THE CASE AGAINST FOSSIL FUELS

GREENPEACE

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June, 2021

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ACKNOWLEDGEMENTS

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PREFACE

The world stands at a crossroads. Down one path lies a sustainable healthy future, a diversity of life, healthy ecosystems, and a flourishing human civilization.

The other path leads to untold suffering and ruin.

The choice is ours. And the deciding factor is our dependence on fossil fuels. Burning coal, oil and gas for electricity, transportation and manufacturing has been the primary driver of the climate crisis that threatens to engulf our world.

As a scientist, who has spent decades studying the impact on our climate of greenhouse gas emissions from the burning of coal, oil and gas, the case against fossil fuels is absolutely clear. We must, with utmost urgency, cease using these destructive energy sources and make the shift to a society powered by cleaner, safer renewable energy.

As I argued in my most recent book, The New Climate War, the most important and urgent action to take is at the systems level. We must rapidly transform our energy systems from polluting fossil fuels to renewables with the utmost urgency.

I have spent time living and working in Australia - it is a country in which I was made very welcome and came to know and love. And I have been saddened as I watch it ravaged by climate change.

This report, prepared by Greenpeace Australia Pacific is a significant document, because it lays out the full case against fossil fuels in Australia in stark but accessible terms. It details the role that fossil fuels have played in creating and accelerating the climate crisis, from the extreme heat, epic floods, coastal inundation and super-charged bushfires with which Australians are now all too familiar

I have been both frustrated and saddened by the Australian Federal Government's refusal to develop meaningful climate policies. Australia is a country on the climate crisis frontlines, with so much to gain from embracing clean energy solutions - and so much to lose by failing to do so. And yet, the Australian Government has repeatedly failed to act to protect its people from the greed of the fossil fuel industry.

As this report details, the impacts of climate change, driven by the fossil fuel industry and those who aid and abet it are wreaking havoc on public health. People are dying from toxic air from climate-accelerated bushfires and noxious coal-burning power stations.

Groundwater supplies, so precious and scarce in a famously arid land like Australia, are being contaminated by a rapacious fossil gas industry. Globally, our food security is at risk as farmers struggle to adapt to a rapidly warming climate.

Social justice is intrinsic to climate action - simply acting to reduce emissions is acting to alleviate social injustice, because global warming disproportionately harms those with the fewest resources to adapt. This report also makes clear that the wider damage to society caused by fossil fuel use thas a similarly asymmetrical impact on the most vulnerable.

Australia's wonderful wildlife, which has spent millions of years adapting to the rugged conditions of this continent, faces the possibility of an ongoing mass extinction event unless we can adequately reduce greenhouse gas emissions and limit any further climate changes.

As Greenpeace Australia Pacific's report lays bare, the case against fossil fuels has never been stronger. The case could not be clearer: we must act boldly and immediately

I urge you to read this report and absorb its stark findings and I commend Greenpeace Australia Pacific for taking a broad and collaborative approach to addressing the climate crisis and for a commitment to achieving the systemic changes necessary to prevail in the new climate war.

Michael E. Mann
Distinguished Professor of Atmospheric Science and Director of the Earth System Science Center
Penn State University.

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EXECUTIVE SUMMARY

Fossil fuels, predominantly coal, oil, and gas, have been the major source of energy across the world for over a century. Their unrestricted use has come at an immense human and environmental cost.

The mining and burning of fossil fuels produces greenhouse gases - primarily carbon dioxide and methane - which are the greatest drivers of dangerous climate change: a worsening crisis that is already having measurable, disastrous effects. These include increased global temperatures, heatwaves, changing rainfall patterns, extreme weather - including droughts, floods, bushfires, cyclones, and other ecological disasters - melting ice sheets, rising sea levels, and ocean acidification.

None of the world's 15 largest emitting nations are on track to meet an emission reduction goal that would limit warming to 1.5°C.

It is imperative that the world's nations work together to reduce their greenhouse gas emissions and ensure that the Earth's mean temperature does not rise more than 1.5°C compared to pre-industrial times. To date, 197 countries have signed on to the 2015 Paris Agreement on climate change, pledging to decrease their greenhouse gas emissions. However, none of the world's 15 largest emitting nations are on track to meet an emission reduction goal that would limit warming to 1.5°C. This includes Australia, the largest per capita emitter in the Organisation for Economic Co-operation and Development (OECD), which is a global policy forum with 38 member countries including China, the United States of America, and the United Kingdom.

While the climate crisis is the number one threat facing the planet, fossil fuels also cause significant harm in a number of other areas.

Fossil fuels degrade public health on multiple fronts which is an increasing area of concern, especially for many developing countries, where rapid industrialisation and urbanisation without emissions standards have led to an air pollution crisis. Air pollution from fossil fuel emissions has serious health consequences and is directly correlated to numerous health conditions and the incidence of premature deaths. As the main driver of climate change, fossil fuels are directly connected to climate-induced health impacts, which include heat stress, neurological conditions, cardiovascular and respiratory problems, and the spread of infectious disease.

Since a predictable, stable climate is the key prerequisite for agriculture and adequate food production, its disruption is compromising food security worldwide. Crop yields, soil health, and livestock are already being affected by heat stress, drought, and shifting rainfall patterns. Changing climate patterns also create concerns for food safety and the spread of pathogens in food.

Recent decades have seen major changes in the global water cycle. These shifts are leading to an increase in incidence of drought across the world, particularly in arid zones like much of the Australian landmass. Freshwater availability is declining in many places, and will continue to do so in many more. While in some regions water availability is going down, others may experience an increase in heavy rainfall events, leading to extensive flooding and damage. Fossil fuel extraction processes are also continuing to place water sources at risk, on account of being water intensive as well as increasing the risk of contamination to surface and groundwater from their operations.

Climate change is significantly reshaping ecosystems and threatening biodiversity, with a number of plant and animal species now at risk of extinction, including the Bramble Cay Melomys: the first mammal to become extinct as the direct result of climate change. Rapid shifts in temperature and rainfall have meant that many organisms are struggling to adapt fast enough. Scientists have declared that the planet is currently undergoing a mass extinction event, with 1,125 species of mammals and 1,150 species of birds at significant risk of extinction due to climate-related changes.

The actions of fossil fuel companies have severely harmed Indigenous populations worldwide. Not only are climate change impacts disproportionately affecting Indigenous communities, but the interests of fossil fuel companies and governments continue to impinge on the rights of First Nations peoples with regard to self-determination and fossil fuel pollution on their lands.

Scientists have declared that the planet is currently undergoing a mass extinction event.

The actions of fossil fuel companies have severely harmed Indigenous populations worldwide. Not only are climate change impacts disproportionately affecting Indigenous communities, but the interests of fossil fuel companies and governments continue to impinge on the rights of First Nations peoples with regard to self-determination and fossil fuel pollution on their lands.

Wellbeing concerns also arise due to the fossil fuel sector often relying on fly-in, fly-out (FIFO) working arrangements. This setup is vastly altering the fabric of regional communities and has been linked to numerous negative social issues, as well as being taxing on the physical and psychological health of its workers.

Economic arguments are often a core justification for the continuation of the fossil fuel industry. Yet the economic impacts of climate change are increasing to the point where they are predicted to shrink the world's economy by 3% by 2050, and cost the Australian economy over $1.1 trillion - or 1.8% of GDP - by 2050. Decommissioning mines, oil wells and gas wells also bears a heavy environmental and economic price tag, costing taxpayers millions each year due to fossil fuel companies' habitual disregard of their own obligations to clean up their mess. Moreover, global energy appetites are shifting due to a growing awareness of these impacts. As a result, fossil fuels, particularly coal, are becoming consistently less financially viable. In May 2021, the G7, comprising the world's seven largest economies, agreed to stop international financing of GHG-emitting coal projects by the end of the year, and committed to phase out such support for all fossil fuels.

Institutional corruption is rife in the fossil fuel industry, which has contributed millions in political donations to Australia's major political parties. In turn, it is continuously benefiting from generous subsidies and tax breaks, and expedited project approvals, all while some of its wealthiest players continue to pay zero tax.

The world has reached a pivotal point where it is no longer viable to continue in this way. This is all the more the case now that the economics of renewable energy have shifted decisively, shining a clear light towards a future powered by wind and solar. A transition to renewables is now inevitable. However, in order to prevent any further damage, this change must happen as swiftly as possible.

INTRODUCTION

The Case Against Fossil Fuels is a synthesis of how fossil fuels are harming people and the environment. It is a compilation of the evidence and arguments for why the fossil fuel industry is damaging and unreliable, should not be publically funded, and should be phased out as soon as possible.

Part 1

People and Planet outlines how fossil fuels are harming people and our planet by driving climate change and creating pollution. It begins by outlining the leading role fossil fuels play in hastening climate change via greenhouse gas emissions, gives an overview of the global scale impacts of climate change, and outlines the insufficient steps which have so far been taken by the world's largest emitters to reduce their impact (Chapter 1). It then outlines how fossil fuels are impacting public health (Chapter 2), food security (Chapter 3), the world's water (Chapter 4), and natural ecosystems (Chapter 5). Chapter 6 outlines how the fossil fuel industry is harming Indigenous populations worldwide and impinging on the rights of First Nations peoples. Chapter 7 examines how FIFO working arrangements, integral to coal, oil and gas extraction, can be problematic for both workers and the communities where they reside.

Part 2

Corruption and Cost focuses on the corruption of the fossil fuel industry and the growing financial burden it is placing on taxpayers and governments. It examines the costly impacts of climate change, and how unprofitable fossil fuels are set to become in a changing global market (Chapter 8). It then outlines the heavy hidden costs of decommissioning mines, oil wells and gas wells (Chapter 9), concluding by looking at the corruption at the heart of the industry, evidenced by the large political donations it has made and the heavy tax subsidies it receives (Chapter 10).

The report is illustrated with case studies which provide clear examples of the issues covered and ground the overall findings. While the report's main focus is on Australia, much of its findings apply as much to the fossil fuel industry and its supporters across the globe.

PART 1
PEOPLE AND PLANET

1. CLIMATE CHANGE AND FOSSIL FUELS

Climate change is the greatest environmental and social challenge facing the world today. Its impacts are becoming increasingly concerning, in Australia and around the world. The physical evidence is clear, with observed increases in global mean air temperature, melting glaciers, a rise in ocean heat content, sea level rise, and the melting of sea ice.

1.1 The Role of Fossil Fuels and the Greenhouse Effect

There is irrefutable evidence that human activity is driving climate change via the production and combustion of fossil fuels. This leads to the emission of greenhouse gases (GHGs), which warm the planet's surface by strengthening the greenhouse effect.

The greenhouse effect is a natural phenomenon which occurs when solar radiation is trapped in the Earth's atmosphere by GHGs and aerosols. This makes the Earth habitable, keeping temperatures 33°C warmer than they would be without this effect, for an average surface temperature of 15°C.[1]

When solar radiation in the form of heat travels from the sun to the Earth, it can take several paths: some radiation is reflected by the Earth's atmosphere, while another portion will travel through it. Here, it will either reach the Earth's surface, or it will be absorbed into the atmosphere and re-emitted by greenhouse gas molecules.[2] This warms the Earth's lower atmosphere and surface (Figure 1).

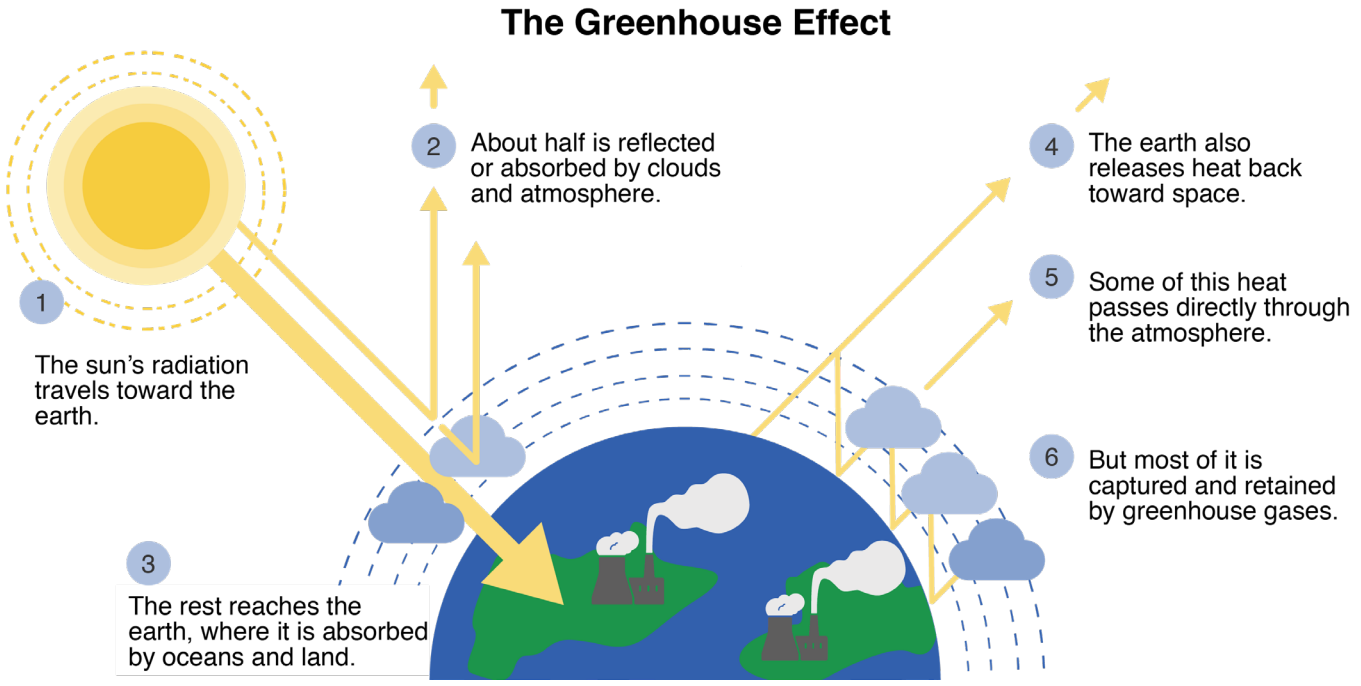


Figure 1 The greenhouse effect.
Image Credit: World 101 from the Council of Foreign Relations (2017-2021).

Increasing the amount of CO2 and other GHGs in the atmosphere strengthens this effect, causing the planet to warm. Of all GHGs, carbon dioxide (CO2) is the largest contributor to climate change.[3] Methane is the second largest, and while it is more short-lived in the atmosphere, it is much more potent.[4] Other key greenhouse gases include halocarbons, nitrous oxide (N2O), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), and nitrogen dioxide (NO2).

