

Submission on the Greenhouse Gas Emissions Assessment Guidance - Consultation

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Healthy planet, **healthy people.**

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Doctors for the Environment Australia

Doctors for the Environment Australia (DEA) is an independent, self-funded, non-government organisation of medical doctors in all Australian states and territories. Our members work across all specialties in community, hospital and private practices. We advocate to prevent and address the diseases – local, national and global – caused by damage to our natural environment. We are a public health voice in the sphere of environmental health with a primary focus on the health harms from pollution and climate change.

Executive Summary

Australia's contribution to the global carbon footprint continues to grow, as emissions from both domestic and export activities increase. Concurrently, the urgency for action on climate change has increased, as actual global consequences outstrip predictions from highly sophisticated climate models.

Much of the responsibility for rapid reductions in Australia's greenhouse gas emissions (GHG) resides with the state Environmental Protection Agencies (EPAs). State EPAs are aware of the close relationship between environmental hazards, reduced environmental quality and GHG emissions - and the substantial role of coal, gas and oil mining/extraction, transport, and waste handling which contribute to all three.

The magnitude of total GHG, particularly from the gas sector of WA, makes Australia a significant contributor to accelerating climate change and poses a great risk to the world's ability to meet the Paris Agreement to limit global warming to 1.5°C. As a result of the continued reliance on, and expansion of fossil fuels for domestic and export purposes, Australia is not on target to meet its own agreed commitment.

Addressing export ambitions by allowing expansion of existing and opening of new gas and oil developments is completely inconsistent with

the science of climate change, which urges drastic reduction of CO₂, methane and other short-lived climate pollutants through rapid transition away from coal, oil and gas. Exporting energy generated by renewable sources, instead of fossil fuels, would carry vast benefits. DEA has long advocated for energy transition on local, regional and global health grounds².

A moratorium or ban on new or expansion projects, and replacing these with renewable energy generation, storage and transport innovations, would be consistent with the first and most effective principle of the “mitigation hierarchy” of first avoiding emissions.

The benefits to Western Australia of urgent GHG reductions are clear. WA is uniquely vulnerable to climate impacts, with the health of many among its population being particularly vulnerable due to remoteness and underlying conditions. While projected health impacts are yet to be fully and specifically ascertained, the links between climate change and health are well established with health impacts being already being experienced by the state. The sustainability of the agricultural sector threatened by rising temperatures, decreases in rainfall and loss of biodiversity and ecological services, will be alleviated by urgent reductions in GHG.

WA EPA is working in an environment of federal policy failures in acknowledging, committing to and effectively reining in emissions, and no appetite for effective taxation or emissions trading policies. The EPA carries a significant responsibility for preventing a substantial magnitude of potential GHG emissions from resources in WA and protecting its highly vulnerable population and environment to climate impacts.

Some positive steps are already evident in the EPA’s draft GHG Assessment Guidance which set thresholds and requirements for proposals that exceed the 100,000 tonnes per annum. Over time, however, the WA EPA threshold for facilities should be progressively lowered to 25,000 tonnes per annum, in line with the trigger of the National Clean Energy Act³.

In summary, there is overwhelming scientific evidence demonstrating the threat of continued GHG emissions, especially CO₂ and methane, into the atmosphere which mainly come from mining and combustion of oil, gas and coal. Given the vulnerability of the state to climate impacts, WA must prioritise protection of the health and well-being of its people by adopting strong mitigation measures to reduce emissions as quickly as possible. Future developments require firm decisions based on enhanced regulatory standards and compliance mechanisms.

Key points and recommendations

Given the urgency and magnitude of actions required for protecting people, we call upon the WA EPA to take substantial steps in reducing and preventing escalation of GHG emissions from current and future proposed developments, particularly of oil and gas. Deep cuts, not new increases, in Australia's emissions are required if we are to act in accord with the science to protect the health and well-being of our communities.

We recommend that the WA EPA:

Embrace the overall aim to achieve rapid decarbonisation of domestic and export activities in line with the latest science.

