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Wildlife welfare and the 2019–20 wildfires

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Summary

- Given the magnitude of the 2019–20 wildfires, there were exceptional numbers of affected animals.
- There was profound community concern for and media attention directed to the welfare of fire-affected animals.
- There were marked mismatches between some media and community expectations for treatment of fire-affected animals and the reality of established triage principles and welfare considerations.
- There were major taxonomic biases in response, with a preponderance of care given to larger and iconic mammal species.
- Review of the rescue and rehabilitation activities highlighted some notable successes in outcomes, demonstrated the need for and utility of the application of ethical and welfare-based responses, and provided some important advances in the evidence base.
- However, the scale of animal welfare concerns revealed major shortcomings and inconsistencies in existing response plans and systems, and limitations on the available expertise and knowledge base. These shortcomings need to be, and are being, addressed to ensure better preparation for future comparable environmental catastrophes.

Introduction

What is animal welfare?

Enhanced scientific understanding and acceptance of sentience in many species has led to a welcome growth in the recognition of animal welfare as a core scientific discipline. This in turn, has led to the topic of animal welfare rapidly maturing as a societal issue gaining public attention (Hampton and Teh-White 2019).

Animal welfare is a characteristic of an individual animal. It describes the quality of an animal's life as it is experienced by the animal. A scientific definition that adequately

captures the complexity of welfare is Broom's (1986) definition that 'animal welfare is the state of an animal as regards its attempts to cope with its environment'. This definition incorporates both the feelings as well as physical health of an animal, but it also acknowledges that welfare is a state that can be measured and can sit on a scale from negative to positive.

Each species is equipped to cope with a range of relevant stimuli through behavioural and physiological processes. However, if an animal is in an environment where it is challenged beyond its tolerable limits, there will be failure to cope and the animal will experience biological consequences such as ill-thrift, compromised immune response and, in some cases, death.

A useful framework designed to support conceptualisation of animal welfare is the Five Domains model, which describes four physical domains (nutrition, health, environment and behaviour) and one mental domain (the affective state). It was originally developed in 1994 but has since evolved through multiple iterations to incorporate the latest science (Mellor *et al*. 2020).

Wildlife welfare

The dominant drive for advancements in animal welfare science has been to guide what humans should do to protect animals in their care and give them a good life. This has been almost exclusively focused on domesticated animals and captive wildlife. The welfare of free-roaming wildlife has not been the topic of enough debate or focus in the literature, despite being of significant public interest. This interest has grown as more people become aware of the substantial impact humans have on wild animals. The growing scale and impact of anthropogenic factors on wildlife and wild places have led to an increasing sense of moral obligation to help wildlife in need in an attempt to restore or counterbalance imposed adversity (Englefield *et al*. 2019). As news about wild animal suffering across media platforms increases, this trend is expected to continue.

Humans can impact wildlife in a variety of adverse ways, including disturbance or destruction of habitats, the spread of diseases, hunting and road trauma, as well as more indirect impacts through well-intended activities such as wildlife tourism and research (Berg *et al*. 2020). When the focus is on species-level interventions, welfare of an individual animal has historically been considered a lower priority. However, as our ethical reflection deepens and scientific techniques advance, opportunities to improve both individual animal welfare and conservation outcomes have expanded. Indeed, wildlife conservation and animal welfare share the common goal of preventing harm to wild animals. Beausoleil *et al*. (2018) describe how cross-disciplinary sharing and collaborative research are needed to advance our approach to conservation and animal welfare, calling for incorporation of both 'feelings' and 'fitness' in how we approach animal and environmental interventions.

Animal welfare risk factors associated with wildfires

Although many Australian animals have evolved mechanisms to sense fire long before it arrives, giving them time to flee or seek refuge, high-intensity, fast-moving fires, or fires occurring over a large area, can overwhelm the protection afforded by these adaptive behaviours. Exposure to fire can lead to heat stress, smoke inhalation, burns and other injuries sustained in attempts to escape the immediate area. Water and food sources for all species can be impacted, resulting in dehydration and starvation, risks that are heightened if the fire occurs during drought conditions. Habitat damaged by fires can

limit shelter opportunities, exacerbating the possibility of environmental exposure and predation.

