The Threat Posed by the Increasing Rate of Bushfires to Farmers & Livestock

A Research Report to Identify Design Opportunities for Assisting Farmers in Bushfire Emergencies

DNB 311: ID7 Capstone

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Executive Summary

This report investigates the unique challenges that farmers face during bushfire response, preparation and recovery and explores how design interventions could support the Australian farming industry. Secondary research identified gaps in fire preparation, a reliance on minimal modern technology and equipment and the threat to both livestock and farms. Benchmarking was then conducted to analyse what is currently on the market and where market gaps are. This research showed a low level of cost effective products on the market that provided high levels of protection and assistance.

Primary research was next conducted through the distribution of a survey and interviews. This research identified a lack of fire plans, reliance on visual and community fire detection and the financial barriers to better systems and high cost of fire recovery. Lifestock safety was also reinforced through this research as a high priority for farmers, willing to put themselves at risk for their protection.

Through this research, four key design implications have been identified. The need for cost effective solutions, a desire for assistance in livestock safety, minimal fire detection methods and a need to minimise the risks farmers take in bushfire emergencies.

Ultimately the farming industry will benefit greatly from effective design solutions that address these core implications. The implementation of this reseach has the potential to reduce livestock death, financial strain and protect farmers and properties from the increasingly frequent and intense bushfire seasons.

Authenticity Statement
This is to certify that to the best of my knowledge, the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

AI Statement:
In the development of this report, I have utilised Chat GPT for collating products used in benchmarking and have used AI interview coding tools to polish coding. No AI was utilised for the writing of this report.

Word Count: 4377

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Introduction

Over the summer of 2019/20 in Australia, the black summer fire caused record unprecedented destruction across the country. In these fires alone, 24 million hectares of land was burned and almost a third of it was farm land (Davey, et.al, 2020). In addition to the land loss an estimated 56000 livestock were also killed or euthanised as a result and this is only one fire season. With the frequency of extreme bushfires expected to increase like it already has in recent years, farmers are threatened by this most. With bushfires often starting in bushland that is adjacent to properties or fires starting on properties, more must be done to protect farmers, properties and livestock.

This is not only a major issue for our farmers but for the health of our nation. According to a 2024 study by the Australian Bureau of Agricultural and Resource Economics and Sciences, the farming industry makes up 2.7% of our GDP (ABARES, 2024). With so much of our rural area being made up of properties, mostly owned by independent Australian families, supporting farmers using design interventions that address their issues is vital. Whilst there has been rapid development of advanced equipment and design for firefighters, the same cannot be said for the farming industry. With studies indicating a high likelihood of farmers staying to defend their properties (Smith et.al, 2015) more can be done.

The aim of this project is to explore the unique challenges that farmers face in the preparation, response and recovery efforts whilst protecting their properties and livestock during bushfire emergencies. This research report will use both secondary and primary research methods to explore these issues and identify areas for potential design intervention.
sponded that they had firebreaks in place on their properties and 74% conducted controlled burns or other fuel management techniques. Whilst participants had methods for staying informed about large fires from fire services and radio, the same can not be said about detecting fires on their property. Only 3 of the 14 responses to the question said they had cameras or other systems in place to detect fires whilst the rest relied on themselves or neighbours spotting a fire. With bushfires having the potential to intensify rapidly, early detection could mean the difference between saving or losing a property. This makes the current absence of reliable detection methods a major issue for farmers during the fire season.

Background

To formulate an understanding of the current challenges that bushfires create for the farming industry, secondary research has been conducted. This research has identified both risks that bushfires pose and the unique problems for the farmers.

Farmer Risk and Preparation Gaps
A 2014 case study conducted on livestock producers in South Australia found that 73% of respondents would choose to stay and defend their property (Smith et.al, 2015). This high percentage becomes even more concerning when a majority had no actual bushfire plan in place despite the recommendations of needing one by most fire services. 81% of these properties were directly impacted by bushfires that year losing land, equipment and livestock. This is not a unique case with similar reports of farmers opting to stay and defend in the 2020 black summer fires (Thomas et. al, 2025) and 24 farmers losing their lives. Despite the risks, farmers are more likely to stay and defend as the threat of losing your livelihood is too great (Whittaker et.al, 2012) even though farmers tend to have little assistive technology or plans in place often relying on experience and visually identifying and assessing fires (Eriksen & Gill, 2010). Additionally farmers report some preparation actions such as creating firebreaks (ploughed land or dirt walls), having water trailers and community efforts but this still falls short of fire service recommendations(QFS, 2024).

Threat to Livestock
With farmland often situated near bushland and in the direct paths of emerging bushfires, they pose a threat to the health and safety of livestock. In the 2019/20 black summer bushfires, an estimated 56000 livestock were killed or euthanised due to fire related injuries (Cowled, B.D. et al, 2022). This number represents not just a loss of life but the death of farmers' livelihoods. Whilst this number is massive, it only addresses those killed. A study was conducted on both fire affected farms and those in close proximity to the bushfires in 2020. The study found that the smoke inhalation affected livestock health, meat quality and also led to additional deaths on farms that weren't in the fire directly(Eid,B et. al, 2021).

Conclusion
With bushfire frequency increasing worldwide due to climate change, the threat to farmers will only grow in the coming years (Robinson et. al, 2018). With farmers defending their livelihood and livestock, it is clear why they decide to stay. These findings show a clear need to further investigate what is needed for farmers to safely deal with fires to minimise property loss, livestock death and minimise human risk.

