

Post-disaster recovery in small towns: learning from the experience of tornado
recovery in two communities

by

Natalie Kate Walls

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF REGIONAL AND COMMUNITY PLANNING

Department of Landscape Architecture and Regional & Community Planning

College of Architecture, Planning and Design

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2024

Approved by:

Major Professor

Dr. Shakil Kashem

Abstract

Tornadoes are a type of natural disaster that can occur anywhere in the world and cause massive amounts of destruction and loss of life. Since tornadoes develop rapidly and can occur anywhere, they are very difficult to predict, and communities have trouble properly preparing for and ultimately recovering from them. Tornadoes can be even more devastating for small rural communities that are already struggling to sustain their population base. The overarching goal of this study is to explore, what response and recovery strategies contribute to long-term recovery, including population recovery, in small communities? We applied a comparative case study approach for the cities of Greensburg, Kansas, and Parkersburg, Iowa, both of which experienced EF-5 tornadoes in 2007 and 2008 respectively but had different paths toward tornado recovery. While Parkersburg succeeded in recovering and growing its population post-tornado, Greensburg continued to lose population over time. Through key informant interviews and document analysis, the strategies they have implemented to recover are explored and the strategies that worked well and that didn't in terms of long-term recovery are identified. Some strategies that have supported recovering communities like Parkersburg and Greensburg with varying levels of success include rebuilding the basic needs of the community first, having a pro-growth strategy that capitalizes on the build-back better mindset, and marketing the cities' unique characteristics such as new infrastructure and supply of buildable lots. Having a hazard mitigation and disaster recovery plan in place and accelerating the planning process so the population doesn't move elsewhere also helped these communities. These strategies show the importance of disaster preparedness and rapid planning initiatives post-disaster for the long-term recovery of small communities. Findings from this study can contribute to the planning initiatives of other small towns in tornado-prone areas in hopes of easing their recovery processes.



Post-Disaster Recovery in Small Towns: Learning from the Experience of Tornado Recovery in Two Communities

Natalie Walls
Kansas State University
2024



Copyright

© Natalie Walls 2024.

TABLE OF CONTENTS

CHAPTER ONE**INTRODUCTION 2**

Literature Review	3
Tornadoes	3
Disaster Planning Cycle	5
Hazard Mitigation	6
Disaster Recovery	9
Challenges of Small Towns	12

CHAPTER TWO**STUDY METHOD 15****CHAPTER THREE****POST-TORNADO RECOVERY OF
GREENSBURG, KANSAS 21**

Greensburg, Kansas Before	21
About the Tornado	22
Recovery Process	25
Greensburg, Kansas Today	32

CHAPTER FOUR**POST-TORNADO RECOVERY OF
PARKERSBURG, IOWA 38**

Parkersburg, Iowa Before	38
About the Tornado	40
Recovery Process	42
Parkersburg, Iowa Today	47

CHAPTER FIVE**STUDY FINDINGS & RECOMMENDATIONS 53**

Towns Before	53
Tornadoes	54
Recovery Processes	55
Towns After	59
Recommendations	61
Conclusion	68
References	70
Appendix A	75
Appendix B	78

LIST OF FIGURES

Figure 1	Five most common barriers to recovery from each category	9
Figure 2	Overview of Study Method	15
Figure 3	Case Study Selection Process	16
Figure 4	Case Study Process	16
Figure 5	Study Area Representatives	17
Figure 6	Interview Process	18
Figure 7	Greensburg, Kansas	21
Figure 8	Greensburg, Kansas Tornado Track	22
Figure 9	Tornado Track Through Greensburg, Kansas	23
Figure 10	Greensburg, Kansas Population	33
Figure 11	Greensburg, Kansas Age Breakdown	33
Figure 12	Greensburg, Kansas Occupancy Status	34
Figure 13	Greensburg, Kansas Household Type Breakdown	34
Figure 14	Greensburg, Kansas Median Household Income	35
Figure 15	Greensburg, Kansas Unemployment Rate	35
Figure 16	Parkersburg, Iowa	38
Figure 17	Parkersburg, Iowa Tornado Track	39
Figure 18	Tornado Track Through Parkersburg, Iowa	40
Figure 19	Parkersburg, Iowa Occupancy Status	48
Figure 20	Parkersburg, Iowa Household Type Breakdown	48
Figure 21	Parkersburg, Iowa Population	49

Figure 22	Parkersburg, Iowa Age Breakdown	49
Figure 23	Parkersburg, Iowa Median Household Income	50
Figure 24	Parkersburg, Iowa Uemployment Rate	50

Acknowledgements

Thank you to everyone that has guided me throughout this research. To my major professor, Dr. Shakil Kashem, thank you for all your advice and for always being willing to answer my never-ending questions. To my committee, Dr. Susmita Rishi and Dr. Bimal Paul, thank you for your continued support and input. Thank you to Chris Luhring, Jeff Kolb, Matt Christenson, and Stacy Barnes for your participation in this report, this report would not have been possible without you. Lastly, to my friends and family, thank you for your endless support and encouragement throughout this process. A special shoutout to my mom for always answering my calls and finding ways to help me in any way that she could.

CHAPTER ONE

INTRODUCTION

Tornadoes are a type of natural disaster that can occur anywhere in the United States and cause massive amounts of destruction both physically and socially. Each year, tornadoes cause billions of dollars in damage and over 1,000 injuries and deaths, signifying the physical and societal risks that these extreme weather events pose (Gensini & Brooks, 2018). Tornadoes are very hard to predict as they develop rapidly and can occur anywhere. This unpredictability makes it difficult for communities to properly prepare for and ultimately recover from tornadoes when they do occur.

Disaster planning efforts can and should be made everywhere, not only for tornadoes but also for other types of disasters that may affect the planning area. Disaster planning starts with hazard mitigation and the creation of a hazard mitigation plan. The goal of a hazard mitigation plan is to minimize the impacts of all types of disasters that may affect an area. However, tornadoes have historically received less attention than other disasters in hazard mitigation plans because they have a much smaller footprint than other disasters and are considered to be a low-risk-of-occurrence phenomenon. The disaster planning process then moves through the preparedness and

response phases before reaching the final step of disaster recovery. Recovering well from disasters is extremely important because the consequences of natural disasters, such as tornadoes, have the potential to destroy communities if immediate response and recovery actions after a disaster are not done properly.

In this research, I intend to present information on recovery strategies for communities to implement in response to tornadoes. Using the information, I will compile a list of best practices for tornado recovery that cities and towns across the country can apply in hopes of easing their recovery processes. I have also collected some information about hazard mitigation strategies regarding the preparation for future events as that is part of the overall tornado recovery process. The goal of collecting information on hazard mitigation strategies is to provide communities with strategies to implement that reduce their vulnerability to tornadoes. The overarching goal of this research is to answer the question: what response and recovery strategies contribute to long-term recovery, including population recovery, in small communities?

Literature Review

Tornadoes

Tornadoes are a type of extreme weather event that can be produced during severe thunderstorms. Tornadoes are a very destructive and dangerous phenomenon due to high wind speeds that can exceed 300 miles per hour (Clements & Casani,

2016). Tornadoes pose not only physical risks but also social and economic risks to communities. Tornadoes can cause damage to infrastructure including homes, businesses, roads, and utilities, and can also cause injuries and deaths as well as losses in the quality of life for community members. These physical, social, and economic risks are influenced not only by the characteristics of the tornado but also by the characteristics of the community that is affected, meaning its demographics and social vulnerability, and the affected people's attributes, meaning their preparedness and previous experience with severe storms, if any (Clements & Casani, 2016). Tornadoes have a smaller footprint than many other types of natural disasters, but the places that are affected by tornadoes are typically severely affected. On average, the impacts of tornadoes are calculated to be \$5.4 billion per year (Gensini & Brooks, 2018). This figure includes an average of 60 deaths quantified at \$7.6 million each (EPA 1997) and an average of 1,000 injuries quantified at \$76,000 each (1 percent of a statistical life) (Kern et al., 2010). Everyone needs to understand the risks of tornadoes and be prepared for them because they can occur anywhere in the world and they pose very real threats to entire communities (Gensini & Brooks, 2018; Farney & Dixon, 2014).

Climate change has led to increased interest in studying the behavior of tornadoes in the United States (Agee et al., 2016). Researchers have hypothesized various changes in tornado activity patterns, including shifts in the center of activity, changes in frequency and timing, and increases in strength (Gensini & Brooks, 2018). Historically, tornado activity has been concentrated in the Great Plains region known

as ‘Tornado Alley’, however, recent studies suggest a shift towards the southeastern United States, an area dubbed ‘Dixie Alley’ (Gonteski, 2023). Understanding these climatological changes is crucial for emergency planners, especially in regions where tornadoes were previously less common. Communities unaccustomed to tornado threats may be ill-prepared for their impacts, necessitating a reassessment of state and local hazard mitigation plans (Gonteski, 2023).

According to Farney and Dixon (2014), the amount of research on extreme weather events, including tornadoes, has increased as human behavior has increased our exposure to them. If we know what factors are causing our increased exposure to tornadoes, we should be able to better prepare for and ultimately be able to recover from them more easily. The goal of preparing for tornadoes is to reduce or avoid the impacts of a disaster. Disaster recovery, in this case from tornadoes, is extremely important because it aims to repair and recover what has been lost and mitigate against future similar disasters occurring.

Disaster Planning Cycle

According to Coppola (2021), to prepare for disasters, tornadoes included, and their associated risks, a process known as disaster planning is used with the goal of reducing harm to life, property, and the environment. The most utilized disaster planning approach is a four-phased approach of mitigation, preparedness, response, and recovery (Coppola, 2021). Mitigation seeks to reduce the likelihood of a hazard

occurring or to decrease the negative impacts of a hazard before it occurs. Disaster preparedness can be defined as “the actions taken in advance of a disaster to ensure adequate response to its impacts and the recovery from its consequences” (Coppola, 2021, p. 275). Disaster response is defined as actions “aimed at limiting injuries, loss of life, and damage to property and the environment before, during, and immediately after a hazard event” (Coppola, 2021, p. 321). Lastly, “disaster recovery is the process of repairing, reconstructing, and regaining what has been lost as a result of a disaster and, ideally, reducing the risk of a similar disaster occurring again in the future” (Coppola, 2021, p. 405). The four phases of the disaster planning cycle overlap and influence each other, as they are often executed simultaneously and share similar goals.

According to Howe et al. (2014), climate change is affecting the frequency and intensity of extreme weather events, including tornadoes, which is leading to questions about how the United States and other countries should be devoting their resources and where disaster planning efforts should be encouraged. In short, disaster planning should be encouraged everywhere, as disasters of all types can occur anywhere in the world. Another benefit of disaster planning is that hazard mitigation measures can also serve as a form of climate change adaptation, which is important as climate change is one of the factors causing changes in the behaviors of extreme weather events.

Hazard Mitigation

Disaster planning for tornadoes often focuses on the mitigation and preparedness

phases rather than the response and recovery phases as they seek to reduce the consequences of a disaster before one occurs (Coppola, 2021; Clements & Casani, 2016; Godschalk, 2003). This emphasis on mitigation and preparedness comes from the threats posed to both infrastructure and people by tornadoes (Clements & Casani, 2016; Godschalk, 2003). With this focus on mitigation and preparedness, recovery from tornadic events should be easier because some of the impacts of the event were minimized or avoided. The reason for focusing on mitigation and preparedness measures is so that social and economic losses can be the priority, rather than focusing on rebuilding infrastructure.

Hazard mitigation includes a wide variety of different strategies that can be implemented based on the goals that planners aim to achieve. Hazard mitigation goals are typically aimed at either risk consequence reduction, risk likelihood reduction, risk acceptance, risk avoidance, or risk sharing (Coppola, 2021). Each option that disaster managers or planners can choose from carries a level of feasibility, a degree of acceptability, an associated cost, and an expected success rate for overall risk mitigation. Strategies for hazard mitigation can either be structural, such as engineering and building code standards, or non-structural, such as land-use planning and property acquisition (Godschalk, 2003). Structural mitigation is aimed at reducing risk through construction or alteration of the physical environment, while non-structural mitigation is aimed at reducing risk through modifications in behaviors or processes that occur without engineering solutions (Coppola, 2021).

Mitigation efforts have produced a measurable reduction in the incidence and impact of several different types of hazardous events including tornadoes (Coppola, 2021). However, mitigation measures tend to be costly, time-consuming, socially unpalatable, and disruptive (Coppola, 2021; Rose et al., 2007). Through a benefit-cost analysis of FEMA mitigation grants, it was found that the ratio is 4:1, meaning that for every dollar spent on a FEMA hazard mitigation grant, there were, on average, four dollars of benefits produced (Rose et al., 2007). This represents a significant return on public dollar expenditures that went towards reducing property damage, business interruption, environmental damage, societal losses, and emergency response (Rose et al., 2007). Overall, Americans have benefited greatly from FEMA's investment in mitigation.

