Chapter 13
Reimagining Human Responsibility Towards Animals for Disaster Management in the Anthropocene

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Andreia De Paula Vieira and Raymond Anthony

Abstract Animals, like human beings, are prone to suffering harms, such as disease, injury and death, as a result of anthropogenic and natural disasters. Animals are disproportionately prone to risk and adversely affected by disasters, and thus require humane and respectful care when disasters strike, due to socially situated vulnerabilities based on how human communities assess and value their moral standing and function. The inability to integrate animals into disaster risk and management practices and processes can sometimes be associated with a lack of understanding about what animal ethics and animal health and welfare require when designing disaster management programs. This chapter seeks to reimagine human responsibility towards animals for disaster management. The pervasiveness of disasters and their impacts on animals, human-animal and animal-environment relationships underscore the importance of effective animal disaster management supported by sound ethical decision-making processes. To this end, we delineate six ethically responsible animal caretaking aims for consideration when developing disaster management plans and policies. These aims, which address central vulnerabilities experienced by domesticated animals during disasters, are meant to be action-guiding within the disaster management context. They include: (1) Save lives and mitigate harm; (2) Protect animal welfare and respect animals' experiences; (3) Observe, recognize and promote distributive justice; (4) Advance public involvement; (5) Empower caregivers, guardians, owners and community members; (6) Bolster public health and veterinary community professionalism, including engagement in multidisciplinary teams and applied scientific developments. To bring about these aims, we offer a set of practical and straightforward action steps for animal caregivers and disaster management teams to ensure that animals' interests are systematically promoted in disaster

A. De Paula Vieira
Animal Welfare Scientist and One Health Researcher, Curitiba, Brazil
e-mail: apvieirabr@gmail.com

R. Anthony (✉)
Department of Philosophy, University of Alaska Anchorage, Anchorage, AK, USA
e-mail: rxanthony@alaska.edu

management. They include: (1) Respect and humane treatment; (2) Collaboration and effective disaster communication; (3) Strengthening systems of information sharing, surveillance, scientific research, management and training; (4) Community outreach and proactive contact; (5) Cultural sensitivity and attitudes check, and (6) Reflection, review and reform.

13.1 Introduction

We are living through the Anthropocene, an epoch defined by the fact that human activities have touched nearly every aspect of life on Earth,[1] including accidental or inadvertent pollution from industries that result in the deaths of fish and pigs,[2] as well as intentional projects such as damming rivers that flood and drown a plethora of animal species and rapid, widespread urban development that contributes to wildfires that consume wild animals' habitats.[3] Further, the effects of climate change and environmental degradation have left humans and animals vulnerable to drought, food shortages and lack of habitability. In addition, the rise of emerging infectious disease outbreaks has been connected to industrial agriculture, environmental destruction and habitat loss (FAO 2017; Johnson et al 2020; Hiko and Malicha 2016).

Animals are constantly vulnerable to disasters and are not equally protected when they occur. For example, at the time of drafting this chapter, the world is gripped by two major disasters—the Australian bushfires and a novel coronavirus pandemic. In the first instance, conservative estimates point to upwards of 800 million mammals, reptiles and birds affected by the New South Wales fires.[4] A viral Internet video from Adelaide of a koala approaching a group of cyclists and climbing on one of the bicycles to get a drink has become an iconic image during this calamity.[5] It and other images of injured or charred animals have ushered in an overabundance of concern, including handmade goods and medical supplies from across the globe to help the animals injured in the heatwave and wildfires. Could the Australian animals' vulnerabilities have been reduced and many lives spared? What landscape management disaster plans were in place and were they designed to safeguard the wildlife populations and their habitats and/or shepherd human behavior to care for the animals during an anticipated climate-induced crisis? How might real-time sentinel mapping of wildlife populations have mitigated these negative effects? What disaster strategies were in place to evacuate animals in vivariums as well as in research and shelter facilities in case the fires reached these places? In order to prevent similar future disasters,

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[1] The authors are grateful to Clemens Driessen for helpful comments in an earlier draft.

[2] https://www.bbc.com/news/world-us-canada-48911918 and https://www.theguardian.com/environment/chinas-choice/2014/apr/17/china-water, respectively.

[3] https://www.nytimes.com/2019/03/21/climate/missouri-river-flooding-dams-climate.html and https://www.bbc.com/news/world-us-canada-46178230, respectively.

[4] https://www.abc.net.au/news/2020-01-31/fact-check-have-bushfires-killed-more-than-a-billion-animals/11912538.

[5] https://www.abc.net.au/news/2019-12-28/thirsty-koala-fed-by-cyclist-in-adelaide/11830276.

what have decision-makers learned and implemented about effectively integrating animal, human and environmental health and welfare? What disaster regulations should be enacted?

In the second instance, the SARS-CoV-2/COVID-19 outbreak,[6] which originated in China, has led to a global pandemic that had infected more than 25 million people by 5 September 2020. Animals can be major reservoirs of zoonotic diseases, which can jump to humans and vice versa, especially when basic public health measures are not vigilantly observed in relation to animals and the environment. These measures include prevention, detection, monitoring and eliminating outbreaks and epidemics through sanitation and epidemiological surveillance. Initial reports speculate that the COVID-19 outbreak was caused by a spillover infectious virus that surfaced at a live wholesale seafood and wet market in Wuhan, China. Differently from the bushfires in Australia, perhaps due to delayed confirmation and notification of the outbreak by the local authorities, little was said by field investigators and researchers about the number of animal deaths and the impact of the outbreak on the health and welfare of infected and non-infected animals. It is unclear what has happened to the tens of thousands of animals that would have been sold in Wuhan in conjunction with the Lunar New Year celebrations after authorities banned the trade of live animals. Have they been slaughtered (if so, how) or have some been abandoned and what was the main motivation for doing so?

The questions associated with these examples highlight significant ethical challenges posed by disasters. While a host of difficult choices must be made during a disaster, our ethical commitments to animals will frame how they count morally and how disaster planning, together with improved emergency-response capacity, should be designed and deployed to prevent and reduce risks to both humans and animals. Thus, further research, regulations and practices in animal disaster management should consider what outcomes are intended for animals in specific disaster events, how are they justified, and what ethical and scientific blind spots exist when it comes to how the substance and effects of human activities, such as better animal welfare and care and husbandry practices, influence regard for animals and their welfare.

Our focus in this chapter is on the plight of domesticated animals—those with whom we have direct or proximate contact.[7] We begin by defining "disaster" and discuss the ethical biases that result in many animals, by and large, still being left out of or minimized in disaster management plans. Next, we discuss the importance of improving disaster management for animals in the Anthropocene. We argue that animal health and welfare perspectives, together with an emphasis on human-animal-environment relationships should be strengthened in disaster risk reduction and management strategies, together with measures traditionally considered. We

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[6] https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-int ernational-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-cor onavirus-(2019-ncov).

[7] Some animals that are recovered from disasters for rehabilitation by qualified animal health and welfare professionals become domesticated if they cannot be returned to the wild.

discuss six ethically responsible caretaking aims for animal disaster management, and in concert with these aims, we end by offering practical and straightforward recommendations to increase the visibility of animals' interests during a disaster. These recommendations are meant to catalyze further engagement and strengthen policies and practices on the subject.

13.2   Animal Disaster Ethics: Developing Disaster Frameworks

Disasters are emergencies endured by people and animals and can be induced by anthropogenic or natural agents. Anthropogenic cum technological disasters include fires, environmental contamination, toxicological or chemical events, and disasters due to human negligence or abuse, conflict, criminal activity or terrorism. Meanwhile natural disasters fall under four broad categories: (a) Hydrometeorological-climatological: floods, wave surges, storms, hurricanes, cyclones, landslides, avalanches, fire, droughts and climate change; (b) Geophysical: tsunamis, earthquakes and volcanic eruptions; (c) Biological: pandemic diseases, epidemics and insect infestations; and (d) Extraterrestrial: asteroids, meteoroids, and comets that alter interplanetary conditions that affect the Earth's magnetosphere, ionosphere, and thermosphere (EM-DAT 2020; Heath 1999). Disasters can be international, national or local in scope. The onset of a disaster can be sudden/rapid (fire, flood, avalanche, mudslide and earthquake) or slow (disease, biosecurity breach).

A disaster occurs when the ability to anticipate and reduce risk to natural or anthropogenic hazards overtakes standard health and well-being accommodations and the conventional capacity to cope is destabilized. Disaster management is necessary when the scale, timing and unpredictability of events threatens to overrun routine capabilities of civic and public health systems, communities and individuals to address the emergency (Nelson et al. 2007). Disaster management activities include risk communication, regulating environmental conditions, minimizing and detecting disease threats and outbreaks, planning for emergency medical and public health response capacities, and preventing secondary emergencies following a disaster (Salinsky 2002). Disaster management teams must address a complex emergency situation in the most humane and respectful way possible for all the parties involved—human, animal and environment (Murray and McCutcheon 1999). The experience and skills of the social, behavioral and health sciences, prevention and surveillance, risk communication, data gathering, architecture and planning, environmental sciences, engineering, and public safety are commonly required in traditional disaster management.

