

41ST PARLIAMENT



Education and Health Standing Committee

Report 7 - Discussion Paper

**NEW BITE**

*How alternative proteins could improve dietary and planetary health*

---

Presented by Mr C.J. Tallentire, MLA

May 2024

## *Committee Members*

---

Chair	Mr C.J. Tallentire, MLA Member for Thornlie
Deputy Chair	Ms L.L. Baker, MLA Member for Maylands
Members	Mrs L.A. Munday, MLA Member for Dawesville
	Ms C.M. Collins, MLA Member for Hillarys
	Mr K.J.J. Michel, MLA Member for Pilbara

## *Committee Staff*

---

Principal Research Officers	Dr Sarah Palmer (from 11 April 2024) Catie Parsons (until 10 April 2024)
Research Officers	Maddison Evans (from 4 December 2023) Sylvia Wolf (until 1 December 2023) Franchesca Walker (until 2 June 2023)

Legislative Assembly  
Parliament House  
4 Harvest Terrace  
WEST PERTH WA 6005

Tel: (08) 9222 7494  
Email: [laehsc@parliament.wa.gov.au](mailto:laehsc@parliament.wa.gov.au)  
Website: [www.parliament.wa.gov.au](http://www.parliament.wa.gov.au)

Published and printed by the authority of the Education and Health Standing Committee  
of the Legislative Assembly of Western Australia, Perth.

May 2024

ISBN: 978-1-922759-31-3

(Series: Western Australia. Parliament. Legislative Assembly. Committees.  
Education and Health Standing Committee. Report 7)

328.365



## Education and Health Standing Committee

---

# New bite

How alternative proteins could  
improve dietary and planetary health

---

Report No. 7 - Discussion Paper

Presented by

**Mr C.J. Tallentire, MLA**

Laid on the Table of the Legislative Assembly on 9 May 2024



## Chair's Foreword

This discussion paper, *New bite – How alternative proteins could improve dietary and planetary health*, is the Committee's seventh report to the 41st Parliament. Notice of the intention to produce a short report on this topic was given to the Legislative Assembly on 18 May 2023.

Feeding a global population of 10 billion people is a challenge as pressing and immediate as addressing climate change. Indeed, the two problems are inextricably linked. Now is the time for humanity to move to sustainable food systems that also meet healthy diet standards and equity in global food distribution and security.

Although not the focus of this report, our Western Australian farming sector has the proven capacity to adopt new food production technologies, new crops and more sustainable agricultural systems. WA's farmers are equal to the challenge.

Human health concerns including cancer risks, heart disease and the emerging threat of antimicrobial resistance are all associated with increased per capita consumption of animal proteins. The Australian Dietary Guidelines indicate how we should be eating. This report outlines some of the shortcomings of the typical Western diet and some of the alternatives.

Highly visible land degradation has been one negative environmental consequence of livestock grazing for food production. In Australia, whole landscapes have been altered by cloven-hoofed animals, namely sheep and cattle, grazing introduced grasses on highly fragile soils. Production of protein by other means could allow the containment and potential reduction of grazing areas.

In addition to the land degradation, the Food and Agriculture Organization of the United Nations estimates that livestock supply chains account for 14.5 per cent of the world's human-induced emissions.

The challenge is to ensure the components of a healthy diet are produced with a net zero goal and with no further land degradation or biodiversity loss.

While noting that the health aspects of plant-based alternative proteins require further investigation, there is clearly an opportunity for them to be tasty, healthy and environmentally friendly.

At its best, the livestock industry strives for commendable 'paddock-to-plate' traceability and transparency. It is important that the alternative protein sector seeks to provide consumers with similar opportunities to know where their food has come from.

During the researching and drafting of this report we have benefited from the expertise of excellent parliamentary research officers. Thank you to principal research officers Catie Parsons and Sarah Palmer and to research officers Franchesca Walker, Maddison Evans and Sylvia Wolf.

I thank and acknowledge my fellow Committee members, Ms Lisa Munday MLA, Ms Caitlin Collins MLA and Mr Kevin Michel MLA, for their work. I would especially like to acknowledge Deputy Chair Lisa Baker MLA for communicating to the Committee the significance of this topic, and thank her for her work and commitment.

A handwritten signature in blue ink that reads "Chris Tallett". The signature is written in a cursive style with a large initial 'C'.

MR C.J. TALLENTIRE, MLA  
CHAIR

# Contents

Chair’s Foreword	iii
Executive Summary	vii
Ministerial Response	ix
1 The call to transform the global food system	1
2 The arguments for eating more plant-based foods	2
2.1 Many Australians are consuming more meat than is good for their health	2
2.2 Meat overconsumption is linked to cancer, diabetes and heart disease	3
2.3 Growing demand for meat has increased the risk of antimicrobial resistance	4
2.4 The livestock sector has a significant impact on the environment	7
2.5 Climate change is affecting Western Australia, which in turn affects our health	10
3 The role of alternative or complementary proteins	13
3.1 The alternative proteins industry includes a wide range of products	13
3.2 Plant-based alternative proteins could help people achieve a healthier diet	14
3.3 Plant-based alternative proteins may help to tackle climate change	17
3.4 The way alternative proteins are produced can impact the environment	19
3.5 More transparency is needed	21
3.6 Quality and affordability is an important consideration	22
4 Multiple approaches are required to improve health and climate	24
Appendices	27
1 Committee’s functions and powers	27
2 Acronyms	29





## Executive Summary

**E**XPERTS have warned that persisting with current dietary habits and global food production practices will have dire consequences for human health and the environment. In 2019 the EAT-Lancet Commission recommended a reduction in meat consumption as the key plank of a planetary diet. Overconsumption of animal-sourced proteins was shown to have a negative effect on human health and to contribute to environmental degradation and climate change. Alternative proteins, such as plant-based substitutes and meat mimics, offered potential for a healthier, more sustainable diet. This paper outlines the health and environmental imperatives for reducing meat consumption and explores the status of alternative proteins, also known as complementary proteins.

### **Consuming too much meat has a negative effect on human health**

Australia ranked third in meat consumption among OECD countries last year and our red meat consumption is double the limit recommended by the Australian Dietary Guidelines. Despite health recommendations to limit meat intake, many Australians do not believe it negatively affects their health. This is despite international research linking excess meat consumption to non-communicable diseases such as cancer, type 2 diabetes and heart disease. This is concerning, considering non-communicable diseases are responsible for 89 per cent of deaths in Australia.

As meat consumption increases around the world, so does the risk of antimicrobial resistance in livestock. The intensification of livestock production systems to meet growing demand has led to reliance on antibiotics to promote growth and protect the health of animals. While Australia reportedly has one of the most conservative approaches to antimicrobial use, there is limited up-to-date publicly available data. A study which relied on open access information to compare nations found Australia was among the highest consumers of veterinary antimicrobials.

### **Livestock production has a big impact on the environment and food security**

Agriculture accounted for a significant proportion of greenhouse gas emissions in Australia in 2023, with the majority from livestock methane emissions and management of livestock waste.

Livestock production also causes water contamination when large numbers of animals are concentrated in a relatively small area. Fertilisers used on crops to feed livestock can also affect water quality when they leach into waterways. Agriculture uses a significant amount of the world's fresh water, with livestock production accounting for a third of global agricultural water use. Efforts to improve water supplies in agricultural areas and promote efficient use of water in food systems are crucial.

The increase in greenhouse gas emissions contributes directly to climate change, which in turn impacts primary production as productive land diminishes. This could lead to higher levels of food insecurity, affecting people in remote and socio-economically disadvantaged communities in particular. People who are unable to access nutritious food due to lack of

availability and higher prices will be led to cheaper foods with higher fat and sugar content, as these provide dietary energy at a lower price.

### **Alternative proteins may provide a solution**

The alternative proteins industry covers a wide range of products, including plant-based alternatives, cultured meat, insects, precision fermentation products like animal fats and dairy products, mycoproteins, algae, and bacterial protein. They all have the potential to play a role in transitioning to healthier and more sustainable diets. Plant-based alternatives in particular can help people transition to a healthier diet as they mimic the taste and texture of animal meat products. Concerns have been raised about the health impacts of cultured meat, which may present similar health risks to animal-based meat.

More research is needed to determine the health benefits of alternative proteins. It is important to consider how these products fit into a healthy, balanced and sustainable diet, as some plant-based meats are classified as ultra-processed foods. Additionally, the environmental footprint of alternative proteins must be carefully managed. While plant-based alternatives have the potential to reduce greenhouse gas emissions and land use, this benefit may be eroded if ingredients are sourced from chemical-intensive crop monocultures and international supply chains.

Transparency in the alternative proteins industry is crucial for consumers, especially younger generations who want to know how the products are made. Quality and affordability are also important factors, with alternative proteins generally costing more than animal meats. Improving affordability and transparency in the production of alternative proteins, along with taste, could assist in uptake.

The Committee notes there are barriers to Australians changing their diets, such as the association between masculinity and eating meat. Lack of awareness of the impact of food production on climate change also affects motivation to implement change. Social, cultural and traditional factors influence consumer choices, but institutions and public health policies can also influence demand.

There are economic opportunities in the growing demand for alternative protein products, with potential for WA's agriculture and food industries to reap the benefits. Given that there are also multiple health and environmental benefits, consideration should be given to promoting alternative proteins within a wide range of government programs and activities.

## **Ministerial Response**

In accordance with Standing Order 277(1) of the Standing Orders of the Legislative Assembly, the Education and Health Standing Committee directs that the Minister for Health, Minister representing the Minister for Agriculture and Food, Minister for the Environment and Minister for Water report to the Assembly as to the action, if any, proposed to be taken by the Government with respect to the recommendation of the Committee.



# New bite: How alternative proteins could improve dietary and planetary health

---

The gods created certain kinds of beings to replenish our bodies; they are the trees and the plants and the seeds.

