Wellbeing and the environment – the impact of the bushfires and the pandemic

ANU Centre for Social Research and Methods

Professor Nicholas Biddle, A/Professor Ben Edwards, Emeritus Professor Toni Makkai

Abstract

The 2019/20 Australian Spring and Summer was one of the hottest on record, with bushfires (wildfires) devastating large parts of the Australian continent. The fires resulted in the loss of thousands of properties, deaths of civilians and firefighters, deaths of wildlife estimated to be in the hundreds of millions or even billions, and large-scale emissions of carbon into the atmosphere. Earlier in 2019, the government of Scott Morrison was returned in a national election, fought in part on action or lack thereof to climate change. During the fires, the climate record of the Morrison Government was severely criticised (in Australia and internationally), as was the short-term response to the fires. Since the bushfire season, Australia (like other countries around the world) has been impacted by the COVID-19 pandemic, taking the focus away from environmental issues and focusing them on economic and public health challenges. A key question for public opinion research is whether a climactic event like that experienced in Australia can have large effects on public opinion, and whether that effect is maintained during another external shock (the COVID-19 pandemic). The aim of this paper is to make use of longitudinal public opinion data from the ANUpoll series of surveys to answer the following questions: How do public attitudes towards climate change and related policy change after an extreme weather event? Are there differences in the change between those who were directly exposed and those who were not? Are there differences in the change based on pre-existing political beliefs? Do those who are exposed to the negative aspects of the COVID-19 pandemic change their opinions again, prior to the subsequent fire season?

Acknowledgements

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1   Introduction and overview

1.1   The Black Summer fires

The bushfires that occurred over the 2019/20 Australian spring and summer (also known as the Black Summer fires) were unprecedented in scale and global in impact, with smoke from the fires affecting air quality in New Zealand and South America[1] and releasing 430 tonnes of carbon dioxide into the atmosphere (Jalaludin et al. 2020). Estimates using satellite imagery found that the total area burned was 30.4 million hectares and almost one fifth of Australia's eucalyptus forest coverage was burnt — 'a figure more than 7.5 times higher than the annual average percentage burnt for the past 18 years' (Bowman et al., 2020). Although the Australian continent is relatively fire prone, typically less than two per cent of the forest biome burns even in the most extreme fire seasons whereas the 2019/20 forest fires burnt 21 per cent (Boer, Resco De Dios et al, 2020). This is a globally unprecedented percentage of any continental forest biome burnt. Further, the country appears to have lost over a billion birds, mammals and reptiles, with additional loss of life of insects, amphibians and fish (Australian Academy of Science, 2020).[2]

Although there have been more fatalities in previous bushfires, most notably the Black Saturday fires in Victoria in February 2009 when 173 people lost their lives, the impact of the 2019/2020 bushfires was felt across a much larger per cent of the population due to the unprecedented geographic range of the fires. Throughout the fire season there were bushfires in every state and territory of Australian spanning almost 6 months. Thirty-four people lost their lives and 'the vast majority of Australians (78.6 per cent) were impacted either directly, through their family/friends, or through the physical effects of smoke … [and] around 2.9 million adult Australians had their property damaged, their property threatened, or had to be evacuated' (Biddle, Edwards et al. 2020). More than half of the adult Australian population reported some form of anxiety or worry due to the fires. The Australian Government has allocated at least $2 billion towards a National Bushfire Recovery Fund and Australians donated millions of dollars to support the victims of the fires.

While the economic costs of the 2019/20 bush fires are still emerging, the insurance costs, as of mid-January, was $1.4 billion ($2019).[3] Based on the experience of previous major fires, the total economic costs will be a multiple of the insurance costs. For example, the insurance costs of the 2009 Victorian Black Saturday fires were also $1.4 billion (in $2019) whereas the total economic costs are estimated to be $7.4 billion ($2019).

A number of specific public polls on the fires have been published. The Australia Institute (2020) published data (with a sample size of 1,033, conducted on the opt-in YouGov panel between 8 and 22 January) on self-reported impacts of the fires and views on climate related issues, making some comparisons with previous surveys on related issues. They found relatively high levels of reported impacts, with the most common being people changing their routine (33 per cent), with more severe impacts (missing work, home or property being unsuitable to live in) having a relatively low incidence (8-9 per cent).

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1   https://www.bbc.com/news/world-australia-51101049
2   https://www.science.org.au/news-and-events/news-and-media-releases/australian-bushfires-why-they-are-unprecedented [accessed 29 March 2020]
3   Data from the Insurance Council of Australia.

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A separate report on the poll from the Australia Institute also found that there was a 10 percentage point increase in those who were very concerned about climate change (from 37 per cent in July 2019 to 47 per cent in January 2020) and a 14 percentage point increase in those who said that we are experiencing a lot of the impacts of climate change (The Australia Institute, 2020). It should be noted though that much of that change appears to have come from a decrease in those who thought we were experiencing a little of the impacts of climate change, rather than those who thought we were experiencing not very much or not at all (which stayed relatively stable).

1.2 Emergence of COVID in Australia

Immediately after the last of the major fires, Australia like the rest of the world began to be impacted by the spread of the SARS-CoV-2 virus around the world. The first confirmed case was identified on the 25th January 2020 in Victoria when a man returned from Wuhan, China. On January 23 screening of all flights from Wuhan had been implemented and from 31 January all foreign nationals from China were required to spend a fortnight in a third country before entering Australia. On the 1st of February Australian citizens from China were required to self-quarantine for 14 days. On the 27th February the Australian Health Sector Emergency Response Plan for Novel Coronavirus (COVID-19) was activated by the Prime Minister. By the 16th of March all travellers arriving in or returning to Australia were required to self-quarantine for 14 days and on the 20th March Australia closed its borders to all non-resident and non-Australian citizens. With high rates of infections amongst returning travellers, in late March all returnees were required to quarantine in designated hotels. With some exemptions Australians were banned from travelling overseas.

During this time cases were being detected across a range of cruise ships the most infamous being the Ruby Princess, which was later found to result in the deaths of 28 people, including the first reported death from COVID-19 in Australia on the 1st March.[4]

By international standards, mortality rates stayed quite low in Australia in *per capita* terms. Australia's infection rate of approximately 1076 confirmed cases per million people and the mortality rate of 35.49 deaths per million people (as of the 22nd of October at the end of the second wave of infections concentrated in Melborune) is far lower than not only the USA, but also Canada, the UK, Spain, Italy and many other continental European countries.[5] Australia does, however, have a higher mortality rate than Taiwan (0.294), Singapore (4.786), New Zealand (5.184), South Korea (8.836), and Japan (13.323), with infections and deaths also concentrated in one particular jurisdiction – Victoria. However, deaths in Australia have been concentrated in aged care facilities with approximately 75% of all deaths occurring in aged care homes (Comas-Herrera et al, 2020).

Like many other countries, Australia has suffered economically from the spread of COVID-19, and the associated public health measures. According to the Australian Bureau of Statistics' Labour Force Survey (ABS 2020), between March and May 2020, there was a 10.4 per cent decline in monthly hours worked for all Australians (9.4 per cent for males and 11.8 per cent for females). By September 2020, around half of this decline had been reversed, though there

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[4] https://www.dpc.nsw.gov.au/assets/dpc-nsw-gov-au/publications/The-Special-Commission-of-Inquiry-into-the-Ruby-Princess-Listing-1628/Report-of-the-Special-Commission-of-Inquiry-into-the-Ruby-Princess.pdf

[5] Data from https://ourworldindata.org/coronavirus-data#tests-cases-and-deaths.

still has been a 5.7 per cent decline for males and a 4.3 per cent decline for females in monthly hours worked between March and September 2020 (5.1 per cent decline for males and females combined). There has also been a mental health worsening over the period. Using the longitudinal dataset presented and analysed for this paper, Biddle, Edwards et al. (2020) showed that:

> In February 2017 … the average value [for the K6 measure of psychological distress] was 11.2. By April 2020, the score had increased to have a mean of 11.9. Between April and May 2020 there was a significant reduction in psychological distress, although the K6 measure was still above the pre-COVID-19 values (mean = 11.5 in May 2020). Mental health worsened again though between May 2020 and August 2020, with an average in our most recent data collection of 11.7.

