Pet Shelters and Planning for Sheltering Pets during Hurricane Evacuations:

A Case Study of Hurricane Harvey

by

Melanie Ratchford

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Committee Members:

R. Denise Blanchard, Ph.D.

Alexander Savelyev, Ph.D.

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Abstract

When a major hurricane strikes it is important that pets are included in evacuation plans and that they are safely sheltered. A lack of sufficient planning or communication of information during a hurricane may lead to increased confusion and result in devastating losses in the aftermath. Leaving pets behind in the event of an evacuation often causes significant problems that not only endanger the lives of the pets but also humans. The issues that have been present in previous storm events were also present during the catastrophic landfall of 2017 Hurricane Harvey. Animal shelters will sometimes be able to take in animals during major storms, however, many shelters may potentially experience issues during their response. This project attempts to examine the responses and problems experienced by animal sheltering facilities during Hurricane Harvey.

Introduction and Problem Statement

In a major hurricane, there are many issues that may occur as a result of devastating flooding and winds. A recurring issue during hurricanes that often leads to more problems is the failure of pet owners to evacuate with their pets or leaving pets behind during a mandatory evacuation. In the dangerous conditions of a hurricane, failing to evacuate or find shelter for pets threatens the safety of pets and people. These issues were present during Hurricane Harvey, which struck the coast of Texas in August of 2017 causing devastating losses. These losses were also especially evident during the events and aftermath of 2005 Hurricane Katrina. As a result, a significant number of pets were lost or left behind as residents were evacuated and the city flooded by heavy rains and storm surge. According to the Louisiana SPCA website, it was discovered in the aftermath of Hurricane Katrina that 104,000 pets were left behind during the disaster and that 50,000 to 70,000 pets were thought to have died (Louisiana SPCA n.d.).

Research from the Fritz Institute, also according to the Louisiana SPCA, reported that the reason 44 percent of citizens did not leave the area was because they made the decision to remain with their pets during the storm (Louisiana SPCA n.d.). This disaster was a major turning point that led to important changes in policy and improvements that would allow for the needs of pets to be included in future disaster preparedness plans.

Because of the confusion that occurs during a hurricane event, it is necessary for communities to prepare and ensure their animals are taken into account prior to a potential disaster. In the section, "Pets and Animals," on the Department of Homeland Security's website, Ready.gov, it is recommended that pet owners take essential steps to become informed beforehand about preparations for their pets' safety, including where to lodge pets prior to a hurricane's landfall (Department of Homeland Security n.d.). Failing to do so, inevitably, will lead to pets being left behind and the losses associated with it, as was quite evident during Hurricane Katrina. Many people consider their pets as part of the family and for some, support animals are crucial to their wellbeing because they are a necessity. Because of this, it is important that owners make disaster preparedness plans and address issues to help prevent future problems. It should be acknowledged that there are many factors to consider and many reasons why pet owners might fail to make plans for their pets and evacuate with them in disasters. Among those reasons is a lack of resources, information or quite simply failing to act. There are, however, several recommendations and instructions available to pet owners explaining what actions to take when a hurricane is expected in a given area. In addition, pet sheltering facilities will often take in and house stray and lost pets in a disaster. Various types of facilities such as Animal Control offices, city animal shelters, and various non-profit pet shelter facilities are quite capable of attending to the needs of pets during a disaster event. In the section of the United

States Humane Society website, "Make a disaster plan for your pets," it is stated that, "Some shelters may be able to provide foster care or shelter for pets in an emergency. But keep in mind that shelters have limited resources and are likely to be stretched during a local emergency" (The Humane Society of the United States n.d. n.p.).

The goal of this research was to understand the experiences and resources of animal sheltering facilities in the Houston metro area that were available to pets during Hurricane Harvey in 2017. This project uses Hurricane Harvey as a case study because of its severe impact on the Houston area and the strain that was placed on its resources. The city and surrounding areas were devastated by the hurricane leaving a lasting impact that continues to affect the city and its residents today. This information will hopefully, be valuable in helping to plan for future disasters and evacuations. To understand the experiences of animal shelters during the storm and what resources were available to pets and their owners, three research questions were asked. The first crucial question inquired about the resources and procedures that were in place during the hurricane. Examining the events of Hurricane Harvey and the preparations that were made as well as how the city dealt with its aftermath, provided answers to this initial question. The second question asked about problems encountered by these facilities as they sheltered pets during and after the hurricane. It was necessary to ask this question because most disasters intensify problems that are already in the system due to restricted resources that become overburdened. Understanding the experiences of shelters can help develop or improve current disaster plans in order to keep those existing problems, that some facilities already experience, from intensifying. The final question inquired about whether additional resources would be required in the future if problems were found to exist and if so, to identify the additional resources. Since Houston is home to more than 2.3 million inhabitants and encompasses 665

square miles, according to the City of Houston website, "About Houston Facts and Figures," it is vital that it be prepared for future hurricane events as its population and size continues to expand (City of Houston n.d.). With this continued growth there will be an increased need for resources and services to help accommodate and assist them in future disaster events.

Background

The Houston metro area as mentioned above was chosen as the study area for this research project as it was heavily impacted by the events of 2017 Hurricane Harvey. With a population in July 2018 of 2,325,502, Houston is the most populated city in Texas, only the cities of New York, Los Angeles and Chicago exceed it according to the City of Houston website (City of Houston n.d.). The website also states that by the end of the 2020s, it could be the third most populated city in the country (City of Houston n.d.). The United States Census Bureau estimates that the city's population has grown 11.1 percent from 2010 to 2018, increasing by more than 230,000 people (United States Census Bureau n.d.). Nine different counties comprise the "Houston-The Woodlands-Sugar Land Metropolitan Statistical Area," making it larger than the state of New Jersey with a size of 9,444 square miles (City of Houston n.d.). As the city of Houston continues to grow in population, so will its pet and service animal population. It becomes increasingly important that residents are prepared for disasters and that they have the appropriate resources to help themselves and their pets when disaster strikes.

Hurricane Harvey hit the coast of Texas on 25 August 2017 and had a devastating impact on the Texas coast and surrounding areas. During a hurricane, damaging winds and flooding from increased rainfall and storm surge cause devastating and dangerous conditions for affected areas. According to the National Weather Service webpage, "Major Hurricane Harvey – August 25-29, 2017," on 25 August, it was projected to strike the coast as a Category 3 hurricane but it

quickly grew to a Category 4 later that day (US Dept of Commerce National Oceanic and Atmospheric Administration n.d.). According to the document, "National Hurricane Center Tropical Cyclone Report Hurricane Harvey (AL092017)," by Eric S. Blake and David A. Zelinsky, it had not originally been expected that the "rapid intensification" of the hurricane would occur after it reformed in the Gulf of Mexico (2018). Blake and Zelinsky also stated, "A Hurricane Watch was first issued at 1500 UTC 23 August and a Hurricane Warning was first issued at 0900 UTC 24 August" (2018, 13). The state of Texas had not seen such a deadly hurricane since 1919, and 68 deaths were directly attributed to Hurricane Harvey with 36 of them occurring in the Houston metropolitan area (Blake and Zelinsky 2018). Significant amounts of catastrophic flooding and rainfall of 36 to 40 inches occurred in the Houston metro area with reports of bridge collapses and many rescues (Blake and Zelinsky 2018). In addition to the rainfall, there were 150 tornado warnings and 52 tornados, with half arising close to the Houston metro area and to its south causing minor damage (Blake and Zelinsky 2018). It was the second most costly hurricane to hit the United States, causing billions of dollars in damages with the flooding of more than 300,000 structures and 500,000 cars in areas of southeastern Texas (Blake and Zelinsky 2018). This storm greatly impacted the people in Texas and Louisiana as well, with estimates of 40,000 people evacuating to shelters (Blake and Zelinsky 2018). This hurricane is quite an example of the resulting dangerous conditions that not only endanger the lives of people but their animals as well. Consequently, it is important to make sure that pet owners keep themselves and their animals out of harm's way.

In the wake of a hurricane or devastating disaster, it is often too late to take action to safeguard a city's residents and its pets, therefore, it is important that a plan is in place for the needs of residents and their animals. The Pet Emergency and Transportation Standards Act of

2006, or the (PETS Act), was an important step in addressing the safety and needs of pets by incorporating them in disaster plans. This legislation was created as a result of another devastating hurricane to make landfall in the United States. Although the needs of pets and animals were considered in previous disasters, 2005 Hurricane Katrina, which severely impacted the city of New Orleans, causing devastating floods and losses was the push for a much-needed change. One story in particular, mentioned in Lisa Zottarelli's article, "Broken Bond: An Exploration of Human Factors Associated with Companion Animal Loss during Hurricane Katrina," described a child crying when the family's dog was taken away as they evacuated the city (2010). This story showed the devastating difficulties residents encountered with their pets and service animals during evacuations, as many pets would be left behind and abandoned in the aftermath of the hurricane.