However, disaster management is also a poignant animal issue. Indeed, animal disaster management is a "wicked problem" (Glassey 2020), marked by the confluence of increasing human dependence on animals for survival (Delgado et al. 1999) including nutrition, food security, health, safety and livelihood. The challenges posed

by climate change and extreme natural events, population growth and urban sprawl, emerging and reemerging diseases, and global political and economic instability also bring focus on human ethical commitments towards animals. The capacity for human communities to recover after a disaster is inextricably linked to how animals fare.[8] According to the international Sendai Framework for Disaster Risk Reduction (United Nations 2015), countries should enhance their disaster preparedness and recovery efforts, strengthen governance and invest in disaster risk reduction since there are significant economic, social, environmental and public health and safety benefits in doing so. A focus on understanding the complex interconnections between health and welfare at the intersection of human-animal-nature conflicts can lead to preventative and mitigation measures that reduce the number of deaths, injuries, disabilities and losses in economic, physical, social, cultural and environmental assets. The Sendai Framework includes strategies for stakeholder engagement and dialogue to develop implementable community guidelines and financing intervention, dependable surveillance, strategic planning that enhances clear lines of governance and authority for decision-making in veterinary and public health emergencies, early warning systems, coordinated and reliable risk analysis, equitable triage protocols for animals during medical support and rescue, and practicable policies for landscape planning and infrastructure (e.g. evacuation centers and temporary housing) that reflect scientific advice and the most recent evidence-based information.

How a disaster is framed is key in successfully preparing for and responding to it. In framing a disaster in terms of its management aims, the disaster management team reveals their ethical commitments. This involves making explicit the priorities, values and moral assumptions, and reasons underpinning crisis policies and actions while fostering coordination at all levels to manage an all-encompassing crisis (Institute of Medicine 2007). Disaster management aims can highlight the adequacy of the infrastructure involved in advancing equity, inclusion and community relationships, which will be necessary in mobilizing political will. Further, this framing provides a window into the people, devices, systems, procedures and methods necessary to realize significant community ends during a disaster, including constraints such as existing laws, regulations and public policies. A disaster calls for specialized communications and surveillance systems, adequate equipment, trained responders and deployment of professionals who can provide quick and appropriate response to the threat (Institute of Medicine 2003; O'Toole et al. 2002). Furthermore, adequate disaster preparedness involves a well-prepared community to ensure vulnerable populations are well-integrated into an existing infrastructure (for example, see

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[8] A case in point is the January 2019 collapse of the Feijão dam in Brumadinho, which has been billed as Brazil's worst industrial accident. The incident not only killed at least 248 people, but also engulfed nearby farms, thus affecting the environment on which local and regional communities built their economies. Numerous farm animals were terminated on humanitarian grounds per the directive of the Federal Council of Veterinary Medicine (CFMV) (https://www1.folha.uol.com.br/cotidiano/2019/01/animais-agonizando-sao-mortos-a-tiros-em-brumadinho.shtml). In addition, the response team also rescued more than 400 animals (https://crmvpb.org.br/a-atuacao-da-brigada-veterinaria-no-resgate-de-animais-em-brumadinho/).

AVMA Emergency Preparedness and Response Guide 2012; Itoh 2018; Murray and McCutcheon 1999; Vinícius de Souza 2018; Powers 2016). Government and animal industries' investments in capacity building and personnel training, together with practical operation and maintenance records allow for better governance, since they prevent mistakes in operating pre-established contingency and biosecurity plans. For example, previously designed action plans to address a pandemic like COVID-19 were not executed due to under-resourced facilities and a lack of personal protective equipment for frontline animal caregivers (Winders 2020). Since an essential objective of disaster management is minimizing the vulnerability of affected populations, animal disaster management plans should include detailed information about mitigation and prevention such as housing, husbandry and waste management standards for animals, the built environment, and social, political, environmental and economic structures around animals, including those in animal facilities. These include zoos, vivariums, sanctuaries and concentrated animal feeding operations to minimize both the loss of animal lives and poor welfare conditions during recovery from a disaster.

Particularly urgent in the Anthropocene are holistic framings which can serve as a foundation for governments, civic and public health systems, disaster management professionals, animal health and welfare, veterinary emergency care, surveillance and public health, private sector stakeholders, animal-related organizations and facilities, university researchers and communities to investigate specific risk reduction strategies, develop guidelines for disaster management and provide effective messaging during outbreak response.

The One Health Framework,[9] which is gaining popularity in zoonotic disease control, brings the connectivity of human-animal-environmental health and welfare issues into sharp focus when dealing with animal, environmental and public health crises (ECDC 2018; Rist et al. 2014; Stauffer and Conti 2014). One Health seeks "to promote, improve and defend the health and well-being of all species and the ecosystem, by enhancing cooperation and collaboration between physicians, veterinarians, other scientific health and environmental professionals and by promoting strengths in leadership and management to achieve these goals" (http://www.one healthinitiative.com/mission.php). The One Health resolution marks the first time a holistic definition was formally agreed upon to address the interconnections between human-animal-ecosystem health, and it resulted in greater public visibility for the well-being of animals (Zinsstag et al. 2011). Here "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (https://www.who.int/about/who-we-are/constitution). Within this framework, field investigations and scientific and technological disaster developments would seek to clarify the effects of past disasters on climate and environmental variability, welfare and disease occurrence in order to predict and plan for future disasters. Further, because disasters challenge the welfare of the agent-environment-host triad, as in the case of a pandemic, the framework may be applied to ongoing challenges to shed light on changes in the intensity of disease outbreaks in humans and animals, the

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[9] A competing framework, One Welfare, has also been gaining traction in disaster management as an alternative to One Health (Pinillos 2018).

access of pathogens to new landscapes, the relationship between previous disaster variables and the epidemiology of diseases and interventions, as well as the effects of biological development, emergence and re-emergence of infectious diseases. The OIE (World Organisation for Animal Health), a One Health initiative partner, has taken a leadership role in the development of animal disaster guidelines and in identifying the current state of disaster management and risk reduction processes (Dalla Villa et al. 2017). The OIE supports the Veterinary Services of member countries to enhance their resilience and strengthen their disaster management capacity, reduce risks at the global level and promote close collaboration among emergency services and all other agencies involved in disaster management. The OIE also provides wide access to the epidemiological information that public veterinary institutions and organizations are called to collect at national and international levels through the OIE Information System WAHIS, the World Health Organization (WHO), and the Animal Disease Notification System (ADNS-EC) in Europe.

Considering animal disaster management through the lens of One Health can broaden current knowledge and provide new ways to minimize harms, such as revealing how animals cope immunologically with infections or respond in search and rescue missions. A One Health perspective can offer an important set of orienting questions to guide disaster management. For example, could improved welfare practices boost animals' immunity and reduce the spread of infectious diseases amongst animals and humans? To what extent have climate mitigation or adaptation strategies been designed to reduce harms to animals? Could the transmissibility of recent outbreaks have been minimized if the health and welfare of animals were given priority?[10] Could scientists demonstrate the possible link between human and animal welfare in terms of the social, economic and political complexity of emergency planning, response and recovery involving animals? Could animal welfare science improve search and rescue missions often performed by animals? While One Health is a promising candidate for animal disaster management, the questions outlined here reveal various anthropocentric biases, animal ethics and considerations as well as other moral, political and budgetary priorities and commitments (Van Herten et al. 2019).