To achieve this aim, we recommend the following objectives:

1. **Create and enforce a regulatory emissions framework** that is based on the constantly updated scientific understandings and observations of climate and health agencies.
2. **Improve accounting of emissions and compliance requirements** by including the full life cycle, including Scope 1 (direct emissions), Scope 2 (supply chain emissions) and Scope 3 (downstream emissions) that result from projects and which require adherence to all EPA guidelines and time frames.
3. **Conduct independent and comprehensive research on the true climate impacts of gas and oil extraction**, given the magnitude of their warming potential, known contributions of shale gas mining to global atmospheric methane levels, and the urgent need for reduction in emissions of methane and other short-lived climate pollutants.
4. **Cease approvals of new or expanded fossil fuel projects** which undermine the stability of our global climate and the physical and ecological systems required for human health, safety and food security.
5. **Account for full life cycle of emissions** when considering new developments that exceed the 100,000 tonnes per annum. However, given the need to rapidly decarbonise, we argue that the threshold for facilities should be progressively lowered to 25,000 tonnes per annum, in line with the trigger of the National Clean Energy Act³.
6. **Move rapidly towards net zero emissions for all polluters.** New projects must be required to achieve this goal immediately, while existing polluters must demonstrate a direct and deliberate decline in emissions in order to achieve net-zero emissions as soon as possible, and no later than 2050. A protocol needs to be established for existing polluters to begin and maintain the process.

7. **Apply a 'mitigation hierarchy'** and, as a last resort, require certified pollution offsets where benefits clearly outweigh risks, where time is needed to achieve reductions and where truly effective offsets are available. Offsets should be compliant with the existing NCOS (National Carbon Offset Standard) and must be relinquished or surrendered prior to or at the time when the emissions are produced. Preference should be given to offsets sourced in WA where it could benefit the economy and provide new employment.

Supporting evidence

Introduction

DEA firstly would like to commend the WA EPA for preparing guidelines for considering GHG in assessment of developments in the state. They are an important first step and represent an excellent opportunity to stimulate community dialogue and education to increase understanding of their importance. It is clear from past experience in Australia, however, that in order to achieve sustained community acceptance, the guidelines should be situated more broadly within an overarching climate change policy that emphasises the urgency of the situation and the health and economic losses that will occur from no or insufficiently weak action.

WA is the only Australian state without a net-zero emission target and whose emissions continue to rise⁴. Nonetheless, we acknowledge the government for beginning the process of developing a climate change policy and strong guidelines to achieve the policy objectives.

In this submission we are in broad agreement with the EPA's position and recommendations; however, we argue that the assessment guidelines do not go far enough to seriously address the magnitude or urgency of the problem of climate change and its potential impacts on the state.

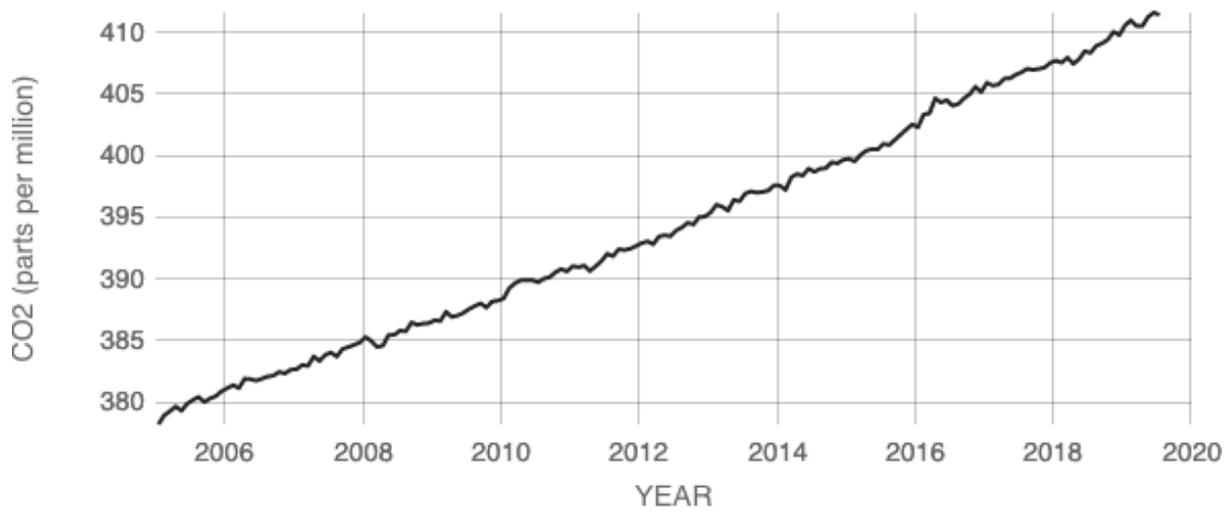
The failure of federal policy to reduce our emissions, the magnitude of potential GHG emissions from resources in WA and the vulnerability of the state to climate impacts demands urgent action and deep cuts to our emissions, if we are to protect the health and well-being of our communities.

