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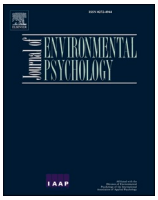

Solastalgia following the Australian summer of bushfires: Qualitative and quantitative insights about environmental distress and recovery

Samantha K. Stanley [a,*], Timothy Heffernan [b,a], Emily Macleod [a], Jo Lane [c], Iain Walker [a,d], Olivia Evans [a], Lisa-Marie Greenwood [a], Tim Kurz [e], Alison L. Calear [f], Julia Reynolds [a], Tegan Cruwys [a], Bruce K. Christensen [a], Stewart Sutherland [a], Rachael M. Rodney [g]

[a] School of Medicine and Psychology, Australian National University, Australia
[b] School of Built Environment, University of New South Wales, Australia
[c] National Centre for Epidemiology and Population Health, Australian National University, Australia
[d] Melbourne Centre for Behaviour Change, University of Melbourne, Australia
[e] School of Psychological Science, University of Western Australia, Australia
[f] Centre for Mental Health Research, Australian National University, Australia
[g] Centre for Entrepreneurial Agri-Technology, Australian National University, Australia

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ABSTRACT

People derive less solace from environments that become degraded or destroyed, which is an experience called solastalgia. In the wake of Australia's 2019–2020 bushfires, many Australians faced a markedly different natural environment: one, for example, charred by fire and void of the animals that once lived there. We examined experiences of solastalgia through individual, semi-structured interviews ($N = 22$) and a quantitative survey ($N = 592$) with members of bushfire-affected communities in Australia. In interviews, bushfire survivors described using environmental cues to understand and prepare for fire risk, and how environmental change led to emotions of sadness and frustration as well as personal and environmental regrowth and resilience. We also identified temporal aspects of solastalgia, including an anticipatory form distinguished by fears about future fires and environmental loss. Survey data showed that participants experiencing greater solastalgia reported higher symptoms of post-traumatic stress and anxiety, and feeling more anger and loss of control. Arid areas around the globe will be affected by bushfires of increasing intensity and frequency as the climate changes. Our findings provide timely insights into the likely psychological effects of such environmental change.

1. Introduction

Between July-2019 and March-2020, Australia experienced severe bushfires that damaged over 24 million hectares of land (Binskin et al., 2020). Images of raging fire fronts charring landscapes and destroying property gripped the world's attention (Mocatta & Hawley, 2020). Areas once bustling with wildlife and greenery became vacant and blackened as the fires affected up to three billion animals (van Eeden & Dickman, 2023, p. 154). Living through unwelcome environmental change can cause a form of distress that Albrecht (2005) named 'solastalgia'. Once familiar and cherished landscapes become alien to us. No longer a source of solace, the environmental transformation leads to a sense of home-sickness while still at 'home' (Albrecht, 2005). Solastalgia is experienced as a constellation of negative emotions, powerlessness to unwelcome change, and grief for the loss of one's former lifestyle and surroundings (Albrecht, 2005; Albrecht et al., 2007).

Here, we examined experiences of environmental change and solastalgia in the context of the 2019–2020 Australian bushfires. In Study 1, we explored the qualitative nature of how human inhabitants of these landscapes experienced this ecological and psychological shock. In Study 2, we explored the extent to which these experiences quantitatively varied across demographic, psychological, and experiential factors. Our goal was to use these sources of information to understand both the lived experience of bushfire-related environmental decline in participants' own words, and to gauge who is most affected by solastalgia and how it may affect their wellbeing more broadly. In the global context, worsening climate change creates the environmental conditions conducive to solastalgia. We aimed to generate timely insights from this

* Corresponding author.
E-mail address: s.stanley@unsw.edu.au (S.K. Stanley).

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bushfire context to improve conceptualisation of solastalgia and support researchers, clinicians, and communities understand and prepare for the difficulties faced by those confronted with environmental change.

1.1. Literature review

Whether caused by war, industrialization, or natural disaster, Albrecht (2005) argues that solastalgia is universally relevant for those facing environmental transformation to their home, and that it can escalate into both physical and mental health problems. It was in the context of transformation of Australia's landscape for open-cut coal mining that Glenn Albrecht (e.g., Albrecht et al., 2007) observed a form of distress that he later reflected on as solastalgia, a term that pairs the Latin words for *solace* and *pain*, while reminiscent of a form of *nostalgia*; a homesickness for the way the environment once was (Albrecht, 2005). While most investigations of solastalgia have been qualitative (Galway et al., 2019), quantitative assessment of solastalgia was enabled by Higginbotham et al.'s (2006) development of the Environmental Distress Scale. A subscale from this measure asks about solastalgia experiences (e.g., feelings of sadness about the unwanted environmental change), and those in degraded environments report substantially higher scores than those in environments that are not experiencing desolation (Higginbotham et al., 2006).

Investigations of solastalgia following fire are scarce. Eisenman et al. (2015) found through survey research that those experiencing solastalgia suffered greater psychological distress one year after Arizona wildfires. Also using survey methods, Leviston et al. (2023) identified that poorer wellbeing as a result of greater exposure to Australian bushfires was mediated by solastalgia, suggesting it may be a risk factor for poor wellbeing post-bushfire. In interviews about measures to reforest fire-affected Californian land, forest owners described intense emotional impacts relating to the loss of their forests, including a "sorrowful nostalgia" (p.32), and a desire to quickly restore the forest (Waks et al., 2019). The strong yearning for a changed environment to resemble how it was in the past illustrates a temporal component of solastalgia. Together, this research points to the potential for large bushfires to cause solastalgia that affects long-term wellbeing and may have a future-looking quality.

Environmental change can disrupt long-standing feelings of past connections to an area. Place attachment has an important temporal quality (Askland & Bunn, 2018) that can trigger past memories and personal connections to place that contribute to self-conceptualisation in the present (Wright, 2012). When disrupted by unwelcome change, feelings of grief, homesickness, worry and disconnection can follow, which can be exacerbated by a concurrent decline of the usual coping resources from one's environment (Brown, 2023, pp. 1–17). It follows that climate change and increasing climate-related disasters can fuel ongoing feelings of dread and worry about unwanted future environmental change, which can bear negatively on place attachment, belonging and wellbeing (Ellis & Albrecht, 2017; Phillips & Murphy, 2021).

There are increasing concerns about the mental health effects of environmental change, including the emotional impairments caused by a mere awareness of climate change (Cianconi et al., 2020; Clayton, 2020; Hickman, Marks, et al., 2021). However, research on the emotional responses to climate change and environmental disasters (referred to as 'eco-emotions', e.g., Stanley et al., 2021), and on solastalgia specifically, are still in their infancy (for reviews, see Galway et al., 2019; Pihkala, 2022). Solastalgia is not a mental illness, but the experience correlates with symptoms of mental health conditions, including depression (Khan et al., 2012), anxiety (Elser et al., 2020), and general psychological distress (Eisenman et al., 2015).