1.3 Public and political attitudes over the period

There were a number of polls of political attitudes over the Australian summer and then into the COVID-19 period. In the January 12th Newspoll,[6] found the Labor party had taken a slight lead over the governing Coalition party in two-party preferred terms (51 to 49) for the first time since prior to the May 2019 election. By February 2nd, this lead had widened to 52 to 48 in favour of Labor. On March 15th, immediately prior to the spread of COVID-19 in Australia during the first wave of infections but following the 2019/20 Black Summer bushfires, Newspoll estimated a two-party-preferred vote of 51 per cent to Labor and 49 per cent to the Coalition. This different had flipped by the next poll (April 5th) with the Labor vote staying below or the same as the Coalition vote throughout the COVID-19 period, with the biggest gap occurring on July 19th with a lead of 53-47 to the Coalition.

While potentially indicative and highly informative, all of the existing published public opinion suffer from one or more important limitations. Sample sizes tend to be small; the representativeness of the samples is questionable; they are commissioned and reported on by organisations with pre-existing political agendas (some pro- some anti-environmental policy); do not include validated measures; or are relatively early in the bushfire season. Furthermore, there is currently no public opinion data that is based on a longitudinal sample, which would allow pre-existing attitudes and beliefs to be held constant when looking at the effect of direct or indirect exposure to the bushfires on attitudes, as well as tracking of public opinion post-fires and during the COVID-19 period. The aim of this paper is to fill these gaps with a unique and targeted dataset.

Specifically, we attempt to answer the following research questions:

1. How does wellbeing and public attitudes towards climate change and related policy change after an extreme weather event and during the COVID-19 period?

2. Are there differences in the change between those who were exposed to the bushfires and those who were not?

3. Are there differences in the change between those who were exposed to negative aspects of the COVID-19 pandemic and those who were not?

4. Are there differences in the change based on pre-existing political beliefs?

In order to answer these questions, the remainder of the paper is structured as follows. In the

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[6] https://www.theaustralian.com.au/nation/newspoll

next section (Section 2), we outline the datasets and measures used in the paper, including the measures of bushfire exposure. In Section 3 we look at the relationship between bushfire and COVID-exposure and changes in wellbeing over 2020, with Section 4 looking at the relationship with changes in attitudes towards the environment. In Section 5 we provide some concluding comments.

2   Data and measures

The data used in this paper are drawn from a series of surveys that collected data from the probability panel called 'Life in Australia'™ (Kaczmirek, Phillips et al. 2019). The panel was developed and is maintained by the Social Research Centre who collect data online and offline to ensure representation from those who are unable to complete the questionnaires online.

The contact methodology adopted for online Life in Australia™ members is an initial survey invitation via email and SMS (where available), followed by multiple email reminders and a reminder SMS. Telephone non-response of panel members who have not yet competed the survey commences in the second week of fieldwork and consists of reminder calls encouraging completion of the online survey.

The contact methodology for offline Life in Australia™ members is an initial SMS (where available), followed by an extended call-cycle over a two-week period. A reminder SMS is also sent in the second week of fieldwork. Computer Assisted Telephone Interviewing (CATI) is used for the offline Australian population. Around 6.5 per cent of interviews are collected via CATI.

The data collections used in this report occurred in October 2019, January 2020, April 2020, May 2020, August 2020, and January 2021. The October 2019 collection provides baseline data prior to the majority of the bushfires that occurred in Australia over the summer. January 2020 asked detailed questions about exposure and experience of bushfires during the height of the fires. In April, May and August data was collected on exposure to negative aspects of the COVID-19 pandemic. August also included a module on attitudes towards the environment. In January 2021, infection rates due to COVID-19 in Australia had reached very low levels. There was some bushfire activity during that time, but to a far smaller extent than in January 2020. During this wave of data collection, we repeated the questions on views on environmental issues.

There were 3,061 individuals who completed the August 2019 ANUpoll. Of those individuals, 2,790 (91.1 per cent) completed all the surveys through to August 2020. Looking forward from August, 2,766 individuals (90.4 per cent) who completed the August 2021 survey completed the January 2021 survey This dataset therefore provides a large sample of people whose attitudes and experiences can be tracked overtime. Importantly, observed changes reflect 'real' change at the individual level and not aggregated change.

Unless otherwise stated, data in the paper is weighted to population benchmarks. For Life in Australia™, the approach for deriving weights generally consists of the following steps:

1.   Compute a base weight for each respondent as the product of two weights:

   a.   Their enrolment weight, accounting for the initial chances of selection and subsequent post-stratification to key demographic benchmarks

   b.   Their response propensity weight, estimated from enrolment information available for both respondents and non-respondents to the present wave.

2. Adjust the base weights so that they satisfy the latest population benchmarks for several demographic characteristics.

2.1 Measuring exposure to bushfires

There are two ways to capture bushfire exposure in the data used in this analysis. The first is through the postcode of a person's place of usual residence, which we can match against the postcodes identified by the Australian Tax Office as being in the disaster relief area. These areas (and our sample of affected residents) are spread across NSW, Queensland, South Australia, Tasmania and Victoria.[i] Of the 3,249 respondents in our sample, 402 lived in a bushfire affected area. With and without weights, this represents 12.4 per cent of the January sample.

Not every individual who lives in a bushfire area is likely to have been directly affected though (the postcodes are geographically quite large), and there are likely to be people who live outside those areas who were either directly or indirectly affected. This could be because of second homes, travel to those areas during bushfire periods (i.e. direct effects), or because they have close family/friends in those areas or were affected by smoke from the fires (i.e. indirect effects).

We therefore also use a set of variables based on asking people explicitly about a range of exposure measures. Specifically, we asked respondents:

> We would now like to ask you some questions about your experiences with bushfires. Thinking first about the bushfires that have occurred / are currently occurring over this spring and summer in Australia. Which of the following, if any, have you experienced?

Eight forms of exposure were provided, with varying degrees of severity. These are listed below with the labels used in the remainder of the analysis.

a) **Direct damage -** Your home or property (including pets or livestock) has been damaged or destroyed by the fires
b) **Direct threatened -** Your home or property has been threatened but not damaged or destroyed by the fires
c) **Friend/family damage -** The home or property of a close family member or friend has been damaged or destroyed by the fires
d) **Friend/family threatened -** The home or property of a close family member or friend has been threatened but not damaged or destroyed by the fires
e) **Evacuated -** You were advised by emergency services (directly or indirectly via media) to evacuate from the area in which you live or were staying in due to the fires
f) **Travel/holiday -** Your travel or holiday itself, or travel and holiday plans have been affected by the fires
g) **Smoke -** You felt physically affected by smoke from the fires
h) **Anxious or worried -** You felt anxious or worried for the safety of yourself, close family members or friends, due to the fires.

