

MELBOURNE'S FOODBOWL

Now and at seven million

A Foodprint Melbourne report
December 2015

Funder

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Version 1.1

Section 4.2 of the report has been amended to clarify the use of long-term (from 1946 to now) urban density trends to calculate agricultural land lost to accommodate a growing urban population.

Disclaimer

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Executive Summary

Melbourne is located at the centre of a highly productive agricultural area – it is a city surrounded by its own foodbowl. This report from the Foodprint Melbourne project explores the capacity of Melbourne’s foodbowl to feed Greater Melbourne now and with a projected population of 7 million in 2050. It is the first project of its kind in Australia to model the capacity of a city foodbowl and the impact of urban sprawl on production in the foodbowl.

The key findings of this research include:

- Melbourne’s foodbowl includes multiple relatively small areas of food production scattered around the city fringe
- Melbourne’s foodbowl produces a wide variety of fresh foods, particularly fresh fruit and vegetables, but also eggs and chicken meat, and some beef, lamb, pork and dairy
- Melbourne’s foodbowl produces around 47% of the vegetables grown in Victoria and around 8% of fruit
- Highly perishable foods, such as leafy greens and berries, are typically grown in the inner foodbowl, close to the city. The outer foodbowl produces a more diverse range of foods that includes fewer perishable foods, such as fruit and vegetables, but more livestock products and some oilseeds
- Melbourne’s population is predicted to grow to at least 7 million by 2050, and Melbourne will require 60% more food to meet the population’s needs
- By 2050, around 16% of the farmland in Melbourne’s foodbowl could be lost if long-term urban density trends continue, including up to 77% of farmland in the inner foodbowl
- Melbourne’s foodbowl currently produces enough food to meet around 41% of the food needs of Greater Melbourne’s population, but by 2050 urban sprawl could reduce the capacity of the city’s foodbowl, so that it can only produce enough food to meet 18% of the city’s food needs
- Melbourne’s foodbowl currently produces enough vegetables to meet 82% of Greater Melbourne’s needs, but by 2050, urban sprawl could reduce the capacity of the foodbowl to meet Greater Melbourne’s vegetable needs to around 21%
- If Melbourne is able to accommodate the predicted population increase in a way that contains urban sprawl and retains the city’s capacity for peri-urban food production, Melbourne’s foodbowl could contribute to a more resilient city food supply in the face of increasing climate pressures on food production



SECTION 1

The Foodprint Melbourne project

1.1 Introduction

Foodprint Melbourne is a two-year project that investigates Melbourne's 'foodbowl', the highly productive agricultural region on the city fringe. It is the first project of its kind in Australia to model the capacity of a city foodbowl and the potential impact of losing farmland on food production.

Foodprint Melbourne explores the capacity of Melbourne's foodbowl to feed Greater Melbourne now and with a projected population of 7 million in 2050. It also explores the city's 'foodprint' – the amount of land, water and energy required to feed the city, and the amount of greenhouse gases and waste that are generated.

Like many other world cities, Melbourne was founded in an area with fertile soils and good water resources to provide a reliable source of food for its population. Melbourne still produces a considerable amount of fresh food on its peri-urban fringe, enough to meet around 41% of the food needs of Greater Melbourne's current population. However, the significance of 'Melbourne's foodbowl' is under-recognised, and foodbowl areas are being lost to urban development as the city continues to expand to accommodate a rapidly growing population.

This report explores the diversity of production in Melbourne's foodbowl, its significance for the city's food supply and its potential to contribute to a more resilient and sustainable food system for Melbourne in the context of rapid population growth and increasing climate pressures.

1.2 About this report

This report:

- Presents the findings from Part 1 of the Foodprint Melbourne project about Melbourne's 'Foodbowl';
- Explores the potential implications of Melbourne's projected population growth for food production in the foodbowl and the capacity of the foodbowl to feed the city; and
- Describes the methodology and data sources used for the research

About the Foodprint Melbourne project

The Foodprint Melbourne project is led by the Victorian Eco-Innovation Laboratory at the University of Melbourne in collaboration with Deakin University and Sustain: The Australian Food Network. The project is funded by the Lord Mayor's Charitable Foundation. The Foodprint Melbourne project has three parts.

Part 1: Melbourne's Foodbowl - Part 1 investigates Melbourne's 'foodbowl'. It explores what grows in Melbourne's foodbowl and the capacity of the foodbowl to feed Greater Melbourne now and as the city expands in future.

Part 2: Melbourne's 'FoodPrint' - Part 2 explores the environmental impact of producing the food required to feed Greater Melbourne's population. It investigates how much land, water and energy are required, and the greenhouse gas emissions and waste generated. Part 2 also explores the potential environmental impacts of feeding a bigger city population.

Part 3: Melbourne's regional food economy - Part 3 will explore the current economic value of Melbourne's foodbowl, and the potential costs and benefits of expanding food production in the city's foodbowl. It will also explore the potential costs and benefits of strengthening the resilience and sustainability of Melbourne's foodbowl.

1.3 Research method

Throughout the report, the research method and data sources are summarised in breakout boxes, so that the research findings can be further explored and the research approach can inform similar studies in other cities.

This research uses the Australian Stocks and Flows Framework (ASFF), which is a database and simulation system that is used to understand physical processes and resource flows (e.g. use of land, water, energy) across the domestic economy.

The ASFF can be used to explore scenarios of potential outcomes in the future as a result of actions and policy choices made now. In this project, it has been used to evaluate the potential impact of urban sprawl, and to validate other data sets by checking them against long-term trends¹.

This research has revealed some gaps and challenges in analysis of city-region food systems in Australia, and these challenges are discussed in Section 5.

1. For more detailed information about ASFF, see Turner GM, Hoffman R, McInnis BC, Poldy F, Foran B (2011) 'A tool for strategic biophysical assessment of a national economy – The Australian stocks and flows framework' and Larsen K, Turner GM, Ryan C, Lawrence M (2011) 'Victorian Food Supply Scenarios: Impacts on availability of a nutritious diet'





SECTION 2

Melbourne's foodbowl

This section defines Melbourne's foodbowl and describes what grows in its inner and outer foodbowl regions.

2.1 Introducing Melbourne's foodbowl

Melbourne is located at the centre of a highly productive agricultural area – it is a city surrounded by its own foodbowl. The term 'foodbowl' is often used to describe productive regional areas of Australia, such as the Murray Darling Basin, that are an important source of food. The urban fringes of Australia's major cities are not typically thought of as 'foodbowls', but are some of the most highly productive agricultural regions in Australia².

Melbourne's foodbowl comprises many small highly productive regions scattered around the fringe of the city. The Foodprint Melbourne project divides these regions into two areas – an 'inner foodbowl' and an 'outer foodbowl'.

The inner foodbowl is the metropolitan area of Greater Melbourne – it includes urban local government areas and the 'Interface Councils', the local government areas that are on the edge of the metropolitan fringe and border the city's Urban Growth Boundary (see Figure 1). The inner foodbowl includes well-known areas of food production, such as the Yarra Valley and the Mornington Peninsula, as well as lesser known regions, such as Cranbourne and Koo Wee Rup to the south-east of Melbourne, and Werribee to the west.

The outer foodbowl is the next 'ring' of peri-urban local government areas that includes regions in the 'Peri-Urban Group of Rural Councils', such as Bacchus Marsh and Baw Baw Shire.

Other areas of food production outside 'Melbourne's foodbowl' are also important in feeding Greater Melbourne. These include areas just outside the city's foodbowl in Melbourne's hinterland, as well as areas of regional Victoria, such as the Murray Darling Basin. Indeed, Greater Melbourne is fed by a global food system that includes other states of Australia, as well as other regions of the world. State, national and global sources of food are all important to the stability and resilience of Melbourne's food system. However, this study focuses specifically on the capacity of peri-urban Melbourne to feed the city.

Melbourne's foodbowl, including its 'inner' and 'outer' regions, are illustrated in Figure 1 on the following page. For a full list of the local government areas included in these regions, see Appendix 1.

2. Houston P (2005) 'Re-Valuing the Fringe: Some Findings on the Value of Agricultural Production in Australia's Peri-Urban Regions'