The contribution of human emissions to atmospheric greenhouse gas concentrations is demonstrated by the Keeling Curve. This curve is based on measurements of atmospheric CO2 concentrations from 1958 to present. It clearly depicts a steep and consistent rise in atmospheric CO2 levels since 1958 (Figure 2).

This is even more alarming when put into a historical context. Ice cores from polar regions contain information about past temperatures and the atmosphere. This information is based on gas bubbles trapped in the ice from thousands of years ago to the present. The youngest ice is found close to the surface, while the oldest ice is further down. This means we can compare old ice and young ice and see how much CO2 levels have changed over time. This lets us examine atmospheric CO2 levels extending back 800,000 years. Compared to levels dating back 800,000 years, atmospheric CO2 concentrations throughout the last few decades are anomalously high (Figure 3). In May 2013, they passed 400 parts per million (ppm), which is the highest they have been in 3 million years; they have since passed 410 ppm, and continue to rise.[5]

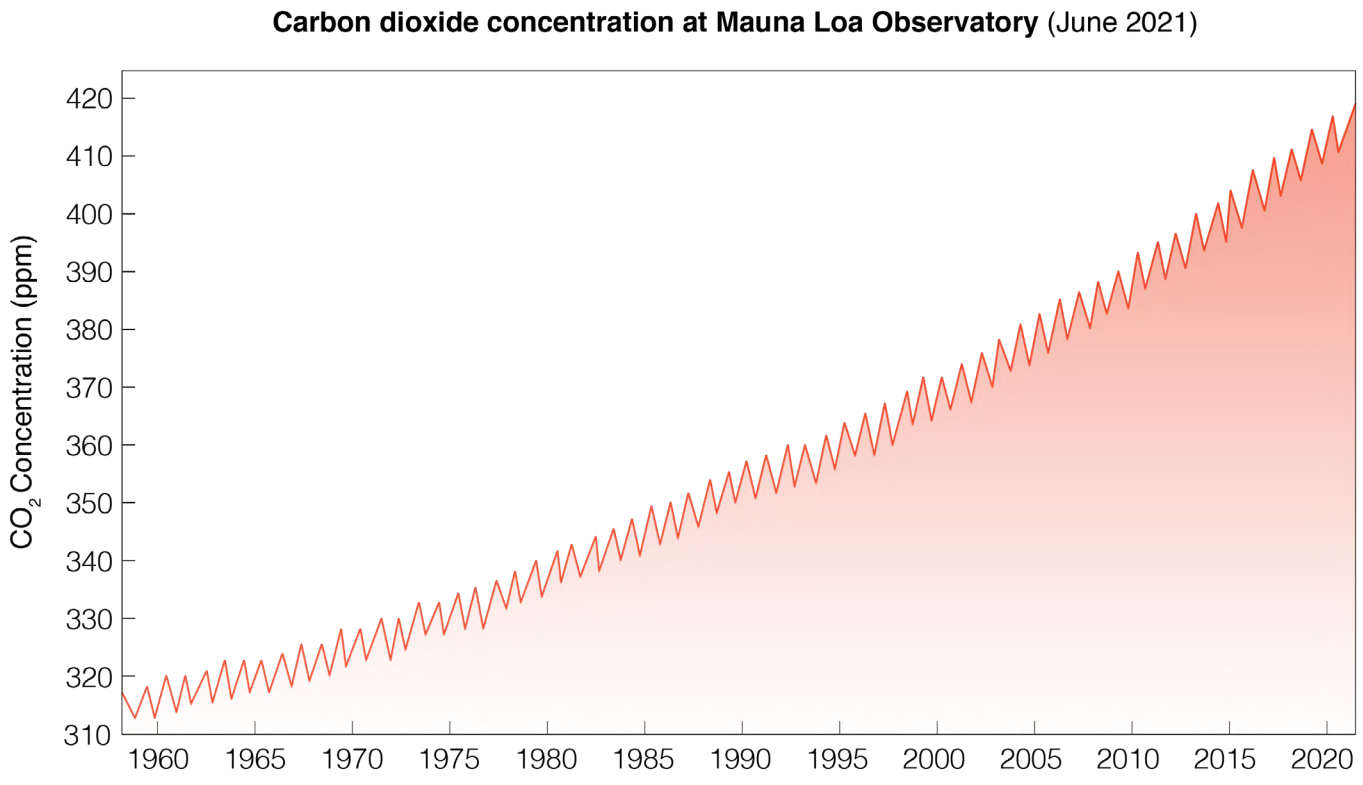


Figure 2 Keeling Curve, from Scripps Institution of Oceanography, UC San Diego (2021)

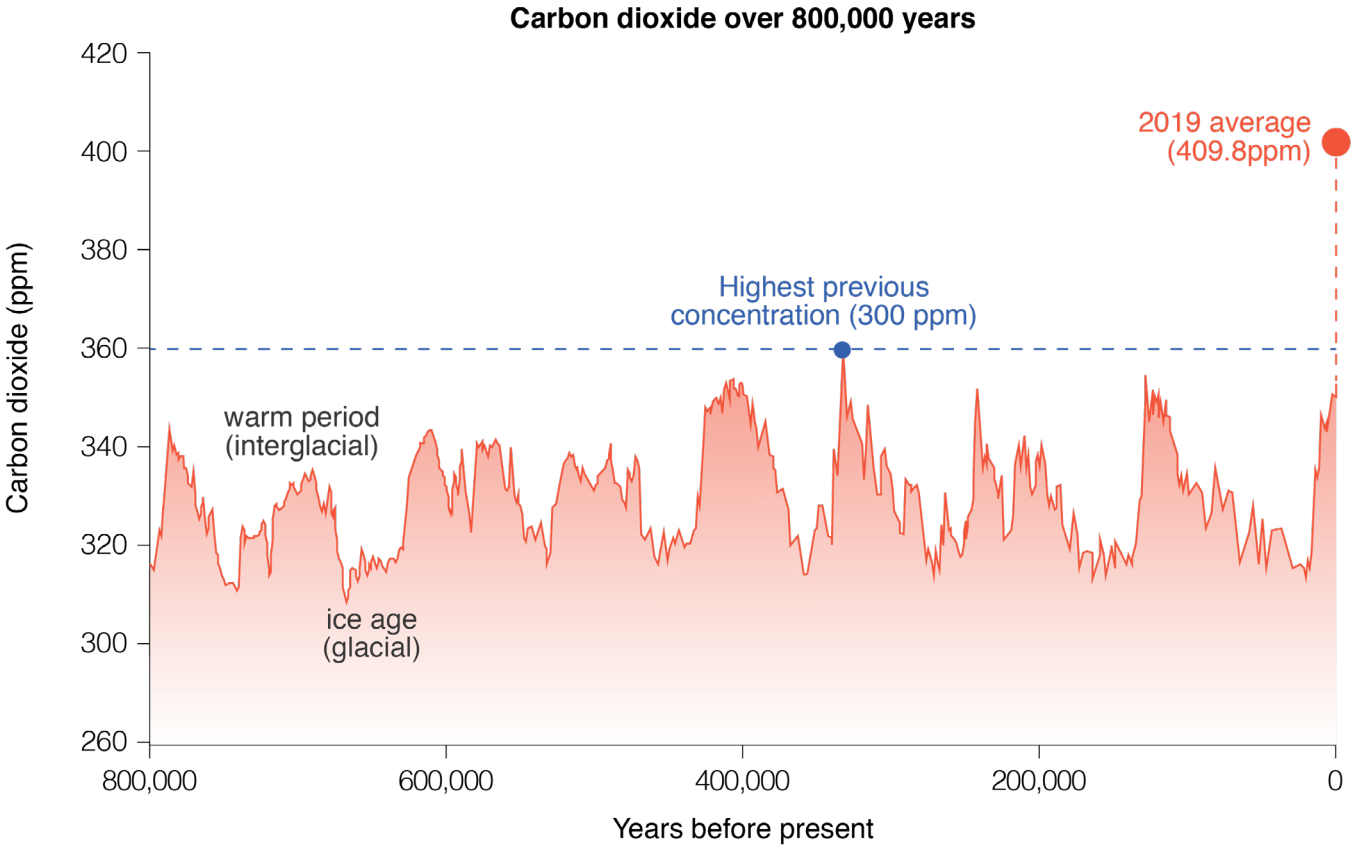


Figure 3 Graph by (NOAA, 2020a). Based on data from Lüthi et al., 2008, provided by the NOAA NCEI Paleoclimatology Program.

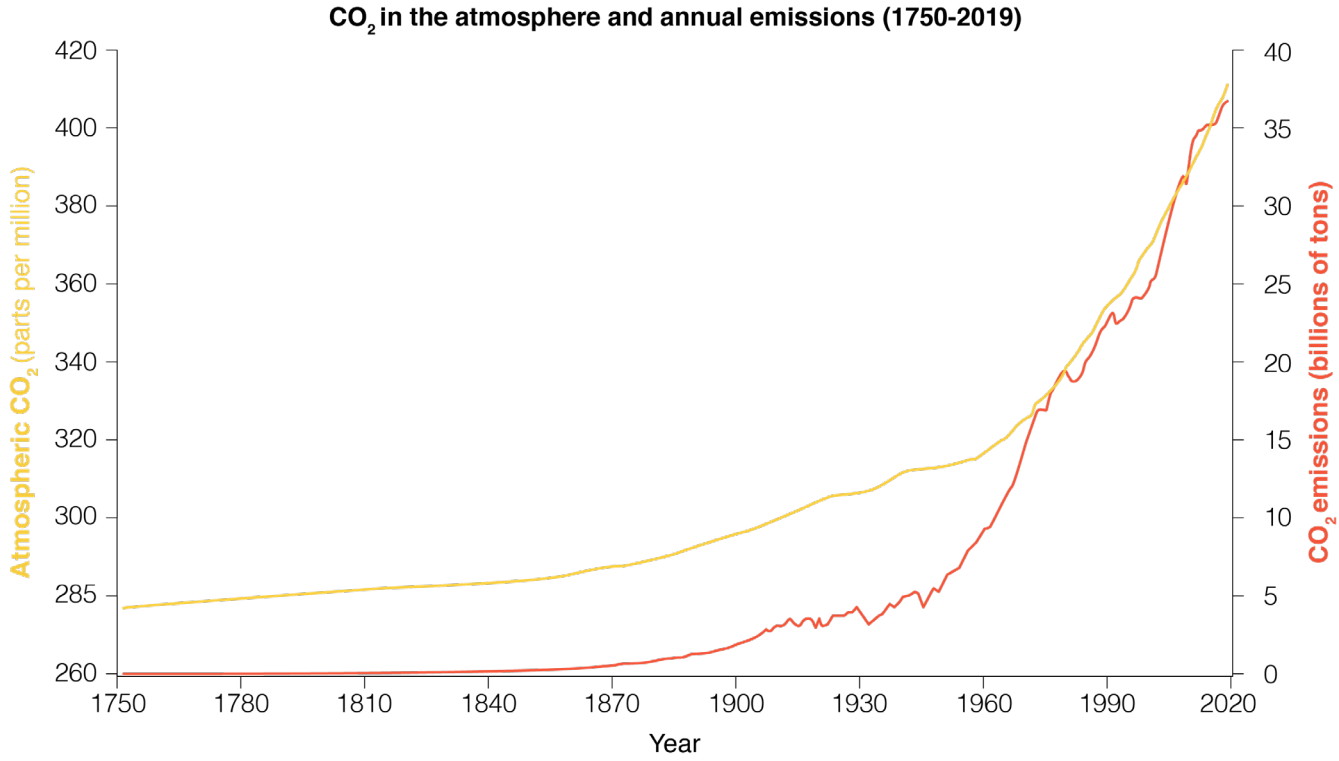


Figure 4 Carbon dioxide levels in the atmosphere (pink line) have increased along with human emissions (blue line) since the start of the Industrial Revolution in 1750. Emissions mid-20th century reached 5 billion tons per year, then surged to over 35 billion tons. From NOAA (2020a).

Until the 20th and 21st centuries, the forces which shaped past changes in the Earth's climate were natural.[6] Milankovitch's Theory of Orbital Configuration may explain long term climatic changes. This occurred as a result of the Earth's orbit changing to increase or decrease the distance between our planet and the sun, with the Earth's surface growing warmer when it was closer to the sun.[7] However, this theory explains long-term trends over tens of thousands of years, and cannot adequately explain the abrupt changes we have seen in the space of several decades.[8]

Recent climate change is undeniably linked to human activity and greenhouse gas emissions, which have been increasing consistently since the Industrial Revolution (Figure 4).[9] The timing of the recent drastic increase in CO2 concentration coincides with global mean temperatures growing warmer; no other possible explanations have been able to account for the increase in planetary temperatures over such a short period.[10]

The Intergovernmental Panel on Climate Change (IPCC), representing the consensus of hundreds of climate experts from around the world, has stated that the majority of the Earth's recent warming which occurred between the years 1951 and 2010 can be attributed to anthropogenic forcing, primarily from human greenhouse gas emissions.[11]

Recent climate change is undeniably linked to human activity and greenhouse gas emissions.

Image © Greenpeace

1.2 Climate Trends

Concerning trends are being observed in the Earth's climate patterns. Global mean air temperatures have increased approximately 1°C since 1850, and every decade since 1980 has been warmer than the one previous.[12] Australia's mean air temperature has been increasing since 1910, with surface temperatures also rising in surrounding oceans.[13] Average mean air temperature has increased 1.44, plus or minus 0.24 °C, in Australia since 1910, when national records began.[14] Worldwide, the last seven years from 2014 to 2020 were the hottest on record, based on mean temperature.[15] For Australia, the last 8 years were amongst the 10 hottest, with 2019 being both the hottest and the driest on record.[16]

Extreme weather events are a serious concern associated with climate change, and are linked to increasing global temperatures and changing precipitation patterns. Extreme weather can include heatwaves, drought, and extreme rainfall events. This can intensify climate-related disasters such as bushfires, hurricanes and flooding.