Post-traumatic stress disorder (PTSD) is a disorder characterized by significant distress following a traumatic event. People with PTSD experience recurrent thoughts and nightmares about the traumatic event that are accompanied by emotional and physical reactions, avoidance, and feeling easily startled (Hansen et al., 2010). PTSD is often studied in relation to disaster (Bonanno et al., 2011; Norris et al., 2009) and, more recently, solastalgia relating to climate change (Luce, 2021). Whereas PTSD is typically oriented towards the past (i.e., traumatic events), anxiety is typically oriented towards the future (i.e., avoiding anticipated negative events). Overlap between solastalgia and PTSD could occur as people look back on the events that have reshaped their environment and feel distress. However, solastalgia may also be concerned with an anticipation of future unwelcome change (Higginbotham et al., 2006). Thus, in the context of ongoing environmental threat that triggers anticipatory emotions (e.g., Böhm, 2003), solastalgia may be experienced alongside anxiety symptoms. Research on the association solastalgia has with mental health has typically conceptualized solastalgia as the driver of poorer wellbeing (e.g., Leviston et al., 2023), consistent with Albrecht's (2005) theory that solastalgia can escalate to mental health problems.

Solastalgia is also experienced with feelings of powerlessness and a lack of control over the changes gripping one's environment (e.g., Albrecht et al., 2007; Askland & Bunn, 2018; Phillips, Murphy, & Bresnihan, 2022), as well as frustration and betrayal that those with the power to protect the environment failed to do so (e.g., Phillips & Murphy, 2021). The heightened intensity of the 2019–2020 fires was widely attributed to climate change, about which many Australians feel the government has not done enough to mitigate (Hickman et al., 2021). Others pointed to a diverse range of land management bodies and practices, such as expressing frustration about insufficient management of fuel loads leading to more severe environmental change. These frustrations may also be part of the solastalgia experience, which Albrecht et al. (2007) says encompasses a "negative affect that is exacerbated by a sense of powerlessness or lack of control over the unfolding change process" (p. S95).

Climate change is now unfolding in front of us, and yet we know little about the lived experience and flow-on effects from the shock and distress from experiencing unwelcome change connected to climate change. Climate-induced disasters are irrevocably altering the natural environment, and with it, people's connection to and their solace and wellbeing derived from place. Together, the solastalgia literature indicates that solastalgia is a complex and multi-faceted experience, likely characterized by negative emotions (including powerlessness and grief), disrupted place attachment, and longing for the environment of the past. However, solastalgia remains a new concept that has rarely been examined in relation to climate change-related environmental losses, and there are calls to clarify its features through additional qualitative and quantitative investigations of environmental loss (Galway et al., 2019).

1.2. Current study

We contribute to this call by investigating the key commonalities and variabilities in the experiences of solastalgia by Australians with lived experience of bushfire-related environmental change. We incorporate a novel focus on temporal components of solastalgia in these analyses in acknowledgement of the escalating risk to Australian landscapes as climate change intensifies fire seasons (Lindenmayer & Taylor, 2020). We first qualitatively map the nature of these solastalgia experiences in Study 1. In Study 2, we use quantitative methods to generate new insights regarding who is at risk of experiencing solastalgia (associations with age, gender, and socioeconomic factors are currently under debate; Galway et al., 2019), how objective (e.g., loss of property) and subjective (grief for wildlife losses) bushfire impacts differ in their relation to solastalgia, and the strength of solastalgia's relationships with psychological variables, such as the (typically past-oriented) experience of PTSD, and the (typically future-oriented) experience of anxiety. This convergent parallel mixed methods design allows us to draw distinct yet complementary insights about solastalgia by accessing a) the qualitative nature of how solastalgia is experienced, and b) the extent to which the

quantity of these experiences varies as a function of psychological, experiential, and demographic factors.

2. Study 1

2.1. Introduction

In our first study, we aim to depict what solastalgia feels like by presenting the main ideas that bushfire-affected participants shared about environmental loss. Our aim was to use their words to convey a rich and vivid sense of the lived experience of this environmental change. This addresses a specific need to clarify the distinguishing features of solastalgia that Galway et al. (2019) identified in their review of the solastalgia literature. To do so, we examined interview transcripts that touched on multiple topics including health, wellbeing, coping, and resilience during and after the bushfire season. The specific question guiding our analysis of these data was: what are the characteristics of bushfire survivors' experiences of unwelcome environmental change? Interview content was, therefore, only considered relevant to this research if it concerned environmental change (e.g., sadness about the bushfire experience broadly was omitted, but sadness about the loss of special nature places was relevant).

Through this study, we examined features of solastalgia that have been documented through investigations of other environmental crises, such as grief and sadness, feelings of powerlessness and frustration, and descriptions of cherished places lost (e.g., Albrecht et al., 2007; Connor et al., 2004; Phillips et al., 2022). A lived experience of environmental desolation has been a key element of definitions of solastalgia (Albrecht, 2005), yet recent research presents the possibility of an anticipatory form capturing present distress about future environmental losses (Stanley, 2023). We believed that the extraordinarily severe 2019–2020 Australian bushfires were an ideal case study to elucidate the temporal qualities of solastalgia. The Royal Commission that examined this event stated that "… what was unprecedented is now our future" (Binskin et al., 2020, p. 6), illustrating the trajectory of increasingly severe bushfire in Australia and the potential of both past-focused and future-oriented distress about environmental change. To our knowledge, these temporal elements of environmental distress are yet to be examined in the context of solastalgia.

2.2. Method

2.2.1. Participants

Authors 2–4 interviewed 22 bushfire-affected participants (P1–P22) living across 13 postcodes in two states. Participants' mean age was 51 years ($SD = 11$), 77% identified as women and 23% identified as men. The majority (95%) lived in regional Australia and in areas with low (decile 1–3; 55%) or medium (decile 4–7; 45%) socioeconomic advantage (deciles range from 1 – most disadvantaged to 10 – most advantaged; Australian Bureau of Statistics, 2016). Regarding their highest educational qualification, 36% of participants had a postgraduate degree, 23% had an undergraduate degree, 23% had a certificate or trade qualification, and 14% a highschool certificate. Ethical approval was provided by the Australian National University Human Research Ethics Committee (2020/591).

2.2.2. Measures and procedure

Interviews were semi-structured and invited participants to share their bushfire experiences and what helped (and hindered) their preparations, response, and coping. The full interview schedule is included in Table S1. For this study, we analysed sections of interviews where participants discussed environmental change. This was often in response to the prompt: "How do you feel about what happened to the environment?"