These overwhelming events resulted in the creation of the PETS Act shortly after Hurricane Katrina (Zottarelli 2010). According to Congress.gov, the PETS Act became a public law on 6 October 2006, and is an amendment to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Congress.gov 2006). It calls for the Director of the Federal Emergency Management Agency (FEMA) to examine and ensure that the necessities of people and their pets are taken into consideration in both local and state preparedness plans in all stages of a disaster (Congress.gov 2006). The PETS Act gives the Director the power to examine and create plans, if necessary, to accommodate the requirements of citizens with pets and service animals (Congress.gov 2006). The Act also allows state and local authorities to receive monetary funding that has been approved by FEMA's director, by way of projects and programs, to be used specifically for obtaining any buildings or materials for new construction or repairing any existing emergency shelter locations required for setting up accommodations for people with

pets or service animals (Congress.gov 2006). Federal agencies are also given the power through the PETS Act to give aid deemed important to pets, service animals and property threatened by a disaster, as well (Congress.gov 2006). However, it was mentioned by Hillary A. Leonard and Debra L. Scammon in the journal article, "No Pet Left Behind: Accommodating Pets in Emergency Planning," the PETS Act does not provide any specific procedures that must be included in the disaster plans, there is only the requirement of a plan (2007). Texas also has legislation to protect and provide humane treatment of pets and service animals called Texas HB-88, "Simba's Law." Under "Simba's Law," mentioned in the "Animal Issues Committee Guidance Document" on the Texas Animal Health Commission website, it is mandatory for the State of Texas, Division of Emergency Management to assist local governments in creating disaster plans to provide transportation, and temporary shelter to pets and service animals during evacuations (Texas Animal Health Commission n.d.). The PETS Act was also examined in Steve Glassey's article, "Did Harvey Learn from Katrina? Initial Observation of the Response to Companion Animals during Hurricane Harvey," when it stated it has yet to be determined by the government how effective the PETS Act has been (2018). Glassey found in the research that while the PETS Act has appeared to make a change in the culture, there is still a long way to go in the application of the Act (2018).

It is necessary to examine current disaster planning for pets and their owners in hurricanes. Pet owners should bring their pets with them when they are evacuating from a disaster and ensure that necessary preparations have been made for them. If they cannot do so during a hurricane, pet owners should be able to find a safe place to board their pets. It is strongly recommended to avoid the problems associated with mass evacuations, to evacuate before an order has been made, as it becomes increasingly difficult to do so once a disaster

strikes (The Humane Society of the United States n.d.). The Houston/Galveston National

Weather Service provides the document, "Hurricane & Severe Weather Guide," which

recommends that pet owners plan ahead of time to ensure that the hotel or shelter they will be

staying at will allow their pet (National Weather Service of Houston/Galveston n.d.). There are

additional instructions provided in the guide that include keeping pets up-to-date with

immunizations, having adequate identification and pictures of them, bringing their carrier, as

well as any additional supplies required by the pet (National Weather Service of

Houston/Galveston n.d.). If pet owners are unable to take their pets with them, the Humane

Society of the United States suggests that owners call veterinary clinics, shelters or boarding

facilities prior to a storm to see if they can board their pets (The Humane Society of the United

States n.d.). Local emergency management offices should also be contacted if one has any

concerns or questions about what to do and where to go with their pets (The Humane Society of

the United States n.d.). In the event of a major hurricane it is important to take the necessary and

recommended precautions to ensure the safety of people and their pets.

In addition to planning on the part of pet owners, it is important for communities, shelters

and organizations to also plan for pets and disasters. Sebastian Heath and Robert Linnabary

suggested in the article, "Challenges of Managing Animals in Disasters in the U.S.," that a

possible solution for shelter planning includes knowledge of the following: understanding the

circumstances that shelters will be open, what locations will shelter pets and "who carries

liabilities," the required staff and their responsibilities, the amount of training for animal care

workers and volunteers, along with the appropriate paperwork required from pet owners (2015).

The National Alliance of State and Agricultural Emergency Programs (NASAAEP), Heath and

Linnabary believe, have the "best practices for animal shelter policy/guidelines," they also make

the additional suggestion that owners care for their pets and that shelters have specific procedures, for instance requiring an owner to stay with their pet for the duration of their stay (2015). Ensuring that there are suitable plans and that people are aware of what to do before a disaster strikes is important for the prevention of most problems. It is often too late to attempt to address any problems once the evacuation of a city has begun.

Literature Review

Pet ownership, its relationship to evacuation and the problems associated with it, have been examined in the literature. Many pet owners have a strong attachment to their animals and the loss of a pet during a disaster can be devastating and can contribute to the feelings of desperation often encountered in these events. These strong attachments described by Ashleigh Day in the journal article, "Companion animals and natural disasters: A systematic review of literature," may lead pet owners to put their lives in danger by returning to a dangerous area in their attempts to locate and retrieve them (2017). According to the academic journal article, "Pets and Evacuation: An Ongoing Challenge in Disasters," by Ashley K. Farmer, Sarah E. DeYoung and Tricia Wachtendorf, pets should be considered in evacuations because they keep pet owners from refusing to leave or trying to return too soon to pick them up and it also addresses problems with mental health and food systems that present themselves at these times (2016).

When residents do not have a clear course of action or have insufficient information about the potential dangers during a disaster, many serious problems can surface (Heath and Linnabary 2015). Heath and Linnabary's article mentioned that disasters often worsen the lack of resources that exist in many facilities and create bigger problems in the long-run (2015). They also suggested that when it comes to examining solutions, the problems of managing animals

during disasters are dealt with by temporary means rather than by addressing the preexisting inadequacies in having long-term objectives (Heath and Linnabary 2015). They also emphasized that animal welfare laws at a state level are not cohesive and uniform when it comes to standards, execution and enforcement because they are not solving problems and lack clear goals (Heath and Linnabary 2015). When discussing local ordinances, however, several examples of mitigation are provided, such as enacting rules to limit the number of pets one may own because the greater the number of pets in a household, the less likely an owner will evacuate (Heath and Linnabary 2015).

A continued lack of funding and resources is another potential source of problems in disaster preparedness for pets. Heath and Linnabary mentioned that some animal control agencies do not have enough workers and funding for them to continue their work, which in turn impacts a community's means to have adequate plans in place for disaster preparedness and response (2015). Other issues that decrease a community's ability to help pets in disasters include the fact that pets are not always considered a high priority, animal control personnel are sometimes inadequately trained, are poorly compensated and unable to keep up programs and facilities (Heath and Linnabary 2015).

A common topic that may be found in the literature is the topic of pet ownership and the reasons for evacuation failure. "Human evacuation failure" occurs when people choose not to evacuate from a disaster, while "pet evacuation failure" happens when a pet is left behind while their owner evacuates (Heath and Linnabary 2015). Evacuation failure may also be the cause of many other issues that occur during and after a storm. To better understand the issues that result from evacuation failure, it is important to examine and recognize the reasons why pet owners may fail to evacuate an area. The following statistics presented by Heath and Linnabary,

indicate where this is most apparent; they stated that owning a pet was the reason for 20 to30 percent of failed evacuations and that failed evacuations occur particularly in homes without children (2015). Animals being left behind in disasters are a frequent occurrence in the United States (Heath and Linnabary 2015). Heath and Linnabary suggest that the main reason pets are left by their owners is due to "low attachment" with a pet when the disaster strikes, however, they also suggest that advice and positive reinforcement through public service announcements could reduce this by educating and encouraging pet owners to take their animals with them (2015). Other factors contribute to an individual failing to evacuate an area with their pet during a mandatory evacuation or leaving their pet behind. Demographics, no reliable transportation, and vulnerable populations, such as the elderly are listed by Zottarelli as factors that can further increase the risk of evacuation failure (2010). In the city of Houston, 10.1 percent of the population is 65years old or older, according to the U.S. Census Bureau, and 6.6 percent of the population under the age of 65 has a disability (United States Census Bureau n.d.). It is possible that this population and their pets could be at risk for evacuation failure because it is more difficult to respond to an evacuation order quickly. Heath and Linnabary claimed that in order to decrease evacuation failures, it is vital to make plans and preparations ahead of time, and suggest that pet supplies, such as carriers or leashes be offered to ease in the transporting of animals during an evacuation (2015). K. Thompson's 2018 article, "Facing disasters together: how keeping animals safe benefits humans before, during and after natural disasters," acknowledged another reason for evacuation failure, the possibility that first responders worried about the safety of their own pets may affect their ability to report to their jobs.

