities to deliver global and societal wellbeing within the context of low carbon living and resource security. This part of the project is focused on the relationship between our eating habits and climate change as a starting point from which to address the much more complex and multifaceted issue of the relationship between health implications and environmental impacts of diets. This comes with some limitations: it is not always true that a low carbon food choice will be good for our health or will not result in another type of environmental burden. This means that the findings presented in the following pages will need to be put into a broader context.

The purpose of this little book is firstly to define what a low carbon diet would look like, and in doing so we use a robust, scientific approach to make sure we do not fall into *common-sense myths* about sustainable food that are unfortunately quite widespread amongst the general public. Then we bring together a number of initiatives that cities have introduced to enhance food security and discuss how they also promote the uptake of the eating patterns we have previously identified.

Comparing apples and oranges



We have all been taught not to compare apples with oranges. But in this case, this is exactly what we have to do. And it's not just apples and oranges; we are going to go even further and compare all sorts of different types of food.

When experts talk about eating sustainably, they often mention that one of the best ways is to cut down on animal products, such as meat and dairy. Even though the full picture is more complex, and the impacts of food consumption depend on a number of factors (what we eat, how it was produced, where it was produced, how it arrived on our tables and how much was wasted in the process), it is true that *what* we eat plays a very big role.

As can be seen from Figure 1, there are significant differences in the greenhouse gas emissions caused by different types of food.² These emissions have been calculated by considering all the different steps of the production of a food item by a method called *life cycle assessment*. For example, it considers everything from the production of fertilizers and the irrigation of crops, up to the operations carried out by the manufacturers. Imagine, for instance, the energy used in a cookie factory! In order to compare the emissions arising from different types of food, we searched the academic literature and found 215 studies that calculated this for one or more food items. For example, in the case of beef, we collected 80 values of carbon footprint and then calculated the average. Once we had finished this task, we had the values of carbon footprint for more than one hundred types of food that are commonly eaten in British households.³ In this Little Book, we present a selection of 12 food items, and instead of showing their carbon footprint, we show the equivalent distance by car that would produce the same emissions as the production of one kilogram of

each food item.



Figure 1. The carbon footprint (CF) of different types of food (driving emissions were calculated for an average sized diesel car).

Many would criticise Figure 1 for presenting the values of carbon footprint on a “per kilogram basis”, saying that eating 1 kg of lamb is very different from eating 1 kg of carrots. Later, we will use these values as a starting point to make more meaningful comparisons. But for now, we will talk a bit more about this figure.

There are a number of interesting things that emerge from this comparison: first, that fruit and vegetables have much lower emissions than animal products; second, that beef and lamb cause five times more emissions than pork and chicken; and third, that cheese has higher emissions than pork, chicken and fish (and the same can be said for milk, cream and butter). This suggests that vegetarian recipes that have a lot of dairy ingredients may be worse for the planet than recipes with fish or chicken and also that avoiding beef and lamb is probably one of the most effective things that we can do to reduce the footprint of our diets.

The food miles debate

The carbon footprint values presented above were calculated up to the farm gate (for fresh food like tomatoes or carrots) and the factory gate (for things like canned tuna or pasta). This means that they did not include the emissions related to transporting these goods from the place of production to the distribution centres and then eventually to the supermarkets, shops and markets to be sold.

In the last few decades, food chains have become more and more globalized, and we are all aware that the food we buy in supermarkets has probably travelled a long way before arriving there. This is generally perceived as the main source of emissions caused by the food industry, but it is often not the case. Again, thanks to life cycle assessment, it is possible to calculate the emissions related to transporting goods around the world and comparing them with the emissions that these goods have already caused even before they leave the factory. By doing this, we realised that how we choose to transport food plays a big role: for example, transporting one tonne of goods by cargo ship causes ten times less emissions than transporting them by truck, and transporting them by plane causes approximately 90 times more emissions than shipping them. Not surprisingly, a study conducted in 2002 found that although only 1% of food was imported to the UK by plane, this was responsible for 12% of the total carbon emissions caused by food imports (DEFRA, 2005).

Figure 2 shows the relative emissions caused by the production and transport to the UK of one kilogram of mango produced in Pakistan, lamb coming from New Zealand and tomatoes grown in Spain. As we can see, in the case of mango, which has a carbon footprint of production similar to potatoes (represented in Figure 1), shipping it from Pakistan makes the total carbon footprint slightly more than double compared to the production phase, whilst transporting it by plane dramatically increases the carbon footprint (to the point that the production phase accounts for just two percent of the total figure). In the case of lamb, which has a much higher carbon footprint of production (see Figure 1), shipping it from New Zealand would release emissions that are negligible when compared to producing it, but if the same distance is covered by plane the transport emissions are almost equal to the emissions of production. Finally, for tomatoes produced in Spain, if they are shipped to the UK, the transport phase contributes to just 10% of the total carbon footprint, but if they are carried by truck this value goes up to more than 40%.