As these are self-reported exposure there is potentially some uncertainty around the estimates based on these questions. First, we asked whether the person had been exposed with a yes or no response rather than a severity scale. Second a number of the terms in the questions are open to interpretation (damaged; close family; advised by; affected). Thirdly with any sample survey there is a level uncertainty. For all our figures we add 95 per cent confidence intervals around our estimates, and include confidence intervals around the numerical estimates for
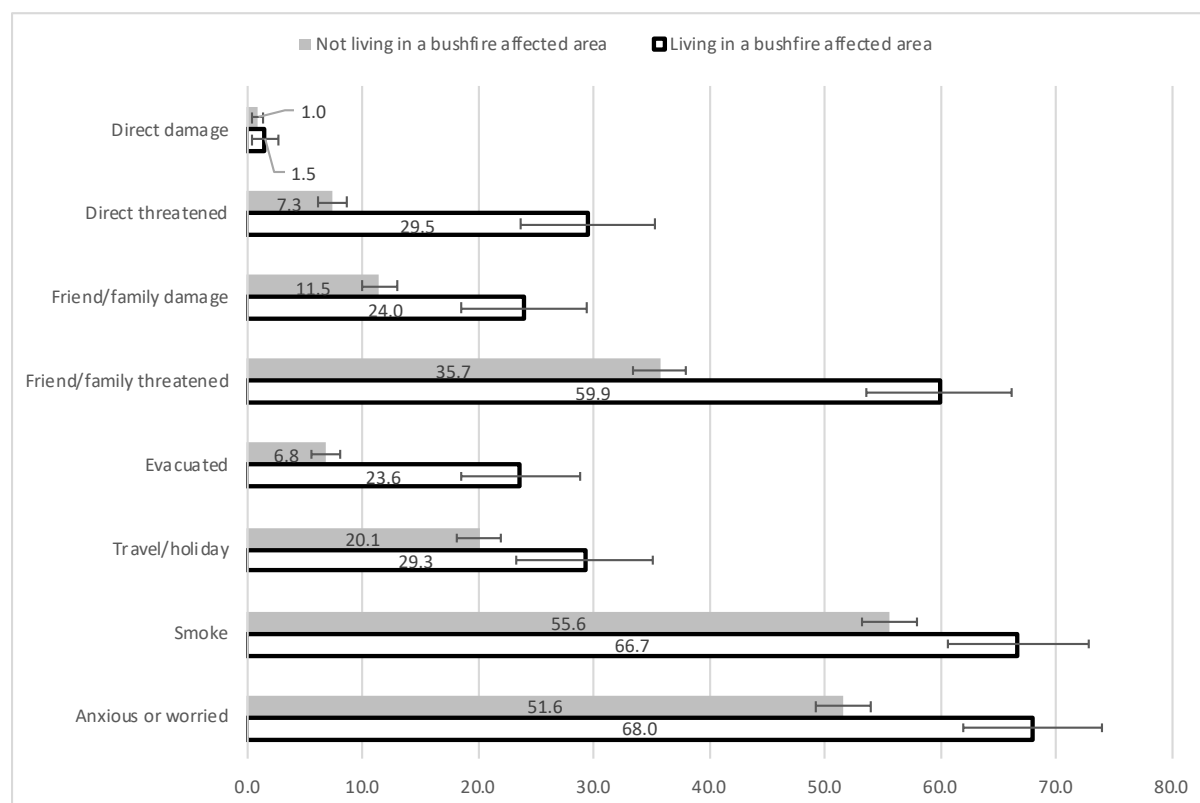
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exposure. A final source of uncertainly is results from obtaining precise estimates of outcomes with relatively low incidence.

Uncertainty also comes from the timing of the survey in January 2020. It predated some of the fires (including in and around Canberra), but was also a number of months after the start of the fire season, leading to potential issues of recall bias. Finally, the fires themselves may have impacted on survey response rates. It is difficult to ascertain the size and direction of some of these potential sources of error, though we do not think that any of the conclusions are likely to be affected.

In total, for our January 2020 sample, 78.6 per cent reported at least one form of exposure, with Figure 1 giving the percentages for each of the individual types of exposure, as well as the uncertainty around those estimates (as 95 per cent confidence intervals). The most severe form of exposure, having one's home or property damaged or destroyed, was only estimated to have been experienced by 1.0 per cent of the adult population. However, it should be noted that this may be an undercount as survey non-response could have been affected by exposure to the bushfire. Furthermore, this still equates to between 120,000 and 280,000 adults who reported some form of damage from the bushfires (Table 1), with our best estimate being around 200,000 adult Australians directly affected.

The subjective measures of exposure are much higher for those who live in disaster relief areas (Figure 1). In particular, someone who lives in a disaster relief area is 4.0 times as likely to say that their home or property was directly threatened and 3.5 times as likely to say that they were evacuated. Nonetheless, not every individual who lives in a bushfire area says they have been affected and there are many people who live outside those areas who have been.

Figure 1: Exposure to bushfires and related events – by area of residence

Source: January 2020 ANUpoll

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Bushfire exposure and impacts

Combining those who had property damage, property threatened, or had to be evacuated, around 14.4 per cent of the Australian population report at least one of what we could classify as the most severe forms of exposure. This equates to around 2.9 million adults in Australia. Not surprisingly, the vast majority of people who reported severe or direct exposure also experienced one of the other forms of exposure (94.9 per cent). One of the characteristics of the bushfires over the 2019/20 Black Summer is the very large geographic range, the length of time that they lasted and the large amount of smoke haze that spread across some of Australia's largest cities and regional towns. It is perhaps not surprising then that there are many more people who reported indirect exposure, with more than three quarters of the population reporting some other form of indirect or secondary exposure. Looking at individual items, more than half of the adult population (57.0 per cent), or around 11.2 million adults were estimated to have felt physically affected by the smoke from the fires.

The final exposure measure that we ask is whether someone felt anxious or worried due to the fires. More than half of Australian adults (53.6 per cent) reported that they felt anxious or worried due to the bushfires. This question in particular is likely to mask a large degree of severity, and there are likely to be important factors that predict the degree of anxiety and worry, conditional on the person's specific experience (a point we return to later in the paper). Nonetheless, it does demonstrate the very wide population coverage of those who had a subjective negative experience.

Table 1 : Exposure to bushfires and related events – percentages and population estimates

Exposure type	Per cent	Estimated number (millions)		
		Lower bound	Point estimate	Upper bound
All	78.6	15.2	15.5	15.9
Severe/Direct	14.4	2.5	2.9	3.2
Indirect/secondary	77.8	15.0	15.4	15.7
Direct damage	1.0	0.1	0.2	0.3
Direct threatened	10.1	1.7	2.0	2.3
Friend/family damage	13.0	2.3	2.6	2.9
Friend/family threatened	38.7	7.2	7.7	8.1
Evacuated	8.9	1.5	1.8	2.0
Travel/holiday	21.2	3.8	4.2	4.6
Smoke	57.0	10.8	11.3	11.7
Anxious or worried	53.6	10.2	10.6	11.0

Source: January 2020 ANUpoll

2.2   Measuring exposure to COVID-19 and the relationship

Exposure to COVID-19 is measured in three ways – exposure to testing, contact with a confirmed case, and subjective anxiety. The questions were asked consistently in April, May and August. The first set of questions begins with the introduction: 'We would now like to ask you some questions about your experiences with COVID-19, which is the respiratory illness caused by the Coronavirus.' We then ask 'Thinking about the spread of COVID-19 that is currently occurring which of the following, if any, have you experienced?' The first option was

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Bushfire exposure and impacts

'You have been tested by a doctor or nurse for COVID-19.' Consistent with increased testing across Australia in April 2.1 per cent reported being tested increasing to 5.2 per cent by May and then 19.3 per cent by August.

Respondents are then asked whether they 'have had close contact with someone who has had a confirmed infection of COVID-19'. The per cent of respondents who said they had had close contact stayed reasonably constant over the three waves at 6.1 per cent in April 2020. Most infections have been concentrated amongst travellers or visitors to Australia who have been quarantined or in workers and residents in hospitals or aged care residents. This is reflected in the lower reporting rates for contact with a confirmed infection. However, when asked about 'close contact with someone who may have been infected with COVID-19' the percentages do increase over the waves – 0.8 per cent in April, 0.9 per cent in May and 5.9 per cent in August.

In terms of a more subjective measure of exposure to COVID-19, more than three-in-five Australians (62.6 per cent) in the August ANUpoll reporting that they 'felt anxious or worried for the safety of yourself, close family members or friends, due to COVID-19.' This is an increase from May 2020 (57.3 per cent), but still a slight decline from the April 2020 peak (66.7 per cent). When asked about how likely they thought it would be that they would become infected by COVID-19 over the next six-months. There was an initial fall in the percentage of Australians who thought that it was likely or very likely that they would be infected, from 39.5 per cent in April to 31.5 per cent in May 2020. However, the expected likelihood rose again between May and August, to 34.1 per cent of the population. The pattern reflects the impact of wave 1, followed by a lull and then wave 2. Although the direct impact of wave 2 has been largely concentrated in Victoria, all states and territories have had significant focus on stopping and controlling outbreaks in their jurisdictions thus reinforcing vigilance.