2.2.3. Analysis method

We followed Braun and Clarke's (2006) six phases of thematic analysis, approached from a realist perspective, treating participants' accounts of their experiences as direct reflections upon those experiences (rather than as accounts produced for particular situated

Table 1
Themes and codes relating to the experience of environmental change as discussed by bushfire-affected people.

Themes and codes	Meaning
Evaluation of fire risk	
Looking to the environment for warning signs	Signs in the environment warn of a bad fire season or oncoming fire.
Greenery as protection	Green areas provide comfort and reassurance.
Fear of future disaster	Concerns about further changes to the environment, sometimes presented as *anticipatory solastalgia*: distress in the present about expected future environmental losses.
Emotion and loss	
Negative eco-emotions	Negative emotions or loss of positive emotions experienced in relation to environmental loss.
Loss of special places	Places that held special meaning lost to the fires.
Loss of idealised view of place	Only saw the value and beauty in place, not its potential harms and dangers.
Lost and displaced wildlife	Moved by the impacts to native animals.
Betrayal and powerlessness	
Fire load mismanagement	Feelings about those who failed to protect the environment, despite having the power to do so, which they blame for the severity of the fires and damage caused. Either presented in relation to concerns about fire load mismanagement or climate inaction.
Inaction on climate change	
Descriptions of environmental change	
Landscape degradation	Descriptions of areas destroyed or burnt.
Regrowth as recovery	Witnessing the environment recover from the fires.
Regrowth but *not* a return to normal	As the environment recovers and greenery returns, it has changed from how it once was.
Long and uncertain time course of recovery	Environment will take a long time to return to how it was, if it recovers at all.
Distress about fire management strategies	Solastalgia relating to intentional environmental changes to manage fire risk made or considered since the 2019-2020 fire season.
Seeking solace in nature	
Seeking out blue and green spaces as sources of solace	Restoring wellbeing by spending time in nature areas unaffected.
Avoiding affected areas	Protecting themselves by avoiding burnt areas.
Protecting the environment as recovery	Taking action to protect the environment to manage distressing emotions or in response to bushfire experience.
Helping native animals recover	Helping native animals recover (e.g., bringing water to kangaroos in affected areas).

social-interactional purposes within the interviews). First, all authors familiarised themselves with the data by reading several transcripts each. Next, the first author compiled key ideas relevant to our research question across the first 10 interviews following a largely inductive approach: development of codes and themes were directed by what we identified in the data, rather than pre-determined from the literature review or theory. Next, the initial codes, theme definitions, and representative quotes were shared with the wider authorship team for feedback. A refined codebook was then developed and updated by having the first author read and code all transcripts using NVivo (1.7.1 Mac version). The final themes and codes are presented in Table 1 along with their definitions. We then discuss them with illustrative quotes. For a minority of quotes, we made grammatical edits to improve clarity.

2.3. Results

2.3.1. Evaluation of fire risk

Participants used environmental cues in the lead up to bushfire to understand their fire risk. Although this theme is not typically included in definitions of the components of solastalgia experiences, the content shows the deep connection to place experienced by participants, with place attachment being central to solastalgia (Albrecht, 2005). It also establishes relationships with the environment in a temporal sequence: before, during, and after the fire front passed. Evaluation of fire risk included *looking to the environment for warning signs*. Participants recalled ordinarily green pastures turning brittle from drought and kindling accumulating on hillsides: "just looking over the bush and seeing all the really brown patches in the canopy … pretty much from then I knew that we were going to have a really bad fire season" (P1). Drought left the bush "as dry as anyone had ever seen it in their whole life" (P16), so that "you could walk on the grass and it was crunchy - whatever was left of it" (P11). P7 summarised the conditions as "the perfect storm for the fire".

Some participants watched the fire front approach, such as P8, who said: "where we live, we look over to the hills. And we could see all the hills on fire around us." This sometimes manifested as high vigilance: "when one of us was sleeping, the other looked out for things like burnt leaves or embers" (P3). A unique feature of the 2019–2020 bushfires was the smoke- and fire-induced thunderstorms. P10 witnessed this phenomenon and described seeing "the pyro-cumulonimbus clouds. The fires creating their own weather patterns", which were "pretty daunting and humbling to see … there is a sense of foreboding that comes with that."

Participants also described stretches of green areas as sources of assurance that they were safe: *greenery as protection*. P1 described the "green valley in between us and the majority of the bush in the west" that meant they "knew that we weren't in immediate danger." However, P21 expressed their frustration that others held this view, describing people's false assurances that "the bush is green. It's not going to burn". To them, green growth signaled places that will burn in the future: "we've got lots of green growth … Where do you think the next fire will be? And people start to pale".

Following the fires, these warnings link to the *fear of future disaster*. P3 shared: "that's the scary thing, I think. That we've never seen anything like that, and it will happen again." Participants expressed concern about further bushfires and changes to the environment, such as: "we're also quietly nervous because it's all regenerating and it's just like I don't want to be here for the next one … nothing's going to get out of it alive." (P14). Others warned that "these fires will come back in two years. All this rain's giving it wonderful fuel." (P19), and "as soon as it dries out - look out" (P2). While many of these concerns centered on the safety of people and property to future bushfires, some were concerned that a future fire will affect "so much more forest. It will just decimate all the animals" (P14). These concerns can be seen as representing a future-oriented form of solastalgia. For example, P21 said: "if you thought 2019 was bad, wait for the end of the next 10-year drought and see what happens then … Awful. And we live in paradise." P4 talked about nature reserves that were so special to them, now twice affected by fire, and worried that "you just think a lot of it won't come back. If there's another big fire, that'll be it." Fear of future disasters affecting cherished environments may manifest in a future-oriented solastalgia: distress felt in the present about expected future environmental losses.

2.3.2. Emotion and loss

We also encountered affective components of environmental loss that are characteristic of solastalgia, including *negative eco-emotions*. The range of eco-emotions was vast, including feeling sad, depressed, distressed, devastated, horrified, and angry. P5 described feeling "a grief for the loss of the bush", and P17 described their experience as "profoundly disturbing to see the nature, the scale, the significance of harm and loss." Emotional impacts left some participants in a heightened emotional state. While P4 clarified that they are "not a person that cries", they did "a lot of crying during that period because … I was just so upset about the National Park". P19 described having to hide away because "what's happened to the planet makes me sad and makes me cry". Their reflection on the situation: "the only sane reaction to an insane world is to … feel this way. Not to make a peace with it." Their view reflects growing acknowledgement that negative eco-emotions are rational responses to environmental decline. They elaborated that, in their view, paying attention to environmental issues ought to provoke emotional responses:

> "If you're doing it right you should be alienated and you should be battling with confidence and depression and all of that. If you're doing it right. If you're fully connected to this planet, that's how you should be." (P19).