For animals that are removed from the wild, physical and psychological harms can result from capture, transport, examination and temporary housing in captivity, especially if operations are poorly planned, facilities are not species appropriate, and the people involved are untrained. While some animals appear to cope better than others, the development of objective assessment tools for Australian wildlife welfare in rehabilitation settings is still in its infancy.

Animals in the wild and in care can experience distress and fear, although overt signs may be masked. The ability to exhibit species-specific behaviour may be impaired by habitat degradation or inadequate captive housing. Pain and suffering may be prolonged if veterinary care is not sought or if there are delays in decisions to euthanise or release animals.

Some of these wildfire-induced welfare impacts are difficult to mitigate. However, with advances in welfare science and the growing recognition of the significance of human factors impacting wildlife welfare during these events, there is considerable opportunity for practices to improve.

The human dimension

A range of people is likely to come into contact with wildlife during and following a wildfire, including fire-fighters, government-employed officers, park rangers, wildlife rescuers and rehabilitators, veterinary professionals, members of the public and land owners. It is critical to recognise that all interactions with wildlife, either direct or indirect, in an emergency have the potential to influence welfare outcomes.

In natural disasters, there is often a strong sense of empathy for wild animal victims. Amid devastating losses, people typically feel an intense desire to help. Community support can buoy the spirits of animal care staff and help organisations to mobilise resources quickly while working in what are often highly stressful situations.

Although interventions are invariably well intentioned, in some cases offers of help can hinder effective response and may also have adverse animal welfare impacts. For example:

- People may attempt to rescue or treat animals without the appropriate knowledge and skills.
- The logistics of dealing with unnecessary consumable donations risks diverting precious resources from the front-line.
- Emotional attachments and unrepresentative media stories and accounts can lead to unrealistic expectations that every injured animal can be saved, regardless of prognosis.
- Interpersonal conflicts, and the temptation of self or group promotion, can deflect attention away from the relief of suffering and the provision of high-quality care for rescued animals.

To help navigate these risks, it is useful to view the situation from an animal-centric perspective, to recognise the circumstances that typically compromise animal welfare and to be cognisant of judgment-impairing factors. The Five Domains model provides a useful framework to support consideration of animal welfare risks during natural disasters. Table 26.1 utilises an adapted version of the model (with 'human interaction' added as a sixth domain) applied to wildlife affected by wildfire.

Table 26.1. Examples of key welfare risk factors for consideration to assist with decision making to improve welfare outcomes for wildlife affected by fire (adapted from Mellor *et al.* 2020).

Domain	Wildlife in the wild following a fire	Wildlife in care (e.g. hospitalisation or rehabilitation) after a fire
Health	• Injury/functional impairment as a result of the fire • Presence of illness or disease • Poor physical fitness or body condition • Presence of hazards that may predispose to injury or illness • Impact of fire retardants, chemicals and ash post-fire (particularly for aquatic species)	• Injury/functional impairment as a result of the fire • Presence of illness or disease • Poor physical fitness or body condition • Impact of medical treatments or inappropriate nutrition • Biosecurity risk of housing in proximity to other species/ individuals • Fitness pre-release • Inadequate pain management • Lack of access to appropriate facilities for species-specific medical treatments
Nutrition	• Restricted access to suitable drinking water and species-appropriate natural food of appropriate quality (e.g. vegetation availability)	• Restricted access to suitable drinking water and species-appropriate natural food of appropriate quality (and ability to consume that food) (e.g. lack of browse paste for inappetant koalas)
Environment	• Weather extremes • Habitat structure that impairs retreat from threats (weather or conspecifics) • Terrain, substrate and inability to disperse to other habitats	• Inappropriate facilities for medical treatment and recovery (inability to deliver medications, isolate from other animals) • Inappropriate sensory environment (e.g. lighting, noise exposure, presence of predators) • Inappropriate enclosure furnishings and features to allow animals to build strength pre-release
Behaviour	• Restricted opportunities to express complete range of normal behaviours • Behaviours indicative of injury, illness or pain (e.g. lethargy)	• Restricted opportunities to express motivated behaviours relevant for recovery (e.g. rest) and build pre-release fitness • Behaviours indicative of injury, illness or pain (e.g. lethargy)
Human interaction	• Lack of appropriately trained people to make informed assessments and judgments • Anthropogenic activities (e.g. roads, fencing, habitat destruction, noise, disturbance)	• Lack of appropriately trained people • Excessive human interaction, human dependency • Prolonged time in care
Affective state	Examples of associated mental experiences based on physical domains above: • minimise negative states: pain, discomfort, thirst, hunger, exhaustion, isolation, fear; • maximise positive states: exploration, foraging, social, satiety, vitality, calm, content, reward.	