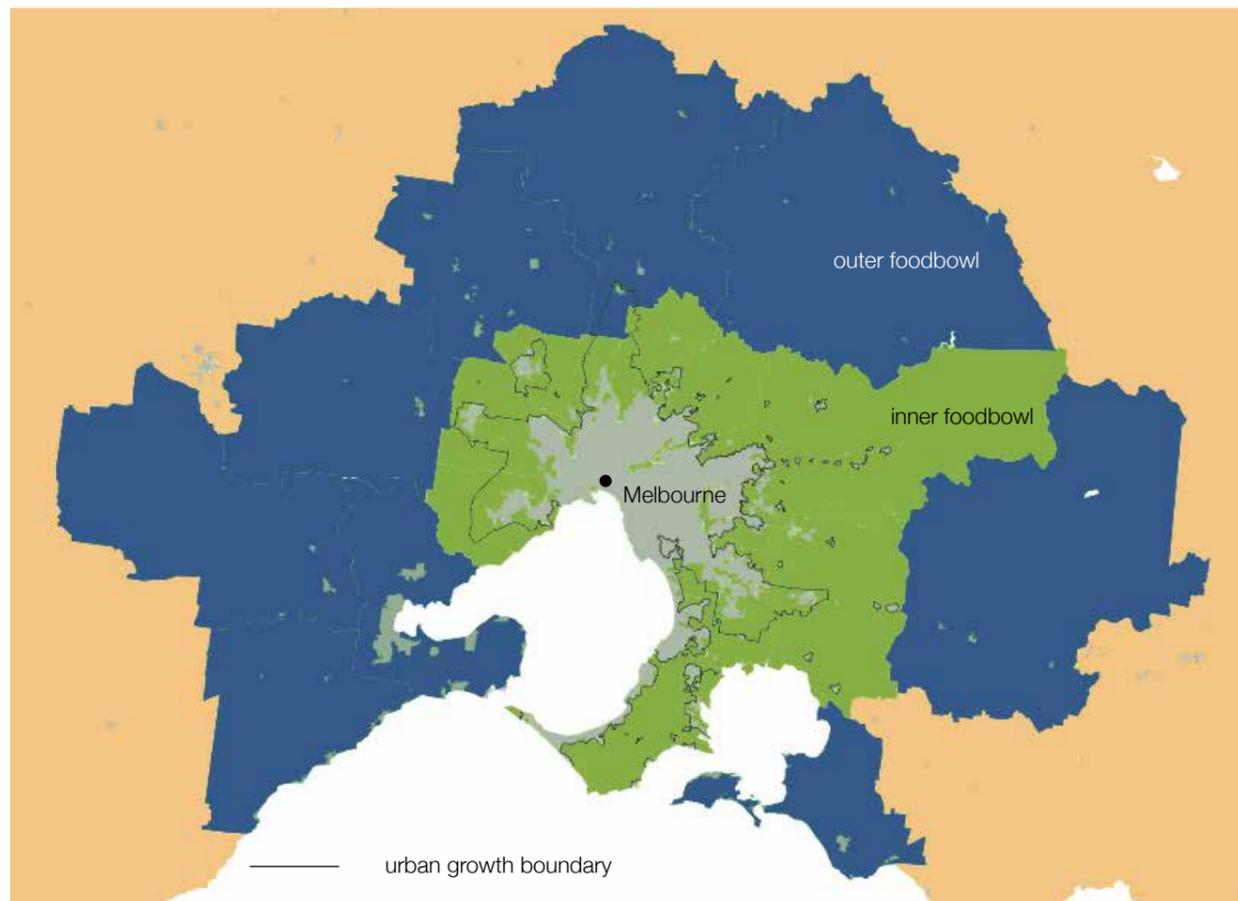


Figure 1: Melbourne's foodbowl

Melbourne's foodbowl produces a significant amount and variety of food

2.2 Food production in Melbourne's foodbowl

Melbourne's foodbowl produces a wide variety of fresh foods, particularly fresh fruit and vegetables, but also eggs and chicken meat, and some beef, lamb, pork and dairy. Melbourne's foodbowl produces around 47% of the vegetables grown in Victoria and around 8% of fruit³.

Highly perishable foods, such as leafy greens and berries, are typically grown in the inner foodbowl, close to the city. The outer foodbowl produces a more diverse range of foods that includes fewer perishable foods, such as fruit and vegetables, but more livestock products and some oilseeds.

Some areas of Melbourne's foodbowl are highly significant for the production of particular types of crops, because they have soil types, climates or other growing conditions that are ideally suited to those crops. For example, the Yarra Valley produces around 78% of Victoria's strawberries, and Koo Wee Rup grows over 90% of the nation's asparagus. See the foodbowl 'snapshots' 12, 13, and 16 for other examples.

Food production in Melbourne's foodbowl is typically intensive, high value production that takes place on relatively small areas of land. Food production that requires more land tends to take place outside Melbourne's

3. Calculated from Australian Bureau of Statistics (ABS) (2013) 'Agricultural Commodities, Australia, 2010-11', cat. no. 7121.0

foodbowl in regional Victoria. This includes production of dairy, cereals (e.g. wheat and barley), oilseeds (e.g. canola) and pulses (e.g. lentils), as well as much of Victoria's livestock grazing. Regional Victoria also accounts for a high proportion of Victoria's fruit production, including the stone fruit industries concentrated around Shepparton, the citrus and grape industry based in Mildura, and other fruit growing areas located within the Murray-Darling Basin.

There are a number of crops that Victoria produces little or none of. Rice is an 'opportunity crop' that is only produced during years of high water availability in the Murray-Darling and Murrumbidgee Basins in northern Victoria and New South Wales⁴. Other crops that require tropical conditions are grown elsewhere in Australia e.g. sugar cane or fruits like bananas and pineapples.

Table 1: % of Victoria's Production Occurring in Melbourne's Foodbowl

Food Type	% of Victoria's production occurring in Melbourne's foodbowl
Dairy	12%
Sugar	Not produced
Fruit	8%
Oil crops	7%
Cereal grains	3%
Vegetables	47%
Red meat	15%
Chicken meat	81%
Fish & seafood	Not studied
Rice	0%
Legumes	1%
Eggs	67%

% of Victoria's production

inner foodbowl
outer foodbowl
regional Victoria

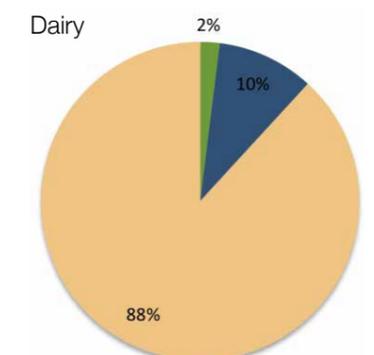
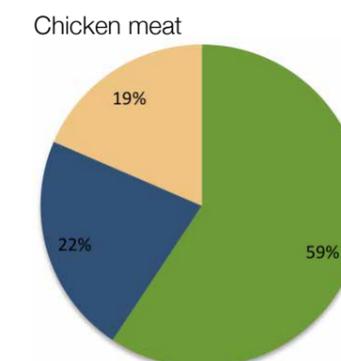
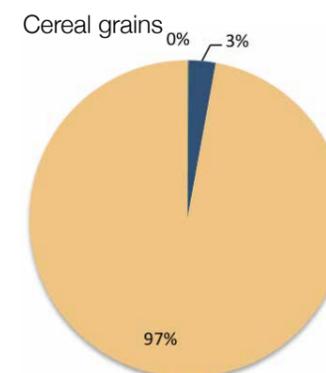
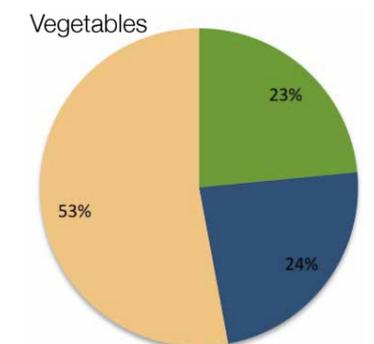
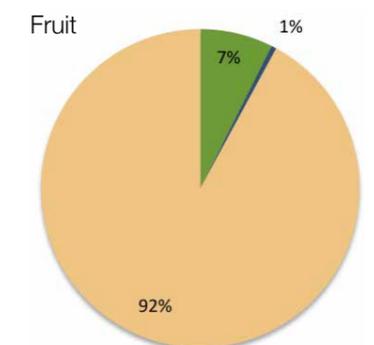


Figure 2: % of Victoria's Production Occurring in Melbourne's Foodbowl and Regional Victoria

4. Australian Department of Agriculture and Water Resources (2015), 'Rice'

Casey, Cardinia, and the Mornington Peninsula

What grows there?

Almost all of Australia's asparagus production (90%) occurs in Casey-Cardinia thanks to rich, peaty soils. The area also produces a broad variety of vegetable crops, including 70% of the state's herbs, and a little less than one fifth of the state's pumpkins, potatoes, and blueberries⁵.

Mornington Peninsula's frost-free maritime climate supports a broad range of production, including a third of Victoria's lettuce production, a quarter of the state's herbs and around 15% of a variety of horticultural crops, including strawberries and broccoli⁶.

Almost a third of the state's chicken meat production occurs in the South-East, split across Mornington Peninsula and Casey-Cardinia⁷. The area also produces excellent pastures and fodder crops that support beef cattle, some dairy cattle, and sheep for mutton and lamb.

History of the area

Market gardens have been under cultivation in the area since the late 1890s, and have made important contributions to Melbourne's food supply. In 1973, the suburbs of Clyde and Dalmore provided around 40% of Melbourne's onions, 15% of its potatoes, and 66% of its tomatoes⁸. In recent decades Mornington Peninsula has developed an increasingly strong agritourism and artisanal produce sector, including u-pick farms reliant on proximity to Melbourne⁹.

Strengths

This area has some of the state's richest soils and access to recycled water, making it a relatively drought-resilient area. The Eastern Treatment Plant is Melbourne's second largest water treatment plant, which currently produces 21 gigalitres of Class A recycled water each year¹⁰.

Challenges

The farmland in Melbourne's South-East encapsulates the advantages and challenges of farming on the city fringe. The land is highly productive across a range of commodities. However, large areas of farmland in Casey have been lost to urban development in recent expansions of the Urban Growth Boundary.

5,6,7. ABS (2013) as previously

8. Johnston et al (2004) 'City of Casey, Thematic Environmental History (Post European Contact)'

9. Stewart G (2014) 'Mornington Peninsula Shire Agricultural Analysis'

10. Bureau of Meteorology (BOM) (2015) 'Climate Resilient Water Sources'

Werribee South

What grows there?

Werribee South, 30 kilometres to Melbourne's west, is Victoria's brassica and leafy greens powerhouse. This small suburb with only 0.02% of the state's agricultural land produces 10% of Victoria's vegetables, including¹¹:

- 85% of the state's cauliflower
- 53% of the state's broccoli
- 34% of Victoria's lettuce

History of the area

Werribee South has over 3100 hectares of market gardens on rich basalt soils that were turned over to irrigated farming in the 1920s¹². It's an area of Italian heritage, with strong community and family relationships across farms as the original 12 farms of the 1920s have been divided and passed down to each generation since.