Emotions can motivate action on environmental issues; however, several participants described losing hope or developing a newfound pessimism. P1 said: "I used to be a little bit hopeful. And I don't think that I'm hopeful anymore". P3 described feeling "so pessimistic about the future … these dystopian movies, that's where we're going to end up." The perceived inevitability of environmental decline also affected P16, who used to be an environmental activist but "after the fires I just felt like this is it. Climate change is here. It's all over, red-rover. And I felt an absolute apathy towards trying to do any of that kind of work in my life."

Some expressions of eco-emotions were accompanied by descriptions of the *loss of special places*. P4 recounted feeling distressed and anxious, and when describing a special place in nature (their "soul place") that was destroyed, said: "I just found [it] horrific because it's my place in the world that I really love … to see it just being devastated by the fire was just totally horrific." They described the loss as "heart wrenching". Recounting the beauty of a local tiered waterfall, P21 commented, "We looked down the gorge and there was nothing. There were just rocks and burnt trees as far as you could see". P19 described many special places near their property, set within a surrounding National Park. They watched from a distance while "from right to left [their mountainside] was on fire … throwing out embers that were hitting the crowns of treetops 100–200 metres ahead and exploding like big artillery shells." In the morning they heard their property was lost to the fire, and "by then I'd decided I hoped it [my property] was all gone anyway, because where I lived was paradise."

Loss of idealised view of place captures the blinkered experience of place, seeing only its value and beauty prior to disaster and overlooking its potential harms and dangers. This idea, to our knowledge, has not been identified within the solastalgia literature before, but it arose throughout our interviews with participants distressed about the environmental change. By the end of the prolonged fire season, for example, P14 and their partner "were both ready for the house to burn down. Like it didn't feel like home anymore." P17 described the fires as "hell being visited upon me. And all of my assumptions about my safety and the integrity of these most ancient of forests was blown up." P7 also experienced this firsthand and "for the first time, started Googling about

moving", suggesting that a shock to place disrupts people's attachment to their home environment. Several participants shared a contrasting view that "if you live in that sort of environment, you've got to … take the good with the bad" (P13), and as a matter of fact, "it is a severe fire danger area. But that's it, you either love it or you don't live here. Easy." (P21). However, P22 had a similar stance before losing their home and facing the stark difference between "that abstract concept of risk versus reality".

Several participants remarked on witnessing a loss of idealised view of place among community members who had moved to rural areas for a 'tree change', without realising the danger and ferocity of a large bushfire. P14's community had recently seen an influx of people moving from cities to live in the "nice area", but they warned that "it's not so nice when those sorts of things happen." According to P1, "people don't realise that they've moved into a community where there are landscape scale fires, that will threaten homes and threaten lives" and the bushfires "affected people's sense of connection to this area" by forcing them to grapple with a reduced sense of safety and the realization of risk. P7 described it as "really quite surreal that people couldn't see the danger" and P14 expected that people would now "re-think living in a forest".

Participants also described their loss in relation to *lost and displaced wildlife.* The bushfires had profound impacts on native animals and ecosystems. Many witnessed these impacts directly, encountering kangaroos that had perished as they "tried to escape the fire" (P4). They described their distress about areas once busy with wildlife now sparsely populated: "when I go into the bush, I don't hear birds… That's one of the reasons I moved here" (P7). P2 described the event as "an extinction fire". While there used to be thousands of kangaroos in the hills behind their property, "None of them are left. It's wiped out the whole ecosystem." P4 found it confronting to see country that "was full of life and now there's nothing." P21 encountered for the first time "No bird song. No scuffling in the ash. Nothing. No butterflies. Dead silence", and for them, "the hardest thing was to see the loss of the bush and the animals—the silence."

Several participants commented on the migration of animals, such as "wombats [now] living in town" and black cockatoos that never used to be in the area now "dependent on all the unburnt bush down here" (P7). Two participants recounted small unburnt areas where animals relocated to after the fires. P16 described a relative's property where, after the fires, "you couldn't hear one bird", yet they found animal life in one small patch of bush that survived the fires: "there were so many animals in that little bit of bush … at least some had survived." Similarly, P17 had "thought that the yellow-bellied gliders [*Petaurus australis*] would become extinct and about six months after the fires, I heard them", eventually finding that "they've moved into the 1,000 acres that we kept." Others noticed animals returning to affected areas, but in limited numbers and many months after the fire: "it was only … maybe six months ago I saw the first goanna and echidna come through that we used to see all the time. So that was encouraging but also you know, really sad over quite a long period where it was just so dark, so black." (P13).

2.3.3. Betrayal and powerlessness

The perception that others failed to protect the environment and avert devastation, despite them having the power to do so, was raised in ways reminiscent of classic findings in solastalgia (e.g., Phillips et al., 2022), though the sources of betrayal identified are unique to this bushfire disaster. A common theme was the view that those with lived experience were not heard in the lead-up and aftermath: "the government or whoever is [the] responsible agency, need to come back and listen to the people on the ground" (P21), "they are not listening to people or valuing people's opinions or their insight" (P20). Nevertheless, there were diverging opinions about who was to blame: climate inaction, or fire load mismanagement, yet our interviews reveal that both sides had in common the feeling that their voices were not heard, and that leadership failures led to more severe environmental change. Many felt that the severity of the fires was caused by *fire load mismanagement*, such as P2: "it's mismanagement of the forests, wilderness areas. The mistake they made, and we've been telling them for bloody years, probably 30 years … We can blame it on climate change. It's not to do with that." The remnants of fire reminded them of their frustration that "Something that you know, I've worked with 50 plus years and to see it brutalised in that manner". There was a view that "they just let the bush run [grow] rampant now" (P18) and community voices were not heard: "despite the fact we're saying, 'we need a controlled burn' … that's why the intensity of fire was so great" (P11).

Other participants raised similar concerns about feeling betrayed in regard to *inaction on climate change*. These participants attributed the severity of the bushfires to human-caused climate change, expressing frustration that "as a species, we are the makers of our own desolation." (P21) and "we're literally at an exponential level making our future much, much, much more dangerous" (P17), with the anthropogenic nature of the problem making P4 "a little bit anti-people sometimes." P3 felt then-Australian Prime Minister, Scott Morrison, bore responsibility: "I'm still angry at the Prime Minister that just doesn't get it and there's nothing I can do about that". While some expressed their view that these disasters will not be avoided until climate change is addressed: "it's not until we actually reduce our carbon load that that's going to be, you know, kind of dealt with" (P11). Others were more pessimistic, "climate change. It's too late. Even if we did everything we said we're going to do, it still wouldn't change a fucking thing" (P19).

2.3.4. Descriptions of environmental change

Many participants shared descriptions of areas close to them that were destroyed or burnt, which we coded as *landscape degradation*. These stories make clear the total devastation of the fires, wiping out every mature tree in P2's valley, and leaving "nothing left except the steel" of their farm in what they described as "a purge":

> "It was everything. There was nothing under the trees. The trees were all dead obviously, blackened from the forest so there were no leaves. But it had burnt everything on the forest floor. So it looked for all the world like somebody had gone through with a vacuum cleaner and just completely cleaned everything."

