Protective Decision-Making in Bushfire Part 2: A Rapid Systematic Review of the 'Leave Early' Literature

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Abstract: In Australia, residents can choose to remain to defend their property against bushfire but, since the 2009 Black Saturday bushfires, considerable emphasis is placed on leaving early, well in advance of a bushfire. However, many householders delay their protective decision. The insights offered by the literature into how and why some people leave early before their personal safety is threatened can inform bushfire safety policy and practice. This systematic review reports the findings of 90 papers selected from 216 identified through a search of papers in Scopus, Science Direct and Google Scholar published between 1995 and May 2021 in English. This review establishes the reasons people leave early; the influence of official and unofficial warnings; gender and other demographics; the influence of self-evacuation archetypes; planning and preparation; the influence of children and other dependents and pets; triggers initiating leaving; factors impeding and facilitating leaving; and policy issues around early leaving. This review also details 12 seminal studies that capture much of the evidence on the decision to leave early.

Keywords: wildfire; bushfire; systematic review; leave early; evacuation; protective action; decision-making; safety policy

1. Introduction

Increasing wildfire in North America, bushfire in Australia and forest fire in Europe reflect a growing threat to individuals [1–3] worldwide. Increasing frequency and severity of wildfire threaten communities and assets including homes, property and infrastructure [4]. The 2009 Victorian Black Saturday bushfires killed 173 people and injured 414. Four hundred and fifty thousand hectares were burnt, and 3500 building destroyed including more than 2000 homes [5]. The 2019–2020 Black Summer bushfires burnt approximately 18.6 million hectares along the Australian east coast in New South Wales and Victoria and into South Australia. The bushfires were linked to at least 34 fatalities and destroyed over 6000 structures including 3000 homes. The south coast of New South Wales, the Blue Mountains near Sydney, East Gippsland in Victoria and Kangaroo Island off South Australia were all impacted [6,7]. Catastrophic wildfires have also resulted in fatalities and destruction in Europe including Portugal and Greece [8], and the USA and Canada [9]. In the United States the Californian Camp Fire (2018) killed 85 people and destroyed almost 14,000 residences, including the town of Paradise. At that time, it was the most destructive and caused the greatest number of fatalities of any fire in Californian history [10].

The evidence suggests that more frequent, intense, large, and destructive wildfire result from a complex interaction of factors. Population growth in peri-urban or wildland/urban interface areas (WUI) mean increasing numbers are living close to bushland. Expanding populations into areas that border highly flammable vegetation, especially in the WUI [11], significantly increases the number of houses at risk [12,13]. Housing growth in peri-urban areas increases the likelihood of bushfires because they are primarily human-caused [14–16]. Growing evidence suggests that more catastrophic wildfire will be driven by climate change related loss of rainfall and higher average temperatures [17]

both internationally [18,19] and in Australia [20–22], including rural and urban interface areas [17,23,24]. Resource constraints on the application of improved land management practices and effective vegetation management [25,26] have also contributed to the growing wildfire threat.

This report begins by describing Australian bushfire safety policy as enabling Australian householders living in bushfire-prone areas a choice of remaining and defending their property or evacuating in advance of the threat. Since the 2009 Black Saturday bushfires in Victoria there has been a stronger emphasis placed on leaving early in most bushfire situations. The policy position strongly advocates clear decisions to stay, or leave, well in advance of a bushfire, and that these are taken before a threat is imminent. However, this is not always the case. Householders delay their decision to remain and defend or evacuate for a range of reasons, including assessing the circumstances of the bushfire and choosing an appropriate course of action. There is much to be learned from the literature about how and why some people are decisive about their decision to leave before a bushfire becomes a threat to their personal safety, and why others delay this decision.

To extract these learnings a rapid systematic review of the 'leave early' literature has been undertaken and reported here, building on the learnings that have been identified in two previous reviews of community safety issues in wildfire [1,2]. 'Leave early' is defined; a process of systematic review is described, including databases searched, and inclusion and exclusion criteria; review of papers, reports and other materials and assessment of their quality; and synthesis of all materials in a narrative review.

Improved community education policies and programs promoting community safety through enhanced preparation and planning and effective and safe response during a bushfire event depends on the emergency services better understanding peoples' protective action decisions and behaviours when threatened by bushfire. This report contributes to understanding why some people 'leave early' before, or as a bushfire threatens their town or village. The purpose of the rapid systematic review of literature is to: address a research gap in the understanding of 'leave early' to develop approaches that better reflect how people are likely to behave during a bushfire; and extend the body of evidence that drives the development of new and existing community safety programs and informs decision making (targeting and tailoring programs to meet community needs). The research question is:

Why do people at threat from a bushfire decide to leave immediately they become aware of the bushfire threat (before or when it reaches their town or village)?

Data collected in CFA post-season bushfire research (*n* = 3542) over the four years between 2018 and 2021 have confirmed the importance of addressing this question. An unweighted average of 33.8% of respondents would leave as soon as they were aware of a bushfire threatening their town or suburb, 11.8% intend to stay and defend their property and 45.4% would delay their decision. The remainder would have left in advance of any fire on a day of high fire danger (8.1%) or did not know what they would do (0.9%).

The review draws on identified peer-reviewed studies and materials and reports in the grey literature, including qualitative, quantitative, and mixed methods studies, to establish why people leave early from a bushfire threat.

Australian Bushfire Safety Policy and Protective Response

The 2009 Black Saturday bushfires in Victoria, Australia, caused 173 fatalities and the destruction of 2029 homes resulting in substantial changes to bushfire safety policy and practice framed around the message 'Prepare, Act, Survive' (PAS) [5,27]. Australian bushfire safety policy aims at greater predictability and reduction in bushfire risk, and to improve response capability, enhancing safety and survival. The policy promotes leaving, well before a bushfire becomes a threat, as the safest option, and encourages pre-event planning to support those actions. Fire Danger Ratings (FDRs) forecast bushfire danger at least 24 h in advance and people are advised, for the most dangerous days, to leave even in the absence of a local bushfire [28]. The policy recommends careful monitoring of bushfire

conditions, including official bushfire warnings, to avoid dangerous late evacuation [29]. Emergency authorities' hope that as part of accepting shared responsibility for their safety, householders will take their advice during a bushfire. Similarly, it can be reasonably expected that the emergency authorities will incorporate the attitudes, needs and responses of householders into their operations and their education and engagement policies and programs [30–32]. Householders are responsible for making critical protective decisions to remain and defend or evacuate from an imminent bushfire threat [27,30,33]. Research indicates that a satisfactorily prepared house can provide safe refuge from bushfire and appropriately equipped householders with adequate physical and emotional resources can defend against ember attack and prevent the destruction of property [33], although this was questioned following the extreme Black Saturday bushfire behaviour.

Householders respond to bushfire in ways inconsistent with official advice and warnings [34], firefighting strategies, and fireground management of the emergency services [5,27]. The timing and manner of their evacuation are determined by householder's individual circumstances and states of mind [35–37]. The literature reports many householders fail to take protective actions or behave in ways consistent with bushfire safety policy. Most do not leave potential disaster risk areas on days of the highest bushfire danger [4,37–39]. Many individuals carry out straightforward preparations [40–42] such as gardening and general property maintenance. Many do not systematically plan property defence or evacuation [37]. Few bushfire plans are written, take account of possible unexpected contingencies or are practiced by the household [5,40–42]. Many householders plan to delay protective decisions to see how a bushfire develops before deciding to remain or evacuate [4,5,40,42–45], including waiting for direction from the emergency services [5,42,43,46] despite the preference of bushfire agencies for a clear-cut decision to leave early. Householders who delay protective decisions are of concern because this behaviour is associated with poor decision-making [47] and dangerous late evacuation [4,5,45]. Householders who delay undertake fewer property and evacuation preparations than those who make a clear decision in advance to stay and defend or evacuate [44].

