

# Climate change impacts on health & wellbeing in the Mornington Peninsula Shire

## Summary brief 1: Climate change impacts on health & wellbeing

This brief outlines some of the key ways in which climate change impacts on health and wellbeing in the Mornington Peninsula Shire. Further detail is provided in *Detailed assessment of climate change risks to community health and wellbeing – Background Report: Mornington Peninsula Shire*.

### Climate change Key messages

- Climate change will have impacts on higher average temperatures and more extreme temperatures, less rainfall overall, but also instances of extreme precipitation and flood events, bushfires, and sea level rise<sup>1</sup>
- While climate change will impact on hazards, it will also over time alter our social and ecological conditions, creating new interactions, dynamics, and risk<sup>2</sup>
- Climate change will have disproportionate impacts amongst people experiencing socio-economic disadvantage and marginalisation.<sup>3</sup>

### Key facts

- In Victoria, there has already been over a 1.0°C of warming since official records began in 1910<sup>4</sup>
- No one under the age of 23 who has always lived in Victoria has experienced a year of below-average temperature<sup>4</sup>
- This warming is the result of human activities and global warming and “is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate.”<sup>5</sup>

### How climate change impacts on health & wellbeing

There are three primary pathways through which climate change impacts on health:

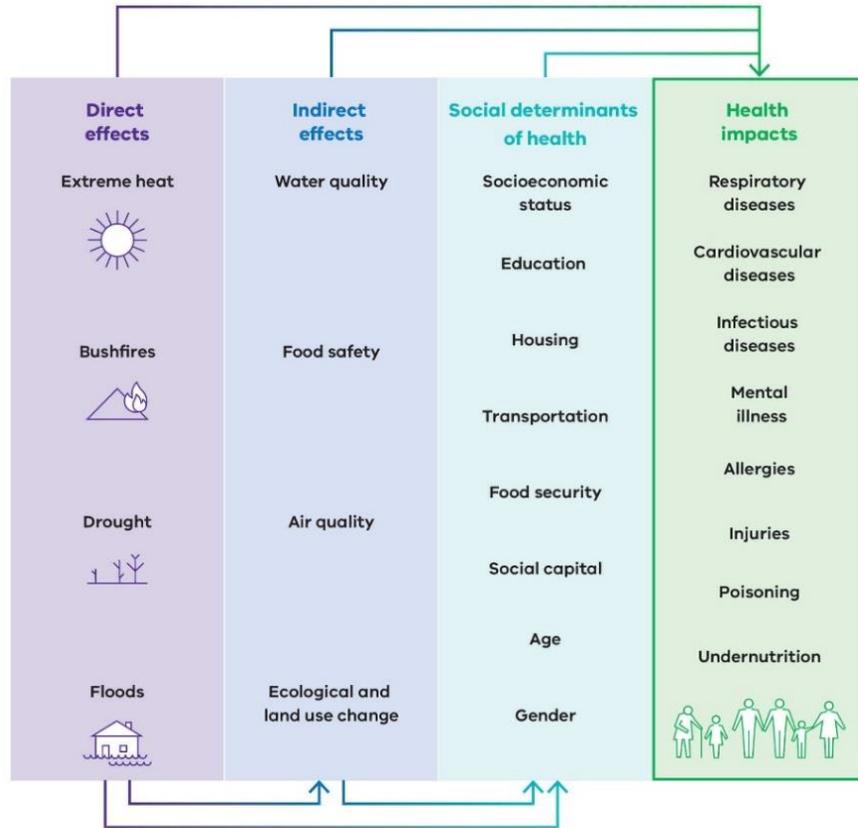
- Direct effects on health and wellbeing in the Mornington Peninsula Shire include heat, floods and storm, and bushfires
- Impacts on natural systems which influence health and wellbeing in the Mornington Peninsula Shire include water quality, air quality, and disease vectors
- Impacts on human systems which influence health and wellbeing in the Mornington Peninsula Shire include mental health, occupational health, and food security.

The direct and indirect effects of climate change on health and wellbeing are illustrated in Figure 1 (overpage).

While these pathways to health impacts are discussed separately below, impacts on health can be both direct and indirect, and have multiple pathways. For example, temperatures influence fire danger. Bushfires pose both direct threats to human life and injury, as well indirect risks through impact on air quality through smoke haze (natural systems), trauma, and displacement (human systems).

