

FOODPRINT MELBOURNE

CAN MELBOURNE'S POPULATION HAVE A SECURE FOOD SUPPLY IN 2050?

INTRODUCTION: FOR TEACHERS

Ensuring a reliable food supply for a population is important to a city or country's food security. To maintain a stable supply of food requires the production of quality and safe foods, provision of easy access between the point of production and people, and regular delivery of the foods at a price that meets the needs of both consumers and farmers. A stable food supply also depends on sustainable use of natural resources like land, water and energy.

This unit of work looks at the security of the food supply for Melbourne, in particular via its city fringe foodbowl – that is, agricultural production close to the urban area. Melbourne has significant capacity for food production on its city fringe. The land use is typically intensive with high value production on relatively small areas of land. Melbourne's foodbowl is particularly noted for its capacity to supply around 41% of Greater Melbourne's food needs. These areas also have the capacity to meet 82% of the city's vegetable needs.

POPULATION GROWTH

But this ability to supply stable quantities of high quality foods for the people of Melbourne is at risk. As Melbourne's population continues to grow and to spread further from the city centre, planning is required to retain land for the city's foodbowl. Strong planning regulations need to be applied if land is to be retained for agricultural production. Melbourne's Urban Growth Boundary was first put in place in 2002 and was intended as a permanent boundary. This boundary has been expanded several times. Limited land availability and the high cost of land in the foodbowl – along with sub-division of land for housing or hobby farming, high land rates and complaints from residential neighbours – all affect the viability of farming on the city fringe. Of particular concern is the capacity of Melbourne's inner foodbowl to meet the city's vegetable needs, as the inner foodbowl accounts for 36% of the state's vegetable growing land. The city's expansion could see the ability of the foodbowl to feed Melbourne's population fall from 41% in 2015 to an estimated 18% by 2050. The question then is – How will Melbourne's fresh food supply be sustained? Food production on Melbourne's fringe is one important part of a more resilient food supply – particularly for fresh foods, like fruit and vegetables. However, most of our food comes from outside Melbourne's foodbowl.

CLIMATE CHANGE

Seasons have always played a role in the production of food. Climate change, with patterns of increasing temperatures and decreasing rainfall, is bringing changes to the length and variability of seasons. Unpredictable extreme weather events are forcing farmers to adjust to heat waves and lengthy droughts, excessive rainfall and floods. Changing weather patterns also increase the risk and occurrence of cyclones. Climate pressures are challenging food supply.

THE FOOD ECONOMY

The importance of Melbourne's foodbowl goes beyond providing a stable food supply at an affordable price. This foodbowl contributes economically to the wellbeing of Melbournians and Victorians. Agriculture in Melbourne's foodbowl directly contributes to the Victorian economy \$956 million per annum, with a further \$742 million per annum from indirect inputs (such as machinery, fertiliser, seed, water purchases) and \$756 million from 'downstream' food manufacturing producing processed foods. Combined, these three sectors relating to food production in Melbourne's foodbowl contribute \$2.45 billion

FOODPRINT MELBOURNE

CAN MELBOURNE'S POPULATION HAVE A SECURE FOOD SUPPLY IN 2050?

per annum to Victoria's economy. In addition, these three sectors provide 7687 Full Time Equivalent (FTE) jobs in agriculture, 5719 (FTE) jobs in support of farming and 7595 (FTE) in food processing. Due to the seasonal nature of work related to food production, the actual number of people employed in these agricultural industries is higher (e.g. 9200 are employed in agriculture).

Of the agricultural sectors, the fruit and vegetable industries make the biggest economic contribution across Melbourne's foodbowl (\$400 million +), followed by poultry production (\$400 million), dairy production (<\$300 million) and beef production (about \$200 million). The ability to retain these levels of production may be challenged in future.

Today, the role of small-scale farmers is acknowledged as an important part of a reliable food supply for Melbourne. Small-scale farmers are building relationships with consumers through foods that are directly marketed at the farm gate, via U-pick, at farmers' markets and with agri-tourism. These motivated farmers are often using innovative, sustainable farming practices to add to the resilience of Melbourne's food supply.