Plato

---

## 1 The call to transform the global food system

In 2019, an international group of health, agriculture, political science and environmental sustainability experts released to the world what they considered to be the optimal diet for both human health and environmental sustainability. The Planetary Health Diet took into account the contribution of unhealthy diets to premature death as well as the environmental degradation and threat to the climate caused by global food production. The group, known as the EAT-Lancet Commission,<sup>1</sup> said that a ‘radical transformation’ of the global food system was urgently needed.<sup>2</sup>

The Planetary Health Diet comprises mainly plant-based foods—vegetables, fruit, legumes, nuts and whole grains—with considerably less reliance on foods derived from animals. The Commission argued the Planetary Health Diet has enough flexibility to adapt to dietary needs, personal preferences and cultural traditions without compromising the overarching goal of achieving a sustainable food system that could deliver a healthy diet for an estimated 10 billion people by 2050.<sup>3</sup>

Animal sourced proteins (meat, poultry, eggs and fish) comprise only a very small proportion of the Commission’s recommended diet. Reaching this would require a significant reduction in current consumption levels—especially of red meat, a major component of the Western diet in particular. One way to reduce meat consumption is through increased use of alternative or complementary proteins, which incorporate plant-based substitutes, precision fermentation and analogues or meat mimics. These are plant-based and food-technology products that can act as alternatives to conventional animal protein products.<sup>4</sup>

This paper outlines the health and environmental imperatives for reducing meat consumption, before exploring the status of alternative proteins and their potential to be a component of a diet that is kinder to the environment and to animals and better for our health.

---

1 The EAT-Lancet Commission was made up of 19 Commissioners and 18 co-authors from 16 countries. It was a combined effort of EAT, a global, non-profit foundation aimed at transforming the global food system, and The Lancet group which oversees a stable of medical journals.

2 EAT-Lancet Commission, *Healthy diets from sustainable food systems, Summary report of the EAT-Lancet Commission*, EAT, Norway, 2019, p. 5.

3 EAT, *The EAT-Lancet Commission*, n.d., accessed 19 April 2024, <<https://eatforum.org>>.

4 University of Melbourne, *Alternative proteins: Testing the claimed benefits*, n.d, accessed 31 May 2023, <<https://sustainablecampus.unimelb.edu.au>>.

## 2 The arguments for eating more plant-based foods

### 2.1 Many Australians are consuming more meat than is good for their health

Australians are some of the biggest consumers of meat in the world. In 2023, Australia's total meat consumption per capita was indicated to be the third highest amongst OECD member countries, after Israel and the United States. Australia's consumption of red meat was seventh highest.<sup>5</sup> In 2022, Australia's red meat consumption was nearly double the maximum amount recommended by the Australian Dietary Guidelines (the Guidelines).<sup>6</sup>

While public health recommendations are to limit meat consumption, many Australians do not believe that eating meat negatively impacts their health. Just over half of respondents in a 2017 survey of Sydney men aged 18 to 57 said 'meat consumption has nothing to do with health and health related issues' while one-fifth said eating up to 100 grams per week had positive health outcomes.<sup>7</sup>

Professor Dora Marinova, Professor of Sustainability at Curtin University, has studied attitudes of men toward meat consumption and is particularly concerned:

If we want our men to die younger, feed them only meat because there is serious evidence that over-consuming meat is not the best nutritional option for anybody, including men.<sup>8</sup>

The Guidelines suggest people limit red meat intake to 65 grams per day, but do not recommend cutting out all meat, recognising that people have different nutritional needs. Meat is a valuable source of nutrients such as protein and vitamin B12 and its iron and zinc is more easily absorbed than that of plant foods such as nuts or legumes.<sup>9</sup> It can be an important food for pregnant women, infants, children and athletes,<sup>10</sup> and the Guidelines recommend many young women actually increase their meat intake to account for iron lost through menstruation.<sup>11</sup>

---

5 OECD-FAO Agricultural Outlook, *Meat consumption (indicator)*, 2021 edition, accessed 27 March 2024, <<https://data.oecd.org>>. Based on beef and veal, pork and sheep meat consumption.

6 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 2, citing NHMRC, *Eat for Health: Australian Dietary Guidelines*, NHMRC, Canberra, 2013.

7 Diana Bogueva and Dora Marinova, 'What Is More Important: Perception of Masculinity or Personal Health and the Environment', in Diana Bogueva, Dora Marinova and Talia Raphaely (eds.), *Handbook of Research on Social Marketing and Its Influence on Animal Origin Food Product Consumption*, IGI Global, Hershey, PA, 2018, pp. 151, 152.

8 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 2.

9 National Health and Medical Research Council and Department of Health and Aged Care, *Lean meat and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans*, n.d., accessed 26 May 2023, <<https://www.eatforhealth.gov.au>>.

10 National Health and Medical Research Council (NHMRC), *Eat for Health: Australian Dietary Guidelines - Summary*, NHMRC, Canberra, 2013, p. 20.

11 NHMRC and Department of Health and Aged Care, *About the Australian dietary guidelines*, n.d., accessed 26 May 2023, <<https://www.eatforhealth.gov.au>>; NHMRC, Department of Health and Aged Care and Manatū Hauora, *Nutrient reference values for Australia and New Zealand: Iron*, n.d., accessed 26 May 2023, <<https://www.eatforhealth.gov.au>>.

The type of meat consumed is important. Lean red meats and lean poultry are preferred over processed meats such as bacon, mince and sausages.<sup>12</sup> The Guidelines regard the latter as discretionary food to be consumed 'sometimes and in small amounts'.<sup>13</sup>

## **2.2 Meat overconsumption is linked to cancer, diabetes and heart disease**

The Guidelines are based on international research which links the overconsumption of meat to a range of non-communicable diseases, including cancer, type 2 diabetes and heart disease. Given that non-communicable diseases are responsible for 89 per cent of deaths in Australia,<sup>14</sup> our high levels of meat consumption are concerning.

### **2.2.1 Cancer**

Evidence has now established a link between cancer and the consumption of processed meat and red meat. A 2015 review of epidemiological literature by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) classified consumption of processed meat as 'carcinogenic to humans' and red meat as 'possibly carcinogenic to humans', concluding that the risk of colorectal cancer increased with the amount of processed meat consumed.<sup>15</sup> The IARC also identified possible links between red meat and pancreatic and prostate cancer, and between processed meat and stomach cancer.<sup>16</sup>

The World Cancer Research Fund similarly identified a strong link between red and processed meats and colorectal cancer. Its 2018 expert report, which arose from its ongoing analysis of evidence about diet and cancer prevention, found processed meat was a 'convincing cause' and red meat a probable cause of colorectal cancer.<sup>17</sup>

Professor Marinova explained that meat is a good source of iron, but:

when you have too much in your system, we are not designed to get rid of it, so it stays, and this is where the link between red meat consumption and colorectal cancer has been proven yet again.<sup>18</sup>

### **2.2.2 Type 2 diabetes**

There is a less direct link between meat and type 2 diabetes, although research does suggest heavy meat eaters have a higher risk of diabetes than people who consume meat less frequently. This is mainly because meat eaters tend to have a higher body mass index, which

---

12 NHMRC, *Eat for Health: Australian Dietary Guidelines - Summary*, NHMRC, 2013, p. 22.

13 NHMRC, *Eat for Health: Australian Dietary Guidelines*, NHMRC, Canberra, 2013, pp. 49, 67.

14 World Health Organization, *Noncommunicable diseases: Progress monitor 2022*, World Health Organization, Geneva, 2022, p. 18.

15 International Agency for Research on Cancer, *IARC Monographs evaluate consumption of red meat and processed meat*, media release, 26 October 2015.

16 World Health Organization, *Cancer: Carcinogenicity of the consumption of red meat and processed meat*, 26 October 2015, accessed 26 May 2023, <<https://www.who.int/news-room>>; International Agency for Research on Cancer, 'Red meat and processed meat', *IARC monographs on the evaluation of carcinogenic risks to humans*, vol. 114, Lyon, 2015, p. 497.

17 World Cancer Research Fund and American Institute for Cancer Research, *Meat, fish and dairy products and the risk of cancer*, Continuous Update Project, Third Expert Report, 2018, pp. 9, 27, 31, accessed 26 May 2023, <<https://www.wcrf.org>>.

18 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 2.

is the most critical risk factor for type 2 diabetes, and non-meat eaters generally have healthier lifestyles than people who consume meat.<sup>19</sup>

### **2.2.3 Heart disease**

Studies have indicated that diets with a high fruit and vegetable intake have a lower risk of heart disease and that vegetarian and vegan diets have a ‘protective effect’ against coronary heart disease.<sup>20</sup> Coronary heart disease is caused when the arteries supplying blood to the heart become narrowed due to a build-up of fatty deposits. It happens slowly over time; although the process begins when people are young, coronary heart disease primarily affects those aged 65 and over.<sup>21</sup>

An analysis of studies conducted in 2021 found that both processed meat and unprocessed red meat increased the risk of coronary heart disease. While the researchers acknowledged the lack of diversity amongst study participants (most were white adults living in Europe or the US),<sup>22</sup> they broadly concluded that:

- Each 50 g/day higher intake of processed meat increased the risk of coronary heart disease by 18 per cent.
- Each 50 g/day higher intake of unprocessed red meat increased the risk of coronary heart disease by 9 per cent.
- There was no clear link between eating poultry meat and an increased risk of coronary heart disease.<sup>23</sup>

### **2.3 Growing demand for meat has increased the risk of antimicrobial resistance**

Global consumption of meat has doubled since 1961.<sup>24</sup> Increased population and economic growth have driven most of this demand—people with higher incomes tend to want more varied diets, typically ones that are richer in meat.<sup>25</sup> Urbanisation, higher labour participation, and a proliferation of ‘away-from-home’ food services also encourage a higher level of meat purchases.<sup>26</sup>

---

19 World Health Organization European Office for the Prevention and Control of Noncommunicable Diseases, *Plant-based diets and their impact on health, sustainability and the environment: a review of the evidence*, WHO Regional Office for Europe, Copenhagen, 2021, p. 2.

20 *ibid.*

21 Australian Institute of Health and Welfare, *Cardiovascular disease fact sheet: Prevalence of coronary heart disease in Western Australia*, Australian Institute of Health and Welfare, Canberra, 2015, p. 1.

22 University of Oxford, *Red and processed meat linked to increased risk of heart disease, Oxford study shows*, n.d., accessed 25 May 2023, <<https://www.ox.ac.uk/news>>.

23 Keren Papier et al., 'Meat consumption and risk of ischemic heart disease: A systematic review and meta-analysis', *Critical Reviews in Food Science and Nutrition*, vol. 63, no. 2, 2023, pp. 426–437.

24 Priyadarshi R Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Technical Summary, Intergovernmental Panel on Climate Change (IPCC), 2019, p. 40.

25 *ibid.*, p. 472.