Strengths

One of Werribee South's greatest strengths is its potential to become a drought-proof foodbowl area. The Werribee South market gardens are located next to Melbourne's Western Treatment Plant. During the Millennium Drought, water allocations from Werribee River fell to just 5% of the usual allocation and a ban was placed on pumping groundwater due to risks to the water table, but market gardeners were able to continue producing vegetables using recycled water from the water treatment plant¹³.

Challenges

Recycled water from the water treatment plant is more saline than the river water, and some farmers have experienced negative impacts on crops as a result. Reducing the salinity of the water is an ongoing challenge.

11. ABS (2013) as previously

12. Wyndham City Council (2014) 'Agricultural Competitiveness'

13. Rodda C (2008) 'Background to the establishment of the scheme'

Data sources

Data about production in the foodbowl region is based on the ABS Agricultural Commodities 2010-2011. This data provides the most detailed available breakdown of crops grown in the foodbowl area. The total production of specific crops in the foodbowl was calculated by summing together data from all SA2 areas in the foodbowl. SA2 areas provide detailed data on local areas similar in size to a suburb.

2.3 Inner foodbowl

The inner foodbowl produces substantial amounts of many highly perishable crops. The area represents just 2% of Victoria's agricultural land, but contributes a significant proportion of the state's total production of some fruits and vegetables, including:

- 96% of berry fruits
- 94% of asparagus
- 92% of cauliflowers
- 88% of mushrooms
- 66% of broccoli
- 62% of lettuce
- 93% of herbs

The inner foodbowl also produces 35% of the state's eggs and 59% of the state's chicken meat¹⁴.

The highly perishable foods produced in the inner foodbowl benefit from being close to markets, sources of labour and food processing facilities. Many of the fruit and vegetable crops also rely on rich soil and reliable access to water, and most of the fruit and vegetable production in the inner foodbowl is concentrated in a relatively small irrigated area¹⁵.

Almost half of the land in the inner foodbowl region is used for agriculture, but only 4% of this land is irrigated. However, this small amount of irrigated land makes an extraordinary contribution to Victoria's agricultural production with 86% of vegetable production and 61% of fruit production occurring on irrigated land¹⁶.

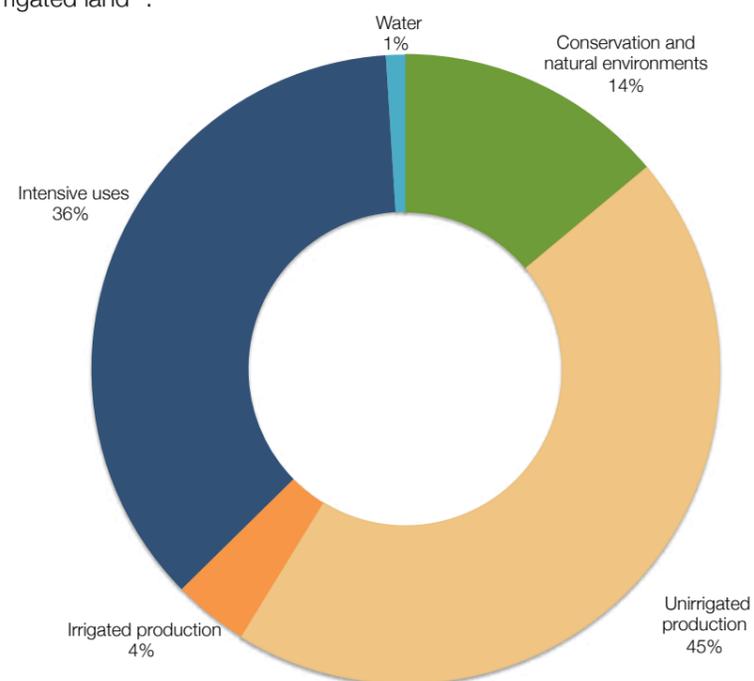


Figure 3: Current Land Use in the Inner Foodbowl¹⁷

2.4 Outer foodbowl

The outer foodbowl is also highly productive. The outer foodbowl is a diverse region of food production that grows between 10 and 15% of a broad range of crops, including fruit and vegetables, as well as livestock. However, the region produces fewer highly perishable crops, such as leafy greens and berries. The outer foodbowl produces:

- 40% of the state's potatoes
- 32% of eggs
- 24% of chicken meat
- 19% of onions
- 46% of sunflowers

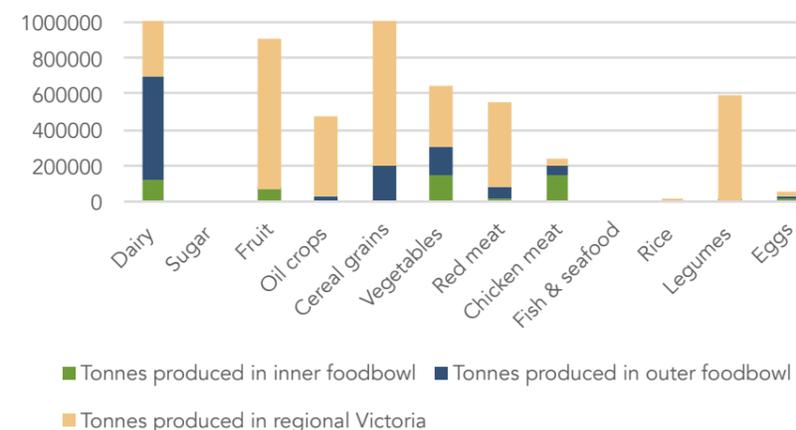


Figure 4: Proportion of Victoria's Food Production from Foodbowl Regions¹⁸

Livestock production in the outer foodbowl includes raising of sheep, beef cattle, dairy cattle and pigs. Significant amounts of chicken meat and eggs are also produced in both the inner and outer foodbowl regions.

Sheep and cattle are typically raised in 'extensive' grazing systems on pasture. However, chicken meat, egg and pig meat production is mostly 'intensive', rather than free range production, as is typical of these industries. Around 95% of pig meat in Australia is intensively produced¹⁹, 85% of chicken meat²⁰ and around 70% of eggs²¹. Although demand for free range production is increasing²², free range systems require more land, which could constrain the expansion of free range production in Melbourne's foodbowl, particularly in the inner foodbowl region.

14. ABS (2013) as previously

15. Over half of this irrigated area in the foodbowl is used to produce fruit and vegetables, calculated from ABS (2014a) 'Water Account 2012-13', cat. no. 4610.0

16. ABS (2014a) as previously

17. ABS (2012) 'Land Account: Victoria 2012', cat. no. 4609.0

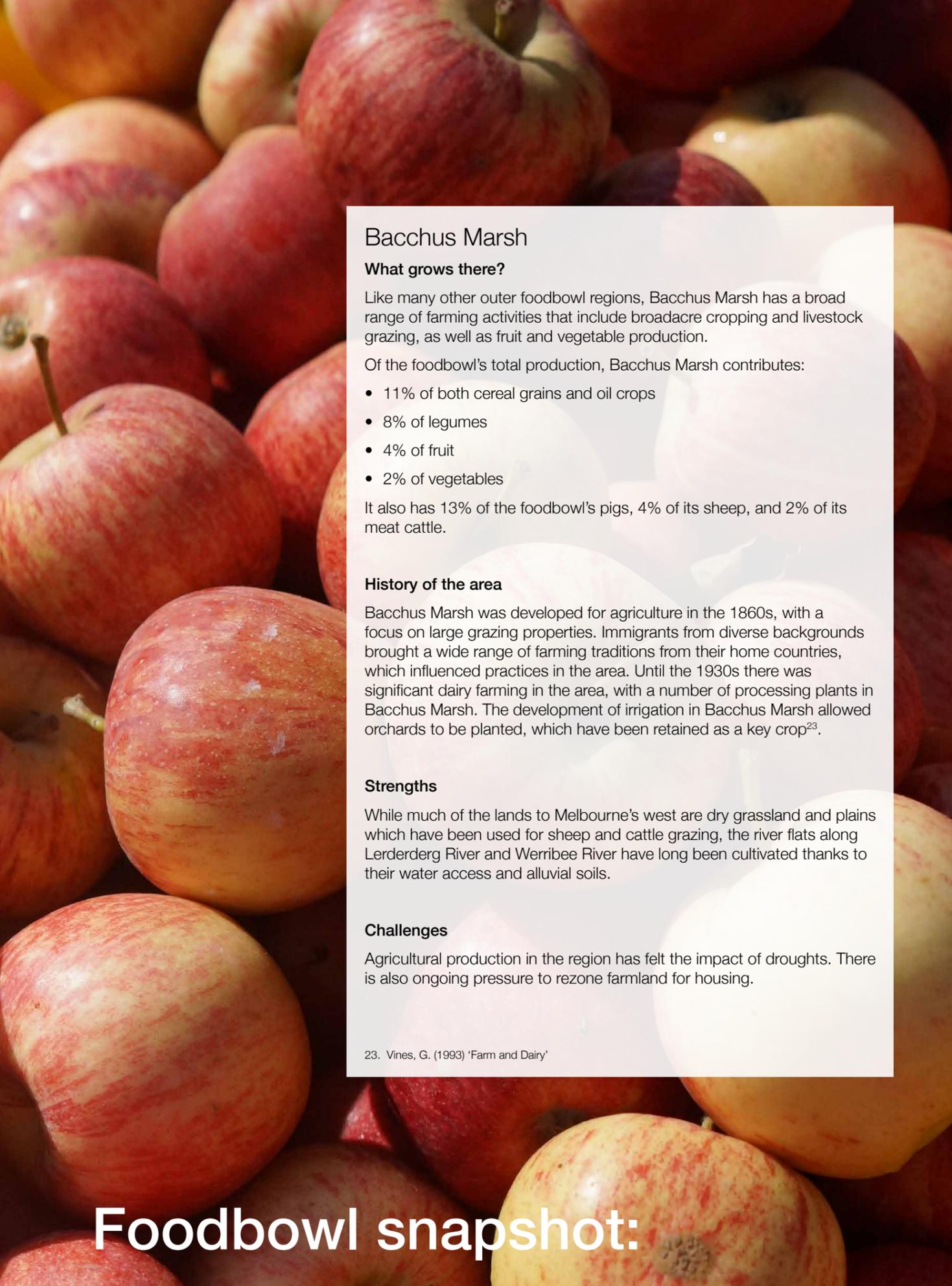
18. ABS (2013) as previously. NB. Chart capped at 1,000,000 tonnes, but dairy and cereal grain production is greater than this.