Disaster management, poverty reduction, and improving health services can all help to alleviate the negative impacts of climate change on health.<sup>6</sup>

### Direct and indirect effects of climate change on health and wellbeing



Adapted from Watts et al. 2015, *The Lancet, Health and climate change: policy responses to protect public health*.  
 Reference: Victorian Government 2020, *Tackling climate change and its impacts on health through municipal public health and wellbeing planning: guidance for local government*, September 2020  
<https://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/climate-change-and-health>.

Figure 1: Direct and indirect effects of climate change on health and wellbeing - source DHHS 2020

## Key climate change and health impacts: How the Mornington Peninsula Shire is tracking

### Direct effects

#### Temperature & extreme heat

Exposure to heat is "an immediate and direct impact of climate change" on health, and is associated with increased rates of death (mortality) in Australia.<sup>7</sup> For the Mornington Peninsula Shire – in the Central District – heat health alerts are issued when temperatures are forecast to significantly impact on human health.<sup>8</sup> In the Central District, five heat health alerts were issued for 2019-20, and eight heat health alerts were issued for 2018-19. The number of hot days which pose a risk to human health in Victoria has increased since 1910. Figure 2 shows unusually hot weather in Victoria.

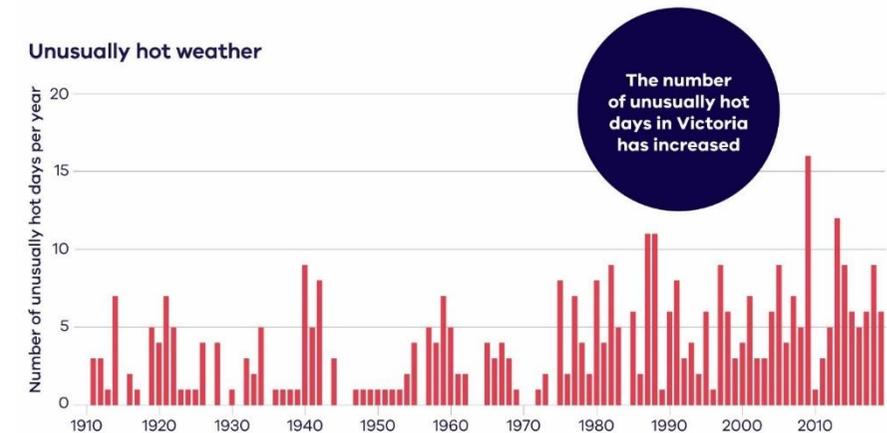


Figure 2: Source - DELWP 2019. Figure shows days per year when the Victorian average temperature is 'unusually hot'. Unusually hot days are those above the 99th percentile of each month from 1910 to April 2019 (BoM, 2019).

The Department of Health have reported on the 2009 and 2014 heatwaves in Victoria. Both events saw a substantial increase in demand for a range of health services including general practitioners and emergency room presentations.<sup>9,10</sup>

- During the 2009 heatwave across Victoria, an estimated 374 excess deaths were reported<sup>8</sup>
- During the 2014 heatwave, an estimated 167 excess deaths were reported.<sup>9,10</sup>

## Floods & storms

A significant proportion of the Mornington Peninsula Shire is prone to flooding.<sup>11</sup> Impacts from floods and storms on human health include "drowning, injuries, hypothermia, and [indirectly through] infectious diseases."<sup>6</sup>

Further indirect effects on human health may include disruption to health services, chemical hazards, injuries resulting from clean up, and damaged essential infrastructure (for example, electricity outages, which can have flow on implications for health) resulting from floods.<sup>12</sup>

There is evidence that floods and windstorms have significant impacts on mental health.<sup>6</sup>

In urban areas in Victoria, there is an increased risk of flooding (current and future) because of climate change.<sup>13</sup>

## Bushfire

In Mornington Peninsula Shire, 32% of the municipality - 9,983 dwellings - are managed by the Bushfire Management Overlay, indicating land which "may be significantly affected by extreme bushfires."<sup>14</sup>

During the 2019-2020 summer (known as the 'Black Summer') Australia experienced bushfires that were unprecedented in both their intensity and the devastation caused. 2019 was both Australia's driest year on record, and Australia's warmest year with the mean temperature for 2019 1.52 °C above average, highlighting the role of climate change in contributing to these fires.<sup>15,16,17</sup> Fire danger has increased in Victoria, and this is projected to intensify (see Figure 3).<sup>4</sup>