Image © Kiran Ridley / Greenpeace

1.3 Heatwaves

Heatwaves and extreme heat days are becoming more frequent as a result of climate change. An extreme heat day occurs when the mean temperature averaged over the area of Australia is above the 99th percentile of each month from 1910-2015.[17] Heatwaves can be defined as periods of three consecutive days or more where temperatures are unusually high. Worldwide, there has been an increase in the frequency, intensity and duration of heatwaves in recent decades.[18] Across Australia, heatwaves have increased in intensity, duration and frequency from 1953-2020.[19] The impacts of heatwaves are wide-ranging and can be severe, affecting agriculture, human health, the economy, public infrastructure, natural hazards such as bushfires, workplace productivity, and ecosystems.[20]

1.4 Rainfall

Rainfall patterns have been changing globally since the 1950s; this is evident in historical records of precipitation, streamflow and drought indices.[21] Rainfall in Australia is highly variable and is influenced by climate drivers such as El Niño, La Niña, the Indian Ocean Dipole and the Southern Annular Mode.[22] Climate change is linked to more frequent positive Indian Ocean Dipole Events and has resulted in an increase in the frequency of extreme El Niño events since the 1970s. These are both known to be the leading causes of drought in Australia, leading to a drying trend in southern parts of the country.[23] Models predict a continuation of this trend across many land areas globally, with severe and widespread droughts over the following 30-90 years as a result of decreased precipitation and/or increased evaporation.[24]

1.5 Drought

The intensity and frequency of drought is expected to increase in coming decades as climate change accelerates. The impacts of drought include damage to agriculture, the economy, communities, ecosystems, and a prolonged fire season. In 2019, drought was estimated to cut Australia's GDP by 0.5 to 0.75 per cent, costing between $9.5 billion and $14 billion.[25]

In Australia, rainfall analysis from 1880 to the present has shown that the drying trend in recent decades across parts of southern Australia has been the most sustained large-scale decline in rainfall since the late 1880s.[26] There has been a sustained decline in rainfall during the cool season (April to October), declining 12% in the country's southeast from the late 1990s to present and 16% in the southwest.[27]

CASE STUDY

Drought in Australia[28]

Drought in Australia has had crushing human impacts, with farmers among those most severely impacted. While the Millennium Drought broke in 2011 after 13 long years, another intense drought followed in 2017. Australian farmers have therefore faced two major droughts within a decade. Particularly hard hit was Vivien Thompson, a farmer from Muttama, New South Wales, along with her partner Robert. When the drought broke in 2011, they set about rebuilding their business and working to recover. However, the reprieve lasted only 6 years before the 2017-2019 drought set in. Even after the first drought broke, Vivien describes a feeling of dread at the thought of facing another one so soon. She says the experience of watching native plants dying, and animals and wildlife struggling without food and water was "heart-wrenching".

1.6 Bushfires

Bushfires are a major natural hazard in Australia and worldwide. They are closely associated with increased aridity and warmer temperatures, as well as available fuel and ignition sources. Fire seasons impact the entire Australian continent, and 40% of the Earth's land consists of fire-prone ecosystems.[29] Fire seasons worldwide are growing longer and more severe, and this trend is set to continue.[30] Globally, the mean length of the fire season increased by 18.7% from 1979 to 2013.[31] In Australia, the bushfire season has extended and parts of the country now experience a year-long bushfire threat.[32] Since the 1950s, there has been a long-term increase in extreme fire weather and a longer fire season on account of a warmer and more arid climate.[33]

CASE STUDY

Australia's 2019/20 Summer Bushfires

Over the summer of 2019/2020, Australia experienced its most devastating bushfire season on record, which burned 12.6 million hectares of land across the country.[34] Forty-four per cent of the total area burned by high-severity fires since 1988 was burned in this one summer.[35] The toll was severe: thirty-three people were killed, 2448 homes were destroyed, and insurance claims totaled $1.8 billion.[36] Three billion animals were killed or displaced.[37] The agriculture sector was hard hit, with thousands of farms dealing with losing livestock at a time when drought has already been placing an immense burden on farmers.

Air quality across the country suffered, and air quality in Canberra on New Year's Day was the worst in the world.[38] Fifty-seven per cent of Australia's adult population, or 11.3 million people, reported being impacted by bushfire smoke, which made its way around the globe.[39] Poor air quality from the fires contributed to over 400 deaths and led to over 4,000 hospitalisations.[40]

After a bushfire began burning out of control on the 3rd of January 2020, 4,000 people found themselves trapped in Mallacoota, Victoria. Seeking refuge on the beach, the Australian Navy had to be called in to evacuate them.[41]

Julie Brown was a resident of Cobargo on the NSW South Coast who lost her home in these horrific fires. As of January 2021, a year after the fires, she was still unable to return home, and was volunteering as a cook in the Cobargo BlazeAid Camp. Her life, like many others, has been turned upside-down since the fires. She reports moving every four days following the fires, and living in a caravan while unable to return home.[42]

Image © Kiran Ridley / Greenpeace

1.7 Extreme Rainfall

The impact of climate change on rainfall is not uniform and can result in extremes in both drought and rainfall events. This is because climate change intensifies the Earth's water cycle: warmer temperatures mean more extreme evaporation, further drying out arid zones. Meanwhile, there may be increases in extreme precipitation and rainfall in other regions due to increased moisture availability. In Australia, rainfall has increased in northern Australia during the northern wet season, and there has also been an increase in the intensity of heavy rainfall events.[43] In some parts of Australia, for example, the intensity of short-duration heavy rainfall events has increased by 10% in recent decades.[44] These events are associated with flash flooding, which can pose extreme risk to communities. Heavy rainfall events are expected to increase in frequency and intensity in a warming climate.[45]

1.8 Extreme Weather Events

Climate change is also impacting the intensity and frequency of extreme weather events, including bushfires, cyclones, and monsoons.[46] The Bureau of Meteorology has reported that, although the frequency of cyclones in Australia has been decreasing, they are increasing in intensity and severity.[47] These events are also further exacerbated by rising sea levels, which increase flooding severity, erosion, and inundation.[48] The cost of extreme weather events in Australia for the 2010-2019 decade was $35 billion, double what it was in the 1970s.[49]

Image © Rob Parsons / Through The Looking Glass Productions / Greenpeace

1.9 Melting Ice Sheets and Glaciers

Climate change has caused disproportionate warming in the polar regions, especially in the Arctic.[50] This is caused by a process called polar amplification, which causes the poles to warm at a higher rate than the tropics. Record-breaking summer temperatures have been recorded in the Arctic over the last few years, with a new record of 38°C observed in the Russian town of Verkhoyansk on 20 June 2020.[51] The warming trend in the polar regions is accelerating the rapid melting of ice sheets, sea ice and alpine glaciers.[52] The melting of the Greenland ice sheet has been accelerating in recent decades, increasing from 41 Gt/year from 1990-2000, to 286 Gt/year from 2010-2018.[53] This decline of glaciers and ice sheets is clearly visible in the natural world (Figure 5 and 6 below).

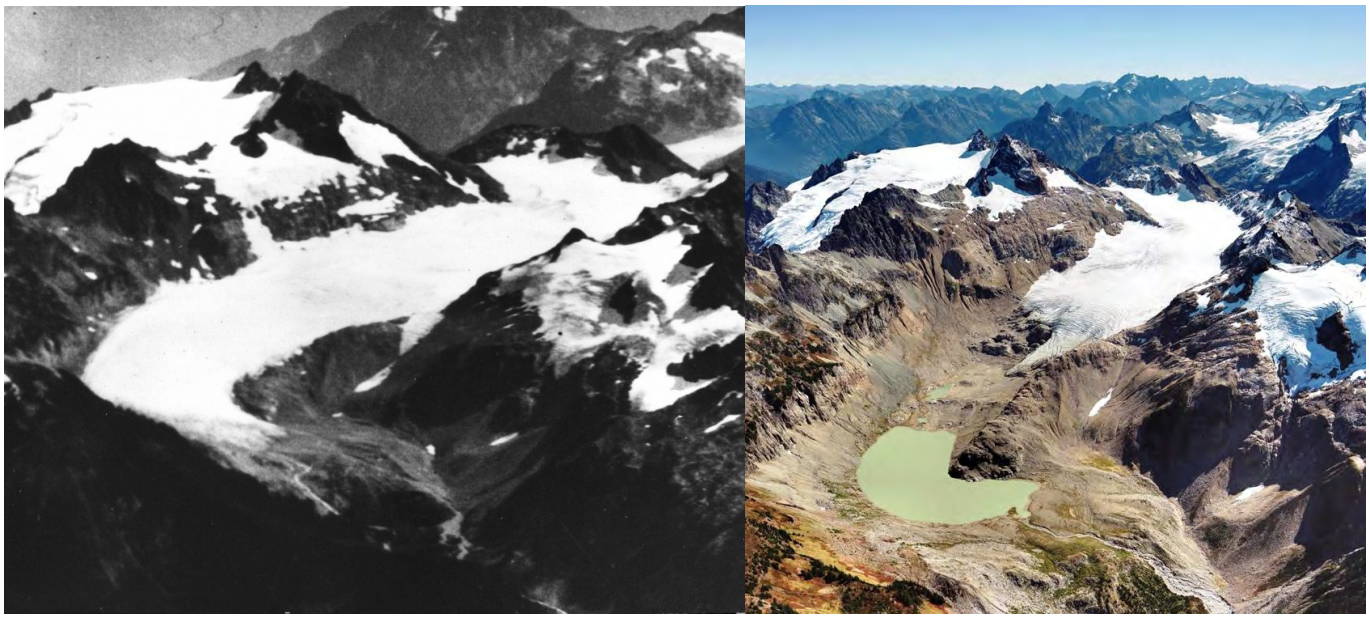


Figure 5 Photos showing the decline of the Southern Cascade Glacier, USA. Photos courtesy of: USGS (1928-2006).

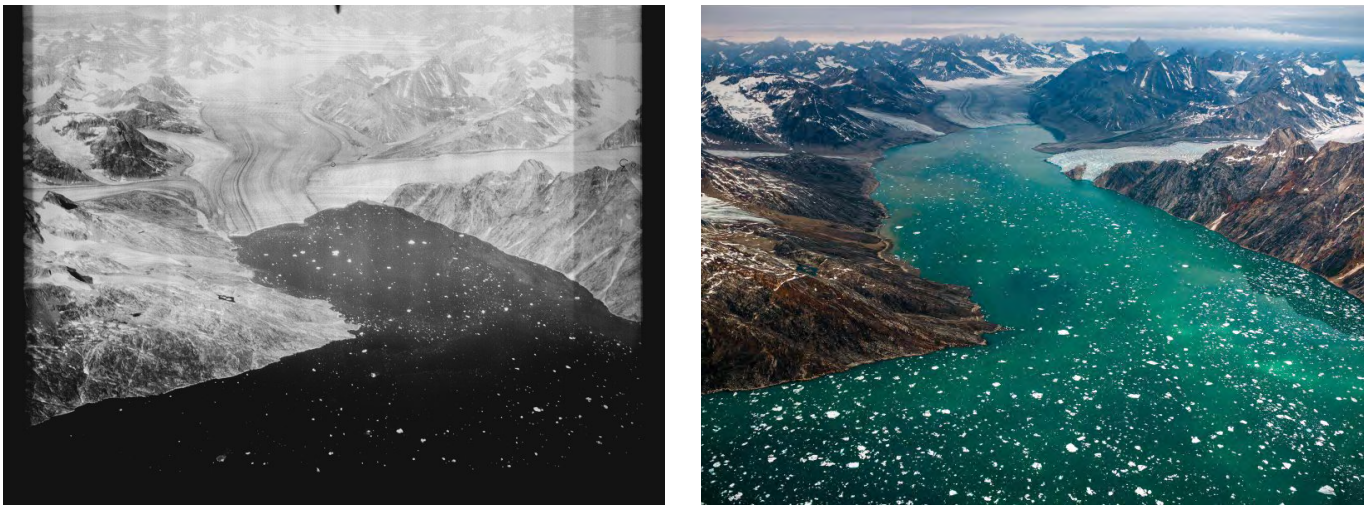


Figure 6 Photos showing the melting and retreat of the Karale Glacier, Greenland. Photos accessed through Time (2016), originally from Bjork et al. (2014).

1.10 Sea Level Rise

Global mean sea levels have risen by approximately 25 cm since 1880 (Figure 7).[54] Melting of land-based ice (glaciers and ice sheets) and ocean thermal expansion are the two major causes of sea level rise.[55] Climate change is exacerbating both of these processes, and there is further substantial sea level rise expected in the future.[56] The majority of the Earth's heat is being absorbed by the world's oceans, whose heat content has increased consistently since the 1960s.[57]

The rate of future sea level rise remains uncertain and is dependent on the extent to which the world's nations successfully reduce their emissions and limit global heating. Conservative estimates under lower emissions scenarios predict a rise in the range of 50-70 cm by 2100. However, rising concern about the fate of the Antarctic Ice Sheet has recently also suggested that, even if emissions reductions goals of the Paris Agreement are met, global mean sea level could rise 2 metres by 2100 and not return to its original state.[58]

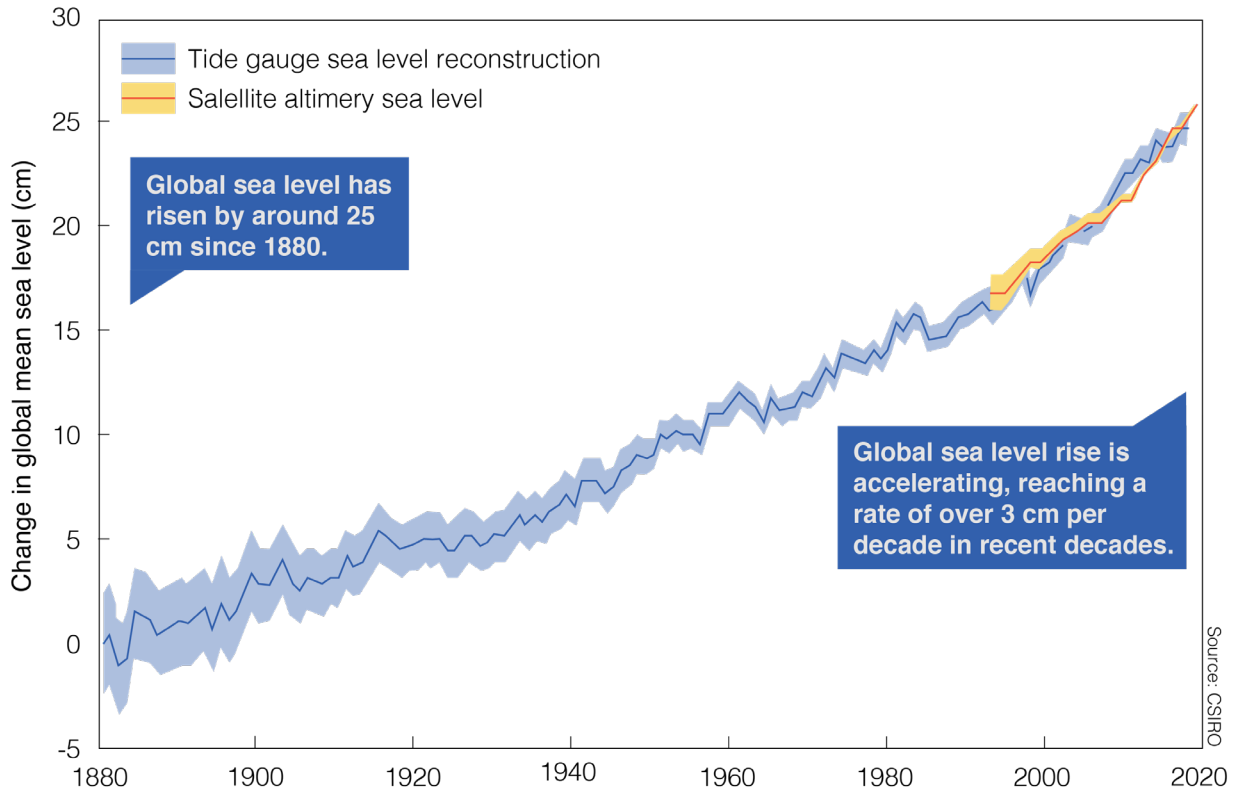


Figure 7 Sea Level Rise based on tide gauge data from 1880 (From BOM, State of the Climate, 2016; Image Source: CSIRO)

1.11 Sea Level Rise Impacts

Rising sea levels place communities, infrastructure and ecosystems at risk. Sea level rise is threatening low-lying communities, with coastlines being eroded, more frequent flooding, higher king tides, greater tidal surges during storms, cyclones and hurricanes, increased water table salinity, worse crop yields, and a reduction in available fresh water.[59] Island communities, such as those in the Pacific Islands, are disproportionately impacted and it is likely that many island nations will have to undergo managed retreat (see below) in coming decades.[60]

In spite of carrying the least responsibility for climate change and contributing very low emissions, these communities are bearing some of the greatest impacts.