19. Australian Pork Ltd (2015) 'Types of farming'

20. Australian Chicken Meat Industry (ACMF) (2011) 'The Australian Chicken Meat Industry: an industry in profile'

21. Parker C (2013) 'Voting with Your Fork? Industrial Free Range Eggs and the Regulatory Construction of Consumer Choice'

22. ACMF (2011) as previously. Department of Primary Industries (2015) 'NSW poultry egg industry overview: intensive livestock production'



Bacchus Marsh

What grows there?

Like many other outer foodbowl regions, Bacchus Marsh has a broad range of farming activities that include broadacre cropping and livestock grazing, as well as fruit and vegetable production.

Of the foodbowl's total production, Bacchus Marsh contributes:

- 11% of both cereal grains and oil crops
- 8% of legumes
- 4% of fruit
- 2% of vegetables

It also has 13% of the foodbowl's pigs, 4% of its sheep, and 2% of its meat cattle.

History of the area

Bacchus Marsh was developed for agriculture in the 1860s, with a focus on large grazing properties. Immigrants from diverse backgrounds brought a wide range of farming traditions from their home countries, which influenced practices in the area. Until the 1930s there was significant dairy farming in the area, with a number of processing plants in Bacchus Marsh. The development of irrigation in Bacchus Marsh allowed orchards to be planted, which have been retained as a key crop²³.

Strengths

While much of the lands to Melbourne's west are dry grassland and plains which have been used for sheep and cattle grazing, the river flats along Lerderderg River and Werribee River have long been cultivated thanks to their water access and alluvial soils.

Challenges

Agricultural production in the region has felt the impact of droughts. There is also ongoing pressure to rezone farmland for housing.

23. Vines, G. (1993) 'Farm and Dairy'



Foodbowl snapshot:



SECTION 3

The capacity of Melbourne's foodbowl to feed Melbourne

This section outlines how much food is required to feed Melbourne and how much of this food can be produced by Melbourne's foodbowl.

3.1 How much food is needed to feed Melbourne?

Greater Melbourne's current population of around 4.37 million requires around 15,080 tonnes of food per day, which is equivalent to around 3.45kg per person.

Melbourne's food needs have been estimated based on the average Australian diet, using data from the Australian Health Survey²⁴. The population of Melbourne is defined as the population of Greater Melbourne²⁵, which is also equivalent to the population of the 'inner foodbowl' region. See the 'Data sources' breakout box for more information about the data and calculations behind this estimate. The typical daily Australian diet is detailed in Table 2 below.

Feeding Melbourne for a day requires around 15,080 tonnes of food – 3.45kg per person per day

Table 2: Per capita Food Requirements in the Typical Australian Diet

Foodstuffs	Grams eaten per person per day
Dairy	322.4
Fruit	218.8
Vegetables	184.8
Cereal grains	144.3
Sugar	76.2
Chicken meat	51.7
Beef & veal	48.1
Eggs	29.7
Pig meat	26.7
Seafood	26.6
Oils	23.2
Rice	19.4
Legumes	16.9
Mutton & lamb	11.1
Nuts	8.4
Salt	2.0
Total food:	1210.2

24. ABS (2014b) 'Australian Health Survey: Nutrition, 2011-12', cat. no. 4364.0

25. See Appendix 1 for the full list of local government areas included in this definition of Greater Melbourne.

Data sources

The food needs of Greater Melbourne have been estimated for a current population of 4.374 million, which is the sum of the populations from each local government area in Greater Melbourne¹⁷. The amount of food required to feed the population of Greater Melbourne²⁸ was calculated using data from the ABS Australian Health Survey: Nutrition (2011-12), which is the first survey to look in detail at what Australians eat.

Each individual item within the average diet was broken down by weight into the ingredients used to make it, and these were categorised into broad food groups - such as cereals, legumes and vegetables - to estimate a total amount of each food group that the average person eats. This data was then used in the Australian Stocks and Flows Framework to estimate how much food must be produced in each food group in order to meet this food requirement. For example, the average person's daily consumption of savoury and rice snack biscuits is 5.2 grams, of which 1.6 grams is allocated to cereals, 0.9 g to rice, 0.2 g to sugar and so on. The entire average diet was allocated in this way to obtain a total weight of each crop type that the average person consumes on a daily basis.

To produce enough food to meet the average Australian's requirement of 3.45 kg per day, significantly more food needs to be grown because a lot is wasted or spoiled²⁶. Estimates of food waste through the food supply chain range from 30-50%²⁷. For example, an extra 45% of fruit is required to compensate for inedible parts, such as apple cores or banana peels, as well as other waste, while it takes around 138 kg of sugar cane to produce 1 kg of sugar.

The amount of waste for each type of food has been taken into account in estimating the required production for Greater Melbourne's current population of 4.37 million people. A total of 15,080 tonnes needs to be produced in order to feed Greater Melbourne. The breakdown of the food requirement is detailed below.

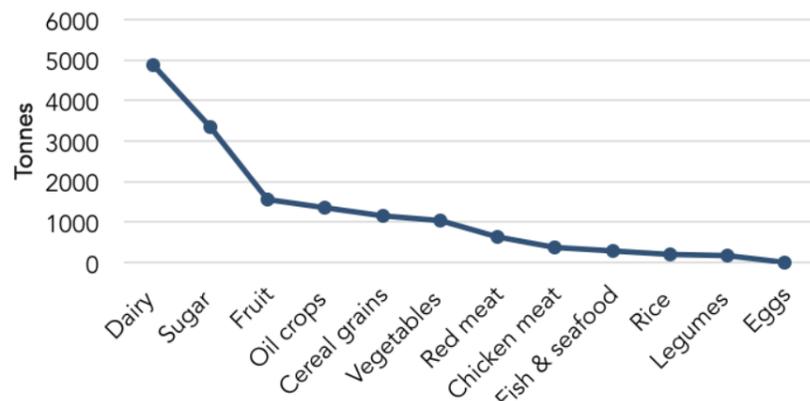


Figure 5: Tonnes of Food Required Each Day to Feed Melbourne

3.2 How much of Melbourne's food can be produced by Melbourne's foodbowl?

Melbourne's foodbowl produces enough food to meet a substantial proportion of the food needs of Greater Melbourne – around 41%, as shown in Figure 6 (See Appendix 2 for more detail).

Melbourne's foodbowl produces enough food to meet around 41% of Melbourne's food needs



Figure 6. Excerpt from Melbourne's Foodbowl Infographic

26. Some of the 'weight' is also removed in processing of the food.

27. Institution of Mechanical Engineers (2013) 'Global Food: Waste not, want not'

28. Calculated from Department of Environment, Land, Water and Planning (DEWLP) (2015) 'Victoria in Future 2015'. There are some alternate estimates of the current population of Greater Melbourne that draw on different definitions of Greater Melbourne. See Appendix 1 for a list of the local government areas included in this definition of Greater Melbourne.

Melbourne's foodbowl is able to meet a high proportion of the city's food needs for some types of foods, including 82% of fresh vegetables (see Figure 6). It also produces a surplus of some types of foods. (see Table 3).

Table 3: % of Melbourne's Vegetable Needs Met by Melbourne's Foodbowl

Vegetable crop	Grams consumed per person each day	% of food needs met by inner foodbowl	% of food needs met by outer foodbowl
Vegetables overall	184.8	42%	42%
Potatoes	46	42%	>100%
Tomatoes	14	5%	7%
Carrots	9	22%	<1%
Broccoli	6.5	>100%	<1%
Lettuces	5	18%	<1%
Onions and garlic	3	29%	92%
Mushrooms	1.4	>100%	<1%

Figure 7 shows the capacity of Melbourne's foodbowl and regional Victoria to meet Melbourne's food needs.

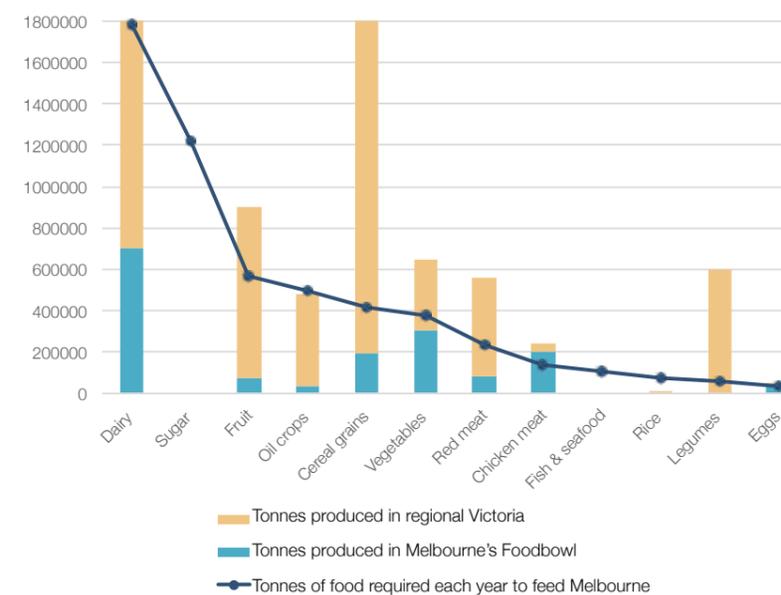


Figure 7: Current Capacity of Melbourne's Foodbowl and Regional Victoria to Meet Melbourne's Food Needs²⁹

Data sources

The amount of food produced in regions of the foodbowl was estimated using production data from the ABS Agricultural Commodities 2010-2011.

