

## Quick Response Report

Submitted to the Natural Hazards Research and Applications Information Center

University of Colorado, Boulder

Animal Protection in Wildfires

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## **Introduction**

On August 4-5, 2012, massive wildfires broke out across Oklahoma. One resident said, "We've got pastures. I have a friend who is down by Stillwater who just lost 600 acres of pasture. ... I'm in the same boat. If it gets on me, I'm going to lose my pasture and under these circumstances, that probably means the loss of my cow herd" (Stillwater News Press 2012). Wildfires struck multiple areas across Oklahoma over the next few days. The predominantly small town and rural locations hosted numerous species and breeds of pets and livestock. Yet, despite recent social science wildfire studies, researchers have failed to investigate animal impacts (e.g., see Daniel 2007; Handmer and Haynes 2008; Desmond 2007). Given the minimal research on livestock evacuations (for an exception on pets, see Edmonds and Cutter 2008; Irvine 2001, 2004, 2006; 2009; for an exception on livestock see Wilson et al. 2012), a study on animal protection in wildfire should provide useful conceptual insights coupled with key practical applications. Research clearly demonstrates that people will work hard to save animals due to their psychological and economic importance (Gull 2013; Hall et al. 2004; Barber and Barber 1988). This quick response report describes the main research questions, the methodology and sample characteristics, and the main findings. The report concludes with relevant applications for both understanding and reducing the impacts of hazards and disasters for livestock and pets.

A group of diverse and interdisciplinary faculty and students partnered to examine animal protection in disasters. Five researchers from fire and emergency management, sociology, veterinary medicine and geography demonstrated, mentored and supervised ten students from these same disciplines as well as agricultural communications and international studies. The study began in October 2012 when the Natural Hazards Research and Applications Information Center provided a Quick Response Grant. Data collection continued into December due to the close proximity of the event to the primary institution, Oklahoma State University.

## **Wildfire Weather**

For the purpose of this Quick Response Report, we are focusing on three areas: Glencoe (Payne County), Mannford (Creek, Pawnee and Tulsa Counties), and Cleveland (Pawnee County), Oklahoma. On August 4<sup>th</sup>, Payne County temperatures began to rise into triple digits at 11:30 AM CST, reaching a high of 113 degrees. Residents reported first realizing wildfire danger existed around 1pm. Wind speed rose to 37 mph, which rapidly pushed the fire to the north. A shift in the wind direction toward the south occurred at around 7pm with associated outcomes for animal owners. People north of Glencoe realized their homes and animals would be saved, while those to the south moved quickly to relocate their pets and herds.

The Mannford fire began to take shape around 1:00 PM CST on August 4<sup>th</sup>, when the temperature rose to 106 degrees, with a wind speed of 13 mph. The temperatures increased to a high of 109 degrees, with the strongest winds measuring 15 mph at 2:30 PM CST. With each shift in wind speed came problems for animal evacuation, as respondents

noted repeatedly that the “fires kept jumping the road.” These unpredictable shifts in wind speed made pet and herd evacuation even more challenging, as emergency officials closed main roads for safety reasons. Such closures left those affected to rely on their own knowledge of “area back roads,” to get their animals and themselves to safety. If one word were to describe the Mannford fires, it would be “unpredictable,” as at least one human lost her life (and the lives of all of her pets and livestock) when she got caught in a “ring of fire” in Mannford, and could not escape.

The fires in Cleveland (Pawnee County) began to impact the community and force evacuations for both humans and animals beginning at 2:00 AM CST and occurred over several days. Evacuations took place during the night. The winds ramped up again to 18 mph around 10:30 AM CST, thereby re-initiating significant evacuation efforts of humans and animals from the area. The fire raged steadily until 9:30 PM CST when the winds again shifted to the south, decreasing the vulnerability of those in Cleveland, OK (data based on [www.mesonet.org](http://www.mesonet.org)).