Key findings

Animal welfare-based decision making during the 2019–20 wildfires

As the 2019–20 wildfires burnt across Australia, an estimated 3 billion native animals were impacted (WWF 2020; Chapter 12). There is no national standard for emergency response for wildlife in such catastrophic events, with each jurisdiction deploying variable approaches according to state or territory-based wildlife legislation and emergency response plans and frameworks.

Despite variation across jurisdictions, core principles and elements in a wildlife response can be applied. For example, the skills and knowledge of experienced wildlife volunteers and veterinary professionals should be recognised and utilised where needed. For animals requiring rescue, welfare needs to be central to decision making at multiple points along the chain of events from the first sighting of an animal in the field to its medical treatment, rehabilitation and eventual release back to the wild (Box 26.1).

Box 26.1. Building an evidence base: koala post-release monitoring protocol

While thousands of sick, injured and orphaned wild koalas are rehabilitated in Australia annually, few studies have investigated the effectiveness of rehabilitation practices.

Over the 2019–20 wildfires, 27 koalas were transferred to specialised wildlife hospitals managed by Zoos Victoria (Fig. 26.1). Following initial health assessment, the severity of burns necessitated ongoing pain assessment and the provision of analgesia, regular debridement and treatment under anaesthesia, diagnostic imaging, clinical pathology and daily monitoring of demeanour, movement, food intake and faecal output. The highly specialised diet, and importance of sufficient browse to maintain healthy gastrointestinal microbiome and bodyweight in koalas, presents a major rehabilitation challenge.

While burns to the skin generally responded to treatment, a progressive deterioration in mobility and function of burnt digits was seen in some koalas, sometimes accompanied by temporary nail loss. The pathogenesis of this condition, referred to as 'progressive digital necrosis' (PDN), is believed to be initiated by thermal injury to the deeper digital tissues at the time of the original burns.

Once hospitalised care was no longer required, koalas were moved to large, semi-wild enclosures at Healesville Sanctuary and Phillip Island Nature Parks. These enclosures, containing multiple mature eucalypt trees to allow development of strength and fitness, also provided a less stressful environment with significantly reduced human contact. Koalas were held in these enclosures for a minimum of 2

Fig. 26.1. Koala being treated at Healesville Sanctuary's Australian Wildlife Health Centre for injuries caused by bushfire: close-up of burns on rear paws once bandages removed. (Photo: Zoos Victoria)

months before release, where formal behavioural assessment showed considerable improvement in fitness, foraging and climbing ability.

In late 2020, 14 *Chlamydia*-negative rehabilitated koalas were found to be in excellent health and fitness, showing wild behavioural responses, and were fitted with radio and GPS collars before being released back into regenerated forest as close as possible to their original location (Fig. 26.2). Tracking frequency gradually reduced over the life of the monitoring period, but the intensive approach provided an excellent opportunity to gain detailed understanding of each koala's behaviour and welfare status once released. A sudden change in demeanour in three released koalas facilitated rapid, in-field veterinary assessment and euthanasia on the basis of clinical findings, preventing a slow deterioration in health and welfare for these individuals and enabling detailed necropsy examination. This led to findings of acute renal disease in two animals, and clinically significant chlamydiosis in one. Further research is required to understand the development of renal disease in released koalas.

Koalas were monitored for between 4–6 months post-release to the wild, and at the end of this period all remaining koalas were in excellent health. Assessment of GPS data showed individual variation in movement, but generally good choice in habitat and spatial behaviour, and the presence of pouch young in eight of nine released females indicated successful reintegration into wild populations.

