An integrative review of the 2017 Port Hill fires' impact on animals, their owners and first responders' encounters with the human-animal interface

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Abstract

Animal welfare emergency management is a critical component of modern emergency management, because the powerful bond between people and animals influences decisions and actions taken during emergency events. High risk behaviour and poor decision-making can negatively affect evacuation compliance, observance of cordons, the safety of frontline responders and the psychosocial recovery of responders and animal owners. This paper reviews documents, including official reports, peer-reviewed journal articles and media reports, concerning the impacts of the 2017 Port Hill Fires on animals, with the aim of providing direction for future research and identifying other information needs. Key themes were identified, including evacuation, cordons, animal rescue, communication and co-ordination. The implications of these for emergency management practice are discussed, including recommendations to: consider animals across all phases of wildfire management; enhance emergency responders' understandings of animal owners' emotional drivers; develop a national animal loss database; include animal ownership in relevant public education; leverage the human-animal bond as a motivator for mitigation and emergency preparedness; more carefully consider animal evacuation logistics, and; develop relevant wildfire response strategy.

Keywords: *Animal welfare, emergency management, wildfire, 2017 Port Hills fires*

In February 2017 a devastating fire burned over 1600 hectares of land on the Port Hills of Christchurch, New Zealand (Langer, McLennan & Johnston, 2018). In the two weeks it took to bring the blaze under control, a firefighter died, nine homes were destroyed, and 450 households were evacuated (Australasian Fire and Emergency Service Authorities Council Limited, 2017). The fire affected rural-urban interface communities (Langer et al., 2018), where households were likely to have a high number of pets and animals such as horses, goats, pigs, cattle, deer, alpacas and poultry (New Zealand Companion Council, 2016).

Past wildfires in New Zealand, such as the 2000 Wither Hills fire, West Melton fire in 2003 and Mount Somers fire in 2004, are known to have affected animals. They have also resulted in significant financial implications for farmers, and impacted the psychosocial wellbeing of affected communities (Kelly, Jakes & Langer, 2008; Graham & Langer, 2009; Jakes & Langer, 2012). Unfortunately, there are known issues with the quality and availability of long-term wildfire records in New Zealand (Doherty, Anderson & Pearce, 2008), and the lack of an official database documenting the impact of wildfires on animals, stock losses and other animal death (Coll, 2013a) makes it difficult to fully appreciate the impact on animals. The 2017 Port Hills wildfires provide a context for the consideration of factors of the importance in disaster responses that involve animals, their owners, emergency responders and other agencies impacted by the human-animal interface.

Animals play an important role in the lives of many people (Darroch & Adamson, 2016). They provide companionship, protection, production-based and other livelihoods. (Trigg et al., 2015b; Taylor, Lynch, Burns & Eustace, 2015a; Westcott, 2015). They are regarded as symbols of identity, (Hamilton & Taylor, 2013) and positively impact on mental and physical health (Hunt,

Bogue & Rohrbaugh, 2012; Nusbaum, Wenzel & Everly, 2007; Travers, Degeling & Rock, 2017). Pet ownership rates in New Zealand are among the highest in the world, with 64 percent of households owning a pet, - a rate nearing the proportion of households with children (Evans & Perez-y-Perez, 2013; New Zealand Companion Animal Council, 2016).

Animal ownership rates are even higher in rural communities, including farms and *lifestyle*, or hobby farm, properties (Westcott, Ronan, Bambrick & Taylor, 2017), and especially true for large animal species such as cattle and horses. Generally, multiple animals are kept on rural properties (Pawsey, 2015). New Zealand has an increasing trend of farm land conversion to smaller rural properties (Nicholas & Hepi, 2017), with a high migration rate of urban populations to rural land in some areas (Langer & McGee, 2017). A clear majority of rural properties use their land for grazing stock (Nicholas & Hepi, 2017). Additionally, New Zealand is heavily reliant upon primary industries economically, with over 70 percent of export earnings derived from agriculture and 12 percent of the national workforce employed in the sector (Ministry for Primary Industries, 2018). Livestock and production losses due to disasters have serious long-term implications for the economy that cannot be immediately remedied from elsewhere within the New Zealand economy (Coll, 2013a). Therefore, it is paramount that New Zealand protects the economic assets and viability of the rural community connected to production animals.