Our society is undergoing change in its eating habits. Fresh food consumption is acknowledged for its health benefits. Melbourne is renowned as a great food city and not only offers a level of liveability for its residents but a range of food experiences for tourists. It is important for health and environmental sustainability to include in our diets an increased range of diverse fruits, vegetables, legumes and wholegrains with lower consumption of meat and fish, moderate consumption of dairy products and very limited consumption of processed foods. The more vegetables and fruit eaten, the less likelihood of the population being overweight, obese and suffering chronic diseases. Some cities are taking steps to reduce meat consumption with a "Meatless" or "Meat-free" Monday, encouraging people to go without meat for a day. The Chinese government has set a target to halve the population's meat consumption by 2030.

Water and land are not the only inputs to food production that are in limited supply. Fossil fuels underpin the entire food system, supplying energy for farm machinery, transportation and refrigeration, and nitrogen for nitrogen-based fertilisers. Fertilisers are also heavily reliant on phosphorous, a non-renewable rock that is fast being depleted globally.

CAREFULLY MANAGED WATER AND LAND RESOURCES

Agriculture in Australia mostly relies on rainfall to water crops and provide grass as feed for livestock. Only 5% of Victoria's agricultural land is irrigated. Water for irrigation comes from water stored on farms in dams, taken from river systems, held in weirs on rivers, stored in reservoirs, and recycled from water treatment plants. These small, irrigated regions make a large contribution to Victoria's food production.

Urban waste streams, particularly recycled water from Melbourne's Eastern and Western Treatment Plants, are likely to play an increasing role in providing a secure water supply to the small scale vegetable farmers within the foodbowl. Of the recycled water produced by these plants, 6% is used for agriculture, 10% is used in other ways and 84% is unused and disposed of at sea. Not all of this water can currently be used for agriculture. For example, there is little demand from farmers for irrigation water during the winter outside of the main growing season. To increase the use of recycled water for agriculture, more investment is needed in infrastructure to store the water for use during the growing season and to deliver it to farmers. Improvements in the capture, distribution and

FOODPRINT MELBOURNE

CAN MELBOURNE'S POPULATION HAVE A SECURE FOOD SUPPLY IN 2050?

purification of rainwater and stormwater from Melbourne's urban areas could also make more alternative sources of water available to farmers in Melbourne's foodbowl in future.

In addition, quality soils, which are scarce in Australia (less than 10% of soils are arable and suitable for agriculture), are often found on the edge of Australia's major cities. A stable supply of foods requires reliable water supplies, from rainfall or irrigation, for optimum production levels. Australia's cities were originally established where food could be grown in areas of suitable soils with access to water. Urban planning needs to protect these areas.

New ways of farming are being explored by some farmers. Some are practising regenerative agriculture to counter soil degradation of Australia's limited fertile soils. Here the farmers strive for sustainable soils through rebuilding soil condition and preventing further loss of land by matching the capability of the land to its capacity. The aim is to maintain crop yields, improve soil health, reduce the over-application of fertilisers, reduce dependence on irrigation and reduce greenhouse gas emissions.

PLANNING FOR A SUSTAINABLE FOOD SUPPLY

To ensure a sustainable food supply that contributes to food security, it is vital that government planning and policies are aligned. If Melbourne can strengthen the productive capacity of its own foodbowl, it will increase the resilience and reliability of the city's food supply. Melbourne's dependence on food from other Victorian and Australian regions, as well as global sources, can be reduced and the resilience of the city's food supply to the impacts of climate change (e.g. from droughts, storms and floods) can be strengthened. Melbourne is not alone in needing to plan to ensure the reliability of its food supplies. Other major cities in Australia, and around the world, face the same concerns, and many are planning for how to retain the productive foodbowls on their urban fringes.

REFERENCES

This unit of work is based around three reports:

1. Sheridan, J., Larsen, K. and Carey, R. (2015) *Melbourne's foodbowl: Now and at seven million*. Victorian Eco-Innovation Lab, The University of Melbourne.
2. Sheridan, J., Carey, R. and Candy, S. (2016) *Melbourne's Foodprint: What does it take to feed a city?* Victorian Eco-Innovation Lab, The University of Melbourne.
3. Carey, R., Larsen, K., Sheridan, J. and Candy, S. (2016) *Melbourne's food future: Planning a resilient city foodbowl*. Victorian Eco-Innovation Lab, The University of Melbourne.