13.3 Animal Disaster Ethics: Revealing Animal Vulnerabilities

As more disasters are emerging, some of unpredictable scale and magnitude, it becomes clear that the Anthropocene has heightened animals' vulnerability. While

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[10] For example, Britain's Foot and Mouth Disease outbreak (2001), avian influenza outbreaks across China and Asia, the highly pathogenic A(H5N8) strain of avian influenza (HPAI) epidemic that occurred in 29 European countries between 2016–2017, the porcine reproductive and respiratory syndrome (PRRS) outbreak, and the H5N2 outbreak that ravaged poultry systems in more than 20 US states in 2015–2016.

concern for some animals is palpable (e.g., companion animals and those that captivate the human imagination such as koalas and polar bears), what constitutes an adequate response to the needs and interests of other animals is not universally consistent (e.g., livestock). Since Hurricane Andrew in 1992 (Heath 1999), emergency and evacuation plans and early warning systems in the United States have started to address the importance of contingency plans to save animals; however, after 25 years, as demonstrated in the responses to Hurricanes Harvey, Irma, and Maria, these contingency plans are still not widespread and lack the breadth and depth to technically, scientifically and responsibly address animals' issues before, during and after a disaster. Other countries prone to natural disasters, such as Brazil (from drought, landslides and flooding) and Japan (from tsunamis, earthquakes, landslides and flooding), also continue to struggle to address the welfare of animals during emergencies (Itoh 2018; Vinícius de Souza 2018). When a disaster strikes, human considerations tend to take precedence or are still considered independently from animal considerations (consider the two examples that began this chapter). Consequently, the necessary infrastructure, methods and capacity to adequately address animal-related issues is absent in many cases (photographer Yasusuke Ota's depiction of this omission in the context of the aftermath of Tohoku earthquake and tsunami in Japan is an excellent example of a lack of aesthetic, moral and evidence-based engagement in disaster management).[11]

Another challenge that pushes for better animal disaster management plans is the problem faced by animal owners who leave companion animals and livestock

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[11] The authors thank Clemens Driessen for alerting us to this exhibition. https://www.aestheticama gazine.com/yasusuke-ota-the-abandoned-animals-of-fukushima-amsterdam.

behind during a disaster. It is still common that first responders have neither clear outcomes for minimizing welfare harms to the fewest number of animals nor the capacity to rescue them because the resources or equipment are not available to save people, animals and property. While animals are considered property under the law in most places, given the intimate relationships people have with their animals (e.g., as members of families, and as sources of nutrition, food security and livelihoods) (Sawyer and Huertas 2018), they are increasingly being granted more social consideration (Meijboom and Stassen 2016). Further, there is every indication that animals' welfare and lives will continue to be a major issue affecting disaster management and rescue in the future (LEGS 2015). The COVID-19 pandemic, for example, has raised fear and anxiety among pet and companion animal owners, livestock producers, zoos, shelters and consumers of animal products. There has been little guidance on how to ensure the welfare of feral, wild and community animals during mandatory stay-at-home orders for those on whom they depend or of livestock when meat and milk processing cannot occur. Local community values and practical constraints in tandem with technical and scientific information should be factored into decision making about how animals are managed during a disaster and what constitutes desired outcomes for animals vis-à-vis disaster response.

Disasters may present opportunities to explore protections for animals in preparation for future ones. In the US, the Pet Evacuation and Transportation Standards (PETS) Act was passed shortly after Hurricane Katrina in 2006 to mitigate loss of life of some animal species during a disaster. As a federal law, the PETS Act mandates that in order for states, cities, and counties to receive federal funding for disaster relief plans, those plans must "account for the needs of individuals with household companion animals, pets and service animals before, during, and following a major disaster or emergency."[12] The Act allows the Federal Emergency Management Agency (FEMA) to provide funding to states and localities for the creation, operation, and maintenance of pet-friendly emergency shelters, along with other disaster emergency actions for companion and service animals.[13] Rescuing and rehabilitating animals need not be in conflict with promoting human welfare and agency, and can serve to soften the human-animal divide. For example, during Hurricane Irma in the US (2017), Florida's Governor Rick Scott urged hotels to waive their no-pet policies for pet owners seeking refuge from the hurricane. The University of Florida's College of Veterinary Medicine (UFCVM), part of the state's disaster response system, also set up pet-friendly shelters so that whole families could stay together. "Do not leave your pet behind," was the refrain from the UFCVM since, "If it's not safe for you, it's not safe for your pet." Similarly, the George R. Brown Convention Center in Houston, Texas, permitted survivors to bring their animal companions with them. Some caregivers and owners will not leave their homes unless they know their animals can accompany them or that their animals will be saved. Owners who do not relinquish their animals during a disaster have made it harder for first responders to evacuate people—their target survivor group—which can also inadvertently sabotage rescue

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[12] See p. 1 of https://www.congress.gov/109/plaws/publ308/PLAW-109publ308.pdf.

[13] https://www.congress.gov/109/plaws/publ308/PLAW-109publ308.pdf.

efforts to save animals, especially if the owners put themselves and the animals at risk when trying to save the latter. Furthermore, when animals are left behind, the trauma of abandoning them can haunt both rescuers and owners. From a public health and biosecurity perspective, however, it must be made clear to owners when it is necessary to practice physical distancing from their pets; quarantined animals may be carrying a pathogenic agent, especially if a natural disaster occurs concomitantly with an animal or public health emergency (WSAVA 2020). In the case of veterinary and public health emergencies, reference laboratories in every country should be considered in disaster management plans and work in tandem to investigate the efficacy of interspecific transmission and the manifestation of a disease in animals so that subsequent diagnostic, therapeutic and prevention interventions can be developed and deployed effectively. Local and international laboratories should be involved early on and interactions should happen often for proper technical collaboration. An example of a multi-nation concerted effort to improve animal disaster management is the OIE Reference Laboratories and Collaborating Centres that have the objective of harmonizing and exchanging data, and sharing information and reference materials to improve disease surveillance, control and veterinary emergencies worldwide.[14]

There are many anthropocentric reasons to provide for animals during a disaster—for example, humans have an acquired responsibility due to animals' membership in our homes, the human-animal bond, their health and welfare, psychosocial and emotional trauma, the potential for environmental degradation, and savings in time, labor and financial expense if animals are neglected during an emergency. While we have a duty to plan and prepare well ahead of a disaster for our own benefit, recent disasters have made clear that the heavy loss of animal lives and their poor welfare due to disease and injury constitutes a moral harm in terms of their injustice and inhumaneness. Therefore, there are also non-anthropocentric reasons for providing aid to animals during a disaster. The weighty effects of our continued domestication of animals in the modern age signal the need to carefully consider the ethical aspects of animal disaster management and to incorporate ethical considerations involving animals into emergency planning activities. For animals, first responders will most likely be their immediate caretakers. Here, it will be incumbent upon the organizations that engage first responders to develop disaster plans that include evacuation (also taking into consideration the capacities of certain species of animals to fend for themselves and the health status of both owners and animals) and having contingency plans if the animals cannot be removed or can be a hazard to humans and vice versa, such as wildlife.

Disaster management is still largely defined by the interests of human communities. Members of the public and elected officials are hardly surveyed to discern their commitment to protecting human and animal lives prior to and during a disaster, as well as its impact on the ecosystem, including their perceptions and the relative weight placed on human-animal lives and how resources should be allocated to mitigate future disasters.

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[14] See https://www.oie.int/scientific-expertise/collaborating-centres/reference-centre-networks/.

Disasters, however, remind us that human beings and animals share an ecological landscape. In a sense, many of our uses of animals themselves may constitute a hazard, exposure or vulnerability for animals when not properly cared for or managed. Human beings have much work to do to ensure conditions for mutual coexistence and alter activities and projects in ways that minimize human-animal conflicts in order for effective interspecies relationships to flourish. Disasters are occasions that can draw people into caring for animals in extraordinary situations and to reconsider the "norms of normality" by rethinking our existing uses of animals and practices that give rise to their vulnerabilities in the first place.[15]

The vulnerabilities experienced by animals take many forms and manifest themselves in different ways. For example, reducing animals' vulnerability during emergencies include mitigation and prevention strategies that prepare for possible evacuation, redesign of animal housing, and handling waste pollution and carcass disposal effectively to minimize public health hazards. Animals also experience socially situated vulnerabilities, that is, how human communities assess and value the moral standing of animals and their function, and how a lack of understanding about what constitutes good animal welfare during disasters may impact their consideration.

Arluke and Sanders (1996) suggest a sociozoologic scale to assign relative moral worth to humans and animals. The socially situated vulnerability that follows species lines and/or our traditionally cultivated uses of animals and that forms the basis of a deep-seated cultural hierarchy of valuing animals, influences how we make decisions about animals in disasters. Irvine (2009) argues that one's species status on the scale influences one's relative moral considerability and the extent to which resources will be devoted to save one's life. The scale is complicated by other considerations such as economic value, function and types of relationships and liability.

Although human lives tend to have priority during an emergency, increasingly animals matter. Our close relationship with dogs and cats and the recognition that the human-animal bond is a significant feature during rescue and evacuation, and has propelled these "near-person" (Varner 2012) companion animals into the "also victims" arena during a disaster. In the US, the PETS Act provides accommodation for companion animals and their caregivers. Livestock and research animals tend to be more vulnerable than companion animals due to the position that livestock occupy on the sociozoologic scale. They suffer disproportionately in the wake of a disaster, especially if no disaster management plan is in effect. Historically (and because of their high stocking densities and paucity of hazard mitigation strategies), livestock experience more injuries, disease and loss of life/termination. Farmers and producers responsible for their care, when faced by delivery failures at processing plants, may not be able to sell their animals even though they care for them (FAO 2020). Rescuing large animal populations (for example, a herd of cattle, wildlife translocation, research animals) is a tremendous effort compared with rescuing a small number of family pets. Whereas a family can often bring their pets in their personal vehicle, moving large numbers of animals requires many transport vehicles

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[15] The authors are indebted to Clemens Driessen for this insightful skein of thought.

and adequate shelter facilities, which may not be possible during an emergency situation because this type of priority is not included in disaster management plans. These conditions make euthanasia, depopulation or culling very likely to minimize harms to these animals. However, we argue that alternative strategies that also prioritize animal welfare should be developed and implemented in the field through practical guidelines that include indemnity procedures for loss of animals and mitigation of animal suffering. During Hurricane Katrina (2005), millions of farm animals in the United States died. Hurricane Sandy claimed the lives of tens of thousands of research animals because there was no conceived contingency plan for them.[16] Meanwhile, more than 3 million chickens and 5,000 pigs died during Hurricane Florence (2018). The US Department of Agriculture (the primary agricultural regulator) does not have the resources to address animal welfare and mortality. The chronic effects of disasters may influence animals and can predispose those that are already health or welfare compromised to infectious and non-infectious diseases due to low immunity that leads to distress, behavioral maladaptation and negative affective states (FAO 2020). In disaster emergency sites, feed and water quality and quantity may be severely lacking and common management practices such as moving manure, moving feed and stock, and automated activities that rely on energy supplies can be subverted due to power outages.

