

“Should I Stay or Should I Go?” Defining the Preparatory Conditions in Support of Active Defence for Different Fire Danger Ratings

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Abstract

In Australia, householders can stay and defend their properties during a bushfire if the household is adequately prepared. State (and territory) fire agencies have provided householders with checklists of desirable preparatory actions, including property preparation, judging ability of individuals, and acquiring equipment and resources for active defence. However, the lack of consistency in the existing checklists implies not all the listed preparatory actions are *critical* for making the decision of actively defending; in addition, agencies agree that the levels of desired preparedness should be associated with Fire Danger Ratings (FDR), the indicator of fire weather intensity. Still, no clarification exists concerning the exact levels to which a household should prepare to actively defend during different FDRs. This study therefore attempts to explore the *critical* nature of preparatory actions in relation to FDRs based on expert knowledge. To this aim, a survey was conducted with bushfire experts who were requested to rate whether each preparatory action is critical under different FDR conditions. Results from 36 experts confirmed our hypothesis that some preparatory items are not critical or only critical at certain FDRs. However, a more in-depth study with a range of experts is required to provide further consensus concerning the critical preparatory actions and to clarify discrepancies of opinions for items highlighted as controversial through the survey process.

Additional Keywords.

Bushfire, preparedness, stay and defend

Background

The AFAC policy (2010, p.11) on Bushfires and Community Safety states that ‘people usually have two safe options when threatened by bushfire: leaving early or actively defending adequately prepared properties’. Therefore, it is important for householders to understand what is meant by ‘being adequately prepared’ when deciding on whether or not to defend their property. However, post-fire studies have indicated that many people who plan to stay and defend often overestimate their preparedness levels and capability to actively defend a property (Handme *et al.* 2010; McLennan *et al.* 2011; Whittaker *et al.* 2013). One major issue that may have contributed to the misjudgement is the lack of explicit explanation or guidelines for sufficient household preparedness for staying and defending. The AFAC position paper (2010) has outlined two major aspects concerning household preparedness to enhance the chance of successfully staying and defending:

- a) The defendability of a property. House defendability should be ensured by creating and maintaining a defendable space, within which bushfire fuels must be reduced to eliminate or significantly attenuate the ability of a fire to burn and spread to buildings, as well as ember-proofing the building structure to minimise the chance of its ignition (AFAC 2010).
- b) Householders' competence in defending their home. The AFAC position paper (2010, p. 10) identified that 'for those planning to defend their homes, they must ensure that they are fit, and have personal protective equipment, adequate water supplies and firefighting equipment for the expected fire conditions'. In addition to physical fitness, defenders must also be psychologically ready to cope with trauma and injury and strategically plan for different circumstances and possible predicaments during the active defence (AFAC 2010).

Corresponding to these aspects of household preparedness, fire agencies across Australia have provided householders with checklists of desirable preparatory actions. However, the existing checklists are only suggestive, and do not provide definitive insight into the required preparatory actions for staying and defending or whether completing a subset is sufficient. In addition, there is little consistency among the various agency-distributed preparation checklists across Australia. Although several studies have attempted to identify subsets of the more important preparatory activities (Paton *et al.* 2006; McLennan and Elliott 2011), these checklists were only developed as research instruments, and thus cannot serve as an indicator of sufficient preparedness in an operational setting. Further research is needed to investigate the operational significance of agency-listed preparatory actions in relation to households' safety for staying and defending.

Furthermore, the current risk communication materials distributed by Australian fire agencies (e.g. CFA 2010; DFES 2012) propose different required levels of preparedness depending on the Fire Danger Rating (FDR) levels. The current FDR system (as summarised in Table 1) is derived from the Fire Danger Index and intends to provide a scale to indicate potential fire behaviour (if started), and the difficulty of suppression given the forecasted weather conditions (Dowdy *et al.* 2009). Table 1 shows a sample of messages distributed by the Country Fire Authority (2010) concerning the meaning of FDRs and their relationships with the action of staying and defending. It illustrates that higher levels of preparedness are desired for actively defending a property at higher FDR levels. The terminology in the messages is abstract, however, in that it does not specify what being sufficiently prepared entails under different FDRs.