Victoria was hit hard by the Black Summer fires, particularly in areas to the State's east, though impacts extended across the state including metropolitan Melbourne. The health burden of the 2019-2020 fire season is estimated to include:

120 excess deaths, 331 hospitalisations for cardiovascular problems, 585 hospitalisations for respiratory problems and 401 emergency department presentations for asthma.<sup>18</sup>

There are interactions with bushfires and indirect effects through air quality, and economic and social disruption – including to health systems and supply chains for medical equipment. Road closures during the Black Summer disrupted supply of oxygen cylinders and other equipment.<sup>19</sup>

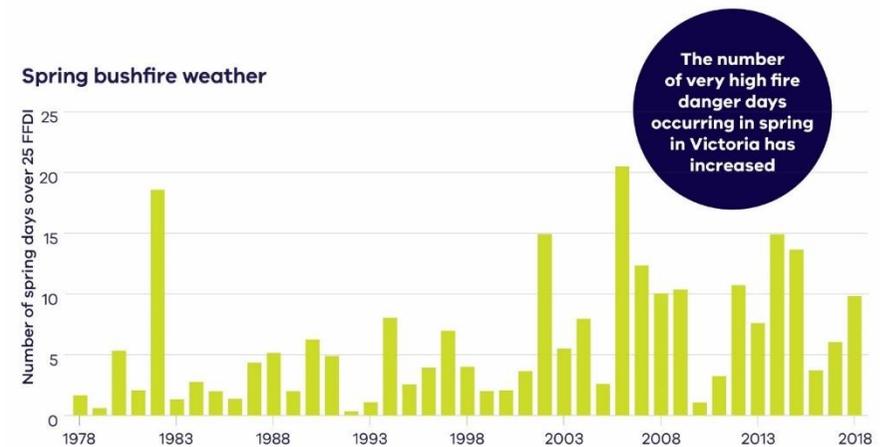


Figure 1: Source - DELWP 2019. The number of very-high fire danger days in spring has increased. The chart shows the number of days with Forest Fire Danger Index (FFDI) greater than 25 (very-high fire danger) in Victoria in spring for the years (1978–2018) (BoM, 2019).

## Indirect effects – natural systems

### Reduced rainfall & drought

The Millennium Drought was "partly the result of climate change" and has highlighted the essential role of water supplies for people, industry and the environment.<sup>20</sup> The Millennium Drought resulted in water shortages and water restrictions across Victoria.<sup>21</sup>

On the Mornington Peninsula, this impacted agricultural production, ecosystems, increased bushfire risks and resulted in some creeks running dry. Throughout this period, increased budgets for fire prevention measures were required to manage the increased bushfire risk.<sup>22</sup> Managed sporting grounds and parks and gardens were also badly impacted.<sup>23</sup> Significant upgrades were required to ensure these areas could continue to be utilised including changing to warm season turf, installation of automatic irrigation systems and water tanks and implementing water conservation programs.<sup>24</sup>

The negative impact of reduced rainfall on ecosystems may impact the positive health and wellbeing outcomes associated with biodiversity,<sup>25</sup> and contact with our natural environment.<sup>26</sup> Reduced rainfall may also make our urban areas hotter, if urban vegetation is not watered.<sup>27</sup>

### Vector borne & infectious disease

Vector-borne diseases typically refer to infections transmitted by mosquitoes and ticks.<sup>6</sup> Some of these diseases may change where they are located and become more common in Victoria (changed distribution) due to:

- Sensitivity to climate-related factors (e.g. heat)
- Through indirect mechanisms<sup>28</sup> (e.g. water storage to respond to a drier climate)<sup>29</sup>
- Stagnant water resulting from flooding, coupled with higher temperatures<sup>30</sup> which affects mosquito breeding (as with the Ross River outbreak in 2016).<sup>30</sup>

Flooding and warmer conditions in Victoria mean it is likely that there will be an increase in outbreaks of:

- Ross River virus
- Other endemic vector-borne diseases such as Barmah Forest virus and Murray Valley encephalitis.<sup>31</sup>

Vectors capable of carrying other pathogens previously not found in Victoria may also migrate here.<sup>31</sup>