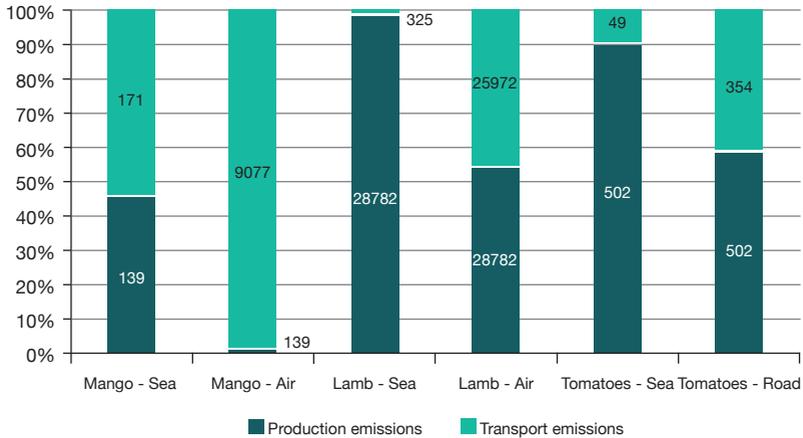


Figure 2. Relative weight of the CF of production and transport for different types of food and transport modes (the numbers in each bar are the absolute values of CFs measured in gCO_{2e}/kg of product).

In conclusion, this work shows that, in order to reduce the emissions caused by transporting food products, we should avoid transporting them by plane as much as possible and that, when feasible, shipping is the best option. Furthermore, it shows that, when food items are shipped from a reasonably close country (e.g. from Spain to the UK), transport emissions are generally much lower than production emissions; however, when items are transported by plane, the transport emissions dwarf those of production.

The importance of eating seasonal

In the previous section we discussed the impacts caused by moving food products around the globe. One could argue that in order to avoid them altogether we should always eat locally produced foods, but the reality is slightly more complex.

Let's take the case of tomatoes. In the UK, tomatoes are seasonal between June and October. This means that, outside this window of time, the tomatoes that we find in supermarkets have either been grown in heated greenhouses or have been

imported from warmer countries (such as Spain). From our research we found that the average carbon footprint of 1 kg of tomatoes grown without the aid of heated greenhouses is $502 \text{ gCO}_2\text{e}^{-2}$, whilst the average carbon footprint of 1 kg of tomatoes grown in heated greenhouses is $2935 \text{ gCO}_2\text{e}^{-}$. This value is much higher due to the high energy consumed (and related greenhouse gas emissions) when heating the greenhouses. However, the tomatoes grown in Spain (where it is not necessary to use heated greenhouses) will need to be transported to the UK. As we can see in Figure 2, shipping the tomatoes from Spain to the UK will bring their carbon footprint to a total value of $551 \text{ gCO}_2\text{e}^{-}$ and transporting them by truck to a value of $856 \text{ gCO}_2\text{e}^{-}$. Hence, if in January we want to purchase a box of tomatoes, by choosing the local option we will pick the ones whose emissions are between three and five times higher than their Spanish alternative. This simple example proves that whenever we choose to purchase locally produced food to reduce our footprint, we have to be sure that the item we are choosing is also seasonal in our country and that by eating seasonal and local food in combination, we can't go wrong.

Comparing eating habits



Three different choices of Sunday meal

The main purpose of food is to nourish us and provide us with the energy needed to lead an active and healthy life. Therefore, when comparing dietary choices to identify those that are sustainable, it is helpful to make comparisons that are based on realistic diets or meals.

In this case, we compared three families according to their usual choice of Sunday meal. In the Smith household every Sunday, a traditional roast beef with Yorkshire pudding and roast potatoes is served. The Jones family prefer a popular alternative: stuffed roast chicken and roast potatoes. Finally, the Abberley family, whose elder son has recently become a vegetarian, have now converted to a veggie option: courgette pasta bake. Each family is made up of six members, they purchase seasonal produce from the UK (whenever possible) and they have cooking appliances (oven and hob) running on electricity. The recipes in each case are illustrated in the table below, where all the quantities refer to six portions. In calculating the cooking time, we assume that in the first two recipes, the potatoes and the meat would be cooked at the same time to make this example as close as possible to reality.

Based on this information, we calculated the carbon footprint of one portion of each Sunday meal⁴. This is made up of three components: the carbon footprint of production of the ingredients used, the emissions arising from the transport of each ingredient (we have assumed that all the British ingredients were transported by truck, and those coming from overseas were shipped) and the emissions from the energy used in the preparation of the meal.