Benchmarking

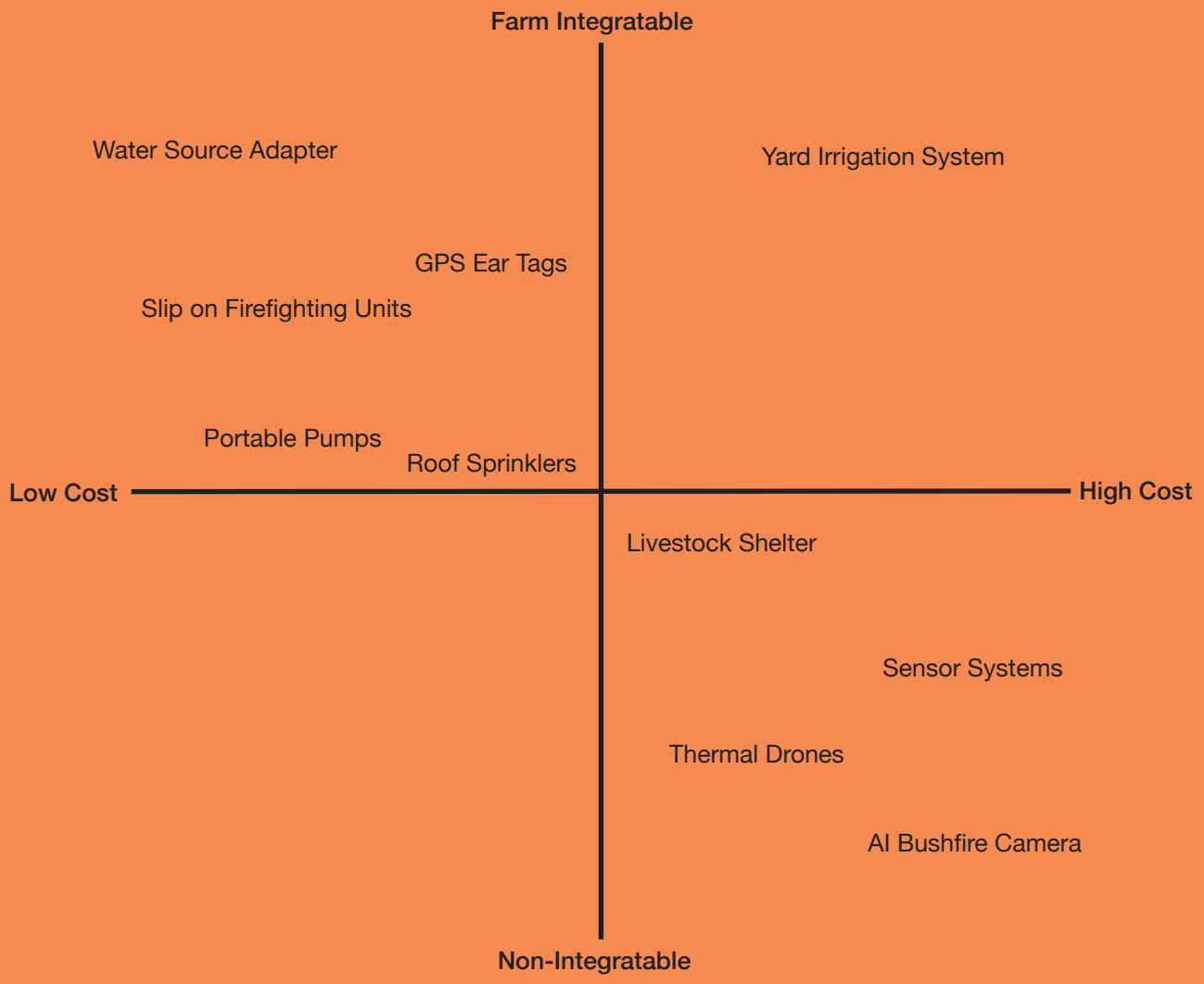
Benchmarking is a vital part of the product design process, assessing what exists in the market currently to identify gaps in the industry and the viability of new design solutions. With the scope of bushfire related products covering a wide range from consumer products to firefighter and professional level devices, benchmarking is uniquely difficult for this area. The following section identifies a key set of products that are compared using a criteria table and product matrix. The table also includes a list of similar products for each as there is a large amount of varied solutions.

Benchmarking Table

The below table outlines the key products being utilised for benchmarking including category, cost and similar products available. In the appendix, a full list of additional comparative data is available. As you can see from the table, there is a wide range of products aimed at different issues from detection to fire fighting. With cost and integration being two of the most important factors, they have been used for the product matrix which compares the categories of products.

Product	Category	Cost (AUD)	Description	Similar Products
PANO AI Camera	AI Bushfire Fire Camera	$20k-80k	AI assisted 360 camera systems used to identify bushfire origins in remote locations via image learning to alert of smoke.	SmokeD, FireHawk, FireScout, Exci
Attentis	Sensor System	~$27k Per Unit	Research based sensor designs aimed at use in remote locations. Capable of sensing pollutants, sounds, weather and more.	N5 Sensors, Dryad Networks
Ember Defender	Building Sprinkler System	$431	Sprinkler systems designed to be setup on rooftops and gutters to wet down buildings and the surrounding ground.	Ember Defender, Irrigear, Roof Saver Sprinklers
Livestock Shelter	Livestock Shelter	N/A	Fire Resistant shelters being tested in Southern Australia as refuges for livestock during bushfires.	N/A
CFA Tank Fitting	Water Source Adapter	~$450	Large hose adapter that allows large standardised fire hoses to be attached to tanks and other water sources.	N/A
mOOvement Tags	GPS Livestock Tracking	$20+ Per Tag	GPS and IoT integrated livestock ear tags that provide accurate location tracking and other data on a herd.	CERES TAG, 701x, LoneStar Tracking
DJI Matrice 30T Thermal Drone	Thermal Drones	$12k-20k	Professional level drone with thermal imaging camera that is used for search and rescue, hotspot identifyig and other practices.	DJI Matrice 350 RTK, DJI Mavic 3 Thermal
TTi Fire Defence, 1000L Capacity	Personal Fire Fighting Device	$6,221	Slip on water tank and pumped hose system for vehicles that are available to convert them into mobile firefighting units.	AquaPath Water Cart, Fire Attack Fire Fighting Pump Unit
Mobile Stockyard Irrigation System	Industrial Irrrigation	$4100	Large industrial irrigation systems used to spray both farm and saleyards with water on larger properties.	K Line Farm Irrigation Kit
Johnson Aqua Jet Dual Water Pressure Pump	Portable Water Pump	$1099	Mobile submersible or attachable water pump to allow high flow rate from water sources such as dams or bores.	Honda Water Pump & Engine

Product Matrix



Insights

As can be observed in the matrix, there are multiple key market gaps that can be identified in addition to other problems with the existing product market. The minimal amount of products that are both high cost and integratable could be seen as a market gap but this is misleading. This gap shows that there may not be a large quantity of farmers able to afford a more expensive solution but some major properties such as cattle stations could fill this gap. Additionally, the large amount of low cost small solutions and supporting devices shows a desire for these types of products. It is also worth noting the types of products that fall into the high cost section. The products here are often targeted at government agencies and provide a more powerful tool such as early fire detection and search and rescue capabilities. If there were products of this nature designed in a cost effective and user friendly manner then it is likely farmers may be able to integrate them into their farms.

Conclusion

The benchmarking conducted in this section will be vital for informing the viability of any design solutions and also in the development of primary research questions. With a low level of bushfire solutions being integrated into the farm ecosystem, it is imperative to understand what challenges could be causing this such as financial barriers and usability.