CASE STUDY

The Pacific Islands and Kiribati[61]

Communities in the Pacific Region, along with other low-lying islands, are among those hit hardest by climate change and climate disasters. In spite of carrying the least responsibility for climate change and contributing very low emissions, these communities are bearing some of the greatest impacts.

Flooding and climate disaster risk is a particular concern, with devastating cyclones impacting these communities in the past decade. Managed retreat appears imminent for many places. In Fiji alone, 830 vulnerable communities now have priority status for relocation. In 2014, inhabitants of the Fijian village of Vunidogoloa were forced to move 2km inland as a result of rising sea levels encroaching on their community.[62] Five reef islands of the Solomon Islands have been claimed by sea level rise and erosion.[63]

Kiribati is a low-lying atoll nation which is currently severely threatened by sea level rise. Kiribati residents regularly experience king tides, which are having a growing impact on small islands as sea levels continue to rise. These are devastating communities with flooding, displacement, destroying gardens which act as a food source, and salinising water sources, impacting freshwater supply.

Itinterunga (Rae) Bainteiti lives in Kiribati. From 2004 to 2007, king tides on the island were reaching their usual size. However, since 2011 they have been rapidly growing to 3 to 4 times greater than they had been in 2004. Recently, homes were inundated by a flooding event in the middle of the night, and flooding has recently reached as far as 200m inland. In 2014, while driving home, Rae had to stop because a causeway was flooded. The water had reached his house, meaning it had risen further than ever before. Numerous residents are now being forced to regularly relocate in order to escape the flooding of the king tides, returning afterwards to clean up.

Even under conservative warming projections, 190 million people currently occupy global land that will sit below future projected high-tide lines in 2100 (compared to 110 million today). Under high-emissions projections, the number of people projected to occupy land below the high-tide line in 2100 is expected to reach 630 million.[64]

Image © Greenpeace / Jeremy Sutton-Hibbert

Image supplied by Itinterunga Bainteiti

One of the things that some of our elders always say is as long as you're breathing, just keep doing your part.

Keep making that noise and also mobilise communities to build that resilience, using the localknowledge, traditional knowledge, and whatever resource that there is for building resilience of these communities, because the conversation on climate change is already mature enough to understand the cost of climate change and we haven't seen anything tangible.

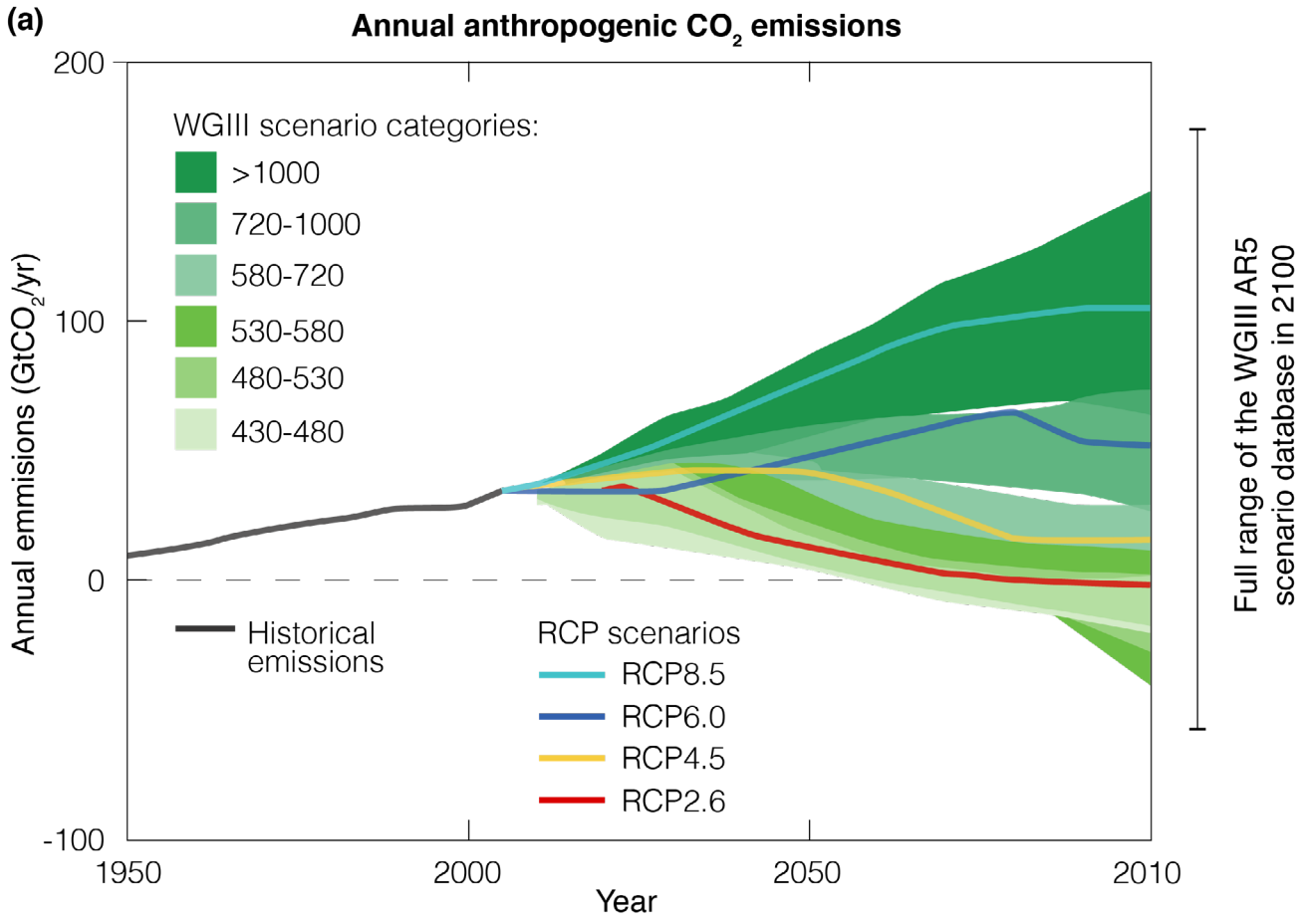
- Itinterunga (Rae) Bainteiti, Kiribati.

1.12 Emissions Scenarios: From Best to Worst Case

Emissions scenarios are used to describe future pathways of greenhouse gas emissions and their outcomes, referred to as representative concentration pathways (RCPs). Based on how much countries cut back their emissions, the RCP emissions scenarios model the impact this will have on future climate. The IPCC 5th Assessment Report presents four potential pathways for GHG emissions, in atmospheric CO2 ppm (Figure 8).[65]

1. RCP2.6: low emissions scenario, with emissions peaking in 2020 then stabilising
2. RCP4.5: moderate emissions, peaking at 2040 then stabilising
3. RCP6.0: moderate emissions, peaking at 2080 then stabilising
4. RCP8.5: high emissions (no reduction), continuing the trend throughout the 21st century

These emissions scenarios have also been modelled in relation to the impacts they will have on global mean temperature, precipitation, sea level, sea ice and ocean acidity (pH). Temperature predictions are based on how much greater the global mean temperature will be relative to the temperature from 1850-1900. Under all scenarios except RCP2.6, global surface temperature is likely to be over 1.5°C warmer than it was in 1850-1900. Under RCP4.5 and RCP6.0, temperatures are likely to increase more than 2°C, while under RCP8.5, this rise could exceed 4°C.



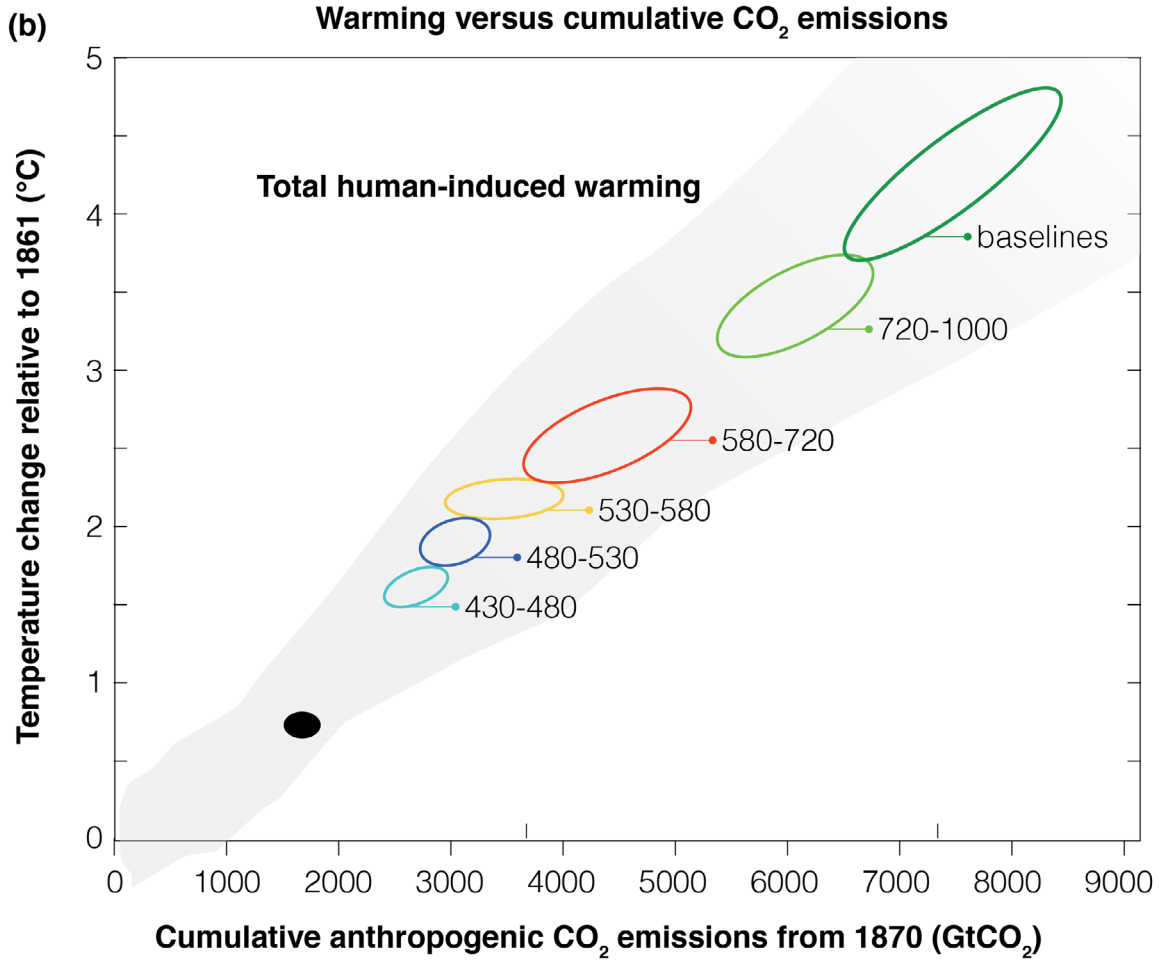


Figure 8 Emissions scenarios showing **(a)** possible future atmospheric CO2 concentrations based on emissions scenarios, and **(b)** potential corresponding global mean temperature increase (compared to pre-Industrial levels). From IPCC AR5 (2014).

1.13 Who is Responsible?

The burning of fossil fuels is the greatest contributor to greenhouse gas emissions. Emissions continuously increased from 1970-2010, with CO2 emissions from fossil fuel combustion and industrial processes comprising approximately 78% of this total increase of GHG emissions.[66] The IPCC has reported that CO2 emissions from fossil fuels burned in the energy sector accounted for 69% of global GHG emissions in 2010.[67] This does not account for emissions of fossil fuels such as methane, which have a much higher level of uncertainty and are more difficult to measure.

Since the mid-1800s, greenhouse gas emissions have increased by a factor of 50, with almost three quarters coming from the energy sector.[68] A small number of countries are responsible for the bulk of these emissions and our current crisis. Historically, the majority of emissions have been produced by 'developed' countries whose economies industrialised faster than 'developing' ones.[69] Although the developing world and small island nations bear the brunt of climate change, they are often amongst the lowest emitters. This highlights the injustice of climate change and the actions of the world's greatest emitters, including Australia.