26 Organisation for Economic Cooperation and Development (OECD) and Food and Agriculture Organization of the United Nations (FAO), *OECD-FAO Agricultural Outlook 2022–2031*, OECD Publishing, Paris, 2022, p. 192.



Livestock production systems have intensified to meet the growing demand for meat and producers have often relied on antibiotics to promote growth and protect the health of animals raised in crowded conditions.<sup>27</sup> This increases the risk that bacterial populations will develop that are resistant to antibiotics and could cause a significant public health issue when those antibiotics are also used in human medicine. As Professor Barry Marshall, director of the Marshall Centre for Infectious Diseases, Research and Training, explained:

[C]ertainly, if you feed antibiotics to animals, you can make them grow faster. If they are antibiotics that could potentially be used in humans, then I am against it. ... You do not want human antibiotics in your animal treatments so that there are resistant antibiotics coming into the community.<sup>28</sup>

The global impact of antimicrobial resistance (AMR) is significant. The WHO has declared it to be one of the world's top 10 public health threats,<sup>29</sup> and notes that it could 'send us back to a time when we were unable to easily treat infections such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis'.<sup>30</sup> The 2016 Review on Antimicrobial Resistance estimated that by 2050 10 million deaths per year would be associated with AMR if nothing was done.<sup>31</sup> An Australian report on antimicrobial resistance projected that AMR would kill 10,430 people in Australia between 2015 and 2050.<sup>32</sup>

A study conducted by the University of Canberra on behalf of Animals Australia tested 404 meat samples (244 chicken and 160 pork) for resistant bacteria. Of the 33 types of bacteria identified in samples purchased from ACT and NSW supermarkets, all but one exhibited some form of resistance to antibiotics. One of the researchers told current affairs program 7.30 that she saw this as 'quite alarming' given the 'high level of antimicrobial resistance, multiple drug resistance and the fact that we isolated so many bacteria that were predicted to be pathogenic towards humans'. However, the chicken meat industry said it was 'a global leader' in terms of its low antibiotic usage.<sup>33</sup>

The Australian Government's AMR website states that Australia has one of the most conservative approaches in the world to antimicrobial use, noting:

---

27 Talia Raphaely, Dora Marinova and Mira Marinova, 'The Future of Antibiotics and Meat' in Talia Raphaely and Dora Marinova (eds.), *Impact of meat consumption on health and environmental stability*, USA, 2016, p. 185; Diana Bogueva and Dora Marinova, 'The links between meat consumption and antimicrobial resistance', *Food Safety Magazine* (web-based), 24 January 2023, accessed 26 May 2023, <<https://www.food-safety.com>>.

28 Professor Barry Marshall, WA Ambassador for Life Science and Director, Marshall Centre for Infectious Disease Research and Training, *Transcript of Evidence*, 15 March 2023, pp. 6, 7.

29 World Health Organization, *Ten threats to global health in 2019*, n.d., accessed 30 May 2023, <<https://www.who.int>>; World Health Organization, *10 global health issues to track in 2021*, 24 December 2020, accessed 30 May 2023, <<https://www.who.int>>.

30 World Health Organization, *Ten threats to global health in 2019*, n.d., accessed 30 May 2023, <<https://www.who.int>>.

31 Jim O'Neill, *Tackling Drug-Resistant Infections Globally: Final Report and Recommendations*, HM Government and Wellcome Trust, London, May 2016, pp. 12, 71.

32 Australian Commission on Safety and Quality in Health Care, *AURA 2021: Fourth Australian report on antimicrobial use and resistance in human health*, Australian Commission on Safety and Quality in Health Care, Sydney, 2021, p. 8.

33 Jason Om, 'The debate over the use of antibiotics in our meat and poultry', 7.30 (web-based), 19 April 2023, accessed 30 May 2023, <<https://www.abc.net.au>>.

- Australia has not registered some antibiotics for use in food-producing animals because they are important for human medicine. Consequently, food-producing animals have not developed resistance to these antibiotics.
- Nearly all antimicrobials must be prescribed by veterinarians before they are used in animals. Veterinary surgeons' boards in each Australian state and territory control how veterinarians prescribe and supply antimicrobials.<sup>34</sup>

The AMR website cites a 2015 report from the United Kingdom that ranked Australia as the fifth lowest for antibiotic use in agriculture among 29 countries examined.<sup>35</sup>

However, there is limited up-to-date publicly available data on Australia's antimicrobial use in food-producing animals.<sup>36</sup> The total tonnage of antimicrobials imported into Australia is reported by the Australian Government's regulator of agricultural and veterinary chemical products, the Australian Pesticides and Veterinary Medicines Authority. But information about where the drugs were used, including the animal species or production systems where they were administered and the stage of life of the animals receiving the drugs, is not reported. This is significant because, as the National Centre for Antimicrobial Stewardship has pointed out, administering antimicrobials for a short period of time to animals less than 4 weeks old 'is likely to have much less impact on transfer of resistance into the human food chain' than administering them for a long period of time to older animals that are about to be slaughtered.<sup>37</sup>

Australia has a surveillance system for antimicrobial use and resistance in human health but not in animal health.<sup>38</sup> *Australia's National Antimicrobial Resistance Strategy—2020 and Beyond* says the livestock sector and research groups have begun surveillance of AMR but it identifies the need for a nationally coordinated surveillance system, to which all sectors (human, animal, food and environment) can contribute usage and resistance data.<sup>39</sup>

The Department of Agriculture, Water and the Environment (Cth) has also supported AMR surveys in industries such as chicken meat and pork production, but the results do not

---

34 Australian Government, *AMR and animal health in Australia*, 13 September 2023, accessed 18 April 2024, <<https://www.amr.gov.au>>.

35 *ibid.*

36 Ranya Mulchandani et al., 'Global trends in antimicrobial use in food-producing animals: 2020 to 2030', *PLOS Global Public Health*, vol. 3, no. 2, 2023; Freya Langham and Allen C. Cheng, 'Antibiotic use in animals and humans in Australia', *Medical Journal of Australia*, vol. 211, no. 4, 2019, p. 159.

37 National Centre for Antimicrobial Stewardship, *Animal Health*, n.d., accessed 25 May 2023, <<https://www.ncas-australia.org>>.

38 Australian Government, *Antimicrobial Resistance*, 29 January 2023, accessed 25 May 2023, <<https://www.amr.gov.au>>.

39 Department of Health and Department of Agriculture, Water and the Environment, *Australia's National Antimicrobial Resistance Strategy—2020 and Beyond*, Commonwealth of Australia, Canberra, 2019, p. 11. See also Department of Health and Department of Agriculture, Water and the Environment, *One Health Master Action Plan for Australia's National Antimicrobial Resistance Strategy—2020 and Beyond*, Commonwealth of Australia, Canberra, 2021, p. 9.

appear to have been released.<sup>40</sup> A Veterinary National Antimicrobial Prescribing Survey is also reportedly in development.<sup>41</sup>

A 2023 examination of 229 countries and territories' antimicrobial usage in food-producing animals relied on extrapolating data from open access information to compare Australia's use to other countries. The authors pointed out that this meant their conclusions may not accurately capture current efforts to reduce antimicrobial use. Nevertheless, they concluded that Australia was one of the top 5 consumers of veterinary antimicrobials in 2020. By 2030, they predicted Australia to have increased its usage by 16 per cent—the second largest increase after Pakistan.<sup>42</sup>

## **2.4 The livestock sector has a significant impact on the environment**

### **2.4.1 Contributions from emissions**

It is widely accepted that the livestock sector contributes significantly to greenhouse gas emissions. However, this varies according to global and regional production systems<sup>43</sup> and differing methodologies and parameters used to measure emissions.

A calculation by the Food and Agriculture Organization of the United Nations (FAO) estimated that livestock supply chains emitted around 7.1 gigatonnes of carbon dioxide equivalent per year, which at that time represented around 14.5 per cent of all the world's human-induced emissions.<sup>44</sup>

Although 2005 data was used to reach this estimate, it is still frequently quoted as the most authoritative estimate of the sector's impact.<sup>45</sup> The estimate included emissions generated by livestock species (i.e. through enteric fermentation) and by manure management, and the production, processing and transport of feed (i.e. the manufacture of fertiliser, which is used to grow crops to feed livestock).<sup>46</sup>

***Alternative proteins are the next battlefield. What people often don't know is that the food system makes up about 34 percent of the total greenhouse-gas emissions globally, and most of it comes from meat and dairy.***

*- McKinsey senior partner Daniel Läubli*

---

40 Animal Health Australia, *Animal Health in Australia Annual Report 2021*, Animal Health Australia, Canberra, 2022, p. 13.

41 Australian Government, *Antimicrobial Resistance*, 15 November 2022, accessed 28 March 2024, <<https://www.amr.gov.au>>.

42 Ranya Mulchandani et al., 'Global trends in antimicrobial use in food-producing animals: 2020 to 2030', *PLOS Global Public Health*, vol. 3, no. 2, 2023.

43 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 8.

44 Pierre Gerber et al., *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities*, Food and Agriculture Organization of the United Nations, Rome, 2013, p. 15.

45 Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, 'alternative proteins' and sustainability*, IPES-Food, Brussels, 2022, p. 35.

46 Pierre Gerber et al., *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities*, Food and Agriculture Organization of the United Nations, Rome, 2013, p. 7.

More recent estimates of livestock's contribution to global greenhouse gases vary from 6 per cent to 30 per cent,<sup>47</sup> with some studies focusing on direct livestock emissions and others using a lifecycle approach similar to the FAO approach.<sup>48</sup>

Ruminants (cattle, sheep, buffalo and goats) are the greatest greenhouse gas emitters in the livestock sector as their digestive processes (enteric fermentation) generate significant

*When microbes decompose and ferment food and fibres in the digestive tract of the ruminant and (rumen), they produce energy and nutrients for the animal, and release methane from digestible energy loss. This digestive process known as enteric fermentation is one of the important sources of methane from livestock.*

*- Food and Agriculture Organization of the United Nations*

amounts of methane. Cattle are the main emitters, accounting for 65 to 77 per cent of all global livestock emissions in 2019.<sup>49</sup>

In Australia, agriculture accounted for 17.7 per cent of greenhouse gas emissions in 2023, with more than three-quarters attributed to enteric methane emissions produced during the digestion process of ruminant livestock.<sup>50</sup>

Livestock waste is another significant contributor to greenhouse gases. When manure and urine break down under anaerobic conditions—often caused when

they are stored in large piles or settlement ponds—they release both methane and nitrous oxide.<sup>51</sup> In 2020, manure management was the third largest source of agricultural emissions in Australia, contributing 6.2 megatonnes of carbon dioxide equivalent, or 9.1 per cent of the sector's emissions, in 2020.<sup>52</sup>

#### **2.4.2 Effect on water quality**

Livestock can negatively impact the quality of nearby water sources, especially when large numbers are concentrated in relatively small areas such as stockyards or feedlots. They create wastes such as manure, spilt feed, dead animal carcasses and liquid wastes like urine, washdown and contaminated run-off. These wastes contain high amounts of degradable organic matter, nitrogen, phosphorus, micro-organisms and pathogens and are very difficult to contain. They can leach into soil and groundwater, run off into surface water and threaten water quality if not properly treated. In intensive systems, livestock waste can also contain

---

47 Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, 'alternative proteins' and sustainability*, IPES-Food, Brussels, 2022, p. 36.