While the primary focus of the guidelines is on new developments, carbon pollution from existing facilities needs also to be addressed.

The urgency for GHG reductions is increasing

A strong and clear scientific consensus opines that there is already too much CO₂ in the atmosphere and that substantial warming of approximately 1°C has already occurred⁵. The world is now approaching concentrations of 415ppm⁶ (Figure 1), which will make keeping within the Intergovernmental Panel on Climate Change (IPCC) recommended 1.5°C of warming almost impossible⁷.

Figure 1. The rising concentration of carbon dioxide (parts per million) in the Earth's atmosphere from 2005 to 2018.



Source: climate.nasa.gov

Data from direct monthly measurements (average seasonal cycle removed) undertaken by the National Oceanic and Atmospheric Administration (NOAA) (available at <https://climate.nasa.gov/vital-signs/carbon-dioxide/>)

The grave threat posed by further warming has been clearly articulated in the IPCC special report on the impacts of global warming of 1.5°C⁸. From a health perspective, the most recent COP24 Special Report on Climate Change and Health highlights the severity of the predicted impacts of climate change to health calling it the greatest threat to the 21st century⁹.

Any considerations of GHG emissions need to pay close attention to the state of the climate and resulting planetary stability. In the latest report of the IPCC (2018), scientists from around the world concluded that in order to maintain a world somewhat similar to today, our carbon emissions must be in steep decline within 12 years (now 10.5 years).

However, recent events such as heatwaves in the Arctic¹⁰ with accelerated permafrost melting¹¹ and fires in the Amazon¹² will result in feedback loops that are going to significantly reduce our existing carbon budget¹³.

One of the world's leading climate scientists, geophysicist and current director of the Earth System Science Center at Pennsylvania State University, Professor Michael Mann stated:

"We are 50 to 100 years ahead of schedule ..., the more observations we get, the more sophisticated our models become, the more we are learning that things can happen faster and with greater magnitude, than we predicted just years before¹⁴".

Scientists will now be reworking their models to take into consideration the acceleration of melting and the extremely warm temperatures driving it. No doubt there will be a re-evaluation of how much carbon can be emitted by humans – shortening our response timeframe – and demanding extreme action to reduce global use of fossil fuels.

Reduction of methane emissions is particularly urgent

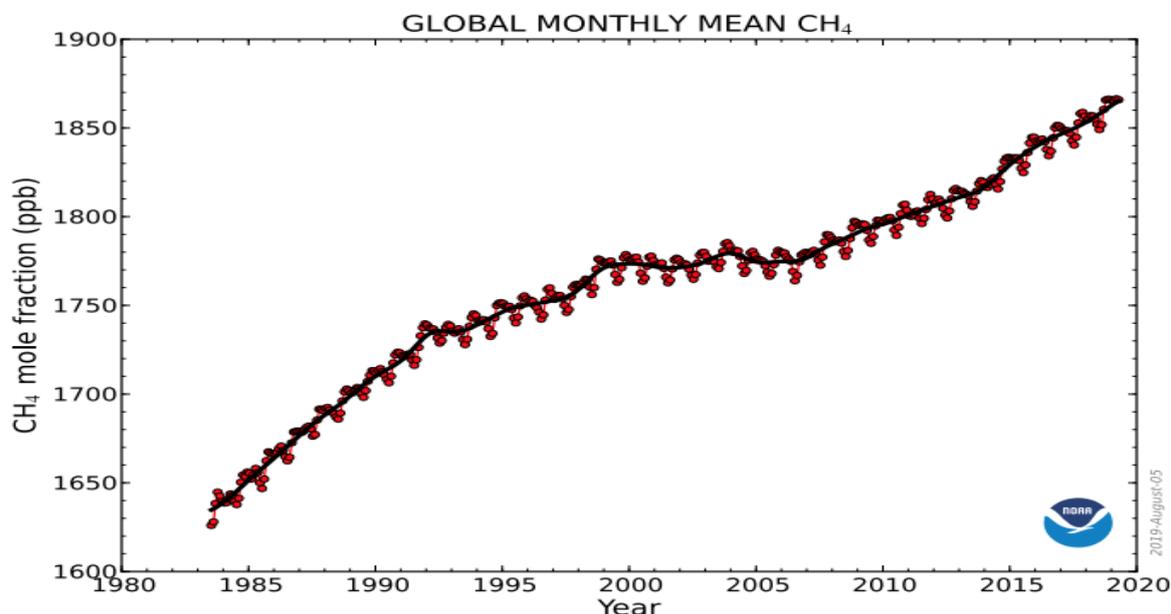
The magnitude of the total GHG emissions from Australia and particularly from the gas sector, of which WA is a major player, is contributing significantly to accelerating climate change.

