

Preparedness, response, and recovery: Disaster management planning for the urban  
forest of Manhattan, Kansas

by

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A REPORT

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## Abstract

Climate change is impacting weather patterns and increasing the frequency and intensity of natural disasters (Trenberth 2018). A natural disaster includes any type of severe weather that poses a significant threat to human health and safety, property, critical infrastructure, and homeland security. Natural disasters that are most impactful to trees, include severe storms with flooding, ice, and/or strong winds, including hurricanes, tornados, and derechos. As means to prepare for natural disasters, many cities create disaster management plans. A disaster management plan refers to “the entire process of planning and intervention to reduce disasters as well as the response and recovery measures” (Blanchard 2008) and typically consists of four phases: mitigation, preparedness, response, and recovery. However, a focus on trees is often missing within disaster management plans. Yet, as natural disasters are predicted to increase, the need for disaster management plans to include specific provisions for trees is necessary. Without strategies for tree resiliency, recovery, and replacement, urban areas may experience catastrophic losses of urban tree canopy for decades after a natural disaster.

To demonstrate how small/rural cities in the Great Plains region can develop disaster management plans that include a focus on trees, this project centers on Manhattan, Kansas and makes key recommendations on how the city can modify its preparedness, response, and recovery phases. To inform the recommendations, interviews with subject matter experts and a case study of Cedar Rapids, Iowa, which was impacted by a derecho in 2020, was developed. Key recommendations for Manhattan include the necessity of conducting a tree inventory, developing an urban forestry master plan, planting for resilience, and creating a specific recovery plan for trees.



# Preparedness, Response, and Recovery:

## Disaster Management Planning for the Urban Forest of Manhattan, Kansas

*Figure 1.1*

*Cedar Rapids  
Vegetative Debris  
Cleanup*

Richard Colwell

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## **Abstract**

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To my mother Maria and friend Candelaria for doing the best you could with what you had to help see me through all of this.

## Dedication

I dedicate this book to Gus van der Hoeven. This is a culmination of my best efforts through higher education. As hard as everything was growing up, you always encouraged me to seek higher education, and made me believe I could eventually earn the title of Landscape Architect no matter the circumstances.

## Preface

The inception of the topic for my research was born out of the search to find a meaningful connection between my work from volunteering in the disaster recovery of the 2020 derecho in Cedar Rapids, and how landscape architects could serve an important role in a city's recovery.

While working in Wisconsin as an ecological restoration technician for my internship, the state of Iowa was devastated by a derecho. Cedar Rapids declared a federal emergency and needed volunteers to help recover. The proximity of Cedar Rapids to where I was living in Wisconsin at the time made it possible for me to commute after my work week and dedicate my weekends in the recovery efforts. One interesting opportunity that arose during my involvement of the cleanup was the tagging of trees in need of pruning or removal from the storm. My education at K-State in the horticulture and landscape architecture departments allowed for me to assist in identifying certain species of trees with city appointed foresters needing help tagging trees. In the end, I would find out through my research and interviewing of professionals that my work involving tagging and identifying trees would be uploaded into Cedar Rapids existing tree inventory, and the public parks would become inventoried for the first time. The inventorying and identifying of said trees would allow for a local landscape architecture firm to help quantify the data, showed what was lost, and ultimately helped in the creation Cedar Rapids ReLeaf Plan.



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## Terms

**Urban Forest** - Like the forests we see in nature, but in our cities and towns.

**Urban Forestry** - A planned and programmatic approach to the development and maintenance of the urban forest, including all elements of green infrastructure within the community, in an effort to optimize the resulting benefits in social, environmental, public health, economic, and aesthetic terms, especially when resulting from a community visioning and goal-setting process

**Urban Canopy** - The layer of tree leaves, branches, and stems from all publicly and privately owned deciduous and coniferous trees, forests, and understory within urban settlement areas which provide measurable coverage of the ground

**Disaster Management Plan** - the entire process of planning and intervention to reduce disasters as well as the response and recovery measures. It is often a neglected element of development planning

**FEMA** – Federal Emergency Management Agency

**PAPPG** - Public Assistance Program and Policy Guide

**NDRF** – National Disaster Recovery Framework

**DFA** – Direct Federal Assistance

**PDA** – Preliminary Damage Assessment

**NUCFAC** – National Urban and Community Forestry Advisory Council

**USDA** – United States Department of Agriculture

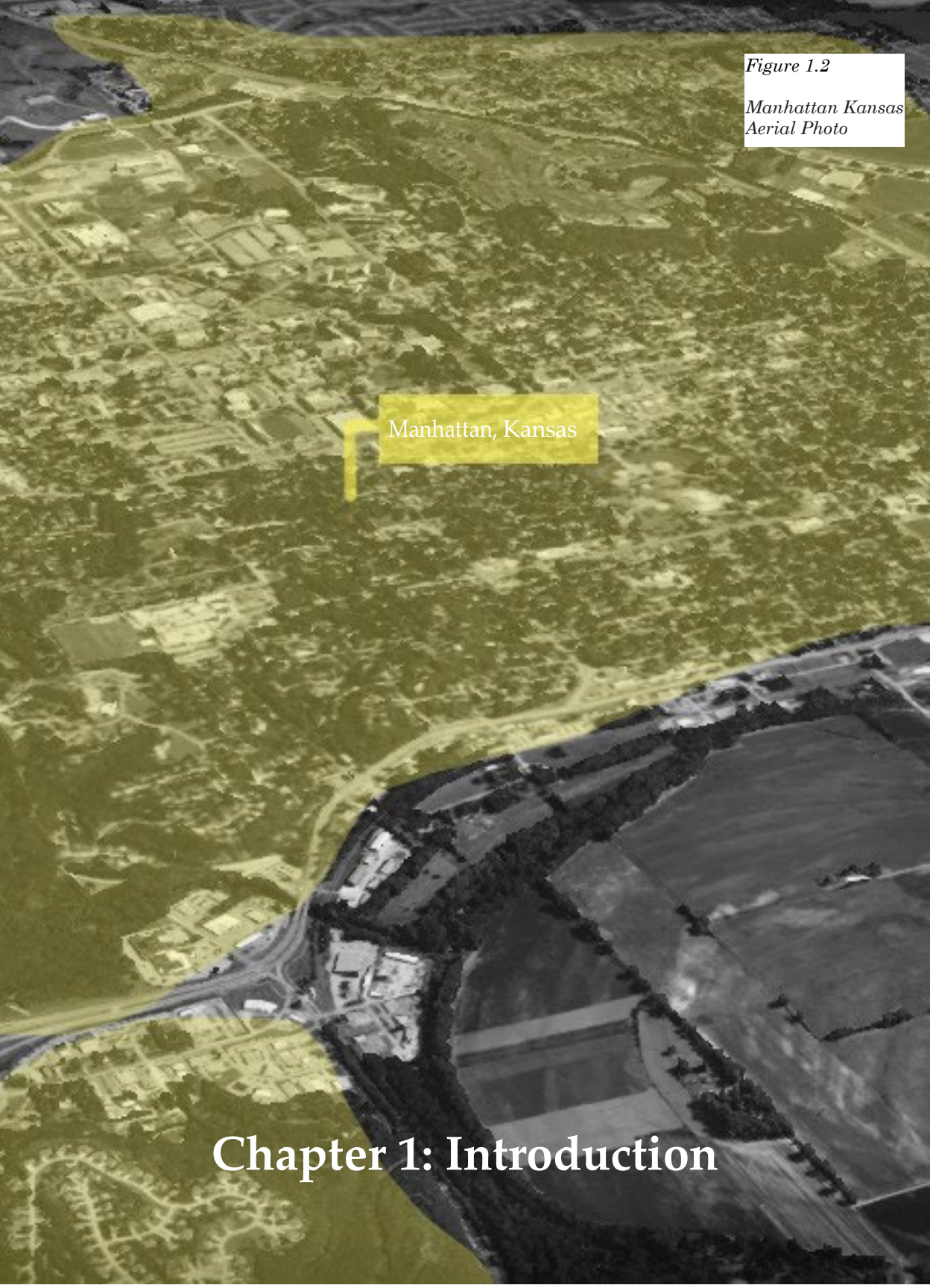
**CERT** – Community Emergency Response Team

**LEPC** – Local Emergency Planning Committee

**WARN** – Weather Amateur Radio Network

**CISM** – Critical Incident Stress Management

**KEMA** – Kansas Emergency Management Association



*Figure 1.2*

*Manhattan Kansas  
Aerial Photo*

Manhattan, Kansas

# Chapter 1: Introduction

# Chapter 1: Introduction

Climate change is a considerable threat to social and ecological systems (IPCC 2014). Climate change is affecting weather patterns and increasing the frequency and intensity of natural disasters (Trenberth 2018). A natural disaster includes all types of severe weather, which have the potential to pose a significant threat to human health and safety, property, critical infrastructure, and homeland security. Natural disasters occur both seasonally and without warning, subjecting the nation to frequent periods of insecurity, disruption, and economic loss (Department of Homeland Security, 2018). As Natural disasters increase, so too do their devastating effects on people, including property damage, displacement, and even death. Accordingly, each year cities are spending more on disaster recovery programs (Schwab 2009).

As means to prepare for natural disasters, many cities create disaster management plans. A disaster management plan refers to “the entire process of planning and intervention to reduce disasters as well as the response and recovery measures. It is often a neglected element of development planning” (Blanchard 2008).

Disaster management typically consists of four phases:

- 1) **mitigation** by preventing future emergencies or minimizing their effects;
- 2) **preparedness** to handle emergencies including preparations made to save lives and help response and rescue operations;
- 3) **response** to emergencies by taking action to save lives, prevent further property damage, and putting preparedness planning into action;
- 4) **recovery** from an emergency by receiving financial assistance, and taking action to return to a normal or safer situation following a disaster emergency (Lindsay 2013).

One aspect typically overlooked in a disaster management plan are trees. Trees provide cities with many environmental, social, and economic benefits, and should be considered a civic infrastructure. However, because an urban forest is not federally defined as infrastructure, like roads, utilities, and dwellings are, tree replacement is not a reimbursable expense. A review of Federal Emergency Management Agency (FEMA) documents revealed that trees damaged or lost in natural disasters are not eligible for federal recovery dollars, but expenses related to tree removal are.

Without a clear disaster management plan in place, hasty recovery efforts can ensue after a natural disaster (Ingram et al. 2006). For trees, hasty recovery entails complete removal of damaged trees, rather than selective pruning. During recovery, cities typically contract out for tree clean-up assistance and contractors are typically paid per removed tree. Untrained contractors may unnecessarily remove trees that could otherwise be saved, potentially leaving neighborhoods, parks, and public spaces with little to no trees remaining (McGrath 2022). Damaged trees are also removed due to public safety concerns, adhering to city ordinances and FEMA guidelines (McGrath 2022).

As natural disasters are predicted to increase, the need for disaster management plans to include provisions for trees is necessary. When a mature tree is lost, if a new tree is planted in its place, it may take 30 to 50 years for the new tree to replace the previous tree's benefits (Pomeroy 2014). Without plans for tree recovery and replacement, urban areas may experience catastrophic losses of urban tree canopy for decades afterwards. However, if a city's disaster management plan includes a focus on trees in all disaster management phases – mitigation, preparedness, response, and recovery – proactive measures can be taken to help lessen potential storm/pest damage, to clarify cleanup roles/processes, and to help guide the replanting of what is lost.

## Project Focus & Dilemma

To demonstrate how small/rural cities in the Great Plains region can develop disaster management plans that include a focus on trees, this project focuses on Manhattan, Kansas as a case study.

Manhattan, KS, a city of 54,000 residents (U.S. Census Bureau 2020) founded in 1854 (Rileycounty.gov). Located in the Flint Hills of the Great Plains, most of the city's urban forest has been intentionally planted. Because of these early planting efforts, the city has mature trees in its older neighborhoods, in several of the city's parks, in Sunset Cemetery, and throughout the Kansas State University campus. These trees are a significant asset for the city, but they are also susceptible to damage from high-winds, tornados, ice storms, droughts, and pests. Manhattan has a municipal forestry department that oversees city tree planting and maintenance, and it has the Arbor Day Foundation designation as a "Tree City USA" ([www.mhkprd.com/216/Forestry](http://www.mhkprd.com/216/Forestry)). However, in recent years the city is replacing fewer trees than they remove annually (LAR741 2021).

Manhattan has a disaster management plan, which is detailed in Chapter 4: Findings, but the plan does not specifically address trees. However, there is an opportunity to modify the city's disaster management plan to include a focus on trees and apply best practices of urban forestry and lessons learned from Cedar Rapids, IA who developed a tree recovery plan in response to a devastating Derecho in 2020.



*Figure 1.3 Archer Daniels Midland grain bins wrecked by the derecho in Cedar Rapids, IA*

## **Research Question**

How can Manhattan, Kansas's disaster management plan be modified to include provisions for the city's urban forest, in preparedness, response, and recovery phase?

### **Sub-questions:**

1. How do existing federal and state level disaster management plans address urban forests?
2. How is Manhattan's urban forest currently funded and managed?
3. What, if any, proactive measures are being taken to prepare Manhattan's urban forest against future adverse effects of natural disasters? (preparedness)
4. What lessons can be learned from Cedar Rapids' response to tree damage caused by the 2020 Derecho?
5. How can Manhattan learn from Cedar Rapids' recovery process and proactively plan for tree recovery after future storm events?

### **Project Goals**

- Explore what urban forest, and disaster management plans for trees exist
- Discover contemporary solutions for issues of tree recovery post-disaster
- Review differences between Manhattan's forestry plans, and Cedar Rapids forestry plans
- Create a plan for immediate response and organize steps for recovery of our urban forest post-disaster
- Create a proactive plan highlighting planting and management of current trees.



Findings from this project are intended to improve the disaster management plan of Manhattan, Kansas, demonstrating how it and other small/rural cities in the Great Plains region can increase focus on their urban forests. The recommendations are structured to parallel the three primary phases of disaster management: preparedness, response, and recovery. The preparedness section suggests how the city can best prepare its urban forest for the future effects of climate change, including natural disasters. The response sections details how the city can immediately respond to, and address fallen and damaged trees after a natural disaster strikes. The third section focuses on recovery, and how the city can begin rebuilding its urban forest.

## **Topic Relevance to Landscape Architecture**

Disaster management for trees is a relevant topic to landscape architects because they apply a systems-thinking approach to problem solving. Landscape architects can serve a role in helping cities with disaster management planning. They are knowledgeable about trees and understand the ecosystem benefits trees provide. Landscape architects help shape space and create pleasant environments with trees, which are essential elements of a healthy ecological system. In Cedar Rapids, IA, landscape architects were essential in post Derecho disaster recovery efforts, helping develop tree planting plans for the replacement of all trees destroyed within the city.

# Chapter 2: Background

To understand how Manhattan, Kansas can modify its disaster management plan to include a focus on trees, the background section of this report describes the professions of disaster management and urban forestry. By reviewing the practices and roles of each profession, opportunities for collaboration are revealed, showing that it takes an interdisciplinary team of professionals and municipal officials to develop disaster management plans that focus on trees across the phases of preparedness, response, and recovery. Additionally, a discussion about climate change and predictions for Manhattan is included to demonstrate the pressing need to focus on the resiliency and care of our urban forests.