48 *ibid.*

49 Priyadarshi R Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Summary for Policymakers, IPCC, 2019, p. 477.

50 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 8.

51 Department of Industry, Science, Energy and Resources, *National Inventory Report 2020: The Australian Government Submission to the United Nations Framework Convention on Climate Change*, vol. 1, Australian Government, Canberra, 2022, pp. 313–314.

52 Department of Industry, Science, Energy and Resources, *National Inventory Report 2020: The Australian Government Submission to the United Nations Framework Convention on Climate Change*, vol. 1, Australian Government, Canberra, 2022, p. 295.

heavy metals, drug residues, hormones and antibiotics, adding further contaminants to surrounding water sources.<sup>53</sup>

Fertiliser is another agricultural by-product that can affect waterways. In 2014, the Western Australian Auditor General found that the condition of the Swan-Canning river system, which flows through the heart of metropolitan Perth, was declining. Highly soluble phosphorus fertilisers, used by farmers on the Swan Coastal Plain, contributed to the decline by entering the river system through groundwater leaching or stormwater runoff. This introduced excess nutrients to the rivers and caused algal blooms and fish deaths.<sup>54</sup>

Fish farming also has a detrimental effect on water systems, with a build-up of organic material affecting flora and fauna and causing changes to sediment chemistry.<sup>55</sup>

The volume of water directed towards agriculture, and livestock production in particular, is also a concern. In 2018, the FAO reported agriculture used around 70 per cent of the world's available freshwater supply. Livestock production used about 30 per cent of global agricultural water and one-third of that was to support beef cattle.<sup>56</sup>

This is worrying given the impact of climate change on access to clean water. According to the Intergovernmental Panel on Climate Change (IPCC), southern Australia has experienced a significant decrease in rainfall since 1910 and this is expected to continue.<sup>57</sup> Under such conditions, WA needs to consider how to get the most from its limited water resources by directing them to the most efficient food systems.

The WA Government has already developed projects aimed at improving the water supplies of agricultural areas. For example, it has established the Community Water Supply Program that provides up to \$100,000 for farming communities to improve their non-potable water (water that is unable to be drunk) in the hope that it will reduce the use of drinking water for non-potable needs and ensure water is available for, amongst other things, livestock.<sup>58</sup>

#### **2.4.3 Land use and biodiversity loss**

Livestock production is estimated to occupy 30 to 47 per cent of the ice-free land in the world. This includes permanent pastures as well as rangelands that are used for activities like

---

53 Javier Mateo-Sagasta et al., *Water pollution from agriculture: a global review (Executive summary)*, FAO and International Water Management Institute, Rome and Colombo, 2017, p. 10; Department of Water, *Stockyards*, Water quality protection note 80, Government of Western Australia, April 2015, p. 1.

54 Office of the Auditor General Western Australia, *Our Heritage and Our Future: Health of the Swan Canning River System*, Office of the Auditor General, Perth, August 2014, pp. 7, 26–27.

55 Australian Marine Parks, *Impact of aquaculture*, 2001, accessed 8 May 2024 <<https://parksaustralia.gov.au>>

56 A Acosta (ed.), *Transforming the livestock sector through Sustainable Development Goals*, FAO, Rome, 2018, p. 51.

57 Working Group I—the Physical Science Basis, *Regional fact sheet—Australasia*, Sixth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC, USA, 2021, p. 2.

58 Department of Water and Environmental Regulation, *Community Water Supply Program: Information for applicants*, Government of Western Australia, Perth, 2020, p. 1.

rough grazing and wild products harvesting.<sup>59</sup> A sizeable proportion of land—around 35 per cent, according to the FAO—is also dedicated to crops destined for livestock consumption.<sup>60</sup> In contrast, human infrastructure (settlements, transportation and mining) covers only around one per cent of the ice-free land in the world.<sup>61</sup>

A 2021 report by the World Wide Fund for Nature named eastern Australia—the only developed nation on the list—as among 24 global deforestation fronts with development of livestock pasture found to be the chief driver of forest loss (accounting for 75 per cent).<sup>62</sup>

Pastoralism also contributes to dryland salinity which reduces, and in some instances eradicates, plant growth. As at 2018, over 18 million of the 21 million hectares of deep-rooted native vegetation had been cleared in WA’s agricultural regions, resulting in 1 to 2 million hectares in the South West being affected by dryland salinity.<sup>63</sup> Salinisation also has an impact on biodiversity, as remaining wetlands, shrublands and woodlands and the species that call them home diminish.<sup>64</sup>

Pastoralism has also contributed to land degradation in some parts of WA, where overstocking and continuous grazing have led to significant soil erosion. In 2017, the Auditor General noted a considerable risk that land degradation, acknowledged repeatedly since 1940, would continue because land condition issues were not appropriately monitored, documented and managed.<sup>65</sup>

## **2.5 Climate change is affecting Western Australia, which in turn affects our health**

Human activities such as the intensification of livestock production are increasing the concentration of greenhouse gas emissions, which is causing the climate to change. In WA, the average temperature has increased by around 1°C over the last century.<sup>66</sup> Extreme weather events, such as intense tropical cyclones, are becoming more frequent<sup>67</sup> and

---

59 Priyadarshi R Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Summary for Policymakers, IPCC, 2019, pp. 82, 85

60 A Acosta (ed.), *Transforming the livestock sector through Sustainable Development Goals*, FAO, Rome, 2018, p. 100; FAO, *Water use in livestock production systems and supply chains: Guidelines for assessment*, version 1, Livestock Environmental Assessment and Performance (LEAP) Partnership, Rome, 2019, p. 3.

61 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, pp. 1–2; Priyadarshi R Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Summary for Policymakers, IPCC, 2019, pp. 85, 86.

62 Pablo Pacheco et al., *Deforestation fronts: Drivers and responses in a changing world*, World Wide Fund for Nature, Gland, 2021, p. 124.

63 Office of the Auditor General Western Australia, *Management of Salinity*, Office of the Auditor General, Perth, May 2018, pp. 5, 7.

64 *ibid.*, pp. 5–6.

65 Office of the Auditor General Western Australia, *Management of Pastoral Lands in Western Australia*, Office of the Auditor General, Perth, October 2017, p. 18.

66 Department of Primary Industries and Regional Development, *Climate trends in Western Australia*, 4 April 2023, accessed 30 May 2023, <<https://www.agric.wa.gov.au>>.

67 *ibid.*

bushfire seasons are becoming longer.<sup>68</sup> Rain patterns are changing with some locations experiencing more drought and others more flooding.<sup>69</sup>

The changing climate inevitably affects people's health. The Climate Health WA Inquiry categorised the effects as follows:

1. Injury or death resulting from an extreme weather event.
2. Heat-related illness. Extreme heat events can reduce the body's ability to regulate temperature, leading to illness such as heat cramp or heat exhaustion through to hyperthermia and death.
3. Mental health impacts of an extreme weather event.
4. Other mental health impacts. Even without extreme weather events, people may experience increased anxiety and stress as they encounter environmental degradation, the loss of biodiversity, ongoing drought and/or changing weather patterns. These experiences might result in financial difficulties for certain groups such as farmers or, for Aboriginal people, an inability to maintain cultural practices and traditions. A sense of fear, loss and hopelessness were some of the mental health impacts arising from climate change, according to the inquiry.
5. Asthma or respiratory distress triggered by bushfire smoke.
6. Other impacts of air pollution. Several conditions are exacerbated by air pollution, such as lung disease, cardiovascular disease (including heart disease and stroke), cancer, pregnancy complications and the incidence of low birthweight babies.
7. Mosquito-borne disease. Temperature, rainfall and humidity is changing and, in some locations, creating mosquito-friendly conditions. This is concerning because of the serious diseases carried by mosquitoes, including Ross River virus.
8. Other infectious diseases. For example, bacteria build up when there are higher temperatures, such as rotavirus in swimming pools or salmonella in food that is not kept chilled.
9. Food quality and security. Climate change is not only impacting the ability to grow the plants and animals that we eat, but also decreasing the nutritional value of plant crops that are able to be harvested.
10. Water quality and security.
11. Population displacement. This particularly affects places experiencing water shortages and food insecurity.<sup>70</sup>

As this Committee noted in *Making Hope Practical: Report of the inquiry into the response of Western Australian schools to climate change*, the impacts of climate change will not be

---

68 Tarun Weeramanthri et al., *Climate Health WA Inquiry: Final Report*, Department of Health, Perth, 2020, p. 31.

69 Bureau of Meteorology and CSIRO, *State of the Climate 2022*, Commonwealth of Australia, Melbourne, 2022, map, p. 7.

70 Tarun Weeramanthri et al., *Climate Health WA Inquiry: Final Report*, Department of Health, Perth, 2020, pp. 31-48.

uniformly experienced. Children and young people will be more severely impacted because of their 'longer cumulative exposure, their developing physiological systems, the more direct ways they interact with their environment, and their dependence on adults.'<sup>71</sup> The Committee was particularly concerned about the prevalence of climate anxiety among children and young people.<sup>72</sup>

Existing health inequities will intensify the impact climate change has on some children, including Aboriginal students, students with pre-existing medical conditions and/or a disability, students in low socio-economic areas, and students in regional and remote areas.<sup>73</sup>

### **2.5.1 The impacts of climate change are likely to contribute to food insecurity**

The global food system is under pressure from climate change as well as non-climate stressors.<sup>74</sup> Global warming is a key factor in reducing crop yields and the availability of food across many countries.<sup>75</sup> Increases in greenhouse gases have been directly linked with reductions in the protein and nutrient content of staple crops.<sup>76</sup>

Over the next few decades Australia's limited agricultural land will be further reduced due to the impacts of climate change, land degradation and competition for land and water use.<sup>77</sup> At the same time, the Australian population is projected to reach between 37 and 49 million.<sup>78</sup> However, there is confidence that despite the impacts of climate change, Australia will continue to have capacity to produce enough food for the expanding population.<sup>79</sup>

Beyond agricultural production capabilities, climate change will shape food security in terms of access. The Climate Health WA Inquiry found that the impacts of climate change on primary production of food are likely to affect food availability and affordability.<sup>80</sup>

Access to nutritious foods is one of the most effective ways to decrease the burden of many diseases and their associated risk factors.<sup>81</sup> Reduced availability and affordability of fresh food will translate to poorer health outcomes for people in vulnerable groups who tend to

---

71 Education and Health Standing Committee, *Making Hope Practical: Report of the inquiry into the response of Western Australian schools to climate change*, Parliament of Western Australia, Perth, June 2022, p. 3.