According to Iglesias et al. (2021), each year, more and more infrastructure is damaged or destroyed by natural hazards. This increase in damage is caused by rapid increases in development in vulnerable areas. It has been found that over half of the existing structures in the United States are located in hazard hotspots, even though hazard hotspots only cover one-third of the United States. Developers in the United States continue to build in these hazard hotspots at a much higher rate than in non-hazard areas, which represents either a lack of education about the dangers of hazards or an unwillingness to limit development in those areas solely because of the dangers (Iglesias et al., 2021; Hall & Ashley, 2008). If development were to start occurring outside of these hazard hotspots at a higher rate, then the amount of money spent on

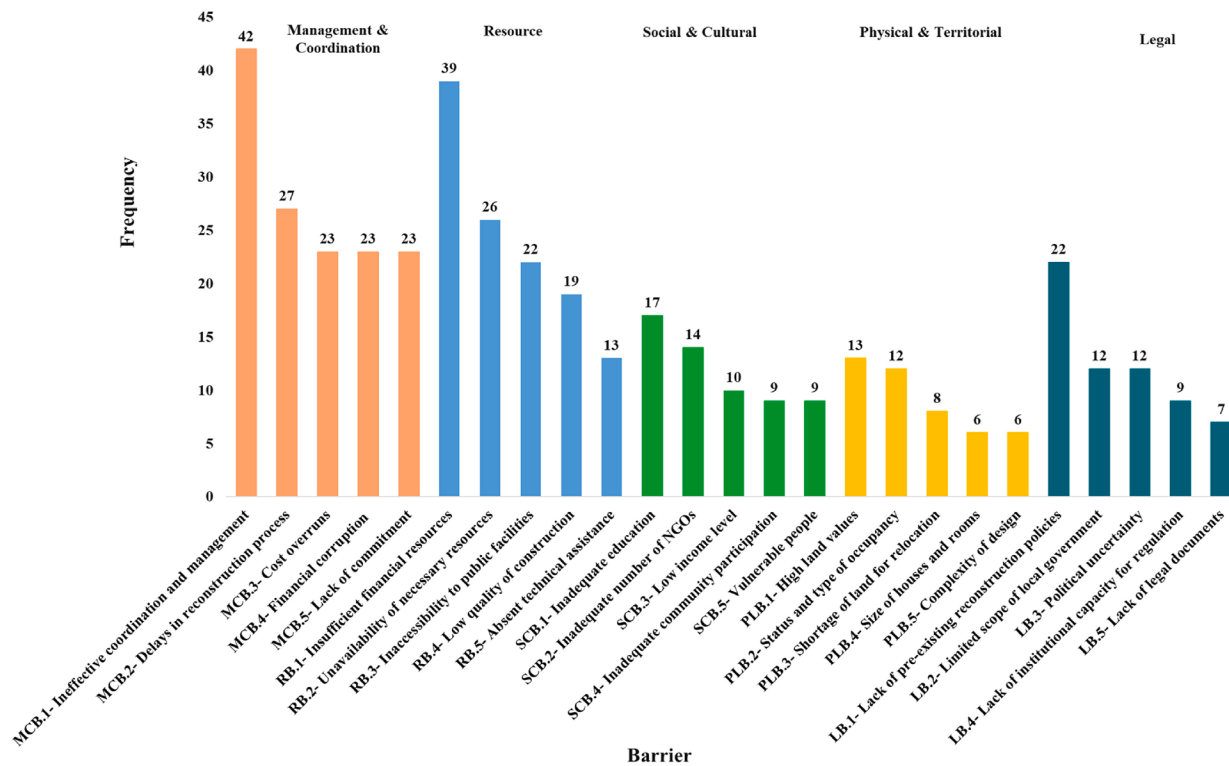


Figure 1: Five most common barriers to recovery from each category (Safapour et al., 2021)

damages and likely the number of fatalities and injuries from disasters would decrease overall (Iglesias et al., 2021). This strategy is an example of hazard mitigation planning as it seeks to move development to less risky areas, therefore decreasing the risk of disasters occurring there.

Disaster Recovery

If the impacts of a disaster are not reduced or avoided through hazard mitigation efforts and the hazard mitigation plan, they need to be addressed quickly through recovery efforts. As stated earlier, “disaster recovery is the process of repairing, reconstructing, and regaining what has been lost as a result of a disaster and, ideally,

reducing the risk of a similar disaster occurring again in the future” (Coppola, 2021). According to Rouhanizadeh et al. (2020), recovery includes economic recovery, the restoration of infrastructure and housing, the restoration of public services, environmental recovery, restarting economic activity, fostering long-term community redevelopment, and many other elements. Long-term disaster recovery focuses not only on returning communities to either their pre-disaster condition or a new stable state but also on helping communities become more resilient against potential future disasters. Disaster recovery starts occurring only hours after a disaster occurs but can continue for several years depending on the extent of the damage and the resources available to the affected community.

According to March et al. (2017), recovery is often considered the most challenging phase of the four phases of the disaster cycle. Part of the reason disaster recovery can be so difficult is the need to balance short-term/immediate needs with long-term disaster recovery and risk reduction goals. For example, the provision of temporary housing is needed immediately following a disaster but the allocation of land for this short-term need impedes the long-term goal of creating the overall image and layout of the redeveloped town. Furthering this idea, Rouhanizadeh et al. (2020) state that disaster recovery can be a very challenging process as the recovery of several different segments of the community must be undertaken at the same time because they are dependent on each other. Another obstacle to disaster recovery is the need for collaboration among agencies and professionals from diverse disciplines and perspectives. Recovery can also

be extremely difficult because it requires significant financial resources to be successful and the affected community may have to rely on state or federal authorities for such support.

If effective disaster recovery strategies are implemented, it leads to decreases in the loss of life, property, and financial resources. However, studies have identified over 60 barriers to effective disaster recovery, that are divided into five categories: social, infrastructure reconstruction, coordination, environment, and economic (see Figure 1) (Rouhanizadeh et al., 2020). Safapour et al. (2021) identified twenty-six strategies to address these barriers to disaster recovery and categorized them into four different phases based on when and how they are applied: pre-disaster, emergency, restoration, and reconstruction. By identifying the potential barriers and effective strategies to mitigate said barriers, communities should be able to prepare better to prevent or decrease the serious impacts of a disaster. Recovering well from disasters is extremely important as the consequences of natural disasters have the potential to destroy communities if immediate response and recovery after a disaster are not done properly.

According to Horney et al. (2018), one of the great tools for disaster recovery starts with various community metrics gathered before a disaster ever even occurs. Then post-disaster the same metrics should be gathered in the community for comparison against pre-disaster metrics. These metrics provide planners and other community professionals with a basis for informed decision-making during recovery. Some of the metrics that should be gathered include the total population, number of businesses,

community facilities, community health care facilities, median home value, median household income, abandoned housing units, unemployment rate, cultural and heritage sites, school enrollment, critical infrastructure, natural resource areas, and others that could provide insight into segments of the community that will require more attention in the recovery process (Horney et al., 2018).

Challenges of Small Towns

Tornadoes are almost always a very destructive phenomenon, but their impacts vary due to a wide range of characteristics, not only of the tornado but also of the community that it affects. For example, the impact of a tornado that strikes a metropolitan area will be more moderate than the impact of a tornado on a small community (Kern et al., 2010). Paul et al. (2023) conducted a comprehensive study of over 500 small communities with populations of less than 5,000 people that were affected by tornadoes. The study revealed that over half of the studied small communities did not return to their pre-tornado population levels.

These small communities struggle to recover their population and other community assets due to significant resource constraints. With fewer resources in terms of planning expertise, financial reserves, and infrastructure, small communities find it exceedingly challenging to navigate the complex process of post-disaster recovery (Jerolleman & Laska, 2020). The recovery process is further complicated by persistent population loss preceding tornado events, as communities already hemorrhaging

residents face further migration in the wake of a disaster, leaving behind diminished populations and dwindling community assets (Paul et al., 2023).

The recovery prospects of small communities are further hindered by a lack of organized or basic government services, including zoning and building code enforcement, which are essential for rebuilding efforts (Jerolleman & Laska, 2020). These challenges are compounded by cutbacks in personnel and limited resources compounded these challenges, leaving rural areas ill-equipped to withstand and recover from the impacts of tornadoes and other disasters (Jerolleman & Laska, 2020).

Overall, the ability of small communities to recover from disasters, including tornadoes, hinges significantly on past population trends and community size. Communities facing persistent population loss and limited resources encounter significant obstacles in rebuilding their social, economic, and physical infrastructure in the aftermath of disasters. Small communities typically possess greater levels of social capital, which is good for recovery and resilience efforts, but these efforts are outweighed by systemic challenges such as shrinking economies, inadequate housing stock, and poverty, which detract from their ability to recover and thrive in the face of adversity (Jerolleman & Laska, 2020).

CHAPTER TWO

STUDY METHOD

The goal of this report is the answer the following question:

“What response and recovery strategies contribute to long-term recovery, including population recovery, in small communities?”

To answer this research question, I applied a case study approach to compare how two different towns recovered from their respective high-powered tornadic event (see Figure 2). For the purposes of this research, we are defining recovery as the accomplishments made in the first ten years following the tornadic events towards returning the communities to their

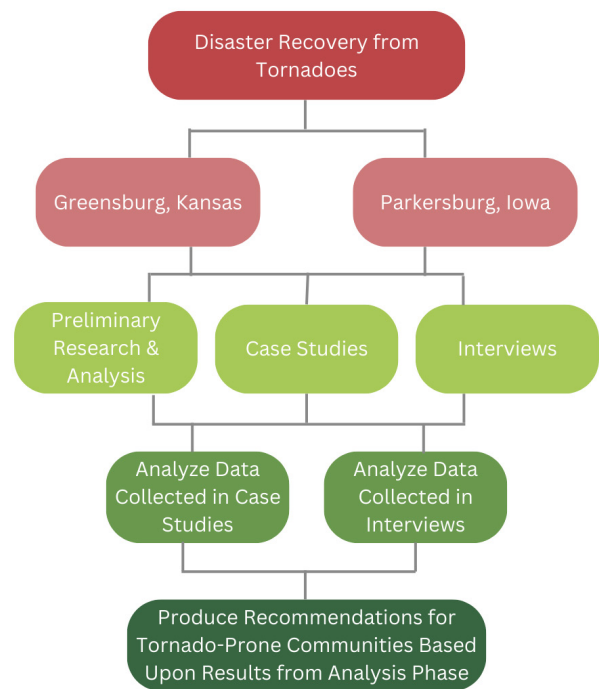


Figure 2: Overview of Study Method

pre-disaster state. The case study was performed primarily through document analysis of each study community’s related documents and was supported by semi-structured interviews with community staff members.

In this study, I chose two towns, both of which were home to a population of less than 5,000 people, in the Midwest United States that each experienced an EF-5-rated tornado between the years of 2000 and 2010, but experienced different population trajectories post-disaster

(see Figure 3). After mapping tornadic

events and small towns and analyzing population trends in tornado-affected towns, Greensburg, Kansas, and Parkersburg, Iowa, were selected as the two cases for this study. These towns were chosen because they each experienced an EF-5-rated tornado

between the years of 2000 and 2010, were home to a population of less than 5,000 people at the time of their tornadic event, and each town experienced a different population growth pattern post-tornado.

Parkersburg, Iowa was able to fully recover and grow its population, while Greensburg, Kansas has failed to recover its population to pre-tornado levels. Further discussions on Parkersburg and Greensburg's

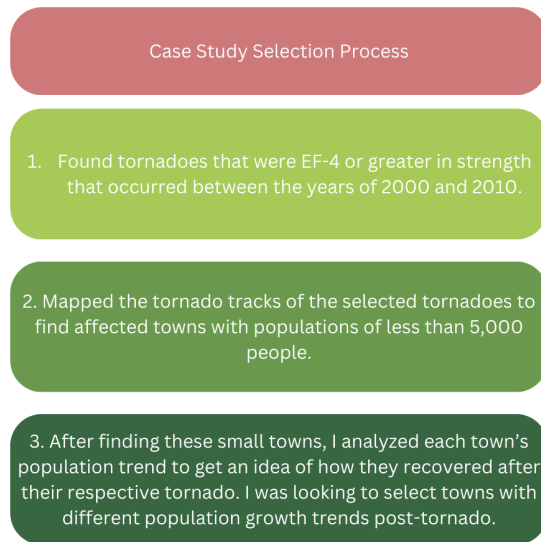


Figure 3: Case Study Selection Process



Figure 4: Case Study Process

tornadoes, processes, and communities are provided in later sections of this report.

During the case study process, I studied a wide range of documents from each study community looking for information related to the community before the tornadic event, the tornado itself, the recovery process they undertook, and the community now (see Figure 4). Studied documents included disaster recovery plans, response documents published by various local and federal government agencies, housing support documents, scientific journal articles, and a few newspaper articles. These documents were found largely through searches on the town and county websites and supplemented by performing a search for related published documents from government sources, scientific journals, and local newspapers.

The document analysis was supported by semi-structured interviews performed with community staff members to get not only a more in-depth analysis of recovery processes but also first-hand experience with those recovery processes. Originally, I planned on interviewing city planners, emergency managers, and other related personnel to collect this information, however, the communities in my study are small and therefore do not have the resources

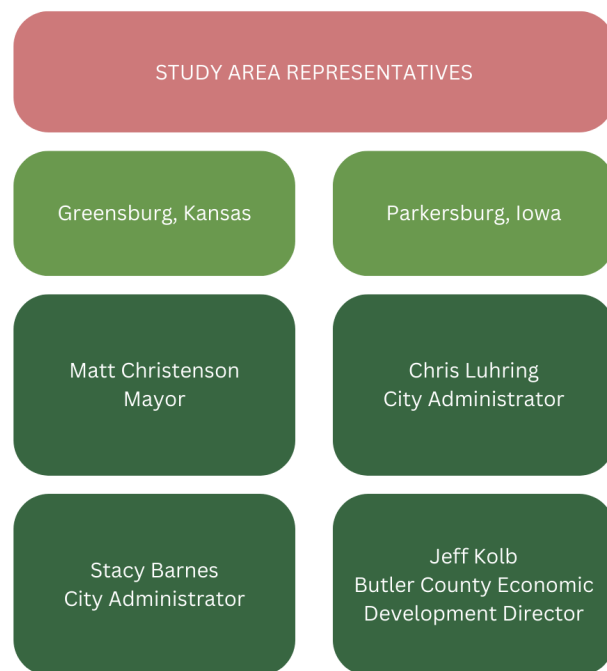


Figure 5: Study Area Representatives

to staff all these positions. For this reason, I had to select and interview staff members in more broad positions. I chose not to interview residents of either study community because the focus of this research was on the governmental response and recovery processes. However, the resident perspective on recovery could be a useful area of future research.

The interviews with community staff members for the case study sites (see Figure 5) included Matt Christenson, currently serving as Mayor for the City of Greensburg, Kansas, and Stacy Barnes, currently serving as the City Administrator for the City of Greensburg, Kansas, and Chris Luhring, currently serving as the City Administrator for the City of Parkersburg, Iowa, and Jeff Kolb, Butler County Economic Development Director. These interviews provided further guidance into what strategies could be the most beneficial for other communities that experience tornadoes to implement for recovery. Each of these interviewees provided valuable qualitative data and experience from within their community that can be used to craft recommendations for

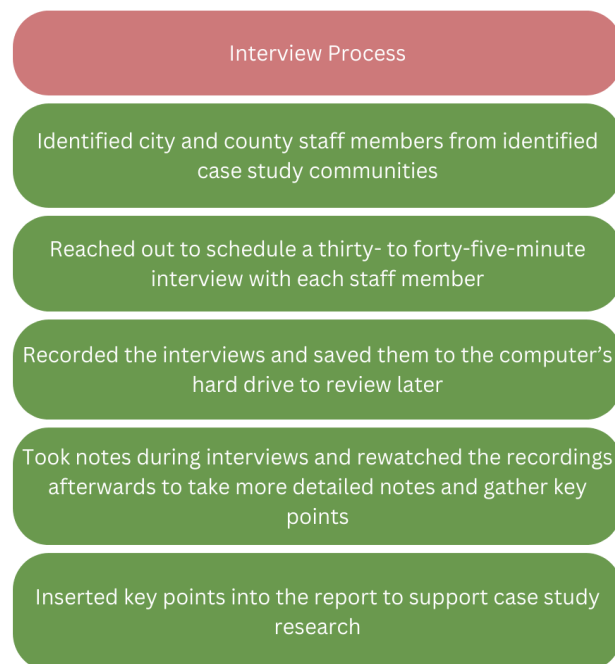


Figure 6: Interview Process

other recovering communities to follow.