Once evacuations are underway, emergency personnel must face the problems of people and pets. K. Thompson addressed the various concerns about the health and safety of all persons

in emergency shelters and why these are reasons pets are rejected (2018). People aware that this will be the case may choose to leave pets behind. For those with companion or support animals, Thompson stated that, "Companion animal loss can impede disaster recovery and resilience," and the loss or separation of a pet can be a traumatic experience (2018, 225). After a disaster most of the pets that are found were already strays and lost or abandoned pets increase the already high stray pet population, a problem which Heath and Linnabary insist will continue as long as communities ignore pre-existing stray pet populations (2015). Once a pet is lost in a disaster situation, it may be very difficult to reunite them with their owners as there is no standard for describing a lost pet in databases (Heath and Linnabary 2015). According to Robin Chadwin's article, "Evacuation of Pets During Disasters: A Public Health Intervention to Increase Resilience," people returning to dangerous areas to retrieve lost pets not only endangers their own lives but also the lives of emergency responders who attempt to rescue them (2017). Returning to retrieve a pet was cited as the reason for 80 percent of residents who returned to an evacuated location before they were given permission by authorities to return (Chadwin 2017). Although Heath and Linnabary stated that this is relatively rare, it is still dangerous and best left to trained emergency responders and animal care workers to determine whether it is safe for all involved to evacuate an animal (2015). Animals in disasters are often scared and might bite or injure those trying to catch them (Chadwin 2017). The spread and risk of disease to people and other pets from bites or contact with infected animals are other problems often encountered in disasters (Chadwin 2017).

There are other issues that surface during and after disasters involving the distribution of funds and resources which well-intentioned contributors have made. Poorly conveying what resources are needed to the public can result in large donations of too many items or unusable

items (Heath and Linnabary 2015). Fundraising fraud is another potential danger that may occur along with the misappropriation of money and donations (Heath and Linnabary 2015). In some cases, problems may arise when people, not part of an emergency management organization and lacking an understanding of procedures, arrive to help (Heath and Linnabary 2015). Volunteers without experience or proper training may also put others' lives in danger or can negatively affect response (Heath and Linnabary 2015).

Another problem noted by Heath and Linnabary, is the issue of animal shelters not altering "adoption and euthanasia policies" in the event of a disaster which would allow pet owners a few additional weeks to find their missing pets (2015). To potentially remediate this problem, they believe additional resources for shelters would be required and this, consequently, would require more funding that is not always an option after a major disaster (Heath and Linnabary 2015). Chadwin mentions that housing pets with their owners so they can care for their own pet in a designated shelter could be a potential solution that would lessen the amount of staff needed to care for them (2017). This seems to be a solution worth taking note of because, as others have mentioned, this would help pet owners overcome the feeling of desperation and add to their ability to cope.

Steve Glassey's journal article examined Hurricane Harvey and its effect on pets by conducting interviews with animal emergency response workers. Respondents of Glassey's study reported that although drafts for emergency plans were being developed there were no animal emergency plans at the state, county and city levels in operation (2018). According to Glassey, "In Houston, the two major animal welfare charities appeared to already have their own operational areas with spontaneous and other groups coming from outside the area to fill coverage voids. In some disaster-affected areas in Texas, where there was no local Society for

the Prevention of Cruelty to Animals (SPCA) or Humane Society, the local animal control provided a default animal emergency response service" (2018, 3-4). Glassey's article also stated that the United States military rescued animals with their owners and was prepared to carry out rescues in the floods (2018). As mentioned previously, problems associated with donations are not a new issue in disasters. Glassey also reported that massive amounts of donations to animal charities were received which caused problems, with organizations receiving so many that in one instance they obstructed traffic (2018). It is stated in the article, microchipping of pets was not widespread and there was a lack of a standardized database amongst all of the animal organizations for lost pets (2018). While there were cases of animals being abandoned, during Hurricane Harvey, Section 821.077 of the "Texas Health and Safety Code" which prohibits tying a dog outside in a hurricane or during extreme weather, was significant in preventing this cruel form of abandonment (Glassey 2018). It also stated that there were other legal issues such as animal hoarding and it is possible that the hurricane uncovered "the first empirical case of disaster hoarding" as well (Glassey 2018). Glassey also noted in a brief review, a media portrayal of the disaster being optimistic to a greater extent showing support by the public instead of outcry when compared to the previous disaster, Hurricane Katrina (2018).

While there have been substantial improvements and legislation to ease the problems with pet evacuations in disasters and an increased awareness since 2005 Hurricane Katrina, more needs to be accomplished to reach a consistent, standardized response. Throughout their article, Heath and Linnabary emphasized the need for planning for pets at all stages of a disaster, but they also addressed the need for improvement (2015). They stressed the importance and need for planning when addressing vulnerable populations with pets such as those with special needs and the elderly who might require extra assistance to escape disasters (Heath and Linnabary 2015).

There was limited peer-reviewed literature relating to the subject of pets and animal shelters during the events of Hurricane Harvey. Because of this lack of literature, learning more about the experiences of animal shelter workers during Hurricane Harvey can provide more insight which can assist affected agencies in planning for future disasters.

Relevant available online news articles at the time of the storm also provided insight to what happened during the events of the hurricane. Upon examination of these articles, many discussed the same topics previously discussed in the literature review. Several organizations helped in the massive effort during the hurricane. Marianna Parraga's article, "Texans refuse to leave pets behind as they flee Harvey," reported that before the storm hit, many animals in shelters on the Gulf Coast of Texas were evacuated (2017). Parraga also described how many people faced the dilemma of not being able to bring their pets to storm shelters when they evacuated their homes and many people who had stayed behind had to be rescued (2017). It was discussed in the article that pets were assisted in different ways by opening shelters to pets, setting up a temporary trailer and sending in a team to rescue animals and their owners (Parraga 2017). In a Reuters article by Chris Kenning, "Hurricane Harvey threatens thousands of pets and livestock," it is mentioned that several shelters remained to brave the storm while some shelters transferred their pets to other shelters (2017). Additionally, the article stated that different organizations were prepared to attempt to assist pets before the hurricane, but there was much uncertainty over how severe the potential impact of the hurricane would be (Kenning 2017). As the number of animals in pet shelters was increasing, some individuals came forward to allow temporary shelter to animals (Kenning 2017). The NBC news article, "Animal Lovers, Shelters Scramble to Save Pets in Wake of Harvey" by Daniella Silva, also described the plight of pets and the race to help and rescue them from the floods (2017). Pet shelters worked hard to process

the large number of pets coming in from the disaster, and to help the frightened pet owners worried about the safety of their animals (Silva 2017). Silva also stated that although there were many shelters that were already filled to capacity, more pets continued to come in, and, animal shelters around the country helped by taking in hundreds of pets from the area (2017).

A 2017 CBS News article, "Thousands of animals expected to flood shelters after Harvey" by Justin Carissimo, also reports how animals were moved to other animal shelters. The New York Times article, "Saving Pets Is Paramount for Many Fleeing Tropical Storm Harvey" by Matthew Haag, also described stories of animal rescues and animals being left by their owners (2017). Eliza Murphy's ABC News article, "Stranded pets rescued amid Hurricane Harvey flooding in southeastern Texas," covered the stories of people and their pets being rescued and how one pet rescue organization reported the number of animals being brought in was increasing rapidly (2017). The Houston Chronicle article, "NRG is sheltering pets that were displaced in Harvey's wake" by Darla Guillen, described a makeshift shelter run by animal rescue organizations that came together to help 500 animals and attempted to help owners find their missing pets (2017). "Houston Shelter Offers Respite For Pets And Their Owners Displaced By Harvey," by Claire Harbage also covered a story about the importance of a temporary shelter opened to people and their pets with volunteers helping to take care of animals and cleaning (2017).

Methodology

For this research project, the defined study area was focused on the Houston metropolitan area. This study area, however, only included cities within the Houston metropolitan area. Unincorporated places, towns and villages were not included in the study area. The list of cities in the Houston metropolitan area was found on the Statistical Atlas website, "Overview of the

Houston Area, Texas (Metro Area)." According to this website, the Houston metropolitan area is comprised of 107 cities (Statistical Atlas 2018).

The list of animal shelters surveyed in the Houston area is comprised of various city shelters, animal control, pet rescue shelters and non-profit organization shelters. Although each of these facilities is quite different, they all perform similar functions and care for animals during a disaster. It was important to note that every community and facility had different capabilities in handling animals in disasters. The locations of animal shelters were identified by using various resources available online such as Google search results, Google Maps, and other websites. Some shelters and websites offered suggestions of nearby shelters. If a shelter's website described itself as having a facility, then it was included in the list. If it was unclear if the shelter had a facility, it was not added to the list. When searching for shelters, some of this information, however, was incomplete or difficult to find as some shelter websites were broken or had limited information available.