These reports are available from the Foodprint Melbourne website - <http://research.unimelb.edu.au/foodprint-melbourne>

Other references

- An introduction to the basic concepts of food security provided by the EC – FAO Food Security Programme can be found at <https://goo.gl/yQ2U9Z>
- The Global Food Security Index (2016) at <http://foodsecurityindex.eiu.com/Country>
Explore this site to see the differences in food availability, affordability, quality and safety as 113 countries are ranked and mapped to provide a profile of each country. An interactive graph allows comparison of various factors between countries.
- For more useful references, see the 'School resources' section of the Foodprint Melbourne website

FOODPRINT MELBOURNE

CURRICULUM LINKS: AUSTRALIAN CURRICULUM AND VICTORIAN CURRICULUM

ACARA

Australian Curriculum v8.3, December 2017
Geographical Knowledge and Understanding
Year 9 Content Descriptions
Unit 1: Biomes and food security

FOODPRINT MELBOURNE

VCAA

Victorian Curriculum, 5 June 2017
Geographical Knowledge and Understanding
Level 9 Content Descriptions
Unit 1: Biomes and food security

FOODPRINT MELBOURNE

Skills

Observing, questioning and planning

Geographical Concepts and Skills

Place, space and interconnection

Develop geographically significant questions and plan an inquiry that identifies and applies appropriate geographical methodologies and concepts (ACHGS063)

Foodprint Melbourne predicts changes in Melbourne's food supply between 2015 and 2050 and considers how the changes might impact Melbourne's food security. Can Melbourne's population have a secure food supply in 2050?

Predict changes in the characteristics of places over time and identify the possible implications of change for the future (VCGGC 127)

Foodprint Melbourne predicts changes in Melbourne's food supply between 2015 and 2050 and considers how the changes might impact Melbourne's food security.

Collecting, recording, evaluating and representing

Evaluate sources for their reliability, bias and usefulness and select, collect, record and organise relevant geographical data and information, using ethical protocols, from a range of appropriate primary and secondary sources (ACHGS064)

Foodprint Melbourne is based on research undertaken at the University of Melbourne. Students can evaluate these resources.

Identify, analyse and explain significant spatial distributions and patterns and identify and evaluate their implications, over time and at different scales (VCGGC 128)

Foodprint Melbourne identifies, analyses and explains the spatial distribution and patterns of Melbourne's food production within its foodbowl, including regional Victoria.

Represent multi-variable data in a range of appropriate forms, for example, scatter plots, tables, field sketches and annotated diagrams, with and without the use of digital and spatial technologies (ACHGS065)

Foodprint Melbourne provides data as visual representations and offers opportunities to represent data in a range of appropriate forms.

Foodprint Melbourne considers the spatial distribution and patterns that may develop between 2015 and 2050.

Represent spatial distribution of geographical phenomena by constructing special purpose maps that conform to cartographic conventions, using spatial technologies as appropriate (ACHGS066)

Foodprint Melbourne provides data for representation of regional food production by constructing GIS maps for interpretation.

FOODPRINT MELBOURNE

CURRICULUM LINKS: AUSTRALIAN CURRICULUM AND VICTORIAN CURRICULUM (CONTINUED)