## **Research Questions**

Given the dearth of existing literature, our research team approached the study chronologically and embedded the questions in relevant social science studies. The research questions for this study included:

- (1) How do animal owners acquire, interpret and act upon warnings for rapid-onset events like wildfire?
- (2) What are the roles of social networks (among neighbors) in protecting animals at risk during wildfire?
- (3) What is the nature of the relationship between animal owners, first responders and emergency managers in a rapid-onset event?
- (4) Are there discernible differences in how owners interpret and respond to warning and evacuation (i.e. pets vs. livestock)?

## **Methodology**

We conducted an interdisciplinary study that integrated several social sciences (sociology, international agriculture, geography) with veterinary medicine. The study relied on a triangulated research design of mixed-methods (in-depth interviews, observations, documents, spatial mapping, and visual data). We gathered data from multiple sites across the state, representing 3 counties affected by wildfire (Payne, Creek, Pawnee,).

*INTERVIEWS:* Well-trained teams of faculty and graduate students gathered interview data to provide context for a grounded theory analysis (Glaser and Strauss 1967). Interviews were arranged with affected animal owners and with first responders and emergency managers involved in the wildfire. The in-person field interviews were digitally recorded, lasting between 30-60 minutes, and were transcribed. The interview guide was designed like a standard checklist, which allowed the interviewee to tell their story. Concurrently,

the researcher listened to ensure that relevant information was recorded and conducted focused follow-up and probing questions as needed (Rubin and Rubin 2012). These standard approaches to qualitative interviewing remain in wide use among quick response researchers, enabling them to capture relevant information. Again, because of our proximity to the event, we were able to exceed the mean number of interviewees for most quick response type of studies. Informed consent, which included confidentiality, was obtained under the Oklahoma State University Institutional Review Board protocol.

Interview questions included:

- Sources of risk and warning information (social networks, law enforcement, media, etc.);
- Ability to herd and evacuate animals (or tactics used to save livestock, e.g., cutting fences;
- Contact with officials and agencies prior to or during the wildfire;
- The role of social networks and social confirmation behavior in attempting protective action for animals;
- Social influences concerning the evacuation decision and factors influencing the decision to return to the affected region;
- Standard demographic data about the respondent and the household. The latter proved especially sensitive, particularly questions regarding race, ethnicity, education and income. Consequently, we were able to gather only a partial picture on the demographic composition of interviewees.

*OBSERVATIONS:* To supplement the interview data, we conducted informal observations in the affected areas as well as at areas where people sought protection for their animals. In the affected areas, we toured the wildfire areas, visited people's properties, walked through their pastures and outbuildings, and drove the evacuation routes to discern issues with traffic movement (signage, road composition, road width, intersections). At areas of refuge for animals, we walked through areas with interviewees to understand animal movement, placement, and protection. We then compared observational information to understand better the nature of interactions between those affected and those responding (such as the proximity of animal refuge locations to formal and informal sources of aid such as the Red Cross or a faith-based shelter).

*DOCUMENTS:* In addition to the interviews, we gathered documents related to the wildfires (e.g., reports, warning messages, response plans, agricultural census data,) from interviewees and from relevant agencies. Documents help researchers to understand the broader context, such as the ways in which agencies attempt to respond, vis-a-vis the way in which they actually responded (Webb et al. 1981).

*VISUAL DATA:* Further, we gathered extensive photos and videos to document the damage, including some donated by interviewees. These visual data served multiple purposes. First, the visual data documented specific elements of the research. Second, the images provided useful information to those working across disciplines, in order to understand contextual information (e.g., a "pig board" or the needed size of an animal pen).

*SPATIAL ANALYSIS.* Project funding provided support for fieldworkers to capture routes used to evacuate animals from areas impacted (or perceived to be impacted) by wildfire. Routes and destinations drawn on sample maps by fieldworkers or respondents were geo-referenced within the geographic information system (GIS) to facilitate analysis and display. GIS facilitated analysis of individual evacuation pathways. Analysis revealed mean distances traveled and uncovered travel distance variations across breeds. Data corresponding to multiple fire events will enable comparisons of evacuation decisions among animal owners and variation in perceptions concerning the perceived safety of shelter locations.