Householders who plan to remain to defend their property may be partially committed to that action and retain late evacuation as an option [5,48]. Some committed to staying may leave, and those who intend to evacuate, remain. Some evacuees return when the bushfire is still a potential threat [48,49]. Uncertainty about when it is best to leave and failure to recognise when leaving is no longer safe was a major challenge for the 'Prepare, Stay and Defend or Leave Early' (PSDLE) policy [5,48] and continues to be for contemporary bushfire safety policy even with its emphasis on planning for unexpected contingencies. Essentially the PSDLE remains at the heart of Australian bushfire safety policy, modified since 2009 to emphasize evacuating early as the safest protective choice.

Substantial policy changes followed the 'Black Saturday' bushfires, but householders confronted by bushfire must still choose between evacuating from or remaining to defend their property. The effect of bushfire safety policy reforms in modifying householders' response has been limited [34,40,50]. Consequently, understanding the attitudes, motivations, and responses of those who leave immediately they are aware of a bushfire threatening their area may be of considerable importance in shaping bushfire safety policy and programs.

2. Methods

2.1. Definitions

People who leave their property as soon as they know a bushfire is threatening their town or suburb are defined as those who 'leave early'.

People who leave when a bushfire enters their town or suburb, or directly threatens or reaches their property, are not defined as *leaving early*. The definition also does not include those who leave the night before or early in the morning when conditions are extreme but before there is any threat of fire. In Australia this is the collective Australian Fire and Emergency Service Authorities Council (AFAC) member agency position on 'leave early',

which is reflected in the information and advice provided by fire agencies to the public [3,4]. The advice is often given in the context of other factors such as the presence of elderly dependents or children, or when people are not physically or mentally fit and prepared. However, the very limited literature on 'leave early' behaviour does not generally use this term to refer to people acting on fire danger weather warnings [33] or taking action on a catastrophic day [38]. There may be some confusion since residents are advised to leave the night before or early on the morning of a day forecast to be of extreme or catastrophic fire danger.

2.2. Inclusion and Exclusion Criteria

Papers were included for review if they addressed bushfire or wildfire disasters and 'leave' or 'leave early' or 'evacuation' behaviour and were published since 1995 in the English language. Studies were excluded if they had been published before 1995, in a language other than English; concerned primarily with natural disasters other than bushfire or wildfire; not concerned primarily with human behaviour (e.g., bushfire behaviour/materials/GIS); concerned with simulations such as transport movement, bushfire behaviour, sheltering, utility availability or other simulations; not concerned primarily with individual/household response to bushfire (e.g.,: Government, community, organizational, emergency management, legal or research response); focused solely on mandatory evacuation; reporting only existing literature; or published in a newspaper or magazine.

2.3. Databases and Sources Searched

Three databases—Google Scholar, Scopus and Science Direct were searched for peer-reviewed and grey literature. Within article references were checked for relevance and a snowballing strategy was used to build the list of papers. Emergency management practitioners and policy makers were consulted about reports, presentations and other materials that may not have been identified in the search of databases

2.4. Literature Search, Screening, and Data Extraction

The database search was first conducted in May 2020 with the search strategy using the following 'leave' search string— 'Leave early' OR 'leave (ing)' OR 'evacuate (ion) (ing) AND bushfire OR wildfire. A further search was conducted to identify relevant papers published between June 2020 and May 2021. Table 1 summarizes the databases and the search strategy applied. One reviewer screened the search results by title and abstract and papers falling outside the criteria, excluded. The full text of remaining papers was screened by the same reviewer to identify final papers for review. A second independent reviewer then examined the inclusion and exclusion decisions, and any disagreements were resolved through discussion. Figure 1 is a flow chart summarizing the literature search process.

Table 1. Search string for databases.

Database	Search String 'Leave'	Area of Document
Scopus	'Leave (ing) OR 'leave early' OR 'evacuate (ion) (ing) AND (bushfire OR wildfire)	All fields
Science Direct	'Leave (ing) OR 'leave early' OR 'evacuate (ion) (ing) AND (bushfire OR wildfire)	Document
Google Scholar	With the exact phrase: 'Leave early' With at least one of the words: bushfire, wildfire Or With at least one of the words leave, leaving, evacuate, evacuation, evacuating. With all the words: bushfire Or With at least one of the words leave, leaving, evacuate, evacuation, evacuating. With all the words: wildfire	Anywhere in the article

2.5. Quality Assessment of Studies

A recently updated scale for the quality assessment of narrative reviews (SANRA—the Scale for the Assessment of Narrative Review Articles) [51] was used as the basis of quality assessment of all articles, reports and materials reviewed in this paper and reported in Table 2. A scale of 0 to 2 was used to rate six aspects of quality: justification of the article's importance for the readership; statement of concrete aims or formulation of question; description of the literature search; referencing; scientific reasoning; and appropriate presentation of data. Each manuscript was assessed by the reviewer against these six aspects rating its totality including the abstract.
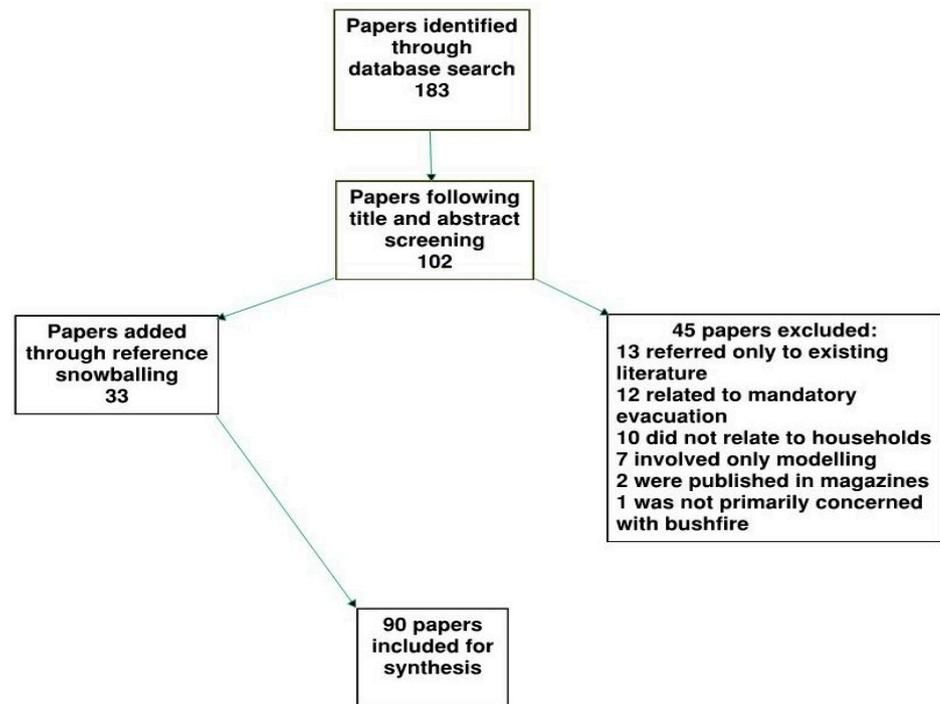

Figure 1. Flow chart showing details of literature search.