Research

Methodology & Methods

Primary research is a vital tool that is utilised in the design process to gain unique and informed perspectives on the issue directly from key stakeholders. The information and perspective provided directly from those that are involved with the issues being explored is often overlooked in secondary research methods and can assist designers in finding specific challenges that design could be used to address.

This project has employed two methods of primary research to understand stakeholder perspectives which are a 22 question survey and a semi-structured interview. The survey provides both qualitative and quantitative data whilst the interview provided just qualitative data. The data collected using each method has been analysed together in this section to identify consistent data across the pair. This section also outlines how each method was conducted in addition to some of the unique recruitment challenges that the primary stakeholders in bushfire areas present that can also inform why this area of bushfire impact is underexplored currently.

Surveys

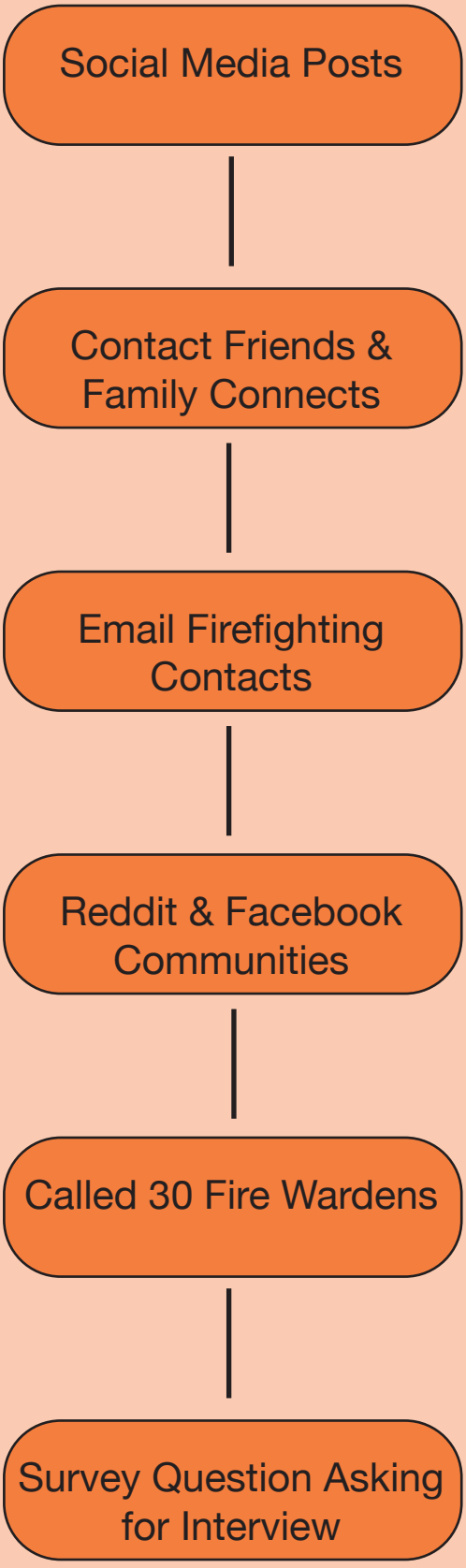
Surveying is a primary research method that enables a larger quantity of feedback from a wider collection of people than other tools such as observations and interviews. This quantity of feedback allows trends and patterns that emerge across the respondents to be easily identified in addition to any unique perspectives that may come from specific regions or farm types in this case. The secondary research conducted prior to this stage was crucial for identifying what questions should be included to best understand the specific challenges for farmers. As the secondary research had identified livestock and farm preparation and response as both challenging issues and under researched areas, the survey has been made for farmers specifically. This tool was utilised as Australia has one of the largest farming industries in the world and getting a high intake of participants for primary research would be achievable through connections and other distribution methods which have been explained below. The final Survey included 20 questions with a mixture of both multiple choice and short response to gather both quantitative and qualitative data. The full question list and responses are attached in the appendices to understand the full data collection.

Recruitment Methods

To ensure that the survey had not only a high number of participants but that the target audience for the survey was reached, a multi level distribution system was used. Thanks to personal background, Initially distribution was to friends and family, followed by social media posts and eventually facebook groups and online farmer's communities. The distribution methods resulted in a total of 17 total survey responses.

Limitations

Survey limitations mean that it is not the ideal method unless being used in conjunction with another and the stakeholders for this specific research also presented additional challenges. Farmers were being difficult to contact through available channels and required multiple reminders and often still resulted in no response. Although the survey was able to reach more Australian farmers than initially expected, the responses provided were not always perfect. The short response questions were selectively answered and resulted in approx. 8-13 answers each out of the 17. Despite this, the answers gathered provided useful information that will be crucial for identifying design implications.



Interviews

Interviews are the additional method of primary research that has been used to gather insights from key stakeholders. Interviews are direct conversations with the stakeholders and using a semi-structured interview format enables you to follow paths in the conversation to understand points in depth whilst still answering a set of key questions to gather important qualitative data. Where a survey is rigid and at most has short response questions, interviews allow the stakeholder to fully convey their perspective including information that is outside of the interviewer's prior scope.

Recruitment Methods

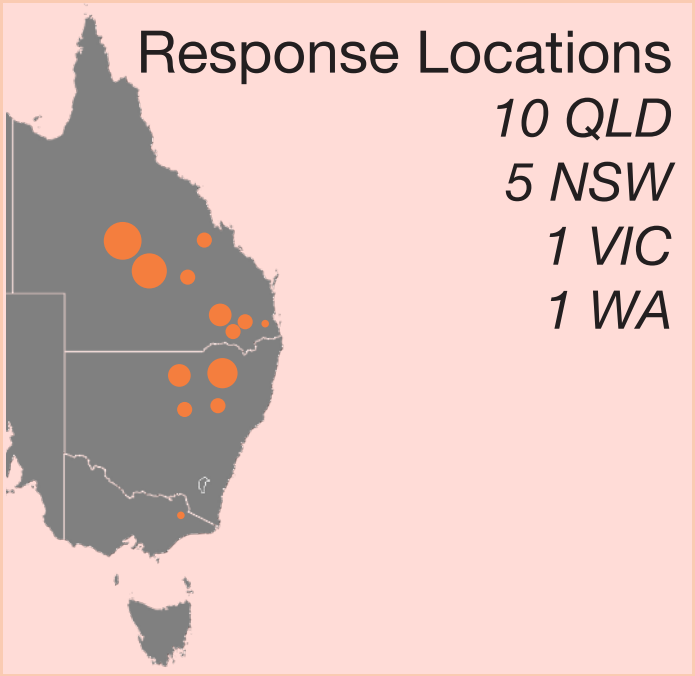
With initial plans for interviews to be conducted with both farmers and members of the firefighting industry, a rigorous recruitment process was employed to achieve the best outcome possible (see figure). This included emails, calls, posts and social media outreach to both personal connections and industry as shown. Despite these efforts, only one interview was achieved with a farmer who has over a decades experience on their family property and had information from their father with over 50 years of experience. At a minimum I aimed to have at least one interview with both a farmer and industry expert (firefighter) but minimal responses and busy schedules made this impossible. This is indicative of why design for farm support in bushfire emergencies is underexplored currently as stakeholders are difficult to contact or unwilling to participate in research projects.