In order to collect information for this project, a survey questionnaire was created to gather relevant information about the shelter's experiences and resources during the events of Hurricane Harvey. A survey questionnaire was developed to allow respondents time to answer or find information for the questions if necessary. The questions on this survey were developed to help answer the three research questions presented in the Introduction. (A copy of this survey questionnaire is included in the appendices at the end of this document.) Forty shelter facilities were surveyed for this project. These shelters were mailed a cover letter two weeks in advance that included details about the survey questionnaire that would be sent to them later. Survey questionnaires were sent either by postal mail or disseminated online through E-mail depending on the availability of contact information found online. Contact information was found online,

on Google Maps, the shelter's website or its Facebook page. The online version of the survey

sent by E-mail was created using the website, SurveyMonkey (SurveyMonkey 1999-2019). The

survey instrument itself consisted of 16 questions, 14 which asked general questions about the

shelter during Hurricane Harvey. The questions were comprised of "yes" or "no" questions,

multiple choice questions, and open-ended response questions that allowed respondents to

choose an answer. It was estimated to take 15 minutes to complete the survey.

The second part of this project consisted of creating and examining maps of the Houston

metropolitan area in relation to the location of shelters. These maps consisted of various layers

displaying information, such as population data, flood zones, evacuation zones and the shelter

locations. Data for GIS creation and analyses of these maps was downloaded from multiple

sources. The maps were created using Esri's ArcGIS Pro, provided by Texas State University

(Esri n.d.). These layers were added to a base map in ArcGIS. While there is no complete list of

animal shelters currently available online, the data layer and list of shelters was compiled using

the different resources stated above and using Google Maps to obtain the coordinates. The 40

shelters surveyed were added to a layer. Shelters that did not respond were removed from the

layer. The City of Houston's GIS Open Data Portal provided the shapefile, "Census 2010

Tracts," which included the census tracts for the study area (City of Houston, ARCGIS HUB

2019a). Information in this shapefile included the population demographics and housing for the

Houston metropolitan area (City of Houston, ARCGIS HUB 2019a). Values for area in acres

and square kilometers were added to the attribute table to calculate the population density. The

shapefile, "Texas County Boundaries Detailed," for the counties in Texas was provided on the

Texas Department of Transportation website and was modified to show the nine counties of the

study area (TxDOT – TPP – Data Management TPP-GIS@txdot.gov. 2016). The City of

Houston's GIS Open Data Portal website also provided the shapefile, "COH Hurricane

Evacuation Zones" (City of Houston, ARCGIS HUB 2019b). The shapefile, "FEMA

Floodplains NFHL 2015," for flood data was found on the Houston-Galveston Area Council

website (Houston-Galveston Area Council 2015). The shapefile for evacuation routes was

provided by the Texas Department of Transportation website (TxDOT – TPP – Data

Management TPP-GIS@txdot.gov. 2019). Reference maps of population density in the Houston

metropolitan area along with a map of evacuation routes and evacuation zones are presented in

Figure 8 and Figure 9.

A map of resources was also made based on the questions answered in the survey

questionnaires. The responses to Question 8 were used for generating a map of the resources

available during the hurricane; however, it should have stated that Question 9 was to be used for

that purpose. The map in Figure 10 displays the resources and services offered by the pet

shelters during Hurricane Harvey. The map of the shelter locations was created using ArcGIS

Pro as mentioned previously. The symbols were created with, and placed onto the base map

image using, Adobe Photoshop Elements 10 (Adobe Systems Incorporated 2011).

Results

While the number of responses to the survey was limited, the data did provide some

insight and were consistent with information previously available. Of the 40 animal shelters

surveyed, 15 (37.5 percent) respondents completed the survey questionnaire and one sent a

document which answered some of the research questions. Respondents from the shelters had

the option to skip any question in the survey if they did not want to answer it. Because of the

low number of returned questionnaires, only descriptive statistics were employed to present the

results from the survey's respondents.

The first question in the survey questionnaire asked the respondent to identify the name of the shelter. A list and map locating some of the responding shelters appears in the appendix. The second question asked if the facility was open to boarding pets as a service for payment. All 15 respondents reported that they did not board pets as a service for payment. The third question asked whether or not the facility was operational throughout the hurricane, and the shelter respondents were asked to provide any extra comments. As reflected in the literature by Glassey (2018), it was not unusual for shelters in this study to evacuate their animals prior to, or after a storm, to keep animals safely sheltered. Of the 15 responses, 87 percent of the responding facilities were able to remain operational during the events of the hurricane. These responses may be seen in Figure 1.
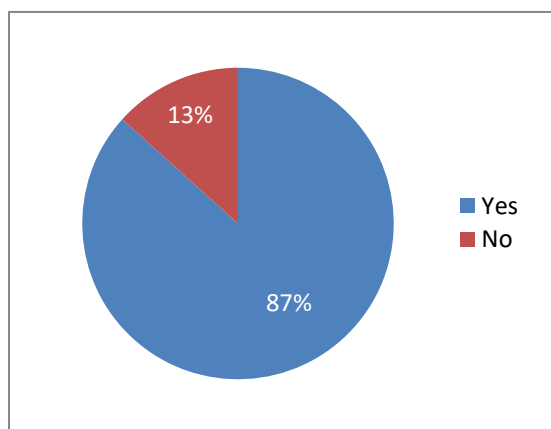

Figure 1: Was the facility operational
during Hurricane Harvey?

Question 4 asked how many days before the hurricane was the shelter taking in pets for boarding. A third of the 12 responses to the question reported taking in pets before the hurricane for boarding. One shelter respondent specifically mentioned that they boarded pets, but not as a service for payment; another specified taking in stray pets. The fifth question of the survey asked what the maximum capacity of the shelter was, while the sixth question asked if that capacity was ever reached during the events of the hurricane. Fifty-four percent of the 13

responses to Question 6 reported that they reached maximum capacity during the events of the storm (Figure 2). In the additional comments provided by the shelters, this was reached at several different points during the storm.
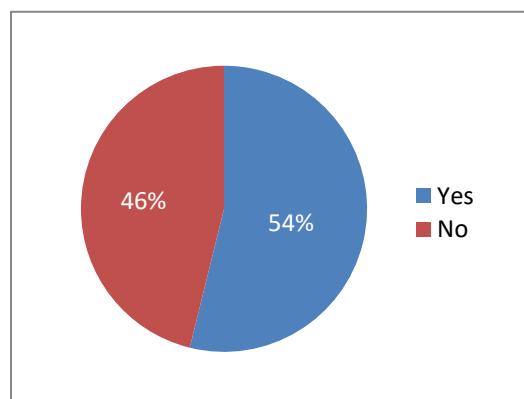

Figure 2: Did the shelter reach maximum capacity?

Question 7 asked for the number of boarded pets and non-boarded pets brought in during the hurricane. This question was asked to provide information on the proportion of owned pets to stray animals that were brought in. One shelter respondent reported taking in pets for boarding during the hurricane, but not as a service for payment. Of the 15 responses to this question, 80 percent reported taking in non-boarding pets.

Figure 3 reflects responses from Question 8 that inquired about the types of pets sheltered as well as approximately how many of each were in the facility at the time of the hurricane. Fourteen shelter respondents answered this question. The six types of pets included dogs, cats, birds, small animals, exotic pets and large animals such as pigs and goats. A majority of the types of pets that were sheltered at the facilities were dogs and cats. Every shelter that responded had dogs in their facility during the storm. Of the total pets sheltered by the responding facilities, about 67 percent were dogs. Cats made up the second largest percentage of pets sheltered during the storm accounting for about 31 percent of the total pets sheltered. Less than

two percent of the pets were other animals. One shelter had a bird at the facility, two shelters had small animals, two shelters had exotic pets, and two shelters housed a few larger animals during the storm.
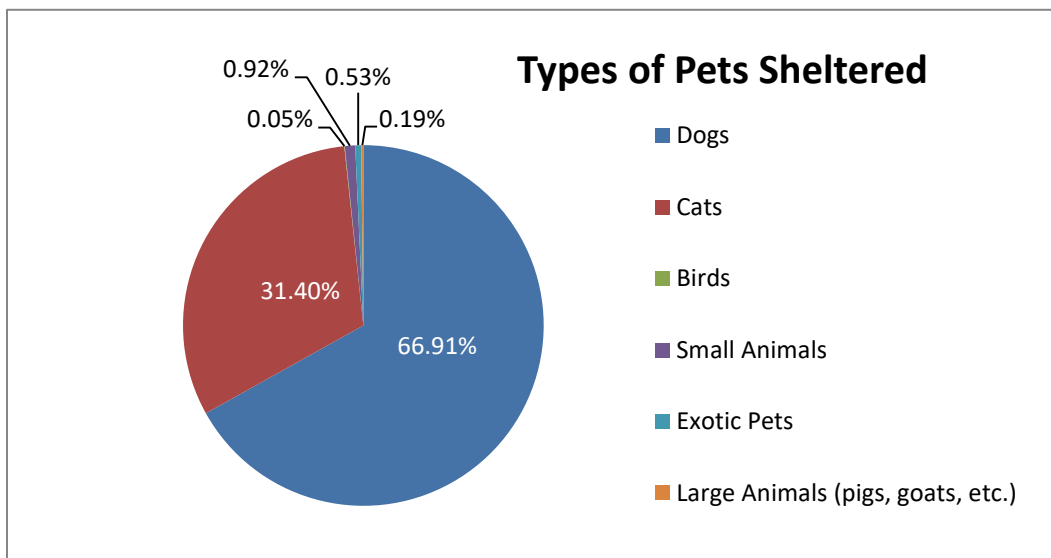

Figure 3: Total number of pets sheltered at all the responding facilities and the types of pets sheltered.