The case study process began with identifying small American towns that had experienced high-powered tornadoes between 2000 and 2010 (see Figure 6). Following this initial step, I conducted a preliminary analysis of each study area by exploring demographic and socioeconomic data before and after their respective tornadic event, tornado characteristics and damage, and basic recovery process. These preliminary findings gave me a good starting point going into my interviews where I was able to further expand my knowledge on each of these topics.

Following the case study analysis, the interview process began with identifying and reaching out to relevant community staff members from each case study town. Each interview was between thirty to forty-five minutes long, in a semi-structured format over Zoom, and was recorded. I took minimal notes during the interviews and then rewatched each interview again, taking more thorough notes and identifying key points. Following these steps, I was able to perform further analysis based on the key takeaways from the interview process.

CHAPTER THREE

POST-TORNADO RECOVERY OF GREENSBURG, KANSAS

Greensburg, Kansas, Before

Greensburg, Kansas is a small town of about 1.79 square miles located in Kiowa County, Kansas. Greensburg is located in southwest Kansas and is about two hours west of Wichita, Kansas, and about 45 minutes southeast of Dodge City, Kansas. Greensburg serves as the county seat and largest town in Kiowa County. Due to being the county seat, Greensburg

is home to the Kiowa County Historical Museum and the Kiowa County Memorial Hospital. Greensburg's grocery shopping scene in 2007 included Dillon's grocery store and fuel center and a Family Dollar store. In total, Greensburg was home to 110 businesses in 2007 (Fox & Wallach, 2013). Greensburg's biggest attraction was the World's Largest Hand-Dug Well, which was opened in 1939 as a tourist attraction in



Figure 7: Greensburg, Kansas

(Best Places, n.d.-a)

which visitors could descend to the bottom of the well and explore the adjacent museum that displayed a 1,000-pound Pallasite Meteorite (*About Greensburg*, 2024).

In early 2007, Greensburg had a population of roughly 1,400 people which shows a population decline since the 2000 Census in which the population was found to be 1,574 (U.S. Census Bureau, 2000). Greensburg had been struggling with persistent population loss since the 1970s when the town's population reached its peak of almost 2,000 residents. According to the 2000 U.S. Decennial Census, Greensburg had 887 housing units occupied by 730 households, of which 453 were families. The median age in Greensburg was 46 years old and the median household income was \$28,438 (U.S. Census Bureau, 2000). At the state level, the median age in 2000 was found to be 35.2 years old and the median household income was \$41,150 (The University of Kansas, 2008). In 2000, it was found that 12.4% of the population in Greensburg was living below the poverty line compared with 10.1% at the state level (U.S. Census Bureau, 2000).

About the Tornado

On May 4, 2007, at 9:45 p.m. a deadly tornado struck the town of Greensburg. The storm cell that produced the Greensburg,

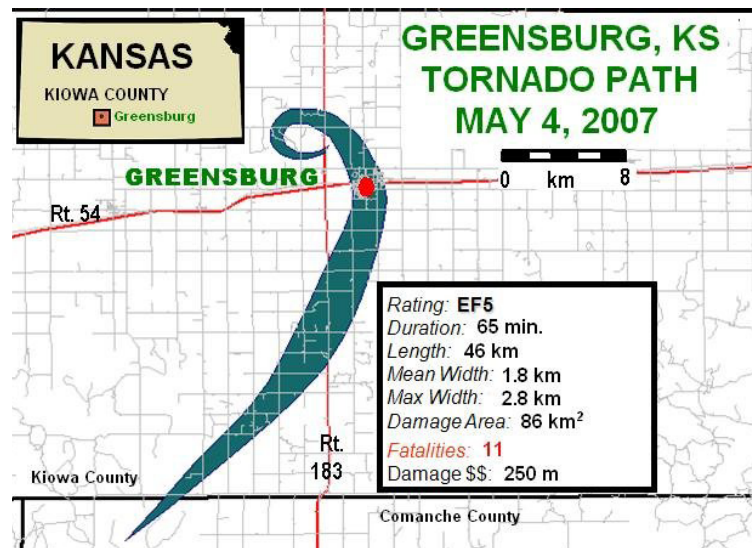


Figure 8: Greensburg, Kansas Tornado Track
(Marshall et al., 2008)

Kansas, tornado originally developed over Harper County, Oklahoma, and traveled northeast across the state line toward Kiowa County. Along its path, a strong hook-shaped weather radar signature developed, prompting emergency broadcasts and tornado sirens in Greensburg. Thankfully, the warnings were made thirty minutes in

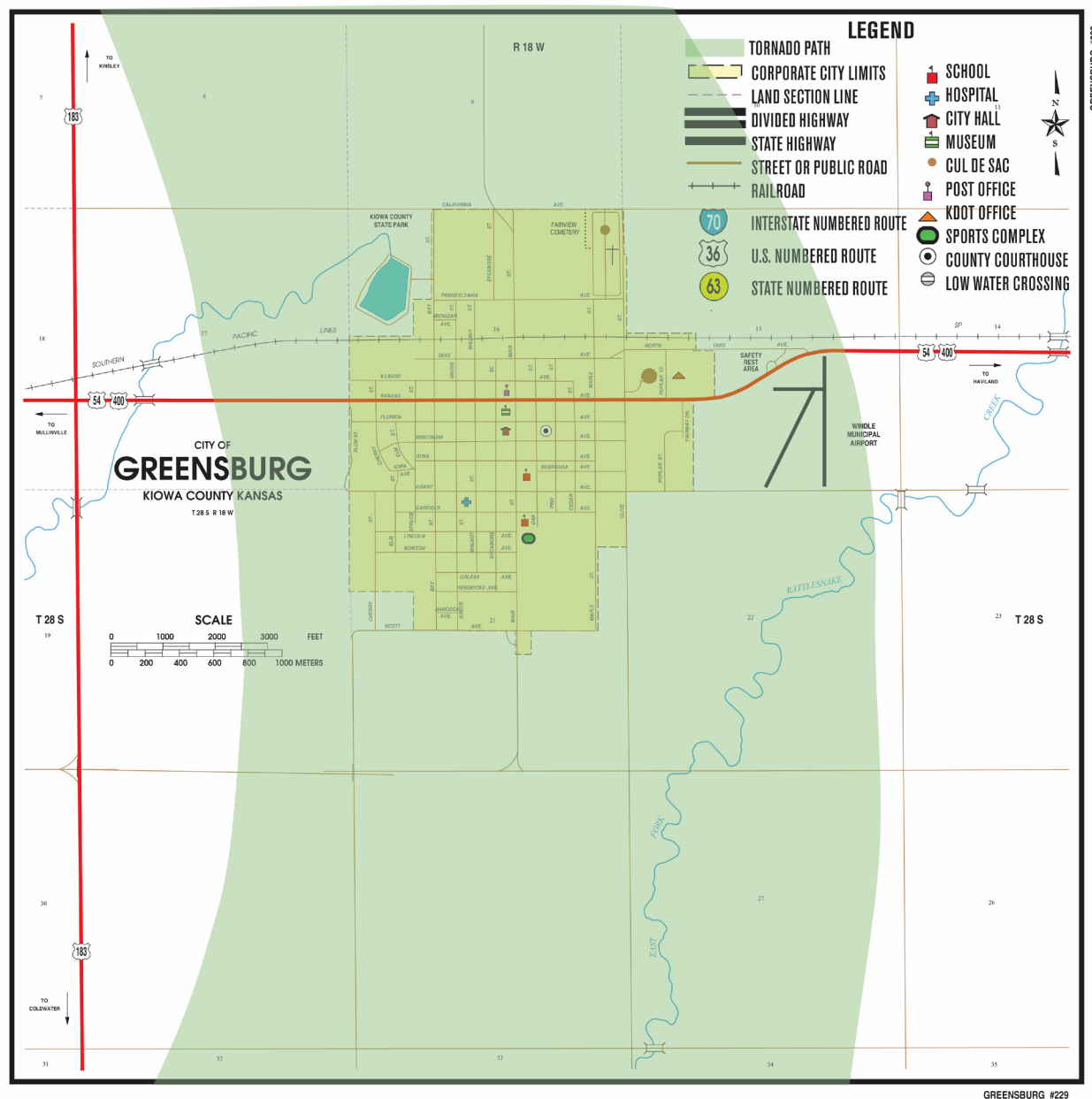


Figure 9: Tornado Track Through Greensburg, Kansas (Map created by Kansas Department of Transportation (2005), modified by Natalie Walls)

advance of the storm getting to Greensburg, allowing time for the population to take cover (Marshall et al., 2008).

The tornado struck Greensburg with wind speeds between 200 and 210 miles per hour and a 1.7-mile maximum path width. The tornado traveled 22 miles in length, initially touching down in Comanche County, Kansas, before traveling northeast through southern Kiowa County and directly hitting the town of Greensburg. The total damage area of the tornado was 32.9 square miles and in Greensburg, 95% of the town was destroyed (Marshall et al., 2008). Greensburg High School, Greensburg Elementary School, Kiowa County Memorial Hospital, dozens of businesses, and more than 500 homes were destroyed in Greensburg due to the tornado. In total, the damage estimates were found to be around \$250 million (Marshall et al., 2008).

The tornado caused a total of eleven fatalities, ten of which were in Greensburg city limits, and around seventy injuries. Despite the double-digit number of fatalities and injuries, this is a relatively small number of fatalities from such a significant storm thanks in large part to the thirty-minute lead time between the emergency broadcasts and the actual tornado giving the people of Greensburg time to respond properly and quickly to keep the loss of life minimal (Marshall et al., 2008).

Between the extreme wind speeds of between 200 and 210 miles per hour and the extensive damage, the tornado was rated an EF-5. An EF-5 rating is the strongest rating a tornado can receive on the Enhanced Fujita Scale of EF-0 to EF-5. The Enhanced Fujita Scale was modeled after the original Fujita Scale and became operational on

February 1, 2007 (Marshall et al., 2008). Due to the short lifespan of the scale, the Greensburg, Kansas, tornado was the first ever tornado to be rated an EF-5 (Marshall et al., 2008). Since it was such a highly rated and powerful tornado, President Bush declared Greensburg a federal disaster area on May 6, 2007, making federal funding available for tornado victims (Paul et al., 2007).

Recovery Process

In the aftermath of the tornado, Greensburg was left almost completely decimated and they needed lots of assistance and a strategy that could guide them to recovering what they had lost. Disaster recovery is often considered the most difficult phase of the disaster cycle and there's no set way to approach it (March et al., 2017). Greensburg's City Administrator Stacy Barnes said, "There's no manual you pull off the shelf when there's a disaster that says, 'Here are steps one through a million of what you do', you just have to figure out what works for your community."

Fortunately, within hours of the tornado occurring, assistance both in the form of donations and volunteers, was flowing in from every level, from individuals to federal agencies. Greensburg had to quickly, but properly, figure out what their steps to recovery were going to be and how they could best utilize all the assistance they were being offered. Part of the struggle with disaster recovery is that city officials wanted to plan how the town would look and operate but this works against homeowners and business owners who wanted to start rebuilding quickly. Greensburg first described

some general practices they were going to follow in their recovery effort so that preliminary rebuilding could begin while broader recovery planning was underway (M. Christenson, personal communication, October 24, 2023). Those general practices included):

- Building back what is needed most first (i.e., utility infrastructure, city/county buildings, emergency services, schools, grocery stores, etc.)
- Accelerate the planning process to avoid more population exodus
- Build with the ‘build back better’ mindset (i.e., building stronger, safer, and more disaster-resilient infrastructure and systems to reduce vulnerability to future disasters)

Another key step early in the recovery process for Greensburg was to create a distinctive identity. Greensburg officials feared that if they didn’t hook people’s attention, then more people would leave Greensburg and recovery would be nearly impossible. Greensburg ultimately decided to play off its name and redevelop sustainably. With this strategy, they tagged the slogan, “Put the green in Greensburg” and incorporated several environmental and sustainability aspects into the design and rebuild of their buildings and infrastructure. Greensburg has been very successful in its sustainable development practices. Some of their accomplishments include (*Sustainable rebuilding*, n.d.):

- Built the first Leadership in Energy and Environmental Design (LEED) Platinum City Hall in the United States

- A large majority of all other buildings in town are also LEED Platinum-certified
- Greensburg is now powered entirely by renewable energy (geothermal and wind energy sources)
- Built a new recycling center and offers citywide curbside recycling services
- Incorporated drought-resistant landscaping

Even with the big sustainability push and focus in Greensburg, officials were careful not to require green building practices as they did not want to elicit backlash or drive people away. While sustainable design was encouraged, officials focused more on educating residents and business owners on how it would save them money in the long run, hoping that the incentives would further encourage people to follow sustainable practices. This focus on sustainability in Greensburg ended up delaying the overall recovery process as it required more comprehensive and long-term planning efforts than would have originally been required, but Greensburg residents capitalized on the opportunity that the near-complete devastation provided them to rebuild their community stronger (U.S. Department of Energy, 2009).

A longer-term recovery effort was the creation of the Long-Term Community Recovery Plan for Greensburg and Kiowa County. The Plan was published in August 2007 and is a result of an intensive 12-week process of many meetings and discussions among citizens; civic groups; business owners; local, state, and federal officials; and the long-term recovery planning team from FEMA. The guiding principle of the plan was to “keep the things that have made Greensburg and Kiowa County a good place to

live, work, and own a business, and then suggest ways to build upon strengths of the community to make it prosperous, appealing, livable, and sustainable.” Unlike most planning documents, the Long-Term Community Recovery Plan serves as an action-oriented menu of key projects intended to be used for making critical funding and resource allocation decisions. The plan includes more than 40 projects that form the foundation of a revitalized Greensburg and Kiowa County (*Long-Term Community Recovery Plan*, 2007). Each project is ranked on its recovery value and includes a project write-up. Some of the highest-value projects recommended by the recovery plan include:

- Establish a sustainable development resource office
- Identify city-wide energy options
- Establish a housing resource office
- Provide direct assistance for homeowners looking to rebuild and repair
- Encourage developers and builders of rental housing
- Establish business development assistance programs
- Create a downtown business incubator
- Renovate the county courthouse
- Rebuild city hall with a community meeting center
- Develop a Big Well Tourism Center
- Prepare a sustainable comprehensive plan
- Rebuild schools and expand educational opportunities

- Rebuild medical and emergency service facilities

Several of the projects and their rankings are based on the projection that Greensburg would experience a steady increase in population and return to its pre-disaster population within five years (*Long-Term Community Recovery Plan*, 2007).