Limitations

When using interviews as a basis for discussion and ultimately potential design implications in the field, it is important to acknowledge some key limitations of the method. The main limitation is the biases of interviewees as they have personal experience that may influence opinions and beliefs. Whilst this can uncover specific issues in the area being researched, some may be unique to one person and not be shared by the community so thorough analysis and comparison to other perspectives such as those in the surveys are important.

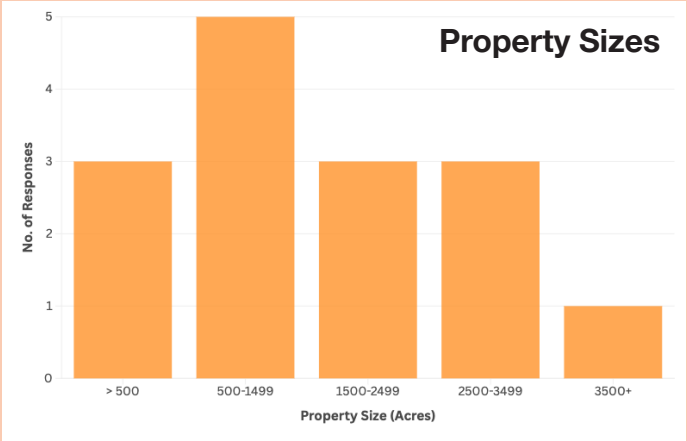
Analysis & Findings

To understand the data that has been collected through primary research, it must be analysed to discover key findings. This section outlines how both the surveys and interview were analysed and some of the key findings that emerged. These findings will be used in the final section to understand what this means and the design implications from it.



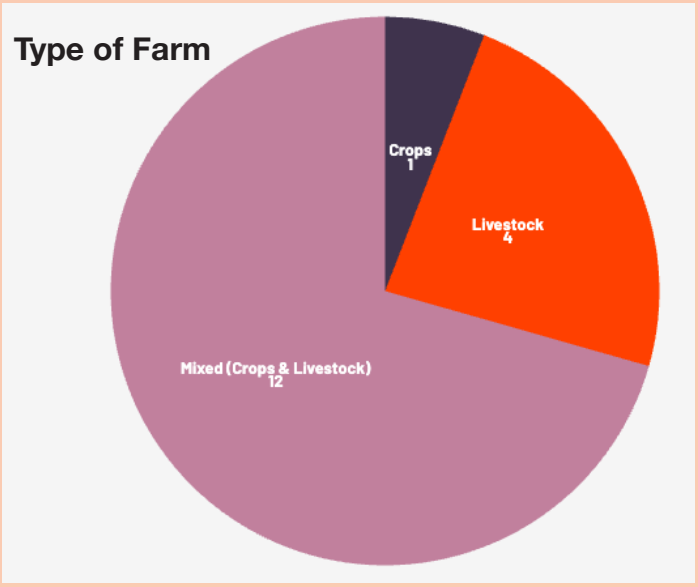
Surveys

The 17 total survey responses were collected over a period of weeks and were subsequently analysed to understand the data. The first stages of the survey provided demographic details before moving into understanding how farmers prepare, respond and recover from bushfires and if there were any apparent issues in these areas. This data was collated using Qualtrics surveys which provided rudimentary quantitative data graphs and qualitative lists. This was then analysed further with graphing done in flourish and by identifying consistent points that emerged from multiple participants in short response questions (qualitative analysis).



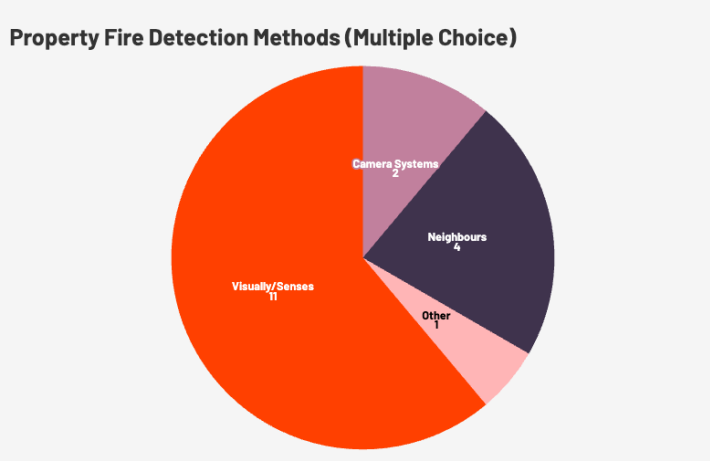
Demographic Details

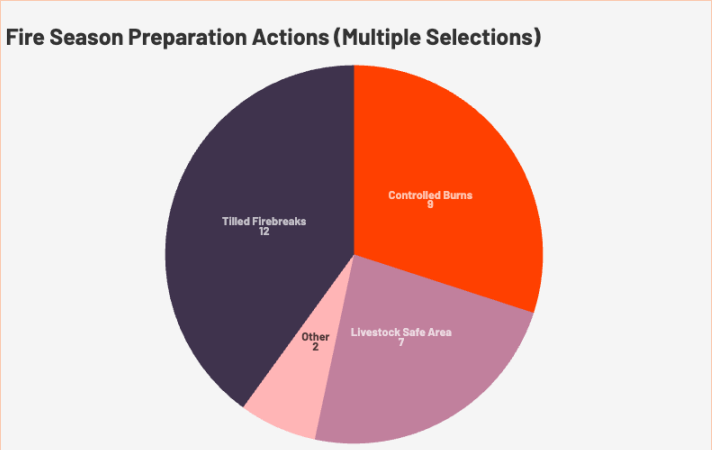
The participants from the survey were widely varied in both location, farm type, age bracket and property size (see maps & Graphs). With questions used to identify if the user had current and/or past farm experience, it was established that 53% currently worked in the farming industry whilst all had past experience. It is also important to note that 94% of participants had livestock on their property which reflects that they are at the core of Australian farming in all areas of the country.