The strong ties between people and both production and companion animals and the legal, moral and ethical aspects need to be considered during uncontrolled wildfires and other hazard events (Bernard, Ronald & Pascoe, 2009; Squance, 2011; Pawsey, 2015, Rogers, Sholz & Gillen, 2015; Smith, Taylor & Thompson, 2015; Taylor et al., 2015b; Thompson et al., 2015; Travers et al., 2017; Trigg et al., 2016a; Westcott et al., 2017). Many people indicate that they would risk their lives to save their own pets (White, 2012) and other animals (Booth & Curtis, 2014). Poor decision-making by animal owners, the public and emergency responders can lead to confusion and inappropriate actions by well-meaning but untrained, inappropriately trained or inexperienced people (Bernard, Ronald, & Pascoe, 2010; Pawsey, 2015; Rogers et al., 2015, Taylor et al., 2015a).

In this paper, we introduce key concepts in animal welfare emergency management in New Zealand, discuss the legislative context, and analyse and discuss documents concerning the 2017 Port Hills fires. As part of an ongoing discussion, the authors will frame the current paper in terms of the role of animal welfare emergency management (AWEM) and current New Zealand legislation concerning animals and wildfires.

Animal welfare emergency management

Animal welfare emergency management describes the management of animal welfare needs through all phases of emergency management: reduction or mitigation, readiness or planning, response and recovery (Squance, 2011; Travers et al., 2017). It is a critical component of modern emergency management because the powerful bond between people and animals may influence decisions and actions taken during emergency events (Brackenridge, Zotarrelli, Rider & Carlsen-Landy, 2012). The strong ties people have with their animals can have a significant effect on their decision-making during emergencies, often putting their own lives at risk as well as that of responders (Bernard et al., 2009; Rogers et al., 2015; Smith et al., 2015; Trigg et al., 2016a; Westcott et al., 2017). This has been been blamed for evacuation non-compliance of pet owners and their return to cordoned areas to rescue or tend to their animals in recent disasters (Heath & Linnabary, 2015; Trigg et al., 2015a; Taylor et al., 2015a; Yamazaki, 2015; Squance, 2011). Heath & Linnabary (2015) explain that inclusion of animals in emergency evacuation plans is one of the single most effective steps emergency managers can institute to reduce evacuation non-compliance.

The experience of Hurricane Katrina was one of the first disasters to be internationally recognised for highlighting the need to include considerations for animals in disaster planning, to avoid compounding the emotional and economic toll on individuals and communities impacted by devastating loss or injury (Heath et al., 2001; Travers et al., 2017; Thompson et al., 2015; Taylor et al., 2015b). Forcing owners to leave their animals behind can lead to reactive decision-making, putting lives at risk, creating tension with emergency responders and decision makers and significantly increasing the resources required to rescue animals in disaster zones (Evans & Perez-y-Perez, 2013; Heath et al., 2001; Nusbaum et al., 2007; Yamazaki, 2015).

> The lack of adequate planning for the management of animals and their welfare in emergencies often result in poor, last minute decisions with dangerous or fatal consequences for animals and their owners or carers.
>
> (Victorian Emergency Animal Welfare Plan, 2016, p. 10)

Animals have always been affected by disasters. Pressure to do something about it is often placed on government agricultural agencies and farming organisations for production animals; animal welfare organisations and the veterinary profession to respond to companion animals; and conservation agencies to address affected wildlife (Pawsey, 2015). However, this often occurs within silos with no co-ordination or collaboration across agencies, leading to duplication of effort (Pawsey, 2015), inaccurate information and a lack of intelligence sharing, and organisations and individuals working outside of the official response (Heath & Linnabary, 2015). Therefore, an integrated, multiagency, multidisciplinary, systematic approach is required (Taylor et al. 2015c) to mitigate tension during response and recovery, that can be addressed through planning and preparation (FAWC 2012; Heath & Linnabary, 2015; Pawsey, 2015; Taylor et al., 2015c; Westcott et al., 2017).