### Food- and water-borne infections & water quality

Swallowing or absorbing (ingestion) of contaminated food and water - including incidental during swimming and through direct contact with "eyes, ears, or open wounds" expose humans to organisms which cause disease: pathogens.<sup>6</sup> Pathogens may be impacted by climate change indirectly by changes to local ecosystems or habitat ("that act as zoonotic reservoirs"), or directly "by influencing growth, survival, persistence, transmission or virulence of pathogens."<sup>6</sup> For example, *Salmonella* and *Campylobacter* infections occur in Victoria,<sup>32,33</sup> and show higher rates of infection and disease rates at higher temperatures.<sup>6</sup>

Harmful algal blooms have been observed in Victoria, which can produce toxins with serious health implications when "consumed, inhaled, or" through contact with the skin.<sup>31</sup>

### Air pollution

Bushfire smoke and smoke from prescribed burns can result in acute air pollution through releasing particulate matter and other toxic substances. Particulate matter usually found in smoke has a very small diameter (PM2.5 - 0.0025 mm or smaller). This means they can penetrate deep into your lungs (and respiratory system) and can even enter your bloodstream.<sup>34</sup> Bushfire smoke is associated with increased death (mortality) and an increase in health service demand, particularly for respiratory conditions.<sup>34</sup> The 2019-20 bushfires in Southeast Australia saw severe and persistent (weeks to months) smoke pollution (see bushfire discussion above).<sup>34</sup>

Air pollution will be impacted by climate change through ground level ozone.<sup>35</sup> Sunlight and elevated temperatures react with precursor pollutants (nitrogen oxide, carbon monoxide, methane, and volatile organic compounds) to form ozone. As temperatures increase, ozone is projected to increase, particularly in urban areas. At lower concentrations, there is not an association between death at an earlier age (premature mortality) and ozone, but at higher concentrations, there is increased risk of death at an earlier age ("the association becomes positive and approximately linear at higher concentrations").<sup>6</sup>

Evidence relating to the interaction of climate change and particulate matter is complex and mixed,<sup>6</sup> however global modelling projects an increase in

death (mortality) associated with particulate matter under scenarios looking at high emissions.<sup>35</sup>

## Aeroallergens

Warm conditions typically favour the production and release of airborne allergens, with implications for asthma and allergic respiratory disease.<sup>6</sup> This will have a disproportionate impact on children, who "are particularly susceptible to most allergic diseases."<sup>6</sup> Carbon dioxide fertilisation may see plant growth and increased release of allergens, and temperature changes may alter flowering patterns. A combination of "droughts and high winds may produce windborne dust and other atmospheric materials, which contain pollen and spores, and transport these allergens to new regions."<sup>6</sup>

Given the interaction of climate change, aeroallergens, and how and where they are transported, there are potential important interactions with thunderstorm asthma and climate change.<sup>36</sup> In 2016, "Melbourne experienced the world's largest epidemic thunderstorm asthma event," with a 673% increase over a 30 hour period in respiratory-related public hospital presentations. This event resulted in 9 deaths.<sup>37</sup>

## Indirect effects – human systems

### Mental health

Mental health is typically negatively impacted by climate-related disasters, and disaster-related trauma can cause significant as well as long-term impacts.<sup>6</sup> Prolonged events such as drought can result in "chronic psychological distress and increased incidence of suicide."<sup>6</sup>

People may also experience "a distressing sense of loss" known as "solastagia" because of significant environmental change. This is particularly associated with "people who are directly connected to their home and environment."<sup>38</sup>

Anxiety and feelings of worry regarding climate change and its impacts can also affect mental health, especially for younger people.<sup>39</sup> While worries and anxiety regarding climate change are a normal response, and often do not need to be treated as abnormal or problematic, they can exacerbate pre-existing anxiety and develop into more specific mental health issues. Climate Anxiety, or Eco-anxiety have been used to describe effects including "low

mood, disturbed sleep, panic attacks, and feelings of anger, guilt, or helplessness" as well as "feeling[s] of existential dread linked with an overwhelming sense of responsibility to deal with something so huge it becomes paralysing."<sup>39</sup>

The risk that poverty and inequality will be exacerbated because of climate change<sup>40</sup> is a potential risk to mental health, with low-income levels in Australia are strongly associated with mental ill-health.<sup>41</sup>

Given the high value many residents of Mornington Peninsula Shire place on "diverse, natural assets," and "clean and green environment and landscape,"<sup>42</sup> the degradation of ecosystems may impact on human health and wellbeing, as there are health benefits associated with contact with our natural environment.<sup>26</sup>