Figure 3 shows the total carbon footprint of one portion of each Sunday meal and presents a breakdown of the contribution of each of the phases mentioned above. Two things are immediately noticeable. First, that the production of the ingredients

Table 1. Recipes of three Sunday meals, all quantities refer to six portions

	Roast beef and Yorkshire pudding	Stuffed roast chicken and potatoes	Courgette pasta bake
Ingredients (6 servings)	Beef - 1500 g	Chicken - 1500 g	Courgettes - 750 g
	Eggs - 150 g	Eggs - 50 g	Pasta - 500 g
	Wheat flour - 115 g	Butter - 40 g	Garlic - 10 g
	Milk - 275 g	Breadcrumbs - 95 g	Onions - 100 g
	Potatoes - 2100 g	Onions - 300 g	Cream - 500 g
	Garlic - 30 g	Potatoes - 2100 g	Cheese - 25 g
Hob	8 min	5 min	22 min
Oven	100 min	90 min	20 min

is, in every case, the main contributor, and this is particularly true for the roast beef meal due to the high carbon footprint embedded in the production of beef, which makes all the other phases almost irrelevant in comparison. Second, we noticed that the veggie meal and the stuffed chicken have a much lower carbon footprint compared with the beef-based meal (which is in line with what is shown in Figure 1).

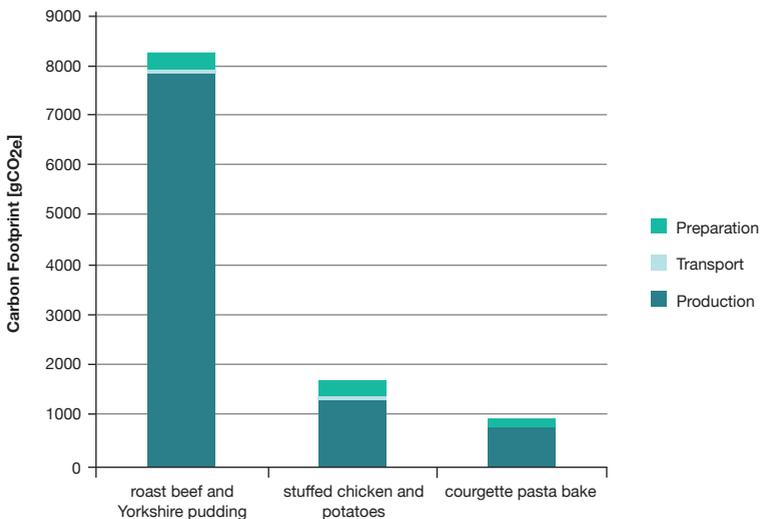


Figure 3. The CF of three different Sunday meals (per portion)

In all three cases, the emissions caused by transport are particularly low; this is because we assumed that most ingredients were sourced from the UK and that the ones imported from abroad would come by cargo ship. If instead we had assumed that most ingredients would come from overseas by truck, as we saw in Figure 2 for the case of tomatoes brought from Spain to the UK, the emissions associated with the transport phase would have been higher. The emissions caused by cooking are also relatively low, particularly for the vegetarian meal. This is due to the shorter time that this last meal needs to be in the oven compared with the other two. Furthermore, we also made the assumption that using ovens and hobs that run on electricity lead to lower emissions compared with using cooking appliances that run on natural gas. In this case, we assumed that the electricity was provided by the national grid, using the conventional electricity mix for the UK; however, if the electricity was produced instead from a larger share of renewable energy sources, the emissions from the cooking phase would be lower.

The following figures show a breakdown of the contribution of each ingredient to the carbon footprint of the three meals presented. In the roast beef option, the main ingredients by weight are beef and potatoes; however, only beef is predominant in terms of greenhouse gas emissions (which makes sense if we look at Figure 1).

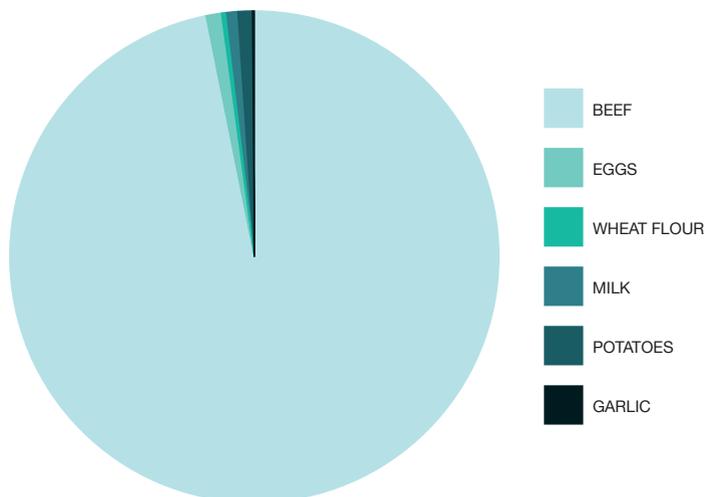


Figure 4. Contribution of each ingredient to the CF of the roast beef with Yorkshire pudding and roast potatoes

Similarly, in the stuffed chicken option, chicken and potatoes are the main ingredients, and the chicken alone causes 85% of the carbon footprint. Finally, in the pasta bake, courgettes are the main ingredient by weight, followed by pasta and cream in equal proportions; in terms of emissions, the main contributor is the cream (70%) followed by the courgettes (15%) and the pasta (10%). In each of these examples, there is one ingredient that is responsible for most of the emissions, and it is always an animal-based food item. This suggests that there is large potential for reducing the impact of traditional recipes by tweaking their composition. For instance in dishes that contain minced beef (like chilli con carne), it is possible to almost halve their carbon footprint simply by replacing half of the beef with lentils (which are a plant based source of protein).