To help answer the first research question, Question 9 of the survey questionnaire asked facilities what types of resources and services were made available to pets during the hurricane. Resources listed by shelter respondents were divided into different categories. These responses appear in the chart in Figure 4.
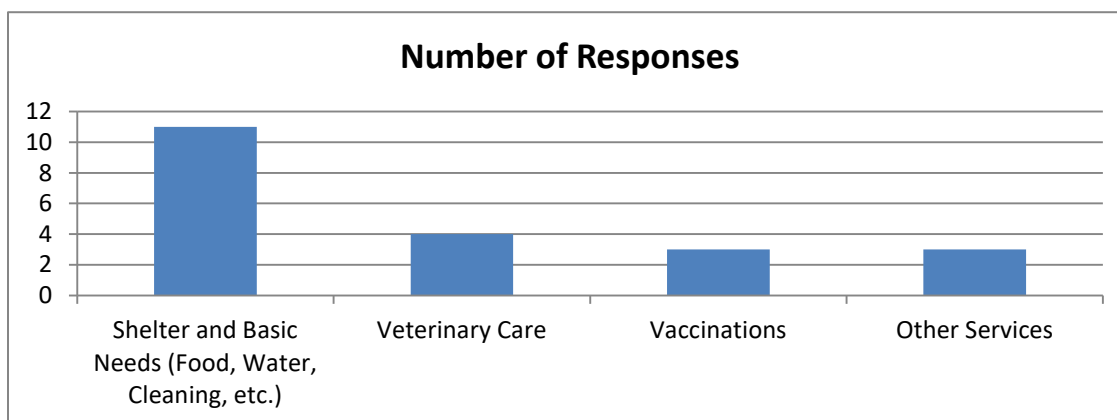

Figure 4: What services and resources were available to pets?

Of the 12 responses to the question, 92 percent reported having shelter and basic needs available to pets during the hurricane with a few that were able to provide additional resources. These basic needs included food, water, clean-up, and walking the pets. A third of the shelters reported that they were also able to provide some sort of medical or veterinary care to pets. Vaccinations for animals were another example of a resource offered by the shelters. Another additional service provided by one shelter was to assist in the reunification of pets with owners. In the only document sent by one of the shelters, they described running a temporary shelter during the hurricane and ensured that pets were able to stay with their owners. They made sure to document all intakes and that animals received vaccinations.

To help answer the second research question regarding the problems that were encountered by shelters during the hurricane, Question 10 of the survey questionnaire asked for respondents to explain any specific problems that had been encountered during the disaster. There were 11 responses to this question. Specific problems shelters experienced that were reported in the responses were consistent with common problems that occur in the events of a hurricane. It was fortunate that several of the responding shelters mentioned little to no problems were encountered. Staff and volunteers caring for pets during the disaster worked hard to ensure that the needs of the pets were met. Although the shelters were able to accomplish their mission, they did report on a few problems. Two of these problems were the need for extra staff and extra shelter space due to the increase of animals being sheltered. Other problems noted included flooding, which made it difficult for staff to report to the shelter and the inability of owners to return for their pets or to find alternate locations to take their pets. There were five shelters that did not report experiencing any problems at all.

Question 11 asked if shelters had to be evacuated before or during the disaster and if so,

when. Ninety-three percent of the 15 responses did not have to evacuate. Only one shelter reported that they had to be evacuated before the hurricane and the pets were evacuated before the events of the hurricane. Another reported clearing almost all the pets in the shelter prior to the storm, but still being able to remain in operation and accept more animals.

Question 12 of the survey questionnaire asked if shelters had made any alterations to their disaster plans after the hurricane. This question helped to answer the third research question regarding the need for additional resources and the type of resources needed. Nearly half responded that they had made changes to their disaster plans since the hurricane. According to the 15 responses, 46.67 percent, answered "yes" and the remaining 53.33 percent answered "no." This information may be seen in Figure 5. This is significant because it showed the impact that Hurricane Harvey would have in the future of planning.
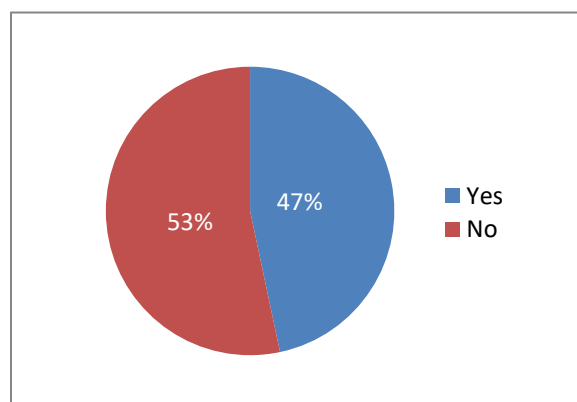

Figure 5: Did you make any changes to your disaster plans after the events of Hurricane Harvey?

The next two questions asked, if shelters would be willing to accept animals either for boarding as a service for payment (Figure 6) or for accepting strays or non-owner drop-offs in the event of a future major hurricane (Figure 7). When shelters were asked if they would be open to boarding animals as a service for payment, 20 percent of the 15 responses answered "maybe," while the remaining 80 percent answered "no." This information is displayed in

Figure 6. When shelters were asked if they would be open to accepting strays or non-owner

drop-offs in the event of a major hurricane, of the 15 responses, 66.67 percent said they would.

Another 26.67 percent of shelters answered that they might and the remaining 6.67 percent

answered that they would not. This information may be seen in Figure 7.
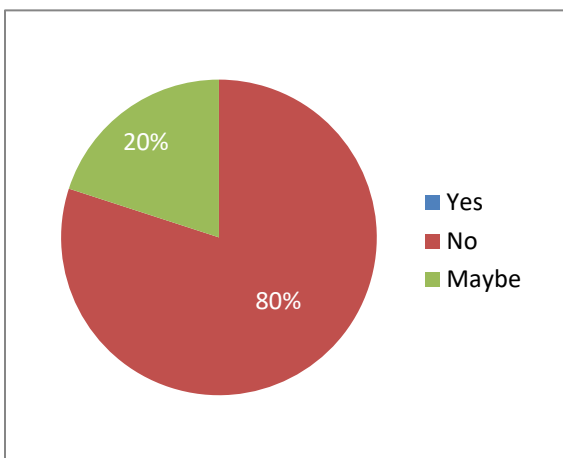

Figure 6: In the event of a major hurricane (Category 3, or higher) in the future, will your facility open for boarding animals as a service for payment?
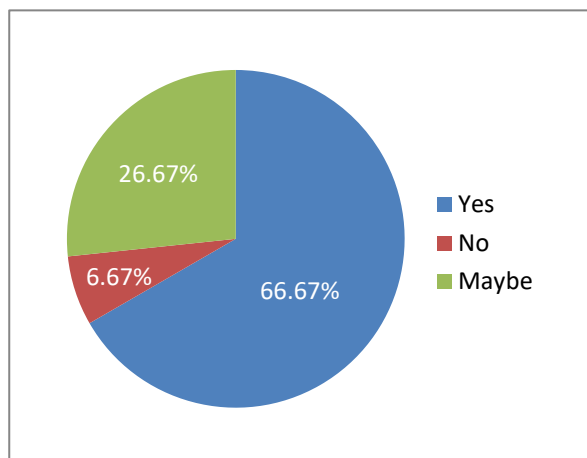
Figure 7: In the event of a major hurricane (Category 3, or higher) in the future, will your facility be open for accepting animals that are strays or non-owner drop-offs?