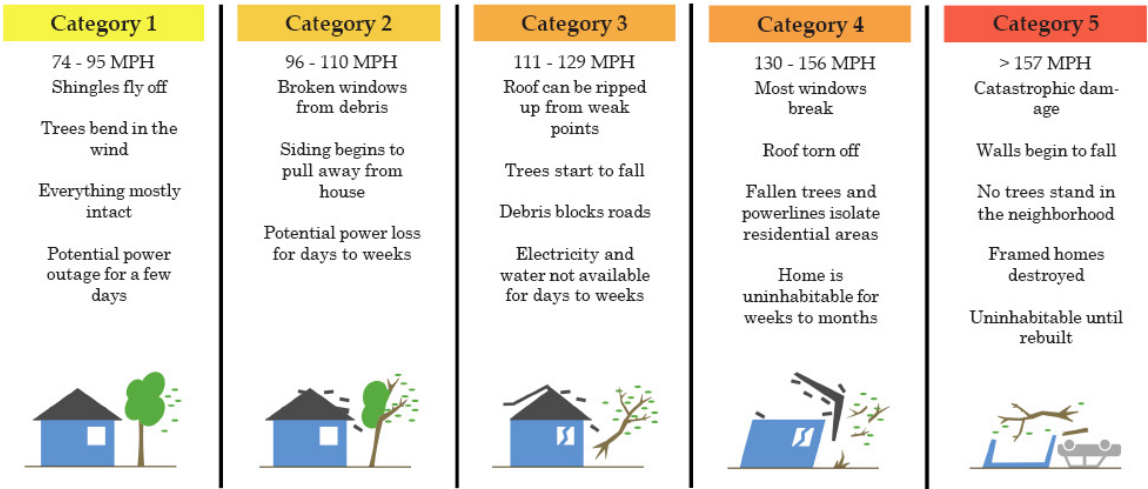


Figure 2.0

Adapted Saffir-Simpson Scale  
Measuring Wind Strength 1-5 Scale

## Natural Disasters and Impacts on Trees

Within the last decade, over 300 natural disasters have occurred annually around the world (Prasad 2017). Though natural disasters are still very difficult to predict, their frequency and intensity are increasing because of climate change (O'Brien et al. 2006).

Within the United States, geography and weather patterns influence what types of natural disasters may occur where. In the Midwest region, natural disasters primarily include floods, droughts, ice-storms, tornados, and derechos.

In short, “a disaster is a sudden, disastrous event that seriously disrupts the functioning of your community or society and causes human, material, and economic losses. Disasters can be caused by both nature but also humans themselves” (Bouchard 2021). There are multiple categories of disasters, including: Biological disasters, such as threat of an epidemic; Geophysical disasters, related to changes due to tectonic plates or fault shifting; Hydrometeorological disasters, which relate to climate, oceans, floods, droughts, and heat waves; and, Natural disasters, which have overwhelming consequences typically associated with resource depletion, mortality, and morbidity (Prasad 2017).

“There would be no natural disasters if it were not for humans. Without humans these are only natural events” (Nelson 2018).

Natural disaster events that are most harmful to trees, include severe storms with flooding, ice, and/or strong winds, including tornados and derechos. Such storms can cause trees to drown, break, or uproot. Depending on the severity of damage to the root and branch structure, trees still standing after such an event may not survive long-term.

Trees are also impacted by prolonged drought and warming caused by climate change. Trees in cities may be specially affected by climate change from rising temperatures caused by the urban island effect (Wilby 2007). Warming trends create a possibility for greater amounts of pest to thrive and thus making certain species of trees more susceptible to being attacked and ultimately dying (Diamond et al 2015). Adaptation practices have been suggested as a possible response to help cities cope with the effects of climate change (IPCC 2014). One such practice could include the increasing the amount of urban canopy coverage within cities to increase shade onto paved surfaces and thus creating cooler urban environments.



*Figure 2.1 Downed trees and a utility pole in front of the home of Tim and Patricia Terres in Walcott, Iowa, on Aug. 10, 2020*

# Disaster Management

“Disaster management is a process of effectively preparing for and responding to disasters. It involves strategically organizing resources to lessen the harm that disasters cause. It also involves a systematic approach to managing the responsibilities of disaster prevention, preparedness, response, and recovery” (Tulane University 2021).

Disaster management is a process of mitigating, preparing, responding to, and recovery efforts undertaken to reduce the impact of disasters (National Research Council 2007).

FEMA’s roles in disaster management regarding preparedness, response, and recovery are outlined in their National Disaster Recovery Framework (NDRF). As stated, the National Defense Recovery Framework Defines:

**Eight principles** that guide recovery core capability development and recovery support activities.

A **coordinating structure** that facilitates communication and collaboration among all stakeholders, guidance for pre- and post-disaster recovery planning.

**Roles and responsibilities** of recovery coordinators and other stakeholders.

The **overall process** by which communities can capitalize on opportunities to rebuild stronger, smarter, and safer. (FEMA 2016).

# Components of a Disaster Management Plan

A disaster management plan is typically structured into five categories: prevention, mitigation, preparedness, response, and recovery.

## **Prevention**

Being proactive is in essence a step towards prevention. Identifying potential hazards and devising the safeguards to mitigate their impacts is a good example of prevention. Typically, this stage involves putting permanent measures into place that can help minimize disaster risk, however, it is important to recognize that all disasters cannot be prevented (University of Central Florida, 2021).

Two examples of the prevention stage include; a teacher leading students to safety in the event of a tornado, or outside during a fire; or, an urban planner designing a city in a way that minimizes the risks of flooding through use of locks, dams, or channels to divert water away from populous areas. (University of Central Florida 2021).

This stage of disaster management requires strong analytical skills to help leaders identify potential threats, hazards, and high-risk areas. Problem- solving abilities are also invaluable in identifying the best ways to avoid or diminish the likelihood of any catastrophic events. (University of Central Florida 2021).

## **Mitigation**

The mitigation stage focuses on minimizing the loss of human life that comes as a result from a disaster. Both structural and non-structural measures can be taken. Structural measures could include the physical changing of characteristics of a structure, whereas nonstructural measures involve adopting or amending building codes to optimize safety for all future building construction. (University of Central Florida 2021).

During the mitigation stage, planning is an important skill. The disaster- management leader will develop strategies and structural changes that can help mediate potential threats, spread awareness, and engage with

community members to ensure constituents are made aware and what steps they can take to prepare for all contingencies. Of all the existing stages in disaster management, mitigation is considered the most crucial because if not done correctly, it can reduce the impact of the next contingency (University of Central Florida 2021).

## **Preparedness**

Preparedness is the ongoing process in which individuals, communities, and businesses plan and train for what they'll do in the event of a disaster. Preparedness can be defined by ongoing training, evaluation, and corrective action, and ensuring the highest levels of readiness (University of Central Florida 2021).

When preparing, it is important to be skilled in training people to Respond to disasters. Staying organized helps ensure readiness, and use of oral and written communication prepares laypeople and emergency response personnel for action in worst-case scenarios (University of Central Florida 2021).

## **Response**

Responding is what happens after a disaster occurs. Ideally a disaster-management leader will coordinate the use of resources i.e., supplies and equipment to help restore personal and environmental safety, as well as minimize the risk of any additional property damage (University of Central Florida 2021).

This stage is considered crucial, and ones ability to quickly make decisions is necessary, as the response stage is almost always time sensitive. Delegating tasks to other volunteers or emergency responders is a valuable skill to have when partaking in a leadership role (University of Central Florida 2021).

## **Recovery**

The recovery stage can take a long time, years and sometimes decades. Hurricane Katrina's effects on some areas of New Orleans are still seen today. The recovery stage involves stabilization of an area and restoring all essential community functions. Prioritization of essential services like food, clean water, utilities, transportation, and healthcare need to be restored first. This stage is about helping individuals, communities, businesses, and organizations return to normal depending on the disasters impact (University of Central Florida 2021)

Finally, as disaster management leaders help their communities to recover, empathy becomes an essential skill, understanding and relationship building bring trust within the community and can help in recovery efforts that would otherwise be short lived (University of Central Florida 2021)



## **Who is Involved in Disaster Management?**

As previously mentioned, community members, business owners, organizations, volunteers, and city officials can all be involved in disaster management, whether directly or indirectly. Most planning and preparations are done at the local municipalities level; however, community members can become involved in the decision-making process such as advocating for the change of a zoning region within a city to better prepare for a catastrophic event, or volunteer during clean up.

Private contractors can be hired to help with post-disaster clean up, as well as government run entities that are on payroll to deal for specific situations like catastrophic events.

## **Pre-Disaster Emergency Declarations**

In some situations, when a natural disaster is imminent, a pre-disaster emergency declaration can be issued, which enables resources and funding to become available ahead of time.

“A Governor or Tribal Chief Executive may request an emergency declaration in advance or anticipation of the imminent impact of an incident that threatens such destruction as could result in a major disaster. Such requests must meet all the statutory and regulatory requirements for an emergency declaration request. Requests must demonstrate the existence of critical emergency protective measure needs prior to impact are beyond the capability of the State and affected local governments or Indian tribal government and identify specific unmet emergency needs that can be met through Direct Federal Assistance (DFA). Such DFA may include, but is not limited to, personnel, equipment, supplies, and evacuation assistance. Pre-positioning of assets generally does not require a declaration. Assistance made available under a pre-disaster emergency declaration will typically be Category B (emergency protective measures), limited to DFA. FEMA may require damage assessments and/or verified costs estimates if additional types of assistance are requested” (FEMA 2022).

## Major Disaster Declarations

After a natural disaster or catastrophic storm event, a declaration can or must be made from the city, county, state, and/or at the federal level. According to the Public Assistance Program and Policy Guide (PAPPG), “Before a Declaration Request is made, a Preliminary Damage Assessment (PDA) must be completed” (FEMA 2020). Afterwards, “A Governor or Tribal Chief Executive may request a declaration from the President through FEMA. A request must be submitted no later than 30 days after the incident occurs (FEMA 2020). The President can declare an emergency for any occasion or instance when they determine federal assistance is needed (FEMA 2020). Emergency declarations supplement State and local or Indian tribal government efforts in providing emergency services. Such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe in any part of the United States. The total amount of assistance provided in a single emergency may not exceed \$5 million. The President shall report to congress if the \$5 million budget is exceeded” (FEMA 2022).

The President can declare a major disaster for any natural event, including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought, or, regardless of cause, fire, flood, or explosion, that the President determines has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work (FEMA 2022).

However, such funds do not cover recovery costs of lost trees. This can be found in the PAPPG, “Plantings ineligible for replacement include, but are not limited to:

- Replacement of trees, shrubs, and other vegetation;
- Replacement of destroyed crops;
- Cosmetic or aesthetic vegetation, such as landscaping around public facilities or in median strips along roadways. This restriction applies even when the vegetation is damaged

during performance of eligible work, such as when repairing underground utilities within landscaped areas” (FEMA 2020).

## **Assistance Available Under Major Disaster Declarations**

Not all programs, however, are activated for every disaster. The determination of which programs are authorized is based on the types of assistance specified in the Governor or Tribal Chief Executive’s request and the needs identified during the joint Preliminary Damage Assessment (PDA) and subsequent PDAs. FEMA disaster assistance programs are as follows:

- Individual Assistance - Assistance to individuals and households, which may include:
  - Individuals and Households Program;
  - Crisis Counseling Program
  - Disaster Case Management
  - Disaster Unemployment Assistance
  - Disaster Legal Services
  - Disaster Supplemental Nutrition Assistance Program
- Public Assistance - Assistance to State, Tribal, and local governments and certain private nonprofit organizations for emergency work and the repair or replacement of disaster-damaged facilities, which may include the following Categories:
  - A - Debris removal
  - B - Emergency protective measures
  - C – Roads and bridges
  - D – Water control facilities
  - E – Buildings and equipment
  - F – Utilities
  - G – Parks, recreational and other facilities
- Hazard Mitigation Assistance – Assistance to State, Tribal, and local governments and certain private nonprofit organizations for actions taken to prevent or reduce long term risk to life and property from natural hazards.

As previously stated, under the PAPPG, trees are not mentioned as a form of necessary infrastructure, and therefore affected areas cannot be reimbursed for the loss of trees post disaster. Trees should be included in assistance for the public as they serve many vital roles and are considered green infrastructure for their benefits to society.

# Urban Forestry and the Benefits of Trees

“Urban forests, like the forests we see in nature, are in our cities and towns. Urban forests come in many different shapes and sizes including; urban parks, street trees, landscaped boulevards, gardens, rivers and coastal promenades, greenways, river corridors, wetlands, nature preserves, shelter belts of trees, and working trees at former industrial sites” (USDA 2021). Manhattan, Kansas, has many of these typologies within its urban area. Urban forests are typically planned connections of green spaces and are considered a form green infrastructure. In terms of scale, green infrastructure works at multiple scales, from city streets, to neighborhoods, to districts, metro areas, and regional landscapes (USDA 2021).

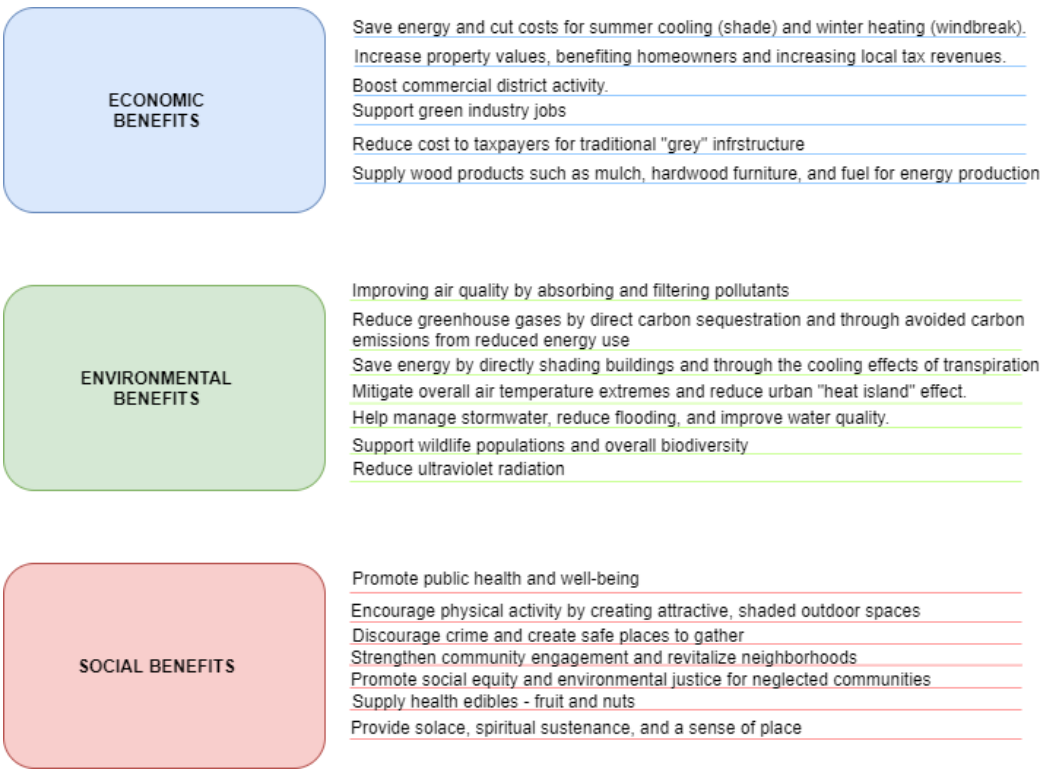


Figure 2.2

Understanding Tree Benefits of  
“Ecosystem Services”

Trees provide many environmental, social, and economic benefits and urban forests are dynamic ecosystems that provide critical benefits to people and wildlife. The benefits associated with urban forests include: filtering air and water, controlling storm water, conserving energy, providing animal habitat and shading, adding beauty, form, and structure to urban design, reducing noise, providing places for recreation, strengthening of social cohesion, create community revitalization, and add economic value to our communities (USDA 2021). They provide; shade on buildings, helping to reduce energy consumption; habitat for local wildlife; carbon sequestration; stormwater interception; and many other benefits (Leff 2016).