72 *ibid.*, p. 5.

73 *ibid.*, p. 3.

74 Priyadarshi R Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Summary for Policymakers, IPCC, 2019, p. 439.

75 Mason Littlejohn et al., *From Townsville to Tuvalu: health and climate change in Australia and the Asia Pacific region*, Global Health Alliance Australia, Melbourne, 2019, p. 16.

76 *ibid.*

77 Submission 4 to the House of Representatives Standing Committee on Agriculture, Inquiry into food security in Australia, University of Western Australia, p. 1.

78 Australian Bureau of Statistics, *Population Projections, Australia*, 22 November 2018, accessed 26 May 2023, <<https://www.abs.gov.au>>.

79 Submission 4 to the House of Representatives Standing Committee on Agriculture, Inquiry into food security in Australia, University of Western Australia, p. 1.

80 Tarun Weeramanthri et al., *Climate Health WA Inquiry: Final Report*, Department of Health, Perth, 2020, p. 46.

81 *ibid.*



resort to foods with high fat and sugar content, due to the easy access to these foods and their capacity to provide dietary energy at a lower cost.<sup>82</sup>

The IPCC has indicated that the consumption of healthy and sustainable diets presents a major opportunity for reducing greenhouse gas emissions from food systems and for improving health outcomes.<sup>83</sup>

### 3 The role of alternative or complementary proteins

Plant-based alternative proteins, cultured meat, precision fermentation and insects may all have a role to play in the transition to more healthy and sustainable diets.<sup>84</sup> More work is needed to establish the best way for these alternatives to complement and improve dietary and planetary health, as well as food security.

#### 3.1 The alternative proteins industry includes a wide range of products

The alternative proteins industry is a 'wide, wide spectrum' covering food made from plants such as vegetarian sausages or burger patties through to cultured meat (also known as cultivated, in vitro, cellular, artificial or lab-grown meat).<sup>85</sup> Precision fermentation products include animal fats and dairy products which are 'animal-free', fermented in tanks in a similar process to brewing beer.<sup>86</sup> Rather than being a new process, precision fermentation has a history of more than 80 years as this is the process used to produce medical insulin.<sup>87</sup> Lesser known products like mycoproteins (meat replacements that come from fungi), algae such as spirulina and kelp, and bacterial protein (also known as microbial protein) also sit under the alternative proteins umbrella.<sup>88</sup>

*Increased focus on detrimental health impacts and environmental issues linked to most animal-based diets have accelerated the shift towards plant-based foods ... 14 per cent of Australians are making a concerted effort to avoid red meat.*

*- Food and Agribusiness Growth Centre,  
2020 Food Innovation Australia Limited*

Traditional plant-based proteins like tofu, nuts, peas and beans are sometimes included in the alternative proteins industry, as are insects (although it would be a misnomer to call

---

82 Submission to the Climate Health WA Inquiry, Department of Health, p. 9.

83 Priyadarshi R. Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Summary for Policymakers IPCC, 2019, p. 440.

84 Priyadarshi R Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Summary for Policymakers IPCC, 2019, p. 440.

85 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, pp. 1, 2.

86 Food Frontier, *What are alternative proteins?*, accessed 8 April 2024, <<https://www.foodfrontier.org/>>.

87 Good Food Institute, *Fermentation*, 2024, accessed 30 April 2024, <<https://gfi.org/fermentation/>>.

88 Katherine Collett et al., *The climate impact of alternative proteins*, Oxford Smith School of Enterprise and the Environment, Oxford, 2021, p. 3.

them ‘alternative’ in many countries given that they are already consumed by at least 2 billion people worldwide).<sup>89</sup>

While cellular agriculture products are not yet regulated for sale in Australia, the first licences are currently under consideration by Food Standards Australia and New Zealand.<sup>90</sup> There are indications that Australia’s alternative proteins industry, while small, will grow in the near future. Already there has been an upward trend; in 2019–20, for instance, the number of Australian brands in major retail and national foodservice grew from 10 to 19 while retail sales rose by 32 per cent to \$185 million.<sup>91</sup> The number of Australian and New Zealand-based alternative proteins companies was reported in 2023 to have grown from 4 to more than 40 since 2018, with products in the Australian plant-based meat retail category rising from less than 80 to more than 300, with two-thirds made locally by 25 businesses.<sup>92</sup> These start-ups are subject to market adjustments and a recent news item reported a slowing in sales in 2023, with companies exiting the industry while others merged or consolidated their work.<sup>93</sup>

### 3.2 Plant-based alternative proteins could help people achieve a healthier diet

While a growing number of Australians are already reducing the amount of meat they consume,<sup>94</sup> plant-based alternative proteins may help address some of the barriers to reducing meat consumption. Products such as plant-based burger patties or sausages emulate the taste and texture of meat products, so that traditional meat eaters are less likely to feel they are missing out on meat when increasing their vegetable intake.<sup>95</sup> Curtin University sustainability professor Dora Marinova said many alternative proteins currently on the market mimic animal meat so closely that people struggle to tell them apart:

There have been many, many studies: blindfolding people trying to distinguish between livestock-based sausage and plant-based sausage, and, you know, people cannot tell the difference. That is where I think is going to be the disruption around using plants to produce a diversity of products that enrich the choices that customers have in our supermarkets.<sup>96</sup>

- 
- 89 Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, ‘alternative proteins’ and sustainability*, IPES-Food, Brussels, 2022, p. 50.
- 90 Cellular Agriculture Australia, *Australia’s first food safety application for cultivated meat*, n.d., accessed 30 April 2024, <<https://www.cellularagricultureaustralia.org>>.
- 91 K Job et al., *2020 State of the Industry: Australia’s Plant-Based Meat Sector*, Food Frontier, Melbourne, 2021, p. 11.
- 92 Food Frontier, *Year in Review 2023*, Melbourne, 2023, p. 3.
- 93 RN Breakfast, ‘Is plant-based meat losing popularity?’, *ABC Radio*, 15 April 2024.
- 94 Roy Morgan, *Rise in vegetarianism not halting the march of obesity*, media release, 12 April 2019; Lenka Malek and Wendy J Umberger, ‘Distinguishing meat reducers from unrestricted omnivores, vegetarians and vegans: A comprehensive comparison of Australian consumers’, *Food Quality and Preference*, vol. 88, March 2021; Vegan Australia, *Climate change driving diet change - 37% of Aussies now reducing meat consumption*, 11 November 2020, accessed 16 May 2023, <<https://www.veganaustralia.org.au>>; Colmar Brunton, *Hungry for Plant-Based: Australian Consumer Insights*, Food Frontier and Life Health Foods, October 2019, p. 2.
- 95 Susanne Stoll-Kleemann and Uta Johanna Schmidt, ‘Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: a review of influence factors’, *Regional Environmental Change*, vol. 17, 2017.
- 96 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 2.

Plant-based alternatives that imitate animal meat products also offer familiarity and convenience, both of which are highly influential in changing consumer habits. The think tank on alternative proteins in Australia and New Zealand, Food Frontier, said that plant-based meats offer consumers a nutritious, familiar taste and format that can be easily substituted into routines and cuisines.<sup>97</sup> This is relevant in light of research showing limited cooking skills as partly responsible for people’s reluctance to increase vegetable intake.<sup>98</sup> In this regard, processed plant-based foods can be a useful stepping stone or transition tool, providing easy opportunities for consumers to reduce their meat consumption.<sup>99</sup>

### **3.2.1 Cultured meat might not have the same health benefits**

The extent to which cultured meat (as distinct from plant-based alternatives) can assist people in achieving a more balanced diet is less straightforward because of indications that cultured meat might have the same impact on human health as animal-based meat. Haem iron, which is found in red and processed meats, is at the centre of this research. Once consumed, it breaks down in the gut and forms N-nitroso compounds, which can damage the cells lining the bowel and ultimately cause cancer.<sup>100</sup> Given that cultured meat is also likely to contain haem iron, there are suggestions it will have the same carcinogenic effects as red and processed meats.<sup>101</sup>

Professor Marinova also drew the Committee’s attention to the immortalised cell lines used to create cultured meat. Normal meat cells will not divide forever, so to grow cell cultures large enough to create cultured meat, companies use immortalised cells—cells that, due to a mutation, constantly reproduce.<sup>102</sup> Professor Marinova said further research is required to determine the effect of these cells in relation to pre-cancerous cells.<sup>103</sup>

*Where diets contain inadequate amounts of fruit and vegetables to meet recommended fibre intake ... plant-based meats can provide a useful supplement as part of a balanced diet to ensure that consumers are getting enough fibre with their protein.*

*- Physicians Association on Nutrition*

Consumers seem more willing to accept plant-based alternative proteins than cultured meat. In a study of the attitudes of Australia’s Generation Z towards meat consumption in relation to climate change and alternative proteins, Professor Marinova and fellow researcher Diana Bogueva found that 72 per cent were not

---

97 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 3.

98 Carmelia Alae-Carew et al., 'The role of plant-based alternative foods in sustainable and healthy food systems: Consumption trends in the UK', *Science of the Total Environment*, vol. 807, no. 3, February 2022.

99 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 3.