Another question to help answer the final research question is Question 15. Question 15

asked respondents to write any specific suggestions for future planning in pet sheltering during

hurricane evacuations. A few shelters responded with specific suggestions for pet sheltering

planning in the event of a future hurricane. One specific suggestion that was recommended by

respondents was for pet owners to ensure they have a disaster plan before a disaster strikes. As

stated before, it is consistent with prior research presented in the literature review and mentioned

by FEMA, as well as, other organization websites. It is extremely important for pet owners to

plan for evacuating with their pets or to find a safe place to shelter their pets ahead of time from

the dangerous conditions of a hurricane. Another suggestion that was made was to ensure that

pets had adequate identification. Several shelters also gave the suggestion to ensure that there

were enough resources to accommodate the increased number of animals, as well as having emergency power. Finally, there was also a suggestion to create state-designated evacuation sites for sheltering animals.

Several findings are also present when examining the map of shelters in the Houston metropolitan area. Information from the responses was also compared to the map. Most shelters were located outside of the floodplain. Six of the shelters were located in a flood zone with four being located in the one percent chance, or 100-year floodplain, and two shelters located in a flood zone with a .2 percent chance, or 500-year floodplain. However, none of the six shelters reported flooding at their facility. It was interesting that the one shelter that did report flooding was not located in either the 100-year or 500-year floodplain. Eight of the responding shelters were located in an evacuation zone.

Conclusion

Many people consider their pets a part of the family and they care about their pet's safety in dangerous situations which include natural disasters. This highlights a need for more research in the field of emergency management at various levels of government. Animal care workers, organizations and volunteers were important in helping to care for pets in 2017 Hurricane Harvey. The problems described by the shelters were not unique to this particular hurricane and have been apparent in other disasters. Many of the issues discussed by shelter respondents were typical during the occurrence of a hurricane.

The first research question, regarding the resources available and the procedures that were in place at the responding pet shelters during the events of Hurricane Harvey, was addressed by several questions in the survey questionnaire. Questions 2, 3, 4, 5 and 9 revealed that shelters had several different resources available and procedures set in place for pets during

the hurricane. Some of the resources provided by the animal shelters as reported by the

respondents included shelter, basic needs such as food, water and exercise, and veterinary care.

The responses from the survey questionnaire also indicated that almost all of the responding

shelters were able to take strays and non-owner drop-off pets during the storm and remain in

operation.

In determining the problems these facilities encountered sheltering pets during and after

the hurricane, most of the problems in this case study were similar to those reported in the

literature review. Questions 5, 6, 7, 8, 10 and 11 confirmed these issues. Two problems reported

by the responding shelters were the need for more staff and a lack of space as the number of pets

coming into the shelters increased. As seen in the findings, most of the shelters reached

maximum capacity and, as news articles reported, animals had to be transferred to other shelters.

These findings reinforce the major problem reported in the literature review of the significant

numbers of stray pets and a need for resources and staff to accommodate them all. The hurricane

also caused difficulties for pet owners and staff attempting to get to the responding shelters. Five

of the shelters also revealed that they did not experience any problems at all.

For the final research question, regarding specific future needs and suggestions, shelters

responded in Questions 7, 8, 12, 13 and 14. Clearly, they revealed that additional resources will

be needed to accommodate the increase in sheltered pets during a major hurricane, Category 3 or

higher. The specific needs reported are for additional trained staff and space. Additionally, the

respondents emphasized the importance of and the need for having a plan for animals and

continuing to encourage future planning. As determined by the suggestions in response to

Question 15, it is important that pet owners, facilities and communities be prepared for their

safety as well as their pets before a disaster strikes. Several responding shelters mentioned in

their recommendations, ensuring that there will be enough resources will be important when planning for future hurricanes. Communication and increasing awareness about proper procedures to pet owners and helping them to understand their options will also be important to consider in the future.

Limitations

It is important to note there were several limitations in this research. First, only 40 pet sheltering facilities in the Houston area were surveyed with a limited number of survey questionnaires returned which limited the results of this project for generalizing to the entire Houston area. There was no consolidated and up-to-date database of all animal shelter facilities in the Houston metro area, therefore, not every facility could be located for receiving a survey questionnaire. When searching for shelters, some websites for different organizations also had limited or missing contact information and at times, it was unclear if the organization had a facility. Also not included were the large number of temporary shelters, pet trailers, and shelters that housed pets with people. Finally, this project, specifically, examined shelters for household pets such as dogs and cats rather than large farm animals such as horses or cows. Large animals require more space and different resources than household pets; however, according to the findings, various shelters also housed a few large animals at their facilities during the storm. As mentioned previously, there were shelters all around the state and country that offered to take in and care for animals during and after the events of the hurricane.

Future Research

Continuing research on this subject will prove useful in planning for future disasters. Improving this survey to ask additional questions about these needs would be beneficial. Expanding the study area to include more of the Texas Gulf Coast or more surrounding areas

would also be beneficial because it would increase the amount of shelters to survey and, therefore, possibly provide more responses from which to gather data. Additionally, expanding other aspects of the research could benefit the study as well, such as including other types of shelters. Future studies could possibly include surveying temporary shelters, boarding facilities or veterinary offices. More responses can lead to an even better understanding of experiences during disasters and can more accurately identify specific needs and problems of pet shelters and the services available to the community by all types of pet care providers. Another possible study to consider in the future would be to survey pet owners during Hurricane Harvey to find out what their needs were during the disaster.
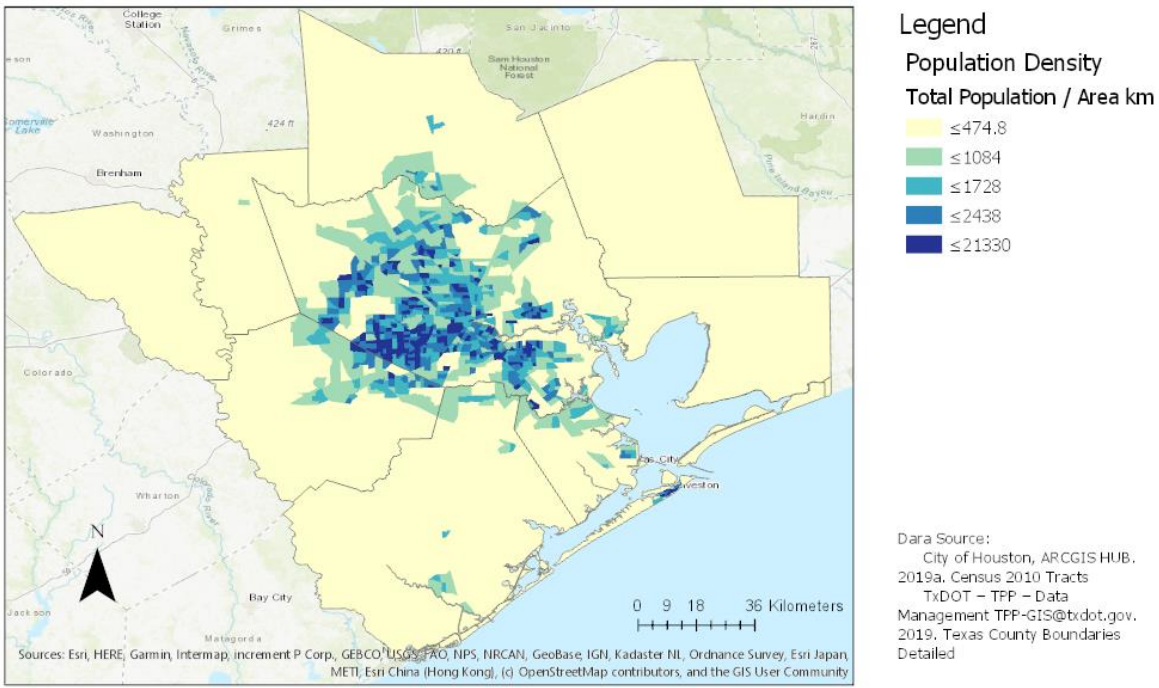
Population Density of the Houston Metro Area

Figure 8: Population density map of the Houston Metro Area.