ACARA (CONTINUED)	FOODPRINT MELBOURNE (CONTINUED)	VCAA (CONTINUED)	FOODPRINT MELBOURNE (CONTINUED)
Interpreting, analysing and concluding			
<p>Interpret and analyse multi-variable data and other geographical information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to make generalisations and inferences, propose explanations for patterns, trends, relationships and anomalies, and predict outcomes (ACHGS067)</p> <p>Apply geographical concepts to synthesise information from various sources and draw conclusions based on the analysis of data and information, taking into account alternative points of view (ACHGS068)</p> <p>Identify how geographic information systems (GIS) might be used to analyse geographical data and make predictions (ACHGS069)</p>	<p>Foodprint Melbourne identifies, analyses and explains the spatial distribution and patterns of Melbourne's food production within its foodbowl, including regional Victoria.</p> <p>Foodprint Melbourne considers the spatial distribution and patterns that may develop between 2015 and 2050.</p> <p>Throughout Foodprint Melbourne, geographical concepts are utilised. Using an inquiry approach, students are encouraged to draw conclusions, using the data provided to answer key questions.</p> <p>In Foodprint Melbourne, raw data is provided for students to construct a GIS map and then analyse the map.</p>	<p>Identify, analyse and explain significant interconnections within places and between places over time and at different scales, and evaluate the resulting changes and further consequences (VCGGC 129)</p>	<p>Foodprint Melbourne investigates the impact of land issues, water availability, climate change and population growth, now and into the future, on the ability of the city to provide its own food supply.</p> <p>Foodprint Melbourne acknowledges the role of regional food production in meeting Melbourne's food supply.</p>
Communicating		Geographical Concepts and Skills Data and information	
<p>Present findings, arguments and explanations in a range of appropriate communication forms, selected for their effectiveness and to suit audience and purpose; using relevant geographical terminology, and digital technologies as appropriate (ACHGS070)</p>	<p>Foodprint Melbourne presents data from the University of Melbourne research and offers a range of appropriate communication forms. It also encourages geographical terminology in the responses.</p>	<p>Collect and record relevant geographical data and information, using ethical protocols, from reliable and useful primary and secondary sources (VCGGC 130)</p>	<p>The University of Melbourne research reports used in this unit of work have gathered geographical data and information from a range of sources, and have used ethical protocols.</p>

FOODPRINT MELBOURNE

CURRICULUM LINKS: AUSTRALIAN CURRICULUM AND VICTORIAN CURRICULUM (CONTINUED)

ACARA (CONTINUED)	FOODPRINT MELBOURNE (CONTINUED)	VCAA (CONTINUED)	FOODPRINT MELBOURNE (CONTINUED)
	<i>Reflecting and responding</i>	Select, organise and represent data and information in different forms, including by constructing special purpose maps that conform to cartographic conventions, using digital and spatial technologies as appropriate (VCGGC 131)	In Foodprint Melbourne raw data is provided for students to construct a GIS map and then analyse the map.
Reflect on and evaluate the findings of an inquiry to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic, political and social considerations; and explain the predicted outcomes and consequences of their proposal (ACHGS071)	In Foodprint Melbourne a role play requires students to respond to the geographical challenge of whether Melbourne can provide a secure food supply for its population in 2050. Proposing a policy to achieve a secure food supply offers students the opportunity to predict outcomes and consequences.	Analyse and evaluate data, maps and other geographical information using digital and spatial technologies and Geographical Information Systems as appropriate, to develop identifications, descriptions, explanations and conclusions that use geographical terminology (VCGGC 132)	Foodprint Melbourne uses a range of data and map representations, including Geographical Information Systems, to identify, describe, explain and draw conclusions about Melbourne's food supply.
<i>Geographical Knowledge and Understanding</i>		<i>Geographical Knowledge</i>	
Distribution and characteristics of biomes as regions with distinctive climates, soils, vegetation and productivity (ACHGK060)	Foodprint Melbourne did not look at the original biomes of the Melbourne area.	Distribution and characteristics of biomes as regions with distinctive climates, soils, vegetation and productivity (VCGGK 133)	Foodprint Melbourne did not look at the original biomes of the Melbourne area.
Human alteration of biomes to produce food, industrial materials and fibres, and the use of systems thinking to analyse the environmental effects of these alterations (ACHGK061)	Foodprint Melbourne is about producing a reliable food supply for a growing city and the human alterations to the environment that are involved.	Environmental, economic and technological factors that influence crop yields in Australia and across the world (VCGGK 134)	Foodprint Melbourne considers the impact of environment on food production; analyses the economic contribution of food production to the Victorian economy; and reveals technological changes across the world that can contribute to a resilient food supply.
Environmental, economic and technological factors that influence crop yields in Australia and across the world (ACHGK062)	Foodprint Melbourne considers the impact of environment on food production; analyses the contribution of food production to the Victorian economy; and reveals technological changes that can contribute to a resilient food supply.	The interconnection between food production and water degradation; shortage of water; competing land uses; and climate change, for Australia and other areas of the world (VCGGK 135)	Foodprint Melbourne uses examples from other Australian capital city foodbowls and international examples to show the interconnection between water, land and climate change and food production.