Schwab provides three definitions of urban forestry in *Planning the Urban Forest* (2009). The first is from *The Dictionary of Forestry* by John A. Helms, stating that urban forestry is “The art, science, and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits trees provide society (1998). The second definition comes from the National Urban and Community Forestry Advisory Council (NUCFAC) “The art, science, and technology of managing trees, forests, and natural systems in and around cities, suburbs, and towns for the health and well-being of all people.” The third definition is “A planned and programmatic approach to the development and maintenance of the urban forest, including all elements of green infrastructure within the community, in an effort to optimize the resulting benefits in social, environmental, public health, economic, and aesthetic terms, especially when resulting from a community visioning and goal-setting process” (Schwab 2009). These three definitions help explain the broad scope of urban forestry, the benefits it brings people living within the urban environment and why urban forests are important.

Jobs within urban forestry include but are not limited to: Tree Inspectors, Forestry Specialists, Environmental Resource Specialist, Urban Forester, Program Manager, Arborist, and many others. Urban foresters are tasked with many jobs within their given titles. They are capable of assessing urban forests, environmental planning and policy, land use planning and policy, pruning planting and management of trees, educational programming, risk management, public relations, and disaster prevention and recovery (Virginia Tech Urban Forestry 2020).

## **Manhattan, Kansas**

The focus area of this project is Manhattan, Kansas, which is in Riley County. Riley County is located in northeastern Kansas, approximately 50 miles west of Topeka, Kansas, the state capitol.

### **Demographics**

According to the 2019 US Census, the population was approximately 55,000 making Manhattan the ninth largest city in Kansas (Data USA 2019). Manhattan has a population size of 2,786 people per square mile, as well as a land area of 18.76 square miles (Census.gov 2019). The median age of people living in Manhattan 24.5 with a median household of \$50,537 (Data USA 2019). Manhattan is home to multiple academic institutions, the largest being Kansas State University. The veteran population in Manhattan is large with most veterans residing here having served in the most recent conflicts of Operation Iraqi Freedom and Operation Enduring Freedom (Data USA 2019). The population has three primary ethnic groups, White (non-Hispanic), Black or African American (non-Hispanic) and Asian (non-Hispanic). The Hispanic population makes up 7.08% of Manhattan's population, approximately 3,920 persons (Data USA 2019).

### **Establishment & Tree Planting**

Manhattan, Kansas is within the Flint Hills ecoregion, which is predominately a tallgrass prairie ecosystem. As such the area would have had few naturally occurring trees, other than ones along waterways. Manhattan was founded in 1854. The first settlers began planting trees soon after. The first plat map of Manhattan, KS was created in 1855 by Abram Berry who coined Manhattan as a "City of Trees." This plat map accounted for street tree planting and future city expansion by suggesting that single rows of trees be planted along streets and double rows of trees be planted along avenues and boulevards (LAR741 2021). As the city grew so too did its urban forest, and by 2015 it had about 28% canopy coverage. This is a strong amount for a city within the Great Plains region.

As comparison Wichita, Kansas has 22% canopy coverage, Tulsa, Oklahoma has a 26% canopy coverage, and Des Moines, Iowa has a 29% canopy coverage. (LAR741 2021). Today Manhattan has mature trees in its established neighborhoods and public spaces, but few trees within newer suburbs.

Manhattan, KS is a Tree City USA. This designation was achieved in 1978 (Arbor Day Foundation 2022). This designation is accomplished through a community meeting the Arbor Day Foundation's four overarching standers. They include:

1. Maintaining a tree board or department
2. Having a community tree ordinance
3. Spending at least \$2 per capita on urban forestry
4. Celebrating Arbor Day (Arbor Day Foundation 2022).

## **Manhattan's Urban Forest**

Manhattan's 28% tree canopy includes a large percentage of mature trees, which can be more susceptible to pests and disease. "Mature trees are also at a greater risk for falling and creating property damage, encroachment, and personal injury" (International Society of Arboriculture 2022).

One issue currently facing Manhattan's trees is the emerald ash borer (EAB), which affects ash trees. If untreated, all infected ash trees will eventually be lost. The total number of existing ash trees is unknown but, the city's forestry department has secured grant funding through the National Association of State Foresters (NASF), in the amount of \$120,000 to support the planting of 500 new trees to replace lost ash trees with a different species (K-State Research and Extension 2021).



## **Manhattan's Climate**

Manhattan receives on average 35 inches of rain per year. The US average is 38 inches of rain per year. Annual snowfall for Manhattan averages around 14 inches per year versus the US' 28 inches. There are 218 sunny days per year in Manhattan compared to the US average of 205. Manhattan on average receives 91 days of precipitation per year. Summer highs are in July and usually around 90 degrees with winter lows being in January around 17 degrees (Climate-Data 2020).

## **Climate Change Predictions for Manhattan**

“Manhattan, Kansas is located in a continental climate zone, with no dry season and hot summers. By the end of the century, conditions in Topeka, Kansas will likely have changed so much that it will be in a new climate zone: a temperate zone, with no dry season and hot summer.” (National Geographic 2020).

# Climate Change Projections at National and Local Level (1981-2099)



Figure 2.3: Continental Climate Zone Topeka, Kansas, Current Conditions.

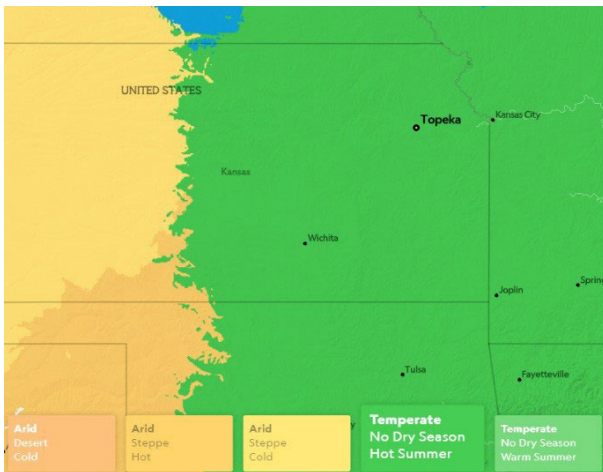


Figure 2.4: Temperate Climate Zone Topeka, Kansas by End of Century.

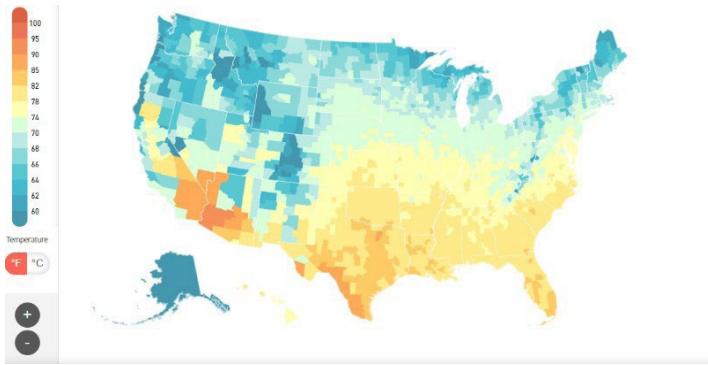


Figure 2.5: United States Climate Impact Map Historical 1981-2010.

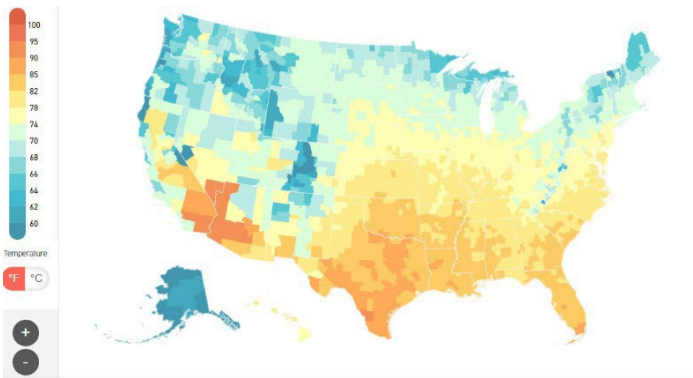


Figure 2.6: United States Next 20 Years 2020-2039.

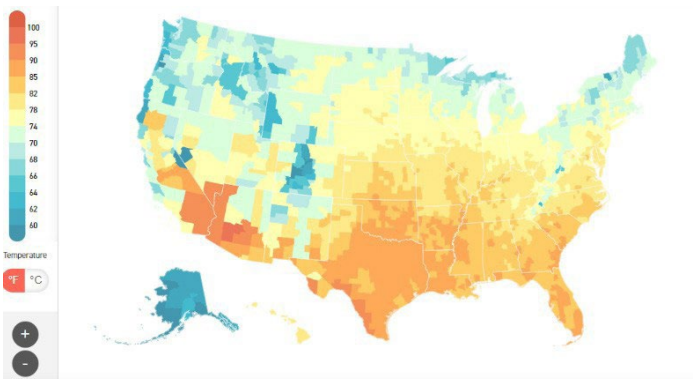


Figure 2.7: United States Mid-Century 2040-2059.

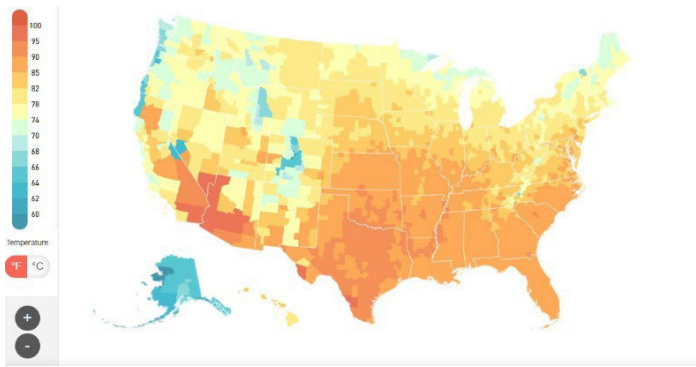


Figure 2.8: United States End of Century 2080-2099.

With a warmer temperate climate, pests and disease may become more widespread among trees. The threat of prolonged droughts may also become more severe. Both of these possible conditions could not significantly impact Manhattan’s urban forest. It is possible the city will lose all Ash trees, due to the Emerald Ash Borer, and all American Elm trees, due to Dutch Elm Disease. These trees are located in some of the city’s older established areas.

## Civic Structure

Manhattan’s civic structure/public administration consists of 6 key departments that make up the city’s local government. These departments oversee the decision making for local policies, and budgeting for the city. All decisions made regarding budgeting and project development are handled by the city commissioner first then flow through the chain of command as listed below (City of Manhattan Kansas 2021).

The departments include:

- City Commission – in charge of local tax rates, development and enacting of policies and ordinances, and planning the funding of taxes used for specific programs in the city;

- City Manager – communicates between city officials, delegates tasks, oversees civic projects, helps create and manage budgets, hiring and firing of department heads, and represents the city;
- Board and Committees – assists the City Commission by providing recommendations on various policy issues;
- Deputy City Manager – reports to the City Manager, but is in charge of overseeing projects done between multiple departments including Parks & Recreation.

## **Manhattan's Disaster Management Plan**

Manhattan's designated disaster agency is Riley County Emergency Management, who have the responsibility for coordinating the mitigation of, preparedness for, response to, and recovery from disasters. According to the Riley County website, their responsibilities are as follows:

- **Mitigation**

The mitigation phase includes determining ways to lessen the impact of a disaster.

- **Preparedness**

Preparedness includes conducting presentations and classes, distributing brochures and pamphlets at events such as the county fair, promoting NOAA all-hazards weather radios, encouraging families to develop a disaster plan, attending classes, developing relationships with local, regional, state, and federal partners, participating in countywide and regional exercises and drills, reviewing and updating county plans (emergency operations, debris management, hazard mitigation), administering the emergency notification system, administering the FireTrax/ID card system, and logging hazardous materials/chemical inventory.

- **Response and Recovery**

Response and recovery phase include working with local, regional, state, and federal agencies after an event to assess the damage and to coordinate assistance for victims and responders. Riley County Emergency Management staff has

responded to national events such as Hurricane Katrina and the Greensburg Tornado.

- **Volunteer Coordination and Management**

Emergency Management coordinates and manages more than 100 volunteers. Those volunteers are members of CERT (Community Emergency Response Team), storm spotters (WARN – Weather Amateur Radio Network), and the CISM (Critical Incident Stress Management) team.

Volunteer Management staff belongs to:

- Riley County LEPC (Local Emergency Planning Committee)
- KEMA (Kansas Emergency Management Association)
- Riley County 911 Advisory board
- Northeast Regional Homeland Security Council

(Rileycountyks.gov 2022)

Though Manhattan has a Disaster Management Plan for the city and surrounding county, it does not include provisions for trees (City of Manhattan Kansas 2021). A more detailed review of the city's Disaster Management Plan is presented in Chapter 4, Findings.

## Chapter 3: Methods

To address this project's research question and make recommendations for how Manhattan Kansas' disaster management plan can be modified to include a focus on trees, the primary methods used for data collection included case studies and interviews.

As discussed in the Background Chapter, a Disaster Management Plan typically includes five stages: however, for this project, mitigation and prevention are consolidated with preparedness. Thus, this project focuses on the categories of preparedness, response, and recovery. The case studies and interviews were structured to gather data within those three categories.

### Case Studies

A case study is “an in-depth study of a single, often contemporary phenomenon or “case.” It aims to understand one thing well – such as an institution, project, band, office, playground, housing project” (LAR725 2021).

The case study method was chosen to create an in-depth understanding of Manhattan's current disaster management plan, which could then be compared to, and informed by, the disaster management plan of a recently impacted Midwestern city. It was important to select a comparative city recently impacted by a natural disaster, because lessons learned about the response and recovery phases could be obtained. In other words, this project did not seek to broadly compare Manhattan's disaster management plan to other cities' plans because the aspect of actual response and recovery would be missing. Thus, Cedar Rapids, Iowa was selected as a comparative case study because it is in the recovery stage of disaster management. The city is currently rebounding from the 2020 derecho, which devastated its urban forest. Even though Cedar Rapids is a larger city, with a large population and more resources than Manhattan, Kansas, the response and recovery efforts have merit and applicability for Manhattan. Data for the case studies came from document review and interviews.

To maintain consistency between the case studies, they are structured similarly, with an introduction, followed by a discussion about the city's disaster management preparedness, response, and recovery, with a focus on trees. However, the content and discussion differ because the case study of Cedar Rapids focuses on how the city was prepared for, responded to, and is recovering from the 2020 derecho, whereas the case study of Manhattan focuses on its existing preparedness response plans, and hypothetical response.

