County-Level Risk Assessment: Williamson County, Illinois

Guide to the Report

Table 1: This table contains basic statistics of the county as a whole which helps set the context for the rest of the analysis and visualizations as described below.

Table 2: This table describes the number of census tracts grouped by their computed resilience levels. The basic resilience values of each tract are grouped into 5 quantiles (resilience levels), where 5 (very high resilience) covers counties having resilience values in the top 20

Table 3: This table contains the Indicator Group Rankings, which contain a five-point rating across five indicator themes: housing, economy, community health, infrastructure, and environment. It shows where the current county falls compared to other counties in the state (Low Risk means the resilience value for the current county is in the top 20

Table 4: This table contains the Indicator Group Rankings computed across all tracts in the county which correspond to rural areas, similar to Table 3. The resilience values across all tracts are aggregated at the county level, which is then converted into quantiles which serve as rankings.

Table 5: This table contains the Indicator Group Rankings computed across all tracts in the county which correspond to urban areas, similar to Table 3. The resilience values across all tracts are aggregated at the county level, which is then converted into quantiles which serve as rankings.

Table 6: This table describes the Census Places in the county grouped by their resilience categories. This is similar to Table 2, the resilience values are categorized into 5 levels and aggregated over all the Census Places over the county.

Table 7: This table contains the Indicator Group Rankings computed across all census places in the county, similar to Table 3. The resilience values across all census places are aggregated at the county level, which is then converted into quantiles which serve as rankings.

Figure 1: This maps plots each census tract in the entire county and color-codes each tract with its computed resilience levels.

Figure 2: This pie chart shows the composition of the county on the basis of percentage of census tracts in each resilience category.

Figure 3: This map shows the urban resilience of all tracts which are classified as 'urban', i.e. they are assigned a USDA RUCA code of 1. Urban resilience is only computed across all urban tracts in the entire state, whereas overall resilience is computed across all tracts.

Figure 4: This map shows the rural resilience of all tracts which can be classified as 'rural', i.e. they are assigned a USDA RUCA code different from 1. Rural resilience is computed across all rural tracts in the state, similar to urban resilience.

Figure 5: In this map, the census places within the state are shown and the subject county is h ighlighted using a red border that outlines the county boundary.

Figure 6: This figure is a map of the subject county showing all the census places inside it, color coded with the places resilience levels. Place resilience is computed across all census places in the state, similar to rural and urban resilience.

Figure 7: This is a pie chart and table showing composition of the county on the basis of percentage of census places in each disaster resilience category.

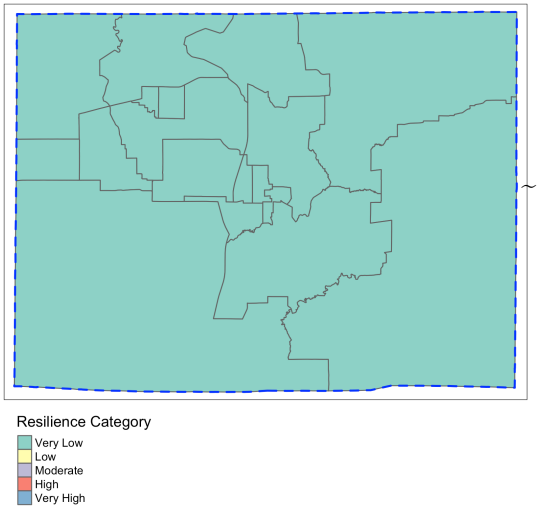
Appendix A: This table contains the different indicators used in the analysis, their definition, what it means when the indicator is said to be at low or high risk, and the risk level computed for this indicator at the county level. The risk level is computed by comparing the value of the indicator across all counties in the state and converting the raw values into quantiles: Very High, High, Moderate, Low, and Very Low.

Appendix B: This table contains the different indicators used in the analysis and their computed risk level for all rural, urban census tracts as well as the census places present inside the county. The risk level is computed across all counties in the state and converted into quantiles: Very High, High, Moderate, Low, Very Low.

Disclaimer: Variables from County health patterns, EQI and County transportation patterns might have aggregation errors at the tract, urban, rural and census place levels owing to unavailability of data beyond the county level.