2.3   Measuring exposure to COVID-19 and the relationship with bushfire exposure

It has been widely commented that the last 12 months has been stressful for many people given that two major disasters have been experienced – the 2019/20 Black Summer bushfires followed quickly by COVID-19. There has also been the impact of the drought in many jurisdictions and localised disasters such as the extensive hail damage in the ACT and flooding in some regional areas. We focus on two disasters – the recent bushfires and COVID19.

There are small differences in our COVID-19 exposure measures based on whether someone lived in a bushfire affected area in January 2020. Compared to the rest of the population, those in a bushfire affected area were slightly more likely to have been tested (20.8 per cent compared to 17.8 per cent), less likely to have had close contact with someone with a confirmed case (0.3 per cent compared to 1.5 per cent), less likely to know someone with a suspected case (3.5 per cent compared to 6.4 per cent), slightly less likely to have been anxious and worried (60.1 per cent compared to 62.7 per cent), and somewhat less likely to think that they are likely to be infected in the next six months (31.3 per cent compared to 34.7 per cent).

Compared to the rest of the population, those who had property damage, property threatened, or had to be evacuated were slightly more likely to have been tested (20.9 per cent compared to 17.7 per cent), substantially less likely to have had close contact with someone with a confirmed case (0.3 per cent compared to 1.5 per cent), slightly less likely to have been anxious and worried (61.5 per cent compared to 62.6 per cent), and somewhat less likely to think that they are likely to be infected in the next six months (32.1 per cent compared to 34.7 per cent). Furthermore, those with direct exposure were more likely to know someone

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with a suspected case than those who didn't have direct exposure (8.2 per cent compared to 5.7 per cent)

There are much larger differences by secondary bushfire exposure and in a somewhat different direction to that described above. Compared to the rest of the population, those who had secondary exposure were substantially more likely to have been tested (20.3 per cent compared to 10.8 per cent), less likely to have had close contact with someone with a confirmed case (1.1 per cent compared to 2.0 per cent), and slightly more likely to know someone with a suspected case (6.4 per cent compared to 4.8 per cent). There are even larger differences in the more subjective measures, with those who had secondary exposure to the 2019/20 Black Summer fires being substantially more likely to have been anxious and worried about COVID-19 (67.6 per cent compared to 44.9 per cent), and more likely to think that they are likely to be infected in the next six months (36.5 per cent compared to 26.7 per cent).

3   Life satisfaction over the COVID-19 period and bushfire exposure

When first reporting on wellbeing during the bushfire period, we found 'there was no statistically significant difference in the change in life satisfaction between October and January between those who reported either direct or indirect exposure to bushfires and those who did not.' We did find a decline in life satisfaction for Australia as a whole, but this difference was consistent across the bushfire exposure measures, implying that all Australians may have been affected by the Black Summer (in terms of their subjective wellbeing), regardless of whether they themselves had any form of direct or indirect exposure.

In Figure 2, we can see that there are no noticeable differences in the trends in life satisfaction during the COVID-19 period between those who lived in the bushfire areas and had either direct or indirect exposure to the bushfires. Well-being is measured on a 10 point scale from a single life satisfaction measure, scale with a high score indicate positive well-being. Data is from repeated cross-sections, which means those who responded to one wave of data but not another are still included in the estimate for the wave(s) they responded to.

Throughout the period, those who had any exposure had slightly lower levels of life satisfaction than those who did not. The trend over the waves is also fairly consistent with a decline from October 2019 to January 2020, further declines to April 2020, a slight increase in May and then a decline in August 2020.

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Figure 2: Trend in life satisfaction during Covid-19 for those with direct exposure to the bushfires
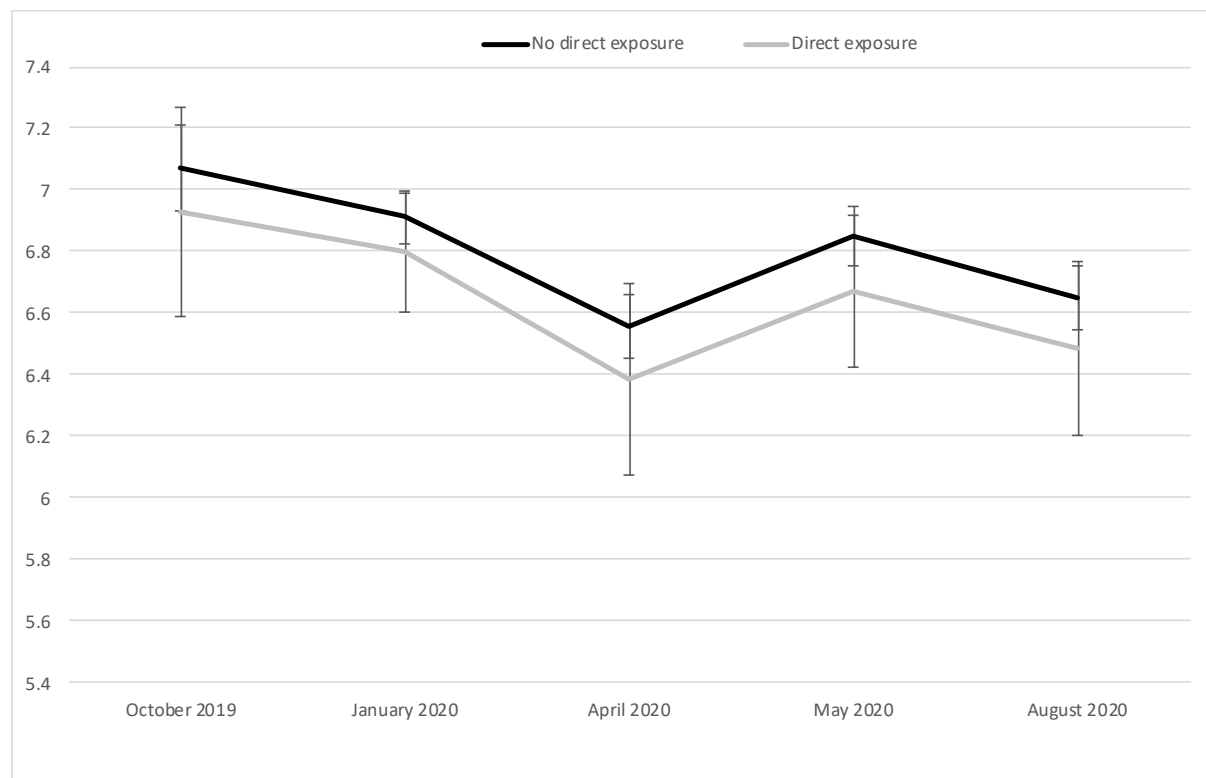
Source: October 2019, January 2020, April 2020, May 2020, and August ANUpolls.