Ethical judgments are implicit in all decisions and recommendations made about how to conceptualize a "disaster" (AVMA 2012; Irvine, 2009), its impact on animal welfare (Anthony 2004; AVMA 2020a, b; Sawyer and Huertas 2018), or which disaster management framework to deploy (e.g., One Health). The current COVID-19 crisis provides many examples about the ethical decisions associated with animal care during a global pandemic. Some farmers in North America have had to dump milk following lockdown and social distancing restrictions when processing plants and institutional buyers shut down (Splitter 2020). Meanwhile, supply chain disruptions meant that some poultry farmers were required to depopulate their animals (i.e., the rapid, large-scale destruction of multiple healthy animals in the most efficient way possible) (Kevany 2020). With fewer slaughterhouse spaces to process the market animal surplus, farmers and farm workers are forced depopulate them, resulting in food waste and animal welfare issues when depopulation or euthanasia go awry. Terminating animals before they are able to go to market has a significant emotional and financial toll on farmers. Ethically, depopulation due to a lack of operational processing plants during COVID-19 is entirely different from depopulation necessary to curtail disease spread within a herd or flock or to society. Another significant animal welfare problem during the COVID-19 pandemic is limiting animals' access to feed and water in an attempt to slow their growth (AVMA 2020a).

Animals are also put at risk differentially by their physical or housing conditions. The way animal facilities are organized and the magnitude of animals housed can result in disastrous consequences for animals and humans alike. For example, erecting concentrated animal feeding operations (CAFOs) in floodplains that are in

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[16] https://www.businessinsider.com/hurricane-sandy-killed-tens-of-thousands-of-research-animals-2012-11).

the path of hurricanes or storms (with little option for animals to evacuate on their own), or encouraging stocking densities that incubate and exacerbate animal diseases without clear disaster management strategy are cases of negligent planning. These forms of 'human-induced' hazards fly in the face of acknowledging the independent moral value of animals. They are examples of difficult conversations we must have regarding how we value certain animals. In the Netherlands, thousands of animals have succumbed to stable fires because farmers did not want or could not afford to invest in fire alarms and management systems.[17] Further, being cognizant of the 'carrying capacity' of a particular geographical locale—that is, the number of animals in a particular location and the location's susceptibility to certain kinds of hazards—is essential for both human and animal well-being and to minimize environmental degradation (Irvine 2009). The proximity of animal farms to human communities and precarious ecological entities, and management of farm waste and pollution, continue to have negative implications for human, animal and environmental health as experienced since the Australian Bushfires or Hurricanes Floyd and Dennis (1999) and Florence (2019), despite being almost 20 years apart.[18]

In summary, an ethical conclusion about whether the interests of animals are regarded morally is largely contingent on the type and magnitude of disaster facing a community, how animals are viewed relative to human interests and priorities, and what disaster management plans are in place to attend to animals during a crisis. High and low income countries should take steps to consider the impact of disasters on both humans and animals since their fates are often inextricably bound together. Acknowledging our 'solidarity' with animals during a disaster can serve as an effective and equitable basis for mitigating harm to all affected parties. Where animals are more directly tied to peoples' livelihoods (and thus, cannot be easily replaced), early disaster interventions for animals need to reduce disaster damage (e.g., animal suffering, mortality, morbidity, displacement, asset damage) and indirect losses, in order to promote overall economic recovery and owners', producers' and communities' and veterinary professionals' psychological and social well-being (Campbell and Knowles 2011; FAO 2020; Knowles and Campbell 2014; Martin et al. 2020; Rollin 2011).

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[17] The authors are grateful to Bernice Bovenkerk for this addition and link: https://www.verzekera ars.nl/media/5048/20180705-actieplan-brandveilige-veestallen-definitief.pdf. To date, a new action plan has been agreed upon by Dutch farmers, the fire department, an animal protection organization and an insurers' organization in order to create safer barns.

[18] At the time of drafting this chapter, citizens in Mozambique, Malawi and Zimbabwe are facing floodwaters and waterborne disease outbreaks (like cholera) in the aftermath of the category 2 Cyclone Idai. Early reports suggest that the storm claimed nearly 1000 human lives and countless livestock lives. Also, floodwaters in the US Midwest have meant that farmers who subscribe to conventional forms of agriculture are contending with economic losses due to lost stockpiled grain and diseased animals and dead livestock (https://www.pbs.org/newshour/nation/for-midwest-far mers-floodwaters-threaten-millions-in-crop-and-livestock-losses).

13.4   Animal Disaster Management: A Reimagining

Animal disaster ethics is a distinctive component of disaster management activity. It asks a central question: "How are animals regarded during a disaster?" The ethical aims orienting this activity involve a societal component—the responsible caretaking of vulnerable animals and groups. It is a systematic social activity governed by norms and motivated by core values to minimize human and animal harm and protect public interests. It aims to bring about welfare outcomes for animals commensurate with their interests and needs. It also obligates communities—not just individuals—to promote these outcomes for the common human-animal good. As indicated above, not all animals are equally protected during disasters and some may be subjected to harms more than once during a disaster (e.g., laboratory animals conscripted in the fight against SARS-CoV-2/COVID-19).

The core ethical problems in disaster management all apply in the case of animals: an unprepared public, limited resources, special responsibilities to vulnerable populations, special obligations of health and veterinary professionals, lack of capacity building and training, community engagement and involvement in all disaster management phases, effective disaster communication, and barriers to gathering relevant evidence to guide interventions. Disaster animal managers need to act rapidly and decisively on the basis of incomplete knowledge. Ensuring public trust and confidence are an essential part of a robust disaster management program involving animals, which can include developing response mechanisms regarding triage care, separation measures such as quarantine, isolation, and physical distancing, and measures to prevent animal-to-human transmission from companion, laboratory, livestock or wild animals (adapted from Heath 1999; Jennings and Arras 2016; OIE 2016). Rapidly growing imbalances regarding supply and demand of essential resources and services during a disaster will require clear ethical guidance on rationing scarce resources and sound triage principles, including implementation procedures that are executable, transparent, equitable, inclusive and engender public trust. Knowledge of animal behavior and of the capacity of different species to cope in different disasters are also crucial.

Transparency and direct links to community and stakeholder involvement will also ensure that public health decision-making related to animal welfare will be effective, humane and just (Vroegindewey 2012), especially if large numbers of animals must be destroyed through depopulation. In the event that depopulation is necessary (such as the highly pathogenic Avian Influenza outbreak in 2014–2015 in the US[19]), adherence to strong ethical standards and procedures, and state and federal laws and regulations should take precedence to ensure that as much consideration as possible is given to the welfare of affected animals.

By and large, animal disaster managers straddle two differing worlds. They are challenged to extend the humanitarian impulse directly to animals within the constraints of a human-centric world. It is imperative, then, that those working in this realm appreciate the vulnerabilities and social and economic positioning of animals

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[19] https://www.ers.usda.gov/webdocs/publications/86282/ldpm-282-02.pdf?v=3994.

within the risk and the emergency scenarios at the intersection of animal welfare and ethics. Here, sensitivity to the moral considerability placed on human-animal relationships should be observed alongside respect for the interests of animals. Assisting animals and their caregivers can ensure greater survivability and better long-term outcomes for the whole community (Sawyer and Huertas 2018; Vinícius de Souza 2018). The perspectives of those interested in good outcomes (e.g., clinical, behavioral and affective) for animals such as animal owners and caregivers, farmers, the public, first responders, veterinarians, industry agents, aid agencies, policy makers and public health officials, and affected communities, should be considered when deciding the fate of animals during a crisis. Without the support of these groups, the public and animal caregivers may reproach governments for their disregard for animal welfare, a sentiment that could frustrate the disaster management process. According to Sawyer and Huertas (2018), common barriers to effective animal protection from disasters include insufficient knowledge of animal needs in emergencies and a lack of animal management skills; absence of resources for veterinary emergencies within the disaster cycle; lack of recognition to protect animals despite a high dependency between people and their animals; responsibility for veterinary emergencies (nationally and internationally) is either unassigned or ineffective; absence of integration (people and animals) in emergency management; lack of organization amongst subsistence livestock owners making emergency management of animals very difficult (pp. 2–3). The current COVID-19 pandemic reminds us that disasters are rapidly evolving situations and can be experienced differently by different communities. Some communities may be better prepared than others and have contingency plans in place. Disaster management plans should have clear decision-making matrices to outline when animals should be quarantined, depopulated, slaughtered in alternative facilities, sent to a shelter and so on. Furthermore, disasters can put extraordinary and sustained demands on essential community services and public health systems, and frontline workers, veterinarians and those caring for animals, leading to compassion fatigue.