In 2016, the World Organisation for Animal Health (known as OIE under their historical acronym) adopted the Sendai Framework for Disaster Risk Reduction 2015 - 2030 and issued guidelines on disaster management and risk reduction in relation to animal health, animal welfare and veterinary public health. The OIE noted that:

> recent disaster events highlight the need to bring all components of disaster management together in cohesive response plans at both national and international levels using a multidisciplinary (thus multi-agency) approach to achieve optimal efficiency and effectiveness
>
> (OIE, 2016, p. 2)

Until recently, only production animals were considered in emergency management, and then only in the recovery phase, where provision was made for attending to injured animals and rebuilding farming infrastructure (Pawsey, 2015; Rogers et al., 2015). However, if we assume that all animals are affected similarly, they should all be included in an AWEM framework to ensure that animal welfare is considered more broadly and in compliance with legislation such as New Zealand's Animal Welfare Act 1999. To achieve this, an all-species approach should be instituted in a national AWEM framework, as has occurred in New Zealand (Ministry of Civil Defence and Emergency Management, 2015). Animals may be considered property. However, the attachment people have for their animals impacts on emergency services. This means that agencies cannot exclude animals from their charter, because excluding animals will put lives at risk as the owners try to save their animals (Taylor et al., 2015a).

Animals in emergency management legislation

The public outcry over the impact on animals during Hurricane Katrina resulted in the enactment of the Pet Evacuation and Transportation Standards (PETS) Act 2006 in the USA (Heath & Linnabary, 2015). This act requires a city or state to include households with pets or service animals in the disaster preparedness plans. While only companion animals and service animals are included in the USA legislation, New Zealand has an all-species national AWEM framework (Ministry of Civil Defence and Emergency Management, 2015a) ensuring that companion (including service animals), production, zoo, and research animals, as well as wildlife are considered in all phases of emergency management.

Under the Animal Welfare Act 1999 (NZ), the primary responsibility for the physical, health, and behavioural needs of an animal rests with the owner or person in charge. However, there are circumstances, such as separation and incapacitation in emergencies, which may result in owners being unable to adequately care for their animals (Heath & Lannabary, 2015). The inclusion of animal welfare as a sub-function of welfare in the 2015 National Civil Defence and Emergency Management (CDEM) Plan serves to address this, as shown in the overview of New Zealand's Co-ordinated Incident Management System, published by the Officials' Committee for Domestic and External Security Coordination (2014).

The New Zealand Ministry for Primary Industries (MPI), as responsible agency for animal welfare, and other support agencies have designated roles and responsibilities under the National CDEM Plan 2015 and accompanying guide (Ministry for Civil Defence and Emergency Management, 2015a; Ricketts, 2017). The animal welfare sub-function includes but is not limited to the provision of animal rescue, animal shelter, food, water, husbandry, veterinary care, and other essentials for all animals (Ministry of Civil Defence and Emergency Management, 2015b). However, this requires that the main lead agency activates welfare functions. In some emergencies, including wildfire, these functions will need to be activated by fire, rather than civil defence, agencies. Additionally, some components of an animal response do not fit well within the welfare function - such as rescue and evacuation, which are

time-critical, particularly for wildfires. These components may be better aligned within the operational function of a response.

Animals and wildfires

The 2009 Black Saturday Fire provides a vivid example of relevant animal welfare issues. Following this fire, it was estimated that over one million animals died (Bernard et al. 2010), including over 11,000 farm animals (Pawsey, 2015) with a direct cost of livestock losses of more than AUD $18 million (Coll, 2013b). These conservative estimates do not account for the loss of animal genetic gains or traits which may have taken generations to achieve (Pawsey, 2015) or the flow-on effects of lost production (Coll, 2013a). Additionally, the Australian Veterinary Association noted that the high numbers of animals burnt and otherwise injured exceeded the capacity of the local veterinarians (White, 2012).