### Occupational health

The largest industry sector of employment in the Mornington Peninsula Shire is construction, representing 14% of employment.<sup>43</sup> The construction sector is currently very vulnerable to heatwave impacts, with risks to health and productivity of construction workers.<sup>44</sup> Economic loss due to loss of productivity can impact on livelihoods – across Greater Melbourne, Economic losses for severe heatwaves in Greater across the construction industry are approximately \$30.2 million.<sup>44</sup> Those who work outside in hot conditions are at heightened risk of heat strike and heat strain, and this increases with physical exertion.<sup>6</sup>

A large proportion of the Mornington Peninsula Shire are also employed in healthcare and social assistance, representing 13.7% of employment.<sup>43</sup> Changes in climate-related infectious disease poses a risk to health workers.<sup>45</sup>

Climate change likely contributed to drought conditions during the 2018/19 drought.<sup>46</sup> The Mornington Peninsula Shire's \$1.1 billion food and agricultural output was severely impacted by this drought. Some farmers reported resorting to mains water to irrigate their crops, adding to financial pressure. Dams were depleted and paddocks were dry, causing some farmers to cease operation during this period. The Peninsula's viticulture Industry was impacted by advance ripening and fruit shrivel, which has lasting impacts on harvest and overall vine health. Similarly, orchards, avocado plantations and

vegetable farms across the Shire faced reduced or failed crops during this period.

The administrative and financial burdens farmers face during droughts such as these times increases stress and exacerbates underlying health issues, not to mention the impacts to the wellbeing of individuals and families and the major reason farmers leave the land permanently.<sup>47</sup>

### Food security

Within Australia, domestic food production exceeds local demand: 60% is exported. Australia has relatively low levels of food insecurity compared with other parts of the world (4% of the Australian population are unable to afford to buy sufficient food).<sup>48</sup>

While this is the case, rates of food insecurity are much higher amongst particular social groups including people seeking asylum, Aboriginal and Torres Strait Islander peoples, people on low incomes, and those who are unemployed.<sup>49</sup> One of the biggest impact to food security in Australian cities is likely to be increases in the price of food,<sup>50</sup> with the potential to deepen existing inequity.

## How the Mornington Peninsula Shire are responding

We must respond urgently to climate change impacts on health and wellbeing through reducing greenhouse gas emissions (mitigation) as well as adjusting to current and future changes in our climate (adaptation). Mitigation and adaptation are complementary responses to climate change and can be integrated with responses to meet the needs of people in place.

The Mornington Peninsula Shire declared a Climate Emergency in August 2019, and in August 2020, the Council unanimously adopted the *Climate Emergency Plan - Our Climate Emergency Response*. The *Climate Emergency Plan* includes an action to address the changing health and wellbeing impacts of climate change.<sup>51</sup>

A key task within this action is to: Develop a Climate Change Adaptation Plan to address climate and related health impacts, including:

- Risks to specific cohorts
- Assessing any gaps in service provision and
- Advocating for action.

The Shire is currently updating the Council Plan 2017 - 2021 and the Shire's Municipal Public Health and Wellbeing Plan 2017 - 2021. Findings included in this assessment are designed to feed directly into the integrated Council Plan and Municipal Public Health and Wellbeing Plan (2021 - 2025).