*DATA ANALYSIS.* The analysis plan relied on: (1) *Grounded Theory Analysis:* used to differentiate the various communication pathways and information vectors associated with animal evacuation. We conducted both open coding to get a "big picture" look at the data and then engaged in selective coding to answer research questions within this report (Glaser and Strauss 1967). In addition, basic domain and then more complex taxonomic and componential analysis took place to reveal strategies, actions, roles and other key findings (Spradley 1980). (2) *Spatial and Temporal Analysis:* to map egress routes through GPS and establish a timeline to differentiate between pet and livestock evacuation coupled with speed of hazard onset.

### **Sample Size and Characteristics**

We interviewed a total of 43 people (see Table 1) and secured data on 11 breeds and associated species (see Table 2). Attempts to secure demographic information proved difficult as participants felt uncomfortable providing race, ethnicity, or income. Gender proved easier to secure, revealing that the majority of professionals were male and nearly all animal organization personnel were female. Residents and helpers (friends, family, organizational associates involved in transportation and shelter) were secured primarily through purposive and snowball sampling. We made attempts to contact all known animal rescue organizations and conducted interviews within the allowable and funded time frame.

**Table 1. Demographic Characteristics of People Included in the Study**

<b>Type of Participant</b>	<b>Total N=</b>	<b>Male</b>	<b>Female</b>
Residents	16	9	7
Helpers	11	5	6
Animal Organization Personnel	10	1	9
Professionals (EMA, Shelter Providers, Veterinarians)	6	4	2
Total	43	19	24

Breeds and species yielded multiple species of pets and livestock. The diversity of the sample ranged from small to large animals. Animal purposes varied from show, food and working animals to various kinds of pets (e.g., fish, ferrets, monkeys, dogs, cats and horses).

**Table 2<sup>16</sup>. Breeds and Species of Animals Included in the Study<sup>17</sup>**

Breeds	Species	Number	Purpose(s)	Outcome
Bovine	Angus, Angus-Cross, Longhorn, Commercial, Hereford	Approximately 150	Food, Breeding	Injuries (burns, smoke inhalation),, Some deaths; Significant sell-offs
Canine	Great Pyrenees, Boxer, Karelian Bear Dog, Great Dane, Lab mix, Pit Bull, Golden Retriever, Border Collie, Pit Bull mix, Chihuahua, Yorkshire terrier, Pug/Cocker Spaniel cross, Shih Tzu, Anatolian	Approximately 120	Pet, Guardian/Working Dogs	Minor injuries, No losses (losses were reported by rescue workers, not owners. Also, the woman who lost her life had dogs who perished)
Caprine (Goats)	Boer, Nubian, Kiko, other dairy breeds	Approximately 470	Food, Dairy, Show	heat stress, smoke inhalation
Equine	Quarter Horse, Arabian, Arabian cross, POA, Percheron mix, Donkey	Approximately 38	Pet, Show, working ranch	Injuries, Sell-offs, Donations
Feline	Domestic Shorthair, Bengal	Approximately 32	Pet	Injuries (burns, smoke inhalation) Some deaths
Mustelidae	Ferret	1	Pet	smoke inhalation
Poeciliidae	Guppy, nonspecified aquarium fish	3 - 7	Pet	no reported survivors

<sup>16</sup> Developed by Tamara Gull, Alyssa Forsyth, Audra Blasi, and Michael C. Fleming.

<sup>17</sup> Interviewees also reported that, in 2011, helicopter aerial use of a deer farm pond to fight a wildfire caused panic flight among the deer. Several of the deer died from cervical fractures caused by running into fences, suggesting that at least 12 breeds faced wildfire during the 2011-2012 wildfire seasons.

Porcine	Duroc, Feeder pigs	7 - 11	Food, Show	Injuries, Some deaths
Poultry	Chicken, Ducks, Turkey, Geese	60 - 70	Food, Pets	Injuries, Some deaths
Primate	Celebes, Macaque, Rhesus Macaque, Spider	14	Pets	No losses

## Research Findings

Research findings address the specific research questions outlined above. Sections that follow report on findings specific to warning information, the role of social networks, the nature of relationships between those affected and those who responded, and variation in responses within animal populations. General findings are reported here along with illustrative quotes

### *Warnings<sup>18</sup>*

*Physical Cues.* In an event that spanned hours and even days, the warning process and information-seeking process blurred. The most common way of learning about the wildfire threat came from physical cues, primarily seeing flames or intense, thick, black smoke. Wildfires started from multiple sources including arson, a possible industrial accident (still under investigation), and wind-fueled flames and ashes. One resident said, “we could see the flames.” Another reported “I pulled out that gate and I looked to the south, there’s this little trailer house to the south of us, and probably three or four hundred yards south of it was a wall of fire.”