Table 2. Primary studies of 'leave early' in bushfire (or wildfire).

Author/Citation	Study Objective	Method/Study Type	Participants/Context	Sample Size	Outcome/Findings on 'Leave Early'	Significance/Implications Regarding 'Leave Early'	Quality Rating (max = 12)
Whittaker et al. 2015. [52]	Examine the gendered dimensions of risk awareness, preparedness and response	Face to face interviews and mail survey	Households affected by the Black Saturday bushfires	600 interviewees 1314 mail surveys	Women (23%), more than men (11%) want to leave as soon as they knew a fire was threatening. However, many women (42%) intended to remain and almost half of men intended to leave. Responsibility for children, the elderly and other vulnerable household members greatly influenced intention to leave. Often women left with children and elderly and men remained to defend. Disagreement within the household arose from men wanting to remain and women wanting to leave. Disagreements arose where there had been inadequate planning or discussion of intentions and where plans changed suddenly, or where men attempted to decide autonomously. Women (35%) more likely than men (13%) to leave on the advice of relatives, friends or neighbours or emergency services (14% vs. 8%). Some men who intended to remain, left to ensure their partners evacuated safely. Women (17%) more than men (9%) were likely to stay because they felt it was unsafe to leave or their attempt to leave was unsuccessful. Women were conflicted in their decision to leave because they wanted to help their husband protect their property.	Warning and advice messages directed at women may be more effective in encouraging evacuation.	Imp (2) Aims (2) Search (1) Ref (2) Reason (2) Pres (2) Total = 11
McLennan. 2014. [53]	Learnings from Parkerville (2014) bushfire	Qualitative semi-structured face to face interviews	Fire affected households	91	49% intended to leave. A total of 19% did not have a plan/intention. Those intending to leave perceive danger posed by bushfire (56%) to household members (13%) especially vulnerable members such as young children (13%) and old/disabled (11%). More people on standard (residential) blocks planned to leave than those on larger blocks. Leavers were not well prepared—42% had a kit of necessities and valuables, 24% chosen safe destination, 11% planned evacuation route and only 7% had a trigger to leave. In total, 2% had sealed gaps and 4% had water supply or hoses. Leavers no not adequately prepare to implement the plan. Lack of urgency in leaving. Many triggers to leave result in late evacuation –, e.g., smoke (47%), flames (24%), face to face advice from neighbours (18%) and emergency services, hearing/seeing firefighting aircraft nearby (16%) People left because of a threat trigger (44%), when it was clear there was a threat (26%), responding to a perceived threat to dependents (12%), instructions to leave from emergency services. Residents' pre-fire bushfire plans (leave; stay and defend; and wait and see) arise from different motivations (avoid danger, protect assets, avoid making an unnecessary decision), so information specifically targeting each type of resident may be more effective than omnibus information about bushfire survival in general.	Leavers are motivated to leave early to protect the safety of household members, especially young children and the elderly/disabled. There is inadequate planning and preparation of leaving as if it will just happen because it is a simple thing to do. There is a need to make leaving as significant, well organised and planned as remaining to defend. Pressing need to widely encourage households to identify a clear and specific trigger for leaving. The different motivations of remainers, leavers and those who wait and see suggests the need to target bushfire safety programs to address these different needs.	Imp (2) Aims (1) Search (1) Ref (2) Reason (1) Pres (2) Total = 9
Tibbits et al. 2007. [48]	Present evidence on the implementation of the stay and defend or leave early policy	Focus groups	Recent experience of bushfire	73 participants	People understood stay and defend but were less certain about the meaning of 'leave early'. Question of what constitutes early and at what point should the decision be made. Leaving would occur as soon as it was clear the area would be threatened. Trigger to prompt leaving would be advice from the authorities or in worst case, environmental cues—heavy smoke or flames. These scenarios lead to late evacuation rather than early leaving. What constitutes early leaving defends on personal circumstances such as age, mobility, reliance on public transport, responsibility for young children; and on location of property and escape routes relative to fire location and direction. Factors influencing decision to leave early were: The home was not defendable. They could not survive there. They lacked the physical and/or mental capability to remain and defend. Lesser commitment to protecting property. Protecting the safety of young children. Protecting safety of pets and animals Lack of property preparation Lack of independent, reliable water source. Lack of preparedness of surrounding properties. Remote or inaccessible location of property.	Early leaving is not well understood but uniform advice cannot be given on the meaning because it depends on the household's particular circumstances. Therefore, categories of trigger may be suggested to initiate leaving.	Imp (2) Aims (2) Search (1) Ref (2) Reason (1) Pres (2) Total = 10

Table 2. *Cont.*

Author/Citation	Study Objective	Method/Study Type	Participants/Context	Sample Size	Outcome/Findings on 'Leave Early'	Significance/Implications Regarding 'Leave Early'	Quality Rating (max = 12)
Whittaker et al. 2009. [54]	Human behavioural factors affecting personal safety and property protection during the Black Saturday bushfires	Qualitative semi-structured, face to face interviews	Fire affected households	301	26% of households had a member who intended to leave. A belief that their house would not survive a bushfire and could not provide a safe refuge, encouraged leaving. Homes were perceived as undefendable due to poor preparation, lack of firefighting equipment, proximity to unmanaged fuels, lack of bushfire knowledge and experience and household members' physical limitations. Responsibility for children, elderly and other vulnerable household members influenced leaving. Commonly women left with vulnerable household members and men remained to defend. Those who left early enough to avoid dangerous evacuation were triggered by extreme weather forecast; becoming aware of the fire; hearing radio announcements to activate plans; seeing distant smoke; being told to leave; and judging the bushfire as too extreme to defend	Lack of safe refuge provided by home encouraged leaving. Responsibility for vulnerable dependents encouraged leaving (especially women). Perception of threat was an important trigger to leave.	Imp (2) Aims (2) Search (1) Ref (1) Reason (1) Pres (2) Total = 9
McNeill et al. 2016. [55]	Examines the role of the value and expectancy tied to potential outcomes of defending vs. evacuating when people become aware of a bushfire threat.	Email and mail survey	Households in areas under potential threat of bushfire	339	Leavers: Are more likely to have children living at home than those who would defend or 'wait and see'. Are less likely to have livestock compared to defenders. See avoiding personal harm as important more than do defenders. See survival and avoidance of damage to their house as less important than those who 'wait and see' and defenders. See welfare of home contents and work equipment as less important than defenders. Have a lower expectation of successfully defending their property than defenders and those who 'wait and see'. Have a higher expectation of preventing harm to their pets (that could be evacuated with them). 65% left safely, 24% left under dangerous conditions and 11% defended or sheltered passively	Leavers are significantly different compared to defenders and those who wait and see, so bushfire safety policy and programs need to be specifically designed to meet their views and responses and targeted to resonate with their beliefs and intentions	Imp (2) Aims (1) Search (2) Ref (2) Reason (2) Pres (2) Total = 11
McLennan et al. 2013. [33]	Examine protective action decisions taken by householders under bushfire threat	Qualitative semi-structured, face to face interviews	Fire affected households	457	22.5% of respondents intended to leave safely while many more—47.2% left. 25% of those who left expected an official warning. Those who left reported specific triggers for leaving: Environmental -smoke, flames, embers Concerns for safety of family Perceived threat Warnings from neighbours or family Main reason for leaving was concern for personal and household members' safety (in context of a lack of preparation for remaining). A trigger event indicating actual bushfire threat is likely to initiate leaving. Householders do not have a clear understanding of what leaving early means for their particular circumstances and the planning and preparation needed to ensure their safe leaving	Households need to better understand and undertake planning and preparation required to safely leave. An important part of that planning is identification of a trigger to leave early	Imp (2) Aims (1) Search (1) Ref (2) Reason (2) Pres (2) Total = 10
McLennan et al. 2013. [56]	Better understand the factors influencing the choice of protective action in bushfire	Postal and on-line survey	Fire prone urban, peri -urban and rural communities	584	47% of respondents intend to leave as soon as possible. Women were more likely to intend to leave than were men. People intend to leave because (i) they are concerned about their safety and household members (ii) staying and defending is perceived as too risky. People leave based on a trigger that indicates imminent danger, specifically: Credible information or warnings about the proximity or intensity of the fire Environmental cues—smoke, flames, embers, sounds of fire. Strength of intention to leave is predicted by (factors associated with safety): Attitude strength-efficacy of the outcome (leaving) Subjective norms -wanting to do what others would prefer. Perceived behavioural control-confident and capable of leaving. Self-determination -decision to leave is my own. Anticipated affect—no regret about leaving or cost. Leavers tend to believe that that the	Perception of danger to personal safety is an important motivator to leave early that should be more effectively used in information and warnings. Planning and preparation for leaving should be treated as seriously and comprehensively in bushfire education as is remaining and defending. Mass communication to promote planning and preparation for leaving is required.	Imp (2) Aims (1) Search (2) Ref (2) Reason (2) Pres (2) Total = 11