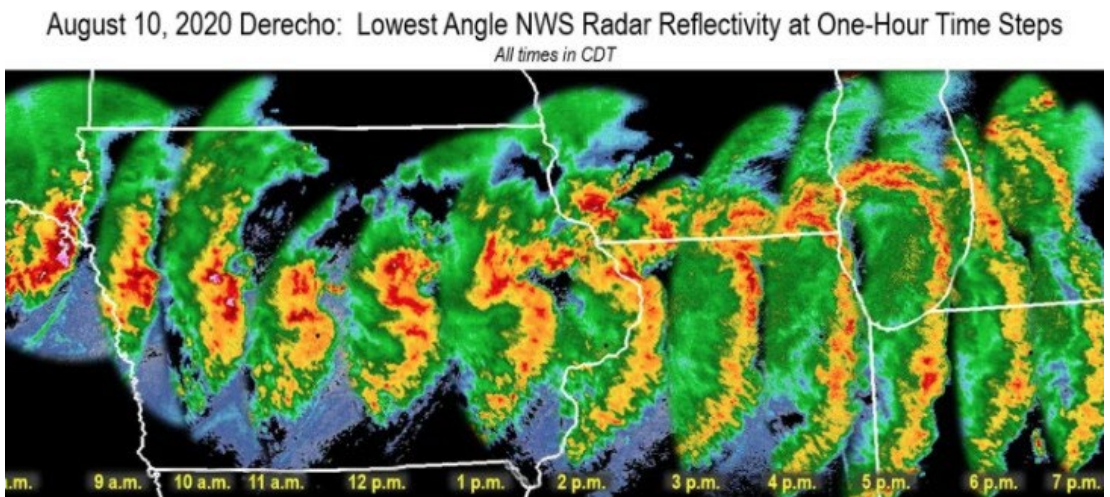


Figure 3.0. August 10, 2020 Derecho Low Angle NWS Radar Image.



## Interviews

Interviews were chosen to inform the case studies of Manhattan, KS and Cedar Rapids, IA because subject-matter experts could provide relevant, first-hand knowledge. Interviewees were identified and selected based on their experience with disaster management and/or urban forestry for Manhattan or Cedar Rapids. In total five individuals were interviewed for Cedar Rapids, and three were interviewed for Manhattan. Individuals were identified by examining city documents, recovery plans, and news articles. Individuals were sent an email to explain the purpose of the interview and to request their participation in a 30-60min. recorded discussion. All but one interview was conducted on Zoom. All were recorded for transcription purposes only.

The interview questions were semi-structured and varied slightly based on the interviewee. All questions were categorized to understand how each city's Disaster Management Plan addresses trees in terms of preparedness, response, and recovery. For Cedar Rapids, the conversation focused on disaster management from the recent derecho. For Manhattan, the conversation was hypothetical, focusing on how the city would respond in the event of a natural disaster.

### Foundational Questions for Cedar Rapids

1. In what ways was the city prepared?
2. Describe the storm event?
3. What was the response to the storm event?
4. How had the city recovered and what has happened since?
5. What were the outcomes and lessons learned?

### Interview Participants for Cedar Rapids, IA:

- Patrick Alvord, Principal of Confluence in Cedar Rapids
- Nick McGrath, Community Disaster Recovery Coordinator for Iowa
- Sandi Fowler, Deputy City Manager for Cedar Rapids
- Jeff Speck, City Planner and Urban Designer hired to partner with the city of Cedar Rapids and Confluence.
- Shannon Ramsay, CEO of Non-Profit Trees Forever located in Cedar Rapids

## Foundational Questions for Manhattan

1. In what ways is the city prepared for a natural disaster?
2. What would the response be?
3. What plans are in place to help the city recover?
4. What are some lessons learned?

## Interview Participants for Manhattan, KS

- Kim Bomberger, District Community Forester of Kansas Forest Service.
- J. David Mattox, Manhattan's Forestry Service Supervisor
- Laurie Harrison, Emergency Management Coordinator of Riley County, Kansas

In Chapter 4: Findings, key points, and themes from each interview are summarized and presented.

## **Chapter 4: Findings**

This section summarizes what was learned from the interviews and presents the completed case studies of Cedar Rapids, IA and Manhattan, KS.

Findings are then used to inform and guide suggested revisions to Manhattan Kansas's disaster management plan, which are detailed in Chapter 5: Recommendations

### **Case Study – Cedar Rapids, Iowa**

This case study illustrates the collaborative nature of the Iowa State Forestry Agency, the City of Cedar Rapids, local police, fire, and emergency services. The Trees Forever non-profit organization, the Confluence landscape architecture firm, and urban planner Jeff Speck to mobilize, handle, and commensurate with the scale of the disaster, and the needs of the community. Specifically, this case study illustrates the importance of considering trees during preparation, response, and recovery phases of disaster management and the necessity of creating a recovery plan focused on urban forests.

### **An Account of the Derecho**

“On August 10<sup>th</sup> of 2020, a storm called a derecho, which could also be described as an inland hurricane, began gathering in Nebraska and South Dakota. This storm would continue growing and becoming more powerful as it made its way towards Iowa, and by the time it had reached Des Moines, the winds were surpassing 100 mph. As the storm continued towards Cedar Rapids the storm had reached its peak speeds between 100 – 140 mph. Areas of Cedar Rapids sustained constant damage for 30 to 45 minutes, and when the storm had passed trees had snapped and uprooted, powerlines fell, homes and buildings collapsed, and roofs had flown off.

The Derecho would destroy 65 percent of Cedar Rapids tree canopy, a reduction of 28 percent overall canopy coverage to 8 percent for the city, an estimated 670,000 trees, the estimation of property damage from the storm resulted in \$4.9 billion in damage, and acreage of cropland larger than the size of Rhode Island, 850,000 acres of corn, had been destroyed” (Confluence 2022). The Community Disaster Recovery Coordinator, Nick McGrath experienced the Derecho firsthand, he stated “The Derecho was so bad when it happened, I was experiencing it at the garden center I was working at and I had to call my loved ones and tell them this was it, we are waiting for the walls to collapse and the windows to blowout” (Nick McGrath, 2022)

## **A Plan for Tree Recovery**

After the derecho passed, city officials from Cedar Rapids realized the tremendous amount of damage caused to the city’s trees. Immediately, they began discussing what recovery steps needed to occur. Having previously worked with urban planner Jeff Speck, city officials invited him to return to Cedar Rapids and help develop solution for the recovery of the city’s urban forest. During the same period, city officials also contacted Confluence, a landscape architecture firm with an office in Cedar Rapids. Confluence was selected because they also had previous working relationships with the city. From August 2020 to January 2022 Jeff Speck and Confluence worked together in creating a draft tree recovery plan that later became *ReLeaf Cedar Rapids – A Plan to Bring Back our Trees*. The ReLeaf Plan is as a guide for how the city of Cedar Rapids can replant lost trees from the 2020 derecho. The plan’s phases span over a decade, but it will take a generation to regain the tree canopy cover lost. The plan is further discussed in the Recovery section below.

## **Preparedness**

The derecho storm event was catastrophic to the city’s urban forest. Though preparedness could have helped alleviate some of the overall tree damage, nothing could have prevented the extent of the

damage. Urban Planner Jeff Speck stated, “You can’t really prepare for something like the Derecho,” (Speck 2022). However, now that the city is in a recovery phase, they are proactively planting new trees to be as resilient as possible to future storm events.

When discussing preparedness, the interviewees’ responses were split. Some understood that the city of Cedar Rapids was prepared and had systems in place to respond to the storm event, while others questioned whether Cedar Rapids was actually prepared for the actual event. Even though Cedar Rapids had a disaster management plan in place, it was not prepared for a natural disaster/storm event with a magnitude like the derecho, nor are many other cities, according to interviewees.

Cedar Rapids is not unfamiliar with natural disasters/storm events. Throughout the last two decades, Cedar Rapids has experienced floods, windstorms, tornadoes, and the most recent, a derecho. Because of the high frequency of storm events in Cedar Rapids, the city has learned from its previous disaster management plans, and developed new plans to ensure better preparedness, response, and recovery outcomes according to Sandi Fowler. “No city is really prepared unless they have experienced disaster response scenarios before and then learned from them, and some cities do better than others, it is fair to say that Cedar Rapids was more prepared than other municipalities would have been.” (Alvord, 2022). Cedar Rapids is considered to be better prepared, in comparison to other cities in the surrounding area, according to Patrick Alvord and Nick McGrath.

Deputy City Manager, Sandi Fowler, has worked with the City of Cedar Rapids for the last two decades dealing with disaster response. “Due to the city having a nuclear powerplant, the city has had a very robust emergency management planning and drilling system in place” (Fowler 2022).

Patrick Alvord, Principal of the Cedar Rapids office of Confluence, a Midwest landscape architecture firm argued, “Cedar Rapids of all cities, may be better prepared than others to respond to storm events, because Cedar Rapids is a city that has withstood a number of natural disasters over the last several years” (Alvord 2022).

Alvord also noted how important it was that Cedar Rapids had a municipal tree inventory, which was completed in 2016. The inventory noted the location, species, maturity, and condition of 70,000 trees within the city (City of Cedar Rapids, 2022). This inventory provided the city with baseline information that they could reference and update after storm events.

Another way to be prepared, in terms of trees, is to conduct routine pruning maintenance. This proactive measure can help ensure the longevity of individual trees. “Cedar Rapids currently has a City Arborist, a Forestry Supervisor, and eleven Urban Foresters. Proactive measures that focus on our urban forest, such as routine pruning has been discussed, however routine pruning is usually not completed due to backlogged work” (Fowler 2022).

In addition to having a clear response plan for tree debris removal, one of the best ways cities can be prepared for a natural disaster/storm event, is to have a tree recovery plan in place. Fortunately, Cedar Rapids was able to quickly develop the ReLeaf plan, post derecho, however, aspects of the plan could have been developed ahead of time. With a tree recovery plan in place the city could have immediately focused effort on following the plan, and not creating the plan.

During an interview with Jeff Speck, Speck mentioned that the original intent of Santamore’s 10/20/30 rule that arborists use when determining diversity with tree populations was “you achieve diversity city wide by having pockets of uniformity. This goes against what is taught to landscape architects in that there needs to be a different tree planted next to each other through the entire length of streets, when in reality the same species of trees need to be planted in clusters, creating pockets throughout streets. The exception being oaks, because they are susceptible to oak wilt and spread that disease through their roots” (Speck 2022).

## **Key-Takeaways on Being Prepared**

1. Cities should have a plan for tree debris removal.  
Knowledgeable experts should oversee contractors work to avoid hasty recovery and the removal of trees that could otherwise be pruned and saved.
2. Municipal tree inventory is needed to ensure an up-to-date catalogue of existing trees within the city and allow of updates on a cities' urban forest post disaster.
3. Regular tree pruning has proven to be a very effective proactive measure in increasing the survivability of trees during storm events, and other natural disasters.
4. When replanting trees, it is important to create biodiversity through planting the same species in clusters throughout streets, and not individual trees that are different the entire length of the street.

## **Response**

Immediately after the storm passed, the incident command center was notified through the emergency operations center, via the Deputy City Manager, that many areas in Cedar Rapids were left impassible. Cedar Rapids' power grid went down, leaving the municipal structures to run off limited power from backup generators. "The public works department made a decision knowing the communications were going to go out within the first few hours to equip the streets department workers with limited communications radios. This allowed for a way to be able to communicate with the road workers clearing debris to remain in contact. Street crews were dispatched to follow their snowplow routes which had been prioritized due to the routes being major corridors for emergency access, secondary routes were streets branching off the major corridor routes" (Fowler 2022). Timely execution, clearing of debris, and efficient management of departments allowed for arborists, tree crews and monitors to begin documenting, cataloging, and clearing/pruning trees damaged/destroyed by the derecho.

Ninety roadworkers who already had known their routes through years of maintaining the same roadways were deployed to clear routes. Through this quick reactive response, emergency medical services, and the fire departments were allowed to get through town to help people and get injured personnel to hospitals and emergency services.

Sandi Fowler, Cedar Rapids' Deputy City Manager, had been a part of communicating the needs of the city with Jeff Speck, and Patrick Alvord, principal of Confluence in Cedar Rapids, as well as hiring on Nick McGrath to become the Community Disaster Recovery Coordinator. Nick McGrath's position was a result of the need for the city, county, and state to have a person reach out to rural communities and begin documenting and submitting requests for federal aid. Through Nick McGrath's hiring on, Shannon Ramsay of Trees Forever, who was scheduled to retire, came forward and communicated with Nick McGrath and the City of Cedar Rapids, how her business could be of service to help. Once communication had been established between Trees Forever and Cedar Rapids, the city had then reached out to Confluence and Jeff Speck, and all parties were in communication to work together to then begin laying out the framework for Cedar Rapids tree replanting, and recovery of trees plan.

When asked to describe the post disaster response, in terms of trees. Jeff Speck replied, "The response was impressive, in that literally within a week of this disaster, people still did not have electricity and the city manager contacted him stating the need to have the ReLeaf plan." In other words, people were already considering needs for tree recovery when their homes were still without power "Trees mattered so much to people that people who were literally trying to find out how to get their next meal, and while volunteers were cleaning up, the city manager recognized the need to start the planning efforts for tree recovery" (Speck 2022).

While Cedar Rapids was implementing response strategies, Nick McGrath was sent out to rural areas of Iowa to seek out members of communities who could begin documentation on federal declaration for disaster aid relief. This allowed for rural communities to receive federal aid through FEMA. "One problem that arose was that the



magnitude of the disaster was so great, that the response had to come from the local communities. Rural Iowa faced issues with not having access to the same resources as Cedar Rapids and tracking the people who could formally write down the FEMA documents, required for aid, were hard to find. Documentation of work done in the rural areas was almost nonexistent, or not formally written to the extent in which Cedar Rapids had done their paperwork” (McGrath 2022). This points to a need to include rural areas alongside planning for city areas. The needs of rural areas may be just as great, but with lower concentration of resources and manpower, responding to fallen trees may be slower and more complicated.

After Jeff Speck was contacted by the city of Cedar Rapids to help with planning efforts, Confluence in Cedar Rapids had also been contacted to work together with community leaders to create an urban forest replanting plan. “One of the big goals that came, was finding out how to engage with communities for long term planning” (Speck 2022). Patrick Alvord, Cedar Rapids Officials, and Jeff Speck all sat down to discuss what the goals for the creation of the ReLeaf plan should be. These goals were set by asking: “What is the plan for? What is the basic approach the group was espousing for in the document? How were they going to determine the numbers, and finally what are the basic recommendations to the lay person to getting trees back in the ground?” “The ReLeaf Plan was made to serve as a public education piece as much as it is an actionable document for city use.” (Alvord, 2022)

While Cedar Rapids, Jeff Speck, Trees Forever, Nick McGrath, and Confluence had begun their work towards what would become the ReLeaf plan, the city had another task to complete, the hiring of contractors to come in and begin immediately clearing all the downed trees and destroyed structures. The contractors assigned to clean up the tree debris were in agreeance with the city to be paid per tree removed. Lessons learned from paying contractors per tree removed created an issue of contractors removing trees that otherwise could have been saved. McGrath and Fowler mentioned in interviews that this is not an action that is uncommon when hiring contractors and that it is important to monitor closely who is hired to help with debris removal.

## **Key- Takeaways on Responding**

1. Cities should clear road debris in a timely manner to allow for city arborists and monitors to begin cataloging and recording damaged trees to increase the trees chances of survivability.
2. It is best to use roadworkers that have memorized their routes when clearing roads in case radio communications are not available.
3. Engaging with community leaders for long term planning of a replanting plan helps gain popular support for a plan.
4. Close effective monitoring of hired contractors for debris removal is necessary to ensure financial resources are not wrongfully used.
5. People are willing to help with responding to disasters, and care about their trees, lost trees, and replacing trees.

## **Recovery**

Cedar Rapids is currently in their recovery phase. One issue for the lost street trees and urban forest has been funding and sourcing. Funding towards the recovery of Cedar Rapids urban forest has been addressed from multiple points. First, the city of Cedar Rapids has dedicated one million dollars a year for the next ten years towards the Releaf Plan's ten-year plan. An additional twenty-seven million dollars is needed for the Plan to be fully realized over the 10 years. This funding will be raised through the private sector and public donations, which is being coordinated between Cedar Rapids and the founder of non-profit Trees Forever.