Once familiar landscapes ultimately changed shape, leaving a hill line of "sharp points of dead tree" (P5), "like the mountains have had a bad haircut" (P3). P11 shared that walking through their garden that was previously "beautiful … like a big park", after the fires "it was just ash and dust and stuff". For P16, it was "just so shocking every day to see that scale of environmental damage". P14 described the landscape blackened for about half a year, "you'd just look out and go that's just horrible. It's disgusting. Like the trees were all burnt. There was no green. We were like, 'Are they ever going to come back?'"

By contrast, several participants talked about the return of green growth. Some of these stories of environmental recovery reflected the idea of *regrowth as recovery*. P3 described that in a matter of months, "you drive through and it's just green everywhere." P11 noticed a similar change, and that while the environment was damaged, there was "Brilliant resilience. Stuff started to grow back. So three weeks after the fire it bloody rained. The dam was full and the grass was green. You wouldn't have known." Others explicitly linked the recovering landscape to their own recovery:

> "As much as it was a dark, difficult time. I clung onto the hope and knew with the newness of life … other things would spring forth. And some of the greenery that was coming out from some of this black darkness, was such a contrast and so bright, so vibrant. It just gave me a real sense of … that inner fight and community coming together and being able to move forward. That despite the obstacles or the pain, that you can actually succeed and grow and spring forth." (P13).

Others perceived environmental change as *regrowth, but not a return*

to normal. New plant life returned, but the environment was still changed. The bush "comes back, but it doesn't come back the same" (P4), and "it hasn't recovered that well, if you actually look properly" (P7). Instead, "it's fucked. Just because it's green doesn't mean it's good" (P19). A common concern was the regrowth of weeds and Wattle trees (*Acacia*), the latter unprecedented: "I've seen fires go through before, but I've never seen Wattle grow like it." (P2). Participant 15 described "the most obscene amount of weeds. Really nasty, insidious weeds".

Several participants shared their sense of the *long and uncertain time course of recovery*, that the environment will take a long time to return to the way it was - if it recovers at all. Some believed "it'll never be the same again" (P20), or it won't happen in their lifetime: "it'll take 100 years before we'll ever get to see what the mountains were like again. You know, you've got to regrow it all and we've got to start from scratch." (P2). Of the ecosystems in their nearby National Park, P17 said "in all honesty, they're not coming back in my life. They're not coming back in decades, centuries, and potentially millennia, if ever." P17 shared that "koalas need about 20–25 years of stable, healthy habitat to regenerate. We only got two years of stable climate to create that." The lack of wildlife was something that some participants noticed daily and shaped their view that "it's not recovered at all, by any stretch of the imagination." (P16).

Bushfire damage was not the only source of environmental distress. Some participants described *distress about fire management strategies*. Strategies like clearing trees and backburning also change the landscape and, for several participants, mean "you lose some of why you live here" (P14). P7 remarked that "you seriously just hear chainsaws. Every weekend, all the time" as people cleared their blocks. Their decision to keep their trees while others "razored clear and turned into lawn" was causing conflict to the point where they considered leaving the community, which no longer has the environmental features that drew them to the area: "it's lost its essence". Similarly, P8 said that when land close to their property was cleared, they "lost all of our bird life" and shared that if the clearing continued, "we would have to look at moving because it's not why we moved here".

2.3.5. Seeking out solace in nature

Some participants also discussed their engagement with the environment after the fires, such as *seeking out blue and green spaces as sources of solace*; restoring their wellbeing by spending time in areas that were not bushfire-affected or since recovered. For P3, this involved "spending more time in the garden", and P4, exploring new places, including visiting "a magnificent rainforest … when you go to those places, they just completely renew your … whole being really". Moderating their engagement with nature by *avoiding affected areas* was another strategy. P4 described eventually visiting an area "I sort of had been avoiding because I just didn't really want to see what it looked like". Seeking areas with "greenery to look at" was another way to avoid the burnt areas, including "that oversaturation of those smells and sounds, and memories." (P13). Similarly, P17 said "whenever I'm in burnt country I just need to get into the unburnt. Because the mission, the greatest mission now is to protect the unburnt."

Some participants took action through *protecting the environment as a form of recovery.* The fires sparked a newfound urgency for environmental protection: the bushfires "made me go to Canberra [the national capital/seat of parliament] and protest", marking the "first time I'd actually got off my arse and done it" (P7). P17 began working in conservation "because we need to, because we're otherwise facing catastrophic fallout". Related to this, some took steps towards *helping native animals recover,* such as through citizen science programs to monitor wildlife, volunteering with rescue groups, and going out to feed and provide water to native animals in bushfire-affected areas. In some communities, this was a shared effort, and P4 encountered "lots of people … like-minded people who were down at the inlet, taking water and food over for the animals … like-minded people who were there burying the kangaroos on the beach". P19 described their longstanding commitment to wildlife rescue. Speaking of future generations and native wildlife, they said: "They're the victims of what we've done, not us. So that's where my resilience comes from".

2.4. Summary

These rich descriptions of bushfire survivors' experiences highlight the profound emotional, behavioural, and attitudinal impacts of this environmental disaster. They also show the impacts of environmental change on connection to place. The unique setting of Australia's 2019-2020 Summer of Bushfires allowed us to identify temporal aspects of solastalgia: participants described using environmental cues to understand their risk in the fast-changing situation prior to the fires, and environmental cues as markers of disaster to come as anticipatory solastalgia. This is important for understanding disaster recovery, which may follow a different trajectory where solastalgia is felt both in regard to past change and feared future changes. Many participants felt that authorities ignored the community's views, which ultimately contributed to the devastation (both environmental and psychological). The source of blame and perceptions of the right course of action were contested, though a sense of betrayal and powerlessness was nevertheless similar for all. This is reminiscent of the characteristic frustration and powerlessness that Albrecht et al. (2007) heard from residents experiencing solastalgia in relation to open-cut coal mines transforming their environment.

3. Study 2

3.1. Introduction

Study 1 provides in depth insight into the ways that solastalgia is experienced, though to understand and prepare for the psychological toll of environmental change, we need information about individual differences in the strength of the experience, which demographic groups are more at risk of solastalgia, and how strongly the experience relates to other aspects of wellbeing. These insights are key gaps in our current knowledge of solastalgia (see Galway et al., 2019) and are best addressed with quantitative research.