The 15 highest-emitting nations are responsible for 73.51 per cent of global GHG emissions.[70]

Despite its relatively small population, Australia is ranked as the world's 14th highest emitter, and is the highest emitter per capita in the OECD.[71]

Nationally Determined Contributions (NDCs) are the emissions reduction goals that countries have set out. NDCs are put in place in order to achieve the Paris Agreement goal of limiting global warming to 1.5°C above industrial temperatures. [72] NDCs are classified under 5 categories, defined in the table below.[73]

Despite being responsible for the majority of anthropogenic greenhouse gas emissions, none of the top 15 greenhouse gas emitters have pledged emissions reductions which are consistent with the 1.5°C heating limit set out by the Paris Agreement; India is the only one of these to have set a goal compatible with a 2°C limit set out by the more lenient Copenhagen Accord.[74] Based on the emissions reduction policies currently in place worldwide, the planet is projected to warm by an estimated 2.9°C by 2100, with possible warming ranging from 2.1°C to 3.9°C.[75] In spite of a decline in global GHG emissions due to the COVID-19 pandemic in 2020, the Bureau of Meteorology has noted that this will not have a significant impact in abating climate change; carbon concentrations in the atmosphere have already rebounded to surpass pre-pandemic levels.[76]

Category	Definition
Critically insufficient (4°C+ world)	**NDCs with this rating are well outside a country's 'fair share' range. If all government NDCs were within this range, global heating would exceed 4°C.**
Highly insufficient (<4°C world)	**NDCs with this rating are outside a country's 'fair share' range, but to a lesser extent than the previous category. If all government NDCs were within this range, global heating would reach 3-4°C.**
Insufficient (<3°C world)	**NDCs with this rating fall in the least stringent part of a country's 'fair share' range. If all government NDCs were within this range, global heating would reach 2-3°C.**
2°C Compatible	**NDCs with this rating are consistent with the 2009 Copenhagen 2°C goal. If all government NDCs were within this range, global heating would reach 2°C, still exceeding the Paris Agreement's goal of 1.5°C.**
1.5°C Paris Agreement Compatible	**NDCs with this rating are consistent with the Paris Agreement's goal of limiting heating to 1.5°C.**

Table accessed via (Greenpeace Australia Pacific, 2020). This report used Climate Action Tracker's classification system for its comparison of NDCs, as reflected in this table: (Climate Action Tracker 2020d). For policy assessments, see (Climate Action Tracker 2019).

1.14 Australia's Role

Australia signed the Paris Agreement in 2015 alongside 196 other countries. This agreement "aims to strengthen the global response to the threat of climate change" by "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change".[77] To do this, countries are required to cut their GHG emissions.

Currently, Australia is not on track to meet its 2030 carbon budget target.[78] The Climate Action Tracker is an independent scientific analysis tracking government actions to reduce GHG emissions. It has rated Australia's Paris Agreement target as "insufficient", not being strong enough to limit warming to 2°C.[79] Australia is the highest emitting country per capita in the OECD, and it has a responsibility on multiple fronts to reduce its fossil fuel emissions and exports.[80]

Image (C) AAP Image

2. PUBLIC HEALTH IMPACTS

The fossil fuel industry is adversely affecting human health across the globe. This is linked to both climate-related health impacts, as well as the health impacts of pollution, emissions, and industry operations such as mining. Fossil fuel emissions have severe public health implications and cost the global economy US$2.9 trillion per year, or 3.3% of global GDP.[81] In addition, fossil fuel production is linked to numerous medical conditions, poor health outcomes and premature death.

2.1 Climate Change and Health

The World Health Organisation (WHO) emphasises that climate change affects both social and environmental determinants of public health: clean air, safe drinking water, sufficient food and secure shelter.[82] Between 2030 and 2050, WHO expects climate change to cause approximately 250,000 additional deaths per year on account of malaria, malnutrition, diarrhea and heat stress.[83] Worldwide, ambient (outdoor) air pollution decreases life expectancy by 2.9 years.[84] Studies have estimated that eliminating fossil fuels completely would increase average global life expectancy by 1.1 to 1.7 years.[85]

Studies have estimated that eliminating fossil fuels completely would increase average global life expectancy by 1.1 to 1.7 years.[85]

Image © Cole Bennetts / Greenpeace

2.1.1 Heat Stress

Heat and heat stress are amongst the most damaging and deadly extreme weather hazards for humans.[86] Heat can lead to illnesses and health complications such as heat stroke, exhaustion, exacerbated kidney problems and cardiovascular complications.[87] Rising temperatures will also exacerbate the Urban Heat Island (UHI) effect and affect the livability of cities. This effect means air temperature in urban areas are even higher than nearby rural areas, making heatwaves more intense in cities.[88] Heat also increases concentrations of pollutants such as ozone, which can exacerbate cardiovascular and respiratory diseases and cause premature death.[89] It also leads to higher levels of pollen and aero-allergens which trigger asthma.[90] With the number of extreme heat days and heatwaves set to increase, this also has implications for the number of heat-related illnesses and deaths.

A long-term study by NSW Health found that heatwaves lead to a 10 per cent increase in deaths and ambulance callouts.

CASE STUDY

Heatwaves, ambulance callouts and mortality in Sydney, Australia

A long-term study by NSW Health found that heatwaves lead to a 10 per cent increase in deaths and ambulance callouts. Specifically, they observed a 10.8 per cent increase in deaths, a 3.4 per cent increase in hospital presentations and a 10.9 per cent increase in ambulance call-outs.[91] Another study of a heatwave in 2011 demonstrated a statistically significant rise in ambulance callouts, emergency department (ED) visits and all-cause mortality.[92] This study noted that all-cause ED visits increased by 2% (95% with a confidence interval of 1.01-1.03), all-cause ambulance calls increased by 14% (95% with a confidence interval of 1.11-1.16), and all-cause mortality increased by 13% (95% with a confidence interval of 1.06-1.22).

Image © Paintings / Shutterstock

2.1.2 Infectious Diseases

Changes in climate variables affect the survival, reproduction and distribution of organisms which cause disease, known as pathogens. It also affects their hosts, and means of transmission.[93] This has implications for the spread of human infectious diseases. Climate-related changes impact the geographic and seasonal patterns of pathogens, along with the intensity and frequency of their outbreaks. This includes vector-borne, water-borne, air-borne, and food-borne diseases.

Water-borne diseases may become more prevalent as a result of shortages of clean surface water and drinking water.[94] More frequent and intense rainfall may trigger stormwater runoff, introducing toxic pathogens into water sources. Warmer surface waters can also provide a suitable environment for pathogens and harmful algal blooms. [95]

CASE STUDY

The Naegleria fowleri outbreak in Lake Liddell

Warmer waters can provide an ideal environment for harmful pathogens to grow. Such conditions resulted in an outbreak of the amoeba Naegleria fowleri - which causes a rare but deadly brain infection for humans - in Lake Liddell, NSW. Naegleria fowleri can grow due to natural increases in surface water temperature, or artificially heated waters. Lake Liddell is used for the discharge of artificially heated cooling water from AGL's Liddell coal-burning power station.[96]

This outbreak led to the closure of Lake Liddell in March 2016 for recreational use. Since it also houses a campground and facilities nearby, this causes concerns for tourism in the area.

2.1.3 Emergencies and Extreme Weather Events

Climate disasters and extreme weather events can result from shifts in climate systems, such as El Niño, La Niña, the Quasi-Biennial Oscillation, and regional-scale hazards (e.g., drought, heatwaves, floods). The frequency of extreme weather events is increasing each decade.[97] An increase in the number and intensity of extreme weather events will have severe consequences for human health, and food and water security.[98] Climate change is altering disaster risk patterns by increasing the frequency and intensity of extreme events, reshaping which areas are affected by hazards, and increasing the vulnerability of certain social groups.[99]

2.1.4 Extreme Weather

The impacts of extreme weather events are set to worsen under climate change.[100] Public health impacts associated with these events will be exacerbated, including death, injury, illness, and mental health impacts.[101] Along with this, public health care is disrupted when extreme weather damages infrastructure.[102] A serious cause for concern with failing infrastructure is the potential for chemical leaks into water, soil and air as a result of extreme weather events such as fire and flood.[103] Bushfires have serious public health implications not only through the fires themselves placing lives at risk, but the associated particulate matter pollution and reduced air quality as a result of bushfire smoke.[104]

2.1.5 Mental Health

Climate change can also negatively impact mental health in a number of ways. Climate-change driven extreme weather events can cause severe mental stress, including depression, anxiety, PTSD and heightened suicide rates.[105] Concern over climate change has also been linked to heightened rates of stress and anxiety.[106] Excessive heat, such as during heatwaves and warmer weather as a result of climate change, can also negatively impact mood, leading to mood changes and increases in aggressive behaviour, as well as decreased workplace productivity.[107]

2.2 Air Pollution

Air quality has a major impact on public health outcomes. Fossil fuels are both directly and indirectly responsible for the majority of anthropogenic air pollution globally. The combustion of fossil fuels in power plants, industry, and vehicles emits pollution that reduces air quality across vast areas. Additionally, climate change adds further concern as warmer weather can also alter the chemistry of pollutants, making them more airborne and potent, and consequently more dangerous.[108] Shifting away from fossil fuels is the most effective way to reduce anthropogenic air pollution, particularly in residential and urban areas. Even with national air quality standards in place in most countries, air pollution can negatively impact and shorten people's lives.

The impact of reduced air quality on public health cannot be understated, particularly for vulnerable groups such as children, the elderly, and those with underlying conditions.[109] Air pollution is associated with a range of disorders and consequences including asthma, reduced lung function, cardiovascular and pulmonary diseases, preterm birth, increased ambulance callouts and premature death.[110]

Air pollution is connected to 3.7 million premature deaths worldwide each year, and approximately 3000 deaths per year in Australia.[111] According to the OECD, by 2060 it could be the cause of 6 to 9 million premature deaths per year worldwide.[112] Effective climate policy and emissions reductions therefore have the potential to prevent millions of air-pollution related deaths worldwide. As many as 150 million deaths could be averted by 2100 through reducing fossil fuel emissions.[113]

Particulate matter (PM) is a mixture of solid particles and liquid droplets, produced by a range of fossil fuel emission sources, including transport and power stations. An increase in bushfire intensity and frequency - exacerbated by climate change - can lead to increased PM pollution. PM pollution also results from the combustion of fossil fuels. While large particles such as pollen and dust can be more readily expelled from the body, PM10, PM2.5 (fine particulate matter) and PM1 (ultrafine particulate matter) are of greater concern – due to their small size, they can readily enter the lungs and be absorbed into the bloodstream.[114] Health effects of PM on humans include lung and heart disease, asthma, stroke, respiratory infections, cognitive impairment and premature death.[115] The World Health Organisation has classed small particulate matter as a group 1 carcinogen.[116]

Air pollution is connected to 3.7 million premature deaths worldwide each year, and approximately 3000 deaths per year in Australia.

An increase in surface air temperature as a result of climate change is predicted to increase ground level ozone concentrations. Heightened ozone levels at ground-level and in the troposphere can lead to acute health impacts, including respiratory and cardiovascular diseases, impaired lung function, eye, nose and throat irritation, and, in serious cases, premature death.[117]

Emissions from motor vehicles, industry, gas-heaters and gas stoves also form nitrogen dioxide (NO2).[118] NO2 is a contributor to particulate matter pollution, as well as to the formation of ground-level ozone. Air pollution also carries the potential to exacerbate and trigger a range of neurological diseases.[119]

2.3 Mining, Oil and Gas Production

The extraction of fossil fuels in mining, oil wells and gas wells harms people's health through exposure to toxic chemicals and pollutants. Coal dust produced as a result of mining is responsible for heightened rates of respiratory disease.[120] Sulfur dioxide (SO2) emissions from coal mines and power stations are another health hazard, with Australia having some of the highest levels in the world.[121] Australia's health regulations for fossil fuel production and combustion are less stringent than many other developed countries, with our air pollution standards for sulfur dioxide levels 11 times higher than the World Health Organisation (WHO) standards.[122]

Coal-burning power station pollution can exacerbate heart and lung conditions, and increase risk of stroke, lung disease and low-weight babies.[123] Research has shown that toxic pollutants from coal-burning power stations were responsible for 800 premature deaths, 14,500 cases of asthma and 850 underweight births in one year.[124] A five-year audit released this year has shown only a small change in pollution from coal-burning power stations, in spite of exposure to this pollution leading to an estimated 4,000 premature deaths.[125] The economic cost of the health impacts of coal pollution in Australia was estimated at $2.4 billion for 2019.[126]

There are also health risks associated with Coal Seam Gas (CSG) extraction, including hidden impacts that have not yet been assessed.[127] This process puts human and agricultural water sources at risk of chemical contamination as material from the coal seams is released and brought to the surface.[128] Hazardous compounds may be found in water that flows to the surface of oil and gas wells. This saline water is known as 'produced' water. These compounds include bromide, arsenic, strontium, mercury, barium, radioactive isotopes and organic compounds such as benzene, toluene, ethylbenzene and xylenes, known as BTEX chemicals.[129] Air pollution from coal seam gas projects may also put public health at risk, including from fugitive methane emissions.[130] Drilling can also release compounds known as NOx and VOCs, which can lead to ozone formation: a significant contributor to respiratory distress.[131]

Australia's health regulations for fossil fuel production and combustion are less stringent than many other developed countries, with our air pollution standards for sulfur dioxide levels 11 times higher than the World Health Organisation (WHO) standards.

2.4 Public Health Costs

The impact of fossil fuels on health generates immense economic costs. Estimating this financial burden is a complicated process, as it requires calculating both direct and indirect costs; direct costs taken in isolation underestimate the true cost of fossil fuel induced impacts on health. In the EU alone, heat-related mortality due to climate change is projected to cost €103 billion per year by the 2050s in a medium- to high-emissions scenario (3-4°C warming), or €80 billion per year by the 2050s under an E1A mitigation scenario (2°C of warming).[132]

Air pollution from fossil fuels is currently estimated to cost the global economy US$2.9 trillion per year, or 3.3% of global GDP (central estimate).[133] This is as a result of health impacts, and respiratory and non-communicable diseases. In Australia, health complications from air pollution cost the government between $11 billion and $24 billion annually.[134] Mitigating fossil fuel emissions improves outcomes for human health and reduces associated healthcare costs.

In terms of the financial implications, the health co-benefits from mitigating climate change far outweigh global policy costs in achieving the target for all Paris Agreement scenarios.[135]

Air pollution from fossil fuels is currently estimated to cost the global economy USD2.9 trillion per year.

3. FOOD SECURITY

Climate change is placing stress on global food security, with the agriculture sector already facing a growing set of challenges.136 This is because climate factors significantly impact food production, supply and availability. Shifting climatic patterns are already affecting, and will continue to impact, the agricultural sector via higher temperatures, changing precipitation patterns, and a greater frequency of extreme weather events, such as drought, flood and fire. Both crop and pastoral systems are vulnerable to this change.137

Climate change will have serious impacts on soil health and agricultural land. Environmental degradation and desertification are expected to accelerate, particularly in locations which have been damaged for agricultural, mining or industrial purposes.138 Contamination of water and agricultural soil may grow more widespread as a result of alternating drought and flood.