Within the carbon budget, reduction in methane emissions (natural gas) are particularly urgent and necessary. Because methane has over 80 times the climate forcing capacity of CO₂ over 20 years¹⁵, drastic methane reductions represent the biggest opportunity to buy additional time to achieve sufficient reduction in the longer acting CO₂ emissions.

The IPCC 2019 report demonstrates the dual need for sharp and progressive reductions in methane as soon as possible, as CO₂ reductions alone will not enable limitation of global temperature rises of 1.5°C (and not likely 2°C). The report demands urgent and deep reductions in emissions of methane, tropospheric ozone and black carbon (also from fossil fuels). The World Health Organization's (WHO) Climate and Health Report (2019) emphasises the need "to identify and promote actions to reduce both carbon emissions and air pollution, with specific commitments to reduce emissions of short-lived climate pollutants in Nationally Determined Contributions (NDCs) to the Paris Agreement."

The reality, however, is that methane emissions have been rising steadily since the industrial revolution, with a temporary slowing between 1995 and 2005, but is again on a clear upward trajectory (Figure 2).

Figure 2. Globally-averaged, monthly mean atmospheric methane abundance determined from marine surface sites (NOAA, 2019)¹⁶.



As reported in DEA’s recent review², “While the contributions of oil and gas extraction have been debated, recent seminal research has reported that atmospheric levels of methane, which accounts for an estimated 17-25% of the increase in the trapping of heat in the atmosphere (causing global warming), have increased steady and substantially in the atmosphere since 2008. Worden and colleagues (2017)¹⁷ have demonstrated that oil and gas production is responsible for between 48% and 75% of the total methane emissions from all human activities, i.e. 12 to 19 of the total 25 Tg (trillion grams) released each year”.

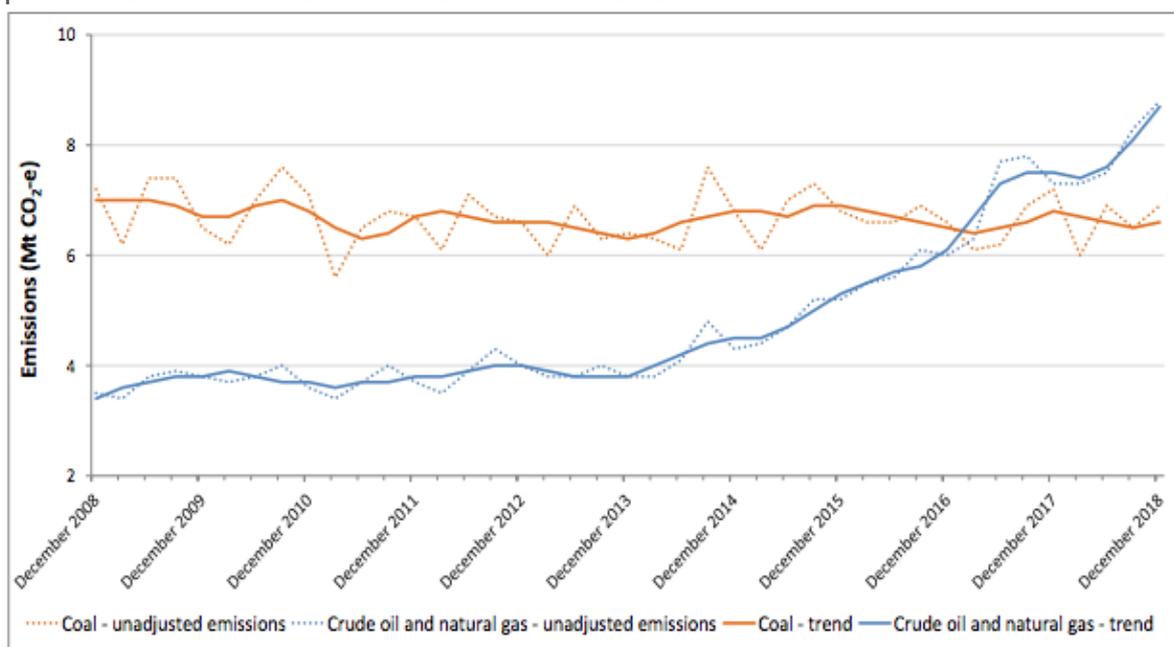
The substantial contribution specifically of shale gas extraction to increased global atmospheric methane levels from all sources (not just human activity) is further supported by recent study by Howath (2019)¹⁸. Taking advantage of the different isotope-specific signature of shale gas compared to other sources of methane, the paper concluded that “shale-gas production in North America over the past decade may have contributed more than half of all of the increased emissions from fossil fuels globally and approximately one-third of the total increased emissions from all sources globally over the past decade”.