100 World Cancer Research Fund and American Institute for Cancer Research, *Meat, fish and dairy products and the risk of cancer*, Continuous Update Project, Third Expert Report, 2018, pp. 74, 75, 76, accessed 26 May 2023, <<https://www.wcrf.org>>.

101 Patricia Marshall and Dora Marinova, 'Health benefits of eating more plant foods and less meat', in Diana Bogueva et al. (eds.), *Environmental, Health and Business Opportunities in the New Meat Alternatives Market*, IGI Global, Hershey, PA, 2019, p. 44.

102 Joe Fassler, 'Lab-grown meat has a bigger problem than the lab', *Financial Review* (web-based), 15 February 2023, accessed 31 May 2023, <<https://www.afr.com>>.

103 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 2.

ready to accept cultured meat, claiming it was ‘unnatural’, ‘abnormal’ and ‘artificial’. However, 35 per cent of people who rejected cultured meat accepted plant-based alternatives and insects, seeing them as ‘natural’ and ‘normal’.<sup>104</sup>

### **3.2.2 The health impacts of plant-based alternative proteins require more investigation**

Compared to animal meats, plant-based meats contain around the same amount of protein and reduced amounts of fat, saturated fats and sodium. They are also a source of dietary fibre where conventional meat has none.<sup>105</sup> There are also suggestions that cultured meat could be adjusted to increase its nutritional value by replacing saturated fats with other types of fats, such as omega-3s.<sup>106</sup>

However, the alternative proteins industry admits that, given the early state of the plant-based meat industry and the nascent stage of the cellular agriculture industry, there is

***The food we eat and how we produce it determines the health of people and the planet, and we are currently getting this seriously wrong.***

*- Tim Lang, Professor of Food Policy, City University, London*

currently only a small amount of academic literature examining alternative proteins and health, particularly in an Australian context.<sup>107</sup> Evidence to the Australian Senate inquiry into definitions of meat and other animal products also noted that more work was needed before any conclusions could be made about the health benefits of these products.<sup>108</sup> Similarly, a University of Melbourne study testing the benefits claimed by Australian alternative protein

companies found ‘few companies provided evidence or data to support their claims’. This included nutrition claims, which were made by 11 companies.<sup>109</sup>

In response to these concerns, Food Frontier told us that the question ‘are these products healthy?’ must be assessed in a situational context rather than taken in isolation.<sup>110</sup> It requires consideration of how a food is prepared, how often it is consumed and what it is being consumed with. Food Frontier said a more meaningful question would be ‘are these products healthier than what was being consumed otherwise, and can they form part of a healthy, balanced and sustainable diet?’<sup>111</sup>

An evidence review of plant-based diets by the WHO has also noted that some alternative proteins can fall within the category of ‘ultra-processed foods’ (UPFs). It should be noted that UPFs include a range of animal-based products and some alternative protein products

---

104 Diana Bogueva and Dora Marinova, ‘Australian Generation Z and the nexus between climate change and alternative proteins’, *Animals*, vol. 12, 2022.

105 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 4.

106 Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, ‘alternative proteins’ and sustainability*, IPES-Food, Brussels, 2022, p. 50.

107 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 1.

108 CSIRO and George Institute in Senate Rural and Regional Affairs and Transport Legislation Committee, *Don’t mince words: definitions of meat and other animal products*, Parliament of Australia, Canberra, February 2022, pp. 81–82.

109 Jennifer Lacy-Nichols, Gyorgy Scrinis and Rob Moodie, *The Australian Alternative Protein Industry: A report for the Future Food Hallmark Research Initiative*, University of Melbourne, Melbourne, May 2020, pp. 4, 6.

110 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 4.

111 *ibid.*

on the Australian market. These are foods that consist of ‘starches, sugars, fats and protein isolates, with little, if any, whole food’, such as breakfast cereals, flavoured yoghurt, ham, sausages, ice cream and instant soup. They often have flavours, colours and emulsifiers added to improve appearance and/or shelf-life.<sup>112</sup> The WHO cautioned that the health impacts of the food additives in these products is not well understood and is an area requiring further investigation.<sup>113</sup>

IPES-Food, the International Panel of Experts on Sustainable Food Systems, raised similar concerns, pointing to:

- A 2019 analysis from the Harvard Medical School, which found the health benefits of legumes used in a range of meatless burgers were ‘somewhat diminished by their high degree of processing, high levels of sodium, and comparable levels of saturated fats’.<sup>114</sup>
- A 2018 UK survey, which found that the average amount of salt per serving in vegetarian burgers on sale at three prominent supermarkets was higher than beef burgers and contained more salt than a large portion of McDonald’s fries.<sup>115</sup>

Food Frontier pointed to new research demonstrating that poor health outcomes are not uniquely associated with all UPF consumption. This supports some experts’ concerns that the UPF classification is too broad, unnecessarily villainising a large range of ingredients and foods, and consideration must still be given to products’ nutritional composition. As with many food categories, there are wide variances in processing methods, ingredients and formulations which often depend on the brand’s intended market.<sup>116</sup>

### 3.3 Plant-based alternative proteins may help to tackle climate change

Proponents of alternative proteins are optimistic about their ability to reduce the climate impacts arising from our food systems. Compared to the livestock sector, plant-based alternative proteins would appear to require fewer inputs—including energy, land and water—primarily because many of the ingredients are derived from plants. A frequently quoted 2018 study of over 38,000 commercial farms in 119 countries compared the carbon footprints for different food products and found that even the lowest impact producers of animal products (those who emit less carbon dioxide equivalent (CO<sub>2</sub>-eq) than others producing the same food) typically exceed vegetable substitutes (see Table 3.1).<sup>117</sup>

---

112 World Health Organization European Office for the Prevention and Control of Noncommunicable Diseases, *Plant-based diets and their impact on health, sustainability and the environment: A review of the evidence*, WHO, Copenhagen, 2021, p. 4.

113 *ibid.*

114 Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, ‘alternative proteins’ and sustainability*, IPES-Food, Brussels, 2022, p. 53

115 *ibid.*; Action on Salt, *2018 Meat-Free Alternatives*, October 2018, accessed 31 May 2023, <<https://www.actiononsalt.org.uk>>.

116 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 3; RN Breakfast, ‘Is plant-based meat losing popularity?’, *ABC Radio*, 15 April 2024.

117 J Poore and T Nemecek, ‘Reducing food’s environmental impacts through producers and consumers’, *Science*, vol. 360, no. 6392, 2018, pp. 987–992; Hannah Ritchie, ‘Less meat is nearly always better than sustainable meat, to reduce your carbon footprint’, *Our world in data*, 4 February 2020, accessed 30 May 2023, <<https://ourworldindata.org>>.

**Table 3.1:** Emissions of the highest-impact producers of plant-based proteins and lowest-impact producers of animal-based proteins

Plant-based proteins - Highest-impact producers		Animal-based proteins - Lowest-impact producers	
Protein type	kgCO <sub>2</sub> -eq/100g protein	Protein type	kgCO <sub>2</sub> -eq/100g protein
Tofu	3.5	Lamb	12
Nuts	2.4	Beef	9
Peas	0.8	Cheese	4.5
		Pork	4.5

Source: Hannah Ritchie, 'Less meat is nearly always better than sustainable meat, to reduce your carbon footprint', *Our world in data*, 4 February 2020, accessed 30 May 2023, <<https://ourworldindata.org/less-meat-or-sustainable-meat>>.

Although the study of greenhouse gas emissions associated with alternative proteins is in its infancy, initial research suggests that they emit less greenhouse gas than traditional meat and dairy products. A 2016 US study of 39 vegetarian meat alternatives concluded that their production process generated around 10 times fewer greenhouse gas emissions than comparable beef-based products.<sup>118</sup> Early analyses of cellular agriculture technologies have also demonstrated the potential for significant reductions in emissions compared to conventional animal production. Cultivated meat can reduce CO<sub>2</sub>-eq emissions by 85 to 92 per cent compared to conventional beef, while precision fermentation-produced whey protein produced 91 to 97 per cent fewer CO<sub>2</sub>-eq emissions compared to whey protein from conventional cow's milk.<sup>119</sup>

Additional environmental benefits come from reducing the amount of land use currently required for food production. Cultivated meat and precision fermentation technologies require significantly less land use than comparable conventional animal proteins. Other research has found that replacing half of current animal products with plant-based alternative proteins by 2050 would allow for cessation of land clearing from forested areas and a 12 per cent global reduction of agricultural land requirements.<sup>120</sup>

Land that is not used for agriculture can be used as a carbon sink. Some studies suggest that converting land currently used for livestock farming into forests would potentially remove billions of tonnes of global greenhouse gases from the climate, with estimates ranging from 0.5 to 10 gigatonnes CO<sub>2</sub>-eq per year.<sup>121</sup>

Professor Marinova cautioned against measuring the value of land according to how it benefits humans, saying 'there is no such thing as unproductive land'. If it is not producing food, it can serve as habitat for native species or provide people with access to nature.<sup>122</sup> She said any plant-based options were a better choice environmentally:

118 Federation of American Societies for Experimental Biology, 'Quantifying the environmental benefits of skipping the meat', *ScienceDaily* (web-based), 4 April 2016, accessed 31 May 2023, <<https://www.sciencedaily.com>>.

119 Klara Kalocsay, *Food Frontier*, Letter, 19 December 2023, p. 8.

120 *ibid.*, p. 9.

121 Priyadarshi R Shukla et al. (eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, Summary for Policymakers, IPCC, 2019, p. 99.

122 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 5.

It does not matter whether you look at it through the lens of water consumption, land use, emissions or biodiversity. From any point of view, that is a much better option.<sup>123</sup>

### **3.4 The way alternative proteins are produced can impact the environment**

Many of the environmental challenges relating to the livestock sector arise from the way we farm rather than some intrinsic characteristic of cattle, sheep or pigs. Intensive livestock operations are a modern development enabled by industrial-scale infrastructure and the availability of antibiotics that allow producers to rear huge numbers of animals in relatively small areas, as discussed earlier.<sup>124</sup> These methods of farming food-producing animals, rather than farming itself, have contributed to the climate crisis we face today.

The alternative proteins industry is not immune from the pressure to produce more for less and may therefore encounter some of the same issues currently affecting the livestock sector. This section examines this complexity, outlining how certain farming practices can actually help WA reduce its greenhouse gases; and, equally, how the alternative proteins industry could negatively impact the environment if not properly managed.