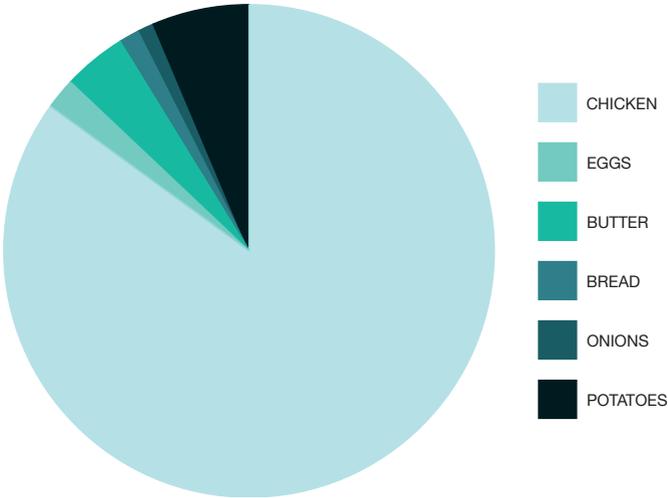


Figure 5. Contribution of each ingredient to the CF of the stuffed chicken with potatoes

The main takeaway from this example is the large gap between the beef-based Sunday roast and the other two options: approximately nine Sunday meals in the Abberley household are needed to produce the same emissions as just one Sunday meal consumed by the Smiths. This means that if the Smiths decided to replace one Sunday meal a month with the chicken option and one with the vegetarian option, they would cut their Sunday meals' emissions by 42% and save in total 1.1 tCO_{2e} in one year. Quite a big achievement for replacing just two meals a month!

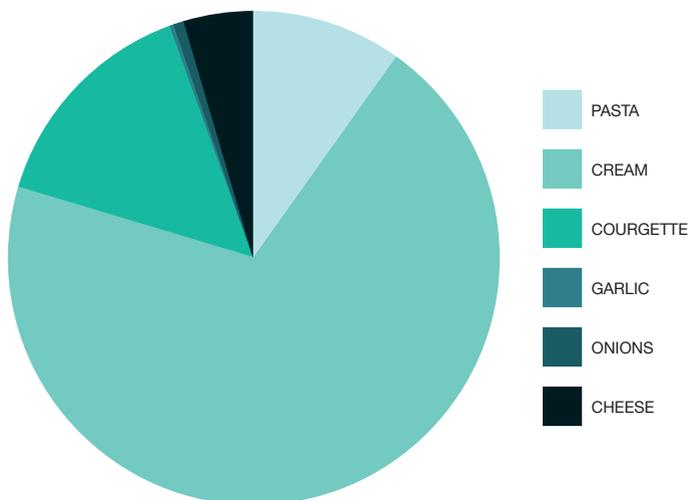


Figure 6. Contribution of each ingredient to the CF of the courgette pasta bake

Household food waste

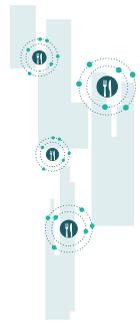
Another factor that can make a big difference in the greenhouse gas emissions caused by the eating habits of a household is the amount of food being wasted. In the UK, on average, 19% of food and drinks purchased by households is wasted (see Quedsted et al., 2012). There are many reasons for this:

- often we buy more food than needed, as a consequence of not planning our meals before going shopping;
- we do not store food correctly at home;
- a last moment change of plan, such as eating out with friends or the decision to order a takeaway, can lead to throwing away something that was about to expire and would have been cooked instead;
- we often prepare more food than what we end up eating, and then we get tired of eating leftovers, or we simply don't know how to prepare a different meal from the leftovers due to a lack of cooking skills;
- we throw away a lot of food that is still good because the (often very conservative) “use by date” or “best before” labels on the package tell us to do so.

Using the previous example, if the Abberley family had prepared twice as much pasta bake instead of cooking for six and then ended up throwing away the leftovers, the emissions per person would have been more than double (considering also that the food that goes to landfill is a source of methane, a greenhouse gas 25 times more powerful in trapping heat than CO₂). If we assume that the Joneses carefully plan their food purchases and manage to avoid wasting food, this would mean that the emissions caused by Sunday meals would be higher in the Abberley household than that of the Jones family.