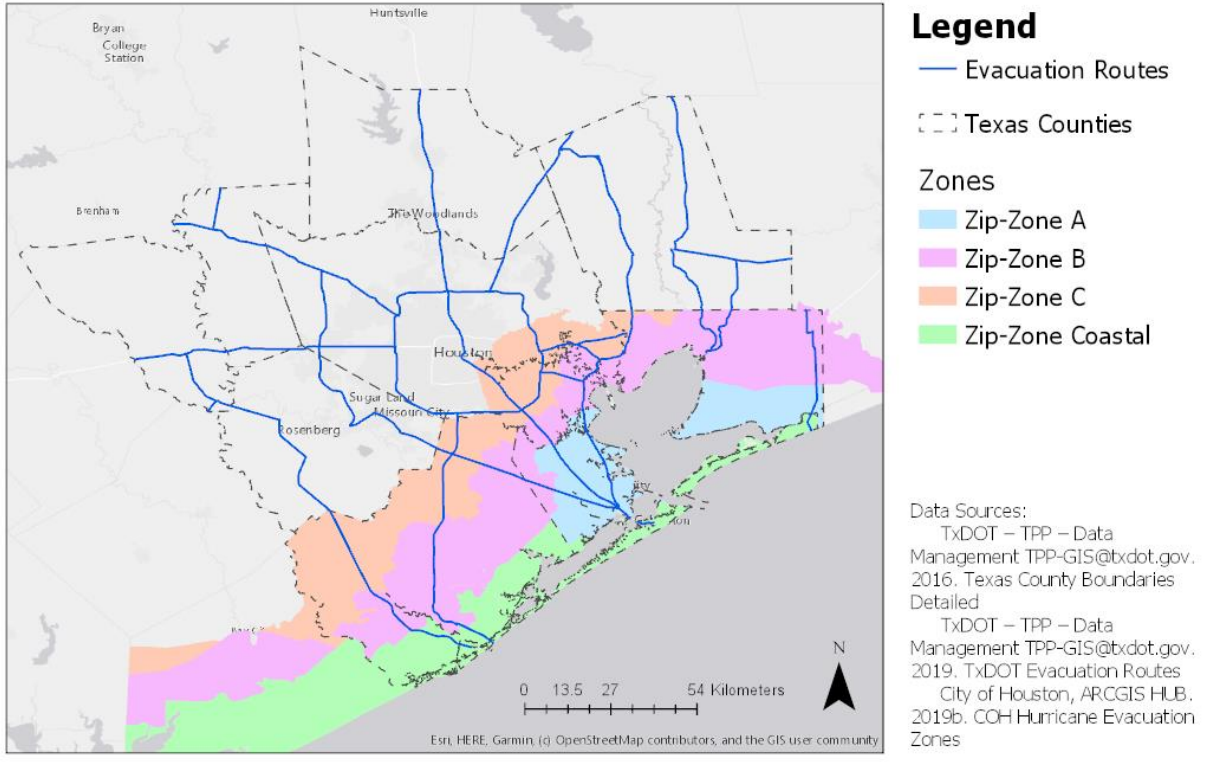## Evacuation Routes and Evacuation Zones

Figure 9: Hurricane evacuation zones and evacuation routes in the Houston Metro Area.

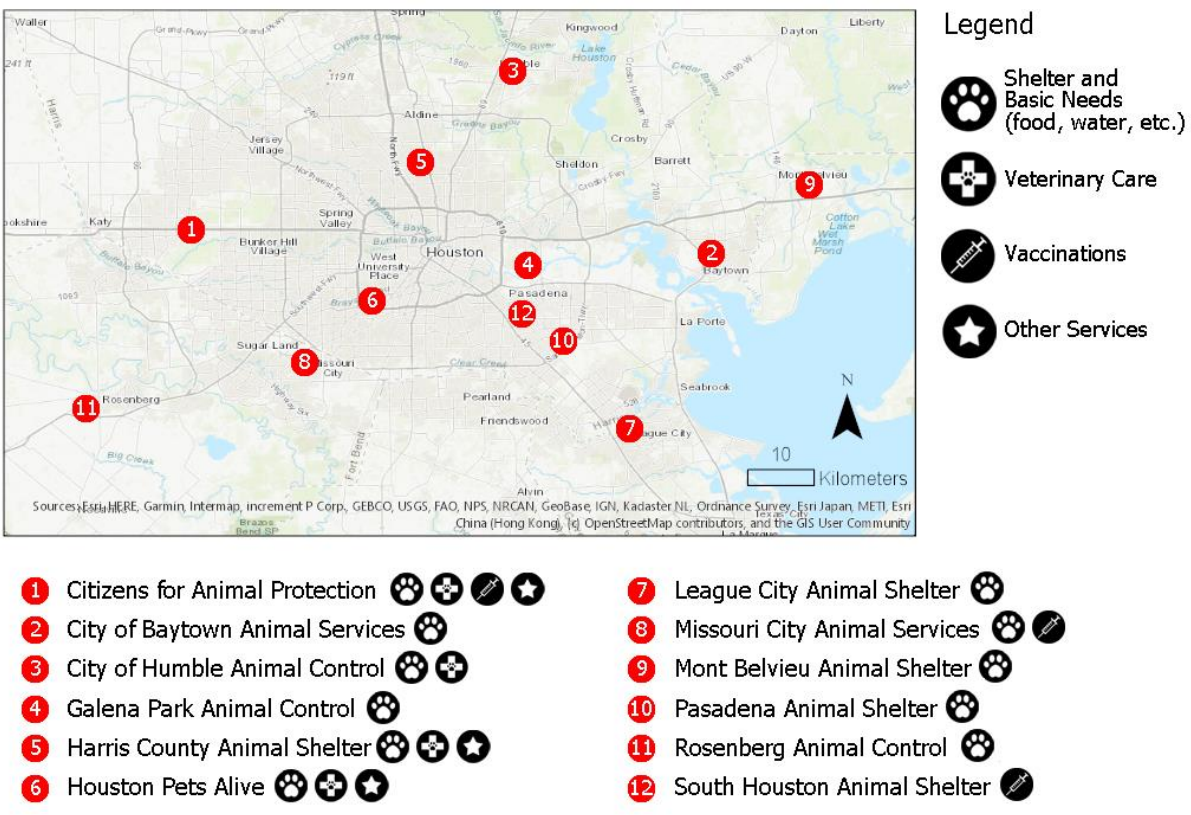# Resources Available by Animal Shelters during Hurricane Harvey

Figure 10: This map shows the resources each shelter had available to pets during Hurricane Harvey.

Sample Survey:

Planning for Sheltering Pets during Hurricane Evacuations

This survey asks about the circumstances experienced by pet shelter facility operators during

Hurricane Harvey in 2017. Your responses will be helpful for understanding how shelter

operators dealt with the acceptance and management of animals during the hurricane disaster.

This information also will be helpful for pet owners as well as those who might just drop-off lost

animals in future disaster occurrences. This survey is part of a master's degree research project

conducted by Ms. Melanie Ratchford from Texas State University (mar254@txstate.edu), under

the supervision of her advisor, Dr. Denise Blanchard (rb06@txstate.edu). Please contact either

of us if you have any questions or concerns. The survey should take no more than 15 minutes of

your time. Your responses may be answered with a typed response. Answers not applicable can

be answered with a N/A. This is a general information survey and we are not asking for any

personal information. Please do not include your name, answer only the questions you are

comfortable with. Questions 1, 2 and 8 will be used to generate a map of locations and resources

that were available during the hurricane. Your responses will be confidential and only Dr.

Blanchard and I will have access to information and data in a secure electronic file. For the final

report, your data and information will be aggregated along with other participants-that is,

individual survey results will be combined together and presented as a group. We will be happy

to send you a copy of the final report if you will indicate your preference at the end of the

survey. Thank you in advance for your assistance.

1. Please type the name of your shelter:

   _____

2. As Hurricane Harvey approached, was your shelter open for boarding pets, where boarding is a service for payment?

      Yes   No

3. During the events of Hurricane Harvey, was your facility operational throughout the duration of the hurricane?

      Yes   No

      Any comments?

      _____

4. How many days prior to the hurricane did your shelter accept pets for boarding?

      _____

5. What was the maximum number of pets that your facility could board?

      _____

6. Was the maximum capacity reached?

      Yes   No

      If Yes, at what point?

      _____

7. How many pets were brought in for sheltering during the hurricane?

      Boarding (payment for service) _____

      Non-Boarding (strays or non-owner drop-off) _____

8. What types of pets and approximately how many were sheltered at the facility?

      Dogs _____

      Cats _____

      Birds _____

Small Animals _____

Exotic Pets _____

Large Animals (pigs, goats, etc.) _____

9. What services and resources were available to pets being sheltered at your facility?

    (Boarding, veterinary care, etc.)

    _____

10. Were there any specific problems that were encountered?

    Please explain:

    _____

11. Did your shelter have to be evacuated before or during the events of the hurricane?

    Yes   No

    If Yes, before or after the hurricane?

    _____

12. Did you make any changes to your disaster plans after the events of Hurricane Harvey?

    Yes   No

13. In the event of a major hurricane (Category 3, or higher) in the future, will your facility

    open for boarding animals as a service for payment?

    Yes   No   Maybe

14. In the event of a major hurricane (Category 3, or higher) in the future, will your facility

    be open for accepting animals that are strays or non-owner drop-offs?