*Social Relationships.* A second source stemmed from social relationships. People (family, friends, and neighbors) called each other as they saw the wildfire appearing or heard about an imminent threat. In the event of at least once case, family members traveled into the fire zone to warn nephews who had worked the night shift, and were sleeping. Had the family members not let themselves into the house to wake their relatives, a herd of cattle, dogs, and humans would have perished in the fire. Residents distant from the wildfire called neighbors and family to check on the proximity of the wildfire, “I wasn’t even around here. I didn’t know the fire was started. I was actually over by [town] and I get a phone call from one of my kids in my high school youth group at our church asking me where the fire is.” Another who went home to check on a property said, “I was a little nervous on my way in, ‘cause my neighbors had already called and said the power is out and the fire is on us.” From within social relationships, cell phones emerged as the most commonly used way to

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<sup>18</sup> Based in part on and analysis by Cindy Webster, Fire and Emergency Management Program, OSU.

communicate warnings and information, at least until batteries died during the long hours and day(s) that followed. Participants used direct phone calls and text messages most frequently with the bulk of the information coming directly from one person to another, “just people texting me and stuff.”

*Technology.* Research participants also reported using various forms of technology, particularly social media, to stay in touch with each other and to conduct their own assessments of impending threat. For the most part, participants used Facebook and Twitter to watch for information on the wildfire and on friends and family. Social media were more common among those who were not directly affected, as they had more time to monitor such media. People at various points of reception (such as a friend who took in livestock for an affected family) managed more frequent use of traditional and social media, “they had the TV on in here and we had people that were in here watching it.” Some relied on social relationships because they could not access traditional media, “I mean I know people were texting me and calling me saying hey what’s going on out there, because they had heard something about it. But initially and during the warning process, I guess I have no idea what was on the television, I was not around one.” Even radio proved problematic, “They weren’t discussing it on the radio. I had the radio on in the car. They weren’t discussing it, nothing, no, I hadn’t heard anything about the county until I got to Creek County.” Several reported extreme frustration with a television helicopter pilot who incorrectly reported that “one-third of the town of Glencoe is gone.” The misinformation caused great anguish for those presumed affected, coupled with concern that the fire would reach their own homes. Indeed, sources differed between those facing immediate wildfire threats and those who could safely monitor the situation, “As soon as I got home, I did turn on the TV, I checked Facebook. I was on Facebook the entire four days.” Another used an Internet connection for information: “I actually did find a website that let me listen to the firefighters...their radios, so I listened to them talk to each other.” Several homeowners reported monitoring the wind direction and speed on the Oklahoma Mesonet ([www.mesonet.org](http://www.mesonet.org)), which offers an iPhone app. “I had heard that the volunteer firemen were probably not gonna be able to keep it contained, ya know, given the conditions and everything, so I jumped on the Mesonet and all that good stuff. Started lookin’ and everything and thinkin’ this doesn’t look real good.” Using this information, they made the decision to evacuate animals when “the wind shifted.”

*Emergency Professionals.* The least commonly reported source of warning information came from emergency professionals. Although most participants said they were very aware of the wildfire threat, they did not get many wildfire-specific warnings or information from official sources. Explanations include being among those facing the flames and smoke to rescue animals and needing to be in contact with those who provided assistance. However, it is also correct that few warnings were issued other than through televised coverage. Multiple wildfires broke out across the state that day, with calls for mutual aid going unanswered “we have no one to send.” Among those who did learn of the information from emergency sources, two common sources emerged: (1) they got a phone alert from a city official that they should evacuate; (2) they got a phone call from a friend who worked as a firefighter.