Census Tracts within Williamson County, Illinois

Figure 1



Basic Statistics

Table 1: Basic Statistics (County level)

Information	Value
Population	66929 persons
Area sq. miles	421.01 sqm
Gross Density(persons/sq mil)	159 p/sqm
Avg HH Size	2.32 persons
Median HH Income	52076 USD

Count of Tracts in each Category

Figure 2

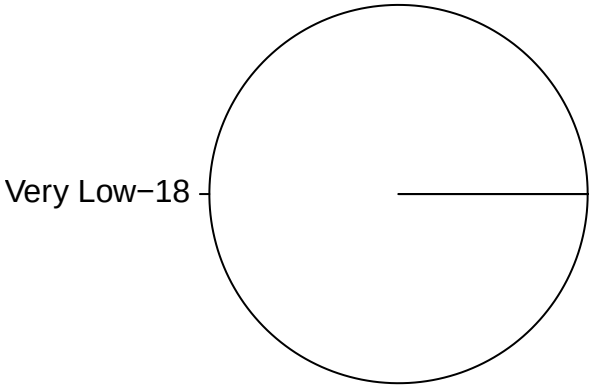
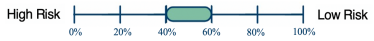
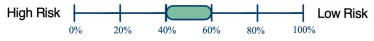
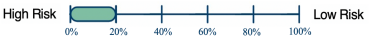


Table 2: Percentage of Census Tracts under each Resilience Category(County level)

Very High	High	Moderate	Low	Very Low
0	0	0	0	100

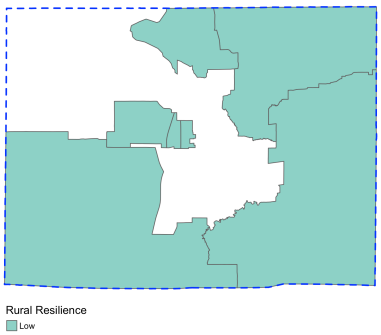
Indicator Group Rankings

Table 3: Overall Indicator Group Rankings

Indicator Group	High Risk Areas	Low Risk Areas
Community 	PrimaryCare Physicians Rate, Percent Disconnected Youth	Young percent, Percent LanguageBarrier, Segregation index
Economy 	Civic related business rate	Others
Housing 	OldHomes, NewHomes, GroupQuarters	Renter MHHI, Gender Pay Gap.y
Environment 	o3, std coal prim pop, std metal prim pop, Radon, Pct Fam Pov, D303 Percent, ClAve, HgAve, W HG, W DALAPON, W DEHA, W SIMAZINE, W PICLORAM, W DINOSEB, W 24D, W PCP, W DCM	std stone prim pop, W CN, W SB
Infrastructure 		Protective Services, Percent BroadbandAccess

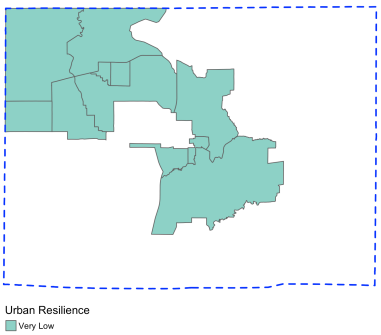
Rural Resilience within Williamson County, Illinois

Figure 3



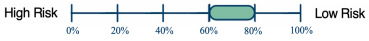
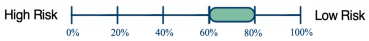
Urban Resilience within Williamson County, Illinois

Figure 4



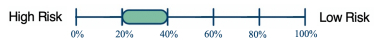
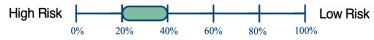
Rural Indicator Rankings

Table 4: Rural Indicator Group Rankings

Indicator Group	High Risk Areas	Low Risk Areas
Community 	Young percent, FemaleHeaded HHs Percent, Skilled Percent, FemaleLaborforce percent, Percent BachelorsDegree, Percent Commuters, PrimaryCare Physicians Rate, Percent Disconnected Youth	Elderly growth percent, Percent LanguageBarrier, Segregation index
Economy 	Income, Agro Percent, Agri, Agri LQ, Edu, Arts LQ, Civic related business rate	WorkNearby percent, Sales, PT, Transport LQ, Info LQ
Housing 	Rental Overcrowding, GroupQuarters	Vacancy, Renters Cost IncomeRatio
Environment 	o3, std coal prim pop, std metal prim pop, Radon, Pct Fam Pov, D303 Percent, ClAve, HgAve, W HG, W DALAPON, W DEHA, W SIMAZINE, W PICLORAM, W DINOSEB, W 24D, W PCP, W DCM, State	nox, std stone prim pop, Kave, W Ba, W Cd, W Cr, W CN, W FL, W SE, W SB
Infrastructure 		Percent BroadbandAccess