One of the highest-value goals was to produce a sustainable comprehensive plan, which Greensburg accomplished in May 2008, one year after the tornado. The plan is meant to serve as a guide to help the community become a socially, economically, and environmentally sustainable city. The plan is broken into sections representing different aspects that Greensburg is striving to achieve and the strategies that can be implemented to accomplish them. The sections include downtown, walkability, built environment, hazard mitigation, economic development, energy, transportation, carbon, housing, infrastructure, parks and green corridors, and future land use and policy. Each section provides some background information and recommendations for addressing sustainability issues related to the section topic (*Greensburg Sustainable Comprehensive Plan*, 2008).

Economic Development

Recovering the economic base of Greensburg was a major task in the recovery process. Greensburg was home to 110 businesses before the tornado, which is relatively high for such a small community, but the town's economy was struggling. The fact that the economy was struggling pre-tornado would make retaining these businesses and

attracting new ones after the tornado a more difficult process than it was already going to be. Thankfully, the Long-Term Community Recovery Plan incorporated several goals and initiatives aimed at driving the economy back up in Greensburg (*Long-Term Community Recovery Plan*, 2007). The goals were:

- Prepare an Economic Development Strategy
- Rebuild Downtown Greensburg
- Establish a Business Development Assistance Program
- Create a Business Incubator
- Develop a Community-Wide Wireless Network
- Develop a US-54 Corridor Design Plan

Another major component of Greensburg's approach to boosting economic development was to utilize the tornado and its redevelopment efforts as an opportunity to rebrand and market themselves differently. They accomplished this by promoting the amenities that Greensburg now had that other communities didn't have. Things like having an entirely new infrastructure, lots of developable lots of all zoning types, and being a sustainable and renewable community (S. Barnes, personal communication, October 23, 2023).

Funding and Support

To make recovery feasible, a tremendous amount of funding and manpower was needed. Thankfully, there was no shortage of either as the tornado made national

headlines and was declared a federal disaster. Greensburg received monetary donations from across the globe and all levels for nearly two years following the tornado.

Greensburg also welcomed more than 7,600 registered volunteers from Kansas and surrounding states during the clean-up and initial rebuilding phases. Many different volunteer groups, non-profits, and private-sector partners donated food, time, money, and materials to support rebuilding efforts (*2007 EF5 Tornado*, n.d.-a). Greensburg's City Administrator, Stacy Barnes, states that "help is why we are where we are today, both from agencies and non-profit organizations, but also volunteers."

Greensburg received more than \$100 million in federal assistance for emergency response; provision of temporary housing; assistance to individuals, families, and businesses; and repairing or replacing tornado-damaged public infrastructure from various agencies (*2007 EF5 Tornado*, n.d.-a). Federal and state agencies including the State Department of Emergency Management and FEMA came in to assist Greensburg. FEMA assisted at a wide variety of levels, but a major aspect of their assistance came in the form of supplying hundreds of mobile homes that served as temporary housing for about 300 families. Funding secured from USDA Rural Development went towards rebuilding permanent housing for these residents (*2007 EF5 Tornado*, n.d.-a).

Outside of federal funding, people largely had to rely on insurance money to rebuild their homes and businesses. Thankfully around 75% of homeowners in Greensburg had insurance; however, the vast majority of those were underinsured. The average insurance estimate was found to be around \$50,000 but the estimated

replacement cost of a 1,300-square-foot home in 2007 was \$140,000 representing a significant gap between what insurance covered and what homeowners had to pay to rebuild (Paul et al., 2007). There was a first-time home builder credit offered for first-time home builders to help offset costs, this helped some homeowners close or shrink the gap that insurance didn't cover. Business owners were offered low-interest loans from the Small Business Association (SBA) for rebuilding or repairing their businesses.

Greensburg, Kansas, Today

In the nearly seventeen years since the devastating tornado struck Greensburg, the town has made significant progress in rebuilding. They have recovered and rebuilt their community buildings and facilities, the Kiowa County Historical Museum, the Kiowa County Memorial Hospital, the Greensburg school buildings, and a significant portion of their housing stock. Also rebuilt was Greensburg's biggest attraction, the World's Largest Hand-Dug Well which is now part of the Big Well and Visitor Information Center which has displays about the history of Greensburg, the Big Well, the 2007 tornado and the rebuilding process, and the 1,000-pound Pallasite Meteorite (*About Greensburg*, 2024). Thankfully, Dillon's grocery store and fuel center and Family Dollar both decided to rebuild in Greensburg after the tornado avoiding food desert status for the area. Greensburg is once again home to a total of 110 businesses, but many of them are different than what existed in 2007 (U.S. Census Bureau, 2021).

According to the 2020 U.S. Decennial Census, Greensburg has a population of

740 people. The population suffered a major decrease of nearly fifty percent due to the tornado and its effects in 2007. In 2010 the U.S. Decennial Census recorded Greensburg's population at 777 (see Figure 10) (U.S. Census Bureau, 2010). With the most recent Census number being lower, we can see that despite their rebuilding efforts, the population in Greensburg continues to dwindle, much as it did before the tornado occurred. This population trend can be attributed to several factors; including people relocating after the tornado for various reasons including inadequate insurance coverage to rebuild and few housing or work opportunities existing in town; businesses not reopening after the tornado; businesses not relocating to Greensburg; and young people leaving town after finishing school (Fox & Wallach, 2013). However, it is important

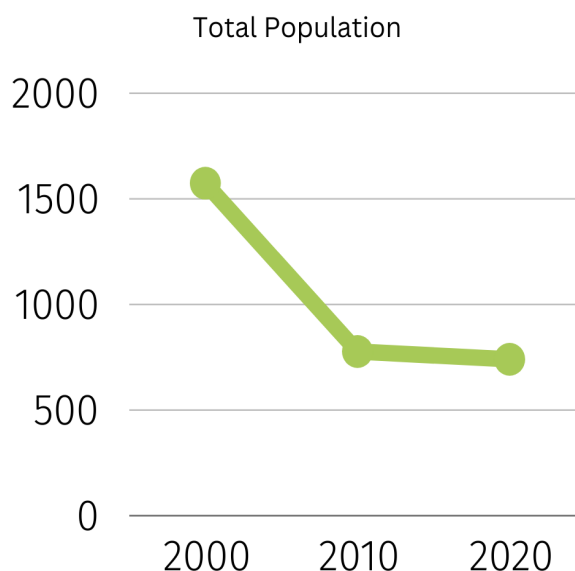


Figure 10: Greensburg, Kansas

Population (U.S. Census Bureau, 2000, 2010, 2020)

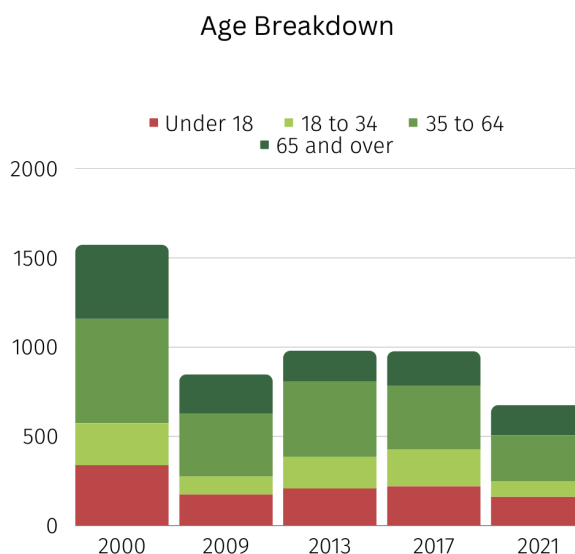


Figure 11: Greensburg, Kansas Age

Breakdown (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

**data is based on estimates from the American Community Survey with a margin of error*

to note that across the country, rural towns are losing their population as more and more people move into cities. In fact, across the United States, 2010 to 2020 was the

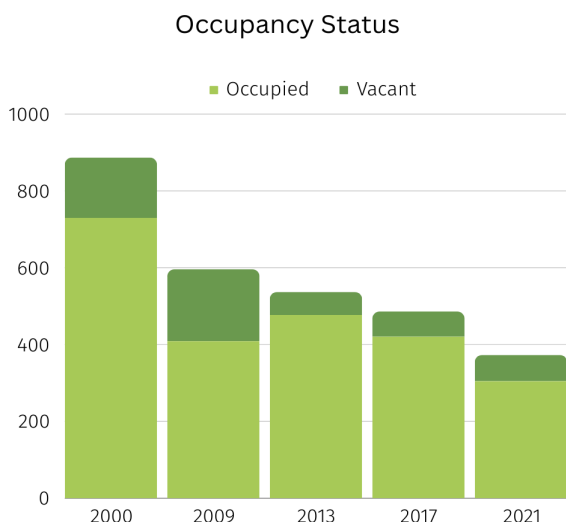


Figure 12: Greensburg, Kansas

Occupancy Status (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

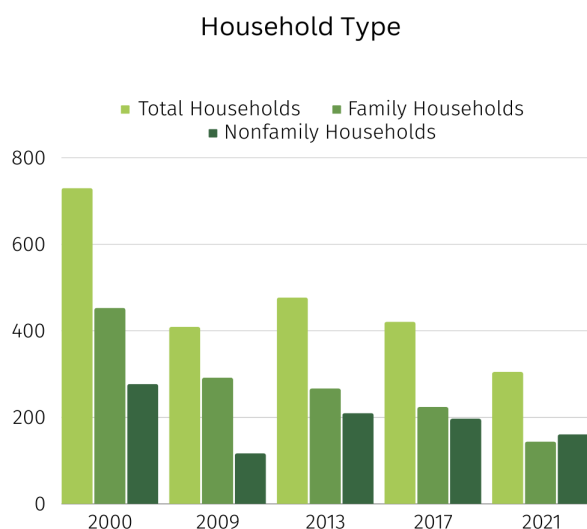


Figure 13: Greensburg, Kansas

Household Type Breakdown (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

first decade-long rural population loss in history (Johnson, 2022). With this endemic problem in mind and the note that Greensburg's population only declined by 4.8% between 2010 and 2020, Greensburg is doing comparatively well. Several surrounding communities lost significantly higher shares of their population between 2010 and 2020 including Coldwater, Kansas, with a 17% population loss rate; Ashland, Kansas, with a 9.7% population loss rate; and Larned, Kansas, with a 7% population loss rate (Johnson, 2022).

There are many other measures outside of population to gauge how a community is doing as noted by Greensburg's City Administrator Stacy Barnes, "we all know that rural America is dwindling. How can we tell that story differently? Are businesses

downtown thriving? Is every shop space full? Yes.”

The 2017-2021 American Community Survey revealed that Greensburg was home to 373 housing units occupied by 305 households, of which 144 were families (U.S. Census Bureau, 2021). These numbers starkly contrast with the pre-tornado statistics (887 housing units/730 households/453 families), underscoring the substantial impact the tornado had on Greensburg’s housing infrastructure (see Figures 12 and 13). The median age in Greensburg in 2021 was 45.6 years old, closely resembling the median age reported in the 2000 Census (see Figure 11). The median household income, determined to be \$45,515 in 2021, reflects a notable increase compared to the \$28,438 median recorded in 2000 (see Figure 14). However, this rise aligns reasonably with a 21-year

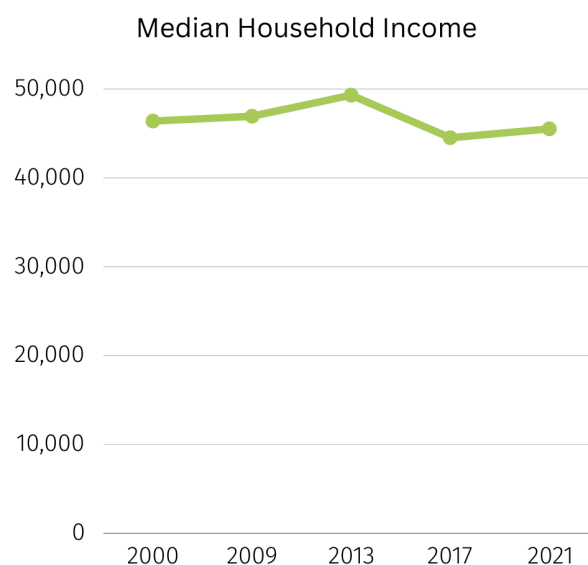


Figure 14: Greensburg, Kansas Median Household Income (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

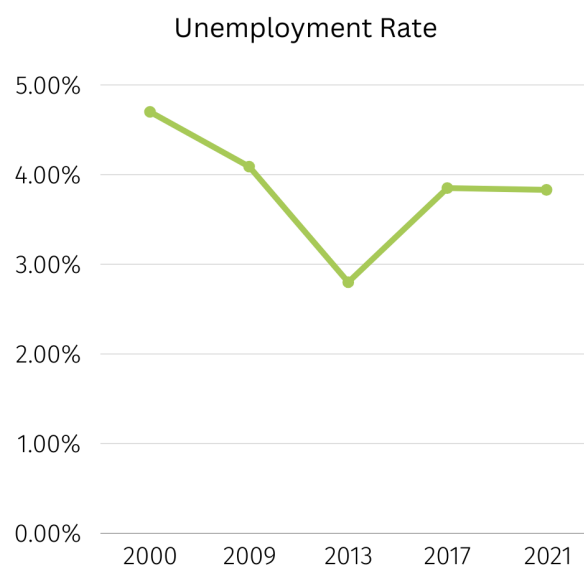


Figure 15: Greensburg, Kansas Unemployment Rate (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

advancement in pay. In 2021, it was discovered that 8.7% of Greensburg's population lived below the poverty line, a marked decrease from the 12.4% poverty rate reported in the 2000 U.S. Decennial Census (U.S. Census Bureau, 2021). In the state of Kansas as a whole, the poverty level increased from 9.5% in 2000 to 11.7% in 2021 (The University of Kansas, 2008).