Although a small sample, this project has provided unique insight into the rehabilitation and post-release survival and health of rehabilitated koalas. The intensive approach required to ensure return to normal function in severely burnt tissues highlighted the importance of constant assessment of welfare during veterinary care and rehabilitation. There is a delicate balance between providing the level of intervention required while minimising the impact of chronic stress on healing and animal wellbeing. Knowledge gained will be used to improve approaches to the rehabilitation and release of fire impacted koalas.

Fig. 26.2. Koala released back to the wild after treatment. This release was included in a monitoring study that tracked post-release survival. (Photo: Zoos Victoria)

Prognostic thresholds for wildlife cannot be directly compared to domestic animals with similar injuries or degrees of illness. If a dog or horse sustains a severe injury and requires intensive care and/or surgery, the assumption is that the animal is likely to remain in human care for the rest of its life, can be reassessed regularly and should receive medication or other therapies as needed. With wild animals, however, veterinarians, wildlife

carers and managers can only deem an animal fit for release if chronic effects are not anticipated and no further intervention or assessment is expected post-recovery. Even if the initial prognosis is deemed fair to good, long-term welfare should be continuously re-evaluated throughout the various stages of rehabilitation. If it becomes clear that the animal will not be physically and behaviourally capable of independent life in the wild – whether that is due to severity of injury or illness, progression of an earlier problem, an inability to cope with captivity or an issue that has developed in care – euthanasia is appropriate.

Figure 26.3 provides a high-level outline of the government-led, collaborative response to assessment and management of wildlife that was deployed in Victoria during the 2019–20 wildfires. It shows the various points at which an animal moves through various assessment stages and the extensive range of welfare risk factors to consider. As a result, rather than survivorship increasing, the number of animals progressing through each successive stage declines as euthanasia may be deployed at any step to prevent current or future suffering. It is usually following initial assessment that euthanasia rates are highest. For example, following the 2019–20 wildfires in Victoria, around 3000 individual wild animals were assessed in the field with only 259 (10%) progressing through to field clinics for further assessment (Parrott *et. al*. 2021) of which 33 (1% of total) were transferred for more intensive veterinary care.

It is important to recognise that triage for wildlife casualties must also take into account factors such as relevant legislation, human health and safety, and the availability of resources and facilities.

The level of veterinary and rehabilitation care required to ensure optimal outcomes for wildlife represents a significant investment in time, expertise and resources. Severely injured or debilitated wild animals, such as those suffering severe burns or smoke inhalation, require specialised intensive care and a high level of ongoing veterinary support. The expenses associated with veterinary medicines and consumables (including advanced wound dressings, sedation, anaesthesia, analgesia and antimicrobial medicines), diagnostic imaging and clinical pathology costs, and the provision of a species appropriate diet, hospital and rehabilitation facilities are significant. An estimate from the 2019–20 wildfires of cost *per week per koala* for intensive care is $16 000. Financial costs can be reduced when treating and housing wildlife, but these reductions often come at the cost of animal welfare and may negatively impact on the success of reintegration of animals back into the wild.

Compounding the challenges, the husbandry needs of wild animal patients are incredibly diverse, demanding dedicated hospital and rehabilitation facilities with the capability to cater for a wide range of species. Appropriate enclosure sizes, construction materials, management of environmental variables (temperature range, humidity, UV exposure and photoperiod) and species-specific feed are all required. While there will always be a spectrum of care needs for wildlife impacted by emergency events, and a corresponding scale in associated costs, emergency response planning must include a transparent and realistic appraisal of the investment required before the decision to undertake treatment, care and/or rehabilitation and release goes ahead.

Species presented

Survey-based research of veterinary personnel and wildlife rehabilitators involved in the 2019–20 wildfire response revealed that only a very small proportion of affected animals were rescued, with a heavy species skew towards mammals, particularly larger

