

# Performance Metrics for Economic Recovery following Natural Disasters

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GOVERNMENT

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## About the Project

This report is the product of a collaboration between the University of Pennsylvania, Fels Institute of Government and the International Economic Development Council (IEDC). Washiq Ahmed is a MPA graduate with the Fels Institute of Government, and he undertook this work as part of a university requirement to fulfill his capstone project.

Thank you to Dr. Frankie Clogston from IEDC for her mentorship and guidance throughout this project. Thank you to Dana Crater, Senior Economic Development Associate from IEDC for her help and skills in polishing this paper. Thank you to Dr. Sean Kates from the University of Pennsylvania for his continued support and encouragement.

*Metrics are the alphabet economic developers can use to read signs of distress, progress, or stability and communicate to one another as well as to a broader audience in a commonly accepted language*

## Executive Summary

This report is intended for local and regional economic developers. Often, in the existing literature surrounding standards to measure socio-economic recovery following the impact of disasters, there is emphasis on national level indicators that may not be entirely relevant or telling of local conditions. Economic developers have to think locally in order to adequately address the economic recovery issues most pressing to their communities. This report will provide economic developers with the thought process on how to establish locally based economic recovery indicators with social equity in mind.

Previously, social equity was at times overlooked when considering the overall state of the economy. Both on a national and local level, metrics are reported as a straightforward average, ratio, or raw total. Unfortunately, this approach of delivering one average or set of averages to tell the story of a region is not fully representative of all community members. Averages may distort the reality of recovery for the socially vulnerable and mask their true economic conditions following a disaster type event. This report will advance the current arena of metric selection by taking a unique approach that will combine characteristics from the Socially Vulnerability Index (SVI), established by the Centers for Disease Control and Prevention (CDC), with traditional economic leading, lagging, and coincident indicators. Ideally, when the two sets of categories are overlayed with one another, they will reveal specific pain points in the economy and magnify which groups need additional support in their recovery.

This report is informed through nine different case studies consisting of seven different disaster types, across twelve different regions of the United States and its territories. Overall, case studies were selected as the most prominent types of disasters over the last decade. In this case, “prominent” means the disaster spurred economic losses at least in the multi-million-dollar range. The timing of case studies ranges from 2011 with a Super Tornado Outbreak to 2021 to the current COVID-19 recovery efforts. Due to the evolving nature of recovery following a global pandemic, all research is informed until August 1, 2021. For all disaster cases any development following August 1, 2021 may impact the scale of recovery for each region studied, but would not be feasible to include prior to publication.

### *Case Study Population:*

Disaster	Community
2011 Super Tornado Outbreak	Tuscaloosa, AL
2012 Hurricane Sandy	Monmouth County, NJ
2017 Hurricane Maria and Irma	Puerto Rico
2018 Camp Fire/Paradise Fire	Butte County, CA

2018 Hurricane Michael	Calhoun and Bay County, FL
2018 Atlanta Cyber Attack	Atlanta, GA
2019 Mississippi River Floods	State of Missouri
2021 Texas Winter Storm	State of Texas
COVID-19 Pandemic	Mix of Rural and Urban Communities

This report concludes with a list of best practices and recommendations local economic developers can keep in mind when building out their own economic metrics toolkits.

**Take globally, apply locally.** Economic developers have the ability to virtually circle the globe and adapt metrics or inputs of metrics used elsewhere for their own settings. However, while the borrowing can be done globally, it is imperative that the application is done with the local setting in mind. Even within the United States, the same exact metric applied can have two completely different interpretations. Take for example, the metric of hotel sales. An uptick in hotel sales in an area like Bay County, a popular tourist destination along the Florida panhandle, can mean something completely different than in an uptick in hotel sales in Butte County, California. Butte County, California is a rural area so if there are sustained hotel bookings six months after a wild fire, this likely means people are relying on hotels as temporary housing and the local economy is still suffering because of unstable housing situations. Conversely, a stabilization in hotel sales in Bay County six months after a hurricane may indicate the tourism industry has returned, which would put the local economy on the rebound as tourism is a significant economic driver. In the immediate aftermath of hurricane landfalls lodging facilities that still remain operational are often booked to capacity with first responders and contractors, so tracking type of customer can also reveal if hotel sales are tied to recovery efforts or genuine tourism activity.

**Averages aren't always the answer.** Averages have the tendency to overstate the actual performance of a region. For instance, in Tuscaloosa, Alabama following the 2011 Super Tornado, the average number of home repair permits were up week over week. Seemingly, this would mean the city was steadily recovering as construction was approved to repair damages. However, permits were being approved at a disproportionate rate in affluent neighborhoods like the Highlands or the Downs when compared to less affluent areas like Alberta City. When an overall average is taken, the entire city looks to be recovering. However, once the average is broken down by territory then it becomes clearer that only certain neighborhoods are quickening their pace in recovery while others are being left far behind. Disaggregation is necessary to understand how different parts of the community are being affected.

**Benchmarks can be internal ones or from peers.** Identifying which parts of the economy to track and collect data on is just the first step. Once the numbers are gathered, correctly reading them brings on a whole host of issues. Instead of relying on just an inward search, peer to peer comparisons allow economic developers and the public to check their results against others. While there will always be some leaders and some laggards, overall a peer group serves as a check to ensure that the results being reported are rooted in some degree of reality. Should there

be considerable deviances from the group, then economic developers can dig in further to uncover any gaps in their data collection that could lead to questionable findings or a change in the technical approach that could have altered results downstream.

**Springboard for further customization.** In each case study, the profile concludes with possible socioeconomic indicators to either pick from or topics to consider. The examples provided are intended to stimulate thinking on the universe of metrics to select from. As more innovation is made in the field, the universe continues to expand and economic developers have a more expansive array to select from. In creating their metrics dashboard, economic developers should keep in mind that a metric borrowed elsewhere needs to be further customized to their own local settings for optimal use. Additionally, a balance of leading, lagging, and coincident indicators viewed through a SVI lens will provide greater latitude in projecting economic recoveries and nudging towards equitable pacing.

After reviewing the case study population, the below set of indicators were uncovered as the most prevalent and fundamental factors used to judge status of economic recovery following a disaster type event. Economic developers should be equipped with this core set of indicators to begin their analysis. While these ten indicators serve as a baseline, further customization and expansion of the indicator inventory may be necessary to adequately analyze local and regional economic recovery phases.

Core Indicator Inventory	
Net Migration for all Residents	Infrastructure Site Repairs and Upgrades
Building or Construction Permit Issuances	Wage Earnings Fluctuations
Return of Transportation Services	Disbursement of Federal Financial Assistance
Return of Public Services (including utilities)	Local Tax Base Stabilization
Employment Rate Fluctuations	Reopening of Small Businesses

## I. Introduction

This report is intended for local and regional economic developers. Often, in the existing literature surrounding standards to measure socio-economic recovery following impact of disasters, there is emphasis on national level indicators that may not be entirely relevant or telling of local conditions. Economic developers have to think locally in order to adequately address the economic issues most pressing to their communities. This report will provide economic developers with the thought process on how to establish locally based indicators with social equity in mind.

Previously, social equity was at times overlooked when considering the overall state of the economy. Both on a national and local level, metrics are reported as a straightforward average, ratio, or raw total. Unfortunately, this approach of delivering one average or set of averages to tell the story of a region is not fully representative of all community members. Averages may distort the reality of recovery for the socially vulnerable and mask their true economic conditions following a disaster type event. This report will advance the current arena of metric selection by taking a unique approach that will combine characteristics from the Socially Vulnerability Index (SVI), established by the Centers for Disease Control and Prevention (CDC), with traditional economic leading, lagging, and coincident indicators. The SVI is composed of 15 U.S. census variables that enable users to recognize what issue areas localities may require support in pre, intra, and post disaster. Since the SVI is based on the scale of census tract level data, it has the potential to provide insight on the recovery conditions of the most vulnerable members of society within a regional community, when combined with traditional economic indicators. Ideally, when the two sets of categories are overlaid with one another, they will reveal specific pain points in the economy and magnify which groups need additional support in their recovery.

As a country, the United States is large in size, unwieldy in its geographic barriers, and diverse with many climate settings. Consequently, residents in just about anywhere in the country can face both extraordinary and ordinary disaster types. Since the same, exact set of local economic indicators may not be of equal use to economic developers based in different communities, this report seeks to provide more of an encyclopedic version of all types of indicators available to economic developers. While the metrics included are not the complete, exhaustive list of every single indicator that can be thought of and applied, at the very least the metrics included will serve as a foundation to build more expansive metric networks. Hopefully, readers will be able to consume the metrics relayed in this report and have inspiration on how they can continue to modify metrics further to suit their needs. In fact, for optimal use further customization may be necessary to ensure that an indicator will fit into community parameters.

Lastly, metrics are useless if they cannot be interpreted correctly. To better aid economic developers, this report concludes with recommendations that compile case examples in metric-keeping and guided advisement on metric interpretation.

## **Relevance of Metrics and Prominence of Disasters**

Over the past few decades, natural disasters have been dispersed, varied and frequent. Consequently, it is now entirely possible to simultaneously have wildfires rage on the west coast and hurricanes make landfall on the east, all while a pandemic oscillates from coast to coast. In fact, extreme weather events from August 27 – September 4, 2021 demonstrate these simultaneous dualling threats as residents around the California Tahoe Basin were ordered to evacuate due to the Caldor Fire and New Orleans, LA residents were similarly evacuated to avoid crossing paths with Hurricane Ida.

Moreover, as COVID-19 lingers, society has adjusted to a more ingrained virtual lifestyle, enabling greater vulnerability to the nefarious tactics of hackers and malevolent cyber actors. Consequently, the emerging growth of cyber-attacks has broadened the definition of what a disaster even is. Frankly, disasters are more frequent, more intense, and more diverse than ever before. Thus, the economic fallout from the shocks disasters bring are prevalent to just about everywhere and relevant to everyone. In order to better manage economic recoveries, basic, fundamental barometers are needed to gauge pace, equity, and resiliency. Metrics are the alphabet economic developers can use to read signs of distress, progress, or stability and communicate to one another as well as to a broader audience in a commonly accepted language.

With the growing presence of disasters, it is crucial local policymakers can rely on a comprehensive, accurate and customized toolkit of economic metrics to gauge how well or poorly their region is recovering from disaster impact. While there are a multitude of reasons to defend the importance of accurate metric-keeping, this report identifies three primary areas of support. First, accurate metrics provide for efficient and fair resource allocation. Typically, in the aftermath of major disasters, local officials seek federal funding to help curb the immediate devastation. Metrics ensure that funds are distributed in a more equitable fashion and help even the pace of recovery. Second, metrics help chart the waves of economic recovery. A mix of lagging, leading, and coincident indicators tell the story of where an economy has been, where it currently is, and where it is likely heading. Lastly, metrics empower policymakers to make data driven decision so that they do not just leave recovery up to random chance. Decisions informed with data also allow policymakers to act with impartiality.

## **Research Scope and Methodology**

This report is informed through nine different case studies consisting of seven different disaster types, across twelve different sections of the United States and its territories. The map below provides a visualization of the geographic balance and diversity in disaster type in this report. Overall, case studies were selected as the most prominent types of disasters over the last decade. Prominent meaning the disaster spurred economic losses at least in the multi-million-dollar range. The timing of case studies ranges from 2011 with a Super Tornado Outbreak to 2021 and the current COVID-19 recovery efforts. Due to the evolving nature of recovery following a global pandemic, all research is informed until August 1, 2021. For all

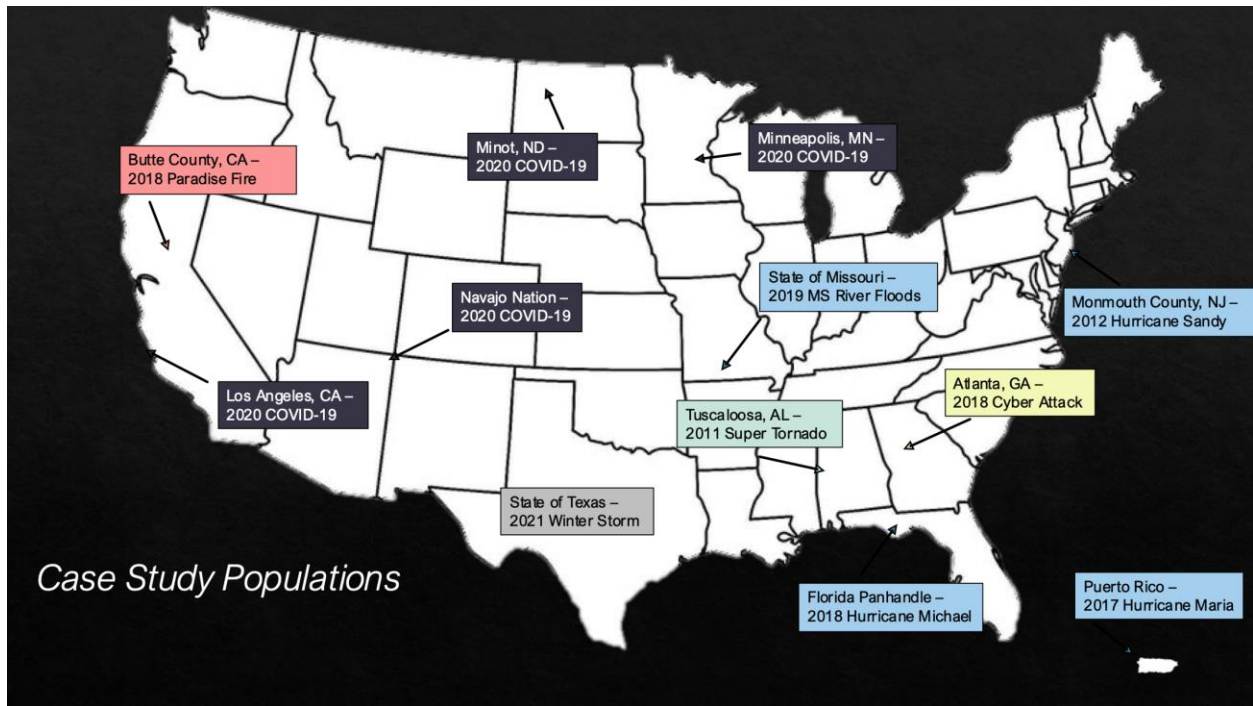


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### *Map of Case Study Population*



Please note map is not drawn to scale and is only intended to provide an overarching view of case study locations.