Greensburg's most recognizable achievement since the tornado has been its reinvention as America's greenest town. Early in the recovery process, Greensburg decided to embrace sustainability and it is currently one of only a handful of places powered entirely by renewable energy. Greensburg is now home to the most LEED Platinum buildings per capita in the United States, they have curbside recycling services available for every resident, their streets are lined by LED lamp posts, electricity is provided solely through wind energy, and they have drought-resistant landscaping on all city-owned properties (*Sustainable rebuilding*, n.d.). These features have made Greensburg a magnet for disaster recovery experts and green-curious policymakers. Additionally, these sustainability aspects have been a major tourism driver for Greensburg (Fox & Wallach, 2013). However, Greensburg's leaders are trying to tell the world that Greensburg is more than just a place that accomplished something remarkable almost two decades ago, even though those decisions put Greensburg on the map.

CHAPTER FOUR

POST-TORNADO RECOVERY OF PARKERSBURG, IOWA

Parkersburg, Iowa, Before

Parkersburg, Iowa, is a small town of about 1.44 square miles located in Bulter County, Iowa. Parkersburg is located in northeastern Iowa and is about half an hour east of Cedar Falls, Iowa; and an hour and 45 minutes northeast of Des Moines, Iowa. Parkersburg is the highest-populated town in Butler County, Iowa, but does not serve as the county seat. Parkersburg's grocery shopping scene

in 2008 was limited to S&S Foods (*About Us*, n.d.). Parkersburg was best known as a football town thanks to its high school football team, the Falcons. The football coach, Ed Thomas had not only coached at least four players who went on to play in the National Football League (NFL), but he was also recognized by the NFL as the 2005 High School



Figure 16: Parkersburg, Iowa (Best Places, n.d.-b)

Coach of the Year. The successes of their football team gave Parkersburg an identity as a tough town (FEMA, 2018).

In early 2008, Parkersburg had a population of around 1,900 people which is very close but slightly higher than the population found during the 2000 Census of 1,889 (U.S. Census Bureau, 2000). Parkersburg's population trend had not been consistent throughout the history of the town with several periods of population growth and several of population loss. However, the population growth periods were consistently larger than the population loss periods, representing an overall population increase. According to the 2000 U.S. Decennial Census, Parkersburg had 850 housing units occupied by 811 households, of which 550 were families. The median age in Parkersburg was 40 years old and the median household income was \$32,083. At the state level, the median age in 2000

was found to be 36.6 years old and the median household income was \$40,991 (The University of Kansas, 2008). In 2000, it was found that 7.3% of the population



Figure 17: Parkersburg, Iowa Tornado Track (Marshall et al., 2008)

in Parkersburg was living below the poverty line compared with 8.3% at the state level (U.S. Census Bureau, 2000).

About the Tornado

On May 25, 2008, at 4:56 p.m. a devastating tornado struck the southern end of Parkersburg. The tornado began near the Butler and Grundy County line, 2 miles south of Aplington, Iowa, at 4:48 p.m. The tornado grew quickly in size and intensity as it approached Parkersburg. A tornado warning was in effect in Parkersburg for much of the afternoon and sirens were sounded as soon as visual confirmation of a tornado was made; however, it only gave Parkersburg residents approximately five minutes

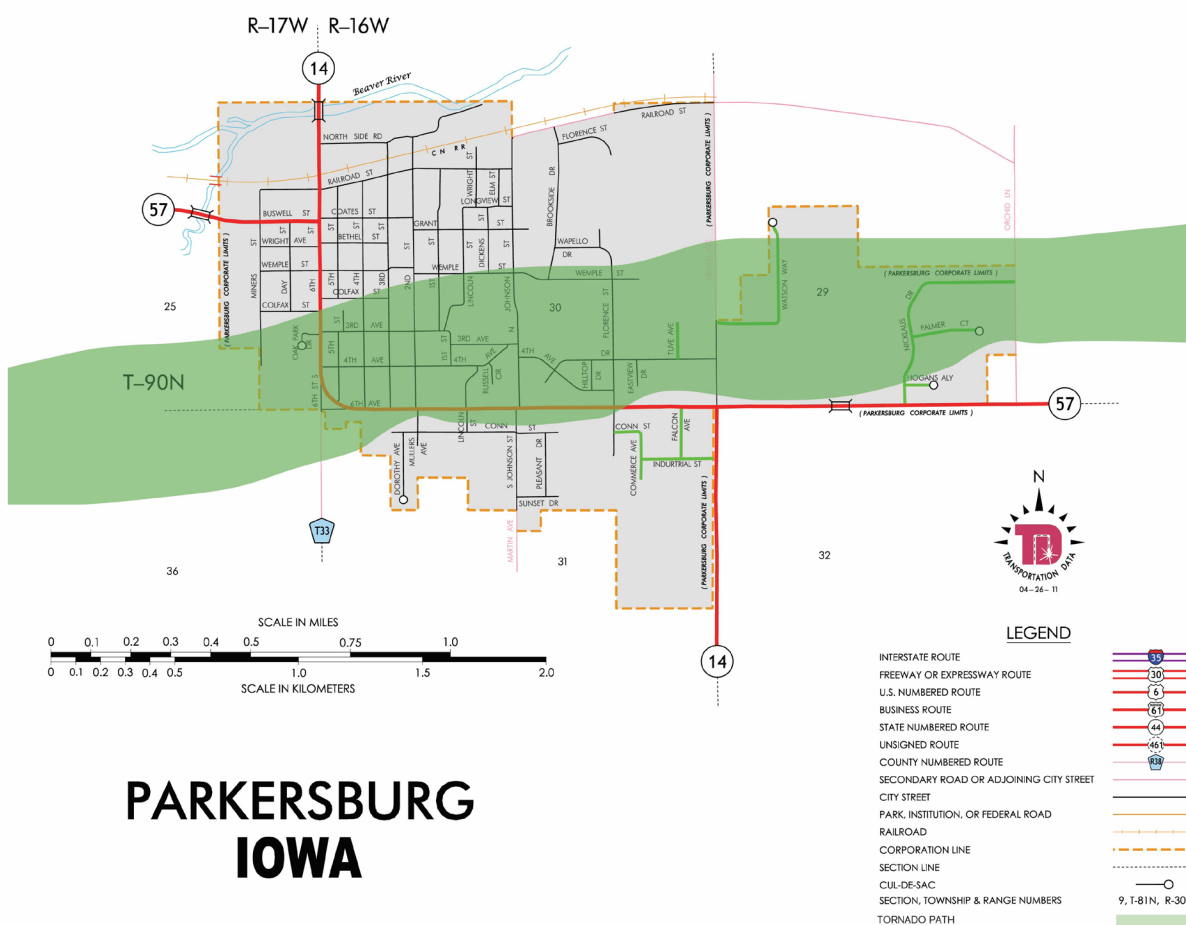


Figure 18: Tornado Track Through Parkersburg, Iowa (Map created by Iowa Department of Transportation (2008), modified by Natalie Walls)

of warning before the tornado entered town (National Oceanic and Atmospheric Administration, 2008).

The tornado struck Parkersburg with wind speeds between 200 and 205 miles per hour and a 0.75-mile maximum path width. The tornado traveled a total of 43 miles, starting two miles south of Aplington, moving through the southern end of Parkersburg, through the New Hartford area, into northern Black Hawk County, and ending just before crossing the Buchanan County line. Thankfully, 98% of the tornado track traversed over rural farmland, greatly reducing damage and fatality risks. The remaining two percent of the track represents the portion of the tornado that traveled through the southern end of Parkersburg (National Oceanic and Atmospheric Administration, 2008). The tornado increased in intensity as it moved further through town due to the ingestion of debris. About one-third of the town was heavily damaged or destroyed. More than 300 residences, two bank buildings, the high school, City Hall, Swimming Pool Park, the fire station, the elementary school, two cemeteries, and twenty-two businesses were destroyed or damaged. The damage left around 1,000 residents of Parkersburg homeless. The tornado caused a total of nine fatalities, seven of which were in Parkersburg city limits, and around 50 injuries (FEMA, 2018). Iowa endured a very strong storm season in the summer of 2008, so estimates of damage caused by the tornado alone are not available due to the flooding that occurred shortly after the tornado (National Oceanic and Atmospheric Administration, 2008).

With the high-velocity winds of between 200 and 205 miles per hour and the

extensive damage, the tornado was rated an EF-5. Only one other tornado in Iowa history had claimed more lives, the 1968 F-5 tornado in Charles City which claimed thirteen lives. Due to its rating as an EF-5 tornado, President Bush declared Parkersburg and its surroundings a federal disaster area on May 27, 2008, making federal funding available for tornado victims (National Oceanic and Atmospheric Administration, 2008).

Recovery Process

After the tornado, nearly one-third of Parkersburg was destroyed and completely unrecognizable to lifelong residents of the community. Recovery efforts were started immediately following search and rescue efforts ended and would continue for years to come. In order for these sustained recovery efforts to happen and be successful, millions of dollars and thousands of volunteers were needed to assist the residents of Parkersburg. Thanks to the caliber of the disaster and its status as a federal disaster area, Parkersburg was able to receive this assistance from all sorts of sources across the country.

Similar to other disaster-struck communities, Parkersburg's first steps in recovery included disaster cleanup and debris removal and the re-establishment of emergency services to ensure safety. Then the focus shifted to rebuilding everything else. Like most communities that experience large-scale disasters, Parkersburg had to figure out how to find a balance between city officials who wanted to plan how the town would look

and operate against homeowners and business owners who wanted to start rebuilding quickly. Parkersburg described some general practices they were going to follow in their recovery effort so that preliminary rebuilding could begin while broader recovery planning was underway (C. Luhring, personal communication, September 25, 2023).

Those general practices included:

- Building back what is needed most first (i.e., utility infrastructure, city/county buildings, emergency services, schools, grocery stores, etc.)
- Build with the ‘build back better’ mindset (i.e., building stronger, safer, and more disaster-resilient infrastructure and systems to reduce vulnerability to future disasters)
- Having a pro-development/pro-growth mindset

Early in the process, Parkersburg’s recovery message was “Parkersburg will always be your home” (FEMA, 2018). Chris Luhring, currently serving as Parkersburg’s City Administrator said that for residents who lost their homes in the tornado, the idea to leave wasn’t an option originally because Parkersburg is a tight-knit generationally inclined community, but this further reinforced that idea. From early in the process, one of Parkersburg’s primary goals was to recover their people. Mr. Luhring stated, “If you have recovery but it’s in the form of places or things and not people, that’s not right. It’s worthless without people.” Social capital can serve as a major factor in determining how a community recovers from a disaster. In places with high social capital, residents are more likely to return and reinvest in their community (Holtkamp, 2023).

Many disaster-stricken communities chose to implement a moratorium on building to stop construction from occurring before officials can put together a plan. According to Mr. Luhring, Parkersburg chose not to implement a moratorium because they didn't want to drive residents away by keeping them from rebuilding their homes. Mr. Luhring stated, "Don't stop people from building as long as they are doing it right, if you stop allowing people to build, they are going to go somewhere else." Parkersburg officials also decided to bring in a retired city planner to help guide the rebuilding of their town (C. Luhring, personal communication, September 25, 2023).

To help Parkersburg and the newly brought-on city planner, FEMA brought in a team of agency specialists skilled in long-term community recovery to help residents envision ways to rebuild and boost the community overall. The group assisted with the facilitation of discussion to identify the most critical recovery needs and goals and then prepared a written plan to keep the community on track. Two of the key identified goals were to rebuild the destroyed high school and bring back damaged playgrounds within one year of the tornado. Parkersburg managed to accomplish both goals and more. Playgrounds were identified as a priority because they felt it sent the message that Parkersburg wanted young families to rebuild there (FEMA, 2018).

Another bigger-picture planning action took shape in the form of the Long-Term Community Recovery Report published in December 2008. The Long-Term Community Recovery Report is a targeted technical assistance effort between the City of Parkersburg, the University of Northern Iowa Institute for Decision Making (IDM),

Iowa Northland Regional Council of Governments (INRCOG), Rebuild Iowa Office (RIO), and the Federal Emergency Management Agency's Emergency Support Function #14 Long-Term Community Recovery Branch (ESF #14 LTCR). ESF #14 LTCR support is offered to communities who would benefit from additional recovery resources, which is determined through an assessment of pre-disaster conditions, disaster impacts, and the communities' post-disaster capability to manage recovery. The LTCR identified several recovery projects and initiatives including the recovery of Aplington-Parkersburg High School and Parkersburg City Hall, a tree donation and planting initiative, the establishment of the Parkersburg Playground Fund, formulation of sidewalk standards, the pursuit of a Safe Routes to School Grant, and the design and implementation of entryway signage for Parkersburg (*Long-Term Community Recovery Report*, 2008).

Economic Development

Recovering the economic base of Parkersburg was another major task in the recovery process. Parkersburg's strong identity as a family town with strong ties likely served as a major contributor as to why all but one of the twenty-two affected businesses indicated that they were going to rebuild their businesses back in Parkersburg (FEMA, 2018). Before the tornado occurred, Parkersburg was a community on the rise, and city officials wanted to regain that status and grow, economic development is one of the biggest contributors to growing communities. The establishment of the county-level long-term recovery coalition in cooperation with the Butler-Grundy Development

Alliance were major drivers of this effort (J. Kolb, personal communication, September 28, 2023).

The biggest approach Parkersburg took to boosting economic development was to utilize the tornado and its redevelopment efforts as an opportunity to rebrand and market themselves differently. They made sure that people knew that Parkersburg was a tough town that survived and recovered from an EF-5 tornado (FEMA, 2018). They promoted the amenities that Parkersburg now had that other communities didn't have. Things like having many lots ready for development, new housing, new playgrounds, a new high school and football field, and a wide range of other brand-new infrastructure (J. Kolb, personal communication, September 28, 2023).

Funding and Support

To make recovery feasible, a tremendous amount of funding and manpower was needed. Thankfully, there was no shortage of either as the tornado made national headlines and was declared a federal disaster. Parkersburg received monetary donations from across the globe and all levels following the tornado. In the end, Parkersburg was subject to financial reinvestment in the tens of millions of dollars from all forms including insurance, government aid, donations, personal savings, and private-sector investments.

Parkersburg received millions of dollars of support from government entities, most notably FEMA. The money FEMA provided was distributed to various sources including

\$1 million towards providing short-term housing and emergency needs and nearly \$6 million towards debris removal, which covered 90% of the total cleanup bill (FEMA, 2018). Parkersburg also received large donations from the NFL thanks to four players who had grown up and gone to school in Parkersburg and now played in the NFL (FEMA, 2018).