In Figure 3, we can see that change through time between October 2019 and January 2020 is slightly more negative for those who reported indirect exposure to the Black Summer fires (p-value – 0.064 for the linked October 2019 to January 2020 dataset). Over the COVID-19 period, however, and particularly after the first wave of infections and into the second wave of infections, those with indirect exposure experienced a relative decline in subjective wellbeing compared to those who did not have indirect exposure. This may be an indication of a delayed effect of indirect exposure to bushfires on wellbeing, or potentially the effect of other external shocks (perhaps related to COVID-19) being more likely to be felt by those who had experienced indirect exposure to the bushfires.
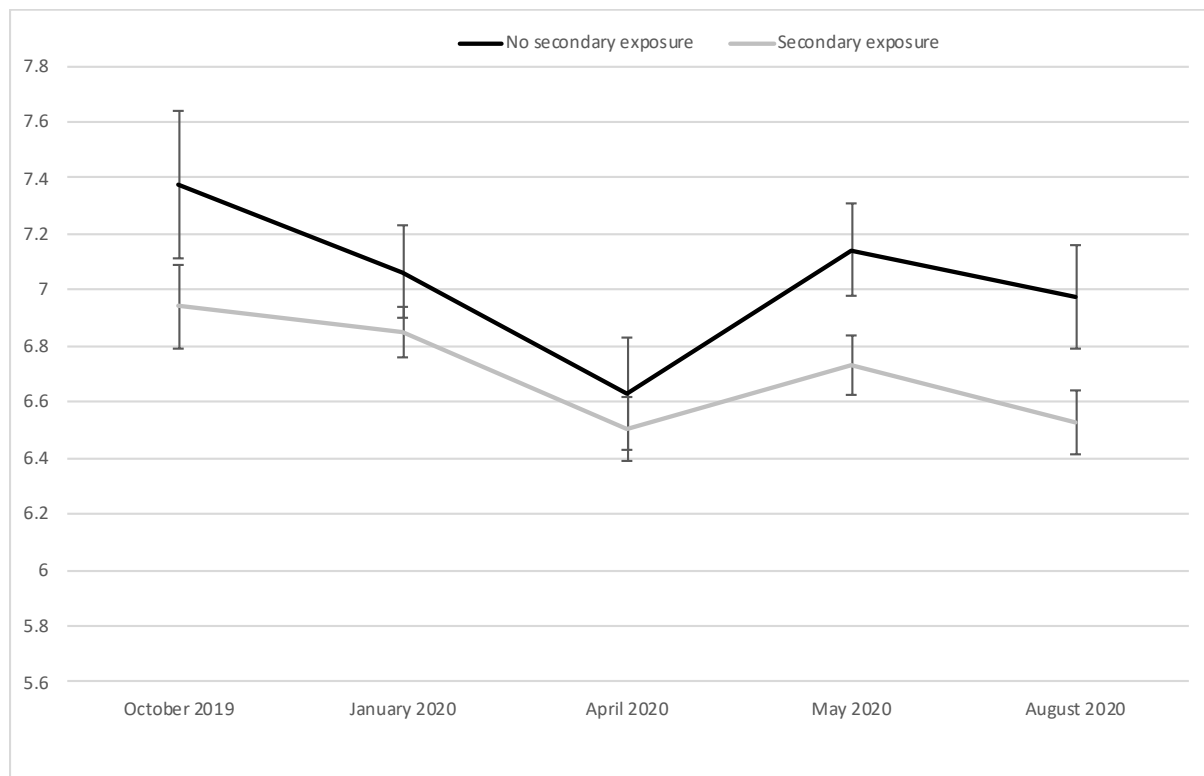
Figure 3: Trend in life satisfaction during Covid-19 for those with indirect exposure to the bushfires

Source: October 2019, January 2020, April 2020, May 2020, and August ANUpolls.

In the final figure on change through time in life satisfaction, we can see very consistent trends in wellbeing between those who live in bushfire affected areas and those who don't, apart from between April and May 2020. During this period, there was a significant improvement in wellbeing for those who lived in bushfire affected areas, from 6.38 to 7.05. For those in the

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rest of the country there was also an improvement over this period, from 6.55 to 6.79, but the difference was much smaller than for those in bushfire affected areas.

Figure 3   Trend in life satisfaction during Covid-19 for those living in a bushfire affected area
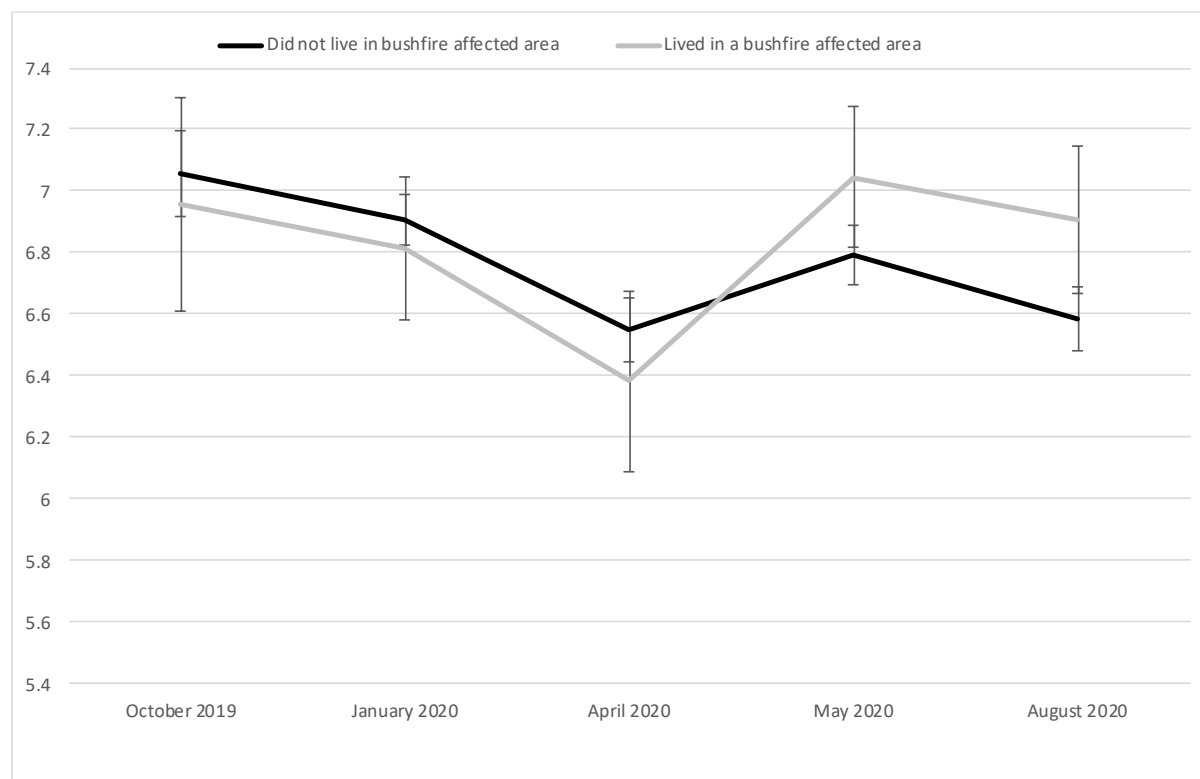
Source: October 2019, January 2020, April 2020, May 2020, and August ANUpolls.

3.1   Explaining the patterns in life satisfaction during the COVID-19 period

Differences in life satisfaction between those who were exposed to the 2019/20 Black Summer bushfires were more apparent between April 2020 and May 2020, at the height of the first wave of COVID-19 infections, than they were between October 2019 and January 2020 when the bushfires themselves were occurring. Previous research has shown that there are delayed and long-term effects of natural disasters that can take months or years to be observed in the data (McFarlane 1986; Agyapong et al. 2019). What is unique about the current circumstances, however, is the very rapid onset of a global health pandemic following a natural disaster. In this sub-section, we attempt to explain the trends in life satisfaction using other observed data over the COVID-19 period.

Specifically, we analyse the change in life satisfaction between April 2020 and May 2020, the period during which the outcomes diverged most by bushfire exposure. The dependent variable is change in life satisfaction over the period, which ranged from -6 to 10 across the sample, with a (weighted) mean of 0.35 and a standard deviation of 1.57. The first explanatory variable in the model is life satisfaction in April 2020, which we control for in order to capture reversion to the mean, or the fact that those with high levels of life satisfaction in April have greater scope for declines over the subsequent month whereas those with lower levels of life satisfaction have scope for greater increases. In Model 1, we include this lagged dependent variable, as well as the three measures of bushfire exposure. Between Models 2 and 6 we progressively add an increasing number of additional explanatory variables to the model, capturing demographic, socioeconomic, geographic, and COVID-specific variables. This allows

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us to test whether changes in wellbeing are due to bushfire exposure, COVID-19 exposure, or other characteristics of the individual.