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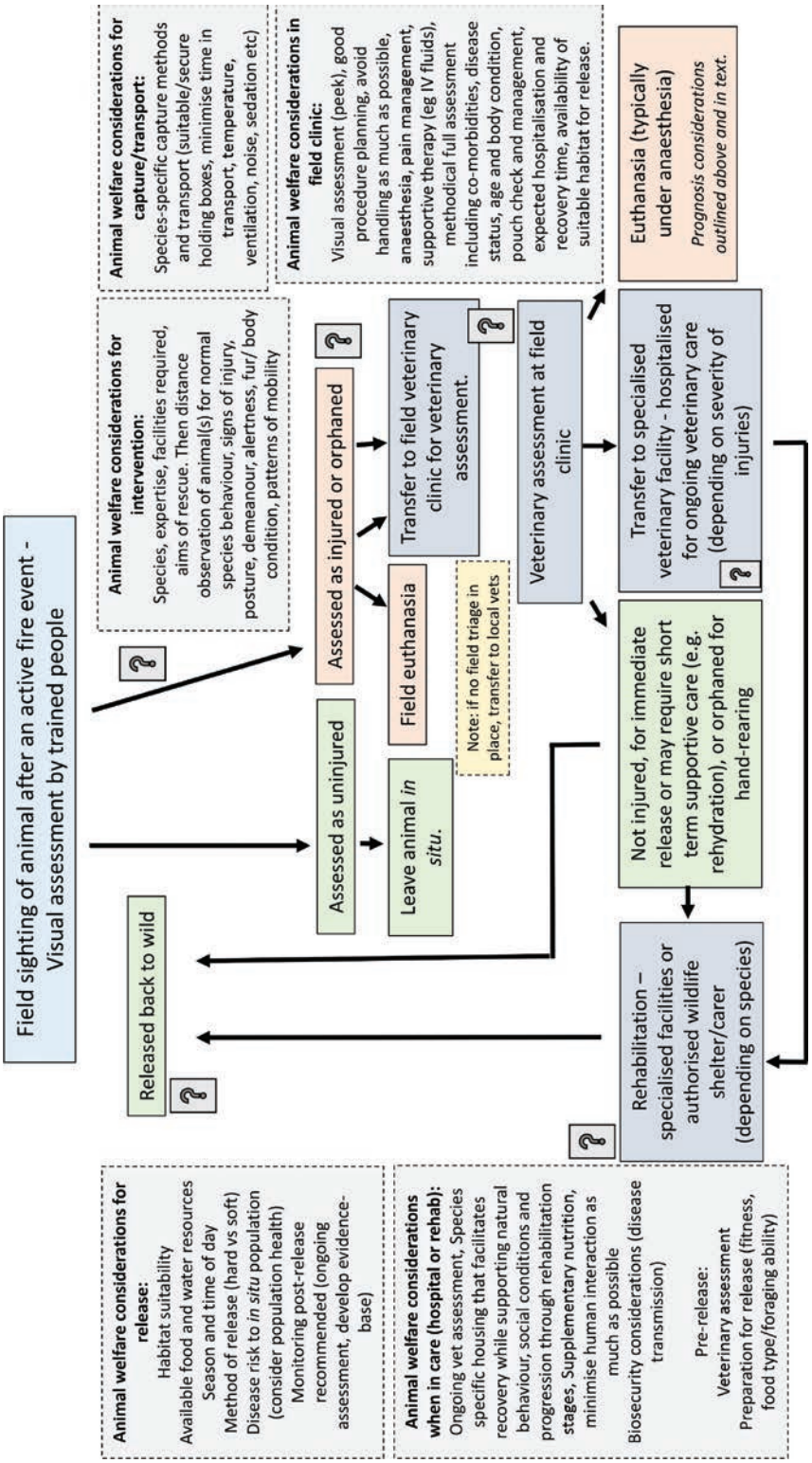

Fig. 26.3. An example of the various points of decision making for individual animal welfare and the relevant welfare risk factors considered during the 2019–20 wildfires in Victoria. '?' represents significant welfare decision points before moving to the next stage.