In Study 2, we contributed to the scarce literature in four additional ways. First, regarding who is at risk of solastalgia, some researchers have proposed (but not tested) that solastalgia is higher among groups generally more vulnerable to environmental change: specifically, women (e.g., McNamara & Westoby, 2011) and young people (Galway et al., 2019). However, gender comparisons are limited, and two studies reveal higher solastalgia in older age (Fuentes et al., 2020; Phillips & Murphy, 2021). Galway et al. (2019) also questioned, but did not test, whether social class and access to resources shape solastalgia experiences.

Second, regarding psychological variables, we expected solastalgia to be associated with greater symptoms of anxiety (future-oriented) and PTSD (past-oriented). Anxiety associations would replicate past research (e.g., Leviston et al., 2023) and the PTSD association is novel to the bushfire context (Luce, 2021). Because solastalgia is experienced with feelings of powerlessness (Phillips & Murphy, 2021), we predicted positive associations between solastalgia and anger at others and perceived loss of control.

Third, regarding experiential variables, we acknowledge solastalgia is not simply caused by exposure to environmental degradation (Higginbotham et al., 2006), but that the *perception* of environmental change is more important than objective exposure (Connor et al., 2004). Despite this, we examined how objective impacts of bushfire, such as the loss of property and community buildings, independently relate to solastalgia, and we expected small associations between these objective impacts of bushfire and solastalgia. One impact unique to this disaster is the scale of wildlife loss. We predicted a positive association between grief for

animal loss due to the bushfires and solastalgia, which to our knowledge has not been examined before.

Finally, we expected certain perceptions of the causes of the fires would be associated with solastalgia. This prediction was based on theoretical links between heightened solastalgia and a perception of betrayal from authorities (e.g., Albrecht, 2005). Specifically, we expected people who attributed the fires to ineffective land management or to climate inaction would report higher solastalgia, though we did not predict associations with other attributions (e.g., drought, wind conditions).

3.2. Method

Between January and May of 2021, we recruited 3,083 adults who lived in Australia during the 2019–2020 bushfires, via postal invitation, news, radio, and social media advertisements, and via panel aggregator Qualtrics (for full details of the survey, see Macleod et al., 2024). Participants were asked to complete the solastalgia measure if their postcode identified they were living in a bushfire-affected area or if they were involved in fighting the fires. Our sample for the current project comprised the 592 participants who completed the solastalgia items in full, of whom 55.6% identified as women, 43.6% identified as men, 0.5% preferred another term, and 0.2% preferred not to disclose their gender. Ages ranged from 18 to 86 ($M = 42.52$, $SD = 15.84$). The median education level was having completed some college or university, and the median household income level was AUD$65,000–90,999 per year. We computed mean scores for multi-item measures after removing 'does not apply' or 'prefer not to say' responses. Missing data were managed using listwise deletion. The study was not pre-registered. Further details are available at the study website: https://psychology.anu.edu.au/research/projects/australian-national-bushfire-health-and-wellbeing-study-bushfirestudy.

3.2.1. Solastalgia

Solastalgia was measured using the Brief Solastalgia Scale (Christensen et al., 2024), developed from Higginbotham et al.'s (2006) Environmental Distress Scale. Participants rated how their local environment changed after the 2019–2020 bushfires by responding to the following items (α = .86) from 1 (strongly disagree) to 5 (strongly agree).

1. I am worried that aspects of this area that I value are being lost.
2. I am upset at the way this area looks now.
3. My lifestyle is being threatened by change in my local area.
4. Unique aspects of nature that made this place special are being lost forever.
5. I am saddened by unwelcome change I see in my landscape.

3.2.2. Demographic correlates

Demographic correlates included age (continuous), gender, and socioeconomic status, which included highest level of education (8 levels, from no formal education to PhD, Masters degree or equivalent), household income for the 2018–2019 financial year (i.e., before the bushfires, with 7 levels), job status (by converting main job from 0/low status to 100/high status using the Australian Socioeconomic Index, McMillan et al., 2009). The five-item Financial Threat Scale (FTS5, α = .93; Marjanovic et al., 2013) captured subjective financial stress (e.g., "How much do you feel threatened financially") from 1 (not at all) to 5 (extremely or a great deal). On average, the sample reported some financial stress ($M = 2.77$, $SD = 1.08$).

3.2.3. Mental health

Mental health was measured using the Generalised Anxiety Disorder 7-item scale (Spitzer et al., 2006) to capture *Anxiety* (α = .92), where participants rated the extent they experienced symptoms such as "feeling nervous, anxious, or on edge" in the past two weeks, from 0 (not at all) to 3 (nearly every day). We used the 8-item (α = .92) PTSD-8 (Hansen et al., 2010) to measure *PTSD symptoms* (e.g., "Recurrent thoughts or memories of the event"), rated from 1 (not at all) to 4 (most of the time).

Table 2
Psychological variables: Descriptive statistics and Kendall's tau b associations with solastalgia.

	M	*SD*	Solastalgia association
Anxiety	1.16	0.80	$\tau b = .10$, $p < .001$
PTSD	2.29	0.81	$\tau b = .23$, $p < .001$
Anger	2.15	1.05	$\tau b = .18$, $p < .001$
Loss of control	1.83	1.04	$\tau b = .17$, $p < .001$

3.2.4. Anger

Anger was measured by rating from 1 (not at all) to 4 (most of the time): "Feeling angry at others for what happened".

3.2.5. Perceived lack of control

Perceived lack of control was measured using the first item from the Perceived Stress Scale 4 (Cohen et al., 1983): "Unable to control the important things in your life" from 1 (Never) to 5 (Nearly always).

3.2.6. Bushfire impact

Bushfire impact was measured by asking participants whether they experienced (1) or not (0) six impacts listed in Table 2.

3.2.7. Grief for wildlife

Grief for wildlife was measured with the item, "I grieve the loss of wildlife caused by the bushfire", from 1 (strongly disagree) to 5 (strongly agree).

3.2.8. Perceived causes of fires

Perceived causes of fires were measured by asking participants to select whether they believed the following factors were associated with the intensity of the bushfires (1) or not (0): drought, strong winds, land management, climate change, extreme heat, housing or buffer zones, each used as single items.

3.3. Results

Our sample reported experiences across the full range of solastalgia (1–5), with $M = 3.29$ and $SD = 0.93$. Although there is no recommended cutoff to mark high levels of solastalgia, 158 participants (27%) averaged 4 or above on the 5-point scale. We computed Kendall's tau b (τb) correlation coefficients where the correlate was an ordinal variable, and point-biserial correlation (r_{pb}) or standardised regression coefficients (β) when examining associations between binary variables and solastalgia.

Of the demographic variables, older participants ($\tau b = .12$, $p < .001$), those experiencing more significant financial stress ($\tau b = .10$, $p < .001$),

Table 3
Standardised regression coefficients where solastalgia is regressed on experiences of objective bushfire impacts.