All cases have been reviewed with the consultation of local comprehensive economic development strategy (CEDS) reports, government recovery plans, academic research, and reporting from news outlets. For most cases, multiple sources were relied upon, depending on the availability of information. At times research sources collected can slightly predate disaster impact in order to gain insight into the state of sophistication local economic developers held prior to disaster strike. In other instances, research sources that were produced at a period post disaster strike were collected to inform on the actual status of recovery and the impact disaster has held. All research sources were located online.

## Definitional Landscape

This subsection will provide a brief definitional overview of what specific terms from social science research are used.

### *Leading, Lagging, and Coincident Indicators<sup>1</sup>*

**Leading indicators** - measures of anticipations or new commitments. They have a “look-ahead” quality and are highly sensitive to changes in the economic climate as perceived in the marketplace.

**Lagging indicators** - more sluggish in their reactions to the economic climate. They help to confirm changes in trend that are first reflected in the more erratic leading and coincident indicators.

**Coincident indicators** - comprehensive measures of economic performance, pertaining to output, employment, income, and trade.

### *Examples of Nationally used Leading, Lagging, and Coincident Indicators*

Leading	Lagging	Coincident
New Orders for Raw Materials	Unemployment Rate	Aggregate Real Personal Income
Building Permit Issuances	Consumer Price Index	Industrial Production Income
New Business Incorporations	Gross Domestic Product	Manufacturing and Trade Sales

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<sup>1</sup> Definitions and Examples are provided via National Bureau of Economic Research, *The Leading Indicator Approach to Economic Forecasting – Retrospect and Prospect*, (1982).

### *Social Vulnerability Index (SVI)<sup>2</sup>*

SVI is composed of 15 social factors across the four themes of socioeconomic status, household composition, race/ethnicity/language and housing/transportation. The Agency for Toxic Substances and Disease Registry (ATSDR) division within the CDC uses U.S. Census data to study the prevalence of SVI characteristics within every census tract. Each tract also has an assigned ranking across for each of the four themes, and one overall ranking. Knowing the significance of any one of these social factors within a census tract allows for economic developers to identify which groups may need additional monitoring and support following a disaster situation.

<b>Socioeconomic Status</b>	<b>Household Composition</b>	<b>Race/Ethnicity/Language</b>	<b>Housing and Transportation</b>
No High School Diploma	Single-Parent Households	Speaks English “Less Than Well”	Group Quarters
Income	Older Than Age 5 With a Disability	Minority	No Vehicle
Unemployed	Age 17 or Younger		Crowding
Below Poverty	Age 65 or Older		Mobile Homes
			Multi-unit Structures

Please note that the presence of one variable implies an individual or household may hold a characteristic that exposes themselves to greater vulnerability than a person or household without any of the characteristics listed. Any compounding effects that the presence of multiple variables may have on one another are yet to be fully determined.

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<sup>2</sup> SVI Definition and Variable breakdown are provided via Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry.

## Overlay of Traditional Indicators with SVI Factors

Taking into account the earlier definitions of leading, lagging, and coincident indicators and combining them with SVI factors, new indicators can be created to view socioeconomic recovery through a social equity lens. The below table includes examples that demonstrate how SVI categories can narrow the scope of traditional indicators in order to ensure marginalized groups have the same opportunity for recovery as the average community member. In some instances, not only can an overlay gauge availability of opportunity in recovery, but they can also allow economic developers to have a better understanding of pace in recovery. While more intersections between SVI categories and traditional indicators exist, the below examples illustrate a few options that are available.

Indicators Through a SVI Lens			
SVI Category	Leading	Lagging	Coincident
Socioeconomic Status	Building/construction permits issued in high poverty areas	Unemployment rate specifically to those without a high school diploma	Real Personal Income of those without a high school diploma
Household Composition & Disability	Average number of hours worked weekly for adults with disabilities	Ratio of debt to income for single-parent households	Adults with disabilities on non-agricultural payrolls
Minority Status & Language	Jobless claim files for individuals with minority status	Receipt of commercial and industrial loans for small, minority owned businesses	Real Personal Income of minority survivors
Housing & Transportation	Building/construction permits for affordable housing units	Unemployment rate of those without reliable transportation	Local sales of hotels, motels, hostels, group housing arrangements

## II. Identification of Metrics by Case Study

The following section will provide profiles of each individual case study, and the corresponding metrics collected. Afterwards, the reader can find a discussion section on similarities and differences across cases and disaster communities. A core section across all profiles is a brief background description that explains the disaster type and overview.

The below chart contains 87 metrics sourced from all case studies. Metrics are organized across the following eight categories of economic development: Education, Entrepreneurship, Finance, Housing & Transportation, Infrastructure, Real Estate, Small Business, and Workforce Development.

While each metric may not be found for every disaster type or case study location, the metric listed was still present for at least one disaster type or case study location. Considering metrics can be categorized in more than one area, economic developers should apply metrics according to the context of their local community.

Education N=4	Entrepreneurship N=4	Finance N=16	Housing & Transportation N=16	Infrastructure N=16	Real Estate N=14	Small Business N=12	Workforce Development N=5
Return of In-Person School (K-12)	Average Number of Patents Produced per 1,000 workers	Unemployment Rate	Development of Mass Transportation System	Return of Local Healthcare Clinics, Hospitals, and Healthcare Providers	Rate of Residential Properties Rented	Payroll Fluctuations	Grants distributed specifically for human capital improvement
Return of In-Person Higher Ed	Tracking of Venture Capital Dollars and Deals within disaster area	Underemployment Rate	Volume of Port Shipping	Return of Nursing Homes and Assisted Living Facilities	Rate of Residential Properties Owned	Reopening of Unique Tourist Attractions	Tracking enrollment of any occupational licensing
Return of School Transit Systems and Ridership	Number of New Business Permits Issued	Average Poverty Rates	Average Number of Nights of Lodging Rented on Weekly Basis	Return of Day Care Centers	Ratio of Residential Properties Rent to Own	Tracking of Tourist Dollars	Develop Trade Skills Programs
Higher Ed Education Attainment	Tracking of any crowdfunding for local startups	Average Net Migration	Average Number of Weekly Cruise Ship Arrivals	Return of Critical Infrastructure (communication towers, sewage treatment plants, emergency management facilities etc.)	Rate of Residential Foreclosures	Number of Full-Service Restaurants that Resumed Service	Human Capital Assessments (level of education, skills and knowledge of labor force, etc.)
		Wage Growth	Rate of Permits Issued for Home Repair	Religious or Cultural Center Reopening	Number of Vacant Lots or Buildings	Number of Grocery Stores that Resumed Service	Rate of Critical Vaccine Distribution
		Proportion of Population on Public Assistance	Monthly Residential Rental Rates	Return of Gas Station Services and Ancillary Transportation Services	Residential Market Prices	Net Number of Start-Up Businesses	
		Average Earnings per household	Tracking Type of Housing in Construction (high-end versus affordable units)	Irrigation Repairs, Replacements, and Return to Service	Commercial Market Prices	Default Rate of Small Business Loans	
		Return of Local Job Markets	Shelter Capacity for Survivors	Return of Services for Public or Government Buildings	Commercial Structures Repair/Rebuild	General Reopening Tracking	

		Tax Base Collection Levels	Number of Mobile Home Parks	Return of Parks and Recreation Centers	Rate of Debris Removal	Rate of Inventory Recovery	
		Repayment of Bonds and Debt Obligations	Proportion of Population Displaces or Homeless	Tree Replanting Tracking	New Land Surveyor Reports Recorded	Return of Total Farming Activity	
		Fulfillment of Insurance Claims	Hotel Occupancy Rates	Dune Site or Coral Planting Restoration and Repair	Establishing New Disaster Resilience Standards	Reopening of Retail Locations	
		Rate of Receipt of Federal Grants or Loans	Return and Repair of Public Transportation Services, Including Air	Return of Courthouses and non-emergency Judicial Services	Number of Real Estate Transactions (ownership exchanges or new leasing agreements)	Number of Industry Visits Personal Care and Laundry Services (monthly basis)	
		Muni Bond Issuances	Return of Maritime Travel and Transportation	Return of Power Grid	Conversion of Blighted Properties		
		Number of Open Job Postings	Repair Boat Ramps and Fuel Docks	Number of Levees Repaired	Number of Property Appraisals		
		Local GDP or GRP Rates	Railroad Track Repairment	Food Security Monitoring			
		Income Gaps Between High- and Low-Income Earners	Expanding Roadways and Parkways to Handle Evacuation Traffic	Return of Established Landfills and Closure of Unregulated Dumps			

Given the diversity in metric collection across Education, Entrepreneurship, Finance, Housing and Transportation, Infrastructure, Real Estate, Small Business, and Workforce Development categories, ten core indicators have been consolidated in an attempt to standardize benchmarking post disaster strike. This report identifies 10 metrics as the most prevalently used across case studies as therefore fundamental to recovery assessment. Indicators are not listed in order of importance.

Core Indicator Inventory	
Net Migration for all Residents	Return of Shipping/Port Services or Volume
Building or Construction Permit Issuances	Average Wage Earnings
Return of Transportation Services	Disbursement of Federal Financial Assistance
Return of Public Services (including utilities)	Local Tax Base Stabilization
Average Unemployment Rate	Reopening of Small Businesses

Definitions for the core indicator list are provided below.

**Net Migration:** The difference between immigration into and emigration from the area during the year (net migration is therefore negative when the number of emigrants exceeds the number of immigrants).<sup>3</sup>

**Building Permit:** The approval given by a local jurisdiction to proceed on a construction project.<sup>4</sup>

**Transportation Services:** Those activities designed to assist a person to travel from one place to another to return to work, obtain services or carry out life's activities.<sup>5</sup> A return of transportation services can refer to either a partial resumption or full resumption of normal operating level pre-disaster strike.

**Public Utility:** Entity that provides goods or services to the general public. Public utilities may include common carriers as well as corporations that provide electric, gas, water, heat, and television cable systems.<sup>6</sup> While the public utility applies to mainly utility services, the term public service can refer to any broader degree of services that governments or quasi-public entities can provide. Additionally, a return of public services can refer to either a partial or full resumption of normal operating level pre-disaster strikes.

**Unemployment Rate:** Represents the number of unemployed people as a percentage of the labor force (the labor force is the sum of the employed and unemployed). The unemployment rate is calculated as: (Unemployed / Labor Force) x 100.<sup>7</sup>

<sup>3</sup> Organization for Economic Cooperation and Development, *Glossary of Statistical Terms*, (2005)

<sup>4</sup> United States Census Bureau, *Definitions – Building Permits Survey*, (2021)

<sup>5</sup> Iowa Administrative Code Supplement, (2013)

<sup>6</sup> Cornell Law School, Legal Information Institute, *Public Utility*, (2020)

<sup>7</sup> U.S. Bureau of Labor Statistics, *Concepts and Definitions*, (2021)

**Port Services:** Activities associated with ports include operation of vessels, cargo handling equipment, locomotives, trucks, vehicles, and storage and warehousing facilities related to the transportation of cargo or passengers as well as the development and maintenance of supporting infrastructure.<sup>8</sup>

**Wage Earnings:** Concept of earnings as applied in wages statistics, relates to remuneration in cash and in-kind paid employees for time worked or work done together with remuneration for time not worked, such as annual vacation and other paid leave or holidays.<sup>9</sup>

**Federal Financial Assistance:** Title VI regulations define the term “Federal financial assistance” broadly to include: (1) grants and loans of Federal funds, (2) the grant or donation of Federal property and interests in property, (3) the detail of Federal personnel, (4) the sales and lease of, and permission to use Federal property or interest in such property without consideration or at a normal consideration, and (5) any Federal agreement, arrangement, or other contract which has as one of its purposes the provision of assistance.<sup>10</sup>

**Tax Base:** Total amount of income, property, assets, consumption, transactions, or other economic activity subject to taxation by a tax authority.<sup>11</sup>

**Small Business:** Firm revenue (ranging from <\$1 million to over \$40 million) and by employment (from <100 to over 1,500 employees). Exact standards to determine small business application vary by industry.<sup>12</sup>

## **Excerpt of Case Studies**

While the Appendix includes comprehensive profiles for each case study, the following excerpt will provide the reader with the necessary background on disaster type and corresponding effects on location.