FOODPRINT MELBOURNE

CURRICULUM LINKS: AUSTRALIAN CURRICULUM AND VICTORIAN CURRICULUM (CONTINUED)

ACARA (CONTINUED)	FOODPRINT MELBOURNE (CONTINUED)	VCAA (CONTINUED)	FOODPRINT MELBOURNE (CONTINUED)
Challenges to food production, including land and water degradation, shortage of fresh water, competing land uses, and climate change, for Australia and other areas of the world (ACHGK063)	Foodprint Melbourne uses examples from other Australian capital city foodbowls and international examples to show the interconnection between water, land, climate change and food production.	Human alteration of biomes to produce food, industrial materials and fibres, and the environmental effects of these alteration (VCGGK 136)	Foodprint Melbourne is about producing a reliable food supply for a growing city and the human alterations to the environment that are involved.
The capacity of the world's environments to sustainably feed the projected future global population (ACHGK064)	Foodprint Melbourne uses examples from other Australian capital city foodbowls and international examples to show the interconnection between water, land, climate change and food production.	Land and resource management strategies used by Aboriginal or Torres Strait Islander peoples to achieve food security over time (VCGGK 137)	This aspect was not part of the research undertaken by Footprint Melbourne.
		Challenges in feeding the current and projected populations of Australia and the world, and responses to these challenges (VCGGK 138)	Foodprint Melbourne uses examples from other Australian capital city foodbowls and international examples to show the interconnection between water, land and climate change and food production.

FOODPRINT MELBOURNE

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

There are 10 student worksheets. Each worksheet is accompanied by a data sheet which provides students with all the information required to complete the worksheet activities. The only worksheets that do not have data sheets are worksheet 3a, which has an accompanying GIS task that uses the free Esri GIS in Schools program, worksheet 9 which is a role play activity and worksheet 10 on taking action.

Printing worksheets and data sheets

We recommend that data sheets are printed at A3 size for optimum presentation and readability. However, they may also be printed at A4 size.

Worksheets have been designed to print at A4 size.

Lessons required: 16–20 lessons

The complete series of inquiries is designed to be taught in 16-20 lessons over 3-4 weeks.

Which lessons and worksheets should I include if I only have two weeks to teach this topic?

If you only have six hours (+) available across two weeks to teach this topic, we recommend that you become familiar with all the issues raised in this overview and also with the information and data in the worksheets (including those that you're not going to use in teaching). This will assist you to gain an understanding of the entire topic and provide the background information that you'll need for teaching and classroom discussions.

If you only have two weeks to teach the topic, the recommended worksheets are:

Worksheet 1: Know your foodbowl (1 lesson)

Worksheet 4: What makes Melbourne a first-rate food city? (2 lessons)

Worksheet 5: Growing over our food (2 lessons)

Worksheet 9: A role play. See 'Alternative C: a discussion'.

If you have time, also consider including worksheet 10 on taking action to protect Melbourne's food supply:

Worksheet 10: Taking action to protect Melbourne's future food supply (1 lesson)

The ideas in this worksheet could also be included in the discussion time for Worksheet 9.

Suggested assessment task

Use Worksheet 8 as a source of data. Select data and questions to suit your class. Suggested questions are 1, 2, 3, 4 and 6.

FOODPRINT MELBOURNE

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

Inquiry 1: What are the characteristics of Melbourne's foodbowl?

Worksheet 1: Know your foodbowl

Allow 1 lesson

Melbourne's food supply is reliant on a range of inputs at different scales – from local, regional, national and international sources. Together these inputs ensure that Melbourne's food supplies are resilient. This worksheet introduces students to these concepts and the knowledge that Melbourne's food comes from a wide range of places, with a focus on the inner and outer foodbowls of Melbourne.

Defining the inner and outer foodbowls of Melbourne can be reinforced by showing the class a map of the local government areas of Melbourne and indicating which areas fall within the inner foodbowl and which fall in the outer foodbowl. A list of relevant areas can be found in Appendix 1 of Melbourne's Foodbowl: Now and at seven million, page 43 - <https://goo.gl/4FMbvQ>

A map locating these government areas can be found at knowyourcouncil.vic.gov.au/councils

Extension activities

The first activity provides students with knowledge about Melbourne's food supply by collecting their own data at a local greengrocer or supermarket.

This activity could be used as an assessment task if students develop their findings by creating graphs of their data and a short report on their findings.