Shortly after the tornado, a county-level long-term recovery coalition was formed and secured and subsequently administered nearly \$2 million in grant funding from various sources to affected residents and business owners (J. Kolb, personal communication, September 28, 2023). Business owners could also secure grants from the Iowa Economic Development Authority, the Small Business Association, and USDA. Outside of federal funding, people largely had to rely on insurance money to rebuild their homes and businesses. Fortunately, most residents and businesses had insurance that covered a portion of the costs of rebuilding, but not all of it. Outside of federal funding and donations, Parkersburg was able to capitalize on the debris cleanup and removal process by collecting money from metal recycling (C. Luhring, personal communication, September 25, 2023).

Parkersburg, Iowa, Today

Over the nearly sixteen years following the devastating tornado that hit Parkersburg, the town has achieved substantial advancements in community recovery and infrastructure reconstruction. Some accomplishments include the reconstruction

of Aplington-Parkersburg High School, city hall, Aplington-Parkersburg Elementary School, Swimming Pool Park, the fire station, and all but one of the twenty-two affected businesses (FEMA, 2018). Additionally, the town has successfully recovered and expanded its housing stock, surpassing Parkersburg's pre-tornado housing stock with 867 units compared to 850 units before the tornado (see Figure 19). S&S Foods, the local grocery store in Parkersburg was one of the twenty-two businesses affected by the tornado. Unfortunately, the owners decided to shut the store down after the tornado, leaving Parkersburg residents without a local grocery store. Thankfully, the DeVries brothers stepped in and opened Brother's Market in May 2009, one year after the tornado (*About Us*, n.d.). Parkersburg is now home to a total of seventy-three businesses

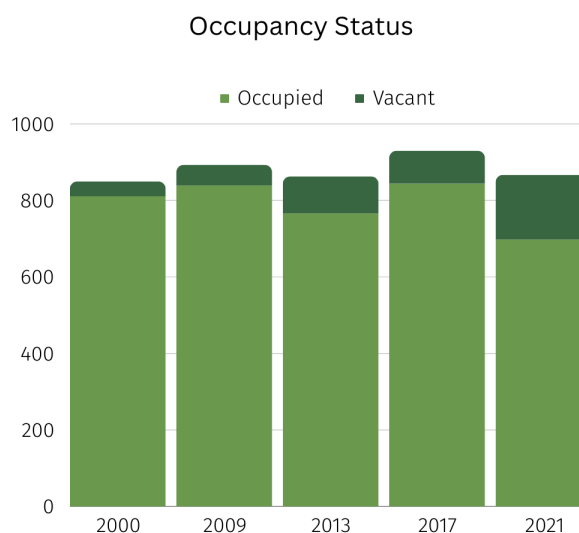


Figure 19: Parkersburg, Iowa

Occupancy Status (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

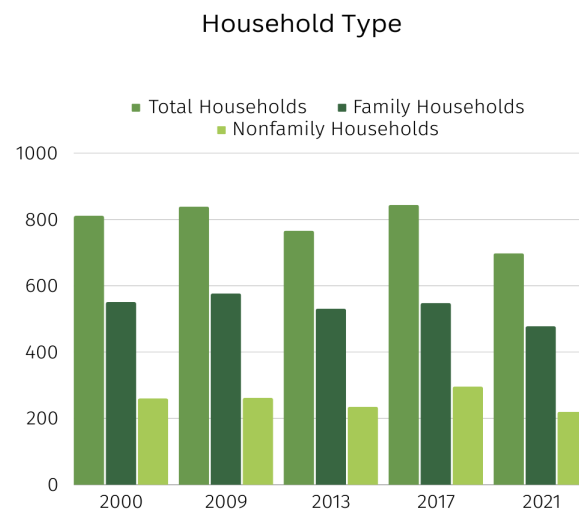


Figure 20: Parkersburg, Iowa

Household Type Breakdown (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

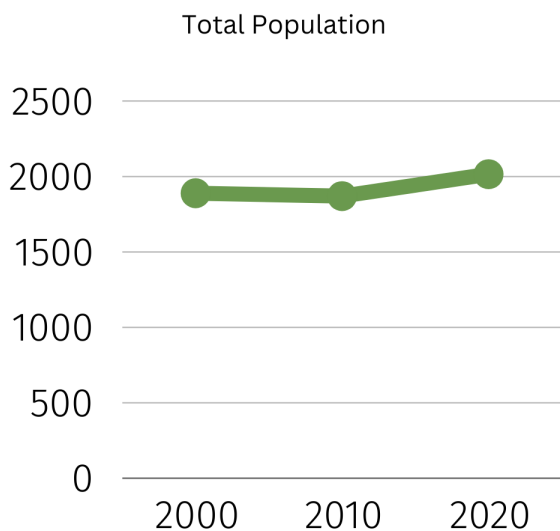


Figure 21: Parkersburg, Iowa

Population (U.S. Census Bureau, 2000, 2010, 2020)

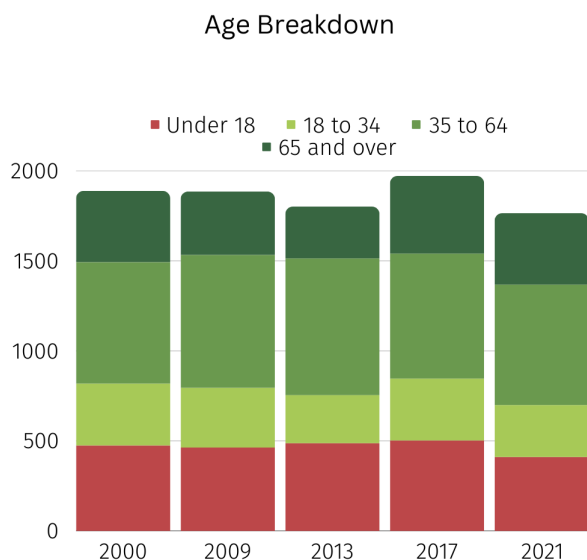


Figure 22: Parkersburg, Iowa Age

Breakdown (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

**data is based on estimates from the American Community Survey with a margin of error*

and the Highway 57 Corridor has been described as “booming” by Parkersburg staff (FEMA, 2018).

According to the 2020 U.S. Decennial Census, Parkersburg has a population of 2,015 people (see Figure 21). Parkersburg’s population only declined slightly between 2000 and 2010, dropping from 1,889 people to 1,870 people, and was likely caused by the tornado and its effects.

However, Parkersburg has been able to fully recover from this slight dip in population and has grown to be larger than ever.

Parkersburg’s strong community identity both kept long-term residents in town and attracted new ones to the community. The 2017-2021 American Community Survey revealed that Parkersburg was home to 867 housing units occupied by 698 households, of which 478 were families.

Parkersburg has recovered its housing

stock to 867 units since the tornado but is home to significantly fewer households and families (698 households/478 families) compared to before the tornado (811 households/551 families) (see Figure 20).

In 2021, the median age in Parkersburg was 46 years old, surpassing the 40-year median recorded in 2000 (see Figure 22).

This shift indicates a gradual aging of the population in Parkersburg. The median household income, determined to be

\$64,479 in 2021, reflects a notable increase compared to the \$32,083 median recorded in 2000 (see Figure 23) (U.S. Census Bureau, 2021). However, this rise aligns reasonably with a 21-year advancement in pay. The 2021 median household income in Parkersburg closely aligns with the state's median household income of \$65,429 (The University of Kansas, 2008). In 2021, it was discovered that 7% of Parkersburg's

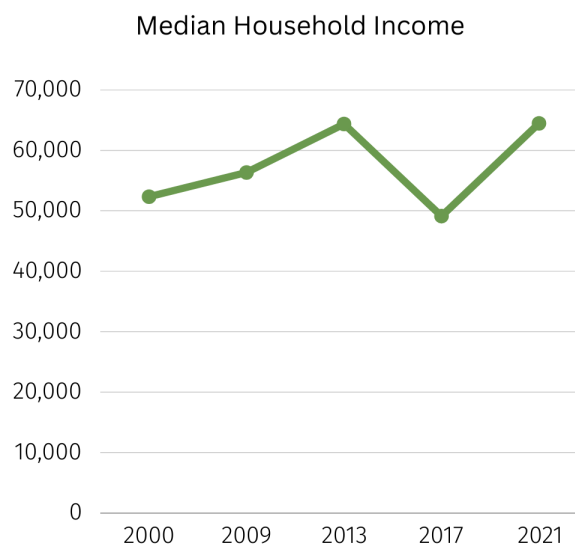


Figure 23: Parkersburg, Iowa Median Household Income (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

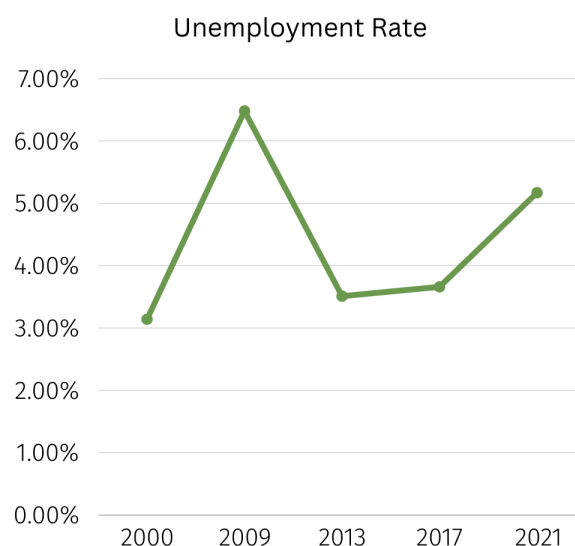


Figure 24: Parkersburg, Iowa Unemployment Rate (U.S. Census Bureau, 2000, 2009, 2013, 2017, 2021)

population lived below the poverty line, which is slightly lower than the 7.3% poverty rate reported in the 2000 Census (U.S. Census Bureau, 2021). In the state of Iowa as a whole, the poverty level went from 10% in 2000 to 11.1% in 2021 (The University of Kansas, 2008).

Parkersburg has been highly successful in its recovery efforts and is considered to be a model of disaster recovery and resiliency in the aftermath of a natural disaster (Scherer, 2011). Parkersburg officials consider the community as a sort of template that other towns can use to recover from their tornadoes (Scherer, 2011). For example, Chris Luhring, the City Administrator, has taken part in speaking tours on recovery from disasters and has offered recovery advice to many other tornado-damaged communities. In Parkersburg today, the path of the giant EF-5 tornado is only visible in the area's lack of mature trees (FEMA, 2018). Parkersburg is still striving to improve its community; the consolidated Aplington-Parkersburg school district has been growing, a new outdoor sports recreation area is under construction, and Parkersburg secured a \$3.5 million federal transportation grant to enhance its streetscape along Iowa Highway 57 (FEMA, 2018).

CHAPTER FIVE

STUDY FINDINGS & RECOMMENDATIONS

Comparisons between Greensburg, Kansas, & Parkersburg, Iowa

Greensburg, Kansas, and Parkersburg, Iowa, are two small communities in the midwestern United States that share a history of experiencing devastating EF-5 tornadoes. These communities share a few other commonalities between them and several other small rural communities across the United States. However, each community has its own distinct identity and are carving very different paths forward.

Greensburg vs Parkersburg Before

Before each community experienced their respective tornado, Greensburg and Parkersburg were small communities located less than an hour away from significant population centers. Parkersburg is located about thirty minutes away from a larger population center whereas Greensburg is about forty-five minutes away from one.

Both communities were, and still are, the largest towns in their respective counties. Greensburg serves as the county seat of Kiowa County, Kansas but Parkersburg does not serve as the county seat of Butler County, Iowa. Pre-tornado, the populations in Greensburg and Parkersburg were comparable with Greensburg having around 1,400 people and Parkersburg having close to 1,900 people. However, Greensburg was struggling with persistent population loss while Parkersburg's population was slowly increasing, as evidenced by its increase from a population of 1,889 according to the 2000 U.S. Census to 1,900 in early 2008 (U.S. Census Bureau, 2000).

Demographically, we can see some key differences between Parkersburg and Greensburg in their pre-tornado populations. Parkersburg was home to a younger and more affluent population than Greensburg as the median age was lower, and the median household income was higher. The unemployment rate was lower in Parkersburg at 3.14% than in Greensburg, which had an unemployment rate of 4.7%. Parkersburg also had fewer vacant housing units pre-tornado with only 39 vacant units compared to 157 vacant units in Greensburg. Education-wise, Greensburg residents were slightly more likely to obtain college degrees than Parkersburg residents were pre-tornado with 17.9% of the population having a bachelor's degree or higher in Greensburg compared to 12.7% of the population in Parkersburg (U.S. Census Bureau, 2000).

Greensburg vs Parkersburg Tornadoes

The tornadoes that Greensburg and Parkersburg experienced had several

statistical similarities, but they affected the communities very differently. Both tornadoes were rated as EF-5 tornadoes, the strongest rating on the Enhanced Fujita Scale meaning they boasted wind speeds of 200 to 210 miles per hour. Both tornadoes were declared as federal disasters by President Bush for federal funding to be available to those affected by the tornadoes. Both tornadoes occurred in the month of May which is historically the most active month for tornadoes followed by April and June.

Despite these statistical similarities, the tornadoes had very different effects on Greensburg and Parkersburg. The tornado that struck Greensburg traveled directly through town and destroyed nearly 95% of the community while the tornado that struck Parkersburg was less direct and hit the southern portion of town, only destroying 33% of the community. Greensburg residents were very fortunate and received warnings thirty minutes ahead of the storm getting to Greensburg, giving residents plenty of time to take cover. Parkersburg residents only got around five minutes of warning before the storm arrived, meaning residents had to act very quickly to protect themselves from the tornado. The Greensburg tornado caused more fatalities and injuries compared to the Parkersburg tornado with 11 fatalities and around 70 injuries versus 7 fatalities and 50 injuries, however, this could be due to the less direct hit that Parkersburg took compared to Greensburg.