3.1 Crop Yields

An increase in global mean temperature will widely impact agricultural productivity; modelling studies have predicted widespread drops in the growth and yield of crop plants.[139] This is especially evident in arid regions, where warmer temperatures will increase evaporation and transpiration rates. Rainfall variability will also impact food production across the globe.[140] Changing rainfall patterns will lead to higher incidence of extreme weather events, such as drought and flooding, which result in increased crop damage and a decline in yield.

Australia's food production and security will also be impacted by future climate change.

Issues of food security are not restricted to developing nations. As a country which is set to continue experiencing rainfall variability, drought and extreme weather events, Australia's food production and security will also be impacted by future climate change.[141] In Australia, a decline in rainfall as a result of drought will affect major agricultural regions.[142] The IPCC identified two regions which would be significantly impacted by climate change: the Murray-Darling Basin in south-eastern Australia, and south-western Australia.[143] Negative impacts on agricultural yields in Australia will have global ramifications due to the region being a major global exporter of wheat, barley, oats and pulses.[144] Across the south of the country, drought is set to impact crop yields, with predictions for more frequent and severe droughts in the coming decades.

3.2 Pests and Diseases

Climate change is predicted to alter the prevalence of pests and diseases which impact the agricultural sector.[145] Pests and pathogens have been shifting their distribution, migrating pole-ward away from the equator as these latitudes grow warmer, and may affect patterns of shock pest events.[146]

Combatting pests will also be more complicated, as some pesticides lose efficacy in dry conditions. Overuse of pesticides in response to these shifts may have detrimental impacts, creating widespread resistance in pest species.[147] It is also likely that there will be increased incidence of animal pests and food-borne zoonoses, infectious diseases transmitted from organisms to humans.[148]

3.3 Livestock and Fisheries

Climate change will degrade fisheries and livestock.[149] Heat stress is harmful to livestock and farm animals, leading to reductions in cattle growth and reproduction, along with milk and egg yield and quality.[150] This occurs due to diminished feeding on when temperatures increase, particularly when they pass 30°C.[151] Temperature changes will also impact fisheries and the fishing industry. Potential fish catch in tropical marine ecosystems is predicted to decrease by 5-10 percent by 2050 if emissions are not reduced, under the IPCC "business as usual" scenario.[152]

3.4 Food Access and Famine

Food security - having a steady access to sufficient and affordable food supply - is vital for human health. Climate change is predicted to impact markets, food prices and supply chain infrastructure, reducing affordability.[153] Global food insecurity due to climate change is compounded in developing countries, where poverty exacerbates the impacts of food shortages.[154]

CASE STUDY

Famine and food insecurity in Kenya

Climate change will increase temperatures and the frequency of heatwaves across East Africa, impacting on food production, water security, health and the energy sector.[155] In Kenya and other parts of East Africa, hot, dry conditions have resulted in a sustained drought which is reducing agricultural productivity, contributing to a food security crisis and famine.[156] At the time of writing, at least 1.4 million Kenyans were facing a severe hunger crisis.[157]

CASE STUDY

Climate Change, Food Security, and the 2011 Egyptian Revolution

There is growing evidence that the risks of climate change extend far beyond direct impacts. These risks extend to national and international security.[158] Food availability and affordability are impacted by climate change. This is in part because agriculture is vulnerable to climatic factors, drought and temperature.[159] In 2011, the Egyptian Revolution broke out as part of the wider Arab Spring movement, in the form of demonstrations and violent clashes between protestors and security forces. While the uprising occurred in a complicated political environment and had a variety of causes, high food prices have been put forward as a key driver of civil unrest.[160] When agricultural output is negatively affected by climate, this can drive up food prices and exacerbate existing social tensions in communities and nations. This is one way that climate change may contribute to future social unrest and security issues.

3.5 Food Safety

Climate change will also jeopardise food safety and increase the risk of infections.[161] Warmer temperatures are correlated with heightened microbial growth rates, creating public health risks.[162] This effect is particularly concerning in fresh fruit and vegetables, with temperature and rainfall patterns closely related to the transport, growth and survival of certain forms of bacteria, with Escherichia coli O157 (E-Coli) and Salmonella spp. (Salmonella) of particular concern.[163] The risk of food contamination is likely to increase as a result.

There will also be implications for seafood safety, with biological and chemical risks arising from increased concentrations of toxic metals, organic chemicals residues, algal toxins and pathogens in oceans and marine organisms.[164] Ocean warming also facilitates mercury methylisation, the process of mercury in ocean water turning into methyl mercury, the most poisonous mercury compound. After forming in ocean waters, methyl mercury is taken up by fish and mammals.[165] Increased methyl mercury concentrations in organisms and the ecosystem also mean there is a greater risk of humans being exposed to mercury through seafood consumption. These risk factors will all have serious implications for human health and wider food security.

Image © Peter Caton / Greenpeace

4. WATER

Fossil fuels are compromising water security, supply and health on numerous fronts. Climate change is correlated with changing rainfall patterns, resulting in widespread drought and water shortages. The IPCC has stated that “water and its availability and quality will be the main pressures on, and issues for, societies and the environment under climate change”.[166] Fossil fuel extraction and processing also places strain on water resources, along with creating a risk of contamination to surface and groundwater.

Image © Arlene Bax / Greenpeace

4.1 Water Availability

Climate change is altering the global water-cycle, changing rainfall patterns across the globe. Although some areas are experiencing concentrated increases in precipitation due to intense rainfall events, storms, monsoons and cyclones, overall the intensity and scale of drought across the globe is increasing.[167] Drought impacts freshwater availability and has far-reaching impacts on human societies and ecosystems.[168]

The area of land globally impacted by drought is increasing. By the 2000s, twice as much land globally was classified as "very dry", compared to in the 1970s.[169] One study has predicted that the land area and number of people impacted by severe drought worldwide could grow to 7-8% of the world by 2100 – this is double what it was (3%) in the years spanning 1976-2005.[170] Meanwhile, the World Meteorological Organization (WMO), projects that the number of people living in areas of potentially severe water scarcity will increase to between 2.7-3.2 billion people by 2050, up from 1.2 to 1.6 billion in the mid-2010s.[171]

CASE STUDY

Facing Day Zero – Water Security in Regional Australia

In 2019, after nearly three years of severe drought, towns across regional NSW, Queensland, Western Australia and Northern Territory began to fear reaching 'Day Zero', the day where their water supply would dry out if the drought did not break in 6-12 months' time.[172] This included smaller towns such as Walcha and Tenterfield, along with larger regional centres such as Orange, Dubbo and Tamworth.[173] In January 2020, the remote town of Nyngan was estimated to have six months left of its water supply if the drought did not break. Smaller communities such as Girilambone and Coolabah were three months away from day zero.[174] Rain did fall in 2020, meaning Day Zero did not come this time. However, with droughts set to increase in severity and frequency, regional communities will likely face more water shortages in future.

4.2 Water Quality

Climate change places water quality at risk. Water quality is compromised by increases in temperature, along with extreme weather events such as flooding and drought.[175] Heavy precipitation events and flooding events are increasing in severity and/or frequency over most areas of the world.[176] Flooding can lead to groundwater contamination and the spread of waterborne pathogens and diseases.[177] This has a direct impact on communities and public health, with drinking water projected to degrade across the globe.[178] There is growing evidence that climate change will increase the risk of waterborne diseases, including diarrheal diseases, which are a leading cause of death in children under five.[179]

The IPCC has found that water pollution may worsen with increases in sediments, nutrients, dissolved organic carbon, pathogens, pesticides, salt and thermal pollution.[180] This degrades ecosystems, public health and water systems.

CASE STUDY

Bushfires and Drinking Water

The 2019/20 bushfires compromised water quality for the NSW South Coast towns of Bega and Boydtown, and threatened other drinking water catchments.[181] When heavy rain washes ash and trace elements left by fire into waterways, this leads to high concentrations of nutrients such as phosphorus, particulate matter, and sulphates.[182] This can stimulate the formation of blue-green algae.[183]

In Tenterfield in late 2019, drinking water was contaminated when rainfall following a fire washed large amounts of ash into Tenterfield Dam.[184] Residents had to boil their drinking water from October to December 2019 until the situation improved.[185]

4.3 Fossil Fuels: Water Use and Contamination

The fossil fuel industry directly impacts water systems throughout the production and distribution of coal, petroleum and gas. These processes are extremely water intensive, with water used at every stage of production.[186] Extraction and mining also have significant physical impacts on water systems, often permanently diverting and reshaping waterways, streams and rivers.[187]

Coal production requires extremely large quantities of water. The total freshwater withdrawn for coal production alone (coal mining and coal-burning power stations) was 2,353,383 ML in NSW and Queensland in 2019.[188] This amounts to 853,000 Olympic swimming pools, 4.5 Sydney Harbours, or 7.2% of all freshwater available in these states. Coal extraction can cause loss of groundwater through evaporation, exposure and poor water quality in voids.[189]

This is also the case for gas production. Both coal and gas production cause groundwater levels to drop and can lead to drawdown, which can compromise water supply and lead to water becoming more saline.[190] Groundwater systems are interconnected, and impacts in one part of an aquifer can extend laterally, far beyond the site of a well or mine.[191] Changes to groundwater can also impact surface water.[192] A large proportion of the water used for gas extraction in Australia is unmonitored; meanwhile, the number of gas wells in Australia is increasing. In the Surat Basin which spans areas of New South Wales and Queensland, the number of coal seam gas wells increased from 6,800 in 2019 to 8,000 at the end of 2020.[193]

Image © Tom Jefferson / Greenpeace

4.3.1 Water Health and Contamination

The extraction and processing of fossil fuels has also led to numerous instances of water pollution and contamination, and these risks continue to be a concern.[194] Coal and petroleum production both have a number of harmful impacts on water systems. Mining and drilling processes can generate large quantities of waste and by-products which can contaminate surface and groundwater.[195] Petroleum production can contaminate water with hydrocarbons, salts, heavy metals, and a number of other nutrients and organic compounds.[196] Acid mine drainage is also a common risk associated with mining and gas extraction, leading to surface water contamination.

4.3.2 Gas and Impacts to Surface and Groundwater

Gas extraction and production also risks contamination to surface and groundwater. Contaminated water is often a by-product of gas extraction, containing toxic substances such as hydrocarbon residues, heavy metals, hydrogen sulfide, boron, and high salt concentrations.[197] There is a risk of this contaminated water leaking to crops, surface water, aquifers and groundwater.[198]

Hydraulic fracturing, or fracking, can lead to extensive contamination of surface and groundwater.[199] Fracking is used in a number of fossil fuel extraction processes, including the extraction of shale gas, natural gas and coal seam gas. It involves injecting water, sand, chemical compounds and BTEX chemicals into coal seams or rock in order to release trapped gases.[200] In Australia, fracking laws and regulations vary between states, with Victoria being the only state to ban the practice.[201]

Extracting coal seam gas without fracking requires dewatering to lower the pressure of the water in the coal seam. This is done by pumping water out of the seam to the surface through wells. This results in high quantities of produced water (see section 2.3).[202] This water may also be polluted with other substances dissolved from coal, making it potentially toxic to animals, plants and people.

5. ECOLOGICAL IMPACTS AND BIODIVERSITY LOSS

Climate change has enormous environmental impacts, including temperature changes, shifting rainfall patterns, rising sea levels, and changing seasonality.[203] Organisms are sensitive to these factors, and many species are unable to adapt quickly enough, resulting in damage to ecosystems, habitats and biodiversity. Ecosystems and biodiversity are closely connected to the human world. Degrading biodiversity and ecosystem health can impair 'ecosystem services', which are the benefits humans gain from ecosystems, such as agriculture. [204] Due to our close reliance on these services, any damage to ecosystems can have wide-reaching implications, including loss of vital resources and economic damage.

Image © Paul Hilton / Earth Tree Images

Our planet is currently experiencing a high rate of species loss, a large part of which is connected to climate change.

5.1 A Mass Extinction Event

Climate change can cause the range sizes of organisms to contract, as suitable habitats shrink and resources grow scarce. Changes to the distribution and geographical range of organisms is one of the most salient climate change impacts, with some species migrating pole-ward in order to move to cooler regions as their environment warms.[205] As habitable zones are reshaped and ecological communities adapt to this change, species interactions can also be affected, creating competition for food and space.[206] All of these impacts can make species vulnerable to extinction.

Our planet is currently experiencing a high rate of species loss, a large part of which is connected to climate change. Terrestrial biodiversity is expected to decrease 10% by 2050 across the globe.[207] Scientists have defined our current era as a mass extinction crisis, calling it the Holocene Extinction or Sixth Mass Extinction Event.[208] The IPCC estimates that between 20% to 30% of species will be at increasingly high risk of extinction by 2100 as global mean temperatures exceed 2 to 3°C above pre-industrial levels.[209]

5.2 Desertification

Climate change is leading to large-scale terrestrial transformations through the process of desertification. This process impacts drylands, regions of water scarcity. They are defined by the UNCCD as “areas other than polar and sub-polar regions, in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05:1 to 0.65:1”.[210] This ratio compares drying to rainfall. It means that drying is generally occurring at a greater rate than rainfall, as the amount of rain the area is receiving is only between 5 and 65 per cent of the water it could potentially lose through drying and evaporation. These zones are home to 2.7 billion people worldwide, 90% of which live in developing nations.[211] The spread of drought and increasingly arid conditions are causing the growth of deserts and arid environments. Desertification degrades land, soil fertility and vegetation cover. It has enormous ecological and economic costs, destroying biodiversity and severely impacting agricultural production.[212]

5.3 Polar Regions

Polar ecosystems are sensitive to climate change impacts, and are warming disproportionately fast compared to the tropics and mid-latitudes.[213] With habitats shrinking, there have been observed changes in the abundance in marine mammals, birds, fish, and Antarctic krill.[214] Due to their low biodiversity, Arctic regions are particularly vulnerable to ecological state shifts and invasive species.[215] Arctic species will also likely be impacted by sub-Arctic species migrating to the poles in search of cooler habitats, creating more competition.[216] Continuous loss of Arctic sea ice will also impact primary producers in sea ice and open oceans. Primary producers, such as plants and phytoplankton, are the basis of the marine food web, supporting an array of other species. Sea ice loss therefore has wide reaching impacts for whole ice-associated and marine ecosystems.[217]

5.4 Marine Impacts

Climate change is affecting the marine environment through changes in temperature, circulation, stratification, nutrient input, oxygen content, and ocean acidification. The biological and ecological impacts of these changes can be enormous.