- In Model 2 we include age, sex, other demographic variables, and the socioeconomic characteristics of the area in which a person lives;
- In Model 3 we add variables for confidence in the Federal Government in April and May 2020;
- In Model 4 we add variables for whether a person experienced anxiety and worry due to COVID-19, as well as their self-reported expected likelihood of being infected in the next 6 months (in April and May 2020);
- In Model 5 we add variables for per person household income, and the number of hours worked per week (in April and May 2020); and
- In Model 6 we add variables for whether or not the person thought their income was adequate to meet their current expenditure and whether or not they were unable to pay their rent or mortgage on time (in April and May 2020).

Looking at the results presented in Model 1, the results confirm that between April and May 2020, there was a deterioration in life satisfaction for those who reported indirect bushfire exposure relative to those that did not, and an improvement in life satisfaction for those who live in a bushfire affected area. While the differences by direct exposure were not statistically significant, the coefficient was reasonably large and almost statistically significant (p-value = 0.106). Controlling for demographic, some socioeconomic, and demographic variables, thee results hold, with the coefficient for direct exposure becoming statistically significant. For an otherwise equivalent (demographically and geographically) individual, there was a worsening in subjective wellbeing between April and May 2020 for those who reported they were affected by the bushfires, but an improvement for those who lived in a bushfire affected area holding self-reported exposure constant.

Looking at the results from Model 3, much of the differences by indirect exposure disappears when we control for confidence in government, which improved substantially between April and May 2020 for those who did not report indirect exposure, but only by a small amount for those that did not. The difference is no longer significant at all once we control for fear of infection (Model 4). It is difficult to prove definitively with the data we have, but it would appear that one of the lingering effects of the bushfire for those who reported indirect exposure was a less substantial increase in confidence in the early stages of the COVID-19 pandemic, perhaps as a consequence of the lingering perceived government failures over the period.

The worsening in life satisfaction for those who reported direct exposure no longer held once we controlled for income in April and May 2020. On the other hand though, even with a very expansive set of explanatory variables (Model 6), those who lived in bushfire affected areas had an improvement in subjective wellbeing between April and May 2020.

Table 2   Factors associated with change in life satisfaction between April and May 2020

Explanatory variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
Life satisfaction in April	-0.379	***	-0.393	***	-0.440	***	-0.446	***	-0.445	***	-0.460	***
Direct exposure to bushfires	-0.151		-0.213	**	-0.217	**	-0.205	**	-0.126		-0.112	
Indirect exposure to bushfires	-0.248	***	-0.266	***	-0.169	*	-0.106		-0.131		-0.124	
Lived in bushfire affected area	0.267	***	0.190	*	0.178	*	0.174	*	0.192	*	0.184	*
Confidence in Federal Government in April					0.108		0.134		0.086		0.127	
Confidence in Federal Government in May					0.621	***	0.595	***	0.609	***	0.569	***
Anxious or worried about COVID-19 in April							0.021		0.013		0.008	
Anxious or worried about COVID-19 in May							-0.154		-0.144		-0.141	
Likely to be infected by COVID-19 in 6 months (April)							-0.048		-0.090		-0.079	
Likely to be infected by COVID-19 in 6 months (May)							-0.233	**	-0.224	**	-0.221	**
Hours worked per week in April									-0.005		-0.004	
Hours worked per week in May									0.002		0.001	
Per person household weekly income in April									-0.00026	*	-0.00024	*
Per person household weekly income in May									0.00041	***	0.00032	**
Unable to pay rent or mortgage since COVID-19 (April)											-0.153	
Unable to pay rent or mortgage since COVID-19 (May)											-0.186	
Difficult to meet expenditure with current income (April)											0.273	**
Difficult to meet expenditure with current income (May)											-0.478	***

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	(1)	(2)	(3)	(4)	(5)	(6)
Female		0.205 ***	0.144 **	0.193 ***	0.209 ***	0.204 ***
Aged 18 to 24		-0.188	-0.163	-0.284	-0.326	-0.306
Aged 25 to 34		-0.129	-0.057	-0.103	-0.145	-0.149
Aged 45 to 54		0.100	0.031	-0.022	-0.078	-0.111
Aged 55 to 64		-0.150	-0.159	-0.196 *	-0.225 *	-0.251 **
Aged 65 to 74		0.066	0.031	-0.051	-0.107	-0.171
Aged 75 plus		0.149	0.080	0.041	0.070	0.005
Indigenous		-0.423	-0.416 *	-0.341	-0.244	-0.270
Born overseas in a main English-speaking country		-0.086	-0.070	-0.066	-0.068	-0.057
Born overseas in a non-English speaking country		-0.324 ***	-0.326 ***	-0.324 ***	-0.315 **	-0.331 ***
Speaks a language other than English at home		0.206	0.136	0.199	0.310 **	0.334 **
Has not completed Year 12 or post-school qualification		-0.010	-0.102	-0.110	-0.049	-0.034
Has a post graduate degree		0.006	-0.010	-0.007	-0.040	-0.037
Has an undergraduate degree		0.032	0.010	0.041	0.012	-0.015
Has a Certificate III/IV, Diploma or Associate Degree		0.099	0.023	0.021	0.012	0.017
Lives in the most disadvantaged areas (1st quintile)		-0.086	-0.102	-0.112	-0.109	-0.073
Lives in next most disadvantaged areas (2nd quintile)		-0.008	-0.044	-0.040	-0.031	-0.008
Lives in next most advantaged areas (4th quintile)		0.066	0.048	0.016	0.018	0.046
Lives in the most advantaged areas (5th quintile)		-0.016	-0.059	-0.053	-0.021	-0.018
Lives in a non-capital city		0.108	0.126	0.109	0.098	0.075
Constant	2.979 ***	3.021 ***	2.925 ***	3.085 ***	3.065 ***	3.297 ***
Sample size	2,773	2,456	2,450	2,302	2,021	2,007
Adjusted R-Squared	0.2500	0.2623	0.3034	0.3165	0.3156	0.3282

Source: January, April and May 2020 ANUpolls.

Notes: The sample is restricted to those who completed both waves of data collection. The base case individual did not report any bushfire exposure, is female; aged 35 to 44; non-Indigenous; born in Australia; does not speak a language other than English at home; has completed Year 12 but does not have a post-graduate degree; lives in neither an advantaged or disadvantaged suburb (third quintile); and lives in a capital city

Those coefficients that are statistically significant at the 1 per cent level of significance are labelled ***; those significant at the 5 per cent level of significance are labelled **, and those significant at the 10 per cent level of significance are labelled *.

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4   Views on the environment

There is significant debate about the specific contribution of different causes to the spring/summer bushfire crises, including the role of arson and hazard reduction.[7] There is a very strong scientific consensus though that climate change or global warming/heating is making such events more likely, last longer, and more intense (IPCC 2014). This is not only because of the direct effect of high temperatures on combustibility during the fire season, but also because of the difficulties of hazard reduction during hotter than average years and the decreased moisture due to prolonged drought (Garnaut 2019).

We hypothesise that the bushfires will have led to a greater importance placed on environmental issues, but that post bushfires and particularly since the spread of COVID-19 that this importance would have waned somewhat. We do find this to be the case. The important research questions though are what is the scale of this change, and are there characteristics that predict a greater or lesser change?

We asked a number of questions related to the environment in the January 2020 ANUpoll, some of which were repeated from recent surveys, with others repeated from much earlier surveys. We repeated one of these modules in August 2020, focusing specifically on perceived seriousness of a number of issues related to the environment.

Specifically, in January 2020, August 2020, and January 2021 we asked the following: 'We are now going to ask you some questions about the environment. How serious do you consider each of the following to be for Australia?', with the following eight potential environmental issues[8]:

    a) Global warming or the greenhouse effect
    b) Loss of native vegetation or animal species or biodiversity
    c) Degradation of rivers, lakes and oceans
    d) Soil salinity and erosion
    e) Environmental damage resulting from logging of native forests
    f) Drought and drying
    g) Bushfires
    h) Tropical cyclones

We provided four potential response options – very serious; somewhat serious; not very serious; and not serious at all. Combining the first two response options, all of the potential issues were rated as being somewhat or very serious by more than three quarters of the population in January 2020, ranging from 78.6 per cent for tropical cyclones to 98.2 per cent for drought and drying. Clearly, environmental issues were very salient during the 2019/20 Black Summer crisis for a large proportion of Australians. There is, however, more variation in the proportion of people who thought the issues were very serious. Furthermore, by looking at the very serious category only, we are able to make comparisons for the first six of the environmental issues with when the question was last asked in the September 2008 ANUpoll (McAllister 2008), as shown in Figure 5.