### **2011 Super Tornado – Tuscaloosa, AL**

The 2011 Tornado Super Outbreak was a four-day event spanning from April 25 - 28, where 362 tornadoes broke out over 13 states. States that had significant effects were: Alabama, Arkansas, Louisiana, Georgia, Tennessee, Virginia, Mississippi, Kentucky, Illinois, Missouri, Ohio, Texas, and Oklahoma. In total, the devastation stemming from the tornadoes led to \$12 billion in damages (2021 dollars) and an estimated 321 deaths.

Historically, while there have been stronger tornadoes that criss crossed across the United States, few struck major urban and suburban areas like the 2011 outbreak did. The bulk of the outbreak was centered in Alabama as the state had the majority of the deaths (230/362 or 63%) and the

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<sup>8</sup> United States Environmental Protection Agency, *Ports Primer: 3.1 Port Operations*, (2021)

<sup>9</sup> Organization for Economic Cooperation and Development, *Glossary of Statistical Terms*, (2002)

<sup>10</sup> U.S. Department of Health & Human Services, Office for Civil Rights, *Federal Financial Assistance*, (2017)

<sup>11</sup> Tax Foundation, *What is a Tax Base*, (2021)

<sup>12</sup> United States Census Bureau, *What is a Small Business?* (2021)



outbreak's costliest tornado event. Within Alabama, Tuscaloosa is referenced as the municipality most affected.

### **2012 Hurricane Sandy – Monmouth County, NJ**

Hurricane Sandy lasted approximately nine days, starting on October 22, 2012. During its landfall, Hurricane Sandy killed 70 people in the Caribbean and almost 150 in the United States. The National Oceanic Atmospheric Administration estimates Sandy caused at least \$70 billion in damages, which at the time placed it among the costliest storms in U.S. history. In the United States, most damage was attributed to storm surges attacking low-lying coastal areas. Due to rising sea levels, ocean waters ventured further inland once storm surge winds powered through the low-lying areas. In total 13 states and territories including Washington DC were impacted by Hurricane Sandy rainfalls: Washington DC, Delaware, Massachusetts, Maryland, North Carolina, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, and West Virginia. Since local reporting deemed that Hurricane Sandy completely devastated Monmouth County, analyzing this particular region may reveal what the priority recovery items were following Sandy's impacts

### **2017 Hurricane Maria – Puerto Rico**

Hurricane Maria was a Category 5 storm that impacted Puerto Rico in September 2017. Damage caused by the hurricane was devastating to the island population. Because of Puerto Rico's data management infrastructure prior to Hurricane Maria, accurate capture of death counts was challenging. However, the local government has reported an estimate of 2,975 deaths. While the Puerto Rico Planning Board has estimated economic damage totaling \$42 billion, independent economists project \$43 billion.

### **2018 Cyber Attack – Atlanta, GA**

On March 22, 2018 the City of Atlanta fell to a ransomware attack. A private hacker group based out of Iran had launched a SamSam virus, which crippled the city's ability to maintain routine online functions. The hackers demanded six bitcoins, equivalent to \$51,000 (2018 dollars), in ransom to restore Atlanta's online frameworks. The city refused to pay and underwent manual operations until their IT departments (Atlanta Information Management & Office of Information Security) could rebuild secure mainframes. Gradually, the city was able to recover some software programs and purchase new hardware to replace infected infrastructure. However, some archives like legal documents, police dash-cam recordings, and email correspondence between residents and city officials were completely lost.

### **2018 Camp/Paradise Fires – Butte County, CA**

The 2018 Paradise Fires spanned for nearly most of the month of November. A faulty Pacific Gas & Electric (PG&E) managed utility power transmission line sparked the first fire on November 8, 2018. The wildfire spread over the course of three weeks and was not fully contained till November 25, 2018. In total 154,000 acres burned, 52,000 people evacuated, ~18,000 buildings destroyed, 85 lives lost, and \$16.65 billion inflicted in damages. Because the

fire impacted so many older buildings, asbestos, heavy metals, arsenic, dioxins, and other hazardous materials were released into the atmosphere. The dramatic introduction of these contaminants in the surrounding area, slowed down recovery efforts. People who were displaced from their homes were not able to move back into the area as quickly. Also, outside help was prevented from entering the area until risks to public health subsided. Ultimately, Camp Fire was the deadliest fire in California history.

### **2018 Hurricane Michael – Florida Panhandle**

Hurricane Michael occurred over October 7, 2018 - October 16, 2018. It transformed from a tropical cyclone to a Category 5 hurricane at landfall. Its landfall on the Florida panhandle was unprecedented as no other Category 5 hurricane had hit the panhandle before. In the United States, Hurricane Michael was responsible for 16 direct deaths and \$25 billion in damages. Of this total, about \$18.4 billion occurred in Florida (with about \$3 billion of this on Tyndall AFB), \$4.7 billion occurred in Georgia, and \$1.1 billion occurred in southeastern Alabama, with smaller amounts of damage in South Carolina, North Carolina, and Virginia. The vast majority of this damage was to property and infrastructure. However, about \$3.3 billion of the damage was agricultural and forestry losses, primarily in Florida and Georgia.

### **2019 Mississippi River Floods – State of Missouri**

In 2019, flooding from the Mississippi River and its tributaries, Missouri and Arkansas Rivers, impacted 19 states and 14 million people. In total, flood damages led to \$20 billion in losses. The 2019 floods were the longest floods on record, lasting from spring through July. Throughout 2019, more than 1.2 million acres of Missouri were inundated by floodwaters and nearly 1.4 million acres of crops could not be planted. In early March 2019, a “bomb cyclone” brought more than 3 feet of snow, which was followed by rapid rises in temperature. Upstream from Missouri, the Spencer Dam broke down in Nebraska, which enabled the Town of Niobrara to be flooded. Through March 2019 to July 2019, the state experienced tornadoes, high winds, hail and heavy rains, which were all contributing factors to additional flooding along the Missouri and Mississippi rivers.

### **2021 Winter Storm – State of Texas**

In February 2021, the State of Texas was staving off two separate but deadly disasters: the COVID-19 pandemic and a vicious winter storm. Given the compounding nature of these disasters, it is difficult to determine with absolute certainty direct loss of life and economic damage. However, officials estimate that at least 151 individuals have died either directly or indirectly because of the February 2021 winter storm. Private weather agency, AccuWeather, estimates that the total cost of economic damage stemming from the winter freeze will cost Texas \$130 billion. \$130 billion may actually be a conservative estimate as other private economic research firms like the Perryman Group project that the range of economic cost is \$195 billion - \$295 billion. At its peak, on February 14, all 254 Texas counties were under a winter storm warning, which was unprecedented, and forced President Biden to declare a state of emergency in Texas under the Stafford Act. Due to freezing temperatures, the state’s entire

energy grid had collapsed. Wind turbines, gas fields, coal plants, and oil refineries all became inoperable in these harsh winter conditions. As many as 4.1 million people were left without power.

### **2020-2021 COVID-19 Pandemic – Mix of Urban and Rural Communities**

COVID-19 was a once in a generation global pandemic that originated from Wuhan, China in December 2019. Via person-to-person transmission, travelers from across the globe were the first carriers of COVID-19 to reach the United States. Unfortunately, many government officials underestimated the effects COVID-19 would have on the public health and were slow to implement quarantine, social distancing, and mask compliance guidelines. Seeing few options to regain control of the situation, state and local officials instituted lockdowns to slow the spread of COVID-19. Many public places were shut down and travel was restricted to just necessary activities like grocery shopping and medical visits. Schools and universities across the country pivoted to virtual teaching and workplaces that did not require constant in-person interaction scrambled to adopt online platforms. Overall, COVID-19 upended entire industries like tourism, manufacturing, and energy.

While every corner and pocket of the United States has felt the pandemic's touch, the following locations were selected for study as they provided the most balance and diversity in research:

*Minneapolis-Saint Paul, Minnesota* – Midsize, midwestern city that demonstrated strong data collection and metrics reporting in peer group cities as well as when compared to large city counterparts

*Minot, North Dakota* – Small, rural, fairly homogenous city with prior disaster flood experience and received one of the largest CDBG-DR grants for a community of its size

*Los Angeles, California* – Large, sprawling coastal city that is racially and ethnically diverse

*Navajo Nation* – Operates as a country within a country and represents the effects of the absence of an integrated health system

### **III. Analysis of Metrics Across Case Studies**

While the case study population was selected because of its diversity in type and geographic balance, broad similarities can be drawn and smaller subsets can be formed. Conversely, because of the inherent diverse nature of the case study population there are also distinct differences that can be explored within the group. The following discussion section will provide the reader with a better understanding of the commonalities and differences that occur when analyzing nine disaster events, which represent seven different disaster types across twelve different sections of the United States.

#### **Similarities**

*Control Failures:* the 2018 Paradise Fire, 2018 Atlanta Cyberattack, and 2021 Texas Winter Storm are three major catastrophes where the devastation could have been significantly

mitigated. In all three instances either a regulatory body or quasi-regulatory body indicated an unfilled gap could lead to damaging events. In Paradise Fire and the Texas Winter Storm, improper utility maintenance were major culprits in the disaster as both utility operators had received warning that frequent maintenance was necessary to safeguard the local community from harm. In Atlanta, an audit report foreshadowed the vulnerabilities present when proper cyber controls were not implemented. Unfortunately, these warnings came from quasi-regulatory agencies who did not have full authority to levy fines or halt services until their concerns were addressed. Parties like utility companies could still operate freely, right up until the moment a disaster stemming from their own devices spiraled out of control.

*Building Back Better:* as seen in most case studies, a common focus of recovery efforts is on rebuilding infrastructure to drive resiliency and increase accessibility. In many instances, local economic developers are the recipient of federal aid and they prudently decide to harden their infrastructure so that their communities are more shock resistant. For example, coastal locations that are hurricane prone are now shifting power and communication lines underground so that even if storm winds take down trees, daily life can still continue without disruption. In other instances, entire succession plans in how to operate remotely have shifted from physical archives to cloud based storage. Previously, emergency plans were physically documented, which meant accessing established plans and enabling wide-scale distribution during disaster situations was heavily burdensome. In the aftermath of disasters, many economic developers decided to transfer all essential documents to cloud storage centers so that they can be nimbler in their disaster response rather than rely on antiquated methods of plan sharing.

*Tourism Metrics Critical to Recovery Measurement for Destination Locals:* three hurricanes or one third of the case study population, 2012 Sandy, 2017 Maria, and 2018 Michael were represented in this study. The respective areas these hurricanes hit, Monmouth County, NJ, Puerto Rico, and the Florida panhandle are all popular tourist destinations. Of course, these destinations are popular because they are near the water, and being close to water inherently makes these locations more susceptible to the dangers of hurricanes. Since tourism is a main driver of the local economies in these regions, economic developers must identify tourist specific metrics that can better inform them on the state of tourism. For example, Puerto Rico is a frequent cruise ship port. Following Hurricane Maria, many of the large docking ports were damaged and could not handle cruise ship arrivals. Eventually, ports were repaired and could accommodate cruise ships again. Effective developers will track the daily number of cruise ship visits so that they can tell at what point they are averaging the same number of weekly visits compared to pre-hurricane levels. The comparison of levels pre and post disaster for cruise ship visits and other tourist activity will provide a clearer picture on the overall state of tourism in the region. Considering tourism is the main economic driver, a firm handle on measuring tourism may also serve as a proxy on how well or poorly the overall economy is performing.

## **Differences**

*2018 Atlanta Cyberattack in a league of its own:* as the only man-made disaster showcased. All other disasters involve nature colliding with fate, but the 2018 Atlanta Cyberattack was a man-made calamity. In addition to being man-made, the cyberattack is also unique because its hold on the local economy was not as long term as that of natural disasters. Usually, following an event

like a hurricane the first order priorities are removing debris from properties, clearing roads, and bringing utility lines online. However, in the case of a cyberattack, depending on how quickly the virus can be purged or new technology equipment installed, the resumption of routine activities is likely quicker than in the aftermath of a hurricane. Also, most economic indicators impacted by natural disasters may not readily apply following a cyberattack. For example, hurricanes and wildfires have a noticeable, causal link on net migration as some residents choose to not return and rebuild their lives elsewhere. In the case of a cyberattack, it is unlikely that a significant number of residents will choose to relocate because of a lockout of online government services.

*COVID-19 economic recovery hinges on public health recovery:* in almost all other disaster scenarios, the economic recovery hinges on the restoration of services/infrastructure. The economic recovery from COVID-19 is not as highly impacted by the restoration of bridges or issuances of new building permits, because the physical landscape has not deteriorated as a result of COVID-19. Instead, the main driver of COVID-19's economic recovery revolves around how quickly the public health can be safeguarded whether it is through vaccinations or a flattening of transmission through masking and social distancing. No other natural disaster recovery depended on members of the public remaining distant from one another. In fact, it was the opposite. Typically, in the aftermath of disasters, there are calls for community members to come together and create support networks to assist one another through the phases of recovery. COVID-19 recovery is a rarity where members of the public still need to rely on one another for support but have to be more strategic on how they approach one another to avoid furthering transmission.

*2021 Texas Winter Storm and COVID-19:* are the two most recent disasters in this study, and the only scenario studied where a disaster made landfall during an on-going pandemic. While these two disasters have compounding effects on one another, it is likely with the pandemic lingering, these types of scenarios may be more commonplace. Until COVID-19 permanently dissipates, the future states of disasters will mean handling the crisis brought on by nature while also combating the spread of transmission. Economic developers will need to exercise meticulous data collection to distinguish the added-on effects of the incoming physical disaster from the ongoing public health crisis. Moreover, data from metrics will need to be reviewed on a frequent periodic scale like a weekly basis so that economic developers can better manage the immediate impacts of an incoming disaster and reduce the chances of conflating the two matters.