International research indicates that animal owners are often more concerned about the safety of their animals than their property (Trigg et al., 2015c) or their own wellbeing (White, 2012; Potts & Gadenne, 2014), with 90 percent indicating that they expect to take their animals with them if they evacuate (Taylor et al., 2015a). Fire response plans need to be based on the potentially problematic human behaviours outlined earlier. Processes are needed that mitigate the risks created by such behaviours and the subsequent impact on human and animal welfare (Westcott et al., 2017).

While wildfire events that impact communities and their animals are infrequent in New Zealand, the risk is increasing due to the combined effects of changes in climatic conditions, demographics and the expansion of urban and rural communities into previously undeveloped areas (Jakes, Kelly & Langer, 2010; Langer & McGee, 2017; Nicholas & Hepi, 2017). Interestingly, a recent report on engaging owners of lifestyle blocks in understanding and mitigating wildfire risk in New Zealand, noted that 83 percent of lifestyle block owners use their land for grazing (Nicholas & Hepi, 2017). This implies a large number of animals at the wildland-urban interface. However, the recommendations in the report did not include utilising the human-animal bond as a motivator to influence lifestyle block owner attitudes and practice in relation to wildlife risk (Thompson, 2013; Trigg et al., 2016a). This highlights the need for a culture of wildfire preparedness and innovative public policy to enhance collaboration amongst agencies that experience the human-animal interface in wildfires and communities (Taylor et al., 2015a; Westcott, 2015).

While the morbidity and mortality of animals in wildfires is thought to be significant, this is based on estimates and anecdotal reports, and exact numbers remain undocumented (Pawsey, 2015; Coll, 2013a). In Australia, this is due to the lack of reporting requirements for animal deaths in disaster events (Pawsey, 2015). New Zealand is not dissimilar, with no national database for recording animal mortality in disasters (Coll, 2013a), as well as the lack of a national requirement for animal identification. Numbers are based on anecdotal evidence; therefore, the full economic and psychosocial impact cannot be accurately addressed. However, if countries want to achieve the goals set out by the Sendai Framework for Disaster Risk Reduction 2015 – 2030, a national loss database, which includes animal mortality, should be instituted.

Methods

For this study we undertook a wide-ranging and inclusive review of peer-reviewed journal articles, media reports, official documents, expert opinions and observations relevant to the 2017 Port Hills fires. We initially searched Massey University's electronic library resources including the NZ Science, Google Scholar, Web of Science and Scopus databases using the key phrase "Port Hills fires". However, this strategy only yielded two published journal articles, which were duplicates. Therefore, to broaden the scope of information considered, an extended search strategy was adopted, using more general searchable resources such as Newztext, Discover, Google and YouTube that cover printed media, television and radio interviews. The time period searched was mid-February 2017 to March 2018. Official documents such as the review of the event by the Australasian Fire and Emergency Service Authorities Council Limited, alongside official Fire and Emergency New Zealand (FENZ) and Christchurch City Council response documents, were also included. Criteria for inclusion were that items were about the 2017 Port Hills fires and referred to animals or provided details about a situation involving animals. The overall search strategy is depicted in Figure 1.

Initially, the literature search only revealed one academic article which was duplicated (one in the Web of Science and one in Google Scholar). The search was extended to other search engines which revealed 896 items in total (Discover 65, Google 66, Newztext 690, and Youtube

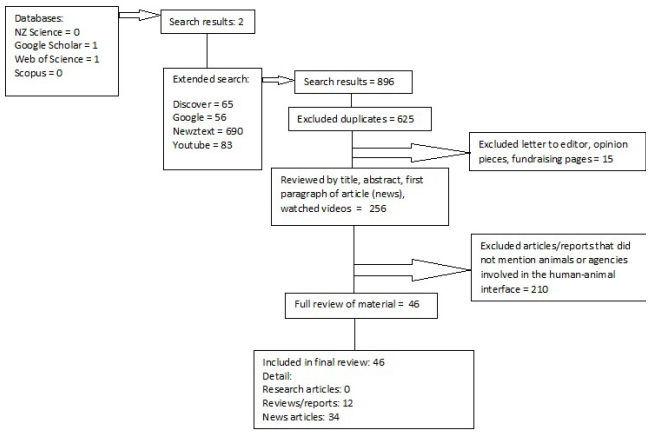

Figure 1. Flowchart of research strategy.