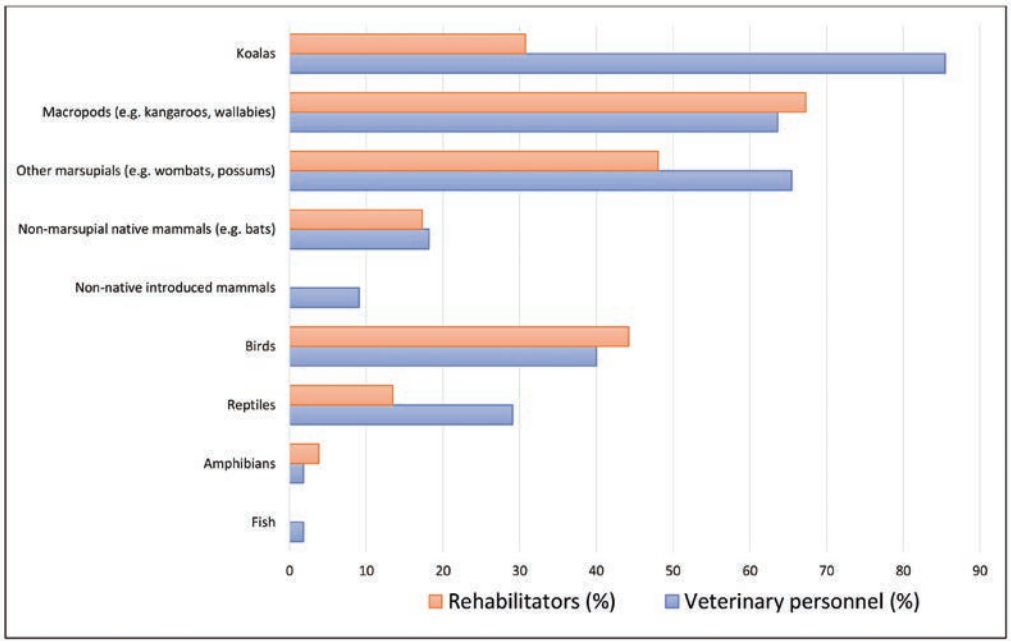

Fig. 26.4. Taxonomic caseload prevalence (%) of surveyed rehabilitators (n = 52) and veterinary personnel (n = 55) involved in the 2019–20 wildfire response (data pooled to include responses from all states and the Australian Capital Territory). Survey respondents indicated which species and or species groups were included in their caseload.

marsupials (Fig. 26.4). Rehabilitators reported caring for macropods more than any other group, whereas koalas (*Phascolarctos cinereus*) were the species most commonly assessed by veterinary personnel. Birds, reptiles and amphibians were brought into care but in much smaller numbers. Conservation status did not appear to play a role in the type of animals rescued regionally or nationally and the time in care of some victims was considerable.

There are several potential explanations for the taxonomic distribution of cases. Humans have a well-described empathy bias towards mammals (Miralles *et al*. 2019) and the fact that koalas and large macropods have high profiles is likely to have played a role. Koalas have limited options to flee a fire-affected area and may also have been easier to catch. Wild macropods are more mobile, but the severity of the fires meant that some were injured in attempts to escape. Pouch young may have survived when their mother became injured or died and, as a result, a proportion of the cases rescued were orphans.

The relative paucity of birds, reptiles and amphibians presented for assessment in comparison to the estimated numbers impacted warrants consideration. Due to their smaller body size and more cryptic nature, it is possible these species are simply not sighted by rescuers. It is also likely these smaller animals succumbed to post-fire predation due to their vulnerability without effective cover. Nonetheless, the welfare needs of these species remain poorly understood and they tend to display less recognisable signs of pain and distress. They may have been more challenging to rescue or members of the public may have been less motivated to pursue treatment for them if they were found injured.

Ethical considerations

Ethics is a philosophical discipline that attempts to discern how we ought to act, how we make decisions and what differential value we place on things. The response to wildfire-affected wildlife highlights how ethics related to animals can have a profound impact on animal welfare.

In terms of the ethical issues encountered in the 2019–20 wildfires, many are familiar to those working in the rehabilitation space, and others were novel to this event:

- There were accounts of conflict between wildlife care groups and individuals with a 'no kill' philosophy clashing with utilitarian advice that was aiming to achieve an overall 'good' outcome in situations with multiple competing interests.
- There was conflict regarding resource allocation, particularly to locally abundant species where treatment may have been of no or limited conservation value.
- There were perverse situations where eucalyptus branches for feeding rescued koalas were being cut from remnant unburnt bushland where unharmed koalas who needed this scarce and limited food resource remained (see also Box 26.2).
- In equivocal situations, there were reports that some animals were treated and response locations selected to elevate dwindling group morale rather than to address animal welfare.