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[7] https://www.abc.net.au/news/2020-01-11/australias-fires-reveal-arson-not-a-major-cause/11855022
[8] In January 2021 a ninth environmental issue was asked about – Floods. This was prior to the major flooding that occurred (in March) in the Hawkesbury/Nepean region of Sydney, as well as Northern NSW and Queensland. 36.9 per cent of Australians reported floods as a very serious environmental issue.

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For all issues that were asked in both 2008 and 2020, apart from soil salinity and erosion, there was an increase in the proportion of people who think that the particular environmental issues are very serious, though not all of these changes are statistically significant. The two biggest percentage point increases were for loss of native vegetation or animal species or biodiversity (a 13.0 percentage point increase) and drought and drying (a 9.0 percentage point increase). Both of these may have been exacerbated or made more salient by the bushfires.

After reaching what appears to be a high value in January 2020, the per cent of people who reported each of the environmental issues as being 'very serious' declined between January 2020 and August 2020. The biggest (relative) declines were for tropical cyclones; and degradation of rivers, lakes and oceans. The smallest (relative) declines were for environmental damage resulting from logging of native forests; soil salinity and erosion; bushfires; and global warming. In absolute terms, in August 2020 the environmental issues that respondents were most likely to say were serious were bushfires (67.8 per cent), as well as drought and drying (64.6 per cent).

Between August 2020 and January 2021, there was an increase again in concern for many of the environmental issues, with none of the issues decreasing in the proportion of people who thought it was very serious. Over that period, there were three main groupings of issues. For three of the issues (soil salinity and erosion, drought and drying, and bushfires) there was a three percentage point increase or less between August 2020 and January 2021, that was not statistically significant. For a further two issues (biodiversity, as well as degradation of waterways) there was a significant increase between August 2020 and January 2021, but percentages were still significantly below those from January 2020. The final three issues (global warming, logging, and tropical cyclones) concern had returned by January 2021 to what it was in January 2020.

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Figure 5   Per cent of population who think specific environmental issues are very serious – September 2008, January 2020, August 2020 and January 2021 ANUpolls
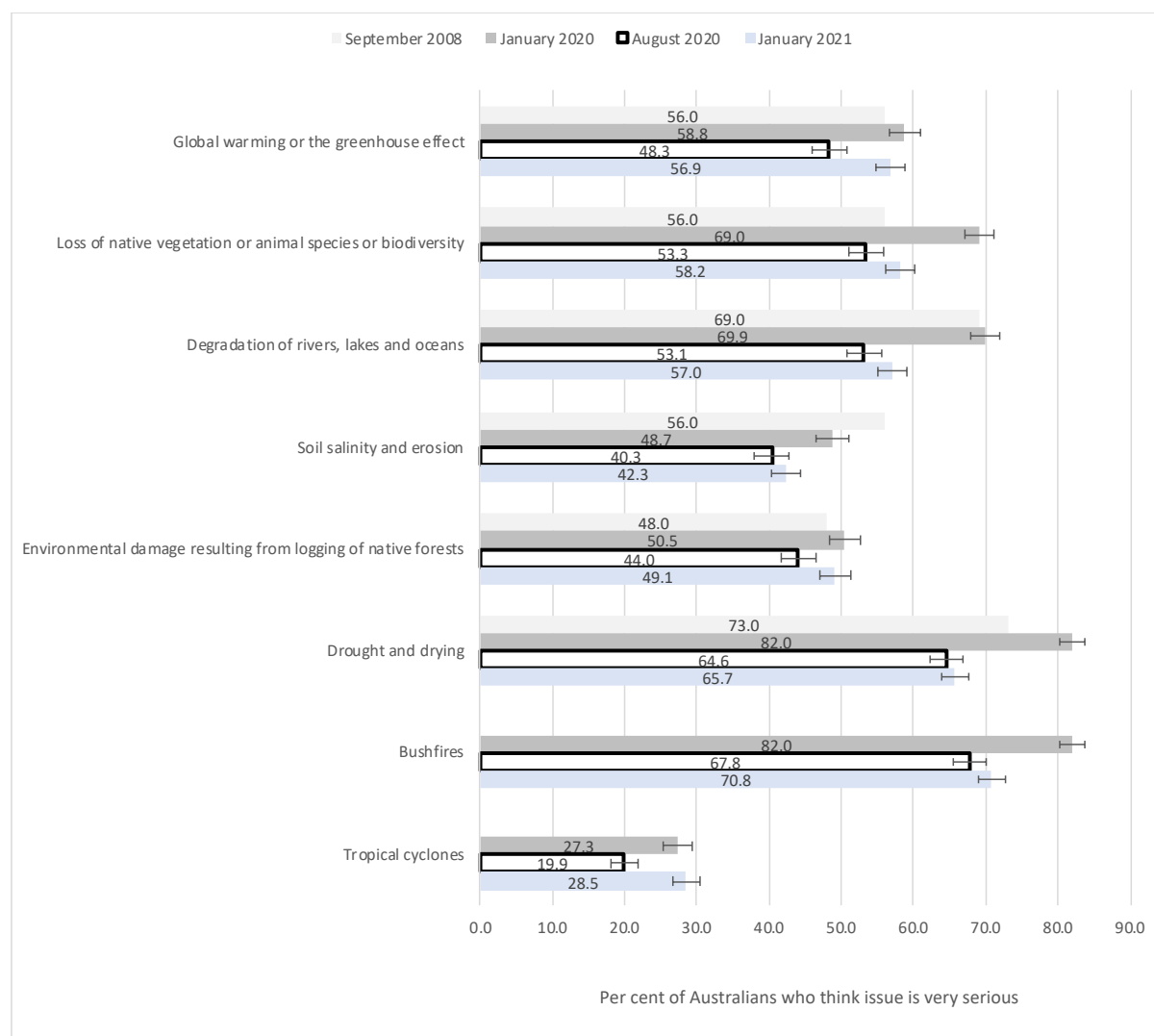
Source: September 2008, January 2020, August 2020 and January 2021 ANUpolls.

4.1   Explaining the change in environmental views

There is a strong correlation for views on the environment across the eight issues. A principle components analysis strongly suggests a single factor solution, with the eigenvalue for the first component being 4.4 and for the second component 0.88. The individual variables all made a similar contribution to the first component, with eigenvalues ranging from 0.29 to 0.39. To construct an index of views on the environment that is able to change through time in mean and standard deviation, a value of 1 was ascribed to those saying the issue was not serious at all; 2 for those saying not very serious; 3 for somewhat serious; and a value of 4 ascribed to those saying it was very serious. All eight issues were then summed, giving a minimum value of 8 and a maximum value of 32 for the index. For those who completed the survey in January 2020, the index of environmental concern was 28.0, with a decline to 26.7 in August 2020. By January 2021, the index value had returned to somewhere in between (27.3), significantly different from both the January 2020 and August 2020 values.

Cross sectionally, that is analysing the results for the August 2020 ANUpoll without controlling for any January 2020 characteristics, there is a greater level of concern for environmental

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issues amongst females; and older Australians (particularly those aged 75 years and over). There are lower levels of concern for those who speak a language other than English at home; those who have not completed Year 12; and those who live outside of a capital city.