Australia’s growing global carbon footprint

Despite the common rhetoric, Australia’s contribution to the global carbon footprint is significant. We are currently the world’s largest exporter of thermal coal, and we will also soon be the largest exporter of natural gas (LNG)¹⁹. Furthermore, when emissions from Australia’s current coal, oil and gas exports (3.6% of global total) are added to domestic emissions (1.4% of global total), Australia’s contribution to the global climate pollution footprint is already about 5%²⁰. Climate Analytics calculate that if current developments in NT, WA, Queensland and NSW progress, Australia’s global contribution could rise to 12-17% by 2030²⁰. On a per capita basis for emissions, we would certainly lead the world as the heaviest emitter should these projects be allowed to proceed – at a time when the science is calling for drastic reductions.

Our domestic greenhouse gas emissions (GHG) continue to rise, driven significantly by greater combustion of fuel for stationary energy excluding electricity (due mostly to the rapid rise in LNG production)²¹ and a 9.9% increase in fugitive emissions from the gas and crude oil sector (Figure below).

Figure 3. Fugitive emissions, unadjusted and trend, by sub-sector, by quarter December 2008 to December 2018



Source: Department of the Environment and Energy

Source: Department of the Environment and Energy; from the Quarterly Update of Australia’s National Greenhouse Gas Inventory¹⁹: December 2018, Commonwealth of Australia 2019, p 16.

It should be noted that Australian greenhouse gas accounting reports do not use actual measurements of fugitive methane emissions; rather a conservative estimation in which 0.5% of gas production is considered lost. This low figure contrasts with estimates of 2-17% of methane lost relative to total gas produced in multiple studies in the United States²².

As a signatory to the Paris Agreement, Australia has a commitment to reduce emissions by 26-28% on 2005 levels and to make all reasonable efforts to reduce and eliminate GHG emissions and fully decarbonise by 2050. Currently our emissions are still rising, with proposed developments threatening to drive even steeper rises, particularly from industries known to contribute significantly to both CO₂ and even more dangerously to methane and other short-lived climate pollutants.

These rising domestic emissions, at a time when international agreements have committed us to sharp falls, demonstrates that there has been a clear failure federally to address this issue. We are not on track to meet our Paris targets²³, sending a dangerous signal to the other 184 parties to the agreement (183 countries and the European Union).

This is especially true because keeping global temperature rises within even 2°C requires that the parties not only meet their original commitments, but also collectively and increasingly raise their ambition and targets over time. This demands broad and consistent national leadership on climate action, any country opting out on the first challenge fails to demonstrate such leadership.

West Australia's carbon emissions and gas ambitions

WA is the only state in Australia without a climate change policy or net-zero emissions target. While most other states report falling emissions, WA's have risen by 23% since 2005⁴.

In the 2018 financial year, 83 facilities in WA emitted over 100,000 tonnes of CO₂ per year (the original benchmark for the EPA's requirement for carbon offsets to be applied), a total of 61.66 million tonnes of CO₂. According to official estimates, production of LNG was responsible for just over one third of the total emissions²⁴.