The 2019–20 wildfires raised the issue of how much wild intervention is appropriate after a disaster. In terms of a 'respect for nature' ethic, how do we now define 'nature' and what is natural in the human-influenced era of the Anthropocene? For example, there was urgent public pressure for support of surviving free-living animals in wildfire affected areas through provision of food, water and shelter (see also Box 26.3). However, careful consideration must be given to how this is done to ensure there are not unintended consequences for wildlife and the environment (e.g. by encouraging the influx of introduced predators or contributing to the introduction of weeds). Multi-stakeholder groups were mobilised during the wildfires to advise government agencies and provide online resources for the community. Even among equally qualified and experienced professionals, opinions differed in terms of how much assistance was considered appropriate.

An effective response to a natural disaster relies on the coordination of many people. Individuals and groups may have to make decisions based on incomplete information in an emotionally charged environment with a high level of public interest. Moral distress and interpersonal conflict can arise from differing ethical viewpoints regarding the appropriateness of particular interventions, the relative value of species, the allocation of limited resources, and philosophies regarding animal euthanasia. Strategies for response personnel to successfully navigate these complex situations include respectful and clear communication; honest consideration and understanding of motivations influencing actions; reliance on evidence, expertise and professional judgment; and clinical debriefing.

Box 26.2. Supplementary feeding of wildlife

Throughout the 2019–20 wildfires, wildlife carers and veterinary professionals actively wishing to assist in the management of wildlife health and welfare worked in an environment of varying or absent coordination, standards and practices or supporting documentation. This affected the opportunities to provide appropriate care and to manage the health and welfare of native wildlife.

While many government agencies and wildlife organisations discourage supplementary feeding of free-ranging wildlife because of the potential adverse effects, the 2019–20 wildfires destroyed enormous areas of habitat, making it difficult for free-ranging wildlife to access the normal sources of food and water both during and after the fires. In recognition of the need for nationally harmonised advice, Wildlife Health Australia (WHA) established a small *ad hoc* Food and Water Working Group, which included ecologists, wildlife veterinarians, wildlife nutritionist, non-government agencies (zoos, universities and wildlife rehabilitation organisations) and representatives from state government to develop advice on the safe provision of food and water to free-living wildlife based on current knowledge. The working group produced several key outputs during the wildfires, including:

- general advice on the supply of water and food for free-living wildlife after natural disasters;
- detailed food and water advice for use by each state or territory environment agency as deemed appropriate for the wildlife impacted within their jurisdiction;
- bespoke advice for key threatened species, as requested; and
- advice on when supplementary food and water are no longer required by wildlife.

Despite the wealth of knowledge held by subject matter experts on the working group, there was a critical absence of evidence-based research to support and inform the advice developed. Many of the critical knowledge gaps remain. Addressing these gaps through an evidence-based, cross-disciplinary approach, while also developing a framework to facilitate dissemination of best practice guidelines to users across Australia, is required. Specifically, this research will provide the much-needed evidence to assist development of best practice guidelines for provision of food and water in advance of the next natural disaster. An added benefit from this work was the subsequent development of a Wildlife Assist app for citizen science engagement on this issue. Wildlife Assist is an app that records, monitors and advises on providing Australian wildlife with food, water and shelter in the field.

Box 26.3. Media and social media impacts on welfare of rescued wildlife

Communication is a vital component of any emergency disaster response. The media, and increasingly social media, play a vital role in facilitating communication.

Animal-related imagery, language and story can have a powerful influence on the perception of the impact of disaster on wild animals and ultimately on animal welfare. There is great potential for wild animal welfare to be enhanced via timely notification of animals at risk, dissemination of information, sharing of decision-making tools and garnering valuable financial and practical support. However, misleading information about on-ground activities and the desire to elicit a powerfully emotive connection can have unintended consequences for the wellbeing of animals.

An analysis of media outlet front pages over the period of the 2019–20 wildfires concluded that the domestic media's imagery largely portrayed a humanitarian disaster.