## ***Social Networks***

Our study confirms the importance of social integration and particularly those (1) within existing organizations; (2) linked to a strong sense of community; and (3) embedded in strong interpersonal networks. The most successful evacuation of animals that we found happened among goat producers. By coincidence, a local fairground was hosting a goat show which was ending just as wildfire broke out nearby. With a few phone calls, members of the goat association (friends and relative strangers) rolled trailers out of the fairground and to nearby goat farms. They used GPS and smart phones to find their way, along with help from locals who rode along. Together, members of the goat association transported and cared for several hundred goats in a remarkably short timeframe and stood ready to transport even more should they need to do so. A second major factor linked to social networks came from the close associations that people felt from living in small towns and rural areas. They reported a strong sense of concern for their neighbors. One resident described how he was helping transport horses and pigs when he saw a woman “just riding her horse along the road not knowing where to go.” Although these two residents did not know each other, the horse and rider came along to a reception point where the horse could be evacuated to safety. It took a few days afterward to reunite the horse with its owner but the sense of being members of a caring community transcended being strangers to each other. In other cases, people called those they knew to be close to the fire, offering pastures, barns, trailers and transporting animals to their own homes. Their local knowledge proved particularly valuable when the fire or emergency responders blocked roads, as they knew where to seek alternate routes. An exceptionally strong set of interpersonal networks existed among both residents and within animal rescue organizations. Simply put, residents relied on their kin and friends to help them during the crisis with transportation, shelter, and long-term animal care when they lost their homes and outbuildings.

## ***Relationships between Residents and Responders***

Significant disconnects seemed to exist between animal owners, animal rescue organizations and response professionals, particularly local emergency management and firefighting. Residents reported minimal information received from official sources, relying instead on their interpersonal social networks for information. In addition to turning to interpersonal networks, they relied on producer organizations, local faith-based affiliations, community organizations, and local officials. These networks can best be characterized as emergent in nature during the wildfire albeit based on pre-existing relationships (Drabek 2003, 1981; Dynes 1974).

Animal rescue organizations indicated that they relied at times on personal relationships with response professionals in order to secure information, gain access to wildfire areas, and rescue animals. Some did so at significant personal risk, while the majority lacked any type of disaster training particularly specific to wildfire. However, animal rescue organizations worked creatively and collaboratively within their own organization, with animal owners, and (when possible) with emergency response professionals (firefighters,

emergency managers and shelter providers). Many animal rescue organizations relied on their own budget or own pockets to secure resources (trailers, vehicles, harnesses, crates, food) and did so willingly, albeit with some trepidation of the ultimate financial impact.

Emergency professionals became involved directly in fighting the fire (as first responders) and directing people (often in person) to evacuate the area. No residents reported receiving assistance from emergency professionals to protect animals directly. However, emergency professionals did become deeply involved in establishing pet shelters in affected areas by providing expertise, resources, and ideas. Residents who could move animals to these shelters received higher levels of assistance from emergency professionals. The proximity of the pet shelter proved significant as most residents attempted to remain close to their properties. One shelter provider indicated the importance of keeping people close to their homes, pets and livestock as psychologically important. Affected residents, particularly children, seemed more comforted with the presence of a pet especially as they worried about pets and livestock left behind.

The State of Oklahoma is in the process of developing and training county-level animal response teams (CARTS) and has developed an animal annex for the state Emergency Operations Plan (EOP). The effort is emerging between state emergency management professionals, veterinarians, and relevant agencies. CART volunteers will be housed administratively under the Oklahoma Medical Reserve Corps which provides a variety of online and in-person training, credentialing (including criminal background checks), and liability coverage (through state-based legislation). Efforts to provide resources to the CARTS are under development but proving challenging given present financial times. An even more significant impediment is the difficulty in recruiting local leadership to aid in developing the CARTS.

### ***Pets versus Livestock: Variation in Responses***

Findings in this section address three aspects of animal outcomes. The first concerns protective actions for animals coupled with associated outcomes. The second looks at the meaning of the animal to those involved in decision-making regarding protective action. A third addresses the variation in responses among animals themselves.