As previously stated, Trees Forever founder and CEO Shannon Ramsay has since been working with the private sector to address the need for tree recovery outside of the city's jurisdiction. Ramsay, who was scheduled to retire shortly after the Derecho, saw the devastation

and knew she had to do something to help the city recover. After the storm passed, Ramsay asked all staff members of Trees Forever to come and see the damage firsthand so they could understand the scope of work they were about to embark on. The staff met with other non-profit organizations to help assess what needed to be done. Ramsay mentioned that about twenty percent of the total trees lost in the derecho were city trees. Trees Forever has been involved with a program called Growing Futures, which hires teens within areas of Cedar Rapids, paying them to work on weekends doing street tree planting and maintenance. “The ReLeaf Plan has identified certain street trees that will be replanted first based off canopy loss, economic status, and proximity to parks... “The ReLeaf plan is for the entire city of Cedar Rapids’ community, not just the city,” said Ramsay.

Fowler stated, “Though houses and roofs can be repaired, the next step is the long-planned process to recover the tree loss.” She went on to explain that “Even after the derecho’s passing, Cedar Rapids does not have a very regimented tree maintenance program, this seems to be a reoccurring thing across many cities” (Fowler, 2022). A lot of tree cleanup work still remains, even though contracting companies, hired by the city, came in and did tree debris removal. “Nine thousand tree stumps remain in the right-of- way alone, which is expensive and time consuming to remove,” (Fowler, 2022). Fowler also noted “An estimated eighty million dollars of the Cedar Rapids money was utilized for the recovery effort, and to date, FEMA has not reimbursed any of the money spent by the city towards recovery,” which poses a significant issue for further tree planting progress (Fowler, 2022).

The post disaster recovery for urban forests requires an interdisciplinary team of experts, including landscape architects, who can contribute during recovery planning and implementation phases. Cedar Rapids being affected tremendously with the significant loss of trees, it was paramount the city began inventorying and finding stock. Confluence looked at a radius of growers within the area ranging from central Iowa, northern Missouri, southwest Wisconsin, Minnesota, and the Dakotas for certain species. Trees Forever and Confluence are in the works of entering a substantial contract to be able to grow a lot of the trees that will be planted through the Cedar Rapids community. One major challenge that came to light was observing the cities spending for trees in their annual planting

program. If the city has any funding for the trees, they must spend that money and have those trees in hand within the fiscal year. This issue does not bode well in the plan because so many trees need to be purchased, limited amounts of person power is available to put the trees in the ground and the city cannot realistically commit funds to something they cannot have within the timeframe of each fiscal year. This issue was addressed by communicated with local nurseries about contract plant growing, for the large quantities, and having Trees Forever commit to the contract because they were a non-profit and therefore not bound by the same constraints of the contract the city has.

When asked how landscape architects have a role in disaster management, or if there is a valuable role the landscape architect could play, Alvord replied, “The tie between landscape architecture and the research that went into creating the ReLeaf plan was interesting. It is not something that Confluence was prepared to do, particularly with respect to the trees themselves. As a planning effort, the process was straightforward and common place, however it was the subject matter that required the team to learn quite a lot as we went along. With a very narrow focus of landscape architecture and urban design, I would be interested to know if that argument could be a legitimate one that is crafted. There is a part and narrow scope of services that traditional landscape architects could respond to as it relates to streetscape design and planning, with an understanding of arboriculture and urban forestry, but it is sort of tangentially related to the work that is normally done. It is not the landscape architects going in and offering that specific focus to the cities or potential clients, and this opportunity was a unique experience.” (Alvord 2022). Confluence had hoped to create their ReLeaf Plan on a grander scale. city wide, but given the limitations with the data, it was not possible. Confluence worked with what they had been given, extrapolated that information and make assumptions for what total future quantities might be based on percentage of lost trees versus percentage of trees remaining. Alvord stating, “It was a really interesting problem to solve from a planning perspective.” Confluence identified several stakeholder groups and convened meetings early in the recovery process. One of the groups were local nurseries, who were considered essential for the long-term success of the ReLeaf Plan. Confluence also understood that tree stock sourcing would be a problem considering

the sheer number of trees needed to accomplish the Plan's goal. They were very thoughtful in choosing species and suppliers, seeking to ensure new trees would be resilient to the changing climate and future storms, as much as possible.

### *ReLeaf Cedar Rapids – A Plan to Bring Back our Trees*

“ReLeaf Cedar Rapids was designed to be a plan for everyone, but how you use it depends on who you are.” (Confluence 2022). It was created by consultant in partnership with the city officials. The plan shows how city efforts can be directed towards replanting trees in public streets and parks. “Currently, 85 percent of the trees are privately owned, so the plan focuses first on helping families and institutions replant their own properties” (Confluence 2022).

The plan serves as a direct response to the citizens and city officials realization of Cedar Rapids urban canopy loss and the importance it had for their city. The destruction of their urban canopy was considered a tremendous loss and spurred a powerful resolve to regrow what was lost with solid commitment and in wasting no time doing so. As the plan was being developed the city began their pledge to millions of dollars to the ReLeaf effort. “ReLeaf Cedar Rapids is a plan of who, what, when, where, why, and how. It describes the role that each person can play, recommends trees by species; devises a ten-year sequence for street and park planting; it directs the location of these street trees and park trees and makes recommendations for yards; it attempts to justify these decisions with ample evidence; and it even provides some detailed instructions for tree planting and care. This is all done with the conviction that, as we tell our children, anything worth doing is worth doing the best we can” (Confluence 2022).

ReLeaf Cedar Rapids also details other cities' responses to storms, how those cities have learned, and how confluence and partners were able to adapt the lessons learned in creating this plan.

## How to use the ReLeaf Plan

The plan's main sections include:

1. **Guiding Principles**; the public process and foundational beliefs that should drive the plan's effort. This chapter describes the outreach process, lays out the resulting nine principles, and ends with the mission statement the constituents generated themselves.
2. **What Trees Do**; this chapter makes the powerful case for planting more trees through showing ample evidence that has been documented on how trees clean our water and air, sustain the food web, fight climate change, improve our physical and mental health, eliminate urban heat islands, generate social capital, improve our home values, lower energy costs, help businesses succeed, and even reduce crime and car crashes.
3. **How Trees Work**; this chapter quickly shares the latest research on the lives of trees: how they grow and survive, how they support each other, and how they can thrive not just in forests, but in our neighborhoods.
4. **Urban Forestry 101**; the experiences and knowledge learned from planting trees in cities has been forgotten, therefore this chapter reinvigorates those lessons, additionally, shows how important trees can be to preserving the food webs that keep our planet habitable; this knowledge gives further direction to the ReLeaf effort.
5. **The Plan for All Trees**; some parts of the plan applies to just city trees, while other parts for private trees. This chapter applies to all trees and is intended for everyone to read. It shares the ReLeaf Tree List, the plan's central resource and provides basic instruction on how to plant and care for trees. The ending focuses on the daunting supply chain challenge and introduces a partial solution in the form of an ambiguous program around seedlings.

6. **Private Trees 1: The Plan for Yard Trees;** outlines aspects for private yards, institutions, streets, and parks. Each section discusses the issue unique to their specific category and ends with a simple summary of specific actions required.
7. **Private Trees 2: The Plan for Institutional Trees;** covering the largest institutions in Cedar Rapids, most losing a great number of trees, the school districts, colleges, universities, private schools, hospitals, golf clubs, cemeteries, churches, and major corporations. This chapter talks about what each of these institutions can do to replant most effectively, why it matters, and what resources are available.
8. **Public Trees 1: Street Trees;** this chapter was made for the city, by the city. It contains not recommendations or advice, but specific actions that the City itself will take as it replants.
9. **Public Trees 2: Park Trees;** this chapter begins with the Park Tree Rules, and then discusses on how the replanting effort can make Cedar Rapids' parks even better than they were before the derecho.
10. **City Ordinances and Policies;** this chapter recommends changes to the wording and implementation of a few rules and policies that have a major impact on the City's canopy.
11. **Implementation;** this final chapter makes an effort to name all the different players and what they can do. It describes the funding process and summarizes the proposed ReLeaf budget. A section on advocacy talks about the different ways that can keep the momentum to ReLeaf Plan going strong.

## **Key- Takeaways on Recovery**

1. The post disaster recovery for urban forests requires an interdisciplinary team of experts, including landscape architects, who can contribute during recovery planning and implementation phases.
2. Identify stakeholder groups early in the recovery process to help ensure clear communication and goals for tree recovery
3. Identify financial resource requirements needed for the number of trees being replanted.
4. Identify sourcing locations for tree species needed in recovery efforts and begin grow contracts.
5. Create and utilize programs that allow for volunteer employment to help lessen the burden of workload on city workers.



## **Case Study – Manhattan, Kansas**

The city of Manhattan, Kansas has experienced several severe storm events within the past two decades including tornados, floods, windstorms, and ice storms. These storm events are not comparable to the 2020 derecho in Cedar Rapids. To understand how the city of Manhattan is prepared for natural disasters/severe storm events, in terms of trees, this case study focuses on the city's existing preparedness, response, and recovery phases of disaster management.

This case study explains the cooperation between the community district forester, Manhattan's forestry supervisor, Riley County's emergency management coordinator, and supporting departments that are responsible to handle severe storm events and natural disaster scenarios.

Three key players who are involved in the city, county, and state were identified and interviewed for Manhattan. For this reason, J. David Mattox was interviewed as he is Manhattan's Forestry Supervisor and has been since 1986, Laurie Harrison for her involvement with coordinating between agencies during disasters for the entirety of Riley County, and finally Kim Bomberger who provides forestry service to 28 counties in North Central and Northeastern Kansas and has experience with post disaster recovery. Interviewing these three individuals provided an understanding of how Manhattan handles tree loss and damage during severe storm events, how agencies communicate after a disaster and what logistics are involved in removal of tree debris, how the city plans to replace lost trees, and finally how the surrounding areas may handle recovery efforts of their trees in post disaster scenarios.

### **Preparedness**

Manhattan has an emergency management building located in the downtown area of the city. The responsibilities of the emergency management team include; mitigation, preparedness, response and recovery, volunteer coordination and management, and a 911 fund which are funds used to purchase necessary equipment and services for the 911 system in Riley County (Riley County Gov 2021). Emergency

management staff belongs to the Riley County Local Emergency Planning Committee (LEPC), Kansas Emergency Management Association (KEMA), Riley County 911 Advisory Board, and Northeast Regional Homeland Security Council. “The Emergency Management coordinates and manages more than 100 volunteers, who are members of the Community Emergency Response Team (CERT), Storm Spotters – Weather Amateur Radio Network (WARN), and Critical Incident Stress Management (CISM) teams.” (Riley County Gov 2021). No local emergency management programs discuss or focus on the recovery and replacement of lost urban trees post disaster, however, in the city’s Hazard Mitigation PDF, it is noted that the Hazard Mitigation Plan for Kansas recognizes the emerald ash borer’s threat to Ash trees and the loss of tree, cost of removal and re-vegetation is considered (Kansas Hazard Mitigation Plan 2020).

There have been multiple severe storms that have affected the city historically. J. David Mattox, Manhattan’s forestry supervisor, mentions “We have encountered some pretty serious storms since beginning my work here, however I have never responded to a catastrophic event,” (Mattox, 2022).

As means of preparedness, the city has performed numerous tabletop exercises over the years to determine what its needs are and what the appropriate response should be based on various event scenarios.

The forestry team’s primary goal after a storm event is to clear streets of tree debris and get arterial roadways open to allow for fluid circulation throughout the city. Subsequent tasks would include removing city trees that have fallen on houses and cars. It is important to note that city crews oversee city trees, and they would not be able to assist private landowners with tree services for their trees.

Laurie Harrison, the county’s emergency management coordinator. As the emergency management coordinator Harrison is able to explain the processes Manhattan and all of Riley County initiate before, during, and after disaster strikes. Previous work involved being a dispatcher of the community serving for 15 years for K-State PD. Harrison is now 22 years in Emergency Management for Riley County and has a lot of experience dealing with disaster management scenarios. Harrison is considered the middle messenger and would keep clear communication running between

all entities during recovery efforts. She also helps plan recovery logistics. The specific entities involved in responding to a storm event depend on the type and location of the storm event. These entities may include: The American Red Cross, Kansas Highway Patrol, Kansas Department of Transportation, Army Corps of Engineers, Manhattan Fire Department, City Public Works, Parks and Recreations office, and County Emergency Medical and Law Enforcement services. Of these, agencies prepared to remove trees post disaster would involve the Kansas Department of Transportation, City Public Works, and Parks and Recreations office. Manhattan's Park and Recreations office is prepared to recover and replant lost/damaged trees post disaster.

Manhattan has a volunteer program called the Community Emergency Response Team (CERT), in which civilians may form a team that helps with basic needs, depending on the storm event, providing additional personnel to departments in need of more workers. Regarding trees, volunteers may be expected to help clear debris out of roads, help load and unload tree debris, and asked from the city to hold contractors accountable for tree removal of damaged or destroyed trees. Training is provided through Manhattan's fire department in coordination with the emergency management department. Persons wishing to become apart of CERT will receive hands-on training taught by trained emergency professionals and must contact Laurie Harrison to receive additional information and become recruited. Volunteers attached to CERT would be learn and be expected to perform the duties regarding:

- **Disaster Preparedness** - Introduction to disasters and the role of CERTs in disaster response
- **Disaster Fire Suppression** - Identifying and reducing potential fire hazards and basic fire suppression
- **Disaster Medical Operations** - Treatment strategies for life threatening conditions, principles of triage, and Head to toe assessments, treatment for fractures, sprains, burns, and other injuries
- **Light Search and Rescue Operations** - Techniques for search, lifting, cribbing, and removing victims

- **Team Organization** - The incident command system and documentation
- **Disaster Psychology** - The post-disaster emotional environment, identifying and handling stress symptoms
- **Terrorism** - Defining terrorism, identify CERT procedures in a terrorist incident
- **Course Review** - Course review and disaster simulation exercise

Kim Bomberger, Manhattan's Community District Forester, who provides technical assistance, education and training to tree boards and city departments in 28 counties throughout North Central and Northeastern Kansas. When communities are affected by natural disasters, Bomberger assists them with collecting information needed for their FEMA documentation, as well as providing services to cities who need certified arborists to document tree damage and loss, informing communities of the forestry service, and helps with tree inventorying. This allows these communities a greater chance of receiving federal aid after disaster strikes. Bomberger also aids these communities further by assisting them in the commencement of a city tree board, or advises them of the prerequisites to become apart of Tree City USA.

### **Key Takeaways on Preparedness**

1. Manhattan has an organized volunteer group to assist after storm events
2. Manhattan performs tabletop exercises with hypothetical scenarios to keep crew members and officials up to date in training
3. Manhattan has its own emergency management building
4. Funds are available for Riley County to purchase necessary equipment with the help of local organizations

## Response

After a disaster strikes, all relevant departments in Manhattan are activated to fill their designated roles. For Mattox, response includes deploying the tree teams to begin clearing out the roads to allow for emergency personnel to make sure they can navigate through the city. Another role of Mattox includes shifting from being the city's arborist to a leadership role in debris management. The change of role usually happens when FEMA has been involved and comes to Manhattan to begin recovery operations. Historically, Manhattan has been able to take care of severe storm events that affected the city. The unpredictability of a severe storm or natural disaster can warrant changes to a city's response time during disasters. This can lead to insufficient means to handle the recovery efforts due to the varying levels of destruction a storm/disaster can leave behind. Historically, Manhattan has been able to respond to disaster/storm events itself, but rising pressures on the recovery phase for trees have added to the existing workload of the city foresters. This extra pressure does not allow them adequate time to put in action any prevention or proactive measures such as routine pruning schedules for existing trees.