## IV. Conclusion - Best Practices and Recommendations

**Take globally, apply locally.** Economic developers have the ability to virtually circle the globe and adapt metrics or inputs of metrics used elsewhere for their own settings. However, while the borrowing can be done globally, it is imperative that the application is done with the local setting in mind. Even within the United States, the same exact metric applied can have two completely different interpretations. Take for example, the metric of hotel sales. An uptick in hotel sales in an area like Bay County, a popular tourist destination along the Florida panhandle, can mean something completely different than in an uptick in hotel sales in Butte County, California. Butte County, California is a rural area so if there are sustained hotel bookings six months after a wild fire, this likely means people are relying on hotels as temporary housing and the local economy is still suffering because of unstable housing situations. Conversely, a stabilization in hotel sales in Bay County six months after a hurricane may indicate the tourism industry has returned, which would put the local economy on the rebound as tourism is a significant economic driver. In the immediate aftermath of hurricane landfalls lodging facilities that still remain operational are often booked to capacity with first responders and contractors, so tracking type of customer can also reveal if hotel sales are tied to recovery efforts or genuine tourism activity.

**Averages aren't always the answer.** Averages have the tendency to overstate the actual performance of a region. For instance, in Tuscaloosa, Alabama following the 2011 Super Tornado, the average number of home repair permits were up week over week. Seemingly, this would mean the city was steadily recovering as construction was approved to repair damages. However, permits were being approved at a disproportionate rate in affluent neighborhoods like the Highlands or the Downs when compared to less affluent areas like Alberta City. When an overall average is taken, the entire city looks to be recovering. However, once the average is broken down by territory then it becomes clearer that only certain neighborhoods are quickening their pace in recovery while others are being left far behind. Disaggregation is necessary to understand how different parts of the community are being affected.

**Benchmarks can be internal ones or from peers.** Identifying which parts of the economy to track and collect data on is just the first step. Once the numbers are gathered, correctly reading them brings on a whole host of issues. Instead of relying on just an inward search, peer to peer comparisons allow economic developers and the public to check their results against others. While there will always be some leaders and some laggards, overall a peer group serves as a check to ensure that the results being reported are rooted in some degree of reality. Should there be considerable deviances from the group, then economic developers can dig in further to uncover any gaps in their data collection that could lead to questionable findings or a change in the technical approach that could have altered results downstream.

**Springboard for further customization.** In each case study, the profile concludes with possible socioeconomic indicators to either pick from or topics to consider. The examples provided are intended to stimulate thinking on the universe of metrics to select from. As more innovation is made in the field, the universe continues to expand and economic developers have a more expansive array to select from. In creating their metrics dashboard, economic developers should keep in mind that a metric borrowed elsewhere needs to be further customized to their own local settings for optimal use. Additionally, a balance of leading, lagging, and coincident indicators

viewed through a SVI lens will provide greater latitude in projecting economic recoveries and nudging towards equitable pacing.

The below “Core Indicator Inventory” chart contains a core set of indicators all economic developers should be equipped with in analyzing disaster recovery. These ten indicators serve as a baseline to build further customization. Additionally, the chart labeled “Indicators Through a SVI Lens” is a condensed list of the range and criteria economic developers should weigh when deciding what metrics to fill their toolkit with. Hopefully, these indicators will inspire economic developers on what is possible within the metrics universe and encourage creativity to holistically capture the dynamic nature of their local economies.

Core Indicator Inventory	
Net Migration for all Residents	Infrastructure Site Repairs and Upgrades
Building or Construction Permit Issuances	Wage Earnings Fluctuations
Return of Transportation Services	Disbursement of Federal Financial Assistance
Return of Public Services (including utilities)	Local Tax Base Stabilization
Employment Rate Fluctuations	Reopening of Small Businesses

Indicators Through a SVI Lens			
Category	Leading	Lagging	Coincident
Socioeconomic Status	Building/construction permits issued in high poverty areas	Unemployment rate specifically to those without a high school diploma	Real Personal Income of those without a high school diploma
Household Composition & Disability	Average number of hours worked weekly for adults with disabilities	Ratio of debt to income for single-parent households	Adults with disabilities on non-agricultural payrolls
Minority Status & Language	Jobless claim files for individuals with minority status	Receipt of commercial and industrial loans for small, minority owned businesses	Real Personal Income of minority survivors
Housing & Transportation	Building/construction permits for affordable housing units	Unemployment rate of those without reliable transportation	Local sales of hotels, motels, hostels, group housing arrangements

## Appendix

### Case Studies - Summary of Recovery Efforts

# 2011 Super Tornado Outbreak, Tuscaloosa, AL

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## Background of Disaster<sup>13</sup>

The 2011 Tornado Super Outbreak was a four-day event spanning from April 25 - 28, where 362 tornadoes broke out over 13 states. States that had significant effects were: Alabama, Arkansas, Louisiana, Georgia, Tennessee, Virginia, Mississippi, Kentucky, Illinois, Missouri, Ohio, Texas, and Oklahoma. In total, the devastation stemming from the tornadoes led to \$12 billion in damages (2021 dollars) and an estimated 321 deaths<sup>14</sup>.

Not only was the frequency of the number of tornadoes occurring in such a short time span notable, but the strength of the tornadoes that transpired is also noteworthy. Prior to 2011 the last EF-5 tornado on the Enhanced Fujita scale had occurred in 2008. Within the span of these 4 April days, there were three EF-5 tornadoes, 12 EF-4 tornadoes, and 21 EF-3s.

Historically, while there have been stronger tornadoes that crisscrossed across the United States, few struck major urban and suburban areas like the 2011 outbreak did. The bulk of the outbreak was centered in Alabama as the state had the majority of the deaths (230/362 or 63%) and the outbreak's costliest tornado event. Within Alabama, Tuscaloosa is referenced as the municipality most affected. In fact, just cleaning up debris following the tornado landings in Tuscaloosa is estimated to have cost \$100 million. Historically, the statewide average for debris removal in Alabama was reportedly \$46 per cubic yard.<sup>15</sup> Considering, more than 1.5 million cubic yards of debris were removed in Tuscaloosa at a total cost of \$100 million, the 2011 Tornado Super Outbreak yielded an increase of 45% in cost from the historic state average to a new removal price of \$66 per cubic yard.<sup>16</sup>

Various news sources and academic resources report that recovery in Tuscaloosa is uneven and SVI groups lag behind. Even in death, SVI indicators reveal that "people who lived in dwellings that were old, poorly constructed, or dilapidated were more likely to die than residents in newer and sturdier housing. Two-thirds of the deaths (65 percent) were recorded in Alberta City, the oldest, poorest, and most residentially segregated area of Tuscaloosa in terms of race and class. Most victims died in pre-1970 wooden dwellings that were constructed before building codes existed in Alabama."<sup>17</sup>

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<sup>13</sup> West Alabama Regional Commission, *West Alabama Economic Development District Comprehensive Economic Development Strategy*, (2012)

<sup>14</sup> Encyclopedia Britannica, *Super Outbreak*, (2011)

<sup>15</sup> New York Times, *The Cleanup Grinds On for Months After Disasters* (2011)

<sup>16</sup> Tuscaloosa News, *Environment Protected in Tornado Debris Removal* (2011)

<sup>17</sup> Weber J, Lichtenstein B. Building Back: Stratified Recovery After an EF-4 Tornado in Tuscaloosa, Alabama. *City & Community*. 2015;14(2):186-205



Researchers split Tuscaloosa into three distinct areas: The Highlands, The Downs, and Alberta City. Prior to the 2011 landfall, the Highlands was viewed as the affluent residential neighborhood. These residents were more likely to have home insurance and the means to rebuild. The Downs was a more middle-class development that rose in the post WWII build. Residential buildings in Downs have a homogenous feel. While these residents were not as affluent as the Highlands residents, they still had a tight-knit community and an active Neighborhood Association that advocated city leaders for their rebuilding needs. Compared to The Highlands and The Downs, Alberta City was a more racially diverse area where residents were more likely to rent than own their homes. Researchers studied that when it came to home repair, permits were issued at a lower rate than either the Highlands or Downs. They predict that “the area’s reputation for poorly maintained rental properties is likely to be reflected in the lack of permits being issued to absentee homeowners. The permitting process also requires considerable information about the home in consultation with a contractor, which could discourage resource-strapped homeowners from rebuilding.”<sup>18</sup>

City leaders also note that the tornadoes wiped out local nonprofit resource centers like the Salvation Army and American Red Cross that SVI groups would be more likely to contact. Therefore, delays in the return of nonprofit services can also slow down the rate of recovery for SVI groups. News reports substantiate that while some areas like the Highlands and Downs have returned to normalcy, Alberta City still has vacant lots from properties that were destroyed and demolished when their occupants desired to no longer return.

Tuscaloosa Mayor Maddox estimates that 70% of the people who were impacted were renting with a median income of less than \$25,000, so there may have been less of an incentive for Tuscaloosa’s poorer residents to return.<sup>19</sup>

A competing factor in recovery efforts may have been the city allowing developers to convert spaces into high-end apartments for University of Alabama students, which made affordable housing less achievable for many of Tuscaloosa’s residents.

## Possible Socioeconomic Indicators to Report<sup>20</sup>

Category	Indicator	Potential Overlay (SVI/Leading, lagging, coincident)
Real Estate	Rate of residential properties being rented	Coincident; Housing & Transportation

<sup>18</sup> Weber J, Lichtenstein B. Building Back: Stratified Recovery After an EF-4 Tornado in Tuscaloosa, Alabama. *City & Community*. 2015;14(2):186-205

<sup>19</sup> NPR, “Day You’ll Never Forget’: Decade After Deadly Tuscaloosa Tornado, Recovery Is Uneven” (2021)

<sup>20</sup> City of Tuscaloosa, *Tuscaloosa Forward, Generational Plan* (2012)

Real Estate	Rate of residential properties being owned	Coincident; Housing & Transportation
Real Estate	Ratio of residential rent to own	Coincident; Housing & Transportation
Real Estate	Rate of residential foreclosures	Coincident or Lagging; Socioeconomic Status or Housing & Transportation
Real Estate	Rate of permits issued for residential demolition	Leading; Housing & Transportation
Real Estate	Rate of permits issued for residential home repair	Leading; Housing & Transportation
Real Estate	Monthly rate of rent for residential properties	Coincident; Socioeconomic Status or Housing & Transportation
Real Estate	Tracking type of housing being constructed (high-end versus affordable housing units)	Leading; Housing & Transportation
Real Estate	Number of vacant lots (comparison between pre and post disaster)	Coincident; Socioeconomic Status or Housing & Transportation
Infrastructure	Return of emergency management facilities	Coincident; Socioeconomic Status
Infrastructure	Return of communication towers, sewage treatment plants, and other critical infrastructure	Leading or Coincident
Infrastructure	Rebuilding community centers with improvements like safe rooms	Coincident; Socioeconomic Status or Housing & Transportation
Infrastructure	Return of local healthcare clinics	Coincident; Socioeconomic Status
Infrastructure	Return of nursing homes and assisted living facilities	Coincident; Household Composition & Disability

Infrastructure	Return of day care centers	Coincident; Household Composition & Disability
Education	Return of schools and school functions	Coincident; Household Composition & Disability
Infrastructure	Return of courthouses and non-emergency judicial services	Coincident
Infrastructure	Return and repair of transportation services like public transit, airport	Leading or Coincident; Housing & Transportation
Finance	Rate of unemployment for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
Finance	Rate of underemployment for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
Finance	Average poverty rates for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
Finance	Average net migration for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
Finance	Wage growth for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
Finance	Proportion of total population on public assistance programs like TANF, Medicaid, Unemployment insurance, etc. and also proportion of population decomposed across SVI Factors	Lagging or Coincident; Socioeconomic Status
Workforce Development	Grants (federal, state, or local) distributed specifically for human capital improvement: job training, workforce development, etc.	Leading; Socioeconomic Status
Entrepreneurship	Average patents produced per 1,000 workers	Coincident
Infrastructure	Cultural center restorations like the Opera House	Coincident

# 2012 Hurricane Sandy, Monmouth County, NJ

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## Background of Disaster

Hurricane Sandy lasted approximately nine days, starting on October 22, 2012. During its landfall, Hurricane Sandy killed 70 people in the Caribbean and almost 150 in the United States. The National Oceanic Atmospheric Administration estimates Sandy caused at least \$70 billion in damages, which at the time placed it among the costliest storms in U.S. history.<sup>21</sup> In the United States, most damage was attributed to storm surges attacking low-lying coastal areas. Due to rising sea levels, ocean waters ventured further inland once storm surge winds powered through the low-lying areas.<sup>22</sup> In total 13 states and territories including Washington DC were impacted by Hurricane Sandy rainfalls: Washington DC, Delaware, Massachusetts, Maryland, North Carolina, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, and West Virginia.

At the height of the storm, nearly eight million people across the East Coast were without power.<sup>23</sup> In the aftermath of Hurricane Sandy, damage estimates revealed that New York, New Jersey, and Maryland were likely the hardest hit states.