A form of food waste which is often neglected is the overconsumption of food. In the UK 57% of women and 67% of men are overweight or obese (Ng et al., 2014) and research conducted by the World Resources Institute shows that there is a global trend towards an increase in overconsumption (both in terms of calories and of proteins⁵). Using the previous example again, if all the households mentioned were made up of four members, but still used the quantities expressed in the recipe for six people, the carbon footprint of a portion of each Sunday meal would automatically increase by 50%. When scaling up these increases in emissions to a city, or even a country, we realise the enormous potential offered by tackling food waste, in all of its forms.

Tips for eating a low carbon diet



Based on the findings reported in the previous two sections, we can provide some advice for eating a low carbon diet.⁶

Tip number 1: Eat less meat and dairy and more greens and pulses

The reason for this is that eating animals (and animal products) is often an inefficient way of converting natural resources (solar energy, land, water etc.) into calories and nutrients. For instance, on average 10 kg of feed is required for a 1 kg increase in the body weight of a cow (pork and chicken are more efficient, or less inefficient, needing 5 kg and 2.5 kg of feed, respectively, on average). However, this weight increase also includes parts of the animal which cannot be eaten (like bones). In order to obtain an increase of 1 kg of edible weight, the amount of feed required is on average 25 kg for beef, 9.4 kg for pork and 4.5 kg for chicken (Smil, 2002). Having said this, there are parts of the world which can only be used for pasture (e.g. sheep in the Scottish highlands), and therefore the most efficient use of land in those areas is to raise livestock.

Furthermore, some species, like cows and sheep produce significant amounts of methane during the digestive process, to the extent that livestock is considered the most important source of human-caused methane emissions globally. This explains why beef and lamb have a much larger carbon footprint than all other food types (as we saw in Figure 1) and similarly dairy products score worse than more efficient types of meat, like chicken. The World Resources Institute found that if all the cattle in the world formed one nation, they would be the third biggest greenhouse gas

emitter after China and the US!

There are many ways to reduce the consumption of meat and dairy: for instance by introducing meat-free days in our week, by reducing the meat content of meals (and partially replacing meat with plant based sources of protein like pulses) and by eating more greens and pulses in general. As it is proven that there is a large difference between the impact on climate change of red meat and white meat, another way to reduce the footprint of our diet is to eat chicken and pork more often than beef, lamb and cheese.

Tip number 2: Air-freighted food is never the best option and sometimes, locally produced food is not the best option either

As explained previously with the example of tomatoes, buying tomatoes produced in the UK out of season makes no sense from a carbon perspective, and it is better in that case to purchase the ones from Spain. Even better would be to eat tomatoes only between June and October (but this is the next tip).

As we saw in Figure 2, transporting food products by ship, even on long distances, generally has a low impact on climate change. However, this will be higher if food is transported by truck and much higher if it comes by plane. It is a good rule therefore to avoid buying air-freighted products.

A good way to follow this advice is to learn more about what types of fruit and vegetables grow in our country and when, and what species of fish live in the water bodies surrounding us.⁷ Due to the higher costs, it is generally only highly perishable food products that are transported by plane to the UK, like certain types of fruit and vegetables such as papaya and asparagus from Latin America, and some species of tropical fish (unless they are frozen, in which case they are usually shipped). So a good tip is to buy frozen seafood, unless we know it was caught relatively close by.

Tip number 3: Prefer seasonal and local food (in combination)

As we showed with the example of British versus Spanish tomatoes, local food doesn't always mean low carbon. However, when a product is both seasonal for our country and local, then it is likely to have a smaller carbon footprint than a similar item imported from abroad. On top of this, advocates of this practice would add that

locally produced fruit and vegetables are likely to be fresher, have better nutritional properties (for instance a locally produced tomato will probably have been picked more recently than those imported from overseas), and by purchasing them we would be supporting and contributing to the local economy.

On the flipside of the coin, barriers to the uptake of this behaviour are that people enjoy having availability of all the common fruit and vegetables all year round and don't like to feel restrained in their choice.⁸ Additionally they may not know what is seasonal in their country throughout the year and what recipes can be made out of seasonal goods.

Tip number 4: Buy less, waste less, eat less

One of the findings presented in section 2 is that when looking at eating habits in households, wasteful behaviour is associated with a much higher carbon footprint. One of the reasons why households waste so much food in rich countries is that, as food is relatively cheap, we tend to buy more than we need. As we explained before, once the food reaches our homes, part of it will be kept in the refrigerator for too long, and go bad, or simply will stay there until it reaches its expiry date, and will then be thrown away. Finally, there is a tendency to consume much more than we need, with all sorts of health implications, and this can also be considered a way of wasting food. All of these things suggest that more food needs to be produced compared to the amount that is required to ensure that people are nourished and have an active and healthy life, which translates into more resources being used, and more emissions being released.