WA's ambitions for large scale expansions of new and existing both offshore and shale gas and oil extraction pose significant risks to the climate that could accelerate global warming beyond safe limits. There is the additional problem that a growing proportion of its greenhouse emissions will be fugitive methane.

The large volume of Scope 3 emissions emanating from the gas industry in WA will come under restriction as measures to address the climate emergency are tightened. This was recognised by the Rocky Hill coal mine decision in NSW and the intended decision by the NSW independent Planning Commission on the Wambo Project to allow coal to be exported only to countries signing the Paris Agreement or which had policies consistent with the Agreement's goals²⁵.

The domestic emissions expected from all offshore gas reserves are about 40-75% above what Western Australia's whole energy sector could emit in order to comply with the Paris Agreement.

Furthermore, the carbon footprint of the gas resources in the Canning Basin alone, which has been left open to mining, is equivalent to about double what **Australia** is allowed to emit in order to comply with the Paris Agreement²⁶.

Since a large and increasing majority of gas produced in WA is liquefied (an energy intensive process) and exported, and high levels of CO₂ are sometimes present within the gas and need to be released, it is necessary for the complete carbon intensity of the entire life cycle to be considered, using realistic and evidence-based estimates of methane and other short lived climate pollutants (ground level ozone, black carbon). Use of inventory estimates of fugitive methane emissions in the United States have proven to be much lower than that established using ground-based, facility-scale measurements validated with aircraft observations²⁷.

The studies of Worden et al¹⁷ (2017) and Howath¹⁸ (2019) demonstrate clearly that uncontrolled emissions growth from the LNG industry or any other industry with significant carbon pollution cannot be allowed to continue unchecked.

In view of these massive carbon resources and their warming potential and with the failure federally to implement policies to reduce our GHG emissions, there is a compelling case based on the science for the EPA to recommend guidelines that achieve an urgent reduction of our GHG emissions in order to protect our environment and to protect the health of West Australians from climate impacts both now and into the future.

Given the inter-related nature of climate impacts with complex interactions, non-linearities and uncertain thresholds and the possibility of large-scale disruption not included in climate modelling²⁸; the real prospect of an underestimate of impacts²⁹; and the fact that most of our carbon pollution comes from a limited number of facilities, the key principles to be considered, as outlined by the EPA (s.4a), the **precautionary principle** and a **polluter-pay-system**, are especially relevant.

West Australia's vulnerability to climate impacts

The state is uniquely susceptible to climate impacts³⁰. Already rainfall patterns in Western Australia have changed over the last 40 years with a marked drying trend in the south-west of the state. There has been a steady decline in rainfall in the south-west since the 1970s which has resulted in a 50% reduction in streamflow and approximately 60%

reduction of inflow to metropolitan dams since the 1970s. This has had serious implications for urban water supplies and agriculture.

Fire risk, fire weather and the length of fire seasons have increased since the 1970s and the mean sea level at Fremantle has increased almost 20 cm since 1897, at an average rate of 1.54 millimetres each year. Since 1991, sea level on the west coast has raised at a rate almost three times the global average. This has contributed to a three-fold increase in flooding events in Fremantle.

Large scale disruption to ecosystems through a massive heatwave in 2011 has been recently documented highlighting the vulnerability of the state to rising temperatures³¹. With predictions of further warming, increase in duration and frequency of heatwaves and diminishing rainfall in parts of the state (see below), more of such disruptions are likely to occur highlighting the vulnerability of the state to climate change impacts.

Given such vulnerabilities, the EPA with its obligations to use its best endeavours to protect the environment, should recommend actions that urgently address our carbon emissions.

West Australian climate projections

West Australian climate projections are that average annual temperature will increase by 1.1-2.7°C in a medium-emission scenario, and 2.6-5.1°C in a high-emission scenario by the end of the century.

Rainfall in the south-west is projected to decline by 6% by 2030 and 12% by 2100 (median values) for a medium-emission scenario, and by 5% and 18%, respectively (median values) for a high-emission scenario.

Temperature extremes are projected to increase in line with projected mean temperatures and the intensity of hot spells is projected to increase over most of WA.

The number of dry days is likely to increase over all of WA. Agricultural drought months (defined as a month of extremely low soil moisture) are projected to increase by up to 20% over most of Australia by 2030 and up to 80% in the south-west by 2070. Included in the projections are that global warming is likely to increase fire frequency and severity³².