Bushfire impact	Independent effect on solastalgia
Felt life was in danger ($n = 82$)	$\beta = .02$, $p = .669$
Home lost or damaged ($n = 163$)	$\beta = .06$, $p = .160$
Still displaced ($n = 94$)	$\beta = -.04$, $p = .342$
Voluntarily evacuated ($n = 153$)	$\beta = .08$, $p = .056$
Forced to evacuate ($n = 126$)	$\beta = .07$, $p = .095$
Lost or damaged community building(s) ($n = 232$)	**$\beta = .18$, $p < .001$**

Note. Community buildings include: place of worship, workplace, child's school/preschool/daycare, relative/friend's house, homes or other buildings (e.g., shopping centre) in suburb.

and with higher educational attainment ($\tau b = .17$, $p < .001$) reported higher solastalgia. We found no significant relationship between solastalgia and binary gender ($r_{pb} = .08$, $p = .058$), job status ($\tau b = .04$, $p = .385$), or income group ($\tau b = .04$, $p = .191$).

Of the psychological variables, we found that those experiencing greater solastalgia also experienced higher symptoms of anxiety and PTSD, more anger at others for what happened and feelings of loss of control (see Table 2).

We conducted a multiple linear regression to understand how the objective impacts of bushfire predict solastalgia ($R^2 = .06$, $F(6, 585, = 5.98$, $p < .001$). Table 3 shows that lost or damaged community buildings was the only impact with a unique relationship with solastalgia, and this association was weak, thus objective exposure only slightly relates to the subjective solastalgia experience. Solastalgia was more strongly associated with grieving the loss of wildlife post-bushfire ($\tau b = .46$, $p < .001$), which participants reported on average some agreement with ($M = 3.73$, $SD = 1.13$, on a 1–5 response scale).

Multiple linear regression ($R^2 = .08$, $F(6, 585, = 7.85$, $p < .001$) also revealed that participants reported greater solastalgia when they attributed the fires to drought ($\beta = .13$, $p = .006$, $n = 357$), climate change ($\beta = .12$, $p = .004$, $n = 323$), and strong winds (i.e., propelling flames; $\beta = .11$, $p = .008$, $n = 75$), and solastalgia was *not* predicted by the attribution to land management ($\beta = -.02$, $p = .709$, $n = 275$), extreme heat ($\beta = .05$, $p = .342$, $n = 308$), or housing or buffer zones ($\beta = .03$, $p = .510$, $n = 345$).

3.4. Summary

In Study 2, we identified that some demographic groups report feeling solastalgia more strongly than others. Although women and young people are thought to be more vulnerable to the experience, we found that older people, those with higher education, and those under financial stress, reported higher solastalgia, and we found no significant difference between men and women. As expected, we also found that more intense experiences of solastalgia were associated with greater symptoms of anxiety, PTSD, anger, and loss of control. Solastalgia was slightly higher among those who suffered losses to community buildings in the fires, and those who more strongly grieved the loss of wildlife. Conflicting with our assumptions about climate inaction and fire load mismanagement predicting increased solastalgia due to the narratives surrounding (in)action from authorities worsening the fires, we found that attributions to climate change, drought, and wind, uniquely related to increased solastalgia.

4. General discussion

Through in-depth interviews and a community survey, our research identified that the 2019–2020 Australian bushfires present a unique case study of solastalgia. First, the scale of disaster and its impacts were unique. Our survey data showed little correspondence between objective bushfire impacts and solastalgia, and a strong association with grief for lost wildlife. This finding highlights the importance of these *subjective* experiences of environmental loss and change, which were further illustrated using interview participants' responses to the loss of special nature places and animals. Second, while the environment changes, it does not remain in the same degraded state post-bushfire. Other case studies of solastalgia have included long-term destruction from events such as coastal erosion (Phillips & Murphy, 2021, 2022), rapid urbanization (Khan et al., 2012), and industrialization (Elser et al., 2020) – all of which usually represent irreversible changes. The regeneration post-fire is unique and contentious. This finding was uniquely elucidated with qualitative methods, where participants held conflicting perspectives, viewing regrowth as evidence of recovery, or an accumulating environmental disaster, and even the environmental changes made to manage fire risk caused distress for some. These divergent experiences support the study of subjective understandings of environment and change as having a profound effect on people and being the basis of solastalgia. Third, the dangerous trajectory of climate change to Australia's bushfire risk profile means that temporal aspects manifest in a novel form as *anticipatory solastalgia*.

One of the key theoretical contributions of our research is identifying and conceptualizing anticipatory solastalgia as an experience of distress regarding environmental change expected in the future (see also Stanley, 2023). The Environmental Distress Scale was designed to capture distress about changes that have already happened, or ongoing degradation. However, Higginbotham et al. (2006) suggested adapted versions could measure distress "from the anticipation of potential disturbance" (p. 253), thus capturing the anticipatory solastalgia we observed in our interviews. They expected that distress would be higher in places where environmental degradation has begun than places where degradation is expected in future. However, fear of future-oriented environmental risk is greater than sadness or regret about risks that have happened (Böhm, 2003), raising the possibility that anticipatory solastalgia could be more intense. Indeed, solastalgia was higher among survey respondents who attributed the fire intensity to climate change and drought, perhaps indicating that those accepting climate change and bracing for severe future impacts are particularly sensitive to (anticipatory) solastalgia. However, we found stronger correspondence between solastalgia and PTSD than anxiety, indicating that solastalgia is heightened among those experiencing symptoms grounded in a past trauma to a greater extent than symptoms associated with a future-oriented worry (i.e., anxiety). The stronger solastalgia-PTSD association could theoretically arise because several PTSD characteristics overlap with solastalgia, including distress from reminders of the trauma from the physical environment, such as the fire-affected landscape (re-experiencing), and the avoidance of these reminders. An anticipatory solastalgia measure has since been validated, which can enable further understanding of this fear-laden, future-oriented form of distress that we have identified (Stanley, 2023).

Rather than reflecting an inappropriate or pathological response, our survey data showed that solastalgia is common, and our interviews reflected solastalgia experiences relating to places that held special meanings and deep connections, where intense emotion is a natural response. The weak relationship with anxiety could further indicate that solastalgia can be experienced without symptoms of poor mental health. One interview participant even shared their view that being engaged with our climate reality *ought* to entail a strong emotional response. This perspective appears in the literature: "experiencing moral injury is a sign of mental health, not disorder. It means one's conscience is alive" (Weintrobe, 2020, p. 352). This idea links into our theme of betrayal and powerlessness, where some distress stemmed from the belief that others had the power to act in ways that would have averted disaster, but failed to do so. Although feeling powerless to avert the crisis as an individual, some bushfire survivors described being motivated by their experience to join collective movements for change (such as protests), which is consistent with theoretical models of collective action driven by perceived injustice and enhanced by collective efficacy (e.g., van Zomeren et al., 2008). Future research is required to understand how people respond to solastalgia (including with climate activism), and how these responses affect their distress.