The production data was classified into the same food groups as the consumption data, and the proportion of Melbourne's annual food needs met by the foodbowl was estimated by comparing food needs to food production for each food group. To determine the proportion of total food needs met by the foodbowl, the contribution each food group makes to the overall diet was multiplied by the fraction of food needs met by the foodbowl, and the figures for each food group were added together.

Combining production figures into broad food groups reduces the sensitivity of comparing food needs to production. For example, if 90% of our fruit consumption was a crop that doesn't grow in the foodbowl, like tropical fruit, then the data would still show that we could meet 13% of our fruit needs locally, because we could meet those needs from other fruits that are produced in the foodbowl.

29. See Appendix 2 for detailed breakdown

There is little data available to understand how much of the foodbowl's production is consumed in Greater Melbourne

3.3 How much food do Melbournians eat from Melbourne's foodbowl?

It is possible to estimate how much food is consumed in Melbourne and how much food Melbourne's foodbowl produces, but there is little data available to indicate how much of the food produced in the foodbowl is actually transported to and consumed in Greater Melbourne.

Food imports to and exports from Australia are relatively well understood, but there is little publicly available data about how much food moves interstate or between major population centres within states. For further details see Section 5, Research Challenges.

Seasonal shifts in production also make it difficult to estimate how much of the food produced in the foodbowl is consumed in Melbourne. For example, the data indicate that the foodbowl could meet all of Melbourne's needs for berry fruits. However, it is unlikely that this is the case because berries are produced during a distinct season, whereas consumers have become accustomed to eating most foods year-round and are likely to source berries from other states or overseas outside of the Victorian production period.

The table below shows the seasonality of strawberry production across Australia, and the proportion of Australia's total strawberry production from each state. This suggests that Greater Melbourne sources berries from other states during its winter, and that Melbourne's foodbowl most likely meets other states' berry needs during its production season. Similar patterns of seasonal production and sourcing can be expected across most fresh fruit and vegetable crops.

Table 4: Australian Seasonal Availability of Strawberries³⁰

State	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	% of Total Production
Vic													32%
QLD													33%
WA													22%
SA													10%
Tas													2%
NSW													1%

For some foods, other parts of Victoria or Australia are inherently more suitable for production than Melbourne's foodbowl, so demand in Melbourne is unlikely to ever be met from the foodbowl. For example, bananas make up about 8% of Melbournians' fruit intake³¹, but 95% of Australia's banana-growing is concentrated in Queensland³².

30. Strawberries Australia Inc (2015) 'Facts & figures & other information'
 31. ABS (2014b) as previously
 32. ABS (2015) 'Agricultural Commodities, Australia, 2013-14', cat. no. 7121.0





SECTION 4

Feeding Melbourne in 2050

4.1 How much food will be needed to feed Melbourne in 2050?

Melbourne is Australia's fastest growing capital city³³, and Greater Melbourne is projected to reach a population of around 7 million by 2050³⁴. The population in the outer foodbowl is also likely to increase by 80%, reaching almost 900,000 by 2050 (the population of the outer foodbowl is not included in the estimate of Greater Melbourne's population).

If Melbournians eat the same diet as they currently consume³⁵, and a similar amount of food is wasted through the food chain, Greater Melbourne will require 60% more food to feed its population by 2050 – around 24,132 tonnes of food per day, at an average of 3.45 kg per person.

4.2 Land loss in Melbourne's foodbowl

By 2050, Melbourne's population is likely to grow by at least an additional 2.63 million people to reach a population of 7 million. This analysis models the possible impact of the predicted population growth on loss of agricultural land and productive capacity in Melbourne's foodbowl, if long-term trends of decreasing urban density are continued. That is, it models the potential impacts of maintaining the long-term trend. Density rates approved by the Metropolitan Planning Authority³⁷ were used, closely validated against Melbourne's urban growth trend from 1946 to now.

If that long-term rate of urban density were maintained, population growth would need to continue to displace farmland to provide the required houses and infrastructure for 7 million people by 2050. If the long-term existing rate of urban density is continued, Melbourne's Urban Growth Boundary (UGB) is also likely to continue to be exceeded. The current Victorian state government has indicated that it intends to maintain the existing UGB³⁸. However, Melbourne's UGB has been moved four times since it was instituted as a permanent boundary in 2002³⁹. There is ongoing pressure for further expansion, and the State Planning Policy Framework currently lacks effective measures to prevent further loss of productive agricultural land⁴⁰

There is likely to be greater loss of farmland in the inner foodbowl compared to the outer foodbowl, because higher population growth is predicted to occur in this region⁴¹. As a result, the impact on foods grown mostly in the inner foodbowl region, such as vegetables, is likely to be particularly significant (see the next section).

Data sources

The estimate of Melbourne's population in 2050 is based on projections from 'Victoria in Future 2015' published by the Department of Environment, Land, Water, and Planning. These projections were also crosschecked with ASFF modelling for the region.

Projections for Melbourne's population at 2050 vary from 7 million to almost 8 million, with different fertility and migration assumptions underpinning the various figures. Plan Melbourne predicts that Melbourne 'could grow by another 3.4 million people to become a city of around 7.7 million people by 2051'³⁶. However, the more conservative estimates used in this project place Melbourne's growth at closer to 7 million by 2050.

The estimate of the food required to feed Greater Melbourne in 2050 is based on the average Australian diet consumed in 2015, and the same rate of food waste (see section 3.1). The average requirement per person has been multiplied by a population figure of 7 million.

By 2050, around 16% of the farmland in Melbourne's foodbowl could be lost if long-term urban density trends were maintained, including up to 77% of farmland in the inner foodbowl

33. DEWLP (2015) as previously

34. This is a conservative estimate for Melbourne's population growth, based on projections from the DELWP. See 'Data sources'

35. This is a conservative assumption about food consumption given current trends for increasing food consumption, which will be further explored in later stages of the project.

36. Victorian State Government (2014) 'Plan Melbourne'

37. The current approved density rate for growth areas has been 15 dwellings per hectare in recent years (Growth Areas Authority, 2009), and is now considered to be 17 dwellings per hectare on a net developable area of 70-80% (Metropolitan Planning Authority, personal communication)

38. Victorian State Government (2015) 'Plan Melbourne Refresh Discussion Paper'

39. Millar R (2012) 'Government shifts green wedge boundary'

40. Buxton M and Carey R (2014) 'The use of planning provisions and legislation to protect peri-urban agricultural land'

41. Estimates of population growth in the inner and outer foodbowl regions are drawn from DELWP (2015) 'Victoria in Future 2015'. See 'data sources' for further information.

Data sources

The amount of farmland that could be lost in Melbourne's foodbowl has been estimated using ASFF. This estimate draws on data from 'Victoria in the Future 2015' about projected population growth to 2031 in the local government areas that make up the inner and outer foodbowl regions. This projected population growth has been modelled out to 2050 using ASFF.

The estimate also draws on data about land use from the 2012 ABS Land Account for Victoria⁴⁵. In projecting changes in land use due to future urban expansion, assumptions have been made about which types of land would likely be lost e.g. water bodies are unlikely to change, and conservation land is unlikely to experience significant change as it comprises public use areas or is protected for the most part by law. The majority of land has been lost from the land use categories of irrigated and unirrigated production. Estimates of the amount of land that would be lost to accommodate population growth are based on long-term density trends in Melbourne, cross-checked with the approved density of development for growth areas. Estimates also include land still in agricultural production that has already been rezoned for urban development and is within the UGB.

This estimate of the amount of farmland that is likely to be lost in Melbourne's foodbowl by 2050 has been modelled using the Australian Stocks and Flows Framework, drawing on population data from the Victorian Government⁴² and land use data from the Australian Bureau of Statistics⁴³. The estimate draws on land use data from 2012 and therefore includes land that was still in agricultural production at that time, but has already been rezoned for urban development. In some cases, this land has already been converted to urban uses. See the section on 'Data sources' for further information.

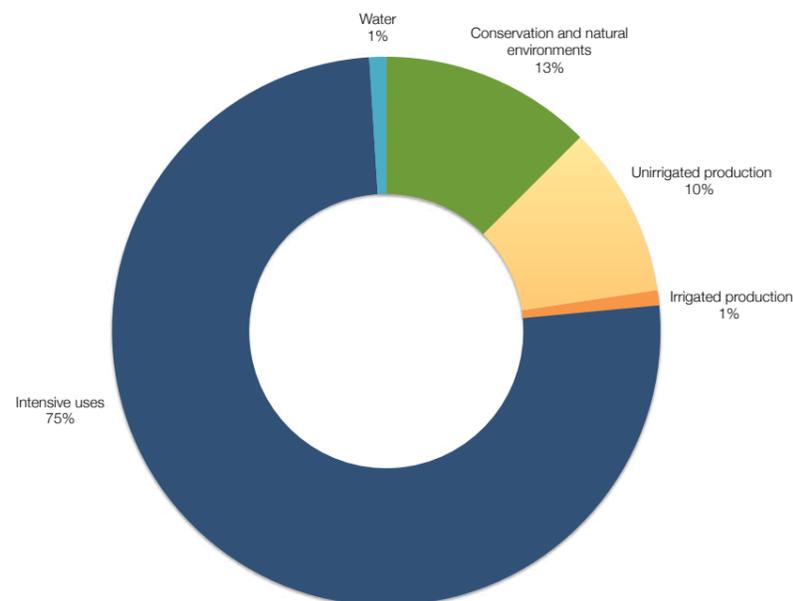


Figure 8: Estimated Land Use in Inner Foodbowl in 2050

By 2050, the area required for intensive use in Greater Melbourne could increase to around three quarters of the total land area in order to accommodate the predicted population growth. Many of the local government areas that are likely to see significant population growth are food-growing regions in Melbourne's foodbowl: while the Victorian population is projected to increase by almost 40% between now and 2031, Casey's population is predicted to increase by 66%, Cardinia by 113%, Wyndham by 116%, Melton by 130%, and Mitchell by 145%⁴⁴.