First, residents and animal rescue organizations worked feverishly to protect their animals, both pets and livestock. Pets included canines, felines, monkeys, and horses, a ferret, and fish. The majority of participants in our study evacuated pets first, usually through and to the homes of friends, family and neighbors. Some relied on shelters that accepted or made accommodations for pets, although a few reported being turned away from shelters that refused their pets. One research participant, who sheltered-in-place with monkeys, secured protective assistance from a local fire department. Others moved horses to locations a few miles away including the homes of family or neighbors or to a local fairground. Animal rescue organizations and emergency professionals used personal homes, public facilities, mobile command centers, and newly-established, but temporary, pet shelters to take in both loose pets and those dropped off by owners.

Residents, animal rescue organizations, and emergency professionals all reported difficulties protecting livestock. Efforts included complete evacuation, shelter-in-place, and micro-movement to protect livestock. Complete evacuation involved moving the animal(s) or herd completely away from the wildfire area with a range of 3 to 90 miles used for evacuation. Sheltering-in-place occurred when such evacuation became impossible as the fire neared or as owners watched ashes falling on their property and awaited any resulting fire outbreak or lacked the resources to move their animals. Micro-movement took place when animal owners moved livestock from pasture to pasture either through gates or by cutting fences.

Variables that influenced success included the availability of transportation resources, a location to take the animals, assistance with moving animals, the size of the herd, dispersal (pastured vs. penned/stabled) and animal, and the rapidity of wildfire onset. Transportation resources included the proper size and type of trailer, coupled with adequate resources at reception locations. Some livestock owners reported taking their own resources (pens and panels) to set up enclosure areas upon arrival. Others relied on the reception location (a family member's farm) to have such resources. In one location, an extensive multi-farm evacuation of goats relied on a nearby fairground which coincidentally had just ended a goat show. Resources became immediately available there, as the goat association staff and members moved sale animals out and evacuated animals in. Pens, panels, trailers, and personnel all happened to be available at the right location and the right time or successful evacuation might have been completely compromised. Size also mattered both in terms of animal size and herd size. Generally, the larger the animal the more difficult it became to protect it. Moving cattle (particularly large herds and bulls) proved nearly impossible. Limited movement of small cattle herds (less than 20) proved possible for some but not all. Preliminary findings demonstrate that larger breeds such as bovines were transported the longest distance from the fire, averaging nearly 28 miles. In comparison, caprine were moved about 17 miles and equine and porcine just less than eight miles. Bovine were moved in an east/northeast direction and porcine and the majority of equine in a northeast direction. In contrast, the majority of caprine were moved southwest.

Animal injuries and impacts, in approximate order of frequency mentioned included:

- Heat stress including dehydration
- Smoke inhalation
- Burns (hooves, legs, paw pads, udders, ears and some generalized burns)
- Lacerations (from fences or other animals)
- Lost animals (panicked, bolted, turned loose and not found)
- Premature sales or donations
- Trapped in a locked building and died
- Crush injuries or deaths from collapsing buildings.

The largest losses we observed occurred among cattle, except for poultry. Residents and animal rescue organizations found poultry very difficult to collect (they run from humans) and transport poultry safely without undue impact. Successful efforts included using dog

crates and personal vehicles but in the majority of cases, poultry became expendable. Losses also occurred when the wildfire simply overran pastures, trapping animals against fences. Though some animals died fairly quickly, others sustained injuries that were not realized by owners for hours or days. In such cases, euthanasia emerged as the most common humane option among livestock. Owners appeared to attempt veterinary treatment more frequently for pets, including injured horses. Costs associated with animal injuries proved particularly challenging.

Ultimately, the impact of the wildfire on top of the preexisting drought meant that many livestock producers had to reduce or completely sell off their herds. Associated factors included the impact on pastures, fences, and outbuildings. A particular problem concerned the loss of wells, when the heat of the wildfire destroyed PVC piping deep into the ground. One county did not receive a Presidential Disaster Declaration following the wildfire, which produced deep anguish among animal owners. Many animals went to local auctions in the months following the wildfires, with producers facing extremely difficult times to retain their economic livelihoods. Some owners felt compelled to give away their pets (horses) because of difficulty in supporting them.