Table 3: Factors associated with environmental concern – August 2020

Explanatory variables	Coeff.	Sig
Female	1.45	***
Aged 18 to 24	0.11	
Aged 25 to 34	0.01	
Aged 45 to 54	-0.08	
Aged 55 to 64	0.23	
Aged 65 to 74	0.37	
Aged 75 plus	0.77	**
Indigenous	-0.63	
Born overseas in a main English-speaking country	0.32	
Born overseas in a non-English speaking country	0.18	
Speaks a language other than English at home	-0.91	***
Has not completed Year 12 or post-school qualification	-0.72	*
Has a post graduate degree	0.09	
Has an undergraduate degree	0.32	
Has a Certificate III/IV, Diploma or Associate Degree	-0.04	
Lives in the most disadvantaged areas (1st quintile)	0.00	
Lives in next most disadvantaged areas (2nd quintile)	-0.02	
Lives in next most advantaged areas (4th quintile)	0.06	
Lives in the most advantaged areas (5th quintile)	0.31	
Lives in a non-capital city	-0.42	*
Probability of base case	26.19	***
Sample size	3,077	
Adjusted R-Squared	0.0449	

Source: August 2020 ANUpoll.

Notes: The base case individual is female; aged 35 to 44; non-Indigenous; born in Australia; does not speak a language other than English at home; has completed Year 12 but does not have a post-graduate degree; lives in neither an advantaged or disadvantaged suburb (third quintile); and lives in a capital city

Those coefficients that are statistically significant at the 1 per cent level of significance are labelled ***; those significant at the 5 per cent level of significance are labelled **, and those significant at the 10 per cent level of significance are labelled *.

In Table 4, we focus on change through time in the environmental concern index (between January and August) and progressively add explanatory variables from January through to August to help explain change in views on the environment. In Model 1, where we control for baseline environmental concerns only, we find that females and those aged 75 years and over increased their concern for the environment, relative to males and those aged 35 to 44 years respectively. There were no other demographic, socioeconomic, or geographic measures that were associated with change through time.

In the second model in Table 4, we add bushfire exposure in January 2020 as independent explanatory variables. Given we are looking at change through time and controlling for baseline environmental concern, the immediate impact of bushfire exposure on environmental concerns are held constant. Instead, in Model 2 we are able to see that those who reported indirect bushfire exposure experienced a relative increase in their concern for the environment compared to those who did report indirect exposure. In absolute terms, there was still a decline in concern for the environment amongst those who had secondary exposure (by 1.2 points on the index, without controlling for other characteristics). However, holding constant baseline concern, the decline was significantly and substantially less than those who were not exposed).

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In Model 3, we incorporate exposure to COVID-19 related measures. Controlling for COVID-19 exposure does not substantially change the relationship with indirect bushfire exposure. However, two of the variables are significant in their own right. First, those who were anxious or worried about COVID-19 in August 2020 had a relative increase in concern for the environment compared to those who were not anxious or worried. This may be tapping into a general level of anxiety about the future. Perhaps more importantly, there was a strong negative correlation between our measure of housing stress (being unable to pay rent or mortgage) and change in views on the environment. That is, those who experienced a negative economic shock during the early stages of the COVID-19 pandemic became less concerned about the environment than those who managed to avoid such a shock.

In the final model presented in Table 4, we look at the relationship between voting intentions in January and changes in environmental concern between January and August. Keeping in mind that concern as of January 2020 was controlled for, we find a significant divergence in concern for the environment for Greens voters compared to Labor voters, and between both and Coalition voters. For Greens voters, concern for the environment started off higher in January 2020 (30.0 compared to 28.9 for Labor voters and 26.2 for Coalition voters), but declined by far less between January and August (-0.72 compared to -1.4 for Labor voters and -1.3 for Coalition voters).

Without controlling for other characteristics, there is no significant difference in the change for Labor compared to Coalition voters. However, when we control for the factor that Labor voters had higher values at baseline (and that higher values at baseline are associated with a greater decline), the decline for Labor voters was less than the decline for Coalition voters.

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Table 4   Factors associated with change in environmental concern between January and August 2020

Explanatory variables	Model 1		Model 2		Model 3		Model 4	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
Index of environmental concern in January 2020	-0.22	***	-0.23	***	-0.24	***	-0.30	***
Lived in bushfire affected area			-0.24		-0.24		-0.31	
Direct exposure to bushfires			0.11		0.14		0.11	
Indirect exposure to bushfires			0.54	***	0.49	**	0.50	**
Anxious or worried about COVID-19 in August					0.33	*	0.29	*
Likely to be infected by COVID-19 in 6 months (August)					0.19		0.23	
Unable to pay rent or mortgage since COVID-19 (August)					-0.58	*	-0.49	
Would have voted Labor if election held in January							0.88	***
Would have voted Greens if election held in January							2.00	***
Would have voted 'Other' if election held in January							0.36	
Unsure of vote if election held in January							1.33	***
Female	0.36	**	0.34	**	0.30	*	0.27	*
Aged 18 to 24	-0.57		-0.62		-0.61		-0.81	*
Aged 25 to 34	-0.31		-0.28		-0.29		-0.34	
Aged 45 to 54	-0.15		-0.14		-0.13		-0.01	
Aged 55 to 64	0.19		0.24		0.22		0.40	
Aged 65 to 74	0.24		0.26		0.20		0.50	*
Aged 75 plus	0.65	**	0.64	**	0.57	*	0.97	***
Indigenous	-0.16		-0.14		-0.12		-0.29	
Born overseas in a main English-speaking country	-0.19		-0.16		-0.13		-0.25	
Born overseas in a non-English speaking country	-0.12		-0.10		-0.08		-0.10	
Speaks a language other than English at home	-0.37		-0.43		-0.41		-0.22	
Has not completed Year 12 or post-school qualification	0.47		0.49		0.56	*	0.69	**
Has a post graduate degree	-0.08		-0.12		-0.12		-0.17	
Has an undergraduate degree	0.45		0.43		0.43		0.41	
Has a Certificate III/IV, Diploma or Associate Degree	0.27		0.24		0.29		0.39	
Lives in the most disadvantaged areas (1st quintile)	0.15		0.20		0.17		0.15	
Lives in next most disadvantaged areas (2nd quintile)	0.40		0.40		0.35		0.34	
Lives in next most advantaged areas (4th quintile)	0.31		0.30		0.33		0.30	
Lives in the most advantaged areas (5th quintile)	0.35		0.32		0.29		0.31	
Lives in a non-capital city	-0.07		-0.07		-0.06		0.01	
Constant	4.57	***	4.46	***	4.48	***	5.40	***
Sample size								
Adjusted R-Squared								

Source: January, and August 2020 ANUpolls.

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Bushfire exposure and impacts

Notes: The base case individual did not report any bushfire exposure, is female; aged 35 to 44; non-Indigenous; born in Australia; does not speak a language other than English at home; has completed Year 12 but does not have a post-graduate degree; lives in neither an advantaged or disadvantaged suburb (third quintile); and lives in a capital city

Those coefficients that are statistically significant at the 1 per cent level of significance are labelled ***; those significant at the 5 per cent level of significance are labelled **, and those significant at the 10 per cent level of significance are labelled *.

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5   Concluding comments

People and countries across the world have been affected by the events of 2020. Australians have had a somewhat unique experience. Along with a limited number of other developed democracies, the level of COVID-19 infections and deaths have been quite low, even taking into account the second wave of infections that occurred in July and into August in Victoria. What is most different about Australia though is that the pandemic arrived very quickly after one of the worst natural disasters in Australia's history, with tens of millions of hectares of land burned, thousands of homes and houses destroyed, and dozens of lives lost in what has come to be known as the 2019/20 Black Summer of bushfires.

At the time of the bushfires, it appeared that overall life satisfaction in Australia had worsened, whereas concern for environmental issues increased. In this paper, we show that wellbeing declined even further during the COVID-19 pandemic (and particularly during the first wave of infections) and that concern for a range of environmental issues declined between January and August 2020.

By utilising the longitudinal data discussed earlier in the paper, however, we were able to show that variation in exposure to the bushfires and COVID-19 have led to very different patterns over the period. Those who reported indirect exposure (due to the effect of the bushfire on family/friends, smoke in the area in which a person lived, and general anxiety and worry) experienced a relative worsening in life satisfaction between April and May 2020, but a smaller decline in concern for the environment between January and August. The effects of the bushfire on attitudes and wellbeing appear to have lingered long after the last fire was extinguished.

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