Table 1. Fire Danger Ratings and associated advices regarding household preparedness for staying and defending (adapted from Country Fire Authority 2010, *Prepare. Act. Survive. Fire Ready Kit.*)

FDR Categories	Fire Danger Index	What does it mean?	Staying and defending can only be considered if one's home is...
Catastrophic (Code Red)	100+	These are the worst conditions for a bush or grassfire. Homes are not designed or constructed to withstand fires in these conditions.	Never
Extreme	75 – 99	If a fire starts and takes hold, it will be uncontrollable and unpredictable. Spot fires will start, move quickly and come from many directions.	Situated and constructed or modified to withstand a bushfire, prepared to the <i>highest</i> level and can be actively defended.
Severe	50 – 74	If a fire starts and takes hold, it may be uncontrollable.	<i>Well prepared</i> and can be actively defended.
Very High	25 – 49	If a fire starts, it can most likely be controlled in these conditions.	Not stated
High	12 – 24		
Low to Moderate	0 – 11		

This study attempted to explore the *critical* nature of preparatory actions in relation to FDRs based on expert knowledge. A survey was conducted with relevant experts across Australia. In this paper, the following research questions are to be investigated via the analysis of experts' responses:

- i. Are some preparatory actions critical for staying and defending whilst some are not so?
- ii. Does the critical nature of a preparatory action for staying and defending vary at different FDR levels?

Throughout this paper, a '**critical**' preparatory action is referred to as an item that is essential for staying and defending in a bushfire; failing to complete a 'critical' item will dramatically decrease the chance of house survival or the possibility of properly defending the property, and thus actively defending is probably not a safe option under such circumstances. On contrary, some items may be helpful but not necessary, and thus should be regarded as non-critical. Failing to complete such items will have only a slight impact on the chance of successful defence if all the critical items have been assured. Theoretically, the clarification of the critical nature of the preparatory actions will provide better reference for residents to assess their preparedness level and make relatively sound and confident decisions regarding active defence; however, it should be recognised that the safety of a household in a bushfire can never be guaranteed, especially during intensive fires.

An exploratory study of preparatory actions

Collection of preparatory items

A comprehensive checklist of preparatory actions was derived from a range of agency-distributed materials concerning household preparedness, including the 'Prepare. Act. Survive' pamphlets released by seven Australian state (and territory) agencies¹ and two materials from U.S. organisations². To integrate all materials, similar items were amalgamated, while omnibus items with multiple detailed actions were split to form an accurate and inclusive list of 100 items. Furthermore, the items were classified into sixteen categories (as shown in Table 2) that were created based on the important preparation aspects identified by the AFAC position paper (e.g. preparation for property defendability, judging ability of individuals, and acquiring equipment and resources for active defence) for the purpose of delineating the entire collection of preparatory actions.

When examining overlap of items across the different materials, around 32% of items were mentioned by four or more of the nine reviewed materials. These items may be more important than others as they were more consistently mentioned. For instance, the item 'cut long grass within the inner zone' is probably critical to mitigate fire impact as it is mentioned by all nine agencies.

¹ North Territory was the only state excluded in this review because no specific Prepare. Act. Survive brochure was released online by the time of research.

² The two U.S. materials are 'Wildfire Preparedness' released by American Red Cross, and 'Checklist for Homeowners' developed by the Federal Emergency Management Agency.

Table 2. Categories of household preparatory actions included in the collective checklist

	Categories	Code	Number of preparatory actions	
PROPERTY DEFENDABILITY	To create defensible space, ...	Create an <i>Outer Zone</i> by managing vegetation and reducing fine fuels.	D1	7
		Maintain vegetation and clear fine fuel within the <i>Inner Zone</i> .	D2	12
		Clear flammable materials within the <i>Inner Zone</i> .	D3	5
		Create fire breaks within the defensible space.	D4	5
	To Ember-proof the house, ...	Clear fine fuels and combustible materials on the building.	D5	4
		Block all gaps in a structure and place metal fly wire mesh on all vents.	D6	13
		Use non-combustible building materials.	D7	9
PEOPLE, RESOURCE AND EQUIPMENT TO ACTIVELY DEFEND	Prepare equipment for actively defending.	D8	10	
	Prepare water resource for actively defending.	D9	5	
	Prepare food and water supply for people who are actively defending the home.	D10	4	
	Prepare survival kit.	D11	7	
	Ensure accessibility for firefighters.	D12	3	
	Ensure coping capacity of those who are staying and defending the home.	D13	6	
	Prepare psychologically for staying and defending.	D14	6	
	Plan for staying and defending.	D15	3	
	Prepare a fire shelter or bunker to shelter in home as a last resort.	D16	1	