Second, it is worthwhile noting that owners viewed their animals in varying ways. Residents that we spoke to clearly identified certain animals (canines, monkeys, felines, horses) as pets and went to great lengths to protect them. Livestock producers (goats, poultry, cattle) also felt a great deal of distress as they labored to save their animals. They felt significant levels of pain as they realized the losses among their herds. Some could not discuss animal losses and wondered about firefighters: “why didn’t they cut the fences?” Some rationalized the losses in business terms, understanding that little could have been done given the circumstances. This was particularly the case with poultry.

Third, owners reported that the majority of animals responded fairly well given the circumstances. On an historic day of high temperatures and wildfire threat, most animals responded to how owners tried to work with them. Few pet owners reported adverse behavioral responses among the animals. Most indicated that “knowing your animal” and “training your pet” made a difference: the animals responded to previous training and behaved appropriately. Shelters that accommodated pets also indicated making attempts to set up sites for various sizes and personalities of pets, particularly dogs. Reception points (family and friends) said that some did make efforts to separate animals known to “not like each other very well.” Livestock owners reported similar responses among the majority of their animals. Though animals could smell the smoke, the majority responded fairly well to being herded, moved onto trailers, and taken into unfamiliar locations. Livestock producers said that again “knowing animals” and having “breed familiarity” made a difference. They knew how to move animals, what tools to use, and what to do during transport and upon arrival. Producers reported using boards and panels to move and guide animals as well as food, halters, and working dogs.

## **Addressing Hazards and Disasters in the U.S.**

### *Contributions to the Empirical Literature*

Certainly, the literature on risk perception for humans indicates that human families prefer to evacuate with household pets when there are sufficient resources to care for the pets during evacuation (Heath et al. 1997; Heath et al. 2001). However, risk increases for livestock during wildfires, as well (Wilson et al. 2012). As an example, only local humane societies completely evacuated pets when hurricane Katrina threatened New Orleans. Furthermore, rescuers took primarily pets, while livestock remained in harm's way (Anderson and Anderson 2006). The rural locations impacted by the Oklahoma wildfires provided a range of locales from small towns to widespread ranches in which to conduct a comparative analysis on animals. Animal owners were far more successful in evacuating pets than livestock, with significant impacts for economic livelihoods.

As noted above, social networks comprise an important resource among humans affected by wildfire. Defined as "the relationships that connect one person to another, creating links between social groups" social networks develop among those "whom people trust, rely upon and seek advice from" (Akama and Chaplin 2013, p. 1). Our study confirms the importance of social networks, particularly among those involved in animal protection. Akama and Chaplin reported (n=10) that strategies for "unlocking and realizing the full value of social networks are under-explored and poorly understood" (p. 2). They found that gender activated social networks, with women encouraging other women to prepare. A secondary finding emphasized the role of social integration, where people develop and maintain strong connections to each other.

### *Contributions to Practical Applications*

To date, only a few critical pieces address information and actionable needs of those trying to protect animals (e.g., see Heath 1999). The majority of applied materials include brochures and checklists with recommended actions, albeit ones that lack empirical verification. The findings on warnings suggest, consistent with extant literature, that practitioners should develop robust and redundant ways to issue alerts including social media (Sutton, Palen and Shklovski 2008; Sorenson 2000; Lindell and Perry 1992; Mileti and O'Brien 1992; Mileti and Sorensen 1990; Sorenson and Mileti 1987; ). Social networks proved particularly valuable in how people learned about and responded to the fire which again confirms relevant literature (Mileti 1999).

Similar to many other states, Oklahoma emergency management agencies and those tasked with animal rescue remain under-resourced and thinly stretched. Oklahoma is in the process of trying to address this problem. Recommendations follow that may prove valuable to those affected by this wildfire and for similar locations.

### *Recommendations for Researchers*

- Expand the study of animals in disaster into rapid-onset events including wildfire.
- Incorporate livestock into studies of animals and disasters.
- Conduct studies that use participatory action research methods among animal rescue organizations and livestock producers.