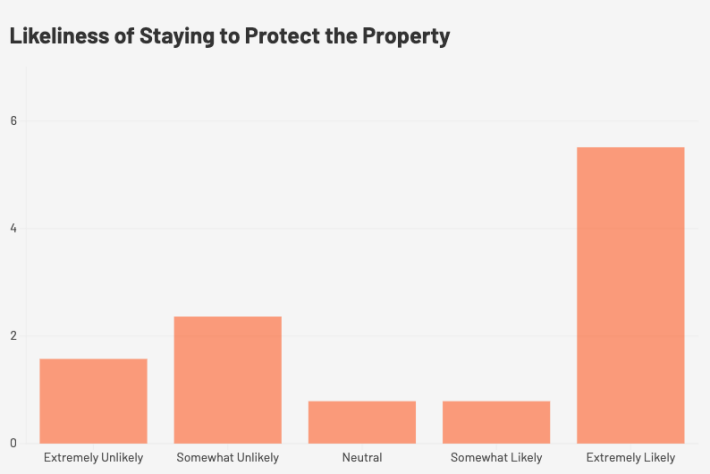


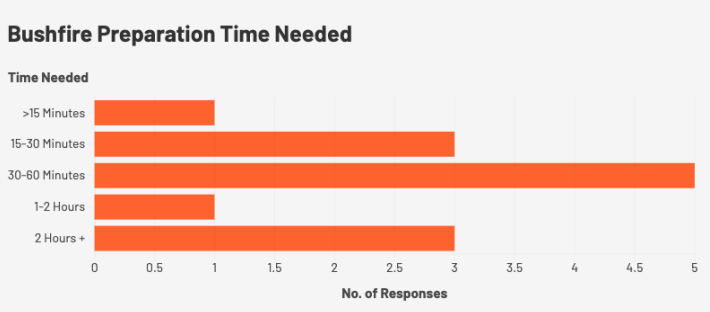
Post Fire Recovery

Qualitative questions also identified challenges faced in the aftermath of bushfires and highlighted financial challenges that could follow. Participants stated repair of damaged fences or equipment, a loss of livestock feed that can also stem from feed suppliers being impacted. Additionally there were multiple statements about the financial toll of losing income sources or not having the ability to replace losses. This is also something that has been mentioned in other sections about the high cost of equipment making fire defence challenging.









Preparation

Survey questions focused on how farmers prepare for the fire season and the systems they have in place for detecting fires on their property which revealed systematic challenges. Although rural fire services recommend a fire plan being in place, only 54% of participants said that there was one in place. Despite this, there was also a range of off season actions that were performed in preparation for potential fire risks. 86% responded that they had firebreaks in place on their properties and 74% conducted controlled burns or other fuel management techniques. Whilst participants had methods for staying informed about large fires from fire services and radio, the same can not be said about detecting fires on their property. Only 3 of the 14 responses to the question said they had cameras or other systems in place to detect fires whilst the rest relied on themselves or neighbours spotting a fire. With bushfires having the potential to intensify rapidly, early detection could mean the difference between saving or losing a property. This makes the current absence of reliable detection methods a major issue for farmers during the fire season.

Response

Questions were next targeted at understanding what the process of responding to a bushfire looks like and what was on hand to assist farmers. 57% of participants were likely to stay and defend their property despite 77% saying there were less than 5 people on their property during fire season. Actions taken once a fire was detected included moving livestock to safe areas, preparing equipment and water to fight the fire and protecting buildings or equipment by wetting down or moving. Participants said that these actions would likely take anywhere from 15 minutes to over two hours emphasising the need for early detection and assistance in performing these actions. Additional concerns and analysis also surrounded livestock specifically as they are vulnerable in fire situations and farmers put themselves at risk to protect them. Outside of protecting efforts in response, livestock behave in a range of ways with panic, running, shelter seeking, injury risks and unpredictability mentioned by participants which can make protecting livestock difficult.

Analysis & Findings

Interview

For analysis, the interview was first transcribed manually after the failure of AI assistive tools such as otter.ai. After initial plans to use ai coding tools, the decision was made to develop the thematic coding of the interview, using methods from Braun and Clarke in 2006. After two iterations a final coding including related quotes was organised into a table that is shown in the appendix. The overall codes that emerged including the 4 major themes and sub codes can be seen in figure ().

Key Themes

Fire Preparation

The preparation that is needed to appropriately address fire dangers had emerging themes of the unexpected and infrequent nature of fires, a lack of assistive products and the importance of community focused efforts. Multiple statements were made about preparation needed, specifically the importance of water availability, fuel management and escape paths for both humans and livestock. With the participant mentioning the infrequent and unexpected nature of fires in their area, it emphasised the problems with fire detection. They stated their reliance on neighbours to see fires in far corners of the property and the risk of fires starting in areas out of view. There were also mentions of reliance on natural barriers like gullies and support needed from community members with water trailers and other fire fighting devices to manage fire threats.

'But what we have now and like we have never had a fire until just this year'

'Yeah no time would definitely be the biggest thing like we have a guy right across the highway there so we learnt pretty quickly'

'we have got the driveways that are wide and dirt and we have like the grass mown all around our house'

'basically you just keep an eye out for smoke.'

Livestock Safety

With livestock being the income source of most properties in Australia it is no surprise that protecting herds is a top priority during a bushfire. Actions taken to protect cattle included opening up gates so they could escape and if there is enough time or the fire is at a low intensity then moving the cattle to a safe area, specifically the yards. These actions can potentially put people at risk if the fire turns for the worse, putting them out in the path of the fire. The behaviour that livestock display during fires can also be a danger with heightened panic and running potentially causing injuries or damage to fences. There is also a need to track or find livestock before or after fires to move them quickly or provide aid if necessary.

'If you have the time you'd move them otherwise just open the gates and hope that they would get out.'

'she went and was looking for the cattle you have to open the gates and move them and the yards is actually a good place for them'

'if you have a faster moving fire than the one that we had… could maybe be injuries if they panic'

Fire Response

Fire response was discussed through the interview process and displayed the risks that farmers take to protect livestock and land, the importance of communication, equipment and experience. Assessing the severity of the fire quickly and accurately appeared vital in deciding what actions would be taken. This assessment and level the fire has reached before detection changes if the fire is fought or vital buildings are protected first and the level of protection that can be given to the livestock. The need for fast communication to contact fire fighters and neighbouring properties in order to stop fires which can be difficult in remote properties. It was also clear that farmers will take higher risks to fight fires with graders or move livestock as there is often no way of getting rapid assistance in most situations. Despite this the participant highlighted how lucky they are to be close to fire services and in a community with multiple farmers close by.

'If dad knew there was a big bushfire that was coming our way he would probably be grating a big row around the outside area of the house and sheds to protect it.'