83). All item titles were reviewed and duplications were removed. This excluded 625 duplicates, mainly from Newztext news articles, however it also excluded letters to the editor, fundraising pages and opinion pieces. The articles were further reviewed for the title, abstract or first paragraph of the news article and all videos were watched through their entirety. A further criterion was instituted to exclude articles that did not mention animals or agencies involved in the human-animal interface. This excluded a further 210 articles. All remaining written articles were fully reviewed. This included 12 reports and 34 news articles.

Based on preliminary results, the research questions were refined to: 1. What type of animals were affected by the event? 2. How were animals, their owners and responders affected by the human-animal interface during the Port Hill Fires? and 3. What agencies were involved? A simple coding process was utilised when a recurrence of themes was apparent, as part of a thematic analysis of the animal-related content of all retrieved documents.

Table 1. Agencies and organisations involved in the Port Hills response

Agency involved in the response	Areas of responsibility
Christchurch City Council	Rural fire Animal control Civil defence and emergency management
Sewlyn District Council	Rural fire Animal control Civil defence and emergency management
Department of Conservation	Rural fire
New Zealand Fire Service	
National Rural Fire Authority	
New Zealand Police	
New Zealand Defence force	
Society for the Prevention of Cruelty to Animals	Christchurch City Centre
Veterinary profession	South Island Wildlife Hospital
Ministry for Primary Industries	Animal welfare

Results and Discussion

The 12 reports and reviews of the event, summarised in Table 1, discussed the management of the response. They also outlined the agencies involved and provided recommendations and lessons learned. Recommendations in the reports did not include reference to animals or animal ownership.

The 34 relevant news articles generally focused on event status updates and individual stories of responders and home owners. These articles described a range of property and animal types impacted by the fire Table 2, including a range of species such as cattle, sheep, horses, dogs, cats and chickens.

Thematic analysis (Braun & Clarke, 2006) was used to identify themes across the retrieved documents to identify repeated patterns of meaning. The identified themes reflect the issues associated with animals in wildfire events noted earlier in this paper. The key themes, of evacuation, cordons, animal rescue, communication and co-ordination, are discussed below.

The Port Hill fires were unique to New Zealand, due to impacting so many communities including the rural-urban interface (McNamara, 2017). This meant that a mixture of farm, lifestyle and urban properties were impacted. These properties contained a variety of animals such as pets and livestock. Wildfires such as the Port Hill Fires is a complex social problem as it significantly impacts livelihoods and is non-routine in nature (Westcott et al., 2017). Therefore, communities are required to make decisions based on limited experience. Issues relating to

Table 2. Types of properties and animals mentioned

Article type	Property type	Animals mentioned
Response reports	Urban residential Lifestyle property	Pets and livestock in general
News articles	Urban residential Lifestyle property Farming property	Dogs, cats, fish, guinea pigs, birds, livestock (sheep, cattle), horses, alpacas, llamas, donkeys, pigs, chickens
Videos	Urban residential Lifestyle properties	Dogs, cats, fish, guinea pigs, birds, livestock (sheep, cattle), horses, alpacas, llamas, donkeys, pigs

international fire response such as evacuation, cordons, animal rescue, communication and co-ordination were nonetheless highlighted in the literature and are discussed below.