#### **3.4.1 Farming can sequester carbon**

In Australia, intensive livestock industries are associated with dairy cattle, beef cattle in feedlots, swine (i.e. piggeries) and poultry (i.e. chicken farms).<sup>125</sup> While the term ‘farming’ has traditionally been associated with cattle and sheep farmed in grazing and mixed (crop-livestock) production systems, it is increasingly likely that it includes feedlots. In the first quarter of 2021, over half of Australia’s beef production came from feedlot cattle. Feedlot cattle made up the majority of beef eaten by Australians.<sup>126</sup> Such intensive farming practices are likely to continue, with the Australian Government’s most recent submission to the United Nations Framework Convention on Climate Change identifying an ‘upward trend in the number of cattle finished in feedlots’.<sup>127</sup>

However, the IPES-Food notes there is evidence that well-managed grazing land can also sequester and store carbon more effectively than other land uses. It points to studies indicating that animal grazing can help sequester carbon in soils and, depending on the

---

123 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 5.

124 See Fiona Harvey et al., 'Rise of mega farms: how the US model of intensive farming is invading the world', *The Guardian* (web-based), 19 July 2017, accessed 31 May 2023, <<https://www.theguardian.com>>; BD Scherf and D Pilling (eds.), *The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture*, FAO, Rome, 2015, p. 180.

125 See Department of Industry, Science, Energy and Resources, *National Inventory Report 2020: The Australian Government Submission to the United Nations Framework Convention on Climate Change*, Australian Government, May 2022, pp. 297, 334.

126 Meat and Livestock Australia, *Grainfed cattle make up 50% of beef production*, 10 June 2021, accessed 26 May 2023, <<https://www.mla.com.au>>.

127 Department of Industry, Science, Energy and Resources, *National Inventory Report 2020: The Australian Government Submission to the United Nations Framework Convention on Climate Change*, Australian Government, May 2022, p. 297.

livestock management practices used, may lead to the finishing period (when livestock is fed an energy-dense diet to meet market specifications) being a net carbon sink.<sup>128</sup>

Soil carbon sequestration is often discussed in conjunction with regenerative farming, a land management approach that seeks to improve soil health, reduce erosion, store carbon and increase biodiversity through the incorporation of trees and perennial plants. Rotational grazing, which moves livestock through a series of paddocks to reduce both the grazing pressure on pasture (particularly perennial grasses) and soil compaction, is a key part of regenerative farming.<sup>129</sup>

WA regenerative farming advocates David and Frances Pollock, owners of Wooleen Station 700 kilometres north north-east of Perth, have applied the Natural Sequence Farming principles—a method that seeks to retain water by designing and building natural landscape structures, reducing grazing pressure and promoting vegetation cover.<sup>130</sup>

In 2019, the WA Government began backing carbon farming on pastoral leases, allowing pastoralists to participate in Human Induced Regeneration (HIR) as part of the Commonwealth’s Emissions Reduction Fund.<sup>131</sup> HIR carbon farming projects manage the timing and extent of livestock grazing and reduce the number of feral animals and weeds with the aim of regenerating native vegetation in degraded areas. As at 31 March 2024, WA had over 90 HIR projects registered with the Emissions Reduction Fund.<sup>132</sup>

The WA Government is also supporting a local company’s vertical farming project, which will address food security and quality with an industrial-scale solar powered indoor farm. When fully operational, Eden Towers will generate 120 tonnes of produce per year, including lettuce, spinach, kale, microgreens, edible flowers and herbs.<sup>133</sup>

### **3.4.2 Production of alternative proteins must be managed to maximise benefits**

Careful management of the production of plant-based alternative proteins is required to maximise their environmental benefits. According to IPES-Food, chemical-intensive crop monocultures are already causing ‘severe environmental and health impacts across food systems’. If manufacturers of plant-based alternatives sourced ingredients from industrial chains, they could exacerbate these problems. As an example, the production of coconut

---

128 Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, ‘alternative proteins’ and sustainability*, IPES-Food, Brussels, 2022, p. 71.

129 Department of Primary Industries and Regional Development, *Rotational grazing for small landholders*, 24 August 2017, accessed 30 May 2023, <<https://www.agric.wa.gov.au>>; Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, ‘alternative proteins’ and sustainability*, IPES-Food, Brussels, 2022, p. 71.

130 Wooleen Station, *Learn Natural Sequence Farming*, 30 December 2020, accessed 31 May 2023, <<https://wooleen.com.au>>; Nik Callow and Rose Anne Bell, *The applicability, efficacy and risks of natural sequence farming in the dryland agricultural zone of south west Western Australia: A report to the Department of Primary Industries and Regional Development*, Natural resources commissioned report 7, University of Western Australia, Perth, 2021, p. 5.

131 Hon Alannah MacTiernan MLC, Hon Ben Wyatt MLA and Hon Stephen Dawson MLC, *Landmark decision to allow carbon farming on pastoral lands*, media release, 5 December 2019.

132 Clean Energy Regulator, *Emissions Reduction Fund Register*, 17 March 2024, accessed 9 April 2024, <<https://cleanenergyregulator.gov.au>>.

133 Peel Development Commission, *Skies the Limit for WA Vertical Farm Company*, 24 January 2022, accessed 8 May 2024 <<https://www.peel.wa.gov.au>>



and palm oil—key ingredients in many plant-based alternative proteins—is often linked to deforestation and ecosystem disturbances in the tropical areas where they are grown.<sup>134</sup>

The emissions generated by international supply chains are another consideration in minimising the environmental impact of alternative protein products. Industry research has found that plant-based meat still has a smaller environmental impact than conventional meat, regardless of whether it is consumed locally or imported from abroad.<sup>135</sup> However, Australian manufacturers of plant-based meat substitutes are currently importing key ingredients because the processing technology required to make meat alternatives does not exist in Australia.<sup>136</sup> Food Frontier notes there is an upstream requirement for investment in local processing and manufacturing facilities to support large-scale production of plant-based products and cellular agriculture in Australia. Costs are significant—up to hundreds of millions of dollars—and the current economic environment poses a challenge to securing the required funding.<sup>137</sup>

Fertiliser and its environmental impact will remain a concern for alternative proteins unless there is a move away from conventional ammonia (the production of which results in carbon dioxide waste) to green ammonia. Algae, mycoproteins (a meat replacement derived from fungi) and insects have fertiliser emissions connected to their production, mainly because the plants used to feed them require fertilising.<sup>138</sup>

Finally, producing alternative protein products can be energy intensive.<sup>139</sup> Food Frontier acknowledged that the availability of renewable energy is critical to realising the full sustainability potential of alternative proteins and many companies have committed to achieving carbon neutrality and using only renewables as they scale operations.<sup>140</sup>

### 3.5 More transparency is needed

Greater transparency is needed within the industry to encourage consumption of alternative proteins. In a hearing with the Committee, Professor Marinova said this was particularly important amongst Generation Z:

[T]hey want to know how they [alternative proteins] are made, what are the ingredients, are they GMO plants that are being used and what is the biofortification that has been used in terms of the nutritional component—so they want all that.<sup>141</sup>

---

134 Philip Howard et al., *The Politics of Protein: Examining the claims about livestock, fish, 'alternative proteins' and sustainability*, IPES-Food, Brussels, 2022, p. 54.

135 Colin Powell, *Addendum to: Impossible Foods Sausage Made from Plants LCA*, WSP Canada, 2021, accessed 9 April 2024, <[ctfassets.net](https://ctfassets.net)>.

136 Emma Alsop, 'v2food to close Wodonga plant despite strong sales', *Grain Central* (web-based), 15 February 2023, accessed 10 May 2023, <<https://www.graincentral.com>>.

137 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 9.

138 Katherine Collett et al., *The climate impact of alternative proteins*, Oxford Smith School of Enterprise and the Environment, Oxford, 2021, pp. 20, 17.

139 *ibid.*, pp. 15, 16.

140 Klara Kalocsay, Food Frontier, Letter, 19 December 2023, p. 8.

141 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 3.

In 2020 and 2021, Professor Marinova was part of a research team that examined men's acceptance of plant-based alternative proteins. The researchers noted that Generation Z participants 'expressed demand for clear labelling and production transparency for these products.'<sup>142</sup> They quoted one participant who said:

You know, producers need to let us know what they are putting into these plant-based options. There is not much transparency about the hidden ingredients. I know they are including the general stuff in the label, but there are many small doses of chemicals that are not disclosed. I read about this recently in one news article. It's quite disturbing. When people find out what is in it, this will be the end of it. (Male, 19 years old, daily meat eater).<sup>143</sup>

The researchers suggested Gen Z's need for transparency may have arisen from 'the burden of inheriting the problems created by preceding generations, including climate change, biodiversity loss, reduced soil fertility, contaminated land and waterbodies, plastics pollution and many other environmental problems'. They argued the alternative proteins industry could gain credibility and broader acceptance by being transparent, as its claims (including through marketing) will be 'closely monitored' by any people who are 'hesitant to change their diets'.<sup>144</sup>

The Oxford Smith School of Enterprise and the Environment also notes the importance of transparency in growing the alternative proteins industry. It says the benefits and challenges of the food products need to be openly discussed and based on scientific evidence, in part so consumers feel 'fully informed and able to make choices based on complete information'.<sup>145</sup> Indeed, people need to know this information so they can make informed decisions and, in doing so, encourage manufacturers to source ingredients from sustainable and diversified systems.

### **3.6 Quality and affordability is an important consideration**

Compared to other parts of the world, Australian consumers have access to a wide range of high quality and affordable food, including fruit and vegetables. Professor Barry Marshall noted that it is relatively easy to eat a balanced diet; if people developed vitamin deficiencies in Australia, it was usually due to a health condition and not malnutrition.<sup>146</sup>

In this food environment, alternative proteins are quite expensive. According to a 2020 analysis, plant-based alternative products sold in Australia were 49 per cent more expensive than animal meats on average (see Table 3.2).<sup>147</sup>

---

142 Diana Bogueva, Dora Marinova and Christopher Bryant, 'Meat me halfway: Sydney meat-loving men's restaurant experience with alternative plant-based proteins', *Sustainability*, vol. 14, no. 3, 2022.

143 *ibid.*

144 *ibid.*

145 Katherine Collett et al., *The climate impact of alternative proteins*, Oxford Smith School of Enterprise and the Environment, Oxford, 2021, p. 21.