Table 2. *Cont.*

Author/Citation	Study Objective	Method/Study Type	Participants/Context	Sample Size	Outcome/Findings on 'Leave Early'	Significance/Implications Regarding 'Leave Early'	Quality Rating (max = 12)
					construction of their house offered little protection from bushfire and perceive high risk in relation to house vulnerability and low protection due to house construction. Leavers were anxious simultaneously about their house being destroyed in their absence and about the dangers of evacuating including being caught on the road by fire, accidents, and threats posed by hazardous driving conditions. Leavers anticipate relief at no longer being under imminent threat and are positive about their decision to leave. Bushfire safety programs need to: Promote substantial planning and preparation for leaving and provide information about how to plan and prepare. promote more active, detailed, and meaningful consideration of triggers for safe evacuation. Design information and warnings to encourage low cost actions to reduce the likelihood of house loss in the owner's absence.		
McLennan et al. 2015. [27]	Establish psychological differences between householders with intentions to leave and those who intend to remain and defend their property against bushfire	On-line survey	Fire prone urban, peri-urban and rural communities	584	Leavers do so to protect personal and family safety. Those who intended to leave displayed large differences to those who intended to remain in relation to perceived: Safety of leaving.Preference of significant others for leaving.Survival chances by leaving. Leavers were highly anxious about their home being destroyed. Leavers displayed medium differences with remainers in relation to: Perceived cost of leaving (inconvenience) Emotional reactivity to threat Likelihood others would also leave. Leavers, compared to remainers, are more concerned about danger posed by bushfire but do not believe they are more likely to be threatened. See themselves and homes as more vulnerable. Believe others understand leaving as a desirable action. Concerned about housing being destroyed in their absence. See leaving as inconvenient. Less likely to plan the implementation of leaving. Less likely to prepare property to protect it in their absence	Psychological differences between leavers and remainers requires messaging to be targeted according to their beliefs and needs.	Imp (2) Aims (1) Search (2) Ref (1) Reason (2) Pres (2) Total = 10
McCaffrey et al. 2018. [57]	To understand why people choose particular protective actions in a bushfire	Postal survey	Fire prone areas In Washington State, Texas and South Carolina.	759	Believing evacuation is effective way to minimize risk results in a tendency to evacuate. Those who plan to leave early primarily pay attention to official cues. Tolerance for financial risk increases the likelihood of leaving early. Suggesting preference for protecting one's safety at all costs. Greater concern about limited evacuation routes increases the tendency to leave early (marginally significant result)	Perceptions of leaving as effective in risk reduction influences decisions to leave early. Official cues influence people to leave early. Those inclined to evacuate are defined largely by their belief in the effectiveness of evacuation as a risk mitigation strategy.	Imp (1) Aims (2) Search (2) Ref (2) Reason (1) Pres (2) Total = 10
Cao et al. 2017. [58]	To offer guidance for the development of effective web-based mapping tools for wildfire warnings	Semi-structured interview	Residents of bushfire prone areas	21	Active evacuators focus on timing of evacuation mostly requiring explicit information on fire location and predicted movement (1 only required an official warning to leave immediately). Active leavers simply required confirmation of fire presence regardless of intensity (reluctant leavers [wait and see+] judge severity of the threat. Information required is: 1) the map of prevailing winds and potentially its forecast change, (2) the accurate map of active fires, (3) the map of closed roads, (4) the personalised mapping of one's home location, (5) calculated distance between one's home to the closest fire front, (6) a description of the fire control status (e.g., 'out of control'), (7) map of warning areas and associated warning levels, and (8) action advice provided by agencies for the designated warning areas.	Effective warnings using maps can encourage active leavers to safely leave early.	Imp (2) Aims (2) Search (2) Ref (2) Reason (2) Pres (2) Total = 12