There are a number of things that we can do that will help us waste less food. One is to plan our weekly meals before going shopping and sticking to the shopping list; others are to cook in batches and freeze single portions, to find new recipes to re-use our leftovers, to freeze food when it is about to go bad and finally to avoid over-consuming food and maintaining a healthy body weight.

Promoting low carbon diets in cities



So far we have talked about what consumers can do to have a low carbon diet. But as consumers will sometimes need to be pushed into following this advice, cities have a strategic role to play. Some cities have already started to actively promote low impact diets and food waste reduction in their climate action planning. In other cases, cities have started to develop their own local solutions to tackle food security and re-design food provisioning (to overcome problems like *food deserts*⁹), in the form of urban food strategies. Most of these strategies will also have an impact on the uptake of low carbon eating habits.

More of these initiatives are expected to appear in the near future as 140 cities worldwide have now committed to the “Milan Urban Food Policy Pact”¹⁰, launched in October 2015 at the World Expo. This is the first international protocol that calls for cities to develop sustainable food systems that grant healthy and accessible food to all, promote sustainable diets and reduce food waste.

In the following section, we analyse existing initiatives, providing examples of cities around the world that have implemented them, and group them into four main themes: promoting urban agriculture, increasing physical access to fresh and healthy products, conducting education campaigns and using public food as a driver of change.

Promoting urban agriculture

There are several reasons for promoting urban agriculture: it is a way to ensure a regular supply of fresh food to city dwellers that have poor access to it (because they

cannot afford it, or they live in *food deserts*, or, as is often the case, both things at the same time); it provides green spaces that enhance the liveability of cities by reducing the urban heat island effect; and it promotes social inclusion through encouraging collaborative activities.

By increasing access to fresh and affordable food, this strategy can support the desirable dietary shift described in the previous section, as participants would be likely to have a higher consumption of fruit and vegetables instead of processed foods, and by being directly involved in growing food, they will learn more about what products can be grown in their country in each season.

Among the cities that have included urban agriculture in their food strategy are:

- London, with its *Capital Growth* project,
- Amsterdam, where each primary school must have access to a nearby working garden,
- Belo Horizonte (Brazil), which besides promoting the creation of community and school gardens, runs workshops to teach the community how to grow medical plants,
- Beijing, where urban agriculture has been incorporated into city planning to avoid distribution problems connected to the delivery of food to a fast growing population,
- Dar El Salaam (Tanzania), where 60 percent of the milk sold in the city is produced within its boundaries, something they've been doing since the 1980s¹¹.

Increasing physical access to fresh produce

In order to tackle the problem of *food deserts*, and make sure that the whole population has access to healthy and affordable food, many city authorities around the world are collaborating with private retailers and farmers to increase the distribution around the city of healthy stores and guarantee quality products at low prices. Thanks to the elimination of intermediaries, they manage not only to keep prices down, but also to increase the income of small farmers. As in the previous section, this strategy can directly support a shift to a more seasonal diet with a higher intake of fruit and vegetables, and of local and seasonal produce.

This strategy has been put in place in the city of Belo Horizonte, where vendors on mobile trucks have received licences to sell in wealthy areas of the city during the

week on condition that they sell in more deprived areas during the weekend, and selected farmers have been allowed to sell at fixed points around the city, with the quality and price of products being closely regulated in both cases. And in Toronto, the city's Food Policy Council created a tool for visualising geographic gaps in the availability of healthy and affordable food, and organized a mobile vending truck to sell subsidized fruit and vegetables in underserved neighbourhoods. The city of New York organised the *Green Cart* programme, distributing 1000 licences to sell fresh products in areas of the city classified as *food deserts*, and the *FRESH* programme, that through zoning changes and financial investments encourages the planning of supermarkets in such areas. Analogously, London's authorities developed the *Green Infrastructure* project, promoting produce from neighbouring regions in the city's wholesale markets and promoting the sale of fruit and vegetables through small retailers working in deprived areas.¹²

Conducting education campaigns

Education campaigns can target different audiences like catering professionals, the general public and school pupils, teaching them about nutrition, food preparation and cookery skills, how to reduce food waste and discussing the impacts of different food choices on the environment. On top of promoting low carbon eating habits such as the ones from the previous section, this type of initiative has great potential for tackling problems such as obesity and other diseases caused by mal- and over-consumption, all related to a lack of food culture.