4.3 How much of Melbourne's food needs will be met by the foodbowl in 2050?

Losing around 16% of farmland to accommodate a population of 7 million by 2050 would have a significant impact on the capacity of Melbourne's foodbowl to produce food. At the same time, the demand for food will increase by 60% to meet the food needs of an extra 2.63 million people. As a result, the foodbowl's capacity to meet the food needs of Greater Melbourne's population is likely to fall from 41% in 2015 to 18% by 2050.

The impact on production in the foodbowl is likely to vary across food types (see Table 5). Only 2% of legume production is likely to be lost, but 59% of vegetable production and 64% of fruit production.

Table 5: Estimated Loss of Production in Melbourne's Foodbowl by 2050

	% of production lost in the foodbowl by 2050
Fruit	64%
Vegetables	59%
Chicken meat	48%
Eggs	36%
Beef & veal	16%
Dairy	10%
Cereal grains	8%
Pig meat	5%
Mutton & lamb	5%
Oils	4%
Legumes	2%

Fruit and vegetable crops will be most affected by this change in land use, because they are water-intensive crops that are particularly reliant on irrigation. Irrigated land currently occupies only 4% of land in the inner foodbowl, and three quarters of this land is likely to be lost to urban expansion.

The capacity of Melbourne's foodbowl to meet Greater Melbourne's food needs is likely to fall to 18% in 2050

42. DELWP (2015) as previously

43. ABS (2012) as previously

44. DELWP (2015) as previously

45. ABS (2012) as previously

This will particularly affect production of vegetable crops in the inner foodbowl as 86% of vegetable crops are irrigated, and they occupy almost 44% of all irrigated land. Losses of unirrigated farmland are also likely to affect vegetable production. As a result, urban expansion could displace the majority of vegetable production in Melbourne's inner foodbowl. Vegetable production in Melbourne's outer foodbowl is likely to be less affected. However, the capacity of Melbourne's foodbowl to meet the city's vegetable needs is likely to fall from 82% in 2015 to 21% by 2050.

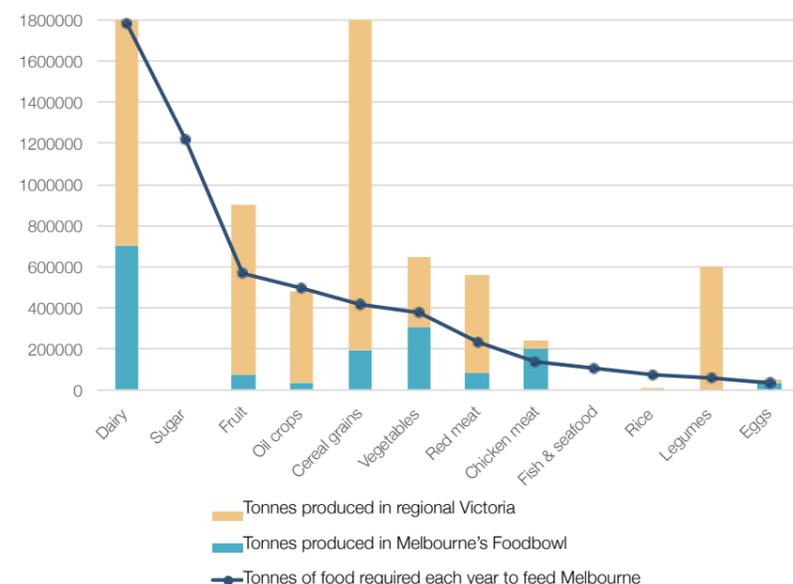


Figure 9: Current Capacity of Melbourne's Foodbowl and Regional Victoria to Meet Melbourne's Food Needs⁴⁶

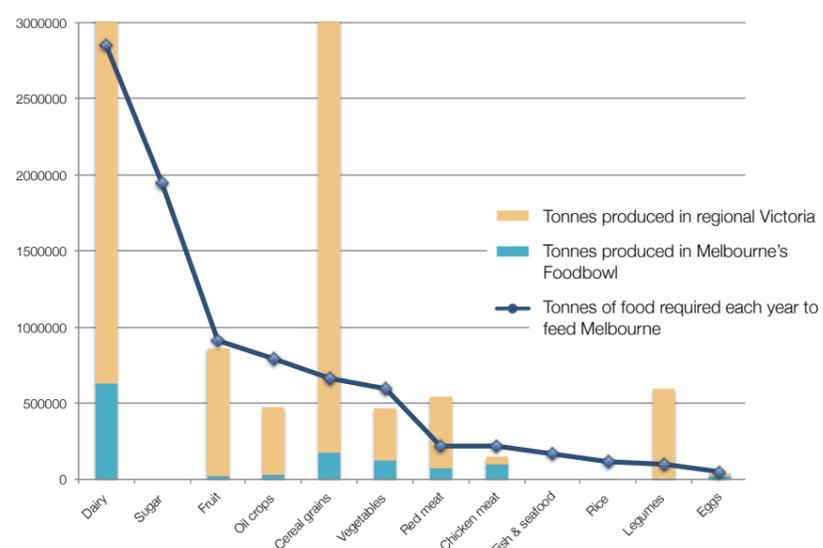


Figure 10: Capacity of Melbourne's Foodbowl and Regional Victoria to Meet Melbourne's Food Needs in 2050⁴⁷

46, 47. See Appendix 2 for detailed breakdown

Livestock and dairy production in Melbourne's foodbowl is likely to be less affected, because it is more concentrated in the outer foodbowl, where there is expected to be less urban sprawl. However, the foodbowl's capacity to meet Greater Melbourne's dairy needs could fall from 39% of total needs currently to 22% in 2050. The capacity of the foodbowl to meet requirements for red meat will fall from around 37% of total needs currently to 34% in 2050.

Some food groups (pig meat, chicken meat and eggs) were not included in our land use calculations due to a lack of data about land requirements, and will likely lose more production than is indicated here.

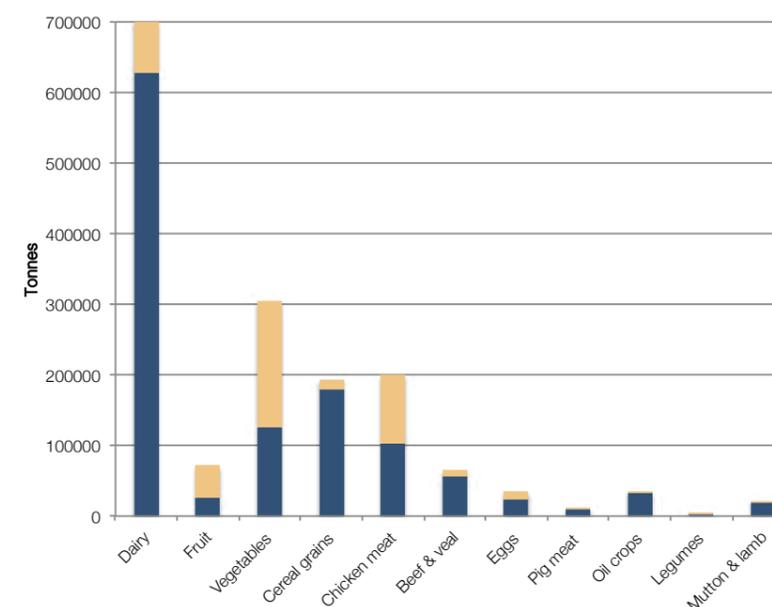
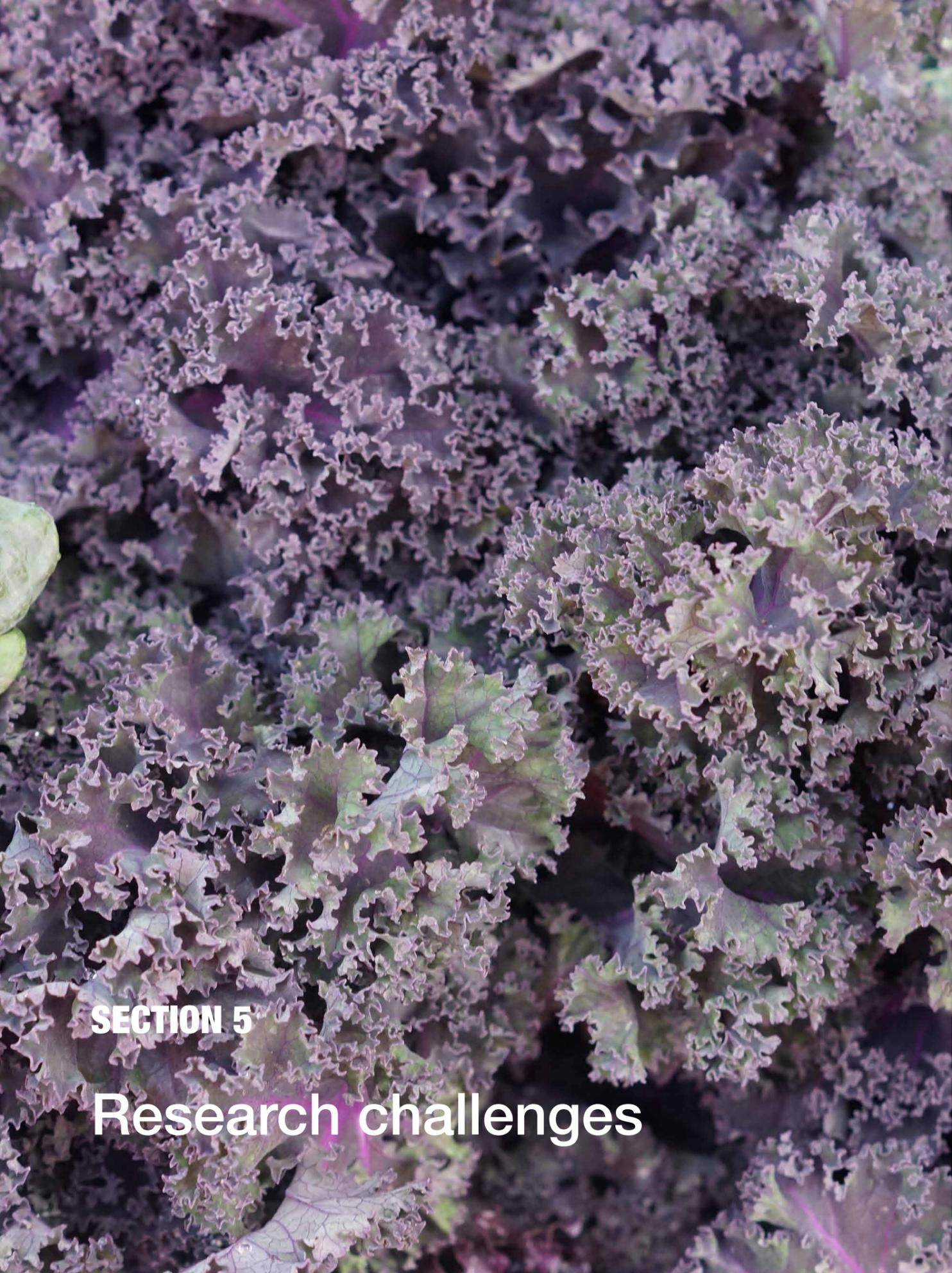