To put into context how unprecedented Hurricane Sandy was in the 21<sup>st</sup> century, the New York Stock Exchange was closed for two consecutive days, which had not occurred because of a weather-related event since 1888. Once Hurricane Sandy started to wane, millions of people were still without electricity and thousands had moved to temporary Red Cross shelters. Gas shortages brought on by closed gas stations and electrical power disruptions contributed to the further displacement of people.<sup>24</sup>

## Possible Socioeconomic Indicators to Report<sup>25</sup>

Category	Indicator	Potential Overlay (SVI/Leading, lagging, coincident)
Finance	Average net migration for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
Finance	Average earnings per household	Coincident, Socioeconomic Status

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<sup>21</sup> National Geographic, *Hurricane Sandy, explained* (2019)

<sup>22</sup> CBS News, *Climate Change made Hurricane Sandy significantly more costly - \$8 billion more, study says* (2021)

<sup>23</sup> NASA, *Hurricane Sandy (Atlantic Ocean)* (2013)

<sup>24</sup> CNN, *Hurricane Sandy Fast Facts* (2020)

<sup>25</sup> Camoin Associates Economic Development, *Monmouth County, NJ Comprehensive Economic Development Strategy* (2014)

Finance	Return of local job markets (retail, health care, hospitality, and professional, scientific, and technical services)	Leading or Coincident, Socioeconomic Status
Education	Reopening of schools (K-12) and daycares	Coincident; Household Composition & Disability
Education	Reopening and return to campus for local colleges and universities	Coincident
Infrastructure	Reopening of hospitals and healthcare providers	Coincident; Socioeconomic Status
Infrastructure	Return of nursing homes and assisted living facilities	Coincident; Household Composition & Disability
Small Business	Reopening of religious centers and additional cultural centers	Leading or Coincident
Small Business	Reopening of small businesses	Leading or Coincident, Socioeconomic Status
Small Business	Reopening of unique tourist attractions - Monmouth County is home to two racetracks, which attract visitors from nearby areas	Leading or Coincident, Socioeconomic Status
Small Business	Small business payroll fluctuations	Coincident or Lagging, Socioeconomic Status
Small Business	Number of full-service restaurants that resumed service	Leading or Coincident, Socioeconomic Status
Small Business	Number of grocery stores that resumed service (either reopened or opened new)	Leading or Coincident, Socioeconomic Status
Infrastructure	Reopening of amusement and recreation locations	Coincident, Socioeconomic Status
Infrastructure	Restoration of utility services (including electricity, gas, telecommunications)	Leading or Coincident
Infrastructure	Restoration of gas stations and ancillary transportation services	Coincident, Housing & Transportation
Real Estate	Local residential real estate market prices	Coincident, Housing & Transportation

Finance	Tracking of highest job growth areas	Leading or Coincident, Socioeconomic Status
Real Estate	Local commercial real estate market prices	Coincident
Real Estate	Number of commercial real estate transactions (property ownership exchanges or new leasing agreements)	Coincident or Lagging
Finance	Tax base collection levels (wages, property, sales)	Lagging, Socioeconomic Status
Housing & Transportation	Development of mass transportation system (New Jersey Transit) service	Leading or Coincident, Housing & Transportation
Infrastructure	Building new resilient infrastructure in the face of climate change, unexpected weather events, and sea level rise	Leading or Coincident
Entrepreneurship	Tracking of venture capital dollars and deals within county borders	Leading
Entrepreneurship	Number of patents issued within county borders	Coincident

# 2017 Hurricane Maria, Puerto Rico

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## Background of Disaster

Hurricane Maria was a Category 5 storm that impacted Puerto Rico (PR) in September 2017. Damage caused by the hurricane was devastating to the island population. Because of Puerto Rico's data management infrastructure prior to Hurricane Maria, accurate capture of death counts was challenging. However, the local government has reported an estimate of 2,975 deaths. While the Puerto Rico Planning Board has estimated economic damage totaling \$42 billion, independent economists project \$43 billion.<sup>26</sup>

Following Hurricane Maria, the Office of the Governor of Puerto Rico published the Transformation and Innovation in the Wake of Devastation – An Economic and Disaster Recovery Plan for Puerto Rico. This report details courses of action, strategic initiatives, local constraints, milestones in recovery, and economic metrics.

Due to Puerto Rico's unique nature, the island encounters many issues specific to its own universe that prevents long term sustainable, economic growth. The below list includes but is not limited to the whole range of issues impacting Puerto Rico's economic health.

- For close to the last three decades, Puerto Rico has been plagued by recessions.
- The *Jones Act* drives up import prices and sales, prices of goods are not competitive.
- The island experiences a drain in talent and has had recent negative net migration.
- Puerto Rico poverty rates are higher than national averages.
- The informal economy crowds out legitimate entrepreneurship. Especially in the housing industry, ~50% of all households were erected or maintained with informal construction, which potentially undermines structural integrity.

85% of PR municipalities are reported to have had disaster preparedness plans prior to the 2017 hurricane season. However, most plans underestimated the level of devastation possible, which in turn made existing plans partially useless against Hurricane Maria. Without plans that were practical enough to address the aftermath of a hurricane with Maria's strength, economic developers were at a considerable disadvantage in formulating an effective response strategy.

## Notable Recovery Mile Stones

Date	Milestone
Sept. 28, 2017	President Trump waives Jones Act for 10 days
December 2017	1,075 of 1,112 K-12 schools had opened (97%)
March 19, 2018	~180 days after landfall, 99% of telecommunications restored, 99% of Puerto Rico Aqueducts and Sewers Authority customers have water, 100% of hospitals operating
June 6, 2018	U.S. Small Business Administration approved 45K loans, totaling \$1.6B

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<sup>26</sup> NBC News, *Puerto Rico lost \$43 billion after Hurricane maria, according to govt. report* (2018)

## Possible Socioeconomic Indicators to Report<sup>27</sup>

Category	Indicator	Potential Overlay (SVI/Leading, lagging, coincident)
Finance	Return of power grid	Lagging; Socioeconomic Status
Finance	Return of water services	Coincident, Socioeconomic Status
Infrastructure	Return of cellular services	Coincident, Socioeconomic Status
Infrastructure	Return of public transportation services	Leading or Coincident; Housing & Transportation
Infrastructure	Return of air travel	Leading or Coincident; Housing & Transportation
Infrastructure	Return of maritime travel/transportation	Leading or Coincident; Housing & Transportation
Infrastructure	Return of port services	Leading or Coincident
Infrastructure	Return of services of repaired roads and bridges	Coincident
Infrastructure	Return of services of public buildings, including schools, hospitals, and other government services	Coincident, Socioeconomic Status
Infrastructure	Return of cultural sites and parks	Coincident
Infrastructure	Tree replanting	Leading
Infrastructure	Sewage removal and return of sewage services	Coincident
Infrastructure	Dune site restoration and repair	Leading or Coincident
Infrastructure	Coral planting	Leading

<sup>27</sup> Rand Corporation, *Transformation and Innovation in the Wake of Devastation, An Economic and Disaster Recovery Plan for Puerto Rico* (2018)



Infrastructure	Return of established landfills and closure of unregulated dumps	Coincident, Socioeconomic Status
Finance	Average net migration for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
Real Estate	New building/construction permit issuances, overall island average and decomposed on municipality level	Leading; Housing & Transportation
Small Business	Number of small business loans issued, overall island average and decomposed on municipality level	Leading or Coincident
Entrepreneurship	Number of new business permits issued, overall island average and decomposed on municipality level	Leading
Real Estate	Repair/Rebuild of residential structures, overall island average and decomposed on municipality level	Coincident, Housing & Transportation
Real Estate	Repair/Rebuild of commercial structures, overall island average and decomposed on municipality level	Coincident
Finance	Level of goods produced in local industries	Lagging
Tourism	Average number of nights of lodging rented on weekly basis	Leading
Tourism	Average number of weekly cruise ship arrivals	Leading
Small Business	Net number of start-up businesses, overall island average and decomposed on municipality level	Coincident, Socioeconomic Status
Finance	Average private payroll employment 3 months, 6 months, a year after disaster	Lagging; Socioeconomic Status
Finance	Average manufacturing payroll employment 3 months, 6 months, a year after disaster	Lagging; Socioeconomic Status
Finance	Wage growth for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status

Finance	Municipality tracking of tax base collections including: sales taxes, property taxes, and business licensing fees	Lagging, Socioeconomic Status
Workforce Development	Tracking enrollment of any occupational licensing	Leading, Socioeconomic Status
Finance	Repayment of bonds and debt obligations	Coincident
Small Business	Default rate of small business loans	Lagging, Socioeconomic Status
Infrastructure	Infrastructure conversion (switching to digital cloud-based storage or adopting fiber cables instead of aerial cables)	Leading

# 2018 Cyber Attack, Atlanta, Georgia

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## Background of Disaster<sup>28</sup>

On March 22, 2018 the City of Atlanta fell to a ransomware attack. A private hacker group based out of Iran had launched a SamSam virus, which crippled the city's ability to maintain routine online functions. The hackers demanded six bitcoins, equivalent to \$51,000 (2018 dollars), in ransom to restore Atlanta's online frameworks.<sup>29</sup> The city refused to pay and underwent manual operations until their IT departments (Atlanta Information Management & Office of Information Security) could rebuild secure mainframes. Gradually, the city was able to recover some software programs and purchase new hardware to replace infected infrastructure. However, some archives like legal documents, police dash-cam recordings, and email correspondence between residents and city officials were completely lost.

In the immediate aftermath of the cyberattack, the following services were no longer accessible:

- Online payment services for utilities or parking tickets
- Online police report submissions
- Court proceedings
- Hiring for city positions
- City workstations and servers
- Warrant issuances
- New inmate processing

In general, most of the services that went offline skewed towards supporting the criminal justice system. While the ransom amounted to \$51,000, city reports estimate that the entire cost of recovery associated with the attack could reach as high as \$17 million.<sup>30</sup> Over time, the city has been able to upgrade its cyberdefense capabilities and resume routine online services, but residents still question whether refusal to pay was the most cost-effective solution. To help maintain a more sustainable online environment, Atlanta hired a new Chief Information Officer, Gary Brantley, in October 2018 to help lead the recovery effort and implement new citywide resiliency measures. These resiliency measures include: improved internal coordination between city offices, better password management, and greater restrictions on accessing sensitive systems.<sup>31</sup>

While Atlanta has stepped up its cybersecurity efforts since the attack, a January 2018 city auditor's report reveals that Atlanta should have been more proactive in its cybersecurity tactics to prevent such a grinding halt. The auditor's report called out the city for lack of standardization in cyber protocol, lack of care in updating servers from using obsolete software, and lack of

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<sup>28</sup> City of Atlanta, *One Atlanta, City of Atlanta, Annual Report* (2018)

<sup>29</sup> CNN, *Six Days after a ransomware cyberattack, Atlanta officials are filling out forms by hand* (2018)

<sup>30</sup> Bloomberg, *What cities can learn from Atlanta's Cyberattack* (2019)

<sup>31</sup> State Scoop, *One Year After Atlanta's Ransomware Attack the City Says its Transforming its Technology* (2019)

general cultural engagement in pursuing cyber best practices.

Direct wording from the auditor's report is as follows:<sup>32</sup>

- missing or outdated policies, procedures and guidance documents
- inconsistent definitions of scope
- lack of formal processes to identify, assess, and mitigate risks
- lack of formal processes to manage risks associated with third-party service providers and suppliers
- unclear data classification policies
- incomplete measurement, reporting and communication related to risks

The auditor's report also included recommendations to help meet these security gaps. It is possible that given the close timing of when the report was published, January 2018, and when the cyber-attack occurred, March 2018, two months was not enough time for city officials to heed recommendations and implement changes.

However, the question remains, if the auditor's report is publicly published, does that attract more attention for hackers to view Atlanta as a weak target? Though the public is entitled to know the findings from audit reports, should the auditor's office have delayed reporting their findings until they had time to privately address their concerns with city officials?

## Possible Socioeconomic Indicators to Report<sup>33</sup>

Category	Indicator
Digital Infrastructure	Cost of purchasing new IT equipment
Digital Infrastructure	Cost of moving to cloud systems for either computing or storage needs
Digital Infrastructure	Cost of purchasing and implementing new operating software and applications
Digital Infrastructure	Cost of purchasing or updating cyber insurance
Infrastructure	Number of days until 911 & 311 dispatch systems return
Digital Infrastructure	Number of days until online payment portals return
Digital Infrastructure	Number of days until online filing of legal documents returns
Infrastructure	Number of days until public transportation systems return
Infrastructure	Number of days until cargo shipping resumes
Infrastructure	Number of days until medical care returns

<sup>32</sup> City of Atlanta City Auditor's Office, *Compliance Audit: ISO/IEC 27001 ISMS Precertification Audit* (2018)

<sup>33</sup> Invest Atlanta, *2019 Annual Report* (2019)

Digital Infrastructure	Number of days until reporting systems like tax collection returns
Digital Infrastructure	Number of days until delivery of online classes return
Digital Infrastructure	Number of days until remote working platforms return
Digital Infrastructure	Number of days until license renewal services return
Digital Infrastructure	Number of days until criminal justice processing systems return
Digital Infrastructure	Improvements made in cyber security, protocol, and policies

*\*Unlike other disasters scoped in our case study population, a cyber-attack does not lastingly alter the shape of local industries in the same manner a natural disaster could devastate communities. Therefore, traditional metrics like unemployment rate, GDP, and net migration may not be suitable proxies to determine economic impact in recovery and resiliency. Also, categories like Real Estate, Finance, Workforce Development, Small Business, Education, Entrepreneurship, and Infrastructure may not be entirely applicable. Additionally, an overlay with SVI factors and leading, lagging, and coincident labels may not also be feasible.*

# 2018 Camp Fire / Paradise Fires, Butte County, CA

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## Background of Disaster

The 2018 Paradise Fires (also referred to as Camp Fire) spanned for nearly most of the month of November. A faulty Pacific Gas & Electric (PG&E) managed utility power transmission line sparked the first fire on November 8, 2018. The wildfire spread over the course of three weeks and was not fully contained till November 25, 2018. In total 153,336 acres burned, 52,000 people evacuated, 18,804 buildings destroyed, 85 lives lost, and \$16.65 billion inflicted in damages.<sup>34</sup> Because the fire impacted so many older buildings, asbestos, heavy metals, arsenic, dioxins, and other hazardous materials were released into the atmosphere. The dramatic introduction of these contaminants into the surrounding area, slowed down recovery efforts. People who were displaced from their homes were not able to move back into the area as quickly. Also, outside help was prevented from entering the area until risks to public health subsided. Ultimately, Camp Fire was the deadliest fire in California history.