Table 2. *Cont.*

Author/Citation	Study Objective	Method/Study Type	Participants/Context	Sample Size	Outcome/Findings on 'Leave Early'	Significance/Implications Regarding 'Leave Early'	Quality Rating (max = 12)
Strahan et al. 2019. [59]	Identify factors that influence householder's decision to self-evacuate from bushfire	Quantitative telephone survey	Householders who had recently experienced a bushfire threat	457	Self-evacuation is predicted by: Perception that leaving is the best action to protect personal safety and is not expensive. The receipt of an official warning Perceived likelihood that the bushfire would damage or destroy property. Perception of leaving as best for personal safety is related to not undertaking property preparation, defensive equipping or having protective clothing. Leavers who prepare their property and plan evacuation are less likely to evacuate than those who do not plan and prepare. Leaving may be seen as less expensive because cost of property preparation and defensive equipping are avoided, and potential cost or property loss can be reduced through insurance. The inconvenience costs of leaving may be perceived as small. Lack of defensive capability due to lack of property preparation, equipment and protective clothing were seen as protective of property, perhaps because of an expectation that fire services would step in and defend the property after leavers evacuated.	The importance placed on protecting personal safety should be more effectively harnessed in communications and warning before and during bushfire to promote early leaving. Reliance on and expectation of receiving official warnings should be leveraged more effectively by providing significantly more sophisticated warnings that are locally focused, continuously updated and provide clear advice that triggers and guides evacuation.	Imp (2) Aims (2) Search (2) Ref (2) Reason (1) Pres (2) Total = 11
Fire Services Commissioner (Victoria). 2013. [60]	Review community response to bushfire threat to 1. Assess whether activities to enhance bushfire safety were in place; 2. Preparation and response of people in bushfire affected areas; 3. Effectiveness of bushfire safety activities in assisting communities to respond.	Semi-structured face to face interviews.	Residents of recently fire affected areas	120	Although Considered Defenders are committed to staying and defending, part of their consideration is to have women and children leave early. Threat Monitors intend to leave if they believe the threat is 'serious' seeing this as a sensible balance between protecting personal safety and property (including animals) by not leaving unnecessarily. Threat Avoiders leave early to avoid risk and protect personal safety. They feel vulnerable (age, lack of skills or resources, dependents in household) to fire threat and intend to leave because their house is undefendable or escape routes are unreliable. They expect an official warning of a fire so they can leave safely. They may delay leaving to organise possessions or minimize time away. They plan evacuation triggers, what to take, where to go and how to get there safely. Few have backup plans. Community bushfire safety activities should be better tailored to peoples' preparation and planning needs instead of generic advice being provided that does not address specific questions about local bushfire threat. Communication channels used for messages and warnings should take account the differing needs of community members. People share resources (transport, knowledge, assistance leaving, pets) with extended family and neighbours to respond to fire threat. Leavers went to family and friends outside the fire affected area. Fire agency planning is enhanced by an understanding of what people actually do in fire, especially those who leave early, in order that this safe response can be encouraged and supported. Extreme and Code Red Fire Danger Ratings do not prompt leaving unless there is also a fire threat. Collaborative local action drawing of fire agency expertise and facilitating community involvement to address local issues, is required	People will leave early if that action reflects their needs and assessments of the local bushfire circumstances. Tailoring bushfire safety activities to people's needs is more likely to encourage preparedness, planning and safer response to bushfire threat. Communication and warning messages should be simultaneously address differing needs and local bushfire conditions by using sophisticated and targeted strategies	Imp (2) Aims (2) Search (1) Ref (1) Reason (2) Pres (2) Total = 10

2.6. Data Extraction and Synthesis of Final Papers

The full text of the included papers was imported into NVivo software (QSR NVivo 12) and searched for references to the review topics. The reviewer sorted extracted data from all included studies and coded them into themes and sub-themes. These were organised into forty-two broad descriptive themes based on the content of the codes and the authors' knowledge of factors influencing bushfire protective action decision making. A summary of the coded text was collated and used to identify twelve analytical themes emerging from the descriptive themes across the included studies. Not all papers addressed every aspect of interest to the review but all 90 offered data for the synthesis.

The PICOT (Population, Intervention, Control [Comparison], Outcome and Time) framework was used to identify the data elements to be extracted and an extraction form consistent with an approach promoted by the Campbell Collaboration (https://campbellcollaboration.org/) was developed. This framework was used to summarize the key data from the 90 papers which were identified as concerned with the 'leave early' research question addressed by this review. Table 2 provides an overview of 12 primary studies including study objective, methods, findings significance and an assessment of quality.

2.7. Analysis and Interpretation of Data

The summary of coded text from included studies was analysed and interpreted within the twelve analytical themes previously identified, and this constitutes most of the following results of the review. Where elements of the summary provided in Table 2 can be used to elaborate results these are discussed in the text.

3. Results

The searches identified 183 papers that met the search criteria. Following title and abstract screening 102 papers were identified for full text inspection. Following the reading of full texts, 33 papers were added through reference snowballing and 45 were excluded. In total 90 papers were assessed as including some material relevant to the review of 'leave early' in bushfire (or wildfire). All these papers and some of their cited references were used in the narrative synthesis of the topic. Through analysis of the number of codes and references generated through the thematic analysis of the papers, 12 were identified as containing considerable material on 'leave early' behaviour and were classified as primary studies to be summarized in Table 2.

Of the 12 primary studies, 11 were conducted in Australia (4 by McLennan et al. and 2 by Whittaker et al.) and 1 in North America, totalling 5116 participants. All studies met at least minimum quality criteria set out in the SANRA assessment.

The elements of the primary papers that are summarized in Table 2 are author; study objective or research question; method or study type; participants or study context; outcome or findings of the study; significance or implications of the study; and a quality rating using the SANRA scale.

The 90 studies focused on a variety of aspects of leave early behaviour in bushfire (or wildfire) and although they did not all report on every aspect of interest to the review, all included data that could be used in the synthesis. The following discussion synthesizes the findings of the papers by providing an insight into the extent that people confronting bushfire threat left early, notwithstanding confusion about what constitutes leaving early. The synthesis also explores: the reasons people leave early; the influence of official and unofficial warnings; gender and other demographics; the influence of self-evacuation archetypes; planning and preparation; the influence of children and other dependents and pets; triggers initiating leaving; factors impeding and facilitating leaving early; and policy issues around early leaving.

4. Discussion

4.1. Uncertainty about the Meaning of 'Leave Early'

The literature has reported for some time that residents of fire-prone areas are uncertain about what leaving early actually means in their specific circumstances [33,48,61]. Identifying triggers [48] for leaving in pre-fire household evacuation plans or providing timeframes for the evacuation of specific areas during a fire event, may provide the clarity and specificity about what leaving early constitutes [61]. However, the diverse circumstances of households such as responsibility for children and other dependents and the management of pets and other animals, the proximity of fire prone vegetation, or access to safe escape routes, are likely to influence the interpretation of leaving early and when it is too dangerous to leave [48,62–64].

The proximity and speed of spread of the bushfire also creates uncertainty about when leaving is early enough, with simulation-based research suggesting that leaving takes considerable time, and urban fringe communities are particularly vulnerable to proximate fires that may make early leaving difficult [65].

4.2. Numbers Leaving Early

A minority of people living in bushfire prone areas say that they intend to 'leave early' if there is a bushfire in their area but this has increased significantly since 2009. Nineteen percent of people who had experienced the Black Saturday bushfires said that they had intended to leave ('early') before they came under threat and left before (48%) or as (43%) the fire arrived [4,5].

Research since the Black Saturday bushfires has suggested that the number of residents of bushfire prone areas intending to leave early has increased. Comparison of pre-Black Saturday research with six subsequent studies shows an increase in those intending to leave early from 24% in 2009 to 41% (unweighted mean of 6 studies 2011-2014) [36] although using data in the paper, the weighted mean number intending to leave early is 34%. This is similar to that reported in North America [66].

Data from the CFA post-season surveys that have been collected almost continuously since the Black Saturday bushfires also show an increased intention to leave early. Rhodes [67] reported that in 2010, 45% of people intended to leave as soon as they were aware of a fire that could threaten the area where they live. Between 2011 and 2017 (excluding 2016) a weighted mean of 43.2% of respondents (n = 4885) intended to leave as soon as they were aware of a threatening bushfire in their area (town or suburb). However, between 2018 and 2020 (n = 2642) this decreased significantly to 33.7% (weighted mean).

The proportion of those intending to leave early has increased since the Black Saturday bushfires from approximately one fifth (19%) to at least one third (33%) and this may be expected to increase to around 40% following periods of significant bushfire activity.