- ❑ Expand existing studies of pet and livestock shelters, particularly within an emergent norm framework.
- ❑ Examine the long-term consequences of disasters including wildfire for livestock producers and pet owners.
- ❑ Study warning dissemination among those facing wildfire, as results here indicate people do not use traditional warning sources.
- ❑ Examine the role media play in dissemination of information including incorrect information.
- ❑ Gather science-based evidence for best practices among ranchers and farmers.
- ❑ Through extension and workshops, educate ranchers, farmers and even emergency responders who will encounter these situations.

#### *Recommendations for Practitioners*

- ❑ Recognize the diverse manner in which animal owners receive warnings and the importance of social networks. Reach out to those networks and encourage them to contact those at risk for animal losses.
- ❑ Develop and test evacuation plans for people with pets and livestock. Encourage regular drills to ensure compliance and feasibility of evacuation plans.
- ❑ Identify secure evacuation sites with the capacity to hold livestock without risk of disease or contamination. Conduct training and drills to ensure success.
- ❑ Develop resources to assist with animal transportation. Stockpile emergency tools (food, leads, carriers, bowls, feed cubes, medication, trailers, halters and lead ropes , etc.).
- ❑ Coordinate and collaborate training and preparedness with local animal rescue organizations and animal associations.
- ❑ Work with local veterinarians to develop treatment protocols. Raise funds to assist those affected with the costs of treatment.
- ❑ Contact animal organizations and associations and involve them in planning animal-centered annexes for the local emergency operations plan.
- ❑ Make livestock and pet evacuation a priority in disaster plans. Psychological well-being and economic livelihoods depend on one's action and animals survive because of professional emergency management and responder efforts.
- ❑ Conduct outreach to organizations, associations, worship locations, high schools and more to address animal preparedness.
- ❑ Support development of County Animal Response Teams and raise funds to provide resources for their work.
- ❑ Create a livestock and pet evacuation hotline to use as a clearinghouse for where to get resources, food, water, hay and other crucial resources into the extended recovery time period. Use social media to distribute information.
- ❑ Educate and involve disaster organizations with assisting with helping animals and owners with preparedness and response (including food, water and related necessities).
- ❑ Educate emergency managers and first responders on the salience of livestock for the local economy, which is no different, conceptually, from protecting a major business/building from a flood or fire

- Train first responders on how to manage a range of behaviors among various breeds and species, such as equine behavior: horses will run back into smoke and fire rather than away from it.
- Train first responders on various strategies to save animals (transportation, cutting fences, etc.).
- Integrate the work of emergency management more intensively with the National Weather Service, USDA, and other related organizations.
- Include county extension agents in the EOC.

### *Recommendations for Residents*

- Have an evacuation plan and a priority if one has more animals than trailer space.
- Have all animals permanently identified (microchip, metal ear tag, unique brand or tattoo).
- Know one's neighbors and what resources they have. Work with neighbors on an evacuation plan.
- Ensure that trailers and other resources are in good working order in advance of wildfire threats escalating.
- Identify evacuation sites in advance of an event.
- Never leave animals trapped in an enclosure. Open doors, cut fences, and pull apart panels if you cannot evacuate. Drive animals out of buildings (barns, swine houses, chicken coops) and prevent them from re-entering.
- Participate in animal organizations such as breed clubs, FFA, 4-H, etc. Fellow participants can be lifesavers in a disaster. Develop a means to contact each other by securing cell phone numbers. Visit each neighbor's farms so you know how best to help each other in a disaster.
- Know alternative routing. Know all routes in and out of one's area, as roads are frequently closed in disasters. Know where the gates are on both one's own property, as well as on that of one's neighbor's pastures, in case you need to drive cross-country.
- Make sure livestock will readily load into trailers in any circumstances.
- Train pastured livestock to come to a signal (rattling feed bucket, truck horn) for food so you can load them faster in a disaster.
- Take obedience training for pets so they respond to your command.
- Keep cell phones charged at all times, not just during fire weather danger. Have a vehicle charger.
- Encourage animal organizations and associations to contact local emergency management and work together before the next wildfire or disaster occurs.
- Cross-train with other organizations like the Red Cross and/or develop community and neighborhood programs like the Community Emergency Response Teams and County Animal Response Teams.

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