146 Professor Barry Marshall, WA Ambassador for Life Science and Director of the Marshall Centre for Infectious Disease Research and Training, *Transcript of Evidence*, 15 March 2023, p. 11.

147 K Job et al., *2020 State of the Industry: Australia's Plant-Based Meat Sector*, Food Frontier, Melbourne, 2021, p. 17.

However, Professor Marinova believes it is only a matter of time before prices decrease.<sup>148</sup> Specific types of alternative proteins have already experienced a price drop.<sup>149</sup> This reduction is important because many consumers are unlikely to start buying more alternative protein products until they reach price parity with their animal counterparts. In addition to animal welfare and environmental concerns,<sup>150</sup> international studies have found that consumers' willingness to eat alternative proteins is driven by the same factors that influence their other food choices, which includes price.<sup>151</sup>

**Table 3.2: Cheapest comparable plant-based and meat products available at Woolworths on 9 April 2024**

Products	Plant-based (Cost/kg)	Meat products (Cost/kg)
Burger patties	\$22.12	\$11.00
Sausages	\$18.57	\$6.67
Mince	\$17.50	\$8.75
Sliced ham	\$50.00	\$19.69
Sausage rolls	\$14.00	\$12.90

Plant-based products: V2 Plant Based Burgers 4 Pack 452g; Unreal Co. Plant Based Beefy Brat Sausages 350g; V2 Plant Based Mince 400g; Meliora Plant Based Ham Style Slices; Pie Society Plant Based Sausage Rolls 680g.

Meat products: Market Value 10 Beef Burgers 1kg; Market Value 24 Thin Beef Sausages 1.8kg; Woolworths Pork Mince 800g; D'Orsogna Leg Ham Shaved 4 Pack; Four'n Twenty Sausage Roll Jumbo 6 Pack.

Source: Woolworths, *Welcome to Woolworths*, n.d. accessed 9 April 2024, <<https://www.woolworths.com.au/>>.

### 3.6.1 Taste

Taste is a key consideration when consumers are deciding what food to buy, and their decisions are generally based on previous experiences.<sup>152</sup> For example, taste featured prominently in Professor Marinova's study of men's acceptance of plant-based alternative proteins. The taste, texture, flavour and juiciness of the burger were seen as a barrier to future consumption. The study ultimately concluded that male consumers who traditionally eat meat need the taste experience 'to be comparable to animal meat for them to accept the new alternatives'.<sup>153</sup>

148 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 2.

149 Kurt Schmidinger, 'Clean Meat: Will We Brew Our Steaks in the Near Future Without Killing Animals?', in Diana Bogueva et al. (eds.), *Environmental, Health and Business Opportunities in the New Meat Alternatives Market*, IGI Global, Hershey, PA, 2019, pp. 90, 92; Zafer Bashi et al., *Alternative proteins: The race for market share is on*, McKinsey & Company, 16 August 2019, accessed 16 May 2023, <<https://www.mckinsey.com/>>.

150 Hans Dagevos, Ella Tolonen and Jaco Quist, 'Building a Market for New Meat Alternatives: Business Activity and Consumer Appetite in the Netherlands', in Diana Bogueva et al. (eds.), *Environmental, Health and Business Opportunities in the New Meat Alternatives Market*, IGI Global, Hershey PA, 2019, p. 194; Diana Bogueva and Dora Marinova, 'Australian Generation Z and the nexus between climate change and alternative proteins', *Animals*, vol. 12, 2022.

151 Fabienne Michel, Christina Hartmann and Michael Siegrist, 'Consumers' associations, perceptions and acceptance of meat and plant-based meat alternatives', *Food Quality and Preference*, vol. 87, January 2021; Christopher Bryant and Julie Barnett, 'Consumer acceptance of cultured meat: A systematic review', *Meat Science*, vol. 143, 2018.

152 Giovanni Sogari, Diana Bogueva and Dora Marinova, 'Australian consumers' response to insects as food', *Agriculture*, vol. 9, 2019.

153 Diana Bogueva, Dora Marinova and Christopher Bryant, 'Meat me halfway: Sydney meat-loving men's restaurant experience with alternative plant-based proteins', *Sustainability*, vol. 14, no. 3, 2022.

Taste can also be a barrier for women. A 5-year study conducted by Professor Marinova and fellow researchers noted many of the 30 participants, which included 16 women, cited taste as a reason for eating meat.<sup>154</sup> Participants' cooking skills appear to have influenced their preference, with some acknowledging that they cooked vegetables in a simple way but the same approach for plant-based meals produced 'plain and tasteless' results.<sup>155</sup> The study included classes demonstrating how to cook with plant-based alternatives to develop participants' skills and improve the taste experience.<sup>156</sup> Over the course of the study, 14 participants (almost half) decreased their meat consumption.<sup>157</sup>

#### 4 Multiple approaches are required to improve health and climate

The EAT-Lancet Commission suggests that food is the 'single strongest lever' we have to 'optimize human health and environmental sustainability on Earth'.<sup>158</sup> However, research suggests that there are considerable barriers to encouraging Australians to adjust their diets.

For example, there is a lack of awareness of the link between food production and climate change. A 2021 survey examining Generation Z's attitudes to meat consumption in relation to climate change and alternative proteins found that only 38 per cent of participants identified livestock and agriculture as a possible contributor to climate change.<sup>159</sup> Participants were more likely to identify factors such as fossil fuels, waste (i.e. plastic, rubbish and food) and transport.<sup>160</sup>

Another barrier is the association of meat with masculinity,<sup>161</sup> which can contribute to men's reluctance to reduce their consumption. In one of Professor Marinova's studies, male participants expressed concern that they might be socially ridiculed for not eating meat.<sup>162</sup> She told the Committee how people use their food choices to express their identities:

[I]n Australia in particular, this is what our research shows, there is also a strong social aspect in relation to food, which is along the lines of anything that has to do with plants or with vegetables, it is food for women, while real men eat meat. This

---

154 Diana Bogueva, Dora Marinova and Talia Raphaely, 'Influencing sustainable food-related behaviour changes: a case study in Sydney, Australia', in Jishnu Bhattacharyya et al. (eds.), *Social and Sustainability Marketing: A Casebook for Reaching Your Socially Responsible Consumers through Marketing Science*, Routledge, Taylor & Francis, New York, 2021, pp. 359, 361.

155 *ibid.*, p. 367.

156 *ibid.*, p. 354.

157 *ibid.*, p. 377.

158 EAT-Lancet Commission, *Healthy diets from sustainable food systems, Summary report of the EAT-Lancet Commission*, EAT, Norway, 2019, p. 5.

159 Diana Bogueva and Dora Marinova, 'Australian Generation Z and the nexus between climate change and alternative proteins', *Animals*, vol. 12, 2022.

160 *ibid.*

161 Diana Bogueva and Dora Marinova, 'What Is More Important: Perception of Masculinity or Personal Health and the Environment', in Diana Bogueva, Dora Marinova and Talia Raphaely (eds.), *Handbook of Research on Social Marketing and Its Influence on Animal Origin Food Product Consumption*, IGI Global, Hershey, PA, 2018, p. 151.

162 Diana Bogueva, Dora Marinova and Christopher Bryant, 'Meat me halfway: Sydney meat-loving men's restaurant experience with alternative plant-based proteins', *Sustainability*, vol. 14, no. 3, 2022.

is where I see that there is need for a lot of communication, a lot of change of attitudes and a role that civil society can play in changing these perceptions.<sup>163</sup>

Consumer choices and dietary preferences are guided by social, cultural, environmental and traditional factors, and institutions and public health policies have the potential to influence demand.<sup>164</sup> Growth in demand for alternative protein products could provide economic opportunities for the agriculture and food industries. Analysis for the Department of Primary Industries and Regional Development identified opportunities for Western Australia to position itself as a leader in the ‘foods for health’ industry, which includes alternative dairy and plant proteins. This industry was projected to offer high growth and high margins, with attractive markets identified both domestically and overseas.<sup>165</sup>

#### **Recommendation 1**

Given the multiple health and environmental benefits and the economic opportunities, the government should provide more support for the development of the alternative proteins industry.



MR C.J. TALLENTIRE, MLA  
CHAIR

---

163 Professor Dora Marinova, Curtin University, *Transcript of Evidence*, 15 March 2023, p. 2.

164 Intergovernmental Panel on Climate Change, *Special Report on Climate Change and Land*, 2019, p. 440.

165 Coriolis, *Prescriptions for Growth: Opportunities for Western Australia food and beverage firms in Foods for Health markets*, May 2021, pp. 5, 10.



# Appendix One

## Committee's functions and powers

---

The functions of the Committee are to review and report to the Assembly on:

- a) the outcomes and administration of the departments within the Committee's portfolio responsibilities;
- b) annual reports of government departments laid on the Table of the House;
- c) the adequacy of legislation and regulations within its jurisdiction; and
- d) any matters referred to it by the Assembly including a bill, motion, petition, vote or expenditure, other financial matter, report or paper.

At the commencement of each Parliament and as often thereafter as the Speaker considers necessary, the Speaker will determine and table a schedule showing the portfolio responsibilities for each committee. Annual reports of government departments and authorities tabled in the Assembly will stand referred to the relevant committee for any inquiry the committee may make.

Whenever a committee receives or determines for itself fresh or amended terms of reference, the committee will forward them to each standing and select committee of the Assembly and Joint Committee of the Assembly and Council. The Speaker will announce them to the Assembly at the next opportunity and arrange for them to be placed on the notice boards of the Assembly.





## Appendix Two

### Acronyms

---

AMR	Antimicrobial resistance
CO <sub>2</sub> -eq	Carbon dioxide equivalent
FAO	Food and Agriculture Organization of the United Nations
GMO	Genetically Modified Organism
HIR	Human Induced Regeneration
IARC	International Agency for Research on Cancer of the World Health Organization
IPCC	Intergovernmental Panel on Climate Change
IPES-Food	International Panel of Experts on Sustainable Food Systems
OECD	Organisation for Economic Co-operation and Development
UPF	Ultra-processed foods
WHO	World Health Organization



---

Parliament House  
4 Harvest Terrace, West Perth WA 6005  
Telephone: +61 8 9222 7222  
Email: [laco@parliament.wa.gov.au](mailto:laco@parliament.wa.gov.au)  
Website: [www.parliament.wa.gov.au](http://www.parliament.wa.gov.au)