13.5 Animal Disaster Management: Humanitarian Impulse and Animal Welfare Science

How might disaster managers and responders sharpen their sensitivity and judgment regarding animals and their interests before and when disaster strikes?

During a disaster, human beings and animals experience atypical and urgent need of rescue and protection. This is a time of shared vulnerability and solidarity. During an emergency, no one is self-reliant and animals in confined settings are dependent on human beings for their rescue, evacuation and care (e.g., during euthanasia and depopulation; when planning management of animal facilities, shelters and so forth; when performing translocation, rehabilitation and release practices; during triage and clinical treatment; when developing scientific and technological prevention and

mitigation strategies). The focus of animal disaster ethics is to understand animals' needs within the context of the humanitarian impulse to aid animals in need, which includes reducing pain, suffering, and loss of life. This humanitarian impulse is at the core of the discipline of animal welfare science, and in the case of disaster management it is recast as respect for animals, ensuring humane treatment, and minimizing harm and vulnerability (i.e., protecting animal welfare), with a view toward the well-being of the entire community and the common good. Animal loss or poor animal welfare prior to, during or after a disaster have devastating implications for owners, caregivers and communities. Communities who rely on animals for social and economic well-being, food security, health, and livelihoods are most in need of community disaster innovations (LEGS 2015; Sawyer and Huertas 2018). The experiences of citizen and animal advocacy groups who self-organized in the wake of Hurricane Sandy underscores the need to consider the collective wisdom and agency of a stricken community. In the aftermath of the storm, animal advocacy organizations like the ASPCA and PETA, local residents, government agencies, FEMA, veterinarians, Petsmart Charities, Iams, and Del Monte Foods banded together as part of a broad though unintegrated coalition to assist the region's animal survivors. Aid came in the form of search-and-rescue operations, food and veterinary services and care, temporary emergency shelters for lost companion animals found during the storm, and use of social media to reunite animals with their families. It is necessary for animal shelters and other animal facilities to establish practical disaster management and planning, and that policies and personnel are prepared and have prompt access to necessary infrastructure.[20]

As animals and their interests gain moral significance in disasters, a deliberate, comprehensive and systematic disaster management system will require sufficient input from central stakeholder groups and planning (i) to prevent disasters through reliable scientific evidence, technology and surveillance sentinel systems, and (ii) to mitigate and prevent potential hazards and strengthen response practices (e.g., by deploying evacuation plans that include animals, since they are evacuated together with their owners or are part of search and rescue operations).[21] The goals of a comprehensive and systematic planning system should be to reduce animal suffering, loss of life, and exposure to agents, venomous and synanthropic animals, chemical and contaminants, contaminated water, and to limit the scale of depopulation and improve recovery initiatives. Research is also needed on the effects of disasters on animal diseases that are not vector-borne and on the impacts of social and economic factors on the consequences of disasters for animals in different parts of the world. Here, animal welfare science is important in determining the research trajectories to pursue.

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[20] https://www.thedailybeast.com/how-pets-survived-hurricane-sandy?ref=scroll.

[21] This aspect of the chapter is currently being pursued by the authors through a grant-funded research project with colleagues in Alaska, Brazil and Japan. Technological solutions (e.g., robots, artificial intelligence and monitoring devices, easy escape housing) that augment animals' capacity to be self-reliant during an emergency may help animals evacuate or seek shelter quickly.

The examples in the introduction and many others highlighted in this chapter, as well as captive animals abandoned in conflict zones and animals harmed by floods and earthquakes, highlight the invisibility or lack of attention to animal care at the population level when disaster strikes. Reducing negative impacts to animals requires advanced planning, and prevention and mitigation strategies. Animals are subject to varied impacts during a disaster; some prosper in the absence of humans while others to suffer. Since disasters that affect animals are likely to become more common in the Anthropocene, much work needs to be done to ensure that animals' needs and interests become part of the established norms in disaster management. Moreover, disaster management programs should lay out practical and executable guidance that considers all phases of a crisis. This involves examining how ethical processes and animal welfare science apply to and are implemented in the content of policies and processes associated with both specific and integrated disaster events (i.e., compound extreme events) that occur alongside natural and anthropogenic calamities. Examples of multiple simultaneous crises that add a further layer of complexity to an already difficult response include the Australian bushfires, a dengue fever outbreak in Singapore, wildfires in California, and inclement meteorological events in Southern Brazil, all of which are happening due to sudden temperature changes and are concurrent with the COVID-19 pandemic. Special preparations are necessary to address such layered disaster events. Responding to local catastrophes during a global disaster highlights the personal decisions each citizen must make and also the stress placed on different systems (e.g., health, food production). Compound extreme events accentuate the need for trustworthy disaster communicators to demonstrate empathy when framing key questions and answers about personal and interspecific threats. Doing so can ensure public acceptance of recommendations regarding how to navigate a human-animal relationship and equitably allocate scarce resources (FAO 2020; OIE 2016).

Animal welfare science (AWS) can be characterized as the rigorous use of scientific methods to study the quality of life of animals, including companion animals, wildlife, research animals, and those farmed for food. AWS, however, is also borne out of ethical concern for animals (Fraser et al. 1997; Fraser and Weary 2003) and while there is still some conceptual disagreement about what constitutes animal welfare and how to assess it (Weary and Robbins 2019), the field of study can inform deliberations about practices involving animals with a view towards animals' perspectives or animal-based measures. AWS integrates ethological or behavioral, psychological, physiological, environmental, and health measures or indicators to identify whether life is going well or poorly for animals in different contexts (De Paula Vieira and Anthony 2020; Fraser 2008; De Paula Vieira et al. 2008). AWS can broaden how veterinarians and other disaster management professionals consider what is important to animals during an emergency, including highlighting human activities and built environments that lead to vulnerabilities for animals, developing frameworks to set desired outcomes for species, and evaluating the likelihood of success of a contingency plan (Allen and Taylor 2014; Anthony 2004; OIE 2018). AWS will also be essential in informing the development of evidence-based assessments in concert with ethical objectives to minimize harm to the fewest numbers of

animals, including when and how euthanasia or depopulation should proceed for the affected species.

In a disaster, AWS can promote good outcomes for animals, through offering technical, systematic and species-specific guidance to manage animals as well as strategies to minimize suffering and loss of life. For example, the welfare impacts of toxins on animals' behavior, physiology and affective states, aversive handling and depopulation techniques, identification of measurable species-specific harms, and effective/positive human-animal-technology interactions in a crisis. AWS training can provide first responders with the knowledge and skills to approach, handle and terminate animals with the least harm and—in the absence of trained responders—empower laypersons who lack specialized knowledge. Training in AWS can help responders recognize when animals are distressed and what constitutes poor and good animal welfare, and to take effective steps to address welfare harms. Further, AWS may also help responders and managers identify animals' natural capacities that might help them cope during rescue or evacuation as well as inform the design of housing systems that can increase animals' chances of survival. AWS can provide, for example, an understanding of population dynamics, animals' affective states and of social behaviors when coping with disasters, provide strategies for curbing zoonoses, animal handling, translocation/relocation management, and the assessment of the effectiveness of a rescue procedure or depopulation techniques at the species level. Through systematic scientific evaluation, AWS can identify indirect harms to non-target animals as a result of ecological or social group disruptions or use of a depopulation technique.

Addressing significant ethical and animal welfare aspects are important to ensuring public support and inclusion of diverse social, cultural, practical and normative perspectives regarding animals in developing a strong, well-functioning disaster management system. Animal disaster management plans should consist of properly trained and well-equipped individuals (e.g., veterinarian animal health and welfare services, animal welfare experts, wildlife service managers, epidemiologists, vaccination administrators, and strike teams) to respond to welfare considerations as well as to the link between humans and animals (Sawyer and Huertas 2018). These management plans should have clear outcomes for animals and their owners in an emergency situation to minimize unnecessary termination of animals' lives through depopulation (AVMA Guidelines on the Depopulation of Animals 2019 Edition). As part of emergency preparedness and response, disaster response teams must decide whether an animal/animals can be saved and what constitutes a good death for the animal/animals given exigent circumstances. Members of the team (which typically will include veterinarians and animal behavior specialists) can advise animal owners, research institutions and animal industries to form an emergency operation plan to minimize welfare harms and the loss of animal life during a disaster as well as promote effective and responsible communication to society and professionals.