Evacuation

Evacuation is noted as being one of the most socially disruptive and stressful impacts of a wildfire (Jakes et al., 2010). This is further compounded by the emotional impact wildfires have on animal owners and first responders when animals are involved. Over 90 percent of owners expect to evacuate with their animals (Taylor et al. 2015a), however, the lack of consideration of animal ownership during an evacuation can lead to public health consequences (Chadwin, 2017; Travers et al., 2017). Additionally, owners may not have access to the resources required, such as appropriate transportation or enough warning to evacuate all their animals. Adequate information to support decision-making for early or pre-emptive evacuation by animal owners would be beneficial, and was identified as lacking by some stakeholders affected by the Port Hills fire for example:

> If ... the risk of evacuations had been considered and communicated to the Christchurch Emergency Operation Centre earlier, it would have enabled the centre to inform residents that evacuations may be required. This would have allowed residents to prepare for evacuations, including making arrangements for pets and removing important possessions.
>
> (Christchurch City Council, 2018, p. 10)

Past experience of wildfires can influence perceptions and actions during an event (Trigg et al., 2015a). It follows that the lack of personal experience of wildfires can affect decision making as reporter John Campbell from Radio New Zealand Checkpoint explained while talking to a resident who was describing their experience of evacuating the family which included an elderly dog with flames lapping at their heels:

> If you were in Australia, in Victoria, you would understand how fast flames move but I don't think we really comprehend that in New Zealand. That they can move like that, especially with that Nor'wester in Christchurch.
>
> (Campbell, 2017, 3.25 minutes)

Animal owners can be more concerned about the animals in their care than they are about themselves. Often animals are their priority when preparing to evacuate and this fire was no exception. There were countless examples of this occurring as explained by a local farmer:

> We were more worried about our stock. We moved 800 breeding ewes and 200 lambs to a lower paddock on the farm away from the fire front ... then all we could do was sit in the paddock and watch. By morning 150 ha of prime late summer grazing was gone. We lost over 6km of fence-line, our late summer grazing and shearing and winter shelter are gone.
>
> (Deavoll, 2017, 8.11 minutes)

Due to fire conditions such as the smell of smoke, sounds of sirens, and flashing lights from emergency vehicles, a normally well-behaved animal can become difficult to handle. This can increase the logistical difficulty and time needed to evacuate. This issue was highlighted in a recorded call to ConCam (Fire and Emergency New Zealand's communication centre) during the Port Hill fire, when a 111-caller who explained that they had 20 horses and were concerned the fire front was getting close. They were looking for guidance on whether they should evacuate their 20 horses. The caller was told that if they felt unsafe, they should evacuate, and was then told that the fire front was not that close, and they would be fine (Fire and Emergency New Zealand, 2017a).

This report not only highlights a conflict about the information communicated to those affected by the wildfire. It also highlights a lack of awareness among responders that the logistics to evacuate 20 horses in a high stress environment would take more than several hours. Less than 3 hour's-notice would not be adequate to facilitate the evacuation of such a high number of horses. The Australasian Fire and Emergency Service Authorities Council (AFAC) (2017) fire review further highlighted inconsistencies with respect to the assistance of members of the public seeking to plan or execute an evacuation:

> Residents were reliant on face-to-face contact with emergency services for information to make decisions. Some residents who felt threatened by the fire on the first night (Monday) began preparations for evacuation including their animals in case an evacuation was ordered. But the first morning after the fire commenced public communication indicated the fire was contained. The visible threat appeared to be less, so many residents unpacked their vehicles thinking the worst was over and carried on with their normal daily activities such going to work and leaving

> their animals at home. Many of the residents who were displaced feel they were given little notice to evacuate.
>
> (AFAC, 2017, p.8).

Therefore, the reports collected for the current study provide evidence that relying on the community who have little to no experience of wildfires, little ability to gauge the seriousness of the threat and to have reasonable trigger points to evacuate, may not be adequate.

Fire agencies can promote premature evacuation of large animals on extreme fire risk days (Trigg et al., 2015c; Thompson et al., 2015; Taylor et al., 2015a; Westcott et al., 2015) to reduce the risk of emotion-based decision-making (Westcott et al., 2017). Likewise, pre-identification of locations for large animal shelters, veterinary triage centres and places for owners to be reunited with their animals could encourage animal owners to evacuate. When planning staging areas for animal evacuation and rescue, the types and numbers of vehicles required to transport large animals should be considered to ensure continued emergency vehicle access (Pawsey, 2015, Roger et al., 2015, Westcott et al., 2017).