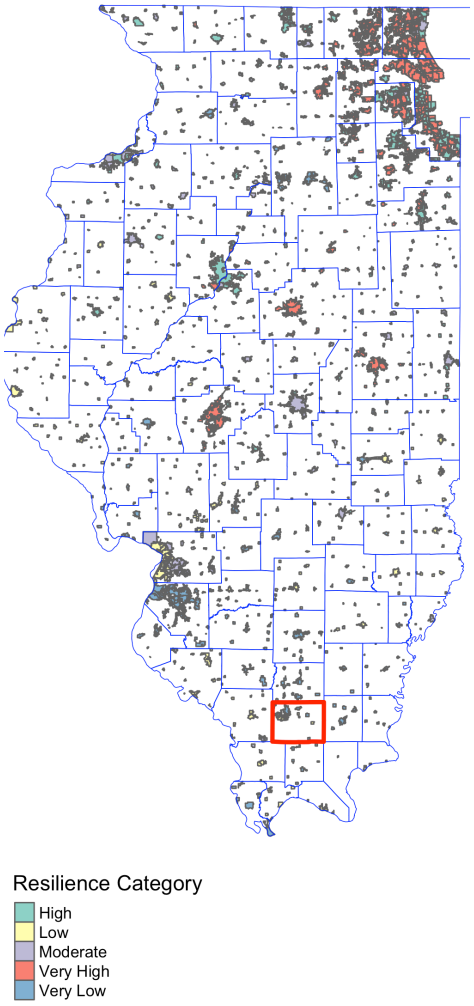
Urban Indicator Rankings

Table 5: Urban Indicator Group Rankings

Indicator Group	High Risk Areas	Low Risk Areas
Community 	Social Association Rate, Percent Disconnected Youth	Population, NotMarried Percent, LargeFam Percent, FemaleLaborforce percent, Inadequate Facilities, COVID-19 death rate
Economy 	Walkability Score, Civic related business rate, Education related business rate	LowIncome Percent, poverty, WorkNearby percent, Service, Manufacturing, Manufacturing LQ, Retail, Transport LQ, Management, Vice related business rate
Housing 	Rental Overcrowding	Homewownership, Rented, Rental CostBurden below20000, NoVehicle Pop
Environment 	o3, std coal prim pop, Radon, Per TotPopSS, ClAve, HgAve	AvgOfD3 ave
Infrastructure 		Pubtrans heavilyDependent

State-Level Places Map

Figure 5



Places Map within Williamson County, Illinois County, IL

Figure 6

Count of Places in each Category

Figure 7

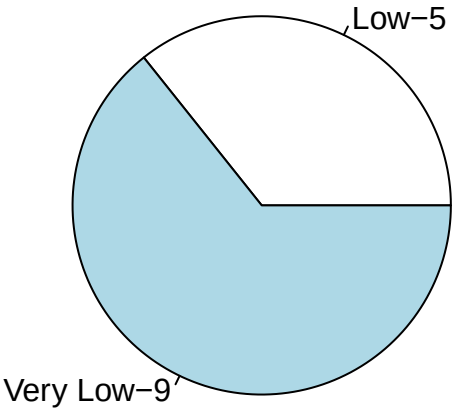
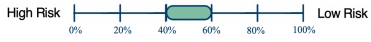


Table 6: Percentage of Census Tracts under each Resilience Category(County level)

Very High	High	Moderate	Low	Very Low
0 %	0 %	0 %	36 %	64 %

Places Indicator Rankings

Table 7: Places Indicator Group Rankings

Indicator Group	High Risk Areas	Low Risk Areas
Community 	Working Nonworking ratio, HelperPool, Percent LanguageBarrier, Percent Commuters, PrimaryCare Physicians Rate, Percent Disconnected Youth	FemaleHeaded HHs Percent, Educated percent, Segregation index
Economy 	Civic related business rate	UnstableEmployment percent, MBS LQ, Sales, Retail LQ
Housing 	OldHomes, NewHomes, Overcrowding, Rental Overcrowding, GroupQuarters	NoVehicle Pop, Gender Pay Gap.y
Environment 	o3, std coal prim pop, std metal prim pop, Radon, Pct Fam Pov, D303 Percent, ClAve, HgAve, W HG, W DALAPON, W DEHA, W SIMAZINE, W PICLORAM, W DINOSEB, W 24D, W PCP, W DCM	std stone prim pop, W CN, W SB
Infrastructure 	Pubtrans heavilyDependent, No Pubtrans, Protective Services	Percent BroadbandAccess

Relevant Resources

The following represent key areas of concern (in order of importance) at the county level:
- **Housing**
The resources below have been extracted from the Disaster Planning Library to facilitate planning for high-risk areas observed through the assessment. Please go through the following tools as a starting point for your planning process and feel free to search the Disaster Planning Library for further information, if required. The resources here are included to facilitate the process of hazard mitigation planning, through the Planning for a Purpose Model of Illinois Extension (see Toolkit).

Housing

Buildings and Codes

- **Partial Implementation Of The Federal Flood Risk Management Standard For Hazard Mitigation Assistance Programs (Interim)**
  Organization : FEMA
  Year : 2021
  Document_type : Planning Tool, Policy
  Disasters : Flood
  Abstract : In its Hazard Mitigation Assistance (HMA) programs, the Federal Emergency Management Agency (FEMA) utilizes the American Society of Civil Engineers (ASCE) 24-14,3 or latest edition, to establish minimum design and construction requirements for structure elevation, dry floodproofing, and mitigation reconstruction.4 Under this interim policy, the FFRMS FVA will be utilized to determine the minimum flood protection elevation for certain project types. This interim policy applies to all HMA programs: the Hazard Mitigation Grant Program (HMGP), HMGP Post Fire, Building Resilient Infrastructure and Communities (BRIC), and Flood Mitigation Assistance (FMA).
  Plan_Components : Strategies, Planning Processes