Harrison immediately begins notifying all departments, as she serves as the middle person for communication. Harrison ensures all communications between agencies are running smoothly to allow for organized cooperation amongst team members from all departments. In addition to regular duties during these events, Harrison takes on the role of logistics officer. She ensures that affected areas have the proper human and equipment resources to handle the event, utilizes them appropriately, and tracks what resources are being used to confirm accountability of used resources.

Kim Bomberger is usually not involved in Manhattan's response to storm events, however, if assistance from the Kansas Forest Service is needed, the city has an agreement with the agency, which can be activated with a phone call. During emergency or severe storm events in the surrounding rural Kansas areas, Bomberger will immediately make her way to the affected community's and head straight to their town hall or wherever their emergency command center is currently set up. Bomberger makes her services known to necessary personnel and then begins assisting with tree damage assessment. She collaborates with existing city personnel and helps

collect data of damaged trees that may be salvageable or mark them for necessary removal. With the information collected, she then assists with properly documenting it to allow for a smooth transition for FEMA emergency declarations and efforts to receive federal aid to address the tree damage appropriately.

### **Key Takeaways for Response**

1. Manhattan historically has been able to clean up and recover from major storm events without the need of FEMA
2. Riley County has an efficient and effective emergency communication infrastructure to help in the event Manhattan has a disaster
3. Surrounding areas in rural parts of Kansas are helped through Kansas Forestry Service which has an office in Manhattan
4. Manhattan's city foresters have become backlogged and understaffed to be able to recover from existing workloads
5. Proactive pruning measures are unable to be performed due to backlogged work

## Recovery

During recovery operations the city of Manhattan will determine which neighborhoods get priority over tree replacements through discussion with J. David Mattox. If the damage from the disaster/storm event does not warrant FEMA declaration for Manhattan to receive funding, then Manhattan is held responsible for carrying the burden of cost for the cleanup, which is limited. The operating budget to allow for Manhattan to get the roads cleared from trees/vegetative debris is essentially an open checkbook to allow for J. David Mattox and his tree crews to get the job done. The tree teams continuously work to get tree debris removed and other city officials will move the city's assets to ensure the smooth operation of recovery efforts.

The city of Manhattan has a mutual aid program in place which allows for surrounding counties to help with recovery efforts within the city, as well as allows for Manhattan to help surrounding communities utilize equipment and personnel to help surrounding areas affected by severe storms. This is important because in times of need in recovery, assistance and resource availability may take days to weeks to come. The mutual aid agreement allows for immediate use of needed resources to begin recovery efforts.

Another entity that has been created in the city of Manhattan is called The Greater Community Foundation. Instances of individuals pretending to be a part of organizations or there to help have taken advantage of vulnerable citizens. "The Greater Community Foundation was created in response to preventing scam artists from stealing money from vulnerable persons in post disaster situations", (Harrison, 2022). The Greater Community Foundation could be a great organization for the citizens and city of Manhattan to work with in securing additional funding for obtaining and sourcing trees for future tree recovery operations.

Sourcing for trees during recovery efforts in post storm events usually comes from local nurseries. "One issue that occurs is when people who had just lost their trees will fall prey to nurseries when asking for something that grows fast to see quick results," (Mattox, 2022). To

counter this issue, Mattox teaches and tries to educate arborists, master gardeners, and affected personnel about tree planting, what to watch out for when purchasing from nurseries, and planting the right tree for the right place. Bomberger also holds classes and seminars to educate the public about the importance of tree diversity, and tree selections for planting in specific regions.

If Manhattan, Kansas, is to utilize/consider private contractors when creating their own Tree Recovery Plan, it is necessary to establish a committee or group of resolute workers to monitor how the contractors will do their work. Through monitoring private contractors, Manhattan can ensure the money being utilized for private contractors is spent as responsibly as possible, and ensure the work is done in accordance with federal and state guidelines.

### **Key Takeaways for Recovery**

1. Manhattan determines which neighborhoods get priority over tree replacements
2. If FEMA is not utilized post-disaster, Manhattan carries the cost of cleanup, this includes tree cleanup.
3. A mutual aid program has been created to allow for surrounding counties to assist in recovery efforts
4. The Greater Community Foundation could have potential to secure future funding for trees, similar to Cedar Rapid's Trees Forever organization
5. Sourcing from nurseries is possible in Manhattan, however sourcing native species could be problematic
6. The State and City Foresters hold seminars and try to educate other professionals and citizens about tree diversity, and tree selections for specific regions
7. Promoting a tree inventory is critical
8. The creation of a Urban Tree Master Plan is vital to the survival of Manhattan's future urban canopy.



## **Chapter 5: Recommendations**

Based on the information gathered from this research, interviews, case studies of Cedar Rapids and Manhattan, and review of the ReLeaf Plan, recommendations for Manhattan to improve its disaster management plan, to include a focus on trees, are summarized below. The recommendations show how Manhattan can better prepare its urban forest to be more resilient, and how it can better respond and recover lost/damaged trees.

### **Manhattan's existing strengths**

Manhattan has veteran city and state foresters with many years of experience. The city's forestry department has a well-trained team and can benefit from the State's mutual aid program to get more people and resources to help at a moment's notice. Manhattan is also fortunate to have a dedicated emergency center, the Manhattan Greater Community Foundation, and other resources/major organizations readily available here that may not be available in rural communities. Finally, a number of nurseries and the Forestry Service in Manhattan provide many opportunities for sourcing and stocking native tree species that could be used to replant lost trees.

### **Manhattan's existing weaknesses**

Unfortunately, Manhattan does not have a formal tree inventory, so it is hard to truly understand what Manhattan's existing urban forest provides for ecological benefits and habitat. Manhattan has not had a major natural disaster that affected its urban forest to a comparable degree like in Cedar Rapids, therefore, it may be hard to influence city officials to invest in a program that may seem unnecessary. Though Manhattan has many nurseries that can supply trees, the type of trees which are available are usually trees that make the horticulture industry money, and diversity and sourcing can be very limited. Another issue facing Manhattan is that educational information availability to the public may not achieve the same success that Cedar Rapid's ReLeaf Plan was able to accomplish for their residents.

**Recommendations for preparation include:**

- 1. **Immediately begin a tree inventory;** to know what the city currently has. An inventory is a fundamental baseline of data about how the city’s tree species, location, and condition. If updated regularly, it can show changes over time, documenting tree loss and tree planting. The inventory can identify areas where new trees can or need to be planted. Most importantly, if a severe natural disaster was to occur, an inventory provides a record of what preexisted.

The diagram below illustrates different ways a tree inventory can be accomplished.

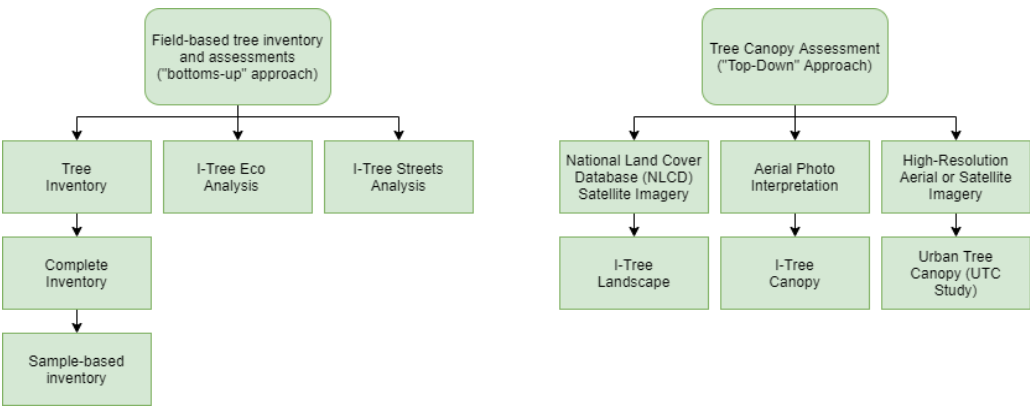


Figure 4.0 Key Ingredients to Inventorying a City’s Trees

- 2. **Hire more personnel and purchase more resources for the city’s forestry department;** Mattox mentioned in an interview that a lot could be accomplished for Manhattan with small upgrades. In turn, all backlogged work can be finished, while helping get Manhattan caught up on replanting trees, as well as beginning a pruning regiment for proactive maintenance.

3. **Run a tabletop training exercise;** If Manhattan ran a tabletop exercise in which they studied Cedar Rapids derecho event, made a similar event for the city, and discussed amongst each other how Manhattan could respond to the exercise, it would greatly benefit preparation and readiness.
4. **Create a city plan specifically focused on the recovery of lost trees;** Similar to how Confluence/Cedar Rapids created their ReLeaf Plan, Manhattan too could create, adapt, and utilize a tree planting/replanting plan dedicated to safeguarding and ensuring a resilient and thriving urban forest for future generations.
5. **Gain popular support;** Through canvassing, creation of guiding principles, and generation of a mission statement created by the public, Manhattan could greatly benefit in securing additional resources from its citizens and create a sense of community in which the citizens are more receptive to the protection, growth, and stewarding of Manhattan's urban forest.
6. **Gain support of business;** Private entities can canvass for locals interested in helping in a recovery effort. The continuous exposure of private businesses to Manhattan's residents provides ample opportunity for advertising, educating, and supporting of a potential tree recovery and replanting plan.
7. **Make sure the trees are being planted;** Manhattan should ensure/prioritize that trees lost or replaced are native first, and or adapted to the region to ensure successful growth.
8. **Ensure diversity of tree species;** Manhattan and the private sector should establish communications to inform each other what trees are being planted where so diversity of tree species can be accomplished in a planned manner.

9. **Support local nurseries;** Manhattan should prioritize sourcing trees from Manhattan first, then within the region. Sourcing from local nurseries generates revenue in the local economy, provide opportunities for employment, and trees may be adapted to Manhattan's existing climate.
10. **Rewrite policy and city ordinances;** Manhattan should consider rewriting policies and ordinances that are similar to the ReLeaf Plan if possible. Rewriting of city policies and ordinances would allow trees to be planted closer together and allow for smaller trees to grow under powerlines.

11. **Provide the public an organized chart of foresters duties;** Manhattan could benefit from showing its residents how the city handles certain areas and aspects of work dealing with the city's trees.

The diagram below depicts a proposed department structure, where street tree management is the top priority.

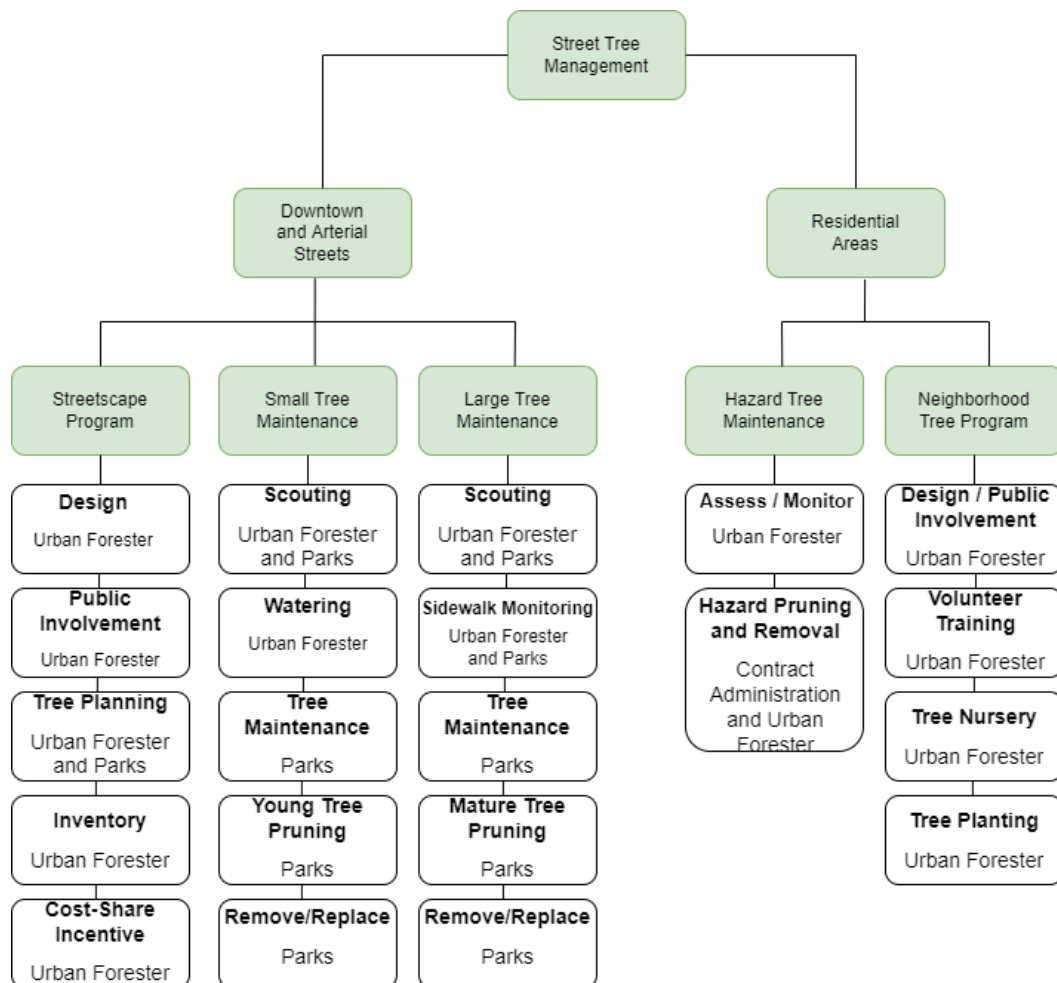


Figure 4.1 Street Tree Organization Chart

12. **Allocate more resources to Manhattan's Forestry Department;** Allocating additional funds to assist with tree recovery operation should be annually reviewed. When budgeting for resources used on sports fields, water parks, and

other public programs, Manhattan should take into consideration the trees and either build in funds to assist with tree damage or reduce and create or supplement a fund for tree recovery in the Forestry Department.

13. **Having dedicated drop off location(s);** Though Manhattan has a local municipal waste site for vegetative debris, when quantities exceed the site's capacity, the excess must be burned.
14. **Set aside time to record affected neighborhoods;** When recovery tasks have been completed, workers should take record of where and what trees had been removed or pruned.
15. **Have nurseries ready to supply native species;** Ensuring native species both locally and regionally are readily available so that the lost trees of the same species are replaced.
16. **Utilize existing local organizations to help with replanting efforts;** Kiwanis Club, Rotary Club, Boys and Girls Club, and others are good examples of organizations that may be able to assist in tree replanting, maintenance, and watering.

## Chapter 6: Conclusions

The primary research question for this project was: How can Manhattan, Kansas's disaster management plan be modified to include provisions for the city's urban forest, in preparedness, response, and recovery phase?