Greensburg vs Parkersburg Recovery Processes

Greensburg and Parkersburg did take some similar steps in their recovery

processes but overall, their approaches to disaster recovery were different. This fact is unsurprising as disaster recovery encompasses so many different aspects and many different approaches can be taken towards regaining what has been lost because of a disaster (Coppola, 2021). Both communities prioritized building back what the communities needed the most first, things like utility infrastructure, emergency services, city buildings, grocery stores, and schools. They also both built with the ‘build back better’ mindset, which means that they intentionally built stronger, safer, and more disaster-resilient infrastructure and systems to reduce their vulnerability to future disasters. The ‘build back better’ mindset is very important in disaster recovery as long term; communities want not only to return to their pre-disaster condition but also want to become more resilient against future disasters. Both communities attempted to speed up the planning process to avoid losing more of their populations while balancing creating a long-term vision for their community. This aspect of balancing short-term needs with long-term disaster recovery is one of the most difficult aspects of disaster recovery (March et al., 2017). Parkersburg was more successful in this effort as the near complete devastation in Greensburg made long-range planning imperative before substantial rebuilding could begin (U.S. Department of Energy, 2009). Both communities also received assistance from the Federal Emergency Management Agency with long-term community recovery planning activities but in different ways. As small communities, Parkersburg and Greensburg both acknowledged that they had limited resources available to them, which is one of the major barriers in small-town disaster

recovery, and took full advantage of assistance from outside entities (Paul et al., 2023).

Both communities were recipients of hundreds of millions of dollars in funding from various sources to help with recovery. Another similarity between the two communities was that residents and business owners largely had to rely on insurance money to rebuild their homes and businesses as most of the funding went towards rebuilding community facilities. In both communities, residents and business owners faced a gap between what insurance covered and the actual cost of rebuilding. Finally, both communities used the tornado as a measure to rebrand and market themselves with a focus on the unique amenities they now had that other communities didn't; things like new infrastructure systems, new housing, and lots of available development lots.

Greensburg created an identity centered around sustainability and the idea of "putting the green in Greensburg." A large component of this sustainability push was the creation of the Sustainable Comprehensive Plan published in May 2008. The Sustainable Comprehensive Plan was one of the goals identified in the larger Long-Term Recovery Plan that was produced in August 2007 with assistance from FEMA in coordination with the public, business owners, and Greensburg officials. The Long-Term Recovery Plan was broken into several sections including sustainable development, housing, economy and business, and community facilities and infrastructure, each section identifying various goals and initiatives for recovery (*Long-Term Community Recovery Plan*, 2007).

Parkersburg made sure its residents didn't want to leave Parkersburg despite the massive rebuilding efforts that needed to be undertaken by re-identifying the strong community that existed in town pre-tornado. The tagline "Parkersburg will always be your home" was the driver behind this initiative to keep Parkersburg residents in Parkersburg. When preparing for disasters, social capital is often overlooked with the focus on infrastructure, but by strengthening community connections, safer and more resilient communities with greater capacity to respond and recover from disasters are created (Holtkamp, 2023). Parkersburg had these community connections created before the tornado and the return in the community is evident. Something else that helped keep residents in Parkersburg was, in coordination with Butler County, a county-level long-term recovery coalition was created after the tornado to support recovery efforts and distribute funds to affected residents and business owners fairly. These efforts by Parkersburg combatted two of the major barriers to effective disaster recovery: social capital and financial/economic resources (Rouhanizadeh et al., 2020).

Parkersburg officials understood that they needed to have a pro-growth/pro-development mindset going into the rebuilding process to properly recover. Parkersburg officials also acknowledged that they would need help rebuilding their community and decided to allocate funding towards bringing in a city planner to help guide their recovery efforts. FEMA and their Emergency Support Function #14 Long-Term Community Recovery branch assisted Parkersburg officials, the newly brought-on city planner, and technical assistance professionals in identifying recovery projects

and initiatives as part of the Long-Term Community Recovery Report published in December 2008 (*Long-Term Community Recovery Report*, 2008).

Greensburg vs Parkersburg After

Greensburg and Parkersburg have both had nearly two decades of recovery time and there is clear evidence of recovery in both communities. Parkersburg and Greensburg have been successful in different aspects of their recovery. Greensburg's biggest achievement since the tornado was emphasizing sustainability in its recovery. Greensburg is considered to be one of America's greenest towns thanks to its successes in using renewable energy sources to power the entire town (*About Greensburg*, 2024). Parkersburg has been very successful overall and is considered to be a model for disaster recovery and resiliency (Scherer, 2011). Other disaster-stricken communities have been turning to Parkersburg for advice and community officials believe this trend will continue for many years to come (Scherer, 2011).

In terms of population recovery, Greensburg believed they would be able to reach their pre-tornado population level five years after their tornado. Unfortunately, ten-plus years after the deadline for that goal, Greensburg has been unable to reach pre-tornado population levels and its population is still declining as it was before the tornado occurred. Parkersburg on the other hand was able to recover its population after the tornado and has grown to be larger than it ever has been in the town's history. Greensburg is not alone in the fact that it has been unable to recover its population base,

in fact, the majority of small communities affected by tornadoes do not return to their pre-tornado population size (Paul et al., 2023). Greensburg was also facing persistent population loss before the tornado occurred, which is another factor contributing to population recovery issues (Paul et al., 2023).

The demographic differences between Parkersburg, Iowa, and Greensburg, Kansas, likely played a significant role in their divergent recovery experiences. Parkersburg's younger and more affluent population, combined with its lower unemployment rate, likely provided a stronger economic foundation and greater adaptability for recovery compared to Greensburg. While Greensburg residents had slightly higher levels of educational attainment, Parkersburg's demographic advantages in age and affluence likely facilitated greater resilience and access to resources, accelerating the recovery process. Although higher educational attainment may have equipped Greensburg residents with enhanced problem-solving skills, Parkersburg's recovery may have been bolstered by its younger population's innovative thinking and adaptability. While other factors such as community cohesion, leadership, and access to resources also influence recovery outcomes, the demographic differences between Parkersburg and Greensburg likely contributed to the observed differences in their recoveries.

With all of that said, both communities are doing comparatively well. Parkersburg is experiencing lots of continued investment from those interested in further improving the community, including funding to improve the 'booming' Highway 57 corridor and many new developments (FEMA, 2018). Greensburg is one of the hundreds of rural

communities in the United States that is experiencing population loss, but compared to other rural communities, it's doing relatively well. Greensburg's population loss rate was only 4.8% between 2010 and 2020 which is significantly lower than other rural communities. Three county seats of surrounding counties experienced higher population loss rates than Greensburg between 2010 and 2020 ranging from a 7% population loss rate up to a 17% population loss rate (Johnson, 2022).

Recommendations

Disasters, including tornadoes, are occurring more frequently and violently thanks to the effects of climate change (Howe et al., 2014). For this reason, disaster planning needs to be encouraged and undertaken everywhere to help communities prepare for them. Disaster planning is a continuous four-phase cycle of hazard mitigation, preparedness, response, and recovery. Disaster recovery is often considered the most challenging phase of the four phases of the disaster planning cycle (March et al., 2017). As the process is continuous, disaster recovery has a major influence on hazard mitigation strategies. This report contributes to the conversation on disaster planning by providing insights into various disaster recovery strategies that have been previously implemented and that have, in turn, created hazard mitigation strategies that communities can implement before a disaster occurs. Hazard mitigation can greatly reduce communities' overall vulnerability to disasters. This report provides a comparative case study of two communities that experienced high-powered tornadic

events and have had over ten years of recovery time. Their respective recovery processes and the successes they have had from those processes are detailed to explain what worked for them in their recovery. The case study supplies us with not only some disaster recovery approaches that communities can apply in the face of disaster, but also some strategies and methods that communities can apply in their hazard mitigation plans or other preparation methods before a disaster occurs.

The goal of this research was to contribute to the planning initiatives of towns in tornado-prone areas in hopes of easing their recovery processes. The following sections detail the recommendations based on the research conducted to answer my guiding research question:

“What response and recovery strategies contribute to long-term recovery, including population recovery, in small communities?”

To answer this question, I have prepared the following recommendations compiled through the comparative case study, interviews, and research described in previous chapters. These recommendations are broken into two sections: hazard mitigation and disaster recovery.

Hazard Mitigation

- Prepare a Disaster Recovery Plan
- Require the Construction of Safe Rooms
- Require Wind-Resistant Building Techniques
- Enforce Smart Land-Use Planning

- Keep up-to-date Community Metrics
- Conduct Tornado Awareness Activities

Disaster Recovery

- Update the Recovery Plan and Create Long-Term Vision for the Community
- Provide Temporary Housing
- Build Back Community Necessities First
- Enforce the 'Build Back Safer' Mindset
- Market the Community's Unique Characteristics

Communities that are preparing a hazard mitigation plan or looking to take mitigation actions should incorporate the following into their approach:

- **Prepare a Disaster Recovery Plan**

A disaster recovery plan outlines strategies and protocols for managing various aspects of recovery, including emergency response, resource allocation, infrastructure restoration, and community revitalization. By identifying potential hazards, assessing vulnerabilities, and developing proactive mitigation strategies, communities can minimize the impact of disasters and expedite the recovery process. Preparing a disaster recovery plan will facilitate coordination among government agencies, emergency responders, community organizations, and other stakeholders, ensuring a unified and effective response to disasters. Additionally, the plan should assign responsibilities and allocate resources in advance, enabling timely and efficient decision-making during crises. Investing

in disaster planning pre-disaster equips communities with the tools and strategies needed to help mitigate risks, protect lives and property, and then recover and build resilience against future disasters (FEMA, 2017).

- **Require the Construction of Safe Rooms**

Requiring the construction of safe rooms is a critical aspect of hazard mitigation plans aimed at safeguarding lives and minimizing the impacts of tornadoes.

This initiative involves promoting the establishment of safe rooms in key community locations such as schools, daycares, and nursing homes, where vulnerable populations often congregate (*Mitigation ideas*, 2013). Also advocating for the integration of safe rooms in residential areas, manufactured home parks, and public places enhances accessibility to safe shelter options during tornadoes. By prioritizing the construction of safe rooms, communities can significantly enhance their resilience and preparedness in the face of tornadoes (*Mitigation ideas*, 2013).

- **Require Wind-Resistant Building Techniques**

Requiring wind-resistant building techniques in hazard mitigation plans is aimed at reducing the vulnerability of communities to the destructive forces of tornadoes. This approach involves advocating for the adoption of various wind engineering measures and construction techniques, such as structural bracing, anchor bolts, reinforced doors and windows, and using wind-resistant materials (*Mitigation ideas*, 2013). Incorporating these techniques will greatly enhance

the structural integrity of buildings, mitigating the risk of damage and ensuring safety for building occupants. This is a proactive strategy that will bolster communities' resilience to extreme weather events (*Mitigation ideas*, 2013).

- **Enforce Smart Land-Use Planning**

Land use planning can serve as an effective hazard mitigation strategy for tornadoes. By carefully zoning and regulating development in tornado-prone areas, communities can reduce risk exposure and minimize potential damage. Key components of mitigation land use planning include avoiding development in high-risk areas and implementing buffer zones. Identifying areas with a history of or high susceptibility to tornado activity should be avoided in development processes and creating buffer zones around existing developments that can serve as protective barriers (*Mitigation ideas*, 2013).

- **Keep up-to-date Community Metrics**

Gathering community metrics before a disaster occurs will give planners and community professionals a basis for comparison after a disaster occurs. These metrics should include things like population, number of businesses, community facilities, median home value, median household income, abandoned housing units, unemployment rate, cultural and heritage sites, school enrollment, critical infrastructure, and natural resource areas. After a disaster occurs, these same metrics can be gathered and the comparison can be used to help make informed decisions during recovery (Horney et al., 2018).

- **Conduct Tornado Awareness Activities**

Scheduling frequent tornado awareness activities is very important in terms of reducing individuals' and communities' vulnerability to tornadoes. These activities could include tornado drills to practice emergency procedures to ensure that residents know how to seek shelter, distributing information about tornado shelter locations, and education initiatives to teach about the dangers of tornadoes and how to take safety precautions (*Mitigation ideas*, 2013).

By raising awareness and providing practical guidance, these activities play a pivotal role in reducing the risk of injury and loss of life during tornadoes (*Mitigation ideas*, 2013).

After a disaster occurs, these recovery methods have been successful in aiding communities in returning to their pre-disaster state:

- **Update the Recovery Plan and Create a Long-Term Vision for the Community**

Following a disaster, communities should make any needed updates and then implement the actions and strategies identified in the recovery plan. Successful recovery will require the community to undertake a structured recovery planning process (outlined in the recovery plan composed pre-disaster), through which the community needs to develop a vision for itself, set goals, and identify concrete methods for reaching those goals (FEMA, 2017).

- **Provide Temporary Housing**

Providing temporary housing options for displaced residents is essential for meeting immediate shelter needs and facilitating the transition to permanent housing solutions. Having some form of shelter is vital for communities because, without it, residents will have nowhere to stay during the recovery process and are more likely to relocate somewhere else.

- **Build Back Community Necessities First**

Prioritizing the reconstruction of critical community infrastructure and services, such as hospitals, schools, city/county facilities, grocery stores, utilities, and transportation networks is vital. By restoring these essential services promptly, communities can ensure the safety, health, and well-being of residents while facilitating the return of residents and the larger recovery process. Without these essential services, a community will not look like a very appealing place to settle or return to following a disaster.

- **Enforce the ‘Build Back Safer’ Mindset**

Adopting the ‘build back safer’ mindset is essential for promoting resilience and sustainability in the aftermath of a disaster. This mindset involves building stronger, safer, and more disaster-resilient infrastructure and systems to reduce vulnerability to future disasters. This could mean integrating state-of-the-art building technologies to mitigate future disaster impacts and incorporating green infrastructure and energy-efficient solutions in the rebuilding process. These strategies all look to build community resilience and ensure a vibrant

future. Embracing the ‘build back safer’ mindset is not only a strategic investment in the community’s future but also a testament to its resilience and adaptability in the face of adversity. ‘Build back safer’ is the preferable tagline to ‘build back better’ as it provides a clearer goal to focus on in post-disaster recovery (Kennedy et al., 2008).

- **Market the Community’s Unique Characteristics**

Promoting the community’s unique characteristics and assets following a tornado will help to attract not only former residents back to the area but also attract new ones and may even bolster tourism. Highlighting the new infrastructure systems that have been built following a tornado and the availability of land for development can encourage further investment in the community and ultimately continue the cycle of making the community look like a good place to live or work.

Conclusion

The recommendations outlined above fall under two categories: hazard mitigation and disaster recovery. These two categories work to address my research question of “What response and recovery strategies contribute to long-term recovery, including population recovery, in small communities?” The study found that demographics play a significant role in disaster recovery, but other factors including community cohesion, leadership, and access to resources also play important roles in recovery.