- **Building Codes Toolkit**
  Organization : FEMA
  Year : 2021
  Document_type : Manual for an Local Organization
  Disasters : Tornado, Flood, Extreme Weather, Earthquakes, Wildfires, Soil Erosion/Landslides
  Abstract : The new FEMA Building Science Branch Building Codes Toolkit offers basic guidance and tools to help building owners and occupants learn about building codes and the process of making a building stronger against natural hazards.
  Plan_Components : Strategies, Planning Processes, Funding Mechanisms

- **Building Code And Floodplain Management Administration And Enforcement**
  Organization : FEMA
  Year : 2018
  Document_type : Policy
  Disasters : Tornado, Flood, Extreme Weather, Earthquakes, Wildfires, Man-Made Disasters, Soil Erosion/Landslides
  Abstract : The Disaster Recovery Reform Act of 2018 (DRRA), amended Sections 402 and 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), and authorized FEMA to “provide assistance to state and local governments for building code and floodplain administration and enforcement, including inspections for substantial damage compliance”1 and “base and overtime wages for extra hires to facilitate the implementation and enforcement of adopted building codes for a period of not more than 180 days after the major disaster is declared.”

Plan_Components : Strategies, Funding Mechanisms

- **Building Codes Save: A Nationwide Study**
  Organization : FEMA
  Year : 2020
  Document_type : General Resource/ Foundational Research
  Disasters : Tornado, Flood, Drought, Extreme Weather, Earthquakes, Wildfires, Soil Erosion/Landslides
  Abstract : The findings of the MAT investigations, the magnitude of recent hazard events,
  and the escalating cost of natural disasters together revealed a compelling need to quantify the value of building codes in reducing damage from natural disasters nationwide.
  Plan_Components : Surveys/Assessments

- **Protecting Communities And Saving Money**
  Organization : FEMA
  Year : 2020
  Document_type : General Resource/ Foundational Research
  Disasters : Tornado, Flood, Drought, Extreme Weather, Earthquakes, Wildfires, Soil Erosion/Landslides
  Abstract : One of the most cost-effective ways to safeguard our communities against natural disasters is to adopt and follow hazard-resistant building codes. Not only are casualties reduced, but the cost of building damage is also reduced during a natural disaster. Building codes also help communities get back on their feet faster by minimizing indirect costs such as business interruptions and lost income. A new FEMA study has made the impact of building codes on sustainability clear. The cost of not adopting building codes is too high.
  Plan_Components : Surveys/Assessments, Strategies, Planning Processes, Funding Mechanisms, Case Studies

- **Resilience Toolkit**
  Organization : ICC (International Code Council)
  Year : 2022
  Document_type : Web-based Resource
  Disasters : Tornado, Flood, Drought, Extreme Weather, Earthquakes, Wildfires, Soil Erosion/Landslides
  Abstract : Over the past twenty years communities worldwide have experienced disaster events that have significantly impacted their society, economy, and culture. As populations grow, urban areas expand, and interconnectedness increases, the potential for a disaster event to have deeper and further-reaching consequences also increases. As a result, there is a need to implement measures that increase resilience across the social, organizational, and infrastructural aspects of communities - community resilience.
  Plan_Components : Strategies, Planning Processes

- **Resilience Strategies For Wildfire**
  Organization : Center for Climate and Energy Solutions
  Year : 2018
  Document_type : Planning Tool, Example Ordinances and Codes
  Disasters : Wildfires
  Abstract : The risk of wildfire is expected to grow across the United States due to reduced precipitation in some regions, and higher temperatures caused by climate change. Wildfire has far-reaching impacts that can ripple through communities, regions, watersheds, and ecosystems. This paper overviews a number of adaptation strategies for areas with a projected increase in wildfire conditions. For each strategy, it will discuss design and operation costs, and primary and co-benefits. The paper includes a community case
  study of Austin, Texas, which has used a number of these strategies, and a list of publications and

interactive tools to help communities become more resilient to wildfire
Plan_Components : Strategies, Planning Processes, Case Studies, Tools, Information

- **Tornado Risks And Hazards In The Midwest United States**
  Organization : FEMA
  Year : 2007
  Document_type : General Resource/ Foundational Research, Planning Tool
  Disasters : Tornado
  Abstract : The purpose of this Tornado Recovery Advisory (RA) is to summarize facts about the Midwest tornado hazard, specifically the area served by FEMA Region VII. Region VII includes Iowa, Kansas, Missouri, and Nebraska. The general population, specifically homeowners and renters, policy makers, local officials, builders, and building officials know and understand
  that tornado occurrence in the Midwest is not a rare event. In fact, more than half of the 20 states with the highest frequency of tornado occurrence on record, and 4 of the top 5 (Texas, Oklahoma, Kansas, and Nebraska) are located in the Midwest
  Plan_Components : Surveys/Assessments, Strategies, Tools, Information