Emergency management planners need to remember that it is not only owners who encounter animals in wildfires and that front-line responders are significantly impacted by the presence of animals on fire grounds (Chadwin, 2017, Westcott et al., 2017). Unfolding disasters such as the Port Hills fire mean that responders are operating within a very complex environment where animals are usually highly stressed, causing a public safety issue due to the increased risk of injuries inflicted by animals, as well as the potential of psychological distress during and after the event (Chadwin, 2017). This includes the fire fighters who have encountered animals. A couple of examples of representative reports from responders to the Port Hills fire evidence the challenges encountered:

> One dog was a little Foxy and the other a brindle or Staffy. We caught the dog, chucked it in the car and one of the crew drove it through the blanket of smoke down to the bottom of the hill. We were worried the dog might have a go at him in the car but it was good, I think the dog knew we were trying to help it.
>
> (Station Officer, cited in Anderson, 2017, para 14)

> We couldn't get to the house and just had to hope the people had gone. We were opening up gates and trying to get stock (cattle and a group of horses) out of the way of the fire. I don't know how they fared.
>
> (Station Officer, cited in Anderson, 2017, para 16).

Early activation of agencies and teams with requisite skills and experience to handle stressed animals and to capably assist with animal evacuations should be instituted. Large animals such as horses require a specific skill set when in a stressed environment such as a wildfire. Stressed large animals, no matter how well they are handled, have been likened to a grenade with the pin pulled and someone poking at it with a stick (Squance, 2015). They are unpredictable, very powerful and have the potential to cause fatal injuries to responders, animal owners and an animal itself.

The use of experienced animal rescue teams would reduce the risks of injuries associated with inexperienced people handling stressed and scared animals. In another situation, a firefighter who was also an experienced horse woman, was tasked with assisting to rescue eight horses, a dog and sheep trapped behind the cordons. They stated, "Here I was, thinking I could do animal control work, but I ended up having a cry – I just couldn't believe that the horse had been left behind. It really got to me." (Thompson, 2017, para 15).

The firefighter had no way of knowing that the owners were away from the property when cordons were put in place and were unable to evacuate the horses. They were distressed because they did not know if their horses were safe and they did not know who to contact to request assistance to rescue the horses. This example highlights the importance of having a registration process that enables animal owners to request assistance for evacuation and reunification with their animals (Pawsey, 2015; Taylor et al., 2015a; Westcott et al., 2017).

Cordons

Cordons are frequently established as part of the response management process, and were employed in this event. However, they presented significant challenges for animal owners. For example, Maja Burry reported that hundreds of people were evacuating their homes, moving livestock and taking pets with them while:

> Other people standing at the cordons saying they have horses in paddocks nearby that they want to

> evacuate, but aren't allowed. But there have been a number of people leading horses out past the cordon to get to safer ground.
>
> (Radio New Zealand, 2017, 29.30 minutes).

In some instances during the Port Hill Fire event, cordons were placed during the day when some householders were away from their properties. In these cases, animals were left behind, posing risks to the safety of the animals, emergency responders and to the psychological wellbeing of the owners and responders. People's emotions can supersede self-preservation and innate human drivers can cause people to make emotional-based decisions about animals (Westcott et al., 2017). A resident waiting in her car at the cordon reported that:

> I am coming home from work and I just can't get home. They are not letting you go up (referring to past the cordons) to get your animals ... I have a cat and dog ... 'm really worried.
>
> (Radio New Zealand, 2017, 0.18 minutes).

Additionally, international research and experience describe how people will break cordons to gain assess to their animals. An example of this is a farmer who broke through a cordon to check on stock and the property, who stated that, "Although the area was cordoned off, on Friday he and his farm worker went 'up the hill to have a look.' It was devastating" (Deavoll, 2017, 8.11 minutes).

The importance of addressing animal welfare needed to end suffering is a time-critical activity following a wildfire (Pawsey, 2015). Veterinary response teams should be given access through cordons to assess animals who have been injured and require immediate medical attention or euthanasia (Madigan & Dacre, 2009). This can be achieved by directly referencing animals in cordon management protocols as a key consideration when identifying early access needs (Pawsey, 2015; Rogers et al., 2015).