Conversely, international media images focused on the impacts on iconic fauna with 52% of all coverage depicting wildfire-affected landscapes or animals. In fact, international outlets featured animals more than 10 times as much as the Australian front pages, with kangaroos and koalas over-represented (Thomson 2021). Similarly, the majority of online wild animal images illustrating the disaster were of living, but seemingly helpless, koalas and macropods. In reality most victims perished, fled or were so badly injured that euthanasia was the most appropriate intervention on welfare grounds.

In the social context of immense loss, there was a desperate hunger for good news. As such, stories of compassion and heroism in animal rescue and the personalisation of animal casualties emerged. There was little discussion of the valuable and highly collaborative work being done by experienced veterinary teams around the country to relieve suffering nor the fate of severely harmed wild animals or those with injuries that would preclude release. Decision making in contemporary wildlife rehabilitation practice is often sanitised in promotional material and media stories. This false impression of the numbers of charismatic victims, their likelihood of survival and the level of available local expertise resulted in prolonged suffering due to distrust of professional euthanasia recommendations and an influx of well-meaning but untrained volunteers who had little understanding of Australian wildlife care needs, codes of practice or triage principles. User-generated social media content provided a mechanism for citizens and organisations to express concerns and values, but in an environment of celebrated heroism and high levels of donation it also, in some cases, invited self or group promotion and competition at the expense of animal welfare.

Images and videos that 'went viral' often appealed to the human–animal bond, depicting people in the process of rescuing or caring for wildlife, without acknowledging that close contact between wild animals and humans can be intensely stressful for animals. Some showed poor judgment, with people posing for media interviews with critically injured animals, delaying their transfer for urgently needed veterinary care; overtly staged images of marsupial orphans being fed in situations that did not represent established standards of care; and the postponement of release for recovered victims to meet publicity obligations. As has been demonstrated in the tourism industry, takers and viewers of wildlife 'selfies' often do not perceive the negative state experienced by the animal during the creation of such an image (Lenzi *et al.* 2020).

An improved understanding and appreciation for wild animal welfare in the context of disaster response is necessary for both the creators and consumers of media and social media content. Mechanisms to enhance the prominence and reach of accurate and ethical messages to this end remain poorly understood. The influence of digital psychological nudges such as framing, social norms, and striking visual and commitment cues have been identified as relevant to disaster communications (Mirbabaie *et al.* 2021), and their role in animal welfare impacts warrants further research.

Conclusions

The disastrous wildfire season of 2019–20 is unlikely to be a stand-alone event. The size, scale and frequency of wildfires has been steadily increasing over the last several decades. As such, we need to consider the events a learning opportunity and driver to enhance preparedness, and embrace courage and innovation in reimagining how we support both people and wildlife through future emergencies.

There are significant gains to be made if we can shape this work into a more holistic, transdisciplinary approach that embraces all knowledge systems. There is an urgent need to tackle the problems collectively as community, environmental and wildlife welfare outcomes are inextricably connected.

Recommendations

Though much good work has been done, the ability to effectively coordinate every level of the currently largely uncoordinated wildlife care sector will be crucial in the future. Partnerships and collaboration are key. Priority recommendations to enhance preparedness that will underpin effective response and recovery activities include the following:

- Develop a national framework for emergency wildlife response that integrates dedicated response roles into the emergency management arrangements of each jurisdiction, including role statements and underpinning skill prerequisites.
- Develop and set clear standards to guide decision making, including:
  - ethical guiding principles for assessment and intervention, developed in advance of an emergency to facilitate preparedness and planning (acknowledging the many factors that can cloud judgment during the event)
  - species-specific veterinary and care documentation for wildlife, including policy, standards and protocols to support an effective, consistent and timely approach.
- Build capacity and capability – identify and train a targeted cadre of on-ground wildlife responders and supporting managers for deployment in specific wildlife response roles. Training should be grounded in the latest animal welfare science. This should be a prerequisite for any involvement in wildlife response during an emergency.
- Foster a continuous improvement philosophy. As knowledge advances, so should our standards and skills for wildlife.
- Build a stronger evidence base – invest in research dedicated to better understand the effectiveness of different rehabilitation approaches, prognostic indicators and animal welfare impacts of various interventions, and build individual and population health knowledge associated with emergency response to identify potential risks.
- Engage with community – have open, transparent conversations about living with wildlife, animal welfare-based decision making and how we can foster a more productive human-nature relationship.

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