- **Tornado Protection Selecting Refuge Areas In Buildings**
  Organization : FEMA
  Year : 2009
  Document_type : Manual for an Local Organization
  Disasters : Tornado
  Abstract : The guidance presented in this booklet is intended primarily to help
  building administrators, architects, and engineers select the best available
  refuge areas in existing schools. Building administrators, architects, and
  engineers are encouraged to apply this guidance so that the number of
  injuries and deaths will be minimized if a tornado strikes an occupied
  school
  Plan_Components : Strategies, Planning Processes, Case Studies, Tools, Information

- **Sustainable Land Development Code City Of Greensburg, Kansas**
  Organization : GREENSBURG PLANNING COMMISSION
  Year : 2011
  Document_type : Example Ordinances and Codes
  Disasters : Tornado, Flood, Soil Erosion/Landslides, Agricultural Disasters
  Abstract : City code for Greensburg, Kansas. The small rural town is a unique example in which the entire town was destroyed by a tornado. This gave leeway for a complete reimagination of the town and code, building a sustainable and resilient community from the ground up.
  Plan_Components : Strategies, Tools, Green Infrastructure, Information

- **Code Of Ordinances Village Of Thomasboro, Illinois**
  Organization : Order of the Board of Trustees, Village of Thomasboro
  Document_type : Example Ordinances and Codes
  Disasters : Tornado, Flood, Drought, Extreme Weather, Earthquakes, Man-Made Disasters
  Abstract : Code of Ordinances for a small rural town in Illinois.
  Plan_Components : Strategies, Funding Mechanisms, Information

- **State Of Illinois Illinois Department Of Natural Resources Model Stormwater Management Ordinance**
  Organization : Illinois Department of Natural Resources
  Year : 2015
  Document_type : Planning Tool, Manual for an Local Organization, Policy
  Disasters : Flood, Drought, Extreme Weather, Soil Erosion/Landslides
  Abstract : In June 2015, the Illinois Department of Natural Resources, Office of Water Resources

(IDNR/OWR) issued a report for the Urban Flooding Awareness Act. The report recognizes that combating the damages of urban flooding requires a coordinated approach from state and local governments. A critical component in that effort is for local governmental entities to adopt sound, comprehensive stormwater management ordinances that incorporate best practices. To that end, IDNR/OWR and the Illinois State Water Survey (ISWS) developed this Model Stormwater Management Ordinance as a
resource for counties and municipalities to use when drafting or revising their own stormwater ordinances. While local development, review, and approval processes are unique, IDNR/OWR provides this document as a template containing the minimum requirements for an effective ordinance and suggestions for more advanced stormwater protection
Plan_Components : Tools, Green Infrastructure, Information

- **Zoning And Disaster Recovery**
  Organization : American Planning Association
  Year : 2021
  Document_type : General Resource/ Foundational Research
  Disasters : Tornado, Flood, Extreme Weather, Earthquakes, Man-Made Disasters, Soil Erosion/Landslides
  Abstract : What if substantial portions of your community were suddenly and severely damaged by a catastrophic flood, earthquake, industrial accident, or other disaster? What role would the local planning agency play in the rebuilding and recovery process? What challenges would you face as you attempted to help residents and business owners rebuild their lives and livelihoods? How effective would your efforts be?

An effective recovery process means more than merely rebuilding what existed before. Disasters also provide important opportunities for proactive planning in which the community emerges more resilient to subsequent hazard events. This opportunity is fleeting, and local policies and ordinances like the zoning code can either facilitate or impede effective and resilient recovery.

This issue of Zoning Practice summarizes some of the zoning-related challenges planners face in post-disaster situations, discusses how communities might think about preparing now for future disasters, and highlights what other communities have achieved by modifying zoning procedures and standards.
Plan_Components : Strategies, Information

Floods and Disaster Mitigation

- **Partial Implementation Of The Federal Flood Risk Management Standard For Hazard Mitigation Assistance Programs (Interim)**
  Organization : FEMA
  Year : 2021
  Document_type : Planning Tool, Policy
  Disasters : Flood
  Abstract : In its Hazard Mitigation Assistance (HMA) programs, the Federal Emergency Management Agency (FEMA) utilizes the American Society of Civil Engineers (ASCE) 24-14,3 or latest
  edition, to establish minimum design and construction requirements for structure elevation, dry floodproofing, and mitigation reconstruction.4 Under this interim policy, the FFRMS FVA will be utilized to determine the minimum flood protection elevation for certain project types. This interim policy applies to all HMA programs: the Hazard Mitigation Grant Program (HMGP), HMGP Post Fire, Building Resilient Infrastructure and Communities (BRIC), and Flood Mitigation Assistance (FMA).
  Plan_Components : Strategies, Planning Processes