The second activity provides a global focus and an awareness that not everyone in the world receives a sufficient or reliable food supply each day. There is additional data on food insecurity in Australia at <https://goo.gl/5Htty8>.

The third activity asks students to consider solutions to providing food to Australians who are not able to afford an adequate food supply.

Worksheet 2: Is Melbourne's foodbowl currently able to feed its population?

Allow 1 lesson

This worksheet focuses on the specific foods produced in Melbourne's foodbowl and the contribution that food from Melbourne's foodbowl makes to the food requirements of Victorians and, more specifically, the Melbourne population. It should become clear that perishable food crops are grown closest to the centre of population (inner foodbowl) so that crops can be transported and provided to consumer outlets rapidly to avoid deterioration and wastage. The outer foodbowl grows a broader range of crops that includes less perishable foods.

Students may need some assistance interpreting the infographics, graph and table. Encourage students to be systematic in looking at the infographics to gain an understanding of the data provided. In studying the graph, ensure that students look

FOODPRINT MELBOURNE

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

initially at the labels on the scales and the key/legend prior to interpreting the data. The table's title will assist students in looking at the vegetable crops. Some basic mathematical skills are required to analyse the data.

Worksheet 3a: Investigating where food grows: Using GIS maps ***Allow 2 lessons***

A GIS activity is introduced to show the location of food production in Melbourne's foodbowl and in regional Victoria. Teachers do not need specific GIS skills for this activity. Detailed instructions are provided for undertaking the activity using the free Esri GIS in Schools program.

We recommend that teachers work through this activity before giving it to students, so that they are familiar with the program and how to navigate the map. Map layers include where different fruit and vegetables are grown and the location of recycled water plants.

Proportional symbols have been used for sources of recycled water. This means that larger dots symbolise a recycled water plant that provides a substantial amount of recycled water, whereas smaller dots symbolise smaller plants.

This activity could be used as an assessment task. Students could print their maps, annotate them and write an analysis to develop a short report on where food is grown in Melbourne and Victoria.

Worksheet 3b: Investigating where food grows: Using ABS data

If you aren't able to undertake the GIS version of this activity (described above), you could instead use this alternative worksheet which draws on the same Australian Bureau of Statistics data about agricultural production that underpins the online GIS maps. The worksheet focuses on agricultural production in three regions of Melbourne's foodbowl (Werribee South, the Mornington Peninsula and the Casey-Cardinia region) for in-depth analysis to help students understand what is produced in different regions of Melbourne's foodbowl and why. The activity introduces information about climate and soil to increase students' understanding of the factors that influence why particular food crops are produced in different regions.

Two other regions of Victoria (Swan Hill and Shepparton) are also used to compare the differences between agricultural production in Melbourne's foodbowl and other regions of the state.

Extension activity

A look back in time <https://goo.gl/GbF4KH> reveals changing patterns in food production as climate change alters environmental factors, population growth puts pressure on land use types, research develops improved seed types, improvements are made to water supply and the systems of farming adjust to the modern world.

FOODPRINT MELBOURNE

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

Inquiry 2: What factors contribute to a reliable food supply for Melbourne?

Worksheet 4: What makes Melbourne a first-rate food city?

Allow 1–2 lessons

Three case studies provide examples of successful food production areas that meet the requirements of a sustainable and resilient food system as shown in figure 1. Other examples may be located in your school's local area that are highly relevant for your students (see the extension activity).

This activity can be used to expand revision of how to approach reading graphs and tables.

The video provides a way of considering the economic aspects of farming and its value to the Victorian community. The video should be viewed twice so that students have the time necessary to respond to the questions. Some students may find that the economic data needs further explanation.

Extension activity

This activity can be completed with the list of the seven factors contributing to a reliable food supply (table 1 of the worksheet). Students could replicate the case studies used in figure 2 of the worksheet. Teachers may need to assist students in identifying sources of data.

Inquiry 3: What are the competing land uses in Melbourne's foodbowl regions?

Worksheet 5: Growing over our food

Allow 1–2 lessons

Time should be spent on a discussion of Melbourne's urban growth. If your school is within the urban growth area or just beyond the Urban Growth Boundary, try to find a local identity who could be interviewed (via Skype) and discuss the changes that they have observed in the area. Also try the local library or historical society for images showing change over time in the local area. Remember that the focus is on food production areas being "grown over" by urban development.