Many cities have implemented food related educational programmes. Some examples are:

- *Good Food Training for London* programme, which aims at making food professionals more 'food aware' (focusing on procurement choices, menu planning, nutritional outcomes, meal preparation and waste reduction);
- Workshops run in Belo Horizonte that aim to educate the wider public, on topics like healthy diets, and the safe manipulation and storage of food;
- Amsterdam's food strategy, which aims at educating younger generations through the inclusion of lifestyle and eating habits in school curricula;
- The *Love Food Hate Waste Campaign*, conducted since 2007 by the Waste and Resources Action Programme (WRAP) in the UK, with the aim of reducing the amount of food waste produced by households.¹³

Using the public food service as a driver for change

Governments and local authorities can use the ‘public food service’, which is the food served in schools, universities, hospitals, prisons etc., to influence and educate consumers about how to have a healthy and sustainable diet (by setting a good example). At the same time, it can use its purchasing power to support sustainable producers and local economies. Furthermore, through public food, cities and governments can tackle under- and mal-consumption of food, and ensure that the most vulnerable members of society, such as pupils, patients, pensioners and prisoners, have access to healthy and nutritious food.

There are several ways in which the public food service can be used to promote low carbon diets: for instance, by introducing meat free days in the menus, as was done for the first time in the USA by the City of San Francisco, or by serving seasonal and local food in school and staff canteens, as is the case of Paris. Similarly, the City of Portland aims to introduce policies that encourage the purchase of low carbon food for public meetings and events by 2020 that leverage the purchasing power of public and private institutions to source low carbon food and educate citizens on low carbon food choices.

The paramount role of this type of initiative is demonstrated by the fact that most of the cities that are considered pioneers for urban food strategies included public food procurement in their agenda, and some of them made it the main focus of it, with a particular interest towards school food programmes. One is the case of Bogotá, which centred its strategy *Bogotá sin hambre* (*Bogotá without hunger*) on a school food programme that increased the number of schools serving lunch, provided schools with kitchen facilities and improved the nutritional quality of the meals served. The school food reform that took place in Rome, which encouraged catering companies to obtain environmental certifications and to serve good quality food, shows the potential of such a measure: since Roman schools have sourced only fair-trade bananas and chocolate, the overall fair-trade market in Italy has increased by 20 percent.¹⁴

Summary



In this little book, we argue that if we want to tackle a whole range of issues (from climate change, to environmental degradation, to the public health crisis related to obesity and non-communicable diseases), a good starting point is by changing the way we eat. Focusing on the relationship between dietary choices and climate change, we have analysed the impact on the environment made by different types of food and different purchasing choices, such as buying seasonal produce or buying products that have travelled a long distance, either by ship, truck or plane. We then used this information to compare the contribution to climate change of households' eating habits, such as their choice of Sunday meal or how wasteful they are with food.

This enabled us to formulate four tips that can be followed by anyone who wishes to have a low carbon diet; these are:

- Eat less meat and dairy and more greens and pulses
- Locally produced food is not always the best option, air-freighted food is never the best option
- Prefer seasonal and local food (in combination)
- Buy less, waste less and eat less

We then went on to suggest some practical ways of following these tips, like choosing a meat free day, learning what foods are seasonal in our country throughout the year, learning how to re-use leftovers and making more use of the freezer. We then ended by discussing how cities can promote the uptake of this type of behaviour, and gave examples of some cities around the world that are already doing so through a variety of initiatives.

This little book provides an easy-to-understand introduction to low carbon diets. Thanks to the adoption of a scientific approach, we managed to go beyond common-sense advice on sustainable diets (such as the idea that eating local food is always *the answer*). Hopefully we have given you some food for thought. We also hope that you will keep our advice in mind the next time you are doing your shopping for groceries, or the next time you are devising a new food strategy or a climate action plan for the city you manage.

Notes

1. We are referring here to three studies conducted for the cities of London (UK) by Riddlestone and Plowman (2009), Oxford (UK) by Low Carbon Oxford (2012) and San Francisco (USA) by San Francisco Department of the Environment (2013).
2. To quantify the greenhouse gas emissions embedded in a product we will use the indicator of carbon footprint (CF), measured in gCO_{2e} (equivalent). For a simple explanation of what a carbon footprint is and what is the physical meaning of measuring it in gCO_{2e} , check out this article: www.theguardian.com/environment/blog/2010/jun/04/carbon-footprint-definition
3. For an overview of all the values collected please refer to De Laurentiis (2017).
4. This was done by using a calculator that we built specifically for assessing the impact of school meals, but that can be used also for homemade meals. To learn more about how this calculator works and what it looks like please refer to De Laurentiis et al (2016).
5. Available at: <http://www.wri.org/blog/2016/04/sustainable-diets-what-you-need-know-12-charts>
6. You can read more on this subject here: Garnett and Strong (2015), Lang (2017), Macdiarmid et al. (2011), and at this website: www.eatlowcarbon.org
7. You can find an overview of what is seasonal in the UK here: www.bbcgoodfood.com/seasonal-calendar
8. As a study by O’Keefe et al. (2016) pointed out, any restriction in consumer choice would not be well received as it would be felt as going “backwards” and against “progress”
9. From the USDA: *Food deserts are defined as parts of the country vapid of fresh fruit, vegetables, and other healthful whole foods, usually found in impoverished areas. This is largely due to a lack of grocery stores, farmers’ markets, and healthy food providers.*
10. Available at: www.milanurbanfoodpolicypact.org
11. You can find more information about these initiatives here: Halweil (2007), Lee-Smith (2006), Wiskerke (2009), Reynolds (2009), Rocha and Lessa (2009), Sustain (2017)