PG&E eventually pled to 84 counts of manslaughter for their wrongdoing in utility maintenance. As part of their plea agreement, PG&E agreed to pay a \$3.5 million fine. PG&E also entered a bankruptcy plan where they agreed to pay \$13.5 billion to those impacted by wildfires originated from their equipment, like Camp Fire.<sup>35</sup>

CA state legislatures passed rulemakings that aim to increase resiliency against Wildfires by implementing new preventive measures.<sup>36</sup>

1. Community economic developers have to ensure public roads are wide enough to handle evacuations.
2. The state raised penalty amounts for any utility company found negligent in correcting for violations on issues including maintenance and replacement.
3. Sets timeline of utility companies to submit wildfire mitigation plans under tight deadlines.
4. Established independent evaluators to review safety operations and infrastructure status of communities in high-risk areas.
5. Ramping up efforts in forestry management (removing dead and dying trees that could be cause for future kindling).

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<sup>34</sup> United States Census Bureau, *Camp Fire -2018 California Wildfires* (2018)

<sup>35</sup> New York Times, *PG&E Pleads Guilty to 84 Counts of Manslaughter in Camp Fire Case* (2020)

<sup>36</sup> KTLA, *California Adopts 22 New Laws Aimed at Preventing Wildfires* (2019)

## Possible Socioeconomic Indicators to Report<sup>37</sup>

Category	Indicator <sup>38</sup>	Potential Overlay (SVI/Leading, lagging, coincident)
Real Estate	Rate of tree removal on private property	Coincident, Housing & Transportation
Real Estate	Rate of debris removal	Coincident, Housing & Transportation
Real Estate	Number of new building permits being issued	Leading, Housing & Transportation
Real Estate	Number of awardees who received a Butte County Rebuild Incentive Grant	Leading, Housing & Transportation
Real Estate	New Land Surveyor reports recorded and submitted	Leading or Coincident, Socioeconomic Status
Infrastructure	Water safety locations tested and cleared	Coincident
Infrastructure	Irrigation repairs, replacements, and return to service	Coincident
Real Estate	Shelter capacities for fire survivors	Coincident, Housing & Transportation
Real Estate	Number of mobile home parks (temporary shelter for fire survivors)	Coincident, Housing & Transportation
Infrastructure	Air quality monitoring	Coincident
Small Business	SBA loan disbursements	Leading or Coincident
Real Estate	Properties certified clean of fire debris	Leading or Coincident
Education	Return of school functions	Coincident; Household Composition & Disability
Finance	Fulfillment of insurance claims	Lagging
Infrastructure	Setting up temporary free health clinics for fire survivors	Coincident, Socioeconomic Status or Household Composition & Disability

<sup>37</sup> Butte County Recovers, *Weekly Recovery Statistics* (2019)

<sup>38</sup> 3CORE, Inc, *CEDS 5-Year Strategy Plan 2016-2021* (2016)

Infrastructure	Infrastructure conversion (moving utility lines underground)	Leading
Real Estate	Updating buildings to have more sustainable design	Leading, Housing & Transportation
Real Estate	Establishing new local fire and safety standards for private homes	Leading, Housing & Transportation
Real Estate	Implementing new policies that constructions have defensible spaces and firebreaks to prevent new fires from escalating	Leading, Housing & Transportation
Infrastructure	Rebuild efforts around creating a walkable downtown to decrease traffic congestion and contributors to air pollution	Leading
Infrastructure	Installing a community sewer system	Coincident
Small Business	Reopening of small businesses	Leading or Coincident, Socioeconomic Status
Finance	Hiring rates for all residents and decomposed across SVI Factors	Lagging, Socioeconomic Status
Finance	Average net migration for all residents and decomposed across SVI Factors	Lagging, Socioeconomic Status



# 2018 Hurricane Michael, Florida Panhandle

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## Background of Disaster<sup>39</sup>

Hurricane Michael occurred over October 7, 2018 - October 16, 2018. It transformed from a tropical cyclone to a Category 5 hurricane at landfall. Its landfall on the Florida panhandle was unprecedented as no other Category 5 hurricane had hit the panhandle before.

In the United States, Hurricane Michael was responsible for 16 direct deaths and \$25 billion in damages. Of this total, about \$18.4 billion occurred in Florida (with about \$3 billion of this on Tyndall AFB), \$4.7 billion occurred in Georgia, and \$1.1 billion occurred in southeastern Alabama, with smaller amounts of damage in South Carolina, North Carolina, and Virginia. The vast majority of this damage was to property and infrastructure. However, about \$3.3 billion of the damage was agricultural and forestry losses, primarily in Florida and Georgia.

The 16 deaths are geographically broken down in the following states: 7 in Florida, 5 in Virginia, 3 in North Carolina, and 1 in Georgia. 43 indirect deaths also occurred, resulting from falls during the post-storm clean up, traffic accidents, and medical issues compounded by the hurricane. All recorded indirect deaths happened in Florida.

Mexico Beach, Bay County, Florida experienced the brunt of Hurricane Michael. In Mexico Beach, 1,584 buildings out of 1,692 in the town were reported damaged, with 809 of those reported destroyed. In total, in Bay County, more than 45,000 structures were damaged, more than 1,500 structures were completely destroyed, and two hospitals were severely damaged.

There were 25 deaths in Bay County, and total insured losses are estimated to be over \$6.2 billion. As of June 28, 2019, 88,692 insurance claims were filed for Bay County, which represent 60% of the total claims filed for all Panhandle counties impacted by Michael.

The span of Hurricane Michael's outreach includes the Cayman Islands, Cuba, Florida panhandle, and southwestern Georgia. Eventually, Hurricane Michael de-escalated to a cyclone and passed over the Carolinas and Virginia.

## Calhoun County<sup>40</sup>

Calhoun County reported \$172 million in unmet need as a consequence of Hurricane Michael's damages. Calhoun County has set 8 strategies to work towards fulfilling their unmet needs:

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<sup>39</sup> National Hurricane Center, *National Hurricane Center Tropical Cyclone Report* (2019)

<sup>40</sup> OVID Solutions, *Calhoun County Long-Term Recovery Plan, A Strategy for Recovery Following Hurricane Michael* (2020)

1. Remove barriers to resources available to support clearing, replanting and restoring the timber industry.
2. Restore and expand the Calhoun-Liberty Hospital.
3. Restore damaged housing stock, following Hurricane Michael.
4. Create opportunities to incentivize the development of new single-family homes in a manner that is consistent with community character.
5. Critical enhancements to public facilities that are outdated and in need of redevelopment and hardening to withstand future storms including ambulance stations and a new jail.
6. Update and expand sewer infrastructure in the City of Blountstown to ensure resiliency and offer opportunities for economic growth.
7. Seek cost-share match to maximize the return on investment of recovery funding.
8. Revitalize downtowns and commercial corridors to help support the growth and expansion of small businesses.

Restoring housing stock is especially important in Calhoun County as over 60 percent of all homes were built prior to the enactment of the Florida Building Codes in 1994 that strengthened homes to withstand the impacts of high winds in response to the devastation caused by Hurricane Andrew in 1992. This means majority of homes were built according to standards that did not account for high winds.

Overall, Calhoun County is fairly rural with ~6,000 homes spread across the county, and a median property value of \$80,000 (less than FL's average of \$170,000). Leading up to Hurricane Michael's landfall, only about 4,600 of these homes were occupied, signaling significant portions of abandoned or unused housing in the area.

Calhoun's unemployment rate in February 2020 (prior to COVID-19), had reasonably stabilized at 3.4%. The largest employment sectors before Hurricane Michael were: forestry/fishing/hunting, construction, healthcare, and retail.

## Bay County<sup>41</sup>

At the two-year mark in recovery (October 2020), Bay County had issued 20,000 disaster permits for roof, electrical, interior and exterior repairs, and rebuilds. Additionally, 1,970 commercial permits related to hurricane damage were issued, which is almost triple the amount of usual issuances over a two-year period. The 1,970 permits are specifically for the unincorporated areas surrounding Bay County, once local municipalities are taken into account, approximately 10,000 commercial permits were issued.

By October 2020, Bay County had spent more than \$327 million in its recovery efforts. FEMA had allotted \$176 million to help cover about 54% of the recovery costs needed.<sup>42</sup> Overall, the \$327 million already spent is less than 5% of the \$6.9 billion Bay County estimates

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<sup>41</sup> Bay County Florida Rebuild, *Bay County Long-Term Recovery Plan* (2019)

<sup>42</sup> Panama City News Herald, *A Look at the numbers: Bay County's recovery two years after Hurricane Michael* (2020)

is needed to fully repair damages related to public services like affordable housing and transportation as well as promote economic redevelopment.<sup>43</sup>

## Possible Socioeconomic Indicators to Report<sup>44</sup>

Region	Category	Indicator	Potential Overlay (SVI/Leading, lagging, coincident)
Calhoun County	Real Estate	Amendments to Local Comprehensive Plan and Land Development Code to encourage affordable housing	Leading, Housing & Transportation
Calhoun County	Real Estate	Conduct an inventory of vacant lots	Coincident; Socioeconomic Status or Housing & Transportation
Calhoun County	Workforce Development	Utilize Hurricane Housing Recovery Program for Workforce Housing New Construction	Coincident; Socioeconomic Status or Housing & Transportation
Calhoun County	Real Estate	Number of homes acquired through Voluntary Buyouts in areas that frequently flood	Coincident; Socioeconomic Status or Housing & Transportation
Calhoun County	Real Estate	Rebuild Florida housing repair and replacement outreach to residents and landlords	Coincident; Socioeconomic Status or Housing & Transportation
Calhoun County	Infrastructure	Calhoun-Liberty Hospital reconstruction	Coincident; Socioeconomic Status
Calhoun County	Infrastructure	Repair Tri-County Agricultural Complex	Coincident; Socioeconomic Status

<sup>43</sup> Tallahassee Democrat, *The Price Tag of Recovery After Hurricane Michael: Billions and Billions of Dollars* (2019)

<sup>44</sup> Florida Department of Economic Opportunity, *State of Florida Action Plan for Disaster Recovery* (2020)

Calhoun County	Entrepreneurship	Revitalize Downtown Blountstown and commercial corridors	Coincident or Leading
Calhoun County	Workforce Development	Develop trade skills programs	Coincident or Leading, Socioeconomic Status
Calhoun County	Finance	Technical Assistance for Crop Loss Grants	Coincident or Lagging, Socioeconomic Status
Calhoun County	Workforce Development	Identify workforce retraining opportunities	Coincident or Leading, Socioeconomic Status
Calhoun County	Infrastructure	Enhance Blountstown Sewer System	Coincident
Calhoun County	Infrastructure	Construct a new jail	Coincident
Calhoun County	Infrastructure	Upgrade and enhance communications infrastructure (broadband capacity)	Coincident or Leading
Calhoun County	Infrastructure	Additional well installation at the Calhoun County Industrial Park	Coincident
Calhoun County	Infrastructure	Wastewater collection and transmission improvements	Coincident
Calhoun County	Infrastructure	Installation of a natural gas distribution system	Coincident or Leading
Calhoun County	Infrastructure	Create a designated shelter	Coincident, Socioeconomic Status
Calhoun County	Infrastructure	Develop partnership programs to address rising crime rates	Coincident, Socioeconomic Status
Calhoun County	Infrastructure	Develop programs to reduce recidivism for inmates in county jail system	Coincident, Socioeconomic Status

Calhoun County	Infrastructure	Riverfront Park Development	Coincident
Calhoun County	Infrastructure	Restore old Calhoun County Courthouse	Coincident
Calhoun County	Infrastructure	Remove debris from Chipola River	Coincident
Calhoun County	Infrastructure	Remove damaged trees	Coincident
Calhoun County	Infrastructure	Restore Tree Canopy	Coincident
Bay County	Infrastructure	Repair and improve existing boat ramps	Coincident or Leading
Bay County	Small Business	Return of tourism economy (tourist jobs and tourist dollars spent)	Coincident or Lagging, Socioeconomic Status
Bay County	Real Estate	Median home sale prices	Coincident, Housing & Transportation
Bay County	Real Estate	Homeownership rates, all residents and decomposed across SVI Factors	Coincident, Housing & Transportation
Bay County	Real Estate	Proportion of population displaced or homeless	Coincident, Housing & Transportation
Bay County	Real Estate	Median rental rates, all residents and decomposed across SVI Factors	Coincident, Housing & Transportation
Bay County	Real Estate	Foreclosure trends, all residents and decomposed across SVI Factors	Coincident or Lagging, Housing & Transportation
Bay County	Real Estate	Taking inventory of stock losses as it relates to commercial buildings, churches, housing,	Coincident or Lagging
Bay County	Infrastructure	Investing in local data storage facilities for resilience post storm	Coincident
Bay County	Infrastructure	Restoration and repair of airport facilities	Leading or Coincident; Housing & Transportation