The most proactive step the city of Manhattan can take, to better position its urban forest for recovery from a natural disaster, is to conduct a comprehensive tree inventory. At a minimum, the inventory should seek to document the geolocation, species, diameter at breast height (DBH), and condition of all city trees. All street trees and trees within the parks and cemeteries should be included. The data can be digitized and kept within a database for access by the Forestry Department. The data can be made public too, with a layer added onto the City's GIS page. The tree inventory can be conducted by a contracted company or by trained city staff and community members. Without the basic data of a tree inventory, there is no way to document widespread storm damage and total loss after a storm. A tree inventory is also needed for the subsequent development of an urban forestry master plan, which is a step the city can take toward preparedness. An urban forestry master plan sets an overall vision and goals for near and long-term tree planting and maintenance. Ideally, the development of this document would include input from many different stakeholders including community partners and neighborhood representatives. Beyond guiding annual forestry efforts, the urban forestry master plan could be used to prioritize replanting efforts, post disaster, should the need occur.

Cedar Rapid's ReLeaf Plan is an excellent model that Manhattan, and other cities should use to guide the development of their own urban forestry master plans. Prior to the 2020 derecho, fortunately, Cedar Rapids had developed a tree inventory. The inventory was essential for being able to document tree damage and prioritize replanting efforts. The tree inventory data was essential for the development of the ReLeaf Plan.

## **Relevance of this Project**

The future of urban forests will increasingly become more important, and so too will the need for landscape architects to work alongside urban foresters, project managers, city planners, and ecologists to inform cities' tree planting and management efforts. Trees provide essential environmental services and bring value to places and people. However, trees are not typically considered an essential infrastructure. If trees were considered and funded like infrastructure, urban forestry would have a larger, more beneficial impact. This project highlighted the importance of trees and the need for cities to treat them as infrastructure.

Most US cities have some type of disaster or hazard management plan, be it formal or informal, but most of these plans do not specifically address how to effectively consider trees. Landscape architects would be able to greatly assist in creating these plans, contributing important knowledge about trees relevant for the planning of preparedness, response, and recovery phases. In terms of preparedness, landscape architects can suggest tree species, planting techniques, and proactive maintenance practices that would lead to the creation of a more resilient urban forest. In response phases, landscape architects can work alongside urban foresters to identify damaged trees that could be pruned and saved, rather than hastily removed by contractors. Then, in recovery phases, landscape architects can work with communities and stakeholders to help determine where to plant, what to plant, and how to equitably prioritize planting, post disaster. Most importantly, landscape architects can help to advocate for the value of trees and how important they are as green infrastructure.



## **Limitations**

During the research process for this report, applicable information for certain topics proved exceedingly difficult to find. It was not until months into the research that the ReLeaf Plan was published. Findings from the report helped to strengthen the Cedar Rapids Case Study and inform the recommendations provided in Chapter 5.

When Cedar Rapid's ReLeaf plan became available, other existing studies proved that there was extremely limited information on how cities in the Midwest region recovered from natural disasters with a focus on trees. Cedar Rapid's ReLeaf is the most contemporary example of how a Midwest city could prepare, respond, and recover their urban forest from natural disaster scenarios.

Though interviewing additional personnel from Manhattan would have been informative, project scope and time constraints prevented this from happening.

## **Future Research**

Future studies could include documenting the total time of recovery for the complete recovery of Cedar Rapids, their successes, and shortcomings after utilizing their ReLeaf Plan.

It would be beneficial to examine other cities within the Great Plains region and learn how those cities have recovered in post-disaster scenarios. By studying how cities can receive funding for their street trees and arguing the street trees should be considered green infrastructure, the argument could help set a precedent that would allow for cities to begin receiving funding for tree replacement.

Finally, refining implementation strategies of a tree replanting plan for communities, and cities at multiple scales would show scalability. Studying actual costs expenditures for more accurate spending amounts and studying regional areas for sourcing of trees throughout the Midwest could help enhance a tree recovery plan. Creating frameworks for all cities to communicate with one another of how those cities are prepared for, responded to, and have recovered from natural disasters when replacing their lost trees within their urban forests would benefit all communities.

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## **Appendices**

### **Summary of Interview with Sandi Fowler – Deputy City Manager of Cedar Rapids. February 25, 2022.**

#### **What was your role in the recovery from the disaster?**

Immediately after the storm had passed, Fowler had reported to the emergency operations center for the city at the Incident Command Center (ICC). Fowler worked with senior leadership and had multiple departments report to her such as the public works, building services, fire department, and incident management team.

#### **When disaster struck, what was the city doing?**

The public works director took lead on the downed trees issue, and the police and fire departments went door to door checking on people. Radios were issued to street crews clearing the roads of debris to keep communications up after power had been lost. The street department, which included some 90 persons, were sent out to clear roads on the routes they had been given for snow removal, this was because these members had memorized their routes and knew where they were going. Utility services were called out to ensure downed powerlines were not active and putting people in danger. Finally, building services were called to go door to door and make damage assessments to determine the severity of damage to individual homes.

#### **How will the replanting plan be funded?**

Cedar Rapids' 10-year tree replanting plan will cost around \$37 million dollars. The city has committed to paying \$1 million per year for the next 10 years and with the help of fundraising through community partners and private donations, plan to receive the other \$27 million dollars to cover the cost.

#### **What is the recovery like now?**

The next step is the long-planned process to recover the tree loss. Plans are to plant a tree on every street. Consulting was done to have the parks trees in Cedar Rapids inventoried. One issue Cedar Rapids faces, like many cities, is the lack of a sufficient proactive tree maintenance program.

## **Summary of Interview with Jeff Speck – City Planner and Urban Designer. February 18, 2022.**

### **Was the city prepared?**

“You cannot really prepare for something like the derecho, however one of the principal goals of this project was to be as resilient possible with the trees that we planted.”

### **How was the tree replanting plan created?**

The plan quotes other researchers about their research and lessons learned. “Trees that are planted closer together are less likely to be blown down due to their roots being connected to other trees, also like trees support like trees.”

“When similar or same species are planted together, they become more resilient.”

“Dr. Frank Santamour who came up with the 10/20/30 rule, made it very clear that you achieve diversity with trees city wide by having pockets of uniformity”

Speck also shared that street trees should not be a random potpourri of trees but should be the same or similar throughout and change when reaching a different street. The only caveat being that oaks should not be planted together due to their susceptibility of catching oak wilt, which spreads through their roots.

Speck made sure to emphasize planting pockets of uniformity to achieve diversity, planting closer together to better protect and allow for more trees, and starting smaller makes more sense due to smaller caliper trees will catch up to larger caliper trees and then outpace them.

Locations not including streets, but parks or open areas should be planted with saplings, or by seed. This is because the cost of a sapling is 1/100<sup>th</sup> of the price of a normal tree and can be planted in mass. “You may lose 9 out of 10 of your saplings however you are still 10 times cheaper than if you had planted a tree. So in locations where you are willing to have a grove, it would make more sense to plant a lot of saplings versus trees 1 – 3 years old.

## **What was the response to the storm?**

Speck was impressed with the response, in that literally within a week of the disaster people still did not have electricity. The City of Cedar Rapids had contacted Speck and asked for the creation of a tree replacement plan. During the time people were trying to find their next meal and waiting to have electricity restored, Speck, Confluence, and the City of Cedar Rapids had begun the planning phase of the tree replacement project.

## **How was funding accomplished?**

The City of Cedar Rapids offered \$1 million per year for 10 years. Private industry sector has opportunity with funding through carbon offset programs, and most of the funding is being handled through Trees Forever, a nonprofit organization seeking private donations.

Speck informed that Cedar Rapids was a lucky and unique case in which Trees Forever and Confluence were both institutions that were able to help with planning and handling the funding for focusing on the tree recovery plan.

## **Personal insights and takeaways to help inform Manhattan, Kansas?**

The next best step is convincing people the value of trees. People cannot change the investment in trees, until there is a community understanding to the value of trees.”

Inform citizens what they stand to gain from planting trees in their streets and neighborhoods.

“A lot of cities are paying for tree plans, a lot of planners start fresh to get the data, but the data is already all there in Cedar Rapids ReLeaf Plan, and recreating the wheel is not necessary”

“Finally, just because the city does not have a committed budget for trees, does not mean in response to a disaster there might not be a commitment subsequently made by the city council to fund replanting for trees.”

## **Summary of Interview with Shannon Ramsay – Founding President and CEO of Trees Forever. February 22, 2022.**

### **Was Cedar Rapids prepared for the Derecho?**

Very briefly, Ramsay said “no.”

### **Information on involvement of the ReLeaf Plan?**

One thing that was emphasized was that the ReLeaf Plan is for the entire Cedar Rapids community and not just the city.

Trees Forever may receive federal funding in the future, however it will most likely come from climate change programs, and other programs through the forestry service.

There are currently no direct funding programs that go towards the sourcing of trees, most funding will come through private donations.

### **How were the tree plantings prioritized in the ReLeaf Plan for Cedar Rapids?**

After a lot of input, planning, and time with Jeff Speck’s guidance, the planning was recommended to be based on concentric circles starting out from the center of the city. The neighborhoods surrounding the downtown area are considered the most underserved areas. By starting the plan this way, this allows initial funding and resources to help the most affected and underserved communities first.

### **Any key takeaways?**

To influence city politics, it is necessary to find cohorts that will work with you, whether that’s finding a city official that is interested in the same outcomes, creating personal networks, or finding people that will back you and are on board with the same goals in mind.

### **Do you know if Cedar Rapids has implemented new codes/laws since the Derecho?**

Cedar Rapids committed to keeping their tree inventories up to date as things are replanted. Trees Forever is mapping all adopted trees out to private residents, and most importantly documenting what has been planted and where.

### **How did private citizens get on board?**

The county and area are a heavy tree supporting community. Stakeholder inputs from surveys, climate change plans, and citizens always made planting their trees priority. The citizens of the Cedar Rapids community are very for trees.

## **Summary of Interview with Nick McGrath – Community Disaster Recovery Coordinator. February 17, 2022.**

### **Being hired by the city**

After the Derecho hit, Nick McGrath found opportunity working for the City of Cedar Rapids through trees forever and the Department of Natural Resources. McGrath's work includes working with all counties that were affected and federally declared in the natural disaster.

### **In what ways was Cedar Rapids prepared?**

For Nick McGrath it was difficult to discern because he had not yet been involved with the city's assessment of the damage, however it was consensus that nobody could have been prepared for what would happen.

### **What was the response after the Derecho hit?**

Power had been down for weeks, and many citizens came out to volunteer with helping clean up, the reason being that there was not much to do. The federal declaration for the disaster would eventually come 10 days after the storm had hit. After federal declaration, many people from all over the United States went to help with the disaster recovery efforts.

### **What has happened since the storm?**

The Community Disaster Recovery Coordinator position was created. Long term planning for rural communities was a major goal that was created. One problem that arose was that rural Iowa faced issues with lack of resources in comparison to Cedar Rapids. Tracking down people who were eligible to file the proper FEMA documentation proved difficult.

### **What was your involvement with the city and the ReLeaf plan?**

Nick McGrath was initially on the steering committee serving as a voice/representative for the Department of Natural Resources. McGrath's involvement included sitting at meetings with architects, city officials, and urban planners.

### **Has any codes or city ordinances changed since the storm?**

The city of Cedar Rapids has changed some things within their city ordinance, and or have plans made that have not yet been approved. One example is allowing for trees to be planted in areas between 20-30 feet from each other versus the original 40 feet or more. This ordinance was allowed due to the research that was presented showing that tree roots that were closer together allowed for their roots to comeingle and create multiple points of securing themselves.

### **Any insight or key takeaways that may help the city of Manhattan, Kansas?**

“The development of planning at the local level can be helpful, like the creation of a neighborhood association with chainsaws, trucks, or generators that could be immediately available.” This is important because the use of such neighborhood association would mitigate the waiting on city and government to help.

### **How did the city of Cedar Rapids prioritize what trees would be planted?**

“A list of native species had been prioritized after many meetings with members across many professions.” This allowed for the professionals to inform one another the negatives of planting trees like Callery Pears and or Norway Maples. One issue still remains with nurseries, if they are not on the same goal as the ReLeaf plan, the nurseries will continue to sell what makes the business profit.

### **Have private citizens since been informed how their trees could be replaced?**

Trees Forever has a program called “Growing Futures” which recruits area teens and pays them on weekend to plant and maintain street trees. ReLeaf’s plan has identified certain streets that will be replanted first based off criteria like canopy loss, economic status, and proximity to parks for example.

## **Summary of Interview with Patrick Alvord – Principal of Confluence Cedar Rapids. March 03, 2022.**

### **Landscape Architecture and Disaster Management Research for ReLeaf plan.**

For Confluence the planning efforts process was straight forward. What was not expected from the firm was the challenge of the focus on replacing of trees directly from the disaster management recovery aspect. No one in any of Confluence's offices had direct technical experience with disaster management and leveraged a lot of the tangential and unrelated experiences to move the plan forward.

Through a disaster management company named Debris Tech, monitoring, and documenting of lost trees through tagging and removal was plugged into Confluence's GIS analysis along with the data set that tree inventory company Armor Pro had prepared in 2016 during Cedar Rapids initial street tree inventory.

One major challenge Confluence had faced was collecting usable data. "If it was not for Arbor Pro's tree inventory along with the data provided from Debris Tech, Confluence felt that they would not have been able to truly understand what the magnitude of loss was on the ground. Nor would Confluence had been able to project what the recovery effort looked like in terms of number of trees needed to be replaced over the life of the plan."

The ultimate goal in the creation of the ReLeaf plan was to create an educational piece that could be given to someone and with a little bit of engagement the people could walk away with the understanding of what the document is about, what the document is advocating for, how the numbers were determined, and basic recommendations the lay person could understand to getting trees back in the ground.

### **Was Cedar Rapids prepared for the Derecho?**

"I would argue that Cedar Rapids of all cities may be better prepared than others to respond because it is a city that has withstood a number of natural disasters over the last several years. With two major floods, the derecho, a second smaller derecho, the city of Cedar Rapids is an entity very well prepared for disaster response, but not necessarily this specific disaster."

"No city is really prepared unless they have experienced disaster response scenarios before and then learned from them, some cities do better than others."

Hurricane Ike in Galveston Texas is an example that is given as well as the ice storm in Calgary Canada that de-limbed most of their trees.

The disaster response between both cities were very different however it could be argued both cities are better prepared now to respond to similar scenarios.

What is the Landscape Architects role in Disaster Management, or is there a valuable role the Landscape Architect can play?

For landscape architects there is a narrow scope of services that the traditional landscape architect can respond to it relates to streetscape design and planning and understanding arboriculture and urban forestry to a degree. The Derecho in Cedar Rapids was a unique experience and normally firms do not normally offer a specific focus like disaster management recovery for trees.

One thing Confluence had learned was that there is a disconnect between urban forestry and landscape architecture.

In urban forestry, trees are viewed as singular assets. Landscape architects view trees with design in mind, looking to see how trees shape space, and create more pleasant environments.

Confluence in the past decade has been able to establish themselves as a valuable partner for the city of Cedar Rapids, welcoming many perspectives from high level professionals in many fields to sit down and work comprehensively together. The creation of the ReLeaf plan was beneficial for the whole of the city because everyone in town worked together to find a common goal.

**How soon did Cedar Rapids recognize something needed to be done, when did Confluence get involved?**

Within 48 hours of the Derecho hitting Cedar Rapids, Jeff Speck had been contacted and asked to together with Confluence. The Confluence team began working together with the Cedar Rapids, Trees Forever, and Jeff Speck by the end of August.

Usually scoping and marketing of a project is done at risk for no fee, however Jeff Speck recognized that the magnitude of this problem was such that Confluence needed to place a small scoping contract to meaningfully utilize that time to figure the project and creation of plan without losing money and being rushed.



## **How was the data used?**

Public input allowed for the creation of priorities and principle.