4.3. Reasons for Leaving Early

People intend to leave because of the perceived danger posed by bushfire [27,68], especially if the household includes children and other dependents [53,55,56]. They see leaving as the best thing to do to minimize risk [57] and protect personal safety against bushfire threat [27,55–57,59,68–71], and are willing to accept the risk that their home will be destroyed [45], including the financial risk [57], or to rely on insurance [72,73]. They believe that their house is not defendable, or they would be unable to defend it [55] and cannot provide a safe refuge [54,56] due to a lack of: preparation [27], equipment, access to a reliable water source [74], knowledge of bushfire and physical capacity of household members; and proximity to unmanaged fuels [48,54,56]. Some recognised that leaving may not be necessary but given the extreme uncertainties in bushfire it was better to be safe than sorry and relieved the anxiety of being at imminent threat [56,70]. There is almost a complete absence in bushfire fatality data, of people who were well prepared to leave and did so, supporting the view that this is the safest course of action [75].

During a bushfire event the determinants/predictors of leaving are their pre-fire intention to leave, perceptions that a threat is possible and their property is vulnerable [71]; perceived severity of the threat or likely property impact [59,61,68,71]; perception that leaving is effective in protecting personal safety; and the receipt of official warnings [27,33,57,59,76]. The perception of leaving as effective in protecting personal safety is itself related to whether long-run hazard adjustments are undertaken including property maintenance such as clearing fuels and combustibles, watering or covering gaps against embers; equipping to fight bushfire and spot fires; and having personal protective clothing [59,76]. The fire authorities' public assessments of the bushfire risk, the recent bushfire history of the area and the perception of the availability of safe escape routes [57] influence perceptions of the level of bushfire risk and the vulnerability of property [71] and therefore the need to leave early.

It is unclear whether prior evacuation experience is related to likelihood of leaving early in a bushfire event with some studies indicating prior evacuation experience having a significant influence on future evacuation [69,77,78] and others suggesting a weaker or no relationship [79].

The strength of the intention to leave early is associated with a general concern to protect personal safety and was predicted by confidence that leaving is a safe option; the decision to leave being self-determined; leaving reflected the wishes of family and close friends; not being overly concerned about the possibility of losing the house; confidence in their ability to leave safely; and absence of obstacles to leaving [37,56]. This suggests that the decision to leave early in the face of a bushfire threat reflects a true expression of the self, making an autonomous choice rather than being controlled by the bushfire threat [37].

4.4. Warnings

The receipt of repeated [71] official warnings [57,59] and from other trusted sources [68,71,78], about an imminent bushfire can contribute to the early and safe evacuation of residents at potential risk. Effective warnings can contribute to an informed decision to leave early [80]. However, there has been evidence of warning failure—residents claiming that they did not receive warnings, that they were inaccurate or not sufficiently detailed or locally focused. During the Black Saturday bushfires residents ignored warnings or were complacent about the potential threat because previous warnings 'had come to nothing' [4,5]. Recent evidence suggests that peoples' belief that they did not receive adequate warning despite their awareness of the event may result from a failure to personalise the risk so the information is believed, understood and trusted by recipients [80,81]. Overwhelmingly people rely on their own assessment of the hazard situation when it conflicts with official warnings and guidance, which are perceived as not accurately describing the fire threat for their specific location [58]. People may be more effectively encouraged to leave early if warnings provide: details about the fire situation [71] including nature, location, time and source [82]; locally focused exposure and vulnerability information that clearly details likelihood and potential impacts of the threat [61]; information about the uncertainty inherent in the warning and possible range of consequences of the threat [61]; and recommendations about evacuation including safe routes and destinations [71,81]. The research suggests that people need to be trusted with more detailed and complex information, so they are more likely to be convinced of the threat and respond to the clear recommendations for action included in the warning [81,83].

Map based warnings have been recently advocated to reduce normalcy bias, appeal to recipients, stimulate risk personalisation and produce appropriate response to threat. There is considerable potential for encouraging and facilitating early leaving by providing personalised hazard and warning information linked to individualised decision support tools that are in development [83] through well designed risk and warning maps [80]. The use of approaches such as this can be supplemented by a standardized national address point database, enabling geotargeted warnings tailored to the needs of specific households [84].

Warnings from neighbours and family can also be influential in encouraging early leaving [52,68,71,85], as can direct or face-to-face advice from emergency services officers [61,71]. Women are more likely than men to heed the advice of family, friends and neighbours to leave [52]. Experience of Australian bushfire warnings to evacuate, which proved to be false alarms, led people to be less likely to evacuate in the future [86] but this finding was inconsistent with North American research [87].

The use of mandatory evacuation powers in North American wildfire strongly encourages residents to leave immediately they are instructed to do so by the authorities [66,88], although some reticence has been reported [89].

4.5. Gender and Other Demographics

Gender is the key demographic reported in the literature associated with the decision to leave early. Following the Black Saturday bushfires, research revealed that women (23%), significantly more than men (11%) intended to leave early (as soon as a fire was threatening) [5]. Other studies since have confirmed this significant gender difference in intention to leave early [3–5,52,56,62,68,85,90–93] although a large minority of women interviewed after the Black Saturday fires remained and over one third of men left [52]. It has been suggested by some that male preference to remain reflects hegemonic masculinity, involving personal and societal expectation of men as emotionless, brave and decisive defenders of their family and property [94]. In contrast, leaving early represents failure to take responsibility for family, to meet social expectations and fulfil obligations, creating feelings of shame and embarrassment [94] and is associated with cowardice, femininity or fear [95]. It has been suggested women's perception of greater threat due to their inadequate knowledge, encourages them to leave [96] but no significant gender difference in threat perception has been identified [90] and socio-political factors related to white male privilege have been suggested as an alternative explanation [95]. Women tend not to be engaged with, or are excluded from, bushfire issues [97], contributing to apathy, denial and feelings of helplessness, resulting in greater indecisiveness about their plan of action in a fire [90,91]. This may encourage their leaving early as a simple risk minimization strategy.

Responsibilities for children and other vulnerable household members is related to an intention to leave early [52,98] or to reversing an intention to remain and defend against fire [99]. In many cases women and children tend to leave while men stay to defend the property [52,54,90,100,101]. Whether this leaving occurs early depends on household dynamics and the resolution of potential conflict between men and women about whether to leave or remain [54]. Disagreement between men and women over whether to leave or remain during a bushfire event is well reported [52,75] and sometimes occurred in a context of gender inequality [101] resulting in a lack of planning or prior discussion, where plans could change at the last minute, or when men took decisions without discussion with their partner [52,97]. Sometimes a resolution required men to change their minds and leave with their partner to ensure her safe evacuation [52]. Where negotiation did not result in resolution, delayed and/or poor decision-making may in some cases have contributed to fatalities [102].

Some women are less certain that they will leave early due to the contradictory aspirations of male partners who intend to stay and defend [58]. Implementing a decision to leave early may be emotionally difficult for the woman due to separation from her partner [101] or because of her preference to remain and protect their home [52].

Based on data from the Black Saturday bushfires, age may play some role [33]. The size of resident's property may also be relevant with those living in standard size (residential) blocks more willing to leave than those on large blocks (small acreage or farms) [53].

There is limited literature about migrants in disaster, and it is mostly based on North American disasters. There is no literature on migrants in bushfire/wildfire disasters. Migrants often fail to respond appropriately to warnings by evacuating [82]. They do not know how to respond and behave because they do not know what they have to do. They may be aware of environmental and social cues but do not know how to respond to

them [103]. Psychological distress and fear, not understanding warnings or directions and not evacuating at appropriate times have been reported in migrant studies. Migrants are unwilling to move to unfamiliar locations, preferring to stay close to home where they feel safe [103,104].