Bay County	Infrastructure	Investment in additional treated water ground storage tanks	Coincident
Bay County	Infrastructure	Conversion of dirt roads to asphalt	Coincident
Bay County	Infrastructure	In addition to improving land-based transportation systems, provide residents and visitors with water transit options	Leading or Coincident; Housing & Transportation
Bay County	Infrastructure	Expanding roadways and parkways to handle evacuation traffic	Leading or Coincident; Housing & Transportation
Bay County	Infrastructure	Construct a series of off-road bicycle paths countywide	Leading or Coincident; Housing & Transportation
Bay County	Infrastructure	Investing in community centers and community gardens to promote communal green space	Coincident, Socioeconomic Status or Housing & Transportation
Bay County	Real Estate	City purchasing property for use as staging areas during and after emergencies	Coincident or Leading
Bay County	Infrastructure	Building electric car charging stations	Leading or Coincident; Housing & Transportation
Bay County	Infrastructure	Rebuilding and relocating fuel docks for greater community efficiency	Coincident
Bay County	Infrastructure	Implement telemedicine system for mental health services	Coincident, Socioeconomic Status or Household Composition & Disability
Bay County	Real Estate	Converting blighted properties into housing for low-moderate income housing	Coincident, Housing & Transportation
Bay County	Real Estate	Establish a community land trust that will own land on which	Coincident, Housing & Transportation

		homes for homeownership can be built and allow long-term leasehold of the land by reducing costs of home ownership.	
Bay County	Real Estate	Consider using natural resources to meet temporary housing needs - Bay County has a vast shoreline which can be filled with floating hotels, riverboats, and smaller cruise ships to house displaced individuals	Coincident, Housing & Transportation
Bay County	Small Business	Create a business incubator and research park to support startup activity and small business growth	Coincident
Bay County	Infrastructure	Provide free internet for all residents - step further than expanding broadband access	Coincident, Socioeconomic Status
Bay County	Education	Provide subsidized childcare - step further than restoring daycare services	Coincident or Leading, Socioeconomic Status
Bay County	Infrastructure	Expand existing port capacity to accommodate large cruise ships in order to boost tourism	Coincident or Leading
Bay County	Small Business	Establish new tourist attractions like an aquarium to attract visitors	Coincident or Leading

# 2019 Mississippi River Floods, State of Missouri

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## Background of Disaster<sup>45</sup>

In 2019, flooding from the Mississippi River and its tributaries, Missouri and Arkansas Rivers, impacted 19 states and 14 million people. In total, flood damages led to \$20 billion in losses.<sup>46</sup> The 2019 floods were the longest floods on record, lasting from spring through July.<sup>47</sup> At its extreme, some areas like Baton Rouge, LA had waters that stayed above flood levels for 211 days.

It is possible that the floods were exacerbated by heavier than normal snowfalls in the northern plains (two to five times more than average). Naturally, the snow fell in the winter and when it melted in the warmer spring months, additional water contributed to prolonged flooding. Eventually, during these periods of snow melt, there was also rainfall 200-300% above normal, which triggered the initial floods.<sup>48</sup> Throughout 2019, more than 1.2 million acres of Missouri were inundated by floodwaters and nearly 1.4 million acres of crops could not be planted.

Specifically, for the State of Missouri, on January 27, 2020 HUD authorized \$30,776,000 for Missouri's disaster recovery efforts for their entire 2019 experience. HUD designated the three Missouri counties of Cole, Holt, and St. Charles as Most Impacted and Distressed (MID) and mandated that 80% of the allocation be used to their benefit. HUD further mandated that 70% of the allocation go to the benefit of Low- to Moderate Income citizens.

Timeline of Missouri 2019 Disasters: In early March 2019, a "bomb cyclone" brought more than 3 feet of snow, which was followed by rapid rises in temperature. Upstream from Missouri, the Spencer Dam broke down in Nebraska, which enabled the Town of Niobrara to be flooded. Through March 2019 to July 2019, the state experienced tornadoes, high winds, hail and heavy rains, which were all contributing factors to additional flooding along the Missouri and Mississippi rivers.

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<sup>45</sup> Missouri Department of Economic Development, *State of Missouri Action Plan for the 2019 DR-4451 Disaster Recovery* (2019)

<sup>46</sup> World Resources Institute, *Nature-Based Flood Mitigation Can Help Mississippi River Farmers* (2020)

<sup>47</sup> Center for Disaster Philanthropy, *2019 Catastrophic River Flooding* (2019)

<sup>48</sup> Feature Review – Missouri State Emergency Management Agency, *Flood Recovery in Missouri* (2020)



## Missouri Focus on Social Vulnerabilities

Indicator Variable	Variable Type	Variable Description	Variable Weighing for Impact Scoring Equation
LMI Score	Count	Score of county owners below 80% LMI as a ratio of all IA county owners below 80% LMI (0-1)	3 X Importance
IA Ineligible, No HOI, but with damage score	Count	Score of county HA ineligible owner applicants with real property loss but with no homeowner's insurance as ratio of all IA county ineligible owners with real property losses but no homeowner's insurance (0-1)	2 X Importance
No FI Damage Score	Damage Sum	Score of total county flood damage for owners without flood insurance as ratio of all flood damage for owners without flood insurance	1 X Importance
Flood Damage Count Score	Count	Score of number of owner units in county with flood damage as a ratio of all IA owner units with flood damage	1 X Importance
Count of Real Property Score	Count	Score of total number of owner units with real property loss in county as a ratio of all IA owner units with real property losses	1 X Importance
Count of Personal Property Score	Count	Score of total number of owner units with personal property loss in county as a ratio of all IA owner units with personal property losses	1 X Importance
Average Personal Property Score	Average Damage Sum	Score of average personal property loss for owner units in county in relation to average personal property losses for all IA owner units with personal property losses	1 X Importance

Objective: Ratios of each indicator to the total state value for that indicator created a value enabling comparison across counties – irrespective of county size. Instead of reporting raw totals or averages, Missouri incorporated a system of ratios into their reporting that enabled comparability of recovery factors through a social equity lens. While other case study regions

may have included some metric tools to allow for comparability, Missouri demonstrated greater sophistication in its metric collection and reporting efforts.<sup>49</sup>

## Possible Socioeconomic Indicators to Report

Category	Indicator	Potential Overlay (SVI/Leading, lagging, coincident)
Finance	Rate of receipt of FEMA Individual Assistance, for all residents and decomposed across SVI Factors	Lagging, Socioeconomic Status
Small Business	Low-interest loans from the U.S. Small Business Association	Leading or Coincident
Finance	Insurance proceeds from the National Flood Insurance Program (NFIP), for all residents and decomposed across SVI Factors	Lagging, Socioeconomic Status
Infrastructure	Number of Levees repaired	Coincident
Infrastructure	Number of roads reopened	Coincident
Infrastructure	Number of railroad tracks repaired	Coincident
Infrastructure	Number of airports reopened	Coincident
Infrastructure	Number of train stations reopened	Coincident
Infrastructure	Number of ports repaired	Coincident
Infrastructure	Number of drinking water systems repaired and returned to service	Coincident
Infrastructure	Number of wastewater systems repaired and returned to service	Coincident
Infrastructure	Proportion of population that regained access to drinking water and wastewater solutions, for all residents and decomposed across SVI Factors	Coincident, Socioeconomic Status or Housing & Transportation
Infrastructure	Tdap and tetanus vaccinations distributed following disaster, for all residents and decomposed across SVI Factors	Coincident

<sup>49</sup> Table and table explanation sourced from: *Missouri Department of Economic Development, Action Plan for the 2019 DR-4451 Disaster Recovery* (2019)

Infrastructure	Amount of debris removal	Coincident
Infrastructure	Number of public buildings returned to service	Coincident
Finance	Number and loan amount of Business Physical Disaster Loss Loans for machinery, equipment, and other real-property damages	Leading or Coincident
Small Business	Rate of inventory recovery for small businesses	Lagging
Real Estate	Participation in Local Voluntary Buyout Program, for all residents and decomposed across SVI Factors	Coincident; Socioeconomic Status or Housing & Transportation
Real Estate	Acquisition and demolition of blighted or disaster damaged properties, where immediate re-use of the property is intended for the development of affordable housing	Leading or Coincident; Housing & Transportation
Real Estate	New construction of affordable multi-family rental housing units	Leading; Housing & Transportation
Real Estate	Dwelling occupancy levels, for all residents and decomposed across SVI Factors	Coincident; Housing & Transportation
Infrastructure	Restoration of natural and cultural community resources	Coincident
Real Estate	Number of new properties appraised post disaster, for all residents and decomposed across SVI Factors	Leading or Coincident; Housing & Transportation
Infrastructure	Creation and implementation of online platforms and resource access points	Coincident
Infrastructure	Creation and distribution of Language Access Plan (ensures meaningful access to agency services, programs, and activities on the part of persons who have limited English proficiency)	Coincident

# 2021 Winter Storm, State of Texas

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## Background of Disaster

In February 2021, the State of Texas was staving off two separate but deadly disasters: the COVID-19 pandemic and a vicious winter storm. Given the compounding nature of these disasters, it is difficult to determine with absolute certainty direct loss of life and economic damage. However, officials estimate that at least 151 individuals have died either directly or indirectly because of the February 2021 winter storm.<sup>50</sup> Private weather agency, AccuWeather, estimates that the total cost of economic damage stemming from the winter freeze will cost Texas \$130 billion.<sup>51</sup> \$130 billion may actually be a conservative estimate as other private economic research firms like the Perryman Group project that the range of economic cost is \$195 billion - \$295 billion.<sup>52</sup>

While different parts of Texas were more adversely affected than others by the winter storm, as a whole, the entire state experienced winter storm activity over the span of two weeks, from February 10-27. At its peak, on February 14, all 254 Texas counties were under a winter storm warning, which was unprecedented, and forced President Biden to declare a state of emergency in Texas under the Stafford Act.<sup>53</sup> Two days prior, on February 12, Texas Governor Abbott had also issued a statewide disaster declaration.<sup>54</sup> Federal and state agencies began to coordinate a response to provide emergency assistance to Texans throughout the state. Some of these outreach efforts occurred virtually like establishing Virtual Recovery Centers to assist small businesses with accessing low-interest federal loans. To date, FEMA reports that they are approved to provide a total of \$172,829,461.84 in total individual and household program dollars.<sup>55</sup>

Due to freezing temperatures, the state's entire energy grid had collapsed. Wind turbines, gas fields, coal plants, and oil refineries all became inoperable in these harsh winter conditions. Millions of Texans were left without power and thousands of businesses were forced to shut down without electricity. While power outages were intermittent during the winter storm, as many as 4.1 million people were at times left without power.<sup>56</sup>

A mixture of a lax regulatory environment and cultural desire for energy independence contributed to an inefficient response from power suppliers. Texas officials thought that by minimizing regulatory control they would unburden power suppliers, who would then transfer some cost savings to consumers, making energy consumption in Texas cheaper than anywhere else in the country. Texas officials were able to maintain distance from federal oversight by

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<sup>50</sup> Dallas Morning News, *Number of Texas Deaths Linked to Winter Storm Grows to 151*, (2021)

<sup>51</sup> Dallas Morning News, *The Texas winter freeze's economic toll climbs to \$130 billion* (2021)

<sup>52</sup> CBS News, *Texas winter storm could top \$200 billion – more than hurricanes Harvey and Ike* (2021)

<sup>53</sup> CBS News, *Texas winter storm could top \$200 billion – more than hurricanes Harvey and Ike* (2021)

<sup>54</sup> Office of the Texas Governor, *Governor Abbott Issues Disaster Declaration, Continues to Deploy Resources As Severe Winter weather Impacts Texas* (2021)

<sup>55</sup> FEMA, *Texas Severe Winter Storms* (2021)

<sup>56</sup> CNBC, *Millions in Texas without power as deadly storm brings snow, freezing weather* (2021)

isolating Texas from connecting with any of the national electric grids. Unfortunately, these predictions did not pan out correctly during the winter storm as power suppliers were slow to react and those that did restore and resume services to customers were accused of price gouging. In fact, some utility companies like Griddy are facing class action lawsuits from residents claiming that they were charged \$9,000 for energy usage over small periods of time like 5 days.<sup>57</sup>

## Control Failures

The following measures could have been taken prior to the winter storm to avoid massive power failures. Texan legislatures are currently debating the necessity of mandating some of these steps to prevent another fallout.<sup>58</sup>

- Compulsory winterization of energy machines like wind turbines and power plant infrastructure
- Integrating Texas with inter-state electric grids
- Updating all household meters to smart meters
- Establishing strategic state-owned oil reserves

Though a few of these steps could be implemented under the governor's direction, to ensure durability of these preventive measures, codification in state law is probably the safest route.