Figure 11: Estimated Loss of Production in Melbourne's Foodbowl by 2050

48. ABS (2014c) 'Water Use on Australian Farms, 2012-13' cat. no. 4618.0

Data sources

The impact of the projected loss of farmland on production in Melbourne's foodbowl was estimated using ASFF, as well as a range of external sources. The proportion of land used for irrigated and non-irrigated production was estimated using ABS Water Use on Farms cat. no. 4618 data⁴⁸. Livestock were measured as 'head' of livestock, and the land used by livestock was estimated by applying the proportion consumed of volume of sown pasture to the hectares of sown pasture in the relevant area. However, pigs and poultry were not allocated a land area. Hectares of irrigated production were proportionally removed from land used by each crop and the proportion each crop used of the total 'unirrigated' land remaining was estimated.



SECTION 5

Research challenges

This project is the first of its kind in Australia to model the capacity of a city foodbowl and the impact of land loss on food production. It is therefore likely that there will be some gaps in the data and potential to improve the methodologies. In this section, we summarise some of the challenges encountered.

5.1 Data sources cover geographical areas with different 'shapes'

One of the challenges in this project is changes in the shape of statistical areas across different years and datasets. For example, the ABS changed their standard statistical areas in 2006, which hinders direct comparison between pre- and post-2006 datasets. Where possible, data was drawn from the smallest statistical areas possible to create new areas which best matched the definitions of Greater Melbourne and Melbourne's foodbowl. This data was also used to map the proportions of older statistical areas. Occasionally, direct comparison of data was not possible. In these circumstances, data was used that was representative of the area studied and the proportions of that area were applied.

5.2 ABS production data

Much of the data used for this project was drawn from government sources, either directly from government departments or from government agencies such as the Bureau of Meteorology and the Australian Bureau of Statistics. In some cases, this data had a high level of error or statistical inaccuracy. This project has used the best available data, with the knowledge that in places the best available data may not precisely reflect on-the-ground reality, particularly in 'difficult to track' fields such as agricultural commodities or freight. In general, ABS Agricultural Commodities data have been found to underestimate production, particularly in peri-urban areas, which often have multiple crops that are under constant harvest. Where detailed audits have been conducted, they have sometimes found significantly more production than is reported by the ABS⁴⁹.

Where there were known weaknesses in some ABS data, this project has attempted to mediate those by using ASFF to calibrate current data points with long-term historical data as a way of validating assumptions and trends. This modelling smooths 'bumps' in data (e.g. decreased production during a drought year) and enables a focus on longer term trends.

49. Houston P (2005) as previously, and Stewart G (2014) as previously.

5.3 Movements of food from production to consumption

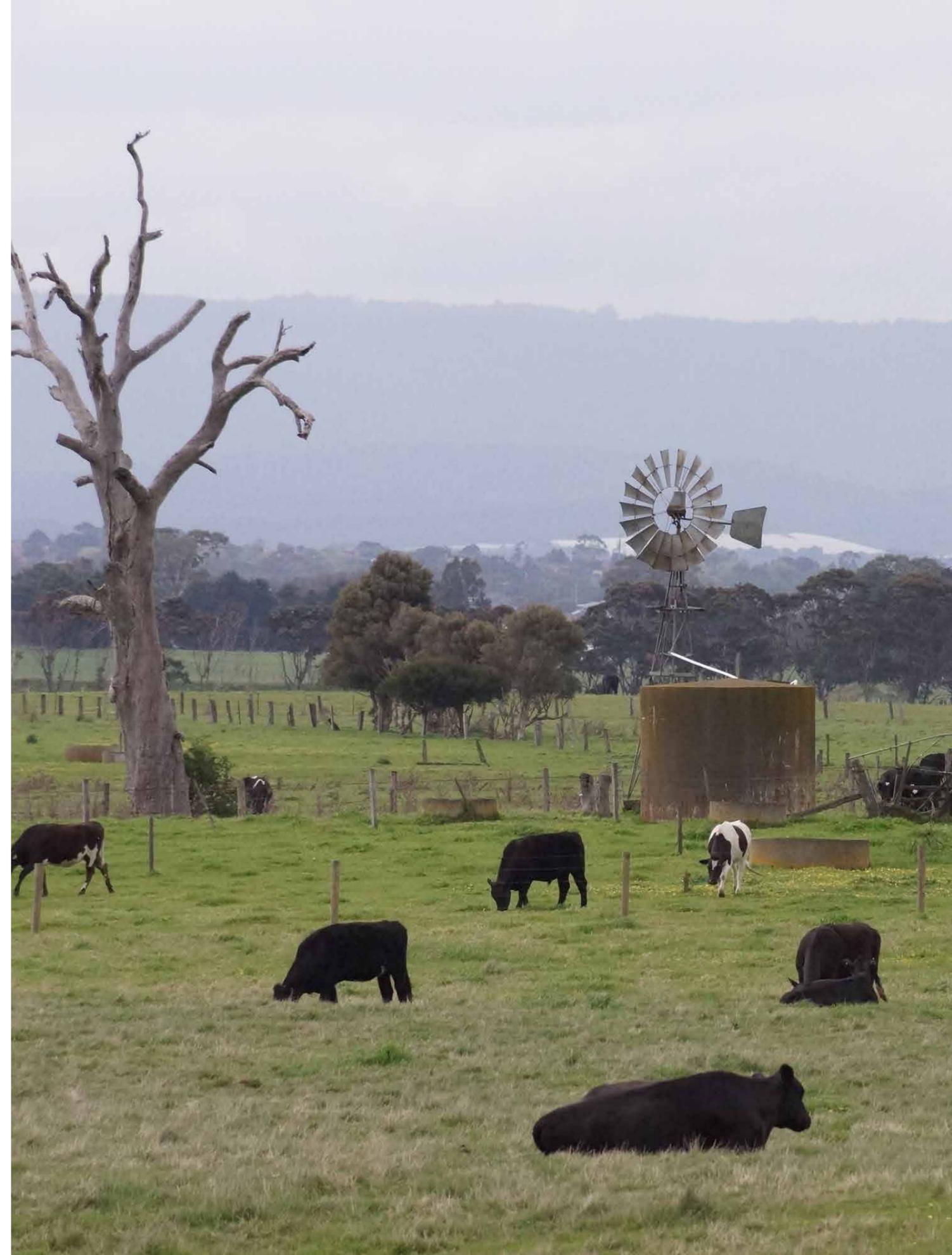
This project has identified significant gaps in data about interstate and intrastate food freight movements in Australia, which have made it difficult to estimate how much of the food produced in Melbourne's foodbowl is actually consumed in Melbourne.

Tracking the relationship between where food is produced and consumed requires detailed analysis of food supply chains, including distribution and retail networks. These are highly complex systems and they differ substantially for different kinds of food. This project has identified some potential data sources, but has not applied them at this stage. This is an ongoing area of investigation for the project.

5.4 Applying the Australian Stocks and Flows Framework to city region food systems

One of the aims of this project is to test the effectiveness of the CSIRO Australian Stocks and Flows Framework for analysis of city region food systems. This framework has to date been used for national or state-level modelling. Some of the challenges of using this framework for analysis at a city region scale include:

- A need to 'convert' data from regions at a small scale to match data sets at a larger scale
- Identifying where national averages are inappropriate to apply at a city region level e.g. grazing areas for livestock are larger on average across Australia than in Melbourne's foodbowl
- Adjusting the settings for food system modelling to reflect specific regional conditions





SECTION 6

Conclusion

This investigation of Melbourne's foodbowl has revealed that Melbourne has significant capacity for food production on its city fringe. It currently produces a wide variety of foods and has the capacity to supply around 41% of Greater Melbourne's food needs, including around 82% of the city's demand for fresh vegetables.