Questionnaire

In May 2012, a questionnaire based on the collective list of preparatory actions was deployed online. In the beginning of the survey, a self-assessment question was used to ensure only experts who are familiar with the pertinent subjects complete the survey. A snowball sampling strategy was employed to recruit preparedness experts from state (and territory) bushfire agencies as well as research institutions across Australia. A list of 48 contacts consisting of relevant experts from each organisation was initially constructed based on recommendations by our personal network and identification through a web search. Emails were sent to each identified expert to request their participation in the survey if they held the necessary level of expertise; moreover, they were asked to help circulate the survey to or provide recommendations of the appropriate personnel within their organisations. Two reminders were sent in two-week intervals. A total of six additional experts were suggested during this process and were thus emailed following the same contact protocol. Besides this, some experts helped propagate the survey link within their personnel's email network. Eventually thirty-six valid responses were garnered. A majority of the participants (33/36) were agency-based emergency management officers and/or experienced fire fighters, and the other three responses came from bushfire community safety related researchers.

Within the questionnaire, fire experts were asked to identify 'at which FDR level(s) does each preparatory action become critical and therefore needs to be completed by the household in order to stay and defend', followed by the definition of '**critical**' preparatory actions. Logically, a preparatory action that is critical at low FDRs should also be critical at high FDRs; however, an action that is not necessary at low FDRs may turn out to be critical at high FDRs to fortify the protection against severe fire conditions. Therefore six options, as listed in Table 3, were given for the raters to choose from. This particular method was adopted to provide an understanding of whether an item is critical for staying and defending, and if yes, whether it is critical at all FDRs. The ratings associated with FDRs should be interpreted as a scale of how critical it is to complete a preparatory item for staying and defending. The items rated as critical at all FDRs are considered to be the most critical and should be completed under any bushfire condition to provide primary protection for active defence.

The items **Table 3**. Rating scale adopted in the Household Preparedness Survey and the coding values for analysis

Answers from the survey	Code
<i>The preparatory item is critical at the FDR Levels of ...</i>	
Low-Moderate, High and all levels above	4
Very High and all levels above	3
Severe and all levels above	2
Extreme level only	1
Not critical at any levels	0
Not sure	Missing Value

rated as critical at Extreme FDR only serve as vital protection for a property only under severe fire circumstances when the fire can easily become out of control. Furthermore, items

rated as not critical at any FDR levels are not considered as necessarily critical, and failing to complete them should not influence the choice of staying and defending in any fire condition. The five viable answers were thus translated to an indicator representing how critical an item is based on a five-point ordinal scale from 0-4, where a larger value signifies a preparatory item is more critical to complete for staying and defending.

Analysis of Survey Results

Criticality ratings

Most preparatory actions obtained at least 32 valid rating values from the survey. All of the experts differentiated their ratings for the 100 items using the 0 to 4 spectrum identified in Table 3. Some experts adopted a more conservative approach than others by rating a large portion of the items as 4, but small clusters of 0 ratings were also observed for some items. This suggests that the experts acknowledged the different degrees of importance inherent in the preparatory actions, and there was relative agreement that some preparatory actions are not critical in making the decision of staying and defending.

A calculation of the mean rating values for each preparatory item manifested that on average, 70/100 of the items were rated greater than 3 ($M_{max} = 3.8$), while 29/100 of them were between 2 and 3 and only one item was rated below 2 ($M_{min} = 1.2$). The average rating for each item was compared with the overall mean rating value ($M_{overall} = 3.11$) through one sample t-tests. As shown in Table 4, 29 items obtained average ratings significantly higher than 3.11 and 15 items obtained average ratings significantly lower than that. The differences in ratings among the items are thus not due to chance, supporting the idea that the critical nature of the preparatory actions should vary at different FDRs. We then examined the relationship between the average rating values and the number of references. For the items referenced in less than four sources, 16 items were rated significantly higher than average (3.11) while 13 were rated significantly lower than 3.11; in contrast, the ratio is substantially larger for the items referenced by four or more sources (12 items significantly larger than 3.11 and one item significantly lower than that). This confirms our prediction that less referenced items may be less critical (i.e. lower rating scores) for staying and defending; however, 'number of sources' is not an explicit indicator of how critical a preparatory action is.