Disaster management should consider a cycle of processes that need to be assessed dynamically and continuously, engaging different sectors and actors. In all processes, animals should also be taken into consideration. Disasters bring into focus the

practical intervention, welfare, public health, civil defense and protection, biosecurity and scientific challenges associated with each phase of the disaster management cycle (FAO 2020) as well as the inevitable normative decisions and choices reflecting ethical values that must be made through judicious deliberation regarding our responsibilities to animals (Mepham 2016; Schwartz 2020; van Herten et al. 2020). Below we exemplify common aspects of the disaster management cycle that should be considered by multi-professional teams when devising disaster management plans aimed at maximizing animal health and welfare (adapted from EM-DAT 2020; OIE 2016; Heath and Linnabary 2015, pp. 174–190; Sawyer and Huertas 2018, pp. 20–23).

(a) <u>Planning</u>: Planning is central to all phases. A community-centered disaster operations plan should be concrete and implementable and consist of contingency and action plans. It should incorporate the needs of animals and their owners. Such plans should identify and prioritize realistic threats and delineate the response mission, goals, capabilities and any gaps to meet them such as through the law or descriptive epidemiology, environmental and other disaster-specific data sets.

(b) <u>Prevention</u>: Prevention is necessary to avoid harms. It should consider the existing infra-structure for animals in rural and urban areas and include geographic information regarding distributions of animal populations and locations, etc. Prevention strategies and funding allocation should include a defined exit strategy involving removal of threats, conservation efforts, epidemiological data of populations through passive and active surveillance, destination or relocation of animals to alternative sites to avoid droughts or flooding and for vector control. Prevention includes mapping risks and vulnerabilities to animals, such as susceptibility of certain populations to landslides and infectious diseases.

(c) <u>Mitigation</u>: Mitigation involves interventions aimed at minimizing the impact or costs of disasters to vulnerable animals ahead of their occurrences through anticipation measures. It includes identifying what legislation, regulations and their enforcement are needed and strengthening commitments to resource availability when disaster strikes to protect animals and their welfare. Mitigation reduces animals' vulnerabilities to physical, behavioral and psychological harms. Specific disaster technologies and scientific developments can help to mitigate harms for animals and should be encouraged. Other examples are strengthening animal shelters and building structures in low-risk zones or constructing physical barriers to prevent flooding or the effects of hurricanes, typhoons or tornadoes.

(d) <u>Preparedness</u>: Preparedness planning involves all threats that cannot be eliminated through prevention or mitigation, but must be executed in order to strategically organize and plan the response when disaster strikes. It involves educating and training community members and professionals. Roles of participating animal health and welfare organizations and other officials and stakeholders should be clearly defined. Vulnerable areas and threats to animals should be identified and a network of operational and public communication strategies,

including simulation exercises that would consider animals in all steps and evacuation plans should be devised. Essential ingredients include credentialing responders, bolstering public awareness of animals' issues during a disaster and strengthening caretaker capacity to address both human and dependent animals' needs.

(e) Alert: Predictive models can warn a population to evacuate before a disaster strikes. This phase relates to disaster prediction through monitoring the level of animal risk via specific technologies and current scientific data, such as seismology networks, hydrometeorology sensors, and cameras, alongside welfare-friendly animal training and signals/cues that would be essential for an evacuation, such as during an earthquake.

(f) Response/emergency relief: Response/emergency relief focuses on minimizing morbidity, mortality and protecting goods, and sets the stage for helping communities bounce back in the recovery phase. This stage involves the execution of preparedness plans (action and contingency) in concert with different disaster management professionals and organizations. It involves search and rescue, veterinary services and care, evacuation and temporary shelter, and safety and protection. The welfare of animals working in search and rescue operations should also receive specific attention. When disaster triage for animals needs to be performed, first responders and related professionals should have the ethical decision-making tools to maximize the use of resources in order to save the most animals and minimize risks to responders. Training in triage care should advance systematic and immediate assessment to treat critically ill or injured animals and rehabilitation.[22]

(g) Recovery/Rehabilitation: This phase involves activities that center around a vision of a desired future or to restore a community to a pre-disaster status quo as best as possible, including reinstating basic services. Here health, genetic tests, psychological and behavioral rehabilitation practices can be intensified in proper animal facilities to prepare for release and essential monitoring of animal populations and wildlife, post-release. The recovery phase is the longest and most expensive and can take several months or years (e.g., the impact of the Exxon Valdez oil spill on animals and the environment in Alaska's Prince William Sound). The recovery phase gives decision makers a unique opportunity to improve the animal health/welfare infrastructure.

(h) Reconstruction: Financial resources to cover material damages or reconstruct animal facilities or to indemnify losses are important assets in this phase. Inter-institutional coordination and implementation of new legislation and practices also underscore this phase.

Unfortunately, current disaster responses adopted globally expose significant gaps and challenges in disaster management. The COVID-19 outbreak, for example, has uncovered a lack of attention to the risks that infected animals and humans pose to public, animal and environmental health. In particular, the FAO Guidelines

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[22] For example, see http://veterinarynews.dvm360.com/hurricane-lessons-four-things-we-learned-harvey-and-irma.

(2020) emphasized that disasters not only impact the supply chain (e.g., resulting in animal losses, reduced slaughtering and processing capacity as well as misconceptions regarding animals and animal products being hosts or vehicles of zoonosis that can infect humans) but also the prevention and control capacity of common animal health and welfare services. These include labor shortages disrupting common animal health and welfare practices adopted by farmers and food processors, delays and reduced testing and diagnostic capacities as well as animal disease surveillance and reporting due to restrictions in testing for animal diseases. Additionally, the COVID-19 pandemic underscores the importance of including animals in disaster management practices in the future. Further, the pandemic stresses the need to engage the public and all relevant stakeholders to develop concerted response mechanisms to be followed by practical and systematic knowledge supported by disaster simulation models and the best available scientific evidence, including from animal welfare science.

Incorporating AWS and ethics into epidemiological and environmental studies could illuminate our current understanding of the natural history of disease and of epidemic processes by considering characteristics of the agent, host and environment together with animal care and husbandry (e.g., success of immune transfer, epigenetic effects, level of pathogens in the environment, pre-clinical and clinical signs, local commitment to animal welfare, effects of the human-animal bond, ability to perform species-specific behaviors, and experience of positive and negative affect). Such characteristics could be used not only in observational and experimental studies, but also in predictive epidemiological models when deciding on criteria such as parsimony, goals and data "best fits." It is paramount that current integrated models of epidemiological population projections (e.g., cohort component models, Bayesian probabilistic projections) begin to include current animal welfare science data and expert opinions in order to enhance understanding of animals and how to improve their welfare in the short, middle and long term. These models would, for example, reflect cutting-edge animal welfare and health knowledge in disease outbreaks, thus allowing veterinary epidemiologists to better represent animals' realities and coping mechanisms under professional frameworks (e.g., the One Health initiative [De Paula Vieira and Anthony 2020]). Information technologies can also be used to improve the quality, completeness, and speed of information obtained in field investigations and the speed and sophistication of reports that can be generated from that information at the individual or aggregate level. An example of a decision support system used for emergency planning, response, and recovery that facilitates decision-making when veterinary services are involved in crisis situations is the Veterinary Information System for Non-Epidemic Emergencies (SIVENE), that includes a database, web application, mobile app, and Web Geographic Information Systems (GIS) component. SIVENE provides Italian Veterinary Services (local health units and national and regional veterinary services) with an emergency management tool for disaster management. The data is maintained within its database and converted into real-time information (Possenti et al. 2020).

13.6 Animal Disaster Management: Aims and Recommendations for Ethically Responsible Caretaking

Disaster or emergency ethics is oriented to promote the public interest. In the human case, it has become a systematic field of study (O'Mathuna et al. 2014; Zack 2009). However, animal disaster ethics has yet to catch on as a systematic field, but its time may be ripe (see Heath and Linnabary 2015; Itoh 2018; Meijboom and Stassen 2016; Mepham 2016; Sawyer and Huertas 2018; Vinícius de Souza 2018). As a practical matter, we have a responsibility to domesticated animals simply by virtue of their dependence upon us. Domesticated animals (including wildlife rescued for emergency treatment and rehabilitation) should not be left to fend for themselves during a disaster. The aims of animal disaster ethics should be to minimize the vulnerability of animals to physical hazards and their social stations. For example, minimizing animals' risks to hazards in the first place, providing humane treatment of animals until they are terminated, selecting and using termination methods that are swift, efficient and humane, minimizing negative psychological and emotional tolls on animal caregivers, owners and the public, and mitigating harm (e.g., spread of disease) to adjacent animals (Meijboom and Stassen 2016; AVMA 2013; Rollin 2009).