'If there is a fire up the back of the place we wouldn't notice it but our neighbours noticed it'

'When the fire came there was 8 neighbours there and they brought their water trucks'

Financial Challenges

The final theme that presented itself throughout discussions were the financial challenges for farmers both in acquiring assistive equipment and if land or buildings are lost in a bushfire. Land and crops are needed to sustain livestock and the burning of them could mean needing to sell cattle and a loss of their livelihood which is why farmers stay to defend their properties at a higher percentage. The financial stress of this loss would be astronomical and the lack of fire tracking and other devices makes this more likely to come to fruition.

'if dad had like 1000 acres burnt then he would just not have enough land to sustain the cattle'

'if you were on a big place and farming fulltime unlike us then you would probably need to be monitoring it more than we do'

'it is obviously just a potential financial problem for us really'

Conclusion

Through analysis of both survey and interview data using methods such as thematic coding and quantitative statistics, key problems and challenges have been identified. This information can now be used in addition to market gaps from benchmarking and earlier research to discuss what this means and the design implications that result from it.

Discussion

Initial research identified clear challenges faced by farmers as a result of bushfires with the threat to livelihoods, livestock and gaps in preparation and response practices. Benchmarking reinforced that gaps in the existing market contributed to these issues with a low level of effective product integration for farms and the high costs exacerbating the problems for farmers.

These initial findings were then used to form primary research through surveys and interviews which aimed to understand what aspects of bushfires are the toughest for farmers and what concerns they had. Surveys revealed that there were minimal plans in place, a lack of detection and reliance on community and personal experience to deal with bushfires. Both interviews and surveys reinforced that farmers are willing to take extreme risks by staying to defend their properties with anything they have available. Both methods also showed the importance of livestock safety. Responses from survey participants and interviewees put the protection of their livestock as a top priority in a bushfire situation, willing to open gates or head into the field to find and move herds to safer locations such as yards or near to homes.

The last major finding that was reinforced and explored further during primary research was the financial challenges in both bushfire preparation and recovery. Responses emphasised the financial stress that fires can cause with the loss of land potentially leading to a loss of livelihood. Additionally, responses explained that using methods such as visual fire detection was the best solution that they could have, showing a desire for more if costs could be validated. Even with the potential loss of livelihoods and livestock, income streams tend to flow towards farm equipment and maintenance and it is clear that most existing products despite all of the benefits are not worth purchasing unless in fire prone areas or for large stations.

Design Implications

Through comparison of primary and secondary research in the previous discussion section, a clear set of design opportunities has been shown. These findings will be outlined in this section to explain what these findings mean for designing products aimed at assisting farmers in bushfire emergencies.

Cost-Effective Solutions
Throughout both primary and secondary research, the importance of cost effective design solutions became clear. Background research identified that existing farm devices that are widely used are low cost or multi use to validate investment. This research also showed that advanced designs such as AI Cameras are currently too expensive for farmers despite their proximity to fire prone areas. Primary research reinforced farmer sentiment with farmers emphasising the high costs of bushfire recovery and the current reliance on using “the best that they have” to deal with the threat. Any design solution should aim to be low in cost or provide protective value to the farm that validates the cost.

Livestock Protection
Livestock rely on the actions of farmers in order to have the best chance of survival in bushfires. Secondary research showed the high loss of livestock in 2020 at over 56000 () and the additional health complications from smoke inhalation. With livestock being the primary income source of most participants in research, it is clear that farmers put protecting their livestock as a top priority when responding to bushfires. Primary research showed that there is little to assist farmers in clearing escape paths, moving cattle to safe areas, protecting safe areas or tracking where cattle are during and after a fire emergency. With farmers placing livestock as a top priority there is an opportunity to design products that can assist farmers in the protection of livestock.

Fire Detection
Fire detection solutions are a clear opportunity for design that was found through analysis of interview and survey data. Respondents to the survey almost all had no assistance with fire detection outside of visually identifying it themselves or by neighbours doing the same for them. With response actions taking usually over 30 minutes up to 2 or more hours according to survey results, the time it takes to identify a fire is crucial. The earlier a fire is detected, the more time farmers have to prepare or stop the fire from reaching catastrophic levels. Both interview and survey respondents said that there was no real tracking methods for fires and highlighted that on a larger or more secluded property, fires may not be detected at all until there is little that can be done. With existing detection technology existing, integrating this into farms could be pivotal and making the use of these technologies user friendly is necessary.

Risk Reduction
It is no question that fires not only pose a risk to land and livestock but also to the farmers. With primary research highlighting the risks that farmers take to deal with fires, there is an opportunity to reduce this risk through design. Primary and secondary research identified that farmers are likely to stay and defend their properties no matter the risks. Interviews also showed some of the risks that farmers will take in a fire by grading in tractors, using water trailers, heading out to open gates and staying to protect their homes and equipment even if the fire is intense. To reduce this risk, design could be implemented to reduce the amount of physical actions to be taken to enact fire plans and protect what is most valuable to farmers.

Conclusion

This research report aimed to explore the unique challenges that farmers are facing as a result of the increasing rate and severity of bushfires. Initial research identified gaps in preparation and risk prevention and livestock safety. To understand what is currently available to help with the preparation, response and recovery efforts, a benchmarking analysis was conducted. This further highlighted market gaps and a lack of integratable designs. Using the questions and gaps identified, primary research was conducted to better understand these issues. Through surveying and interviews with stakeholders across Australia, the risks and challenges were further explored. This exploration identified low adoption of devices, a reliance on personal experience, the difficulties of protecting livestock and the heightened risk farmers are willing to take in a bushfire emergency. The analysis of this data ultimately led to the development of 4 core design implications of cost effective design, livestock protection assistance, fire detection and risk reduction. Any product design interventions for farmers should aim to address these core issues whether the design is targeting preparation, response or recovery. Using this research, future design solutions will be able to address key challenges effectively and be suitable for the existing market.