    Yes   No   Maybe

15. Do you have any specific suggestions for future planning of pet sheltering during

    hurricane evacuations?

_____

16. If you would like to receive a copy of my report, please include the mailing address of

your shelter.

_____

Thank you for your time and participation.

Works Cited

Adobe Systems Incorporated. Adobe Photoshop Elements 10 (version 10.0). September 2011.
Version 10.0.

Blake, Eric S., and David A. Zelinsky. 2018. National Hurricane Center Tropical Cyclone Report
Hurricane Harvey (AL092017). PDF. *National Hurricane Center*.
https://www.nhc.noaa.gov/data/tcr/AL092017_Harvey.pdf (accessed September 11,
2019).

Carissimo, Justin. 2017. Thousands of animals expected to flood shelters after Harvey. *CBS
News*. https://www.cbsnews.com/news/harvey-animals-flood-shelters-houston-texas/
(accessed October 30, 2019).

Chadwin, Robin. 2017. Evacuation of Pets During Disasters: A Public Health Intervention to
Increase Resilience. *American Journal of Public Health* 107 (9): 1413-1417.
10.2105/AJPH.2017.303877.

City of Houston. n.d. About Houston Facts and Figures.
https://www.houstontx.gov/abouthouston/houstonfacts.html (accessed September 10,
2019).

City of Houston, ARCGIS HUB. Census 2010 Tracts [Layers]. Scale Not Given. "City of
Houston, ARCGIS HUB." 2019a.
https://cohegis.houstontx.gov/cohgispub/rest/services/PD/Demographics_wm/MapServer
(October 30, 2019).

—.COH Hurricane Evacuation Zones [Feature Layer]. [750000:0]. "City of Houston, ARCGIS
HUB." 2019b. https://cohgis-mycity.opendata.arcgis.com/datasets/coh-hurricane-
evacuation-zones (October 30, 2019).

Congress.gov. 2006. H.R.3858 - Pets Evacuation and Transportation Standards Act of 2006.
https://www.congress.gov/bill/109th-congress/house-bill/3858 (accessed September 26,
2019).

Day, Ashleigh M. 2017. Companion animals and natural disasters: A systematic review of
literature. *International Journal of Disaster Risk Reduction* (Elsevier Ltd) 24: 81-90.
10.1016/j.ijdrr.2017.05.015.

Department of Homeland Security. n.d. Pets and Animals. Ready.gov.
https://www.ready.gov/animals (accessed March 18, 2019).

Esri. 2018. ArcGISPro. *ArcGIS Pro.* https://www.esri.com/en-us/arcgis/products/arcgis-
pro/overview (accessed October 30, 2019).

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Esri, HERE, Garmin, Intermap, increment P Corp. GEBCO, USGS, FAO, NPS, NRCAN,
GeoBase, IGN, Kadaster NL, Ordinance Survey Esri Japan, METI, Esri China (Hong
Kong) (c) OpenStreetMap contributors, and the GIS User Community

Farmer, Ashley K., Sarah E. DeYoung, and Tricia Wachtendorf. 2016. Pets and Evacuation: An
Ongoing Challenge in Disasters. *Journal of Homeland Security and Emergency
Management* 13(4): 1-13. 10.1515/jhsem-2016-0051.

Glassey, Steve. 2018. Did Harvey Learn from Katrina? Initial Observations of the Response to
Companion Animals during Hurricane Harvey. *Animals* 8(4): 1-9. 10.3390/ani8040047.

Guillen, Darla. 2017. NRG is sheltering pets that were displaced in Harvey's wake. *Houston
Chronicle*. https://www.houstonchronicle.com/news/houston-
weather/hurricaneharvey/article/NRG-sheltering-pets-displaced-dogs-cats-Harvey-
12191559.php (accessed October 30, 2019).

Haag, Matthew. 2017. Saving Pets Is Paramount for Many Fleeing Tropical Storm Harvey. *The New York Times.* https://www.nytimes.com/2017/08/28/us/harvey-pets-animals.html (accessed September 26, 2019).

Harbage, Claire. 2017. Houston Shelter Offers Respite For Pets And Their Owners Displaced By Harvey. NPR. https://www.npr.org/2017/09/02/547855336/houston-shelter-offers-respite-for-pets-and-their-owners-displaced-by-harvey (accessed October 30, 2019).

Heath, Sebastian E., and Robert D. Linnabary. 2015. Challenges of Managing Animals in Disasters in the U.S. *Animals* 5 (2): 173-192. 10.3390/ani5020173.

Houston-Galveston Area Council. FEMA Floodplains NFHL 2015. [File Geodatabase Feature Class]. [1:5,000, 1:150,000,000]. "GIS Datasets." 2015. https://h-gac.sharefile.com/share/view/s3afeac2a3314e4bb (October 30, 2019).

Kenning, Chris. 2017. Hurricane Harvey threatens thousands of pets and livestock. *Reuters*. https://www.reuters.com/article/us-storm-harvey-animals/hurricane-harvey-threatens-thousands-of-pets-and-livestock-idUSKCN1B600I (accessed September 20, 2019).

Leonard, Hillary A., and Debra L. Scammon. 2007. No Pet Left Behind: Accommodating Pets in Emergency Planning. *Journal of Public Policy & Marketing* 26 (1): 49-53. 10.1509/jppm.26.1.49.

Louisiana SPCA. n.d. Animal Rescue Facts. https://www.la-spca.org/about/katrina-dogs-animal-rescue-stories/rescuefacts (accessed February 18, 2019).

Murphy, Eliza. 2017. *Stranded pets rescued amid Hurricane Harvey flooding in southeastern Texas. ABC News Network.* https://abcnews.go.com/Lifestyle/stranded-pets-rescued-amid-hurricane-harvey-flooding-southeast/story?id=49465792 (accessed September 26, 2019).

National Weather Service of Houston/Galveston. n.d. Hurricane & Severe Weather Guide. PDF.

National Weather Service.

https://www.weather.gov/media/hgx/Hurricane%20Guide%202017.pdf (accessed

February 18, 2019).

Parraga, Marianna. 2017. Texans refuse to leave pets behind as they flee Harvey. *Reuters.*

https://www.reuters.com/article/us-storm-harvey-animals/texans-refuse-to-leave-pets-

behind-as-they-flee-harvey-idUSKCN1B82A1 (accessed September 20, 2019).

Silva, Daniella. 2017. Animal Lovers, Shelters Scramble to Save Pets in Wake of Harvey. *NBC*

Universal. https://www.nbcnews.com/storyline/hurricane-harvey/animal-lovers-shelters-

scramble-save-pets-wake-harvey-n797281 (accessed September 26, 2019).

Statistical Atlas. 2018. Overview of the Houston Area, Texas (Metro Area).

https://statisticalatlas.com/metro-area/Texas/Houston/Overview (accessed September 10,

2019).

SurveyMonkey. 1999-2019. SurveyMonkey. https://www.surveymonkey.com/ (accessed

September 10, 2019).

Texas Animal Health Commission. n.d. Animal Issues Committee Guidance Document. PDF.

Texas Animal Health Commission.

https://www.tahc.texas.gov/emergency/AnimalIssuesCommitteeGuidance.pdf (accessed

February 18, 2019).

TxDOT – TPP – Data Management TPP-GIS@txdot.gov. Texas County Boundaries Detailed

[FeatureServer]. Scale Not Given. "Texas Department of Transportation Open Data."

2016.

https://services.arcgis.com/KTcxiTD9dsQw4r7Z/arcgis/rest/services/Texas_County_Bou
ndaries_Detailed/FeatureServer (October 30, 2019).

—. TxDOT Evacuation Routes [Feature Layer]. Scale Not Given. "Texas Department of
Transportation Open Data." 2019.
https://www.arcgis.com/sharing/rest/content/items/f2e4fdd46b764af4a514ce6391900d21/
info/metadata/metadata.xml?format=default&output=html (October 30, 2019).

The Humane Society of the United States. n.d. Make a disaster plan for your pets.
https://www.humanesociety.org/resources/make-disaster-plan-your-pets (accessed May
14, 2019).

Thompson, K. 2018. Facing disasters together: how keeping animals safe benefits humans
before, during and after natural disasters. *Revue scientifique et technique (International
Office of Epizootics)* 37 (1): 223-230. 10.20506/rst.37.1.2753.

United States Census Bureau. n.d. U.S. Census Bureau QuickFacts: Houston city, Texas.
https://www.census.gov/quickfacts/houstoncitytexas (accessed September 9, 2019).

US Dept of Commerce National Oceanic and Atmospheric Administration. n.d. Major Hurricane
Harvey - August 25-29, 2017. https://www.weather.gov/crp/hurricane_harvey (accessed
September 11, 2019).