The current overview of reports and literature following the Port Hills fire supports the previous conclusion, that wildfire response structures should include the consideration of animals to improve animal welfare, human safety and resilience outcomes. The same conclusion was arrived to by the State of Victoria (2015). This must be integrated in the structure of the response and requires effective co-ordination, leadership and communication. As identified in reports regarding the fire, if an animal response is not visible, people will risk their lives to save animals and rogue teams unconnected to the overall response may form and break cordons. This behaviour presents several challenges for firefighting agencies in managing animal owners as well as protecting public safety. Therefore, the following recommendations are offered to start to address human behaviours and reduce psychological impacts both during the event and during psychosocial recovery:

1) Consider animals across all phases of emergency management in relation to wildfires, including the expectations of animal owners and the public health consequences of not including them;
2) Develop a programme which will enhance emergency responders understanding of the emotional drivers of animal owners during an emergency to better support their planning and preparation to develop a culture of organizational support and capacities to deliver an animal welfare response;
3) Develop a national animal loss database that includes morbidity and mortality of all animals to further demonstrate the operational need to consider animals in decision making for wildfires involving animals;
4) Include animal ownership in public education campaigns;
5) Utilise the human-animal bond as a motivator for hazard mitigation, emergency preparedness and response in wildfires;
6) Consider the logistics of evacuating animals, including production animals during the decision making of evacuations;
7) Explore ways to develop an animal inclusive wildfire response strategy.

Conclusion

The emotional attachment between people and animals is complex and has the potential to significantly impact outcomes of a wildfire response. In the wake of the Port Hill Fire, a number of reports provide evidence supporting the development of operational action plans that focus on community at the centre and safety as a priority (Fire and Emergency New Zealand, 2018). A better understanding of the potential impact of animals and their owners in wildfire emergencies and improved multiagency collaboration will assist in achieving these objectives. Animals must be included in wildfire awareness and planning, not only to prevent animal suffering, but to improve the success of the

broader emergency management goals of human and community safety and resilience (Pawsey, 2015). Plans must balance the expectations of communities towards animal welfare and the need to protect human and animal life.

Human and animal welfare are not mutually exclusive and should not be addressed in isolation (White, 2012). Shifting the focus from keeping pets with people to keeping people with their animals acknowledges the importance of the human-animal bond and mitigates the risk behaviour of animal owners. The consequences of inaction outweigh the challenges of integrating human wellbeing and animal welfare in all phases of wildfire response frameworks. This conclusion is core to recommendations made at the end of the current Results and Discussion section, to: consider animals across all phases of wildfire management; enhance emergency responders' understandings of animal owners' emotional drivers; develop a national animal loss database; include animal ownership in relevant public education; leverage the human-animal bond as a motivator for mitigation and emergency preparedness; more carefully consider animal evacuation logistics, and; develop relevant wildfire response strategy.

In order to get a better understanding of the impact of the 2017 Port Hills fires, with respect to animal welfare and response operations, relevant research needs to encompass as many information sources as possible. However, limitations are that these articles in the literature and the media may have a bias on either side of the reporting and do not provide for a more objectively controlled study of the factors involved. The current lack of central reporting within New Zealand also prevents the access to another independent source of information. Likewise, a potentially large body of research literature on the Port Hills fires was still in progress at the time of our literature review. Many documents will have been excluded by starting this review within twelve months of the event.

These and other issues mean that the current review does not purport to be an in-depth study of the issues raised. One additional gap in the current research, that was not highlighted in this analysis, is the lack of inter-agency co-ordination with respect to animal welfare in emergency situations. These issues will be explored in greater detail in forthcoming research such as a survey, focus groups and semi-structured interviews, using both qualitative and quantitative methods. The aim of the survey is to understand Port Hills animal owners' risk perception of wildfire before the event, preparedness measures, what resources they have to evacuate animals, the actions they took during the event, and how they and their animals may have been affected. Semi-structured interviews will be conducted with agencies who were affected by the human – animal interface, to better understand what they believe went well, what could have been done better, and to identify gaps.

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