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Appendicies

1- Coding Table

2- Benchmarking Table

Code	SubCode	Quotes
Fire Response	Fire Origins/Spot Fires	*'So we had a fire.. come kind of off the highway because our property.. it's right next to the highway'* *'the fire broke out from welding like spark while fencing'* *'water trucks and that to help finish it off and stop any spotfires'*
	Property Edges/Public Areas	*'it's right next to the highway and there was a fire in the top paddock'* *'we had a fire.. come kind of off the highway'* *'you will prepare for it and protect the edge of the property if you need to.'*
	Uncertainty	*'it ended up burning. I don't know exactly what from [started it]'* *'if there is a fire up the back of the place we wouldn't notice it'*
	Community	*'luckily that was there and it like got to the gully and stopped.. like people came'* *'if you like see that then you'll contact [the neighbour] and make sure it's not anything to worry about'* *'our fire warden actually turns out to be our neighbours so its very convenient'* *'yeah we called and they were like yeah a fire broke out and mum and dad took a water trailer and they were with a few people'* *'we got a call at like 6am and they said 'just so you know there is a fire on your place''* *'people will say 'hey there's a fire moving north coming in your direction'* *'when the fire came there was 8 neighbours there and they brought their water trucks'* *'if there is a fire up the back of the place we wouldn't notice it but our neighbours noticed it'* *'Everyone rallies together.'*
	Fire Break/Backburns	*'No it didn't jump the gully'* *'it's really about getting ahead of the fire and you grade or if it's a big one you do a controlled backburn ahead of the fire so that it has nothing to burn'* *'you don't put it out it's more about taking the fuel away so it fizzles out and dies'* *'what dad was doing he took the grader and was turning over the topsoil'* *'the big thing that will stop it is your firebreaks or your controlled burn ahead of the fire'* *'but if it's a smaller fire it won't get across where you have graded.'*
	Monitoring/Tracking/Detection	*'if you see smoke you worry. If there is smoke on the horizon.'* *'I think it was last year… I was looking out the kitchen window and was like 'oh that's a lot of smoke next door'* *'basically you just keep an eye out for smoke.'* *'people will say 'hey there's a fire moving north coming in your direction' or something like that'* *'if you were out in the middle of nowhere on a million acres that would be a different story…'* *'if there is a fire up the back of the place we wouldn't notice it but our neighbours noticed it'* *'you have to you know go and find the fire or wouldn't really know until it is quite big…'* *'if you are on a big place you might not know about it until it is already a big deal.'*
	Communication	*'if you like see that then you'll contact [the neighbour] and make sure it's not anything to worry about'* *'you'll have a fire warden and you can reach out you know basically just make a call 'oh what's happening?''* *'we got a call at like 6am and they said 'just so you know there is a fire on your place'* *'people will say 'hey there's a fire moving north coming in your direction' or something like that and you will prepare'* *'so you obviously call the fire warden and they'll come and they'll put out the word and normally you would call your neighbours to help as well.'*
	Delayed Detection	*'if there is a fire up the back of the place we wouldn't notice it but our neighbours noticed it'* *'you have to you know go and find the fire or wouldn't really know until it is quite big…'* *'if you are on a big place you might not know about it until it is already a big deal.'*

	Firefighting Techniques	*'dad said that it is not about actually putting water on it… like you don't put water on a bushfire it's really about getting ahead of the fire and you grade or if it's a big one you do a controlled backburn ahead of the fire so that it has nothing to burn or you do a big like grade which is what dad was doing he took the grader and was turning over the topsoil so that once it gets to it… you don't put it out it's more about taking the fuel away so it fizzles out and dies.'* *'the big thing that will stop it is your firebreaks'*
	Equipment	*'mum and dad took a water trailer'* *'one of those water things with a tank for the ute'* *'what dad was doing he took the grader and was turning over the topsoil'* *'they still bring like water trucks and that to help finish it off'*
	Fire Interception	*'you will prepare for it and protect the edge of the property if you need to.'*
	Fire Wardens/FireFighters	*'our fire warden actually turns out to be our neighbours so its very convenient and the we have like a fire brigade that's at Orange Hill which is maybe like 15 kilometres down the road'* *'you obviously call the fire warden and they'll come and they'll put out the word'*
	Livestock Moving	*'if you have cattle you go and find your cattle and make sure that they aren't trapped somewhere and if you can you'll move them into the yards'* *'she went to go and find the cattle and push them up away from where the fire was.'*
	Risk Management/ Personal Safety	*'there is like a fence through half of it and my sister still went and… because it wasn't a raging bushfire or anything and we weren't going to die..'* *'You do try to but like some fires and some places you have just got to leave but that type of small bushfire you can do a bit more.'*
	Fire Assessment	*'if dad knew there was a big bushfire that was coming our way he would probably be grating a big row around the outside area of the house and sheds to protect it.'* *'unless it is like a massive fire that is moving fast like those ones in Victoria did [black Saturday] in which case you probably can't do much but if it's a smaller fire it won't get across where you have graded.'*
Preparation	Natural Protection	*'luckily that was there and it like got to the gully and stopped.'*
	Visual Checks	*'basically you just keep an eye out for smoke.'* *'Yeah no time would definitely be the biggest thing like we have a guy right across the highway there so we learnt pretty quickly'*
	Minimal Tech. Support	*'you don't track them like there's no real tracking of them'* *'a few people and they had… one of those water things with a tank for the ute'*
	Fire Safety	*'the fire broke out from welding like spark while fencing'*
	Fire Warden	*'each area will have a fire warden'*
	Support Equipment	*'they still bring like water trucks and that to help finish it off'*
	Fire Plan/Strategy	*'the big thing is getting ahead and grading and stopping the fire.'* *'you will prepare for it and protect the edge of the property if you need to.'* *'we really should have had them in place but hes done it now but youre meant to have firebreaks around your property'* *'if you have the time you'd move them otherwise just open the gates'* *'if dad knew there was a big bushfire that was coming our way he would probably be grating a big row around the outside area of the house and sheds to protect it.'* *'If you were in a bushfire prone area then you would probably have more of a plan.'*
	Water Availability	*'they still bring like water trucks'* *'took a water trailer to …'* *'it is not actually about putting water on it'* *'we have taps around the house and stuff like that'*
	Property Protection/Interception	*'if dad knew there was a big bushfire that was coming our way he would probably be grating a big row around the outside area of the house and sheds to protect it.'*