Figure 1 provides another example of a GIS map. The urban sprawl is overlaid onto agricultural areas within the Urban Growth Boundary.

In figure 4 the slider shows the same areas in 1945 and now – about 70 years difference in time. Encourage students to look around Melbourne using the website 1945 (<http://1945.melbourne>) and find other areas that were once areas of food production but have now been paved over by urban sprawl.

The online video of the Schreurs family (discussing the need to move their farming activities to another region of Victoria) should be shown in its entirety and then revisited with pauses so that students can ask questions. It is excellent and covers many issues succinctly.

FOODPRINT MELBOURNE

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

Extension activity

This activity looks at Sydney's foodbowl where a similar study to Foodprint Melbourne was undertaken about the future of the city's food supply. It is important that students understand that although Victoria does receive food from interstate and from other countries (especially produce that cannot be grown in Victoria or is seasonally unavailable in the state), in future food supplies from these regions may also be challenged, because areas of food production elsewhere in Australia and globally face similar challenges to Melbourne's foodbowl.

Inquiry 4: Will there be enough water to grow food in Melbourne's foodbowl in the future?

Worksheet 6: Water for food – is there enough?

Allow 1–2 lessons

Water is a necessity for food production. Most important is its reliability. With climate change, it is important to drought-proof agricultural areas to ensure security of food supply. This worksheet looks at the various ways in which rainfall can be captured, used and reused. A particular emphasis is the greater role that recycled water will have in future-proofing food production.

A doughnut graph is presented that is similar to a pie graph. If students have not used this type of graph previously, it should be explained that the doughnut represents 100% and is divided into segments according to the statistics being graphed.

Figure 6 (a) can be replicated in many of the foodbowl areas around Melbourne by using Google Earth.

Figure 7 presents a GIS map of water treatment plants that provide recycled water across Victoria.

Extension activity

1. The Riverina in New South Wales is a productive, irrigated region in the Murray-Darling Basin. This promotional film provides an excellent background about the importance of irrigation in the region.

2. This activity looks at the millions of dollars being spent on an expanded irrigation system to bring water to areas of Tasmania that had previously been used for non-irrigated farming. These two articles provide additional information:

<http://www.tasmanianirrigation.com.au/index.php/about>

http://www.tasmanianirrigation.com.au/uploads/docs/FIP_v17_Low_Res_Final_all.pdf

FOODPRINT MELBOURNE

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

Inquiry 5: What impact will changes in climate have on Melbourne's food supply?

Worksheet 7: Is Melbourne's food supply at risk with changes in climate?

Allow 2 lessons

Greenhouse gas emissions and climate change have major impacts on the reliability of food supplies. The impact of these extreme events, and their unpredictability, can have devastating effects on food production. The following article from the Washington Post provides a perspective of the global impact of climate change on food production: <https://goo.gl/8WVmC8>

A pie graph is used in the worksheet. If students have not used this type of graph previously it should be explained that the pie represents 100% and then it is divided into segments according to the statistics being graphed.

Cumulative bar graphs in figure 2 have been constructed by each statistic being 'stacked' on top of the other so that the bar represents the total.

Extension activity

1. This activity looks at the impact of unexpected floods on South Australia's foodbowl. The video and the article give a clear description of the event.
2. Climate change is taking place at a global scale with impacts at local and regional scales. This activity looks at the food security vulnerability of regions now and in the future with a worst case and best case scenario.

Inquiry 6: How can Melbourne's foodbowl ensure a reliable food supply in future?

Worksheet 8: Melbourne grows and grows

Allow: 2 lessons

Melbourne's rapidly increasing population continues to sprawl further into the foodbowl. The Urban Growth Boundary is intended to limit urban sprawl but, although there are controls in place to prevent change to this boundary, this has not been achieved. The boundary has been changed several times since it was introduced in 2002, and was last changed in 2014. This worksheet also presents a vision for a more resilient and sustainable city foodbowl for Melbourne.

In figure 1 a table of population data is presented and students use this to draw a line graph. Line graphs are used to show change over time.

Figure 2 is a choropleth map. Here the data for Statistical Local Areas have been colour-coded according to a key/legend devised to group the data and enable a pattern to emerge.