Moving forward, the findings from this study hold significant implications for planning initiatives in tornado-prone areas, offering valuable lessons to aid other small communities in navigating the complexities of post-disaster recovery and fostering greater resilience in the face of future challenges. Tornado-prone areas are changing as studies have found that ‘Tornado Alley’ is shifting towards the southeastern United States, this means that more areas of the United States need to be better prepared for tornadoes and know how to mitigate their impacts. With increased hazard mitigation efforts in place, communities should have an easier time recovering from tornadoes, which is often cited as the most difficult part of the disaster planning cycle.

References

- 2007 EF5 Tornado*. Greensburg, KS. (n.d.-a). <https://www.greensburgks.org/community/pages/2007-ef5-tornado>
- About Greensburg*. Visit Greensburg, Kansas! (2024). <https://visitgreensburgks.com/about-greensburg/>
- About Us*. Brothers Market. (n.d.). <https://www.shopbrothersmarket.com/about>
- Agee, E., Larson, J., Childs, S., & Marmo, A. (2016). Spatial redistribution of U.S. tornado activity between 1954 and 2013. *Journal of Applied Meteorology and Climatology*, 55(8), 1681–1697. <https://doi.org/10.1175/jamc-d-15-0342.1>
- Best Places. (n.d.-a). Greensburg, KS. Best Places. <https://www.bestplaces.net/city/kansas/greensburg>
- Best Places. (n.d.-b). Parkersburg, IA. Best Places. <https://www.bestplaces.net/city/iowa/parkersburg>
- Clements, B., & Casani, J. (2016). Thunderstorms and Tornadoes. In *Disasters and public health: Planning and response* (pp. 411–434). essay, Butterworth-Heinemann.
- Coppola, Damon P. (2021). *Introduction to international disaster management*. Butterworth-Heinemann Inc.
- Farney, T. J., & Dixon, P. G. (2014). Variability of tornado climatology across the continental United States. *International Journal of Climatology*, 35(10), 2993–3006. <https://doi.org/10.1002/joc.4188>
- FEMA. (2017). *Pre-Disaster Recovery Planning Guide for Local Governments*.
- FEMA. (2018). *10 Years After Disaster: Defying the Tornado that Changed Everything - Parkersburg, Iowa*.
- Fox, T. J., & Wallach, D. (2013). *Green Town USA: The Handbook for America's Sustainable Future*. Hobart, New York. Hatherleigh Press.

- Gensini, V. A., & Brooks, H. E. (2018). Spatial trends in United States tornado frequency. *NPJ Climate and Atmospheric Science*, 1(1). <https://doi.org/10.1038/s41612-018-0048-2>
- Godschalk, D. R. (2003). Urban hazard mitigation: Creating resilient cities. *Natural Hazards Review*, 4(3), 136–143. [https://doi.org/10.1061/\(ASCE\)1527-6988\(2003\)4:3\(136\)](https://doi.org/10.1061/(ASCE)1527-6988(2003)4:3(136))
- Gonteski, C. (2023). *Tornadoes – Adapting Plans for a Changing Environment*. Domestic Preparedness. <https://domesticpreparedness.com/articles/tornadoes-adapting-plans-for-a-changing-environment>
- Greensburg Sustainable Comprehensive Plan. (2008). City of Greensburg.
- Hall, S. G., & Ashley, W. S. (2008). Effects of urban sprawl on the vulnerability to a significant tornado impact in northeastern Illinois. *Natural Hazards Review*, 9(4), 209–219. [https://doi.org/10.1061/\(ASCE\)1527-6988\(2008\)9:4\(209\)](https://doi.org/10.1061/(ASCE)1527-6988(2008)9:4(209))
- Holtkamp, C. (2023). *Social Capital builds resilience-and planners can build social capital*. Planetizen. <https://www.planetizen.com/features/125464-social-capital-builds-resilience-and-planners-can-build-social-capital#:~:text=Social%20capital%20is%20grounded%20in,and%20reinvest%20in%20their%20neighborhoods>.
- Horney, J., Dwyer, C., Chirra, B., McCarthy, K., Shafer, J., & Smith, G. (2018). Measuring Successful Disaster Recovery. *International Journal of Mass Emergencies & Disasters*, 36(1), 1–22. <https://doi.org/10.1177/028072701803600101>
- Howe, P. D., Boudet, H., Leiserowitz, A., & Maibach, E. W. (2014). Mapping the shadow of experience of extreme weather events. *Climatic Change*, 127(2), 381–389. <https://doi.org/10.1007/s10584-014-1253-6>
- Iglesias, V., Braswell, A. E., Rossi, M. W., Joseph, M. B., McShane, C., Cattau, M., Koontz, M. J., McGlinchy, J., Nagy, R. C., Balch, J., Leyk, S., & Travis, W. R. (2021). Risky Development: Increasing Exposure to Natural Hazards in the United States. *Earth's Future*, 9(7). <https://doi.org/10.1029/2020EF001795>

- Iowa DOT. (2016). *Highway and Street Map of Parkersburg, Iowa*. Iowa DOT. <https://iowadot.gov/>
- Jerolleman, A., & Laska, S. (2020). Challenges of Post-Disaster Recovery in Rural Areas. In *Louisiana's Response to Extreme Weather: A Coastal State's Adaptation Challenges and Successes* (pp. 285–310). essay, Springer International Publishing.
- Johnson, K. (2022). *Rural America lost population over the past decade for the first time in history*. UNH Carsey School of Public Policy. <https://carsey.unh.edu/publication-rural-america-lost-population-over-past-decade-for-first-time-in-history>
- Kennedy, J., Ashmore, J., Babister, E., & Kelman, I. (2008). The meaning of 'build back better': Evidence from Post-Tsunami Aceh and Sri Lanka. *Journal of Contingencies and Crisis Management*, 16(1), 24–36. <https://doi.org/10.1111/j.1468-5973.2008.00529.x>
- Kansas Department of Transportation. (2005). City of Greensburg. KDOT. <https://www.ksdot.gov/>
- Kern, W. S., Sutter, D., & Simmons, K. (2010). The Socioeconomic Impact of Tornadoes. In *The Economics of Natural and Unnatural Disasters* (pp. 103–124). essay, W. E. Upjohn Institute for Employment Research.
- Long-Term Community Recovery Plan: Greensburg + Kiowa County, Kansas*. (2007). FEMA.
- Long-Term Community Recovery Report: Parkersburg, Iowa*. (2008). Rebuild Iowa Office.
- March, A., Kornakova, M., & Leon, J. (2017). Integration and Collective Action: Studies of Urban Planning and Recovery After Disasters. In *Urban Planning for Disaster Recovery* (pp. 1–12). essay, Butterworth-Heinemann.
- Marshall, T., Jungbluth, K., & Haag, A. (2008). *The Parkersburg, IA Tornado: May 25, 2008*. 24th Conference on Severe Local Storms. Savannah, GA.
- Marshall, T. P., McCarthy, D., & LaDue, J. (2008). *Damage survey of the Greensburg, KS tornado*. Boulder, Colorado: Center for Severe Weather Research.

- Mitigation ideas: A resource for reducing risk to natural hazards.* (2013). U.S. Dept. of Homeland Security. FEMA.
- National Oceanic and Atmospheric Administration. (2008). (rep.). *EF5 Tornado in Parkersburg and New Hartford, Iowa*. Des Moines, Iowa.
- Paul, B., Stimers, M., Sharif, M., Kashen, S., & Lu, M. (2023). Population recovery in the U.S. communities affected by tornadoes, 2000–2010. SSRN. <https://ssrn.com/abstract=4427977>
- Rose, A., Porter, K., Dash, N., Bouabid, J., Huyck, C., Whitehead, J., Shaw, D., Eguchi, R., Taylor, C., McLane, T., Tobin, L. T., Ganderton, P. T., Godschalk, D., Kiremidjian, A. S., Tierney, K., & West, C. T. (2007). Benefit-Cost Analysis of FEMA Hazard Mitigation Grants. *Natural Hazards Review*, 8(4), 97–111. [https://doi.org/10.1061/\(ASCE\)1527-6988\(2007\)8:4\(97\)](https://doi.org/10.1061/(ASCE)1527-6988(2007)8:4(97))
- Rouhanizadeh, B., Kermanshachi, S., & Nipa, T. J. (2020). Exploratory analysis of barriers to effective post-disaster recovery. *International Journal of Disaster Risk Reduction*, 50. <https://doi.org/10.1016/j.ijdrr.2020.101735>
- Safapour, E., Kermanshachi, S., & Pamidimukkala, A. (2021). Post-disaster recovery in urban and rural communities: Challenges and strategies. *International Journal of Disaster Risk Reduction*, 64. <https://doi.org/10.1016/j.ijdrr.2021.102535>
- Scherer, R. (2011). *Parkersburg, Iowa, emerges as model for Tornado Recovery*. The Christian Science Monitor. <https://www.csmonitor.com/USA/Society/2011/0607/Parkersburg-Iowa-emerges-as-model-for-tornado-recovery>
- Sustainable rebuilding*. Greensburg, KS. (n.d.). <https://www.greensburgks.org/community/pages/sustainable-rebuilding>
- The University of Kansas. (2008). *Kansas Statistical Abstract 2007*. Institute for Policy & Social Research. <https://ipsr.ku.edu/>
- U.S. Census Bureau. (2000). *2000 U.S. Decennial Census*. Retrieved from Social Explorer. <https://www.socialexplorer.com/tables/C2000>

- U.S. Census Bureau. (2009). *2005-2009 American Community Survey 5-year Estimate*. Retrieved from Social Explorer. https://www.socialexplorer.com/tables/ACS2009_5yr
- U.S. Census Bureau. (2010). *2010 U.S. Decennial Census*. Retrieved from Social Explorer. <https://www.socialexplorer.com/tables/C2010>
- U.S. Census Bureau. (2013). *2009-2013 American Community Survey 5-year Estimate*. Retrieved from Social Explorer. https://www.socialexplorer.com/tables/ACS2013_5yr
- U.S. Census Bureau. (2017). *2013-2017 American Community Survey 5-year Estimate*. Retrieved from Social Explorer. https://www.socialexplorer.com/tables/ACS2017_5yr
- U.S. Census Bureau. (2020). *2020 U.S. Decennial Census*. Retrieved from Social Explorer. <https://www.socialexplorer.com/tables/CENSUS2020>
- U.S. Census Bureau. (2021). *2017-2021 American Community Survey 5-year Estimate*. Retrieved from Social Explorer. https://www.socialexplorer.com/tables/ACS2021_5yr
- U.S. Department of Energy. (2009). *Rebuilding After Disaster*. The Department of Energy. <http://www.energy.gov/>

APPENDIX A -
GREENSBURG,
KANSAS
INTERVIEW
QUESTIONS

Matt Christenson, Mayor of Greensburg, Kansas

1. Can you give me a little background about yourself and what you do for the town of Greensburg?
2. Have any hazard mitigation measures or strategies been implemented since the tornado to mitigate against future tornado hazards?
3. Did Greensburg build back incorporating the 'build back better' mindset?
4. What were the key priorities during the immediate response to the tornado, and how were resources allocated to address these priorities effectively?
5. What kind of support did your town get from outside of the community?
6. How did the local government prioritize recovery and reconstruction projects following the tornado?
7. What were the main obstacles faced during the recovery and reconstruction phase, and how were they addressed?
8. Were there any specific programs or resources offered to assist residents and businesses in their recovery efforts?
9. What measures for economic and population growth has Greensburg taken since the tornado?
10. What strategies do you think could be taken locally or from the federal or state level to ensure economic development post-tornado?
11. Based on your experience with this tornado, what advice would you give to planners and city managers in other areas to better prepare for and respond to tornadoes?

Stacy Barnes, City Administrator for Greensburg, Kansas

1. Can you give me a little background about yourself and what you do for the town of Greensburg?
2. Do you know if Greensburg had any hazard mitigation measures or strategies in place to mitigate tornado hazards before the tornado occurred?
3. Have any hazard mitigation measures or strategies been implemented since the tornado to mitigate against future tornado hazards?
4. Did Greensburg build back incorporating the 'build back better' mindset?
5. What were the key priorities during the immediate response to the tornado, and how were resources allocated to address these priorities effectively?
6. What kind of support did your town get from outside of the community?
7. How did the local government prioritize recovery and reconstruction projects following the tornado?
8. What were the main obstacles faced during the recovery and reconstruction phase, and how were they addressed?
9. Were there any specific programs or resources offered to assist residents and businesses in their recovery efforts?
10. What measures for economic and population growth has Greensburg taken since the tornado?
11. What strategies do you think could be taken locally or from the federal or state level to ensure economic development post-tornado?
12. Based on your experience with this tornado, what advice would you give to planners and city managers in other areas to better prepare for and respond to tornadoes?

APPENDIX B -
PARKERSBURG,
IOWA INTERVIEW
QUESTIONS

Chris Luhring, City Administrator for Parkersburg, Iowa

1. Can you start by telling me a little about your background with the city of Parkersburg?
2. Do you know if Parkersburg had any hazard mitigation strategies in place to mitigate tornado hazards before the tornado occurred?
3. Do you know if there have been any hazard mitigation strategies implemented since the tornado occurred to mitigate future tornado hazards? If so, what are they?
4. What were the key priorities during the immediate response to the tornado, and how were resources allocated to address these priorities effectively?
5. Were there any challenges or lessons learned during the response phase?
6. Do you think that the response approach has changed since the tornado? Like if another tornado were to occur, would the response be approached the same way?
7. What kind of support did Parkersburg get from outside of the community?
8. How did the local government prioritize recovery and reconstruction projects following the tornado?
9. Were there any specific programs or resources offered to assist residents and businesses in their recovery efforts?
10. What measures for economic growth have been implemented by your community?
11. What strategies have been implemented to rebuild the community's image and communicate that the city is open for business?
12. Based on your experience with this tornado, what advice would you give to others to better prepare for and respond to tornadoes?

Jeff Kolb, Butler County Economic Development Director

1. Can you start by telling me a little about your background with the city of Parkersburg?
2. What were the key priorities during the immediate response to the tornado, and how were resources allocated to address these priorities effectively?
3. What were the biggest lessons learned during the response phase?
4. How did the local government prioritize recovery and reconstruction projects following the tornado?
5. Were there any specific programs or resources offered to assist residents and businesses in their recovery efforts?
6. What strategies are being implemented or were implemented to rebuild the community's image and communicate that the city is open for business?