The IPCC puts sea level rise projections for Australia somewhere between 50 to 90 centimetres by 2090, relative to the average sea level measured between 1986 to 2005³³. But the emerging science indicates this may now be an underestimate³⁴. In the United States, National Oceanic and Atmospheric Administration (NOAA) has recommended that global mean sea level rise of up to 2.7 metres this century should be considered in planning for coastal infrastructure³⁵.

Climate change and health

The links between climate and human health are well established³⁶. The most recent COP24 Special Report on Climate Change and Health highlights the severity of the predicted impacts of climate change to health calling it the greatest threat to the 21st century⁹.

Numerous health organisations around the world including WHO have called climate change a health emergency; these include some of Australia's leading health bodies calling on political parties to recognise "the significant and profound health impacts of climate change to Australian people".³⁷

Climate change effects on human health might be direct or indirect. Direct effects on health include increasing injury, physical and mental illness, and death related to a greater frequency of more intense weather events (floods, droughts, hurricanes and storms), as well as the effects of increasing temperatures and heatwaves. Extreme weather events can lead to both increased pressure on healthcare services and facilities, and damage to those facilities.

Indirect health effects include those mediated via changes in environmental systems, causing alterations in the distribution of vector-, water- and food-borne infectious diseases, air pollution patterns, and the availability of safe drinking water and adequate nutrition. Further health impacts relate to changes in economic and social systems, including as people migrate or conflict over scarce resources.

A recent review has found that Australia is highly vulnerable to the health impacts of climate change, and that the nation's policy inaction in this regard threatens lives and leaves Australia lagging behind other high-income countries such as Germany and the United Kingdom³⁸.

Of concern is that "despite difficulties with data availability and attribution, it is evident that Australians face non-trivial exposure to known climate change-related health risk factors. Since 2000, our biggest cities have warmed considerably, and we now have additional annual heatwave days. Climate change threatens to exacerbate existing food insecurity and malnutrition in Australia."

Awareness is required for the massive biodiversity loss in Australia, partly as a rise of climate change, making this equal in concern to the climate emergency. The underlying problems are detailed in two recent international reports.

The 2019 report on the State of the World's Biodiversity for Food and Agriculture from the Commission on Genetic Resources for Food and Agriculture, of the Food and Agriculture Organization of the United Nations

(UN) indicates that decline in biodiversity and ecological services is a severe threat to food resources³⁹.

The August 8, 2019 IPCC special report Climate Change and Land on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems adds to the details and urgency for action⁴⁰.

The West Australian context for health impacts

From the West Australian Climate and Sustainability Forum Working Group Report in 2018:

"It is recognised the health effects of climate change are already being felt in WA. However, there is little data or documented understanding of either how these impacts are or will be experienced or the costs (both financial and non-financial) within and external to the health system. Extreme weather events are causing heat-related illness, likely contributing to infectious disease incidents (water, food and vector borne diseases) and have presented threats to critical infrastructure. Bushfires and droughts have likely presented increased demand for physical and mental health services. Local councils and residents are already dealing with the effects of sea level rise on infrastructure, and homes, and natural and built coastal assets⁴¹."

Ongoing research now makes it possible to say with increasing confidence that climate change is causing an increase in both the frequency and intensity of extreme weather and weather-related events such as extreme heatwaves, drought, heavy rains, tropical storms and bushfires⁴².

To give some context to the range and magnitude of potential problems, rising sea levels especially using high end projections, would pose a real risk to coastal flooding to many areas of WA. The risk of coastal flooding events trebles every 0.1m of sea-level rise. The Climate Council estimates for Fremantle that a one-in-a-100-year event would in 2100, presuming no action, would happen every month or so⁴³. The threat is real and proximate.

The WA Government recently announced a coastal erosion report⁴⁴. It details 55 locations across the state – 15 metropolitan and 40 regional – that have varying levels of risk, with an additional 31 locations being placed on a watch-list for future monitoring. The Premier also reportedly said that the cost of nullifying coastal erosion at these at-risk sites would be about \$110 million across the next five years. The City of Rockingham is currently developing a Coastal Hazard Risk Management and Adaption Plan, in recognition that "much of the City's coastline is potentially vulnerable to coastal hazards"⁴⁵.