## **How were trees being sourced?**

Several stakeholder groups were identified and asked early on to be a part of the long-term success of the replanting efforts. Confluence had recognized early on sourcing would be a problem, particularly with identifying the heavy plant palette being created.

Categories for trees were created, for example superior trees were considered trees that supported the food web, large canopy, native or native cultivar, and thus the criteria eliminated many trees normally seen on standard tree lists for cities or DNR generated tree lists.

One major issue the city faces is Cedar Rapids spending towards their annual planting program. Cedar Rapids must spend the money allocated for trees during that fiscal year otherwise forfeit the money. If there are no trees available to purchase based off the list, it is a missed opportunity, and if they are able to purchase the trees, finding workers to plant the trees becomes a new problem. Cedar Rapids cannot realistically commit funds to something they cannot have within that fiscal year timeframe. Therefore, contract growing has been set up through Trees Forever to ensure the money allowed for trees from Cedar Rapids is not lost.

## **What are some outcomes and lessons learned that could be used to influence Manhattan, Kansas?**

“Confluence did a review of existing codes and ordinances that Cedar Rapids had that related to trees. Whether preservation of trees, tree mitigation for new development, spacing requirements, and then made recommendations for some changes to advance the agenda of increasing more tree canopy quickly.”

Being more restrictive in tree preservation requirements. Currently developers are given freedom in how many trees they can remove, what size they can remove, and are finding loopholes when hired for projects. Recommendations had since been made to lessen the ability to remove larger surviving trees.

Reducing tree spacing from 40 feet to 30 feet to get trees closer together, creation of a specific tree list for growing under power lines and communicating with municipal utility providers to understand their requirements and restrictions for planting trees.

## Final Thoughts?

“If Manhattan does not have a tree inventory and not know what they have, they can continue to press forward treating each tree as an asset, but Manhattan will not know the actual value of the trees in context to the overall tree inventory. Arbor Pro is a company that did Cedar Rapids tree inventory and charged pennies to the dollar for inventory and provides all their data through GIS. If Manhattan utilizes GIS for all their utility and street infrastructure, then this would be easy adding another data set. Then not only could Manhattan know what they have but also know what they need.”

If Manhattan decides to get a street tree inventory, it is highly recommended parks are included.

## **Summary of Interview with Kim Bomberger – District Community Forester Kansas Forest Service. February 22, 2022.**

Kim Bomberger provides technical assistance, education, training with tree boards, and city departments. Bombergers scope of work covers 29 counties in north central and northeastern Kansas and has a history of helping communities affected by natural disasters, assistance with FEMA documentation, and providing services to cities needing certified arborists to document tree damage and loss.

### **What knowledge should one have and what is the process after disaster strikes?**

FEMA has its criteria and cares about the credentials of who is helping with any city/county FEMA documentation. “It is important to do the job the right way, because then people can trust you and surrounding counties may be able to rely on one another to get the job done correctly.”

FEMA documentation may include looking at trees on public property, looking at the type of damage, whether the canopy of the tree is missing 50% of said canopy, or must be removed due to irreversible damage.

“Depending on the FEMA official reviewing, exposure of the cambium layer may be up for debate.” Bomberger would consider removing trees with major cambium loss.

Once lists are made, the documentation can be submitted to the city for FEMA.

### **How do cities receive funding for replacing trees?**

“Each state in the United States has an opportunity to propose to their forest service region, grant projects, that we can show a need for trees that follow the factors we identify in our forest action plan. Examples include loss of canopy, as a concern for our communities. Pursuing forest service dollars is an option to get funding for replanting trees if one could argue and get aligned with other entities to get the funding for the trees needing replacement.”

## **What are the processes of involvement in post natural disaster scenarios and is there ever a conversation about replacing trees?**

As mentioned previously, Bomberger's job is assessing trees as a team leader, identifying trees, or defining her specific role to help. This includes asking what the plans are for getting trees replaced and what help is needed.

## **Are there any lessons learned from your work in post natural disaster scenarios?**

"There were always discussions about the loss of trees, but how are affected areas moving forward about recovery?" Discussion about creating tree boards, and whether council will support the efforts is always taken into consideration.

Bomberger has witnessed tree boards receive funding for tree planting programs and "in the 12<sup>th</sup> hour" watch the funding be taken away.

## **Any key takeaways for officials of the city of Manhattan?**

Bomberger recommends that identifying the people within the community that have a shared interest in trees are known. The level of knowledge of trees is irrelevant so long as people are willing to get trees planted and cared for.

Finally, when storms are severe, cities will have a mutual aid agreement to help one another immediately while waiting on federal assistance.

## **Summary of Interview with J. David Mattox – Manhattan’s City Forestry Supervisor. March 07, 2022.**

### **How prepared is Manhattan to handle a natural disaster?**

“In short we are not prepared for a catastrophic natural disaster”

Mattox stated that “a lot of it depends on the severity” when discussing a catastrophic type of disaster scenario.

Mattox has encountered some serious storm events since working for Manhattan, however, has never had to respond to a catastrophic event like the Derecho of Cedar Rapids.

The plans currently in place for the city of Manhattan are to immediately respond with the fire department, emergency operations center, and police department.

The primary goal during a serious storm event is to ensure the roads are being cleared, getting travel back to normal, then pruning/removal of damage and destroyed trees on houses and cars.

In 2007 Manhattan was hit by a tornado, and in this moment Mattox job changed quickly from arboriculture to a disaster management position for the city.

Manhattan has performed numerous tabletop exercises over the years to discuss what is needed and what the response needs to be.

### **What are some issues you see with Manhattan’s preparedness?**

The equipment yard that houses all the gear and machinery necessary for recovery does not have a backup generator. “If a storm took out the equipment yard while making its way across town, then we are dead in the water” meaning we are vulnerable in our ability to immediately start recovery efforts.

Mattox has advocated for a mutual agreement with equipment companies that can have equipment available for recovery in a hurry, however, that request has never been acted upon.

“Communications are not in a robust form in which communication could tolerate a natural disaster type of situation.”

Currently Manhattan is capable to work on the average Kansas thunderstorm our city usually experiences.

“If there are trees blocking many streets, then we can have it cleared within a few days. These are that our biggest problems have been historically.”

“If we have our infrastructure hit hard, then we will have some very real problems.”

### **So, a plan does exist?**

“Yes, however the actual implementations of response to a catastrophic event has not actually ever happened here.”

Understanding the plans success is hard to gauge due to Manhattan’s history of never having a catastrophic event that is comparable to cities like Cedar Rapids and their Derecho.

Manhattan’s Forestry Department has contacted a disaster response company through discussion with Topeka, however, the contract that was pitched to Manhattan was not received as something the city was willing to spend money on. This is because Manhattan has never experienced a catastrophic event that warrants the need for this service.

“We are the only city we know of that has done our own clean up, with members from public works and city forestry.”

### **What are the processes when a storm strikes?**

Mattox supervises his unit overseeing the tree response, cleaning, and clearing.

If a storm hits Manhattan and does not warrant FEMA declaration for funding, then Manhattan is responsible for its own costs for cleanup.

The operating budget Manhattan utilizes during these responses is essentially an open checkbook to allow for the city’s departments to effectively clean up and get thing back in order.

### **In your opinion, what do you feel Manhattan needs to be better prepared for responding to tree removal and recovery?**

“The biggest thing, without making addition to the department and putting more resources on the ground at this moment, would be having the ability to have our equipment replaced without jumping through a lot of hoops for a long time.”

The addition of backup generators to ensure the operations building does not go down if the power grid goes down was a recommendation.

“Hardening of the response systems, equipment replacement, and having a contract with a company that could assist with disaster recovery like Debris Tech did for Cedar Rapids.”

One concern Mattox shared was that if funding came in for a tree

replacement plan equal to Cedar Rapids plan, that people may become passionate and begin planting trees without understanding the care a tree needs to survive after its initial planting, thus creating a new problem.

“Another issue is people who lose their trees may fall prey to nurseries when asking for something that will grow fast to see a quick result.”

Mattox is a big supporter of having the right tree for the right place, and nurseries may stock only what earns their company money. Educating the public about tree selection during these times is necessary.

### **What would it take for Manhattan to get a tree inventory?**

After discussing how Cedar Rapids, Confluence, Trees Forever, Debris Tech, and Jeff Speck were able to utilize the data to help create Cedar Rapids’ ReLeaf tree planting plan, Mattox felt that was the best use of a tree inventory he has heard.

The recentness of Cedar Rapids tree inventory proved vital in the recovery and replanting of Cedar Rapids urban forestry. One reservation Mattox expressed was “If the city is not on top of updating that tree inventory, then the inventory quickly will become worthless.”

“The simple answer is money; the city had a municipal tree inventory once.” The city received funding, had a plan to manage the data and information, but it did not go according to plan due to hiring interns learning a system they were not familiar with and by the end of their internships were working on information that was increasingly becoming outdated.

Data collection, documentation, and information gathering has since been updated since then. A tree inventory could be welcomed to the city if it does not see the same fate as the previously poorly executed plan.

Aside from the money it requires to have a tree inventory, Mattox believe it takes people with the city being on the same terms. People need to see the value in having a tree inventory, otherwise it could be argued as a waste of money.

Until then, resources may go towards the hiring of contracting companies that specialize in disaster clean up when handling serious storm events.

## **What resources would be required for the city to proactively take care of Manhattan's existing trees?**

"We could do a lot more without a tremendous amount of additional resources."

Manhattan currently has a huge backlog of work to be done due to covid, budget issues, hiring freezes, and not being able to keep seasonal workers during the covid years. Currently Mattox's department is already trying to perform a lot with less, covid being the factor that buckled a lot of the ongoing operations before affecting our community.

One request was for an additional aerial truck and crew. Currently Mattox has two operating crews, depending on if there are no sick calls or vacations amongst the crews. One crew is always fully operation.

Mattox shared that having two crews of four people always would help. Additionally, a third crew could be hired with its dedicated bucket truck and chipper would allow for finishing all backlogged work. Once completed the third crew could be dedicated to proactive maintenance such as necessary pruning for our street trees.

## **Does Manhattan have a dedicated site to handle the tree debris?**

Manhattan utilizes the transfer station, but it is of limited size. One major issue the city faced during the 2007 ice storm was the amount of debris was so much so that burning had to happen immediately to provide room for the increasing amount of tree debris coming in.

## **What kind of improvements would help Manhattan's forestry department?**

"A combo truck that comes with a chipper attached to an aerial truck would allow for a lot of work to be done in a day, especially for systematic pruning."

Three additional people for the extra crew would allow for normal operations, however having four to five people on said crew would allow for that extra crew to reliably run almost always.

The requests seem realistic in comparison to the amount of money Manhattan spends on maintaining its city pools, lighting for fields, and maintaining of ball fields.

## **What would it take for the city to increase the annually planted trees to two trees planted for every 1 tree removed?**



When Mattox began working for the city of Manhattan, that was standard operating procedure. Since then, the city has grown, and budgeting has been slow to allow for this in current times. Another major issue is finding and retaining seasonal employees, as it is becoming increasingly more difficult to find workers willing to do this line of work.

“Up and down the line, the city needs to come together and find out where the money is and where it comes from to reallocate resources that could be used for something like that.”

### **How does Manhattan prioritize where street trees are planted?**

Tree replacements are first prioritized by the city, if a tree is needing to be removed, then it shall be replaced. Afterwards, trees are replaced based on requests.

### **Your experiences and information that may help the future of Manhattan?**

Based on previous storm events, Manhattan is prepared to handle the typical storms we endure annually. From Mattox’s perspective, preparation is everything.

“We may not have the resources we need, and if a tornado takes out the shop we are in real deep trouble, but we do have a reliable five-person team always running 1 crew that could be in, mobilize and make a huge difference.”

“Disasters are a matter of degree, and we cannot prepare for all of them.”

Manhattan has not changed any ordinances or codes from previous storms as they were not as devastating as Cedar Rapids.

“People need to be methodical about how we would recover and replant trees to ensure there is not any negligence, planting one hundred trees when realistically we can only take care of a few is a main concern of mine.”

“The crews are trained and ready to go and can respond at moment’s notice to get a lot done in a relatively short period of time.”

## **Summary of Interview with Laurie Harrison – Emergency Management Coordinator Riley County. February 18, 2022.**

### **Who is utilized during Storm Events?**

Agencies that respond during storm events include the fire department, city public works, parks and recs office, emergency medical services, and local law enforcement.

Others may be included depending on the event. These agencies may include American Red Cross, Department of Transportation, Kansas Highway Patrol, and the Army Corps of Engineers.

Harrison serves as a messenger and planner for informing all the agencies involved.

Harrison also serves as the logistics officer to make sure Manhattan has the equipment and personnel needed for the job, as well as, ensuring that the resources are being used proper, tracking equipment, accountability of personnel, and demobilizing in a timely fashion post event to ensure Manhattan is not paying for resources when not in use.

### **What equipment is available?**

“Standard forestry service equipment like chainsaws, and protective gear, as well as vehicles like bucket trucks, aerial trucks, skid loaders, etc.”

### **What is response like for rural communities compared to Manhattan?**

“The response in rural communities would be the same, the obvious difference is that rural communities do not have access to Manhattan’s resources unless asked for in mutual aid response. Surrounding counties, and Kansas can supply resources to affected communities in rural areas, but it would take a little more work to get what is needed.”

### **Who makes the decisions on who gets what after a storm event for replacement of trees?**

Manhattan makes the decision on what neighborhoods get priority over tree replacement.

Public Assistance from FEMA is the pocketbook afforded to communities after that community is presidentially declared affected from a disaster. Trees and landscapes are not covered in reimbursement as far as replacement of trees, only for removal.

The Manhattan Greater Community Foundation was established to allow for public donations to be used and prevent scam artists from stealing money from vulnerable persons after disasters.

**How did Manhattan respond to the snowstorm and tornado it experienced in the 2000's?**

First responders are the immediate people to go out. Harrison is located at the emergency operations center and supporting whatever is needed for the first responders, Manhattan fire department, and law enforcement where exactly damage occurs.

“Volunteers come out; we have a community emergency response team in Riley County. This is a volunteer force that is trained to respond after an event, and they can help with search and rescue, basic medical, fire suppression, and are another body that is trained in the field to just be of assistance to the first responders and are a great asset to have.”

Harrison then mentions a term called emergent volunteers; “these are volunteers that come out of the goodness of their hearts. The problem however is these volunteers do not understand the incident command system, nor where to fit in to help, they are unorganized and do not understand the processes they have to go through and documentation. If help is not documented, then it never happened.” The difference between emergent volunteers and the Community Emergency Response Team is the training provided.

A volunteer sign in is set up after storms, where a team leader is appointed, usually from the fire department, and can help emergent volunteers get immediate training and get sent into the field.

“A lot of people usually show up after storm events to help.”

**Do you have any personal input or recommendations that would help the city prepare, respond, and recover from disasters with focusing on recovering trees?**

“Anytime we have had any event, the cities both rural and Manhattan have been good. The emergency center has a good working relationship with all the cities and county agencies and pull together to get the job done.

TO: Jessica Canfield  
Landscape Archit & Comm Plan  
Manhattan, KS 66506

Proposal Number: IRB-10972

FROM: Rick Scheidt, Chair  
Committee on Research Involving Human Subjects

DATE: 12/21/2021

RE: Proposal Entitled, "The Manhattan Kansas Disaster Preparedness and Urban Forest Recovery Plan."

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §104(d), category:Exempt Category 2 Subsection ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

Electronically signed by Rick Scheidt on 12/21/2021 6:48 PM ET