- **Building Codes Toolkit**
  Organization : FEMA

Year : 2021
Document_type : Manual for an Local Organization
Disasters : Tornado, Flood, Extreme Weather, Earthquakes, Wildfires, Soil Erosion/Landslides
Abstract : The new FEMA Building Science Branch Building Codes Toolkit offers basic guidance and tools to help building owners and occupants learn about building codes and the process of making a building stronger against natural hazards.
Plan_Components : Strategies, Planning Processes, Funding Mechanisms

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Plan_Components : Strategies, Funding Mechanisms

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Plan_Components : Surveys/Assessments, Strategies, Planning Processes, Funding Mechanisms, Case Studies

- **Resilience Toolkit**
Organization : ICC (International Code Council)
Year : 2022
Document_type : Web-based Resource
Disasters : Tornado, Flood, Drought, Extreme Weather, Earthquakes, Wildfires, Soil Erosion/Landslides

Abstract : Over the past twenty years communities worldwide have experienced disaster events that have significantly impacted their society, economy, and culture. As populations grow, urban areas expand, and interconnectedness increases, the potential for a disaster event to have deeper and further-reaching consequences also increases. As a result, there is a need to implement measures that increase resilience across the social, organizational, and infrastructural aspects of communities - community resilience.
Plan_Components : Strategies, Planning Processes

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  Organization : Center for Climate and Energy Solutions
  Year : 2018
  Document_type : Planning Tool, Example Ordinances and Codes
  Disasters : Wildfires
  Abstract : The risk of wildfire is expected to grow across the United States due to reduced precipitation in some regions, and higher temperatures caused by climate change. Wildfire has far-reaching impacts that can ripple through communities, regions, watersheds, and ecosystems. This paper overviews a number of adaptation strategies for areas with a projected increase in wildfire conditions. For each strategy, it will discuss design and operation costs, and primary and co-benefits. The paper includes a community case
  study of Austin, Texas, which has used a number of these strategies, and a list of publications and interactive tools to help communities become more resilient to wildfire
  Plan_Components : Strategies, Planning Processes, Case Studies, Tools, Information

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  Document_type : General Resource/ Foundational Research, Planning Tool
  Disasters : Tornado
  Abstract : The purpose of this Tornado Recovery Advisory (RA) is to summarize facts about the Midwest tornado hazard, specifically the area served by FEMA Region VII. Region VII includes Iowa, Kansas, Missouri, and Nebraska. The general population, specifically homeowners and renters, policy makers, local officials, builders, and building officials know and understand
  that tornado occurrence in the Midwest is not a rare event. In fact, more than half of the 20 states with the highest frequency of tornado occurrence on record, and 4 of the top 5 (Texas, Oklahoma, Kansas, and Nebraska) are located in the Midwest
  Plan_Components : Surveys/Assessments, Strategies, Tools, Information

- **Tornado Protection Selecting Refuge Areas In Buildings**
  Organization : FEMA
  Year : 2009
  Document_type : Manual for an Local Organization
  Disasters : Tornado
  Abstract : The guidance presented in this booklet is intended primarily to help
  building administrators, architects, and engineers select the best available
  refuge areas in existing schools. Building administrators, architects, and
  engineers are encouraged to apply this guidance so that the number of
  injuries and deaths will be minimized if a tornado strikes an occupied
  school
  Plan_Components : Strategies, Planning Processes, Case Studies, Tools, Information

- **Sustainable Land Development Code City Of Greensburg, Kansas**
  Organization : GREENSBURG PLANNING COMMISSION
  Year : 2011
  Document_type : Example Ordinances and Codes

Disasters : Tornado, Flood, Soil Erosion/Landslides, Agricultural Disasters
Abstract : City code for Greensburg, Kansas. The small rural town is a unique example in which the entire town was destroyed by a tornado. This gave leeway for a complete reimagination of the town and code, building a sustainable and resilient community from the ground up.
Plan_Components : Strategies, Tools, Green Infrastructure, Information

- **Code Of Ordinances Village Of Thomasboro, Illinois**
  Organization : Order of the Board of Trustees, Village of Thomasboro
  Document_type : Example Ordinances and Codes
  Disasters : Tornado, Flood, Drought, Extreme Weather, Earthquakes, Man-Made Disasters
  Abstract : Code of Ordinances for a small rural town in Illinois.
  Plan_Components : Strategies, Funding Mechanisms, Information