Determining obligations to animals during a disaster requires having a method of ethical assessment and decision-making that explores the various dimensions of both the hazard and decision on animal life and welfare, and which weighs the considerations that will impact the relevant parties according to specific objectives. Practicing responsible caretaking[23] emphasizes the dynamic and multidisciplinary nature of disasters involving animals and the need for a problem-posing approach to animal disaster management that prioritizes concrete problems and reveals inequities. Animal welfare and One Health considerations serve as an appropriate orientation for action-guidance. The fluid, all-encompassing, unpredictable and uncertain nature of disaster ethics requires practicable and operational guidance for veterinary, public health, civil defense and protection services and other interested professionals embedded in disaster management who must act quickly and decisively.

A centerpiece of animal disaster management is saving lives and ensuring that every effort has been taken in the planning and response phases to ensure the humane treatment of animals. Accordingly, improving critical disaster management issues involves identifying and reflecting on ethical principles, values and inherent biases relevant to disaster management and the plight of animals during disasters.

The nature and complexity of the task of animal disaster management suggest that a one-size-fits-all formula is inadequate and that ethical assessment, analysis and

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[23] Haynes (2008) distinguishes an ethics of *caretaking* from one of *caregiving*. The latter is more appropriate to primary caregivers of animals, such as farmers and ranchers. In the case of institutional responsibility such as stewardship of the food system, citizen-consumers, policy-makers and industry agents have a collaborative role to inculcate and express virtues of *caretaking* in the design, development, and maintenance of the industrial food system.

deliberation (involving impact on animals) should occur continuously and at several levels (Mepham 2016; Zack 2009). General principles such as a lifeboat scenario do not provide appropriate guidance in the wake and aftermath of a disaster, for they are largely academic and removed from the realities of a crisis situation. For one thing, tens or hundreds of thousands of animals may be involved in a situation over which human beings have little control. Secondly, the nature of disaster management requires proportionality, flexibility, and patience to allow events to evolve and clarify. In real-world contexts, disasters are marked by the pressure of time, interrupted communications and coordination, constant recalibration in response to uncertainty, imperfect knowledge and inadequate equipment and supplies, and legal sanctions and enforcement. Disaster managers and first responders must also contend with unforeseeable developments, huge financial losses and emotional distress, containment of harm (e.g., zoonotic disease) to the health and well-being of the human public, long recovery time and adequate capacity/resources, and safety of responders and strike team members.

Management and response decisions are context-dependent and reflect the social and cultural norms and prioritization of ethical factors (e.g., analysis of beliefs, values and interests) of various stakeholders, as well as legal, economic and practical constraints and considerations. For example, responses to flooding will be very different depending on a community's capacity to mobilize assistance swiftly. The community's capacity is influenced by whether the disaster is connected to overall readiness, human culpability and whether legal fault can be assigned (this will impact who will pay for response or recovery), geography, local political and economic factors like resource allocation and wealth distribution and how and which ethical issues are recognized, deliberated, weighted and prioritized. Also, different communities may place different importance on human life and livelihoods, protection of property, risks and harms to human and animal safety, suffering and loss of life, and community resilience. These differences can impact the objectives and desired outcomes of a response and rescue. For example, in the case of the collapsed Feijão dam in Brazil, the objective was to rescue human lives first. The rescue efforts were hampered by the scale of the disaster, a lack of overall response readiness, unavailability of equipment and confusion about culpability. By the time a local veterinary group (CRMV-MG) was mobilized, decisions to kill animals that were assessed to be in irrevocable distress were made strictly on technical grounds. However, this decision may have been influenced by a relatively weak network for prioritizing animals' interests that is not yet deep or widespread in Brazil. A seemingly clinical or scientific determination about whether to rescue animal survivors may also be impacted by social, economic and ethical factors, such as who is responsible for the long-term care costs for animals, the possibility of reunification with owners, and the cost of rehabilitation or relocation.[24] In contrast, greater attention and preparation were given to pets and companion animals in the Hurricane Sandy case due

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[24] https://emais.estadao.com.br/noticias/comportamento,sobe-para-57-o-numero-de-animais-res gatados-em-brumadinho-mg,70002701999; and https://www.bbc.com/news/world-latin-america-48935651.

to the availability of reliable weather forecasts, and a deeper network of existing frameworks to mobilize people and resources to rescue animals

Not all communities attribute the same moral status to animals. Further, different communities will subscribe to different risk analyses. These differences will impact investment in local capacity to address large-scale and abrupt onset of a disaster. Hence, the ethical aims of emergency preparedness and response for animal disaster ethics is up against deeply embedded background conditions that result in elevated risks or vulnerabilities for animals during a disaster. While it will take time to dismantle the deep-seated cultural hierarchy of valuing animals, there are specific opportunities for both ethics and science to help reimagine good outcomes for animals in emergency situations. As alluded to above, AWS and frameworks such as One Health can offer evidence-based support to minimize welfare harms to the fewest number of animals and unnecessary euthanasia and depopulation.

The lack of attention to the needs and interests of some animals as a function of their position on the sociozoologic scale is a preexisting inadequacy in the disaster management (including veterinary and public health emergencies) infrastructure and delivery of aid. While not all animals can be saved due to resource scarcity and a stressed response system, it is important to address institutional or systemic biases about the needs of animals and organizational roles in disaster management. A first step in emergency preparedness is to take into account the population of isolated persons and animals in a given area who might have special vulnerabilities. For example, we should not neglect the experiences of rural or farming communities. Next, by addressing implicit and explicit institutional biases around how we talk about or experience animals in our mixed communities (Midgley 1983), we might begin to appreciate their different meanings and see different ways to value them in order to provide effective solutions in times of crisis.

Disaster management activities should protect public safety, and promote health and welfare to produce desired outcomes consistent with a community's social values. In the Anthropocene, animal interests intersect with human interests. Thus, disaster management activities should minimize the extent of death, injury, disability and suffering during and after the emergency. The disaster management objective to reduce morbidity and mortality of isolated individuals also includes protection and promotion of the health and welfare of the human-animal-environment community with a view to the interest of the common good (adapted from Jennings and Arras 2016; OIE 2016; Heath 1999). With these objectives in mind, we propose six ethically responsible caretaking aims involving animals in a disaster:

1. Saving lives and mitigating harm: Disaster management activities should be respectful of and humane towards animals, individuals and groups, with a view toward public safety, health, and welfare and animal care during and after an emergency. These activities should also include confronting structural factors and deep systemic prejudices that give rise to preventable anthropogenic vulnerabilities endured by animals (for example, livestock).
2. Protect animal welfare and respect for animals' experiences: Disaster management activities should be mindful of standard veterinary clinical measures and

veterinary services, the functioning capacities and behavioral needs of different species of animals and their affective states, and how they are coping during the emergency and its aftermath. Well-trained professionals with knowledge of the capacities and behavior of each species and effective handling should be emphasized.

3. Observe recognition and distributive justice: Disaster management activities should ensure that animals and their interests do not remain invisible during a disaster and that the benefits and burden imposed on the population by the emergency are shared as equitably and fairly as is practicable. As COVID-19 reminds us, the health and welfare of animals should not be ignored during a disaster. Research infrastructure and resources to identify the natural history of emerging diseases and spillover events from animal health and welfare perspectives should be strengthened through animal health and well-being disaster reference centers.

4. Advance public involvement: To maintain public trust, disaster management activities should be grounded in and include decision-making processes that are equitable, inclusive, transparent, and accountable. This basis can help to identify participation and knowledge gaps that should be addressed with appropriate systematic ethics and scientific assessment, outreach and education models. In normal times, an open process of community engagement informed by frank and full consideration of the relevant animal health and welfare science and ethical assessment of community values and interests should be encouraged as part of disaster management governance.

5. Empowerment of caregivers, guardians, owners and community members: Disaster management activities should strive to empower animal caregivers, guardians and owners and community members through education, training and mutual communication exchange as part of community vigilance, responsibility, solidarity and resilience, and developing capacity to provide effective animal care during and after the disaster.

6. Public health and veterinary community professionalism: Disaster management activities should recognize and enhance the skills and competencies of, and coordination among, public health and veterinary professionals. It should also include protective and coping strategies that can help minimize unnecessary mental and emotional distress on both the affected animals and the disaster management professionals.

13.7 Recommendations

In the Anthropocene, we—individuals, communities, governments, businesses, and professionals in disaster management—bear a moral responsibility to identify where the barriers to ethically responsible animal disaster management are likely to occur and to take appropriate steps to rectify them in order to prevent or reduce harm to animals. The collective interests embodied in disaster management measures should also include those of animals.