1. IPCC. Summary for policy makers. in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (eds. Field, C. B. et al.) 1–32 (Cambridge University Press, 2014). doi:10.1017/cbo9780511976988.002.
2. McMichael, A. J. & Lindgren, E. Climate change: Present and future risks to health, and necessary responses. *J. Intern. Med.* **270**, 401–413 (2011).
3. IPCC. Summary for Policymakers. in *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* (eds. Pörtner, H.-O. et al.) in preparation (In press, 2019). doi:https://www.ipcc.ch/report/srocc/.
4. DELWP. *Victoria's Climate Science Report 2019*. (2019).
5. IPCC. Summary for Policymakers. in *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to eradicate poverty* (eds. Masson-Delmotte, V. et al.) 32 (In Press, 2018).
6. Smith, K. R. et al. Human health: Impacts, adaptation, and co-benefits. in *Climate Change 2014 Impacts, Adaptation and Vulnerability: Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (eds. Field, C. B. et al.) 709–754 (Cambridge University Press, 2014). doi:10.1017/CBO9781107415379.016.
7. Vicedo-Cabrera, A. M. et al. The burden of heat-related mortality attributable to recent human-induced climate change. *Nat. Clim. Chang.* (2021) doi:10.1038/s41558-021-01058-x.
8. DHHS. *Heat health alert system: Information for local government and other stakeholders.* (2020).
9. Department of Human Services. *January 2009 Heatwave in Victoria: an Assessment of Health Impacts.* [http://docs.health.vic.gov.au/docs/doc/F7EEA4050981101ACA257AD80074AE8B/\\$FILE/heat\\_health\\_impact\\_rpt\\_Vic2009.pdf](http://docs.health.vic.gov.au/docs/doc/F7EEA4050981101ACA257AD80074AE8B/$FILE/heat_health_impact_rpt_Vic2009.pdf) (2009).
10. Department of Health. *The health impacts of the January 2014 heatwave in Victoria.* <https://www2.health.vic.gov.au/about/publications/researchandreports/health-impacts-january-2014-heatwave> (2014).
11. Mornington Peninsula Shire. Building on Flood Prone Land. *Building & Planning* <https://www.mornpen.vic.gov.au/Building-Planning/Building/Building-on-Flood-Prone-Land> (2021).
12. WHO. Floods. *Health topics* [https://www.who.int/health-topics/floods#tab-tab\\_2](https://www.who.int/health-topics/floods#tab-tab_2) (2021).
13. Department of Environment Land Water and Planning, Bureau of Meteorology, Commonwealth Scientific and Industrial Research Organisation & The University of Melbourne. *Victoria's Water in a Changing Climate: Insights from the Victorian Water and Climate Initiative.* (2021).
14. GIS team (Mornington Peninsula Shire). Personal communications. (2021).
15. Bureau of Meteorology and CSIRO. *State of the Climate 2020.* <http://www.ion.edu/Reports/2011/Relieving-Pain-in-America-A-Blueprint-for-Transforming-Prevention-Care-Education-Research/Report-Brief.aspx> (2020).
16. Bureau of Meteorology. Annual climate statement 2020. *The recent climate* <http://www.bom.gov.au/climate/current/annual/aus/> (2021).
17. CSIRO. The 2019-20 bushfires: a CSIRO explainer. *Bushfires* <https://www.csiro.au/en/research/natural-disasters/bushfires/2019-20-bushfires-explainer> (2021).
18. Australian Institute for Disaster Resilience. *Major incidents report 2019-20.* (2020).
19. du Parc, E. & Yasukawa, L. *The 2019-2020 Australian bushfires: from temporary evacuation to longer-term displacement.* [https://www.internal-displacement.org/sites/default/files/publications/documents/Australian\\_bushfires\\_Final.pdf](https://www.internal-displacement.org/sites/default/files/publications/documents/Australian_bushfires_Final.pdf) <https://reliefweb.int/report/australia/2019-2020-australian-bushfires-temporary-evacuation-longer-term-displacement> (2020).
20. DELWP. How climate change impacts Victoria's water. *Adapting to climate change impacts* <https://www.water.vic.gov.au/climate-change/adaptation/how-climate-change-impacts-victorias-water> (2021).
21. DELWP. *Managing extreme water shortage in Victoria: lessons from the Millenium Drought.* (2016).
22. Thorning, S. Personal communications. (2021).
23. Dalla Santa, S. Personal communication. (2021).
24. Mornington Peninsula Shire. *Mornington Peninsula Shire Annual Report 2006/07.* (2007).
25. UN Environment. *Global Environment Outlook – GEO-6: Healthy Planet, Healthy People.* (Cambridge University Press, 2019). doi:10.1017/9781108627146.
26. Shanahan, D. F., Fuller, R. A., Bush, R., Lin, B. B. & Gaston, K. J. The Health Benefits of Urban Nature: How Much Do We Need? **65**, 476–485 (2015).
27. Broadbent, A. M., Coutts, A. M., Tapper, N. J., Demuzere, M. & Beringer, J. The microscale cooling effects of water sensitive urban design and irrigation in a