While researchers' treatment of eco-anxiety has been criticised as a "mash up" of emotions relating to environmental degradation (eco-emotions), including worry, guilt, and sadness (Kurth & Pihkala, 2022), the concept of solastalgia intentionally incorporates a range of emotions (Galway et al., 2019). This inclusive approach aligns with the many emotions we identified through interviews, and with the high internal consistency in survey data on solastalgia items that span worry, upset, sadness, threat and loss. Thus, rather than threatening the validity of solastalgia as a construct, the observed emotional array may reflect that degradation to a cherished environment evokes a range of emotions that are difficult to disentangle. This conclusion further supports the current conceptualisation of solastalgia as an experience encapsulating many

emotions, which offers an alternative to measures of discrete emotions such as eco-anger or eco-anxiety (Stanley et al., 2021). Having a range of discrete emotions, as well as terms that capture complex experiences like solastalgia, is important because accurate labeling of emotions is an essential component of emotion regulation (Torre & Lieberman, 2018). Interestingly, the loss of solace from burnt environments was localised to affected areas. Interview participants described seeking solace in unaffected areas, suggesting environmental change may affect place attachment without interrupting more general connection to nature. One practical implication of this finding is the need to protect, preserve, and promote areas of nature for people experiencing solastalgia to visit.

Amid growing concerns about youth climate anxiety (Hickman et al., 2021), our survey identified that older people were more affected by solastalgia (echoing Phillips & Murphy, 2021). Younger generations have a longer time course of climate impacts ahead, but solastalgia is more likely among those more connected to place (Galway et al., 2019), and older age may be a proxy for time living in the area affected by fire (Phillips & Murphy, 2021). An alternative, novel explanation that is informed by our interview data is that in this bushfire context, older participants' solastalgia is heightened by their perception that the environment is never coming back *in their lifetime*. The motivation to live in an area may also be critical: people moved to "paradise" to enjoy nature, but now their sense of safety is diminished. We identified no gender differences in solastalgia, and financial stress and educational attainment were each associated with higher solastalgia, while other aspects of SES (job status, income) were unrelated. The solastalgia-education association may reflect a better understanding environmental change or greater acceptance of climate change among the more educated (e.g., Hornsey et al., 2016). The association with financial stress suggests that experiencing economic hardship after a natural disaster is a risk factor for solastalgia. Investigating subjective measures of class and status (e.g., subjective social status) may yield more accurate measures of access to power and resources in future (Diemer et al., 2013), which may be key predictors of solastalgia.

Our findings paint a vivid picture of solastalgia evoked by bushfire that contributes to further theoretical development of the construct (Galway et al., 2019). Our interview study reproduced many of the core features of solastalgia in the novel context of the Australian megafires, including emotional effects, mourning the loss of cherished places, and feelings of betrayal and powerlessness (Albrecht, 2005; Connor et al., 2004; Phillips et al., 2022), strengthening the evidence base for their role in the solastalgia experience. However, we also identified novel aspects of solastalgia, such as the loss of an idealised view of place and anticipatory solastalgia. Thus, we propose that the way solastalgia presents might differ according to its environmental driver. This is important because Albrecht (2005) theorized that the solastalgia experience would generalize across diverse impacts such as war, industrialization and climate change. An alternative is that our investigation has uncovered features of solastalgia that had not yet been identified and will generalize across contexts. Further qualitative investigation of different forms of environmental change can help us build an understanding of which aspects of solastalgia are central to this experience, and which may be unique to certain contexts or disasters.

At the same time, the ubiquity of themes of betrayal and powerlessness in solastalgia experiences point to an important practical implication of this research: community voices must be heard during periods of environmental change. Our findings suggest that efforts to preserve the environment may have more positive effects on wellbeing if they meaningfully engage with community perspectives and lived experiences. Such consultation might also identify the most cherished nature places within a community to increase efforts to protect if and when disaster strikes, thus lessening the emotional impacts of environmental change. From a mental health perspective, our data could suggest potential value in community control over environmental management. That said, we acknowledge that communities do have their own divisions and factions, and thus such consultation may not be a simiple or straightforward process.

Our mixed methods approach enabled both a rich, detailed investigation of solastalgia experiences and insights from large survey data that quantify the magnitude of elements of these experiences and how they relate to psychological and demographic factors. The severity and unprecedented nature of this bushfire season may limit how readily these findings replicate across disaster contexts. Our quantitative analysis was also limited by some single-item measures and cross-sectional design, so although distressing experiences of solastalgia may have clinical implications (Rehling & Sigston, 2020), future longitudinal research is needed to understand if and how solastalgia contributes to mental health concerns, or if those experiencing mental health challenges have less resilience to environmental loss and thus experience more solastalgia.

4.1. Conclusions

As we continue to see environmental damage related to climate change, diverse regions across the globe (including Australia) are increasingly vulnerable to bushfires. We found that, for bushfire-affected communities in Australia, dramatic changes to the local environment evoked solastalgia, both in relation to the changes that have occurred and to concerns about future changes. Solastalgia did not closely align with objective bushfire exposure or strongly relate to mental health challenges. Instead, solastalgia is a distinct challenge, and importantly, those grappling with the perception of environmental loss are not necessarily the people most impacted by bushfire, but may include those who perceived greater loss to the aspects that made this nature place special, such as Australia's native mammals and birds. We identified that solastalgia is exacerbated by environmental management that ignores local knowledge, contributing to feelings of powerlessness (Phillips et al., 2022), and associated with anger and perceptions of a loss of control. These findings suggest that environmental protection and restoration, in consultation with local communities, is important to protect wellbeing.

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Data availability

De-identified survey data is available on request from the corresponding author, but interview trasncripts are unavailable to protect participant privacy.

CRediT authorship contribution statement

Samantha K. Stanley: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Timothy Heffernan:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Emily Macleod:** Conceptualization, Investigation, Writing – review & editing. **Jo Lane:** Conceptualization, Investigation, Writing – review & editing, Funding acquisition. **Iain Walker:** Conceptualization, Funding acquisition, Writing – review & editing. **Olivia Evans:** Conceptualization, Writing – review & editing. **Lisa-Marie Greenwood:** Conceptualization, Funding acquisition, Writing – review & editing. **Tim Kurz:** Conceptualization, Writing – review & editing. **Alison L. Calear:** Conceptualization, Funding acquisition, Writing – review & editing. **Julia Reynolds:** Conceptualization, Writing – review & editing. **Tegan Cruwys:** Conceptualization, Funding acquisition, Writing – review & editing. **Bruce K. Christensen:** Conceptualization, Writing – review & editing. **Stewart Sutherland:** Conceptualization, Funding acquisition, Writing – review & editing.

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Declaration of competing interest

None to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2024.102273.

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