The foregoing discussion highlights that disaster management solutions in the Anthropocene have to be at the intersection of human-animal-environmental touch-points and cannot be amended by simply attending to human interests. The list of unanswered questions for animal disaster management in the Anthropocene is long. How can we empower first responders to be resilient under the chronic stress of a zoonosis and natural disaster? How should individuals and communities prepare for layered disaster events? How could animal welfare scientists catalyze the engagement with the public and other professionals to come up with funding, science-based policies and technologies that benefit and maximize resources benefiting animals during disasters? What sort of public engagement, risk communication and early warning systems can improve uptake so that individuals, governments, organizations and communities have feasible and effective intervention strategies at their disposal to act ethically to advance animal care during a disaster or a compound extreme event? While the One Health framework can provide a foundation for guiding collective attention, ethical inquiry that actually improves the lives of all animals during a disaster requires government regulation based on animal welfare, voluntary commercial schemes (e.g., standards and guidelines) to minimize the vulnerability of animals and commitment by private sector stakeholders, communities and individuals towards disaster preparedness and caretaking activities.

Towards advancing the six ethically responsible caretaking aims we need a publicly accountable set of operating procedures or action steps that can empower immediate caregivers of animals and disaster management teams to ensure that animals' interests are systematically promoted in disaster management. They are (not an exhaustive list):

1. Respect and Humane Treatment: Animals should not be considered a "problem" or an afterthought for disaster management. Indeed, animals can be a valuable resource for emergency planning, mitigation and response (e.g., animals as sentinels of danger and vehicles to assist in the evacuation of human beings). Disaster management and implementation should recommend a strategic framework for deliberation and action and strive for humane outcomes for animals in a crisis situation. Disaster management should clearly articulate the legal and ethical bases for achieving certain objectives involving animal welfare and public health, including humane handling and knowledge of animals' anatomy and physiology and temperament of the species being handled or terminated.

2. Collaboration and Effective Disaster Communication: Animal exponents (local farmers, veterinarians, civil defense and protection servants, animal welfare experts, epidemiologists, field workers, IACUC (Institutional Animal Care and Use Committee) representatives, concerned citizens) should have the opportunity to participate actively and directly in advanced planning and communication vis-à-vis emergency preparedness strategies. Disaster planning will be bolstered by these sources of local and specialized knowledge who are familiar with the day-to-day activities and patterns of behavior of various community members who care for, depend on, and/or use animals, as well as with knowledge of the animals themselves. Collaboration is particularly important to create spaces for

dialogue about positions that are ethically defensible, well-informed by science and local knowledge, and empirically relevant. Effective disaster communication is needed to prevent unnecessary abandonment of animals and minimize public panic and to reduce viral spread through effective physical distancing of animals. Public engagement can lead to clear communication of the risks aimed at minimizing disruptions to companion animals, wildlife, laboratory animals and livestock. It should also clearly highlight the interventions being deployed, how practicable they are for laypersons to follow and delineate how animal health and welfare will be advanced. Effective disaster communication will also highlight how priorities for resources and community services are allocated by related officials and disaster management teams and their ethical bases.

3. Strengthening Systems of Information Sharing, Surveillance, Scientific Research, Management and Training: Disaster managers should have up-to-date information concerning the numbers of animals and their whereabouts (e.g., a vulnerabilities database) and be responsive to generate the best available scientific evidence that contextualizes animal welfare in the referred disaster. Reference animal health and well-being research centers are essential for providing reliable information rapidly for the disaster management team, without only prioritizing the welfare of humans. Also, they should have the contact information of the responding/local veterinarians and related services and/or have access to the same real-time data as veterinarians and other collaborators who have jurisdiction to act regarding animals and their welfare (e.g., strike team or depopulation leaders) on the ground. Data management—that is data collection, organization, interpretation and dissemination about disasters—is an increasingly important asset. How data informs the practices and procedures adopted by the official epidemiological services should be reviewed carefully to enhance systematic ethics assessment and judicious priority setting, ideally by an interdisciplinary team. Technologies that mitigate and prevent animal disasters should also be included in any disaster management plan.

4. Community Outreach and Proactive Contact: Appropriate public involvement or civic engagement on animal issues can promote understanding and acceptance of necessary public health measures. Disaster managers and response teams should identify and map community assets and be in contact with communities so that in turn they can help identify and reach vulnerable populations and isolated groups, especially since disruptions to transportation and telecommunications are likely. Core procedures should consider how risk communication with the public and stakeholder involvement should be coordinated and how best to stockpile and ensure equitable and effective use of equipment and supplies.

5. Cultural Sensitivity and Attitudes Check: Disaster managers and responders should not over-generalize beliefs and attitudes or base emergency preparedness on untutored or unexamined assumptions concerning how animals might be vulnerable during the disaster or how they are valued (e.g., as largely moral subjects or commodities). Treatment of animals during a crisis should occur in a manner that minimizes animals' pain and distress as much as is practicable under the circumstances. Public perceptions of the humaneness of the procedures

used to handle or terminate animals are important for the success of a disaster management campaign and/or to mitigate the emotional and psychological toll of depopulating animals *en masse* by field personnel such as strike team members and veterinarians, when doing so becomes necessary, and efforts should be made to educate and gain public support.

6. <u>Reflection, Review and Reform</u>: Upon resolution of the emergency situation, it is important to review the humaneness and effectiveness of procedures involving the treatment of animals during the disaster in order to enhance future procedures and processes and minimize negative outcomes to animals. Doing so will reveal unintended biases regarding outcomes to animals, people and the environment and strengthen future policies and strategies, including improving on crisis standards of care. It will likely enrich understandings of the institutional expressions of social, moral and species inequities shaped by structures of power and politics that drive discourses of animal issues in the Anthropocene.

With the onset of the Anthropocene, humans have unwittingly created the conditions for an increasing amount and severity of disasters. In thinking further about the seemingly irreversible nature of how human beings have changed the planet, we owe it not only to our fellow human beings, but also to our fellow non-human animals to be prepared to deal with these calamities. Humane and respectful treatment of animals during disasters requires, amongst other things, the coordinated action of different professionals, informed by animal welfare science, and a reconsideration of the attitudes of a diverse set of stakeholders towards the moral status of animals.

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Andreia De Paula Vieira (DVM, MS, Ph.D.) is an independent veterinarian, animal welfare scientist and One Health/One Welfare researcher, from Curitiba, Brazil. Between 2015–2020 was Professor of Animal Welfare, Public Health and Epidemiology at Universidade Positivo, Curitiba, Brazil. During the same period, she served as Research Manager at Centro de Pesquisa da Universidade Positivo (CPUP), a multidisciplinary Research Center. Prof. Dr. De Paula Vieira's specializations include Animal Behavior, Animal Welfare Science, Sustainable Animal Systems, Public Health, Disaster Management, Epidemiology, Knowledge Transfer Methods, Instructional and Educational Design and Public-Private Partnerships for the development of policy and best practices. Between 2012–2015, she served as project leader for the Animal Welfare Indicators Project (AWIN - WP4). Her team of IT developers and designers at Universidade Positivo worked together with international collaborators to develop the information architecture for the Animal Welfare Science Hub. Her publications have appeared in Biosystems Engineering, Journal of Dairy Science, Animals and Applied Animal Behaviour Science. She is currently the ISAE (International Society for Applied Ethology) Country Liaison for Brazil. Her current research projects include: wildlife conservation, facial recognition and neural networks and AI for animal systems, public health and human-animal relations in policies and management, values-aware research regarding the sustainability of animal systems and disaster management for animals. Prof. Dr. De Paula Vieira obtained her Ph.D. in Animal Science at the University of British Columbia, Canada.

Raymond Anthony is Professor of Philosophy at the University of Alaska Anchorage. His publications are at the intersection of environmental-animal-climate-food ethics and the philosophy of technology. He serves on the American Veterinary Medical Association's (AVMA) Animal Welfare Committee and is a co-author on the AVMA's Euthanasia, Humane Slaughter and Depopulation Guidelines, respectively. He has published peer-reviewed articles and book chapters with scientists, veterinarians and ethicists on ethical assessment, bioethical analysis, governance and decision-making, stakeholder engagement, sustainability, climate ethics and food and agricultural ethics, including a Council on Agricultural Science and Technology (CAST) report, Well-being of Agricultural Animals: Scientific, Ethical, and Economic Aspects of Farm Animal Welfare (2018). He was co-PI on an USDA research project focused on developing curriculum for agricultural animal bioethics and conducted a CAPES sponsored values-aware research that explores challenges to the sustainability of the dairy chain in southern Brazil. Prof. Anthony co-chaired the food and water systems working group for the Anchorage Climate Action Plan. Currently, he is PI for a National Institute of Food and Agriculture sponsored research project, WELLANIMAL, a project seeking to both map the ethical dimensions and epistemological challenges that affect human-animal relationships and develop strategies to promote farm animal welfare and care, during a novel pandemic.