Ocean warming and marine heatwaves (MHWs) are projected to increase throughout this century, and can have devastating impacts on marine ecosystems.[218] An increase in MHW events and ocean warming can lead to extinction and irreversible loss of habitats and species. This impacts keystone marine organisms such as sea grasses, kelp forests and coral reefs. Keystone species are important for the survival of a range of other plant species, fish species, fish stocks and algae.

Ocean acidification occurs when the pH of ocean water decreases, becoming more acidic. This occurs as a result of oceans absorbing CO2 from the atmosphere. It is estimated that 30% of the carbon dioxide emitted by humans since pre-industrial times has been absorbed by oceans.[219] As fossil fuel and greenhouse gas emissions increase, so too does the amount of CO2 being absorbed by the ocean. This changes the chemistry of the ocean water, making it more acidic. The pH of the ocean has fallen by 0.1 pH units since the Industrial Revolution 200 years ago, which equates to a 30% increase in acidity.[220]

Ocean acidification impacts ocean chemistry, reducing the amount of carbonate in the water. This is significant for the numerous organisms which need carbonate to build shells and skeletons, including corals, oysters, clams, sea urchins, molluscs, crustaceans, pteropods, plankton and echinoderms.[221] These species play key roles in ecosystems and marine food webs.

CASE STUDY

Coral bleaching in the Great Barrier Reef

Coral reefs are comprised of corals and the symbiotic algae (zooxanthellae) that provide their colour and food. They play a key role in marine ecosystems and in the provision of ecological goods and services, but are currently facing numerous threats related to human activity. Even with the lowest emissions scenarios, it is projected that most of the world's warm-water coral reefs will be eliminated by 2050.[222] Under a scenario of 2°C warming above the pre-industrial average, 99% of coral reefs are expected to disappear by 2050.[223]

Rising sea surface temperatures are impacting coral reef survival by breaking down the relationship between corals and the zooxanthellae they depend on for survival. This is leading to coral bleaching of Australia's Great Barrier Reef (GBR). Without a rapid reduction in surface temperatures, bleached corals, starved of their food source, eventually die. In 2020, the GBR experienced its third mass bleaching event in five years, triggered by record-breaking temperatures.[224] The number of all corals in the GBR has halved since the 1990s[225], and the current outlook for the GBR ecosystem is "very poor".[226] At the time of publication, UNESCO has recommended that the GBR be added to the World Heritage 'in danger' list due to the damage it has suffered and the Australian government's failure to take real action. Swift emissions reduction and climate action in the next decade is the best available means of preventing significant further deterioration in the coming decades.

Even with the lowest emissions scenarios, it is projected that most of the world's warm-water coral reefs will be eliminated by 2050.

5.5 Biodiversity and Fossil Fuel Extraction

Habitat destruction is not only a result of emissions and climate change. The processes of extracting, producing and distributing fossil fuels are also leading to losses in biodiversity and damage to ecosystems.[227] Direct impacts of fossil fuel extraction include the destruction and fragmentation of local habitats, noise and air pollution, and visual disturbances. Extraction and distribution can also degrade biodiversity through soil erosion, contamination of water bodies, and deforestation.

CASE STUDY

The Deepwater Horizon Oil Spill

On the 20th of April 2010, the Deepwater Horizon oil rig exploded, leading to a devastating oil spill and the deaths of 11 workers.[228] It took 87 days to cap the spill, which caused over 4 million barrels of oil to flow into the Macondo Prospect in the Gulf of Mexico. Approximately 1,600 kilometres of coastline were oiled, including 130 kilometres of wetland.[229] Other research reported the extent to be much greater, with reports of oil plumes lurking beneath the ocean's surface.[230] Offshore drilling is still unsafe and carries great risk.[231] Oil spills coat beaches and rocky shores and impact marine environments with the toxicity of oil, as well as smothering plants and animals.

CASE STUDY

The Montara Oil Spill

Australia experienced its own oil spill on the 21st of August 2009 with the Montara Oil spill, off the coast of Western Australia.[232] While no definitive study has been performed, it has been estimated that an average of 64 tonnes (400 barrels) of oil flowed out of the spill on each day of the disaster. It took 74 days to contain, leading to an estimated 29,600 barrels total being spilled.[233] This also caused considerable damage to the coastlines of Indonesia and East Timor.

CASE STUDY

The Shen Neng Grounding

Less than a year after the Montara spill, the Shen Neng coal carrier vessel became grounded on the Great Barrier Reef for 10 days, damaging over 40 hectares of the World Heritage listed site and causing significant oil and chemical contamination.[234] With offshore oil operations ongoing, and significant traffic occurring across the Great Barrier Reef and east coast of Australia, the risk of future spills remains.

Image © Daniel Beltrá / Greenpeace

6. IMPACTS ON INDIGENOUS AND FIRST NATIONS COMMUNITIES

Indigenous populations worldwide have been unjustly impacted by the actions of fossil fuel companies. Climate change disproportionately affects Indigenous communities and lands, often threatening their very existence.[235] Rising sea levels impact coastal communities, and may force people to relocate, moving away from their traditional home and lands.[236] For those living in remote regions, extreme weather can affect infrastructure and lead to communities being cut-off for extended periods of time. [237] Shifting climate patterns also affect food supply. This is significant for those who rely on hunting and gathering as a food source, to support their local economy, and also as a core part of their social and cultural identity.[238]

Indigenous populations worldwide have been unjustly impacted by the actions of fossil fuel companies.

These factors create major concerns for the physical and mental health of Indigenous populations. Physical health impacts will likely arise from increased incidence of drought, flooding, bushfires, heatwaves, sea level rise and coastal flooding. For remote Indigenous communities who are far from health services, the cost of healthcare increases, as do existing health disparities.[239] Drinking water is placed at risk due to drought, storms and rising sea levels. Climate change can also increase the burden of waterborne infectious diseases, which have affected some remote Indigenous communities in Central and tropical Australia.[240]

Climate change also impacts social and emotional well-being. Climate-related disasters can trigger trauma, regardless of whether they are sudden (e.g. cyclones) or prolonged (e.g. drought and heatwaves).[241] Extreme physical conditions can also exacerbate existing mental stress and mental illness. There are also indirect impacts to mental health that result from climate change impacting employment, productivity and income, for example through forestry, agriculture and fishing impacts. Disempowerment in the face of the climate crisis can also lead to a sense of despair and further damage mental and emotional well-being.[242] Achieving care for Country can be impacted by the threat of climate change, which can in turn damage social and emotional well-being.[243]

The fossil fuel industry threatens traditional lands which can carry both cultural significance and a means of survival. Indigenous peoples may regard themselves as inseparable from their traditional lands and waters according to their laws and customs. Resource extraction, particularly of fossil fuels, threatens the environment and water sources. This is key when considering the impacts of fossil fuel extraction on Indigenous peoples, for whom land holds abundant spiritual and cultural significance.[244] In Australia, First Nations people have also experienced irreversible damage to sacred and culturally significant sites. Instances of mining and gas extraction impacts not being properly communicated to traditional owners have been documented.[245] Communication of the local impact of individual developments may also not involve full disclosure of cumulative consequences, including from climate change.

Indigenous rights are often compromised in favour of the economic interests of fossil fuel companies.[246] States and corporations pursuing their own interests in fossil fuel extraction at the expense of Indigenous communities has led to conflict, intimidation and state-based violence.

Examples of this conflict have occurred in Nigeria, South Africa and Uganda, with 'petro-violence' and social unrest arising as a result of petroleum extraction and the impacts this has on land and communities.[247] In North America, the state responded with violence after demonstrators, concerned about water contamination and disruption to sacred burial grounds, protested the construction of the Dakota Access oil pipeline.[248]

Australia has a long history of Indigenous dispossession by the activities of extractive industries, which has only been partially redressed by the enactment of various statutory land rights and heritage laws, and then the recognition of the common law doctrine of native title and its subsequent expression in federal native title legislation. The United Nations' principle of 'free, prior and informed consent' has not been implemented under Australian law. An iconic example of the extent to which Indigenous rights in land and water remain vulnerable to the depredations of the fossil fuel industry in Australia is provided by the treatment of the Indigenous peoples of the Galilee basin in Central Queensland, in order to enable the development of the Adani coal mine.[249]

CASE STUDY

Forcible Extinguishment of Indigenous Title over the Adani Coal Mine

The Adani coal mine has been one of the most contentious mining developments in Australia's history. Amongst other concerns, its development has failed to respect the rights of the Wangan and Jagalingou peoples who are the traditional owners of the land and waters of the area. Despite clearly articulated public opposition to the development on the part of the Wangan and Jagalingou peoples, at the behest of the mining company the state government compulsorily acquired the land required for the Adani mine site, extinguishing native title under Australian law.[250]

Indigenous rights are often compromised in favour of the economic interests of fossil fuel companies.

Adrian Burragubba, Wangan and Jagalingou Traditional Owner. (C) AAP Image

7. FIFO IMPACTS ON WORKERS AND COMMUNITIES

Fly-in, fly-out (FIFO) and drive-in, drive-out (DIDO) are common working arrangements for the mining and minerals sectors in Australia; over 100,000 FIFO workers operate in Australia.[251] Since mines and gas-fields are often situated in remote areas, this system affords flexibility and additional opportunities for workers and employers. However, work of this nature takes a toll on workers, their families, and the communities they work in.

Health and well-being assessments have been undertaken by services such as Lifeline, Beyond Blue and the Crosscare Migrant Project, and inquiries conducted by state governments, which have yielded concerning information about worker and community impacts.

Image © Tom Jefferson / Greenpeace

7.1 Health and Well-being of Workers and Families

Fly-in, fly-out workers are often required to work on a high-compression roster. Due to the 24 hour a day, seven day a week operation schedule of mines, 12 hour shifts are common and often standard practice.[252] Many working arrangements operate under a "swing" roster: e.g. 2 weeks on, 1 week off, or more highly compressed to 4 weeks on, 1 week off.[253]

High compression rosters increase the risk of worker fatigue, which reaches dangerous levels towards the end of each compressed roster.[254] This is a safety concern, as the end of swing shifts sees an increase in the rate of fatigue related injuries and accidents.[255]

Fatigue is a physical and psychological stressor. It can affect short-term memory, alertness and concentration, and also has serious long-term health effects.[256] FIFO/DIDO work has a range of physical health impacts alongside fatigue. As it is shift work, it may be associated with issues commonly experienced by shift workers, such as heart disease, stroke, depression, metabolic syndromes, ulcers, cancer, obesity, gastrointestinal dysfunction, reproductive problems and negative pregnancy outcomes.[257]

Several studies and inquiries have explored the impacts of FIFO and DIDO arrangements on workers' mental health. These workers are more susceptible to mental illness and suicide than the wider population.[258] There are also reports of increased alcohol consumption, both at home and in between working hours during a swing.[259]

These workers are more susceptible to mental illness and suicide than the wider population.

FIFO/DIDO work arrangements also impact partners and families of workers. One study noted that partners reported poorer sleep quality, shorter sleep duration, and heightened feelings of loneliness compared to the general population.[260] FIFO work arrangements can increase family stress and often exacerbate relationship issues.[261]

Women working in FIFO/DIDO arrangements experience a further range of difficulties. Many women have expressed feeling a pressure to assimilate into the culture of a male-dominated workplace.[262] A number of women noted issues such as lack of privacy, harassment and discrimination.

CASE STUDY

Fatigue in FIFO Workers

A recent WA Inquiry into FIFO Worker Mental Health found a number of factors which contributed to poorer physical and mental health and safety concerns for FIFO workers, highlighting fatigue as a major concern. FIFO resource website This FIFO Life interviewed FIFO hospitality worker Donna, who described the challenges of her first day back on site. Her day begins at 1 am, taking the shuttle bus to the airport to catch a flight; she begins work directly on arrival, and does not finish her day until 7 pm that evening, 18 hours after it started.[263]

7.2 Community Impacts

FIFO working arrangements also impact the communities in which workers live as temporary residents. Concerns have been raised surrounding social issues, including alcohol, and pressures placed on community resources and infrastructure.[264] Communities report feeling a loss of communal identity, regional solidarity and becoming less attractive as tourist destinations.[265] Businesses also often do not profit from the presence of FIFO workers, due to the self-contained nature of some FIFO accommodation camps.[266]

Communities report rises in crime and social disorder, rises in housing and living costs, and traffic congestion as a result of the influx of FIFO workers.[267] There was also a perception of alcohol and drugs becoming more prevalent with influxes of FIFO workers.[268] This has led to the view that FIFO/DIDO practices are eroding the livability of local communities.[269]

PART 2
CORRUPTION AND COST

8. ECONOMIC DAMAGE FROM FOSSIL FUELS

The decision to support fossil fuels has often been justified by arguments of economic necessity. However, with energy demands and prices shifting, the industry is growing less viable and profitable. The fossil fuel industry is also the leading driver of climate change, which is costing the global economy billions each year.[270] These costs arise from a range of associated issues: extreme weather impacts, infrastructure damage, losses in agricultural productivity and food security, and the costs associated with public health impacts. Climate change is set to shrink the world's economy 3% by 2050.[271] A 2020 report by Deloitte has projected that unmitigated climate change could cost the Australian economy 1.8% of its annual GDP, over $1.1 trillion, and see a loss of 330,000 jobs by 2050.[272]

Unmitigated climate change could cost the Australian economy 1.8% of its annual GDP, over $1.1 trillion, and see a loss of 330,000 jobs by 2050.

Furthermore, the claimed justification that fossil fuels are necessary for economic integrity is false. With solar and wind now the cheapest source of new energy in most of the world, energy appetites are moving away from fossil fuels towards renewable energy sources. This will continue slowing demand for coal and gas.[273] In May 2021, the G7 agreed to stop financing coal by the end of the year. This means the world's seven largest economies are divesting from coal.[274]

Other key factors to consider include the financial burden of decommissioning mines, oil wells and gas fields, and the clean-up costs associated with spills, contamination and accidents. By 2050, fossil fuel decommissioning costs in Australia are estimated to add up to over $60 billion AUD, much of which will be borne by the taxpayer.[275] Taken together, the economic burden makes pursuing fossil fuels unsustainable and unjustifiable.

8.1 Extreme Weather and Infrastructure

Extreme weather costs the global economy billions of dollars each year. Climate change increases the incidence and severity of these events worldwide and is thus adding to this financial burden. The 10 most costly and severe climate-related disasters of 2020 have an estimated cost of $150 billion globally.[276] Taking into account the impact of coastal flooding and sea level rise, these events could cost the global economy over $1 trillion a year by 2050 without adaptation.[277] This is roughly the size of the Australian economy.

The 10 most costly and severe climate-related disasters of 2020 have an estimated cost of $150 billion globally.