Table 4. Comparison of item mean rating values with the overall mean value (3.11)

Item mean rating value	Number of preparatory Items			Total
	From 1 -3 sources	From 4 - 9 sources	Other ^a	
> = 3.11	33	24	1	58
(significantly* >=3.11)	(16)	(12)	(1)	(29)
< 3.11	34	7	1	42
(significantly < 3.11)	(13)	(1)	(1)	(15)
Total	67	31	2	100
				(44)

* $p < 0.05$, based on one sample t-tests to compare the mean rating value of each item against overall mean value.

a. Two items were not sourced from the reviewed materials, and their average rating values are both significantly different from 3.11. The first one is 'have a fire shelter or bunker built in the home which can provide shelter for people', rated as 1.2 on average. The safety of this item has been a controversial, but its construction has been specifically regulated (ABCB 2010), and a well-designed bushfire shelter is recognised as a useful backup option (VBRC 2009). The second item, 'be fully committed to defending the home', was rated as 3.36 on average. Although not explicitly listed in the current materials, this item is proven to be an important facilitator for successfully staying and defending (Brennan 1998).

Interrater Agreement

The interrater agreement (IRA) was investigated to explore whether it is possible to build a national consensus on the identification of critical vs. non-critical preparatory actions at various FDR levels. Analysis of IRA is usually employed to test the absolute agreement among human judges for rating a subject (Richardson 2010). In the present case, two common indices, the r_{wg} (James *et al.* 1984) and Average Deviation (AD) index (Burke and Dunlap 2002), were calculated for each preparatory item. The r_{wg} derives from a comparison of the actual variance obtained from multiple raters and the variance expected in the case of no agreement (usually reflected by assuming a uniform response distribution). Values for r_{wg} should range between 0 and 1 with larger values indicating better agreement. However, negative values of r_{wg} can be observed when the actual variance exceeds the expected variance for a random response, suggesting a complete disputation (LeBreton and Senter 2008). According to the interpretation of r_{wg} statistics proposed by LeBreton and Senter (2008), 46/100 preparatory actions suggested moderate to high level of agreement with r_{wg} values larger than .50, and 27/100 were between .30 and .50, denoting a weak agreement. The remaining 27/100 of the items showed discrepancy among experts' answers with r_{wg} values less than .30.

We further calculated AD, which estimates agreement in the metric of the original scale by averaging the absolute deviation of each rating from the overall mean rating. Accordingly, smaller values of AD indicate better agreement. The AD values calculated for the 100 items ranged from 0.28 to 1.30; 79/100 of the estimates were less than 1.01, the cut-off point for a five-point scale with 36 judges (Burke and Dunlap 2002), suggesting a high level of agreement.

By cross-referencing the IRA indices with the number of sources and mean rating values for the 27 controversial preparatory items (identified as lack of agreement by r_{wg}) in Table 5, we discovered that 23/27 (85%) items were collected from 1 to 3 source materials, and 18/27 (67%) items were with average rating values less than 3. This coincides with our initial conjecture that the controversial items are those less referenced in the sourced materials; however, not all the less recommended items were controversial. In addition, given that only 30/100 items in the overall checklist were rated below 3 on average, it is apparent that the items with low mean rating values occupy a larger proportion (67%) in the list of controversial items. It implies that discrepancy mostly happened when a group of experts provide an item with low rating scores, referring to a rating as critical only in severe fire scenarios or not critical at all.

One major reason for the disagreement is that some experts tended to adopt a conservative approach by rating most items to be critical at all FDR levels, whereas some experts

employed a distinct strategy by distinguishing the preparatory items as related to the corresponding FDRs. For instance, item D6_13 'install wire mesh screens 1.5mm (not aluminium) over all external doors' obtained nine ratings of 4, ten ratings of 3, seven ratings of 2, three ratings of 1 and another three of 0. One expert supplemented his rating of 0 by commenting that this item is 'unnecessary if other listed actions undertaken'. Some raters may have held a similar position by rating it as 1 or 2, while the others probably took a more conservative approach. In fact, all the nine ratings of 4 in this case were served by conservative raters who rated more than 70% of the preparatory items as 4. A different type of discrepant distribution of ratings can be observed of item D10_9, 'ensure that smoke alarms are fitted on every level of the house'. Twenty-nine experts rated this item as 4 with a comment that 'this is part of a general requirement and not linked to a FDR', whilst three experts gave scores of 3, 2 and 1 respectively, and another three rated it as 0, coupled with a comment that it 'will not provide reliable warning of fire in the home due to presence of bushfire smoke'. It is evident in this case that most experts considered this item as highly critical, whereas several experts held extremely different opinions, which could not be fully explored through the survey process.