- **State Of Illinois Illinois Department Of Natural Resources Model Stormwater Management Ordinance**
  Organization : Illinois Department of Natural Resources
  Year : 2015
  Document_type : Planning Tool, Manual for an Local Organization, Policy
  Disasters : Flood, Drought, Extreme Weather, Soil Erosion/Landslides
  Abstract : In June 2015, the Illinois Department of Natural Resources, Office of Water Resources (IDNR/OWR) issued a report for the Urban Flooding Awareness Act. The report recognizes that combating the damages of urban flooding requires a coordinated approach from state and local governments. A critical component in that effort is for local governmental entities to adopt sound, comprehensive stormwater management ordinances that incorporate best practices. To that end, IDNR/OWR and the Illinois State Water Survey (ISWS) developed this Model Stormwater Management Ordinance as a
  resource for counties and municipalities to use when drafting or revising their own stormwater ordinances. While local development, review, and approval processes are unique, IDNR/OWR provides this document as a template containing the minimum requirements for an effective ordinance and suggestions for more advanced stormwater protection
  Plan_Components : Tools, Green Infrastructure, Information

- **Zoning And Disaster Recovery**
  Organization : American Planning Association
  Year : 2021
  Document_type : General Resource/ Foundational Research
  Disasters : Tornado, Flood, Extreme Weather, Earthquakes, Man-Made Disasters, Soil Erosion/Landslides
  Abstract : What if substantial portions of your community were suddenly and severely damaged by a catastrophic flood, earthquake, industrial accident, or other disaster? What role would the local planning agency play in the rebuilding and recovery process? What challenges would you face as you attempted to help residents and business owners rebuild their lives and livelihoods? How effective would your efforts be?

An effective recovery process means more than merely rebuilding what existed before. Disasters also provide important opportunities for proactive planning in which the community emerges more resilient to subsequent hazard events. This opportunity is fleeting, and local policies and ordinances like the zoning code can either facilitate or impede effective and resilient recovery.

This issue of Zoning Practice summarizes some of the zoning-related challenges planners face in post-disaster situations, discusses how communities might think about preparing now for future disasters, and highlights what other communities have achieved by modifying zoning procedures and standards.
Plan_Components : Strategies, Information

Appendix A

Interpretation of High Risk and Low Risk Areas at County Level

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Population	Total Population	A small number of people will be affected by a disaster	A large number of persons will be affected by the disaster	High
Young_percent	Percentage of Young Persons	A small percentage of children would mean less vulnerability to disasters	A large percentage of children would indicate a greater vulnerability to disasters	Moderate
Old_percent	Percentage of Elders**	A lower percentage population of elders indicates a lower vulnerability.	A higher percentage of elder population indicates a greater vulnerability, owing to physical infirmities, functional limitations and care needs.	Low
NonWhite_Percent	Percentage of Non-White Popula-tion**Minority Populations, add Hispanic Population	A lower population of ethnic minorities might indicate a less diverse population. However, in case of disaster vulnerability, a lower population of racial minorities has been represented as a lower vulnerability, owing to its correlations with poverty and health care outcomes.	Race and ethnicity are highly correlated with poverty and thus often with health outcomes. Owing to historical, systemic and structural barriers, racial minorities are often more susceptible to disasters and often lack the support mechanisms required to cope. As a result, a higher population of racial or ethnic minorities might (in conjunction with income, poverty, employment, education and other indicators) represent a greater vulnerability.	High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Females_Percent	Percentage of Females	A good percentage of women represent a stable sex ratio for the area and is therefore a positive indicator	A low percentage of women could indicate an unstable sex ratio, thereby showing that there are fewer opportunities for women in the area. This could have negative consequences during a disaster	High
NotMarried_Percent	Percentage of Unmarried Persons	A lower percentage of unmarried individuals could indicate a lower vulnerability to disasters owing to the availability of social support that comes with having a family	A higher percentage of unmarried individuals could indicate lack of family and social support.	High
Disabled_Percent	Percentage of Disabled Persons	A lower percentage of disabled individuals in the community indicates a lower risk owing to reduced requirements for preparation, disaster and accessibility planning	A higher percentage of disabled individuals is associated with a high risk. They are disproportionately affected owing to inaccessible evacuation, response and recovery efforts and could often be left behind.	High
FemaleHeaded_HHs_Percent	Percentage of Households with Female Householder	A lower percentage of female headed households indicates a lower disaster risk, a more stable family and household structure, greater social integration and family support, and higher socio-economic status at the community level	A higher percentage of female headed households could indicate a higher disaster risk owing to greater chances of poverty, and particular risk from housing shocks and stresses, hunger and food insecurity owing to gender discrimination	Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
LargeFam_Percent	Percentage of Large Families as part of all Families	In case of smaller family sizes, a greater investment of the family's resources is possible leading to greater achievements. Therefore a smaller proportion of big families is a reduced social vulnerability during disasters	In case of large families, the same limited resources are shared by a large group of individuals owing to less investment per person. This can result in differential academic achievements and occupational performance. Thus prevalence of a bigger family size would indicate a higher disaster risk.	High
SingleParent_Percent	Percentage of Single Parent Households	A lower proportion of single parent households indicates a lower disaster vulnerability, owing to lesser probability of financial, academic and behavioural problems which have been correlated with single parent households.	Children living in single-parent households have greater risks to their physical and social health and wellbeing compared with other family structures such as two parent or grandparent headed households. Thus, a greater proprotion of single parent households represents a higher disaster risk	High
Educated_percent	Percentage of Educated Persons	A greater person of educated individuals is interpreted as low disaster risk	Lack of education is associated with social marginalization, lack of preparation and disaster planning. Therefore a lower percentage of educated individuals is interpreted as high risk.	Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Skilled_Percent	Percentage of Skilled Persons	A higher number of skilled individuals represents a lower disaster risk	Lack of occupational skill is associated with lower incomes and employment benefits and therefore less resources for disaster recovery. Therefore, a lower percentage of skilled workers indicates a greater disaster risk.	Very Low
Elderly_growth_percent	Growth Percent of Elderly Population	A lower percentage of older adults represents a lower disaster risk.	Older adults are more vulnerable to dosaster risks owing to functional problems, health and medication concerns. A greater percentage of older adults represents a higher risk.	High
Working_Nonworking_ratio	Ratio of Working to Non-working Population	A high ratio indicates lower risk	This ratio indocates the amount of labor resources available in the market, and signals unemployment, income and other economic factors. A low ratio indicates a lower economic resilience to market shocks and is therefore high risk.	High
HelperPool	Percentage of Helpers in a time of crisis	A higher proportion of helpers indicates a lower risk, since a greater number of persons will be available for disaster recovery and mitigation efforts.	A goood number of participants in the helper pool could indicate greater support and emergency management in the community. A lower percentage of helpers represents a high risk.	Moderate