4.6. Planning and Preparation

Planning for a safe evacuation is a vital element of the intention to leave early, well in advance of a bushfire threat [58]. Without planning, the ability to leave early to protect personal safety during a bushfire may be weakened [54] by a range of factors including: packing necessities and valuables; organising children and other dependents including the elderly; managing pets; identifying and accessing safe escape routes; and accommodating the needs of family members who are not at home [105]. Planning must also allow for multiple contingencies [54,100] including fire proximity, rate of spread, time of day, time of the week, etc. that all influence the necessary response. Fire agencies strongly encourage those planning to leave to prepare a written plan [100,106], discuss and practice it with household members and have a plan B. A contingency plan B is necessary even for those who intend to leave early due to the extremely unpredictable nature of bushfire [106] meaning that evacuation may not be possible, and a place of last resort may be required [5,33,48,99,100,106,107]. Being prepared and ready to leave provides households with a sense of calm and control in a complex and stressful environment [100].

Property preparation is necessary to enhance its defence and personal safety, even if the plan is to leave early, because fires that ignite close by and move quickly, or communication and warning failure may result in people being unable to safely evacuate [105]. Some property preparation also improves its survivability. However, defensive property preparation to reduce the likelihood of the destruction of a house or structure, undertaken by those who intend to leave early, is significantly more limited than those defending or waiting to see [33,53,68,93,100,108] including removing combustibles and clearing vegetation [53,76]. Early leavers place less importance on the survival of their home, contents or work equipment [55] than remainers, or those who 'wait and see', although they are concerned their home will be destroyed as a result of leaving [56]. Early leavers may fail to prepare because they believe their property will not be threatened [109] because they expect less positive outcomes from efforts to defend their property than remainers [55], or because they expect, by leaving, the fire services will have an unobstructed opportunity to protect their property [76] increasing the odds of their house surviving [59,76].

Those who have prepared to leave are able to take more considered steps toward evacuation [59] than those who reactively evacuate [109], reducing the likelihood that they will evacuate [59]. A minority of those who intend to leave, plan or prepare [36,71,109], many believing that they will be protected by the emergency services, insurance or disaster relief grants [96,100,110]. Few (35%) have a plan [56] and of those, few had: identified a trigger to activate leaving (7%); planned an escape route (11%); selected a safe destination (24%); or prepared an evacuation box of necessities and valuables for immediate departure (42%). Many do not consider when or how their plan to evacuate would be implemented [53]. Failure to plan has been explained by the belief that a bushfire was unlikely, and if a fire eventuated, it would be relatively simple to evacuate [36].

Tools are available to assist householders in developing a Bushfire Survival Plan directed at assessment for remaining to defend [111] but planning tools (property organisation and evacuation) targeted specifically at those who intend to leave are not available. Early leavers are advised to assemble an emergency kit and to specify a trigger for activating evacuation [58].

It has been suggested that, as well as for defenders, psychological preparedness is important for those who intend to leave early because conditions when evacuating, such as wind, noise and heat, may be treacherous, requiring mental strength, coping and calmness [112]. Individuals and fire agencies need to be able to assess psychological preparedness as physical preparedness is currently [113].

4.7. Archetypes

Research that has identified various evacuation archetypes displaying typical patterns of risk, attitude, intentions, priorities, and behaviour toward bushfire [60,114] highlights the diverse ways people respond to the threat of bushfire. This response is in many cases at odds with the advice of fire services [115]. This research suggests that Threat Avoiders and Isolated and Vulnerable [60] or Considered Evacuators (CE), Dependent Evacuators (DE) and Responsibility Deniers (RD) [114] intend to leave as early as their circumstances allow. Typically, these archetypes recognise the threat of bushfire, place a high priority on personal safety rather than property protection and perceive leaving as the best way of protecting their lives and the safety of household members. Delays in evacuation arising out of archetypal responses have been reported that may reduce the likelihood of leaving early. Archetypes engage in purposive processes to organise and manage their protective action, delaying immediate evacuation because of reliance on others (DE and RD), implementing their evacuation plan (CE) and consulting with network members (Community Guided) [116].

4.8. Children and Other Dependents

Responsibility for children, the elderly, including First Nations elders [117] and other vulnerable household members influence decisions to leave early [54,55,88,117] to protect them, and especially young children [53,55], from the danger posed by bushfire [53,62].

School aged children can play a positive role and reduce their vulnerability by being involved in household bushfire planning [118]. The accuracy and sophistication of children's knowledge about their personal preparation for leaving, safe destinations and decisional triggers was influenced by the extent that they were involved in household planning. Children involved in this way advocated leaving early to destinations far from the fire danger, while those who were not involved wanted to 'wait and see' or to go to dangerous destinations [118].

4.9. Animals and Pets

The safety of pets is highly influential in people's decisions to evacuate and where they go during bushfire [119]. Pets are extremely emotionally important to pet owners who are highly attached to them [120]. Pets are included in plans [121] to leave because their loss would be unbearable, contributing to the stress of evacuation [119] and potentially risky behaviours [120]. In some cases, a household member may decide not to evacuate with the rest of the household to look after pets and animals [119]. The safe evacuation of pets affects the type of transport used, the time it takes to leave [121] and the number of return trips necessary before all pets are moved [119,120]. If a pet friendly refuge or evacuation destination is not available, pet owners will organise makeshift accommodation, or will simply not evacuate [119]. Family and friends support the evacuation of pets. People who intend to leave early, more than those who would remain or 'wait and see', believe that leaving prevents their pets from being injured, probably because they are able to be evacuated with them [55].

Recognizing the difficulties associated with moving horses quickly, pre-emptive relocation in response to catastrophic weather conditions is advocated as the safest course of action for horse and owner [122]. While pre-emptive action is not always possible, detailed scenario-based contingency planning provides a basis for early leaving under a range of circumstances [122].

Cost -effectiveness of evacuation is particularly important for pet and animal owners because they may be difficult to move, stressed by the process or may require costly interventions [61] to achieve a safe relocation.

4.10. Triggering Evacuation

Many people who leave respond to a specific trigger event [53,57,123] that indicates escalating danger [53,56] and that their property is under imminent threat of bushfire

including: official warnings [53,57,59] including radio announcements to activate fire plans [48,54], environmental cues such as smoke or embers [48,53,54,56,57,61,68,71,100,123], extreme weather conditions [100]; seeing others leaving [33,57,61,69,85]; advice from neighbours [53]; and realisation that the fire is too dangerous to remain and defend [54,68].

However, many people intending to leave early are unable to identify a specific trigger to activate leaving [36,58] placing them at risk of late evacuation [48] and possible death [75].

4.11. Impediments to and Facilitators of Leaving Early

Community members including neighbours and extended family members, assist in bushfire evacuation [60,81], including providing transport, information, advice and warnings, management of pets and local knowledge. Assistance with accommodation away from the fire is also provided by family and friends [60]. Local fire brigades also play an important part in encouraging and assisting people to leave early [110].

Leaving early is not always possible due to a lack of early warnings [99], unavailability of safe escape routes, and accidents and traffic jams resulting from movement of large numbers of vehicles [70].