This analysis also highlights the risk that urban sprawl could significantly reduce the capacity of Melbourne's foodbowl, particularly for fresh vegetable production. The projections model the likely impacts on the foodbowl if the city continues to accommodate future population growth as it has in the past – at relatively low rates of urban density and with continued expansion of the Urban Growth Boundary. This finding has relevance to Australia's other major cities, many of which have highly productive foodbowls on their urban fringes⁵⁰.

Melbourne draws its food supply from a complex global food system that includes regional Victoria, other states of Australia and other parts of the world. This investigation has found insufficient data to determine how much of the food produced in Melbourne's foodbowl is consumed in the city of Melbourne and how much comes from other sources. However, local, regional, national and international sources are all likely to play a part in a resilient and stable future food supply.

The value of Melbourne's foodbowl for the city's future food supply has been overlooked in historical decisions about land use in foodbowl areas. Less than 10% of Australia's soils are arable and suitable for agricultural production. Some of the best soils and most secure sources of water are located around Australia's major cities⁵¹. As the availability of natural resources for food production becomes more constrained, the importance of city foodbowls is likely to increase because of their access to urban waste streams, particularly recycled water. These issues will be considered further in later phases of this project.

Climate change will have a significant impact on agriculture in Australia through decreasing rainfall, rising temperatures, and increasing frequency of extreme weather events. This is likely to have a profound impact on food production in Southern Australia. A drying climate will decrease production in major national foodbowls, such as the Murray-Darling Basin. Melbourne's foodbowl could play an important part in creating a more water-secure food supply through its access to alternative water supplies, such as recycled water. However, this will only be possible if productive farmland in the foodbowl is retained. See the Foodprint Melbourne briefing on 'The role of cities in climate resilient food systems' for more information⁵².

If Melbourne is able to accommodate the predicted population increase in a way that contains urban sprawl and retains the city's capacity for peri-urban food production, Melbourne's foodbowl could contribute to a more resilient city food supply in the face of increasing climate pressures on food production.

50. Houston P (2005) as previously

51. Buxton and Carey (2014) as previously

52. Carey R, Larsen K, and Sheridan J (2015), The Role of Cities in Climate Resilient Food Systems: A Foodprint Melbourne Briefing

Part 1 of this project has highlighted the significance of loss of farmland for the capacity of Melbourne's foodbowl to support the food needs of the city's growing population. This is an important first step in planning for Melbourne's future food supply and understanding the implications of choices made now for the way that future generations will be fed.

Part 2 of the project will extend this investigation to explore the environmental impacts of producing the food required to feed Greater Melbourne's population. It will also identify opportunities to reduce environmental impacts, and to strengthen the resilience and sustainability of the city's food system.

Part 3 will assess the economic costs and benefits of strengthening the resilience and sustainability of Melbourne's foodbowl. It will also explore opportunities for expanding food production in Melbourne's foodbowl.

This project is the first of its kind in Australia to investigate the capacity of a city foodbowl and the impact of urban sprawl on this capacity. This analysis provides a basis on which to continue to build our understanding of Melbourne's city region food system – and, most importantly - an evidence base that can contribute to re-designing this city region food system for a sustainable and resilient future.





SECTION 6

Glossary and definitions

ABS: The Australian Bureau of Statistics

ASFF: The Australian Stocks and Flows Framework is a CSIRO-developed model which was used extensively for future scenario modelling and historical data calibration across this project.

BOM: The Australian Bureau of Meteorology

Inner Foodbowl: The inner foodbowl is an area defined specifically for this research. It is made up of all the local government areas in metropolitan Melbourne and the interface councils. This set of local government areas also makes up Greater Melbourne and the two regions are equivalent. A full list of councils included in the definition is in Appendix 1.

LGA: This is an acronym for Local Government Area, which can also be thought of as a local city council.

Melbourne's foodbowl: Melbourne's foodbowl is used throughout this report to describe the highly productive farmland immediately surrounding Melbourne. It includes the inner foodbowl and the outer foodbowl. A full list of councils included in the definition is in Appendix 1.

Outer Foodbowl: The outer foodbowl is an area defined specifically for this research. It is made up of the ring of peri-urban local councils immediately contiguous to the inner foodbowl. A full list of councils included in the definition is in Appendix 1.

SA1: These are the ABS's smallest area for representing statistical data (the same size as one mesh block). They are designed around a number of factors including population, population density, LGA boundaries, internal interconnectedness of roads within the area, and interactions between various industries and population centres. Rural SA1s generally have smaller populations than urban SA1s. SA1s have a population of between 200 and 800, with an average of 400.

SA2: These are the next size up of the ABS's statistical data areas, and are built by bundling together a number of whole SA1s. They attempt to match gazetted suburbs where possible, although at times particularly large suburbs are broken up or numerous small suburbs are bundled together. This is done based on shared facilities and road networks, and common socio-economic traits. They are usually designed to not cross LGA boundaries. They have a population of between 3,000 and 25,000 with an average of 10,000.

SA4: These are the largest sub-state statistical area defined by the ABS. There are 17 in Victoria. They are made by bundling together SA2s based on labour markets so that, as much as possible, the population in each SA4 both lives and works in the one region. Rural SA4s typically have a population of between 100,000 and 300,000, while urban SA4s have populations of between 300,000 and 500,000.



Appendices

APPENDIX 1:

Defining Melbourne's Foodbowl

Melbourne's foodbowl consists of two regions – the inner foodbowl and outer foodbowl. The following local government areas are included in the definition of the inner foodbowl:

- | | |
|---------------------------|-----------------------------|
| Banyule City | City of Moreland |
| Bayside City | City of Port Phillip |
| Brimbank City | City of Stonnington |
| Cardinia Shire* | City of Whitehorse |
| City of Boroondara | City of Whittlesea* |
| City of Casey* | City of Yarra |
| City of Darebin | Frankston City |
| City of Glen Eira | Hobsons Bay City |
| City of Greater Dandenong | Hume City* |
| City of Kingston | Knox City |
| City of Maribyrnong | Manningham City |
| City of Maroondah | Mornington Peninsula Shire* |
| City of Melbourne | Nillumbik Shire* |
| City of Melton* | Wyndham City* |
| City of Monash | Yarra Ranges Shire* |
| City of Moonee Valley | |

This group of local government areas includes urban areas, such as the City of Melbourne, and areas on the outskirts of Greater Melbourne – marked with an asterisk in the list above – which could be considered the 'interface' with the peri-urban zone.

The councils included in the outer foodbowl region are:

- Bass Coast Shire
- Baw Baw Shire
- City of Greater Geelong
- Golden Plains Shire
- Macedon Ranges Shire
- Mitchell Shire
- Moorabool Shire
- Murrundindi Shire
- Surf Coast Shire

APPENDIX 2:

Food needs met from Melbourne's Foodbowl

Greater Melbourne's current food needs and foodbowl production

food group	Tonnes		Proportion of	Tonnes		Proportion of		Tonnes	Proportion of	
	required each year to feed Melbourne	produced - inner foodbowl	Melbourne's food needs inner foodbowl can meet	produced - outer foodbowl	Melbourne's food needs outer foodbowl can meet	Melbourne's food needs the whole foodbowl can meet	produced in regional Victoria	Melbourne's food needs regional Victoria can meet	Melbourne's food needs that the state of Victoria can meet	
Dairy	1783390	116739	7%	582535	33%	39%	5212726	292%	332%	
Sugar	1216180	0	0%	0	0%	0%	0	0%	0%	
Fruit	570130	66828	12%	4713	1%	13%	832376	146%	159%	
Oil crops	493115	1455	0%	32437	7%	7%	446178	90%	97%	
Cereal grains	415370	8060	2%	185789	45%	47%	6556195	1578%	1625%	
Vegetables	374125	152335	41%	153094	41%	82%	343493	92%	173%	
Red meat	230680	17384	8%	69070	30%	37%	471869	205%	242%	
Chicken meat	137970	145235	105%	54259	39%	145%	45320	33%	177%	
Fish & seafood	104025	not studied		not studied			not studied			
Rice	74460	0	0%	0	0%	0%	2445	3%	3%	
Legumes	59860	233	0%	3134	5%	6%	593611	992%	997%	
Eggs	31755	18211	57%	16858	53%	110%	17655	56%	166%	
Total	15080									

Greater Melbourne at 7 million - food needs and foodbowl production

food group	Tonnes		Proportion of	Tonnes	Proportion of	
	required each year to feed Melbourne 2050	produced - foodbowl in 2050	Melbourne's food needs the whole foodbowl can meet	produced - regional Victoria in 2050	Melbourne's food needs regional Victoria can meet	Melbourne's food needs that the state of Victoria can meet
Dairy	2854080	628223	22%	5212726	183%	205%
Sugar	1946473	0	0%	0	0%	0%
Fruit	912208	25586	3%	832376	91%	94%
Oil crops	789415	32484	4%	446178	57%	61%
Cereal grains	664431	178606	27%	6556195	987%	1014%
Vegetables	598695	125316	21%	343493	57%	78%
Red meat	219963	75167	34%	471869	215%	249%
Chicken meat	220854	102788	47%	45320	21%	67%
Fish & seafood	166059	not studied		not studied		
Rice	119138	0	0%	2445	2%	2%
Legumes	95551	3310	3%	593611	621%	625%
Eggs	50669	22544	44%	17655	35%	79%
Total	8637537					



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