12. You can find more information about these initiatives here: Rocha and Lessa (2009), Mah and Thang (2013), Sonnino (2009a), Reynolds (2009), Toronto Public Health (2010)
13. You can find more information about these initiatives here: WRAP, Rocha and Lessa (2009), Sustain (2010), Reynolds (2009), Wiskerke (2009)
14. You can find more information about these initiatives here: Mairie de Paris (2007), City of Portland & Multnomah County (2009), Ashe and Sonnino (2013), Sonnino (2009b)

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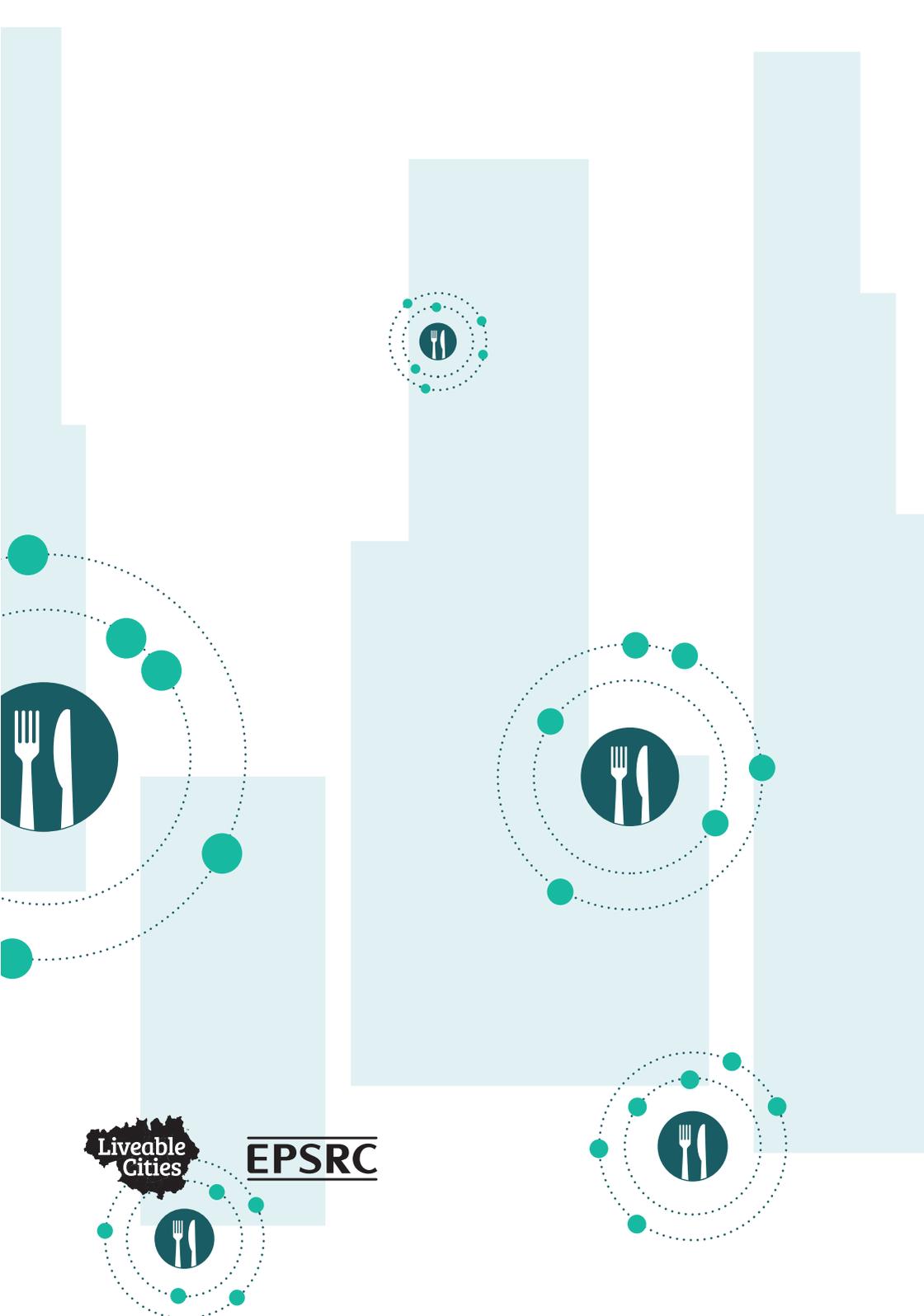
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