In Australia, major impacts arise from heatwaves, storms, drought and bushfires. During 2013-14, heatwaves cost the Australian economy approximately $8 billion due to a decline in productivity and increased rates of absenteeism.[278] Estimates for the costs of the 2019/2020 bushfires sit between $4-5 billion on account of direct losses and subsequent slowing of economic growth and activity.[279] Indirect costs could be as high as $100 billion, according to University of Queensland economist John Quiggin.[280] The cost of drought in Australia in 2019 was estimated to reduce GDP by between 0.5 to 0.75 per cent, costing the economy between $9.5 billion and $14 billion.[281]

The growing risk of climate disasters and extreme weather is augmenting insurance premiums, making insurance unaffordable or unavailable for an increasing number of people. Large areas of Northern Australia are currently grappling with this increasing financial burden[282], with some people's insurance premiums increasing nine-fold in one year following severe weather events.[283]

8.2 Unprofitability of Fossil Fuels

With the risks and impacts of climate change now widely known and accepted, the global appetite for fossil fuels is declining and instead moving towards renewables.[284] Coal production in particular is becoming less financially viable. Coal-burning power stations in Australia's National Electricity Market will also face serious challenges in the next five years due to competition from renewables, and an increased renewable energy supply.[285] The volume of sales and the price of coal are both expected to fall by 2025.[286] In Australia, the price of thermal coal has been continuously falling.[287] Bankruptcy of mining companies is also a concern due to the high cost of remediating disused mine sites.[288]

CASE STUDY

Norges Bank Fossil Fuel Divestment

Many countries, including Sweden, Austria, the Netherlands and India, are prioritising renewables and reducing their coal consumption.[289] Major investors are also pulling funds from large coal companies due to concerns about fossil fuel emissions. This was the case in 2019 when Norwegian sovereign wealth fund, Norges Bank, sold its stakes in 134 companies, voicing concerns about their vulnerability to climate risk; Norges plans to sell stakes of companies which explore and produce oil and gas.[290] In 2020, it gave up its stakes in AGL and Glencore, and placed BHP on an 'observation list' with a chance of divesting in future.[291] Norges Bank manages the Government Pension Fund Global, worth $1.1 trillion and owning 1.5 per cent of shares listed on the global stock exchange.[292]

CASE STUDY

Australia's So-Called Gas-Led Recovery

The Federal Government, guided by a cohort of gas industry advisors in the National Covid-19 Coordination Commission, proposed a publicly funded "gas-led recovery" from the Covid-19 pandemic in 2020, a year which also saw the domestic gas industry lose billions of dollars due to wild fluctuations in the international gas market[293] . Australia is one of the world's largest gas exporters, making domestic gas producers very vulnerable to global market changes. This exposure, shaky investor confidence and the declining role of gas leave any new Australian gas developments at risk of becoming stranded assets.

But while Australia exports huge amounts of gas, Australians pay some of the highest prices for domestic gas in the world[294] with the local gas industry criticised by the Australian Competition and Consumer Commission for 'cartel-like' behaviour, and for pushing electricity prices up.[295] In addition, research has shown that the gas industry is one of the weakest employers in the country, employing just 0.2% of the workforce.[296] Public investment in gas would increase Australia's greenhouse gas emissions, and could lead to higher electricity prices and taxpayer funded stranded assets, while not delivering significant economic or employment gains.

CASE STUDY

The Kurri Kurri Gas Power Station

The Federal Government has pledged $600 million on the new Kurri Kurri gas power station in the Hunter Valley. While the government announced that this would generate 600 jobs in the region, the Environmental Impact Statement (EIS) for the project has estimated that the reality would likely be 250 jobs for the construction of the plant, and only 10 permanent full time positions.[297] The EIS estimates it will only be operational 2% of the time, or just over a week a year. It is set to be built on land owned by Liberal Party Donor, Jeff McCloy.[298]

Image © Greenpeace / Tom Jefferson

9. DECOMMISSIONING MINES, OIL AND GAS WELLS

The fossil fuel industry has long-lasting impacts on the environment. Aquifers and groundwater levels near fossil fuel projects may be permanently altered, and contamination of land and water irreversible.[299] Furthermore, due to lax environmental regulations, mining voids may never be filled, leaving permanent holes in the landscape.[300] Decommissioning mines, drilling sites and oil wells is an extremely costly process and is often left incomplete due to companies going into liquidation, leaving behind insufficient funds to decommission their sites and remediate land.[301] Australia could have as many as 50,000 abandoned mines, a large number of which would not meet modern environmental standards of remediation.[302]

9.1 Environmental Damage

Mine sites, especially open cut mines, dramatically alter the landscape. The Peak Downs/Saraji open cut coal mine in Queensland, for example, left a 50km scar on the land and a clean-up bill amounting to billions of dollars.[303] Many costly tasks must be completed in order to decommission and rehabilitate a mine site. Large quantities of waste rock must be disposed of. Tailings are a common form of mining waste, comprised of a mixture of crushed rock and processing fluids.[304] The disposal of tailings is a recurrent environmental issue. They are often stored in dams, creating the risk of widespread pollution on account of dam failure.[305]

Acid mine drainage is also a source of concern, occurring when sulphurous material is exposed to the air and oxidises. This lowers pH levels to make soils and water systems more acidic.[306] These problems persist for many years after mines are decommissioned.[307]

Gas extraction and fracking processes also have numerous adverse environmental impacts, some of which are difficult to monitor. These include land use changes, erosion, fugitive (undocumented) emissions of methane, risk of contamination to surface and groundwater, the risk of chemical spills, and impacts on water sources due to lowering groundwater levels.[308] There have been documented spills and contamination episodes in Australia and the US.[309]

9.2 Decommissioning Costs

The fossil fuel industry creates a large financial burden for governments and taxpayers due to the cost of decommissioning mines, oil wells and gas wells. This process poses large financial and environmental challenges. Decommissioning in Australia has been largely ineffective and impeded by a number of barriers, such as insufficient environmental regulations and uncertainty surrounding environmental impacts.[310]

Financing the decommissioning of mines and oil and gas wells is another major barrier. By 2050, the decommissioning bill in Australia is estimated to add up to over $60 billion AUD.[311] The decommissioning cost in Australia is also set to increase from $1 billion a year currently, to $4.5

billion a year from the late 2030s onwards.[312] These costs will carry on far into the future if fossil fuel production does not cease; for example, Woodside's North West Shelf LNG plant is planned to operate until 2070.[313]

It is also unclear who will bear this financial burden. If a corporation fails, goes into liquidation, or an international company abandons a local subsidiary, the Federal Government may assume responsibility for the facility, including decommissioning costs.[314] Since they are tax deductible, up to 30% of decommissioning costs for offshore oil and gas wells could fall to the taxpayer.[315] For offshore oil wells, this number could be as high as 58%, since these costs can be borne against and refunded from Petroleum Resource Rent Tax which the company pays.[316]

Australian tax payers have regularly had to assume the cost of decommissioning and rehabilitating sites abandoned by fossil fuel companies. A report by the Queensland Government warned of the potential $3.2 billion cost to taxpayers in future clean ups of the state's coal mines.[317]

CASE STUDY

The Northern Endeavour

The Northern Endeavour oil platform is a vessel situated in the Timor Sea. It was originally owned by Woodside until 2015, when it was sold to an inexperienced company called Northern Oil and Gas Australia (NOGA). After NOGA went into liquidation, the Australian Government assumed responsibility for the oil vessel in February 2020. The vessel faced a number of challenges, with regulators citing environmental and safety concerns. It was subsequently decided that the Northern Endeavour should be decommissioned. However, the cost of this is now being borne by the government. Since February 2020, the cost to the taxpayer to maintain and begin decommissioning the vessel has reached $86 million.[318]

Up to 30% of decommissioning costs for offshore oil and gas wells could fall to the taxpayer. For offshore oil wells, this number could be as high as 58%.

Image © Greenpeace / Tom Jefferson

10. INSTITUTIONAL CORRUPTION

Fossil fuel companies hold a great deal of power and influence. The industry's relationship with key stakeholders and governments has raised concerns of institutional corruption and companies lining the pockets of political parties in order to secure their own interests.[319] These concerns arise from large subsidies being handed to fossil fuel companies by the government. There have also been concerns surrounding approvals for new fossil fuel mine and gas sites, in spite of environmental and economic concerns. Research published this year has indicated that fossil fuel subsidies in Australia reached $10.3 billion in 2020-2021.[320] This compromised situation is further evidenced by large donations to political parties responsible for backing projects and granting approvals.

Image © Sean Davey / Greenpeace

10.1 Political donations

For decades, fossil fuel companies have made substantial donations to Australian political parties. In the 2020 financial year, it is estimated that fossil fuel companies contributed over $1.3 million to the Australian Labor Party (ALP), Liberal and National parties. This is based on calculations from Market Forces ($1,353,202), and the Australian Conservation Foundation ($1,329,754).[321] Market Forces has collated data showing the major donors and their contributions to the ALP, Liberal Party and Nationals. The top three fossil fuel donors were Woodside Energy ($335,415 total), Minerals Council of Australia ($145,709 total) and Santos ($130,500 total). These calculations were based on 2019/20 political party returns from the Australian Electoral Commission.[322]

This trend is increasing, with political donations from fossil fuel companies doubling in the four years from 2015/16 to 2018/19.[323] Gas companies are amongst the largest political donors, a point that is particularly pertinent now when the Australian Government is pursuing an unsustainable gas-led economic recovery.[324] Gas companies were reported to have given $698,339 to the major political parties, while coal companies and peak bodies donated $316,224.[325]

In the 2020 financial year, it is estimated that fossil fuel companies contributed over $1.3 million to the Australian Labor Party (ALP), Liberal and National parties.

The industry which consistently makes the largest contribution in political donations is the resources and energy industry which is responsible for not only mining but also burning fossil fuels.

Australia also has a reputation for poor disclosure of political donations.[326] The term ‘dark money’ refers to political donations from unknown or undisclosed sources. Over the past two decades, 35 per cent, or $1 billion, of political donations came from undisclosed sources.[327] This means that political donations from fossil fuel companies are likely severely underreported. This is enabled by Australia’s weak reporting laws, as donations below $14,300 do not need to be disclosed.[328]

The industry which consistently makes the largest contribution in political donations is the resources and energy industry which is responsible for not only mining but also burning fossil fuels.[329] In the 20 years spanning 1999-2019, this sector donated $13,320,195 to the Liberal Party, $4,884,458 to the ALP and $1,862,546 to the Nationals.[330] Separately, in 2019, Clive Palmer spent over $60 million on his party, the United Australia Party, in an election bid. This sector relies on the government for issuing permits, and these figures highlight the potential for undue influence from these major players.[331] This is a root of public distrust in decisions such as the formal approval given to Santos for its Narrabri coal seam gas project.[332]

10.2 Subsidies and Tax Breaks

Fossil fuel companies are often championed as large sources of capital and as a means of stimulating the economy. However, Australia's Federal and State Governments both contribute enormous sums to fossil fuel companies in the form of subsidies and tax breaks. Market Forces data showed that $12 billion was given to fossil fuel companies by the Government in the form of tax-based subsidies in the last financial year 2019/20, not including additional state government subsidies.[333] This equates to $468 per Australian.[334]

$12 billion was given to fossil fuel companies by the Government in the form of tax-based subsidies in the last financial year

10.2.1 Fossil Fuel Giants Paying Zero Tax

Research based on data from the Australian Taxation Office (ATO) has also shed light on tax avoidance in the fossil fuel sector. Over the last six years, 50 fossil fuel companies paid $0 in tax, in spite of an income totaling over $101 billion.[335] These include ExxonMobil Australia, Chevron Australia, Peabody Australia, and Australia Pacific LNG.[336] This research is based on data made public by the ATO.[337] While Chevron paid nothing in tax, it donated $124,685 to political parties in the 2019 financial year.[338]

CASE STUDY

Subsidies for Multi-Billion Dollar Adani Group's Carmichael Coal Mine

Large projects such as Adani's Carmichael thermal coal mine also benefit from enormous subsidies. Research by the Institute for Energy Economics & Financial Analysis (IEEFA) reported that the Adani coal mine would not be financially viable without government support, and that it was receiving $4.4 billion of subsidies in the form of deferrals, tax exemptions and capital subsidies.[339] In late 2020, a new deal was signed between the QLD Government and Adani, allowing the mining giant to defer royalty payments for an unspecified length of time, the details of which are still unclear.[340]

10.3 Emissions Under-Reporting

Emissions reporting of greenhouse gases is important for corporate accountability. It is essential for accurate calculations of a country's emissions and contribution to climate change, as well as for tracking national progress in keeping with emissions reductions goals. However, this process is often compromised by underreporting. There are numerous known instances of emissions underreporting by fossil fuel companies in Australia. Investigations by Environmental Justice Australia in 2017 revealed underreporting errors by five large coal-burning power stations in New South Wales, with a particularly egregious example involving AGL's Bayswater Power Station manipulating its pollution estimates by only partially monitoring its generation units.[341]

Methane emissions from oil and gas production are particularly problematic, and the gas industry is a major culprit in emissions underreporting.

Fugitive emissions are one of the greatest sources of concern in terms of emissions accounting. These are losses or leaks of gases, often referring to methane, which escape monitoring and are released into the atmosphere in the process of gas extraction, production and transport processes.[342] From 2005 to 2019, known fugitive emissions from oil, gas and coal production in Australia rose 41%, though in reality it is likely to be greater.[343]

Methane emissions from oil and gas production are particularly problematic, and the gas industry is a major culprit in emissions underreporting.[344] Methane emissions from gas production may be 10% greater than the reported amount.[345] If this is the case, the gas industry would be severely underreporting their emissions. Although it is shorter-lived than CO2, methane has a 100 year global warming potential, and can be 28-34 times more potent than CO2 as a greenhouse gas.[346]

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CONCLUSIONS

While it continues to operate, the fossil fuel industry will harm people and the planet. The inevitable decline of fossil fuels has begun. However, with climate change and its impacts rapidly accelerating, the time to act is now. Australia, and the world, has an opportunity to speed up its transition towards renewable energy, a vital step towards a safer future and healthier planet. The sooner this occurs, the sooner we leave behind a corrupt industry which is environmentally, socially and economically unviable. Leaving fossil fuels in the past means moving towards a more sustainable and livable future. This will bring ongoing benefits for human health and wellbeing, the economy and the planet as a whole.

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Bushfire survivor Melinda Plesman lost her home on a property that has been shared by her family for 38 years.

In the small town of Nymboida, southwest of Grafton in NSW, nearly 100 homes have been lost. The fires hit the community on Nov 8, 2019.

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