Thereby, an in-depth study with a taskforce of experts in an interactive environment is needed with the aim to obtain concrete consensus for rating the preparatory items, or explore the complex reasons for disputation. Given that nearly half of the items received moderate agreement indicated by both r_{wg} and AD, it is promising that acquiring expert consensus is possible, at least for a subset of the checklist. The results would therefore be valuable to serve as a unanimous national starting point for bushfire agencies to start clarifying the checklist and identifying the critical items for different FDRs in local contexts so as to define the necessary preparatory conditions for staying and defending.

Table 5. Controversial preparatory items identified by r_{wg}

Preparatory Items	Mean \pm SD	AD	r_{wg}	Sources ^a
D2_11: Within the Inner Zone, replace all highly-flammable plants with low-flammability plants.	3.1 \pm 1.26	0.97	0.20	FEMA. NSWRFS. TFS
D2_12: Within the Inner Zone, chemically treat the area around outbuildings and sheds to prevent the regrowth of vegetation.	3.0 \pm 1.26	0.95	0.20	CFS
D3_4: Within the Inner zone, keep the gas grill and propane tank at least 5 meters from house, and clear an area of 5 meters around the grill.	3.0 \pm 1.45	1.13	-0.05	ARC. FEMA
D4_2: Establish a landscaped garden, vegetable garden, cultivated soil or gravelled areas.	2.5 \pm 1.52	1.27	-0.16	DFES. CFS. TFS
D4_3: Build wide paths, paving, driveways, or tennis court that can provide fuel breaks.	2.6 \pm 1.52	1.27	-0.15	CFA. CFS. TFS
D4_4: Locate any dams, pools and any effluent disposal areas on the side of buildings facing the most likely direction of fire.	2.6 \pm 1.48	1.22	-0.09	CFA. DFES. CFS. TFS
D4_5: Create radiation shields and windbreaks such as stone or metal fences and hedges using low-flammability plants.	2.3 \pm 1.45	1.24	-0.05	DFES. NSWRFS. TFS
D5_2: Install metal gutter protection.	3.0 \pm 1.42	1.12	-0.02	ARC. NSWRFS. CFS
D6_4: Maintain the paint on windows sills so there is no flaking or exposed wood.	2.6 \pm 1.38	1.18	0.05	CFA
D6_6: Ensure that garage doors are tight fitting to door frame if garage is attached to the house.	2.7 \pm 1.24	1.06	0.23	CFA
D6_8: Ensure that external house timbers have a sound coat of paint.	2.7 \pm 1.39	1.17	0.03	FEMA
D6_10: Block all vents and weepholes (e.g. chimneys, stovepipes) with wire mesh screens 1.5mm (not aluminium).	2.7 \pm 1.19	1.06	0.30	DFES. ARC. FEMA. ACTF&R. CFS
D6_13: Install wire mesh screens 1.5mm (not aluminium) over all external doors.	2.6 \pm 1.27	1.04	0.20	CFA. ACTF&R. NSWRFS. QFRS. CFS

Preparatory Items	Mean \pm SD	AD	r_{wg}	Sources ^a
D7_2: Fit the roller shutters with an ember guard at the top of the garage door if the garage is attached to the house.	2.8 \pm 1.21	0.97	0.27	CFA

Continued

Table 5. Controversial preparatory items identified by r_{wg} (*Continued*)

Preparatory Items	Mean \pm SD	AD	r_{wg}	Sources ^a
D7_8: For pipes that are essential to water delivery, ensure that they are metal, or non-metal pipes are buried to a depth of at least 300mm below the finished ground level.	2.7 \pm 1.27	1.02	0.20	CFA. TFS
D7_9: Have a non-combustible doormat, or remove the doormat when there is a fire danger.	3.0 \pm 1.35	1.03	0.09	ACTF&R. NSWRFSS
D10_5: Know the maximum operating temperature as specified for the pump by the manufacturer.	3.1 \pm 1.34	1.06	0.11	CFA
D10_9: Ensure that smoke alarms are fitted on every level of the house.	3.5 \pm 1.25	0.85	0.22	ARC
D10_10: Prepare knapsack spray or garden backpack spray to help you put out spot fires. If using a garden backpack, make sure it has been cleaned out before using it in a bushfire.	3.3 \pm 1.25	0.94	0.22	CFA. DFES
D11_4: Install a sprinkler system around the property.	2.3 \pm 1.27	1.07	0.19	CFS
D11_5: Install a roof-mounted sprinkler system.	2.4 \pm 1.31	1.11	0.14	CFA