- suburban environment. *Theor. Appl. Climatol.* **134**, 1–23 (2018).
28. Rocklöv, J. & Dubrow, R. Climate change: an enduring challenge for vector-borne disease prevention and control. *Nat. Immunol.* **21**, 479–483 (2020).
  29. Beebe, N. W., Cooper, R. D., Mottram, P. & Sweeney, A. W. Australia's dengue risk driven by human adaptation to climate change. *PLoS Negl. Trop. Dis.* **3**, e429 (2009).
  30. DHHS. *Tackling climate change and its impacts on health through municipal public health and wellbeing planning: Guidance for local government, 2020.* (2020).
  31. DHHS. *Pilot health and human services climate change adaptation action plan 2019-21.* [https://www.dhhs.vic.gov.au/sites/default/files/documents/201912/Pilot health and human services climate change adaptation action plan 2019-21-20191209.pdf](https://www.dhhs.vic.gov.au/sites/default/files/documents/201912/Pilot%20health%20and%20human%20services%20climate%20change%20adaptation%20action%20plan%202019-21-20191209.pdf) (2019).
  32. DHHS. Campylobacter infection. <https://www2.health.vic.gov.au/public-health/infectious-diseases/disease-information-advice/campylobacter>.
  33. DHHS. Salmonellosis. <https://www2.health.vic.gov.au/public-health/infectious-diseases/disease-information-advice/salmonellosis>.
  34. Vardoulakis, S., Jalaludin, B. B., Morgan, G. G., Hanigan, I. C. & Johnston, F. H. Bushfire smoke: urgent need for a national health protection strategy. *Med. J. Aust.* **212**, 349–353.e1 (2020).
  35. Silva, R. A. *et al.* Future global mortality from changes in air pollution attributable to climate change. *Nat. Clim. Chang.* **7**, 647–651 (2017).
  36. Thien, F. *et al.* The Melbourne epidemic thunderstorm asthma event 2016: an investigation of environmental triggers, effect on health services, and patient risk factors. *Lancet Planet. Heal.* **2**, e255–e263 (2018).
  37. Department of Health and Human Services. *The November 2016 Victorian epidemic thunderstorm asthma event: an assessment of the health impacts.* <https://www2.health.vic.gov.au/Api/downloadmedia/%7B459A8B36-7C70-4C0E-861E-C648BBF4C818%7D> (2017).
  38. Albrecht, G. *et al.* Solastalgia: The distress caused by environmental change. *Australas. Psychiatry* **15**, 95–98 (2007).
  39. The Lancet Child & Adolescent Health. A climate of anxiety. *Lancet Child Adolesc. Heal.* **5**, 91 (2021).
  40. IPCC. *Climate Change 2014 Part A: Global and Sectoral Aspects. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (2014).
  41. Isaacs, A. N., Enticott, J., Meadows, G. & Inder, B. Lower Income Levels in Australia Are Strongly Associated With Elevated Psychological Distress: Implications for Healthcare and Other Policy Areas. *Front. Psychiatry* **9**, (2018).
  42. Mornington Peninsula Shire. *Our Peninsula 2021: Mornington Peninsula Shire Council Plan 2017-21.* <https://www.mornpen.vic.gov.au/About-Us/Strategies-Plans-Policies/Council-Plan> (2017).
  43. Brown, H. Employment of Residents, by Industry, 2016: from the findings of the 2016 census.
  44. Natural Capital Economics. *Heatwaves in Victoria: A Vulnerability Assessment.* (2018).
  45. World Health Organisation. *Save Lives. Make Hospitals Safe in Emergencies.* [http://www.who.int/world-health-day/2009/whd2009\\_brochure\\_en.pdf](http://www.who.int/world-health-day/2009/whd2009_brochure_en.pdf) (2009).
  46. Steffen, W. *et al.* *Deluge and Drought: Australia's Water Security in a Changing Climate. Climate Council of Australia* <https://www.climatecouncil.org.au/wp-content/uploads/2018/11/Climate-Council-Water-Security-Report.pdf> (2018).
  47. Delaney, S. Personal communications. (2021).
  48. ABS (2015) cat. no. 4364.0.55.009 Australian Health Survey: Nutrition - State and Territory results, 2011- 12. Canberra: Australian Bureau of Statistics.
  49. Lindberg, R., Lawrence, M., Gold, L., Friel, S. & Pegram, O. Food insecurity in Australia: Implications for general practitioners. *Aust. Fam. Physician* **44**, 859–862 (2015).
  50. Casey, R., Larsen, K., Sheridan, J. & Candy, S. *Melbourne's Food Future: Planning a resilient city foodbowl.* <https://minerva-access.unimelb.edu.au/handle/11343/121776> (2016).
  51. Mornington Peninsula Shire. *Our Climate Emergency Response From 2020 to 2030: A place where people and nature thrive.* (2020).