Flood events can have huge social and health impacts. The intangible costs associated with the 2010-11 Queensland floods were estimated to be as large as the tangible costs, at an estimated \$7.4 billion dollars and \$6.7 billion dollars, respectively. These intangible costs relate to mental health issues, substance abuse following these events, impacts on chronic and non-communicable diseases, family violence and short-term employment⁴⁶.

Other health effects from floods relate to water and food borne disease, decreased water quality, injury and skin infection. The Queensland floods earlier this year highlighted this issue with at least 10 reported cases of Melioidosis⁴⁷.

The Yarloop bushfire of 2016 killed 2 people, destroyed 181 homes and building and scorched over 70,000 hectares of land. Almost 2 years on there are reports of the community still suffering psychologically⁴⁸. Experience from the Black Saturday fires of 2009 detail ongoing psychological impacts in survivors 5 years later with intangible costs amounting to \$3.9 billion^{49, 46}.

Aside from the direct impact of bushfires, the mortality effect of heat is well-recognised in the literature⁵⁰. The extent to which heat will impact mortality and morbidity in WA in the future is uncertain because climate modelling is uncertain, it is unknown how much emissions will decrease, and the adaptive capacity of populations is variable. However, in a worst-case scenario, intense and prolonged heat could affect a large portion of the WA population via direct exposure to heat, or via other system failure. Direct exposure to heat would be an issue particularly for outdoor workers, elderly, those with pre-existing illness, populations unable to afford or access air conditioning, Aboriginal people and children and young babies. Existing studies in Perth appear to show between a 4-18% increase in emergency department presentations during heatwaves, depending on the severity of the heatwave⁵¹.

Predicted drought trends for WA with up to a 70% increase in drought months by 2070 will almost certainly impact on the mental health of farmers. Drought impacts on farmers in NSW from 2007-2013 highlight the importance of the issue and the need to prepare and adapt⁵².

Compounding problems of more frequent droughts, bushfires and extreme weather events with less interval time to recover, severely stress people, communities, and health and emergency service. When combined with infrastructure failure from extreme weather events, they highlight the problem of complex interactions causing "unforeseen outcomes"²⁸.

Climate change will also affect the productivity of crops and livestock in WA through higher temperatures, changes in the amount, intensity and distribution of rainfall, and more frequent dry periods. In addition, as

previously outlined, we can expect impacts arising from a decline in biodiversity and ecological services that will affect productivity³⁹.

This could be compounded by policy-related economic pressures including rights to water and energy prices. Social pressures related to liveability of regional communities and health and safety concerns will increase as temperatures increase, particularly in areas where water availability declines⁵³.

In summary, potential health impacts to WA are complex, diverse, likely to be compounded and associated with significant costs.

High vulnerability of Aboriginal people in Western Australia to impact of mining and climate change

In 2018, 13% of the total Australian Aboriginal population, approximately 101,753 people, lived in Western Australia. A substantially higher proportion of this population (38%) compared to most other states live in remote and very remote areas. The Kimberley region, where shale oil and gas have been proposed for substantial development, is home to a large proportion of WA's Indigenous residents.

A carefully researched review of Aboriginal people's health in Western Australia was published in 2019 on the Indigenous Health Infonet⁵⁴.

This review reported that Aboriginal residents had twice the mortality rate across all ages, with the largest disparity among middle age adults suffering from cardiovascular disease, intentional self-harm, and lung and other cancers. The total burden of disease of Aboriginal Western Australians was second only to NT (498 versus 499 per 1,000 persons) and non-fatal disease burden was the highest in the country.

Despite being a high-income country, in Australia problems found in low and middle-income countries who are much more vulnerable to the effects of climate change, are applicable to Aboriginal and Torres Strait Islander communities, especially in tropical Australia.

Parise, in the Australian Journal of General Practice⁵⁵, outlines factors that contribute to their vulnerability: inadequate housing; habitation in areas with vectors; decreased purchasing power; inadequate health and energy infrastructure; decreased water security; and lack of food security that contributes to an already elevated level of chronic illness. He goes on to state that climate change "will increasingly affect the health of Aboriginal and Torres Strait Islander communities and, along with historical and socioeconomic determinants, multiply the challenges to closing the Aboriginal and Torres Strait Islander health gap".

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