Preparatory Items	Mean \pm SD	AD	r_{wg}	Sources ^a
D12_1: Obtain an emergency supply of drinking water (3L per person per day for four days).	2.4 \pm 1.25	1.09	0.22	DFES. ACTF&R. TFS
D12_2: Obtain canned or dried food to last four days.	2.3 \pm 1.28	1.12	0.18	DFES
D12_3: Obtain a water container suitable for washing or cooking.	2.0 \pm 1.50	1.31	-0.13	DFES
D12_4: Obtain a can opener, cooking gear and eating utensils.	2.1 \pm 1.48	1.29	-0.09	DFES
D14_3: No elderly who is not fit to defend.	3.0 \pm 1.29	1.03	0.17	CFA. NSWRFSS
D14_4: No children under 16 is staying and defending.	2.7 \pm 1.42	1.22	-0.02	CFA. NSWRFSS

N = 27

a. CFA = Country Fire Authority (VIC), QFRS = Queensland Fire and Rescue Service (QLD), DFES = Department of Fire and Emergency Services (WA), ACTF&R = ACT Fire & Rescue (ACT), NSWRFSS = NSW Rural Fire Service (NSW), CFS = Country Fire Service (SA), TFS = Tasmania Fire Service (TAS), ARC = American Red Cross, FEMA = Federal Emergency Management Agency.

Checklist adjustment

In addition to the ratings, results suggested an adjustment of several existing items as well as enrichment of the list with several additional preparatory actions, resulting in a refined checklist of 104 items. Moreover, the qualitative comments coupling with missing values (i.e. 'not sure') or controversial ratings explained the obstacles in providing a confident rating and helped identify several types of potential adjustment needed for some items:

Type 1. The criteria of some preparatory items need to allow for adjustment according to jurisdiction policies. For instance, the item 'isolate clumps of shrubs and small trees from one another by at least 10 metres to avoid a continuous wall of trees within the Outer Zone' was claimed to be critical at all fires by one expert, but the criteria of isolation distance was regulated to be 'at least 1 (1.5) times the mature height of any in the clump' by his/her local government.

Type 2. Some preparatory items may be critical only under some circumstances. For example, the item 'clear vegetation along the boundary of the property to create a firebreak' was suggested to only be critical for certain types of properties, depending on 'the size of the property and distance from the boundary to the dwelling'. A lack of specification of such circumstances in the current survey caused a difficulty in rating.

Type 3. Some preparatory items may be compensatory for each other, and therefore only one of the actions has to be completed to allow active defence. One example is the item 'install metal gutter protection', which was suggested as not critical if the other item 'ensure that roof gutters and valleys are clear of leaves and bark' was completed. Therefore, the two actions may be combined as one critical action to allow householders' choice of at least one of them.

These three types of issues shed light on the potential difficulties that may be encountered whilst trying to further clarify if a preparatory item is critical when there is disagreement between experts from different organisations. However, adjustment can be made to adapt the items relevant to these three issues to various local environments, jurisdictional regulations, or other specific conditions. Therefore the three types of potential adjustment suggested from the survey responses can be used as a guideline during future engagements with experts to help identify the issues for relevant preparatory items, solicit opinions to address these issues, and attain relative consensus upon the viable solutions for defining or explicating the critical nature of these complicated items for specific situations in different states.

Conclusion

Through an initial overview of the current communication materials within Australia, we identified a need to clarify the relationship between the necessity of different preparatory actions and FDR levels. This pilot study provides evidence that some but not all preparatory items are critical for making the decision of staying and defending, and in addition, their critical nature should be examined in relation to FDRs. Moderate to high interrater agreement was observed for approximately half of the items, with both high and low average rating values. However, statistics for the controversial items suggest that experts do employ diverse approaches during the individual rating process, and thus a more explicit study should be undertaken to understand the rationale of consensual ratings, to reconcile the different opinions as well as to investigate the specific reasons for disputation. Although the disparate physical and political context across Australia is likely to make it difficult to obtain a national consensus over many preparatory items, we believe this study is a breakthrough in clarifying the operational significance of the preparatory items. It provides a starting point from which a new instrument of household preparedness measure can be developed by bushfire agencies at different scales to assist residents' estimation of their preparedness levels and decision making with respect to active defence. Nevertheless, it should be acknowledged that in a bushfire, although the completion of all the critical preparatory actions will substantially enhance the chance of successful defence, the safety of a household can never be guaranteed due to the complex nature of these types of events.

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