Barriers to leaving have been discussed in detail in a recently published review of the 'wait and see' literature [124] but in the context of leaving well before a bushfire threatens, the literature reports people delay, prevaricate, or drag their feet because they: worry about leaving unnecessarily before the threat is imminent [53,61]; are concerned they will not be able to escape safely [5,36]; fear their unattended house will be destroyed [36,125]; worry they would not be allowed to return when they wanted to; want to avoid the costs of evacuation including the inconvenience of 'coming and going' [27,70].

4.12. Policy

Policy discussion in the literature of 'leave early' protective response to bushfire is not extensive, especially given the importance of the message that leaving early is the safest option in bushfire, and its limited acceptance and implementation by the community. The policy issues reported below are discussed in the context of encouraging people to leave early in bushfire.

4.12.1. Tailoring Programs to the Target Audience

The effectiveness of fire agencies' behavioural change, information and warnings strategies can be enhanced by better understanding the nature of communities and individuals living in bushfire prone areas and designing and targeting policies and programs on the basis of the diverse needs and attitudes of these individuals [27,67,110,115]. Self-evacuation archetypes provide a basis for better understanding individuals' needs, attitudes and responses to bushfire threat. Community education and engagement programs can be targeted and tailored to address the diverse needs of community members to promote early leaving [114].

4.12.2. Advice on what Leaving Early Means/Requires

People report that they have difficulties understanding the meaning of leaving early and knowing when it is safe to leave during a bushfire event [48,61]. Fire agencies need to clarify [48] by providing more detailed and specific evacuation information [33] and suggesting triggers for leaving early and when it is too late to leave [48]. The disconnect between the typical agency definition of leaving early as before, or on the morning of, days of heightened bushfire risk and the definition of leave early as reported in this review, creates a significant challenge for the efficacy of the policy position.

4.12.3. Planning and Preparation

It is a challenge for the fire agencies to motivate early leavers to carefully plan their evacuation given that many will simply see their plan as 'leaving'. Plans need to be com-

prehensive, flexible and adaptable recognising that circumstances may change suddenly, and fire conditions may be extreme [3].

Fire agencies need to contextualize fire risk and develop strategies for local communities which can be used to personalize household bushfire planning [100]. A model that predicts bushfire exposure for individual households and assists them establish the need to leave early could reduce the risk to personal safety [105]. Local bushfire brigade engagement and collaboration with the local community, involving 'bottom up' planning and engaged leadership drives locals to be more resilient and more inclined to leave early [60].

Householders leave in response to a specific trigger event so agencies should encourage and assist in identifying and incorporating such triggers into household bushfire plans [54] in order that they will leave early well in advance of any bushfire threat.

Contingency planning for safe sheltering is required in the event that early evacuation efforts are unsuccessful [99,107]. Many early leavers are concerned about the destruction of their home in their absence but tend not to prepare their property to reduce the chance of this occurring, possibly due to a lack awareness of the effectiveness of this strategy. Fire agencies could consider educating early leavers in appropriate preparation to reduce risk of property loss and consequently motivate people to more willingly leave early [108].

4.12.4. Warnings

The effectiveness of warnings during an emergency is dependent on prior efforts to build community preparedness and resilience [126].

To increase their effectiveness, messages about the threat of fire to personal safety [59] need to be balanced with those that strengthen efficacy by increasing understanding of safety enhancing actions [37]. Recognising the concern of many early leavers about the destruction of their home in their absence, warning information that includes easy, quick and effective means of protecting property and basic preparations for a safe evacuation, would be most effective [55,56]. Effective warnings that are accurate, timely, detailed and locally relevant, that clearly communicate the level of threat to personal safety can encourage leaving early [59].

4.12.5. Migrants

Migrants need understandable information about bushfire, so they recognize risk and imminent threat and are able to respond appropriately. Migrant communities' social and cultural characteristics [110] need to be recognized and integrated into broader community bushfire education and engagement strategies and programs [103].

4.12.6. Pets and Animals

Owners' attachment to their pets (including horses) should be leveraged by the fire services to promote preparedness and planning and reduce reactive responses to a bushfire event [122].

4.12.7. Economic Assessment

Early leaving has a higher cost–benefit than expansion of prescribed burning or home ignition zone treatments, so measures to prioritize early leaving can be justified on an economic basis. Support for developing household evacuation planning, warning systems, and modifying the role of firefighters to assist evacuation [127] can be argued to be economically efficient. There is a need to educate people about the benefits and costs of different ways of responding to bushfire [128].

5. Conclusions

Since the Black Saturday bushfires (and possibly to be reinforced by the Black Summer bushfires) a larger proportion of people say that when confronted with a bushfire threat they will chose to leave early, that is, as soon as they know a bushfire is threatening their town or suburb. This choice is confounded to some extent by uncertainty about when

leaving is early enough to be safe due to the importance of local factors and circumstances that influence this judgement.

People leave early primarily because they want to protect their lives and the lives of household members, especially young children, and to protect pets. Bushfire threat perceptions are heightened by a belief that their home is undefendable due to inadequate preparation, lack of defensive equipment and limited escape options. Leaving is predicted by the perception that it is an effective way of protecting personal safety, the receipt of an official warning and the perception of likely impact of the bushfire. If people intend to leave, they tend to do so. Specific triggers such as official warning messages; smoke, embers and flames; the entreaties of family, friends or neighbours; and seeing others leaving, prompt some to leave while others fail to respond to triggers placing themselves at risk of late evacuation and death. On the other hand, people delay leaving because they want to be sure that the threat is real, and they are not unnecessarily inconvenienced by leaving.

Many people believe that because they intend to leave well ahead of an imminent bushfire threat, which they see as an easy thing to do, they do not need to plan. Since defending their home is not their intention, they also believe that it is not necessary to prepare it beyond normal maintenance. However, planning what to take, deciding on a safe destination, and identifying safe evacuation routes is essential and some property preparation can improve house survivability in the owner's absence. People may be encouraged to plan the implementation of their early leaving if they understand that such planning is as important as planning for remaining to defend. Knowledge that some property preparation can increase the survivability of their house may encourage this preparation and increase their willingness to leave early.

A lack of planning, household discussion and collaborative decision making during a bushfire event can cause disagreement and delay and ultimately place households and especially children and other vulnerable members, at extreme risk of injury and death. Disagreement between men and women during bushfire about appropriate protective response is an important barrier to household members leaving early.

Effective warnings can encourage and facilitate early leaving but overwhelmingly people rely on their own assessments of the hazard situation. Warnings are more likely to influence early leaving if they are extremely instructive about local circumstances and provide extensive information that would assist safe evacuation. More extensive use of GIS and mapping technology offers opportunities to provide personalized hazard and warning information and decision support tools that could significantly increase the number of people deciding to leave early and safely evacuating.

Fire authorities strongly encourage leaving early as the safest option in bushfire, but the policy options canvassed in the literature, to achieve this are limited. There is a pressing need for much greater policy focused research in this area. The literature strongly suggests that better understanding peoples' attitudes and needs and addressing these through targeted bushfire safety policies and programs is more likely to enhance protective decision-making, than rebuking them for failing to share responsibility. As the self-evacuation archetypes illustrate, the reality of how people do respond to bushfire situations, and the subjective nature of decisions around what constitutes early leaving, in many bushfire events, suggests a need to adapt community safety approaches and policy to better take account of the diversity of possible responses and to people's needs.

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