## Inequity in Recovery

While the effects of the storm may be too recent to fully assess inequities across different SVI indicators, anecdotal reports suggest that communities are suffering at disproportionate rates compared to others. Nonprofit organization, Home Coalition, has shared that in Texas lower-income communities are more likely to own older homes without insurance, which hinders their ability to make costly repairs following damage from the winter storm. A Rice University study found that Black and Latino residents were less likely to have cash on hand to meet emergency situations. Despite these inequities, since winter storms do not have the same magnitude for long term displacement like hurricanes, communities of color can still rely on informal support networks to help navigate through the crisis.<sup>59</sup>

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<sup>57</sup> Dallas Morning News, *Texas electricity supplier Griddy hit with \$1 billion class action lawsuit for price gouging after outages* (2021)

<sup>58</sup> Texas A&M Today, *What Went Wrong With Texas' Power Failure And How To Fix It* (2021)

<sup>59</sup> Houston PBS Passport, *Racial Inequities Emerge As Houston Recovers From Last Week's Winter Storm* (2021)

## Possible Socioeconomic Indicators to Report

Category	Indicator	Potential Overlay (SVI/Leading, lagging, coincident)
Finance	Changes in unemployment rate, for all residents and decomposed across SVI Factors	Lagging, Socioeconomic Status
Small Business	Small business reopening	Leading or Coincident, Socioeconomic Status
Real Estate	Hotel occupancy rates, for all residents and decomposed across SVI Factors	Leading or Coincident, Housing & Transportation
Real Estate	Temporary shelter occupancy rates, for all residents and decomposed across SVI Factors	Leading or Coincident, Housing & Transportation
Infrastructure	Food bank visits, for all residents and decomposed across SVI Factors	Leading or Coincident, Socioeconomic Status
Infrastructure	Number of days until power restoration, for all residents and decomposed across SVI Factors	Coincident
Real Estate	Permits issued for home reconstruction or repair, for all residents and decomposed across SVI Factors	Leading, Housing & Transportation
Infrastructure	Number of wind turbines winterized	Coincident
Infrastructure	Number of power plants winterized	Coincident
Infrastructure	Number of oil reserves built up	Coincident
Infrastructure	Number of days until communication towers return to service	Coincident
Infrastructure	Change in price for electricity usage, for all residents and decomposed across SVI Factors	Leading or Coincident, Housing & Transportation
Infrastructure	Number of days until running water returns	Coincident
Infrastructure	Number of days until sewer services returns	Coincident
Infrastructure	Number of days until roads return to normal usage	Coincident

Finance	Number of claims filed with FEMA for loan assistance for all residents and decomposed across SVI Factors	Lagging, Socioeconomic Status or Household Composition & Disability
Finance	Number of FEMA household assistance loans distributed for all residents and decomposed across SVI Factors	Lagging, Socioeconomic Status or Household Composition & Disability
Small Business	Population stabilization of cattle and livestock	Coincident
Small Business	Return of total farming activity	Coincident
Finance	Local sales tax revenue numbers	Lagging

# COVID-19, Various Communities

*Regions Studied: Minneapolis-Saint Paul, Minot, ND, Los Angeles, CA, and Navajo Nation*

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## Background of Disaster

COVID-19 was a once in a generation global pandemic that originated from Wuhan, China in December 2019. Via person-to-person transmission, travelers from across the globe were the first carriers of COVID-19 to reach the United States. Unfortunately, many government officials underestimated the effects COVID-19 would have on the public health and were slow to implement quarantine, social distancing, and mask compliance guidelines.<sup>60</sup> Consequently, community transmission intensified and hospitals soon began to reach max capacity. Few therapeutics were confirmed by public health officials to be effective.

Seeing few options to regain control of the situation, state and local officials instituted lockdowns to slow the spread of COVID-19. Many public places were shut down and travel was restricted to just necessary activities like grocery shopping and medical visits. Schools and universities across the country pivoted to virtual teaching and workplaces that did not require constant in-person interaction scrambled to adopt online platforms. Larger businesses who already had in-house tools to operate online were quicker to a virtual transition while smaller businesses struggled to identify adequate online operating plans. Overall, COVID-19 upended entire industries like tourism, manufacturing, and energy.<sup>61</sup>

Eventually, the Food and Drug Administration authorized three vaccines from different pharmaceutical manufacturers. Politicization of the vaccine led to low vaccination rates amongst some segments of society. While the country did receive a high enough vaccination rate to remove recommended masking protocols in public spaces, many in the unvaccinated ranks of society also followed suit and continued to contract COVID-19. The continuous contraction of COVID-19 led to several mutant strands, with a new Delta variant appearing even more contagious than early iterations. Some local public officials remain wary of the threats mutant variants pose and have urged the reinstatement of mask mandates.<sup>62</sup> Two major cities, Los Angeles, California and Washington, DC, have both reinstated mask mandates in July/August 2021 for indoor locations after previously rolling back mask protocols just a few weeks prior.<sup>63</sup>

Since the onset of the pandemic, there has been a general lack of coordination between local, state, and federal authorities on the direction of masking procedure and adequate social distancing measures. While the impacts of COVID-19 on the national economy can be tracked with increases in unemployment and drops in GDP, impacts on local economies are more difficult to decipher. Undoubtedly local economies have felt the pandemic's touch but due to a lack of standardization in metric keeping, each locality has reported its success or failures in managing COVID-19 differently. What has been clear is that linear patterns rarely hold

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<sup>60</sup> Forbes, *U.S. Government Response to COVID-19 Was Slow. But How Does It Compare to Other Countries?* (2020)

<sup>61</sup> Congressional Research Service, *Global Economic Effects of COVID-19* (2021)

<sup>62</sup> NBC Washington, *DC to Require Masks Indoors Amid COVID Surge* (2021)

<sup>63</sup> Washington Post, *Mask mandates make a return – along with controversy* (2021)



permanent trajectories. For instance, in some states when hospital capacity began to reach max capacity, governors declared lockdown orders. Naturally, lockdown led to a dramatic decline in business activity and the regional economies began to suffer. Though the CDC put forward recommended guidelines like the 7-day moving average to tell if a region had slowed down the rate of transmission to the point where it was safe to resume scaled back normal activities, state and local officials opted to use their own judgement. In some instances, this led to a crash and burn feedback loop where hospitalizations would rise, slowdown under lockdowns, and then rapidly escalate when lockdowns were lifted too early.

#### General US Timeline of COVID-19<sup>64</sup>

Date	Event
January 21, 2020	CDC confirms first US coronavirus case
January 31, 2020	WHO issues Global Health Emergency
February 3, 2020	US declares Public Health Emergency
March 11, 2020	WHO declares COVID-19 a pandemic
March 13, 2020	President Trump declares COVID-19 a National Emergency
March 17, 2020	US expands Telehealth services and Medicare now covers telemedicine visits
March 19, 2020	California becomes first state to declare Stay-at-Home Order
March 27, 2020	CARES Act signed into law, which provides economic aid to hospitals, stimulus to businesses (Payment Protection Program (PPP)), and direct assistance to most U.S. citizens
May 28, 2020	US passes 100,000 COVID-19 deaths
June 10, 2020	US COVID-19 cases reach 2 million
July 7, 2020	US surpasses 3 million COVID-19 infections
August 15, 2020	FDA approves rapid use saliva tests for COVID-19 testing
September 14, 2020	US airports stop screening international travelers, despite high infection rates
November 4, 2020	US reports 100,000 new COVID-19 daily cases
December 11, 2020	US begins vaccination efforts of healthcare workers with approval of Pfizer, BioNTech vaccine
December 18, 2020	Moderna has also been approved to ship COVID-19 vaccines

<sup>64</sup> AJMC Staff, A Timeline of COVID-19 Developments in 2020

December 2020 – August 2021	US vaccination rates mixed across the country as southern states have lower adoption rates compared to national average
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## Case Study Selection

While every corner and pocket of the United States has felt the pandemic's touch, the following locations were selected for study as they provided the most balance and diversity in research:

*Minneapolis-Saint Paul, Minnesota* – Midsize, midwestern city that demonstrated strong data collection and metrics reporting in peer group cities as well as when compared to large city counterparts

*Minot, North Dakota* – Small, rural, fairly homogenous city with prior disaster flood experience and received one of the largest CDBG-DR grants for a community of its size

*Los Angeles, California* – Large, sprawling coastal city that is racially and ethnically diverse

*Navajo Nation* – Operates as a country within a country and represents the effects of the absence of an integrated health system

## Possible Socioeconomic Indicators to Report

Number	Region	Category	Indicator	Potential Overlay (SVI/Leading, lagging, coincident)
1	MSP, MN	Infrastructure	Number of COVID-19 Cases	Leading; Socioeconomic Status
2	MSP, MN	Infrastructure	COVID-19 Vaccination Rates	Leading; Socioeconomic Status
3	MSP, MN	Finance	Employment (total nonfarm employment, people on jobs)	Lagging; Socioeconomic Status
4	MSP, MN	Finance	Job Postings, for all residents and decomposed across SVI Factors	Leading; Socioeconomic Status

5	MSP, MN	Finance	Jobless Claims, for all residents and decomposed across SVI Factors	Lagging; Socioeconomic Status
6	MSP, MN	Infrastructure	Air Travel, for all residents and decomposed across SVI Factors	Leading, Socioeconomic Status
7	MSP, MN	Real Estate	Hotel Occupancy, for all residents and decomposed across SVI Factors	Leading or Coincident, Socioeconomic Status or Housing & Transportation
8	MSP, MN	Infrastructure	Return to Office, for all residents and decomposed across SVI Factors	Leading, Socioeconomic Status
9	MSP, MN	Infrastructure	Transit Ridership, for all residents and decomposed across SVI Factors	Leading/coincident, Socioeconomic status
10	MSP, MN	Small Business	Restaurant Bookings	Leading, Socioeconomic status
11	MSP, MN	Small Business	Small Business Creation	Leading, Socioeconomic status
12	MSP, MN	Entrepreneurship	Startup Funding	Leading, Socioeconomic status
13	MSP, MN	Infrastructure	Food Security	Coincident, Socioeconomic status, Minority status, Household composition
14	MSP, MN	Real Estate	Housing Affordability	Coincident, Socioeconomic status, Minority status, Household composition

15	Minot, ND	Education	Return of student population to Minot State University	Coincident, Housing & Transportation
16	Minot, ND	Education	School transit systems and ridership	Coincident, Housing and Transportation
17	Minot, ND	Real Estate	Number of vacant buildings	Coincident, Socioeconomic Status or Housing and Transportation
18	Minot, ND	Finance	Number of PPP loans distributed	Lagging
19	Minot, ND	Finance	Amount of PPP loans distributed and average amounts per loan	Lagging
20	Minot, ND	Real Estate	Number of families owning homes, number of families renting homes	Coincident, Housing and Transportation
21	Minot, ND	Small Business	Number of reopening of retail locations and openings of new retail locations	Leading
22	Minot, ND	Finance	Issuances of Tax Increment Financing Bonds	Leading
23	Minot, ND	Finance	Receipt of Community Development Block Grants (applies to any city 50k+ pop)	Lagging
24	Minot, ND	Finance	Receipt of USDA Agriculture Business Grants (mostly applies to rural)	Lagging

			business opportunities)	
25	Los Angeles, CA	Education	Higher Ed education attainment (poverty line families)	Leading, Socioeconomic Status
26	Los Angeles, CA	Finance	Income Gaps between high income earners and low-income earners	Coincident, Socioeconomic Status
27	Los Angeles, CA	Finance	Number of workers earning below living wage, at living wage, and above living wage	Coincident, Socioeconomic Status
28	Los Angeles, CA	Small Business	Resuming business activities in the hardest-hit industries: hospitality, arts, entertainment & recreation, motion picture & sound recording, non-essential retail, and personal care & laundry services	Leading, Socioeconomic Status
29	Los Angeles, CA	Small Business	Number of industry visits on a monthly basis of personal care and laundry services	Leading, Socioeconomic Status
30	Los Angeles, CA	Finance	Volume of port shipping	Leading
31	Los Angeles, CA	Finance	Filing of unemployment insurance claims	Leading, Socioeconomic Status
32	Los Angeles, CA	Finance	Job growth broken down across low-	Leading, Socioeconomic Status

			skill, middle-skill, and high skill jobs	
33	Los Angeles, CA	Workforce Development	Introduction of new training programs so that displaced workers have the opportunity to up-skill	Leading, Socioeconomic Status
34	Navajo Nation	Finance	Growth rate of Gross Regional Product (GRP)	Lagging
35	Navajo Nation	Finance	Import/Export levels compared to border towns	Lagging
36	Navajo Nation	Small Business	Small business ownership	Coincident
37	Navajo Nation	Workforce Development	Labor characteristics in both force and productivity	Coincident, Socioeconomic Status
38	Navajo Nation	Workforce Development	Human capital assessments: level of education, skill and knowledge of the labor force	Leading, Socioeconomic Status
39	Navajo Nation	Infrastructure	Natural & Renewable Resources: inventory of raw materials, forestry products, and solar	Leading
40	Navajo Nation	Infrastructure	Physical Capital: number of buildings, equipment, machinery, plants & property	Coincident
41	Navajo Nation	Infrastructure	Technology Capacity: how much	Coincident

			fiber optic there is in the community	
42	Navajo Nation	Real Estate	Land: availability of land	Coincident
43	Navajo Nation	Real Estate	Average house value of Navajo residents	Coincident, Socioeconomic Status
44	Navajo Nation	Real Estate	Proportion of mortgage status of Navajo residents (owner-occupied units with or without mortgage) and compare to renter stabilization	Coincident, Housing & Transportation

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