Figure 3 provides interpretation using a GIS map. The urban sprawl is overlaid onto the agricultural areas within the Urban Growth Boundary.

FOODPRINT MELBOURNE

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

Extension activity

This activity takes one aspect of the vision for Melbourne's foodbowl and looks at the growth of community gardens, which offers students the chance to look within their local environment. Make contact with the people who produce food in this garden and visit the community garden, ask someone to visit your school or organise a Skype interview. It is important to note that community gardens are unlikely to have sufficient capacity to replace the potential reduction in food production in Melbourne's foodbowl areas, but community food production can increase food security and the overall resilience of our food system.

Worksheet 9: A role play or discussion

4–5 lessons for the role play or a 1 lesson discussion

Three alternatives have been provided for teachers to run this activity. These suggestions include alternatives such as using all eight roles, grouping roles and using fewer roles. Teachers can choose the option that best suits their class needs.

Alternative A is the most extensive version of the role play, with 8 different roles. Alternative C is the simplest version of the activity with just 4 different roles.

Alternative A

This is a more extensive, in-depth role play. It involves the class forming groups of 2–3 students. Each group considers the views of, and represents, one of the eight roles outlined.

It is important that the teacher is familiar with all the roles presented and is aware of the information included in each of the groups' activity sheets.

It may be necessary to differentiate the learning in the classroom as some of the ideas/roles are more complex than others. The teacher should ensure that each group is on target to complete the tasks at each stage of the role play.

Teachers are encouraged to provide an online site for posting/communicating the final three key points from each group. These could be shared online so that each student has a summary at the end of the roleplay on which to base a one-page report.

During the discussion, it may be necessary to maintain appropriate protocols and ensure that each group is given equal opportunity to present their views and argue points raised.

We recommend that the teacher introduces the need for an integrated policy framework. That is, that all of these groups represented need to work together with a goal to strengthen the city's food security for the future. Five overarching policy objectives can be used as a guide – protect farmland in Melbourne's foodbowl, encourage farmers to farm in Melbourne's foodbowl, grow a vibrant regional food economy, reuse water to grow food in a drying climate and reduce and reuse food waste and organic waste. To assist with diversity in the classroom, we suggest that teachers assist the students in report writing by providing a scaffold of required tasks.

FOODPRINT MELBOURNE DRAFT

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

Alternative B

This version of the roleplay involves the formation of four groups of 6–7 students. Each group considers and produces a summary response based on the views presented in

1. Farming the land

Farmer
Waste management authority

2. Providing a reliable water supply

Water authority

3. Housing Melbourne's population

Urban planner
Property developer
Resident of a Melbourne suburb

4. Sustainable growth

Economist
Opposition government MP

one of the following four topics:

Suggested assessment task

Use the report writing task generated by the role play as an assessment task.

Alternative C

This is the simplest version of the role play activity.

In two lessons a teacher can guide a discussion through the key points of this unit of study by using fewer roles. We suggest that teachers split the students into four groups with the following roles:

- Farmer
- Water authority
- Resident of a Melbourne suburb
- Waste management authority

Some starter ideas for a discussion are provided here:

- Melbourne's population is expected to reach 7-8 million by 2050. Where will this population be housed?
- How will this population change the shape of Melbourne?
- Will the city "grow over its food sources"?
- Where will this population get its fresh fruit and vegetables from?
- Climate change may also impact food production. How will climatic change impact farming?
- Will farmers be able to get sufficient water to grow their crops?
- Are there alternative supplies of water available and at what cost to the farmer?
- Can government controls protect land and water for farming?
- How can a food supply for a city of 7-8 million be resilient? Brainstorm alternative farming techniques, alternative diets and shopping experiences, reliance on recycled

FOODPRINT MELBOURNE DRAFT

TEACHING POINTS: WORKSHEETS AND DATA SHEETS

water, and government planning.

Suggested assessment task

Use the report writing task generated by the role play as an assessment task.

Inquiry 7: Can you make a difference?

Worksheet 10: Taking action to protect Melbourne's future food supply

Allow 1 lesson

This final worksheet encourages students to become active citizens. As a teacher, you know your students best and know your school's expectations. Select appropriate action for your students, their families and school.