		'you will prepare for it and protect the edge of the property if you need to.' *'if dad knew there was a big bushfire that was coming our way he would probably be grating a big row around the outside area of the house and sheds to protect it.'*
	Fuel Management	*'it's more about taking the fuel away so it fizzles out and dies.'* *'we have got the driveways that are wide and dirt and we have like the grass mown all around our house'* *'Yeah like they do burns and it's actually not a bad thing like to an extent'*
	Prepared Escape Paths	*'dad will open all the gates so that they can go and get out of the creek paddock.'* *'I think if you had the gates open… I- Yeah that would be a good help P- Yeah'* *'if you have the time you'd move them otherwise just open the gates'* *'we have got the driveways that are wide and dirt'*
	ManMade Protection	*'you're meant to have firebreaks around your property like 9 or 12 foot I think dirt walls around your property'*
	Uncertainty/Infrequency	*'we really should have had them in place but hes done it now but youre meant to have firebreaks around your property'* *'he was like no say that we have it and did have it before haha.'* *'But what we have now and like we have never had a fire until just this year'*
	Community Support	*'so you obviously call the fire warden and they'll come and they'll put out the word and normally you would call your neighbours to help as well. Everyone rallies together.'* *'Yeah no time would definitely be the biggest thing like we have a guy right across the highway there so we learnt pretty quickly'*
	Safe Places	*'if you had time you would put them in the yards.'* *'if dad knew there was a big bushfire that was coming our way he would probably be grating a big row around the outside area of the house and sheds to protect it.'*
	Strategic Burns	*'Yeah like they do burns and it's actually not a bad thing like to an extent'*
	Fire Detection	*'Yeah no time would definitely be the biggest thing like we have a guy right across the highway there so we learnt pretty quickly'* *'Yeah if you were on a big place and farming fulltime unlike us then you would probably need to be monitoring it more than we do'*
Livestock Safety	Seasonal Changes	*'its on a rotating thing so there's 50 on there at all times cause they are the breeding cattle and then they have calves and then there is two bulls as well and theres probably about 50 calves on there at the moment'* *'Yeah so maybe 50 to 100 head at any time'*
	Safe Place	*'the yards is actually a good place for them'* *'if you can you'll move them into the yards'*
	Escape Path	*'I think as long as you have your gates open.. they are pretty smart so they will find a way to get out or know to move.'* *'Yeah if you have the time you'd move them otherwise just open the gates and hope that they would get out.'*
	Gate Opening	*'you have to open the gates'*
	Safety Concern	*'what you do have to really worry about is actually cattle'* *'if you have cattle you go and find your cattle and make sure that they aren't trapped somewhere'*
	Location Tracking	*'you will probably just make sure that the cattle… like where are they? What paddock are they in? Can they get out?'*
	Injury Risks	*'if you have cattle you go and find your cattle and make sure that they aren't trapped somewhere'* *'Your biggest thing is yeah making sure you don't have any animals trapped anywhere.'* *'my sister said I think they would do similar like running or moving quickly away from it and… that could be a problem'* *'if you have a faster moving fire than the one that we had… could maybe be injuries if they panic'*
	Behaviour	*'my sister said I think they would do similar like running or moving quickly away from it and… that could be a problem'* *'if you have a faster moving fire than the one that we had… could maybe be injuries if they panic'*
	Survival Instincts	*'it's not a gigantic property so they like know where everything is'* *'I think as long as you have your gates open.. they are pretty smart so they will find a way to get out or know to move.'*
	Moving Herds	*'if you have cattle you go and find your cattle and make sure that they aren't trapped somewhere and if you can you'll move them into the yards'*

		'she went and was looking for the cattle you have to open the gates and move them and the yards is actually a good place for them' *'Yeah if you have the time you'd move them otherwise just open the gates and hope that they would get out.'*
	Grazing Land Loss	*'if dad had like 1000 acres burnt then he would just not have enough land to sustain the cattle'*
Recovery	Crop/Land Loss	*'if dad had like 1000 acres burnt then he would just not have enough land to sustain the cattle'* *'I think about 160 acres it ended up burning'* *'just burnt the um.. Dad had a crop, he has some crops'* *'Yep so it just took out one of his crops sadly'* *'if half our place had went up and not just a part of it then you wouldn't have enough feed for your cattle.'* *'if dad had like 1000 acres burnt then he would just not have enough land to sustain the cattle'*
	Detection Funding	*'you don't track them like there's no real tracking of them'* *'if you were on a big place and farming fulltime unlike us then you would probably need to be monitoring it more than we do'*
	Feed Costs	*'if half our place had went up and not just a part of it then you wouldn't have enough feed for your cattle.'* *'if you had something that took out half the property you would have to feed the cattle manually'* *'he would just not have enough land to sustain the cattle so he would likely sell them'*
	Maintenance & Herd Costs	*if dad had like 1000 acres burnt then he would just not have enough land to sustain the cattle so he would likely sell them'*
	Fire Caused Financial Stress	*'if you had something that took out half the property you would have to feed the cattle manually or sell them'* *'it is obviously just a potential financial problem for us really'*
	Mental Health	*'Yeah but they are more of just a passion project for him'*
	Land Regrowth	*'That paddock will probably end up coming back better actually'* *'it can actually be good like people do burns on their place strategically for regrowth'*

Benchmarking Table

Product	Category	Cost (AUD)	Ease Of Use	Target Demographic	Farm Onboarding	Similar Products
PANO AI Camera	Fire Detection System	$20k-80k	High Difficulty	Firefighting Department	High Difficulty Integrating into Farm Systems	SmokeD, FireHawk, FireScout, Exci
Attentis	Remote Sensor System	~$27k Per Unit	High Difficulty	Environmental Agencies, Government Departments, Wildlife Monitoring	High Difficulty Integrating into Farm Systems	N5 Sensors, Dryad Networks
AQ Mesh	Mesh Sensor System	$5.3k-$17.8k	High Difficulty	Local Governments	High Difficulty Integrating into Farm Systems	Purple Air, Aeroqual, Airly
Wildfire Protection Kit (Roof Sprinkler System)	Fire Protection Device	$431	Intuitive Use	Home owners in fire prone regions	Simple Integration Process	Ember Defender, Irrigear, Roof Saver Sprinklers
Livestock Bushfire Shelter	Fire Resistant Shelter	N/A	Intuitive Use	Australian Regional Government, Farm Communities	Made for Local Farm Community Use	N/A
CFA Tank Fitting	Fire Fighting Device	~$450	Intuitive Use	Farm Owners, CFA Volunteers	Made for Farm Integration	N/A
mOOvement Tags	Remote Tracking System	$20+ Per Tag	Mild Difficulty	Livestock Farm Owners	Made for Farm Integration	CERES TAG, 701x, LoneStar Tracking
DJI Matrice 30T Thermal Imaging Drone	Remote Tracking Device	$12k-20k	High Difficulty	Firefighters, Consumer Market, Professional Drone Pilots	Difficulty Integrating into Small to Medium Farms	DJI Matrice 350 RTK, DJI Mavic 3 Thermal
TTi Fire Defence, 1000L Capacity	Fire Fighting Device	$6,221	Intuitive Use	Farm Owners	Made for farm integration	AquaPath Water Cart, Fire Attack Fire Fighting Pump Unit
Stockyard Mobile Sprinkler	Industrial Water System	$4100	Intuitive Use	Cattle Saleyards, Large Livestock Farms	Made for farm integration	K-Line Farm Pack Irrigation System