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Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
FemaleLaborforce_percent	Percentage of Labor Force constituted by Women	A higher particpation of females in the workforce indicates increased incomes, and lowers or leads to sharing of unpaid care-work with other members of the family, leading to a more economically resilient community. Thus a higher female workforce particpation indicates a low disaster risk	A lower particpation of women in the labour force is associated with lower household incomes and poverty. Therefore a lower female workforce particpation means a higher disaster risk owing to lower economic support.	Moderate
PrimeWorkingAge_percent	Percentage of population in Prime Working Age	A greater number of persons of working age indicates a greater labour pool available for the local economy. Therefore a higher ratio indicates a lower risk.	A lower number of persons of working age represents a greater number of dependents on the existing workfore and is hence a high risk.	High
Avg_HHsize	Average Household Size	A smaller average household size indicates a greater proportion ofhousehold resources available to every individual in the household and is therefore a lower risk	Household sizes relate with the distribution of resources among individuals with the household. A greater average household size indicates a lesser proprotion of resources available to individuals and is therefore interpreted as a high risk	Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Percent_BachelorsDegree	Percentage of Population with Bachelors' Degree	A greater proportion of persons with bachelors' degree indicates a greater likelihood of being employed by a variety of employers, along with a higher concentration of high skilled high income positions. Therefore it is interpreted as a lowrisk	A lower porportion of persons with a bachelor's degree indicates a lower number of persons with skills for career advancement. It indicates lack of skilled labour in the workforce and tehrefore lower incomes and social mobility. Therefore it is interpreted as a high risk factor	Low
Percent_LanguageBarrier	Percentage of Population facing Language Barrier	A lower proportion of persons with language problems indicates greater accessibility to disaster relief efforts and is therefore an area of lowe risk	A higher proportion of persons with language barriers could indicate a higher percentage of people suffering due to communication problems, interpretation of instructions and emergency rescue operations. Therefore it is interpreted as a high risk	Moderate
Percent_AssistanceNeed	Percentage of Population with Assisstance Need	A lower percentage of people withfood assistance indicates higher incomes and economic resilience, and is therefore a low risk area	A high proportion of persons with assistance needs indicates poverty and lack of socio-economic resilience. Therefore it is interpreted as a high risk.	Moderate

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Percent_Commuters	Percentage of Population who Commute to work regularly	A lower percentage of commuters indicates that most workers live near where they work and can continue their jobs irrespective of transportation network disruptions. Therefore it is an area of low risk	Natural disasters invariably affect transportation routes and make it difficult for persons requiring commutes to their workplace to continue their employment. Therefore a greater proportion of commuters indicates a disaster risk	High
Percent_NoHealthIns	Percentage of Population without Health Insurance	Greater health insurance coverage is correlated with better health conditions and higher economic productivity. Therefore a higher number of persons with health insurance is a low risk	Lack of health insurance coverage has negative impacts on health as patients are less likely to receive preventive health care, or affordable medical care during a disaster. A greater proportion of persons without health insurance indicates a higher disaster risk.	High
Physically_UnhealthyDays	Average number of physically unhealthy days per year for the population	A Lower value is associated with low risk	A higher value is associated with high risk because people are more prone to being affected by disaster risks	Moderate
Food_Environment_Index	Index of factors that contribute to a healthy food environment, from 0 (worst) to 10 (best).	A higher value is associated is low risk	A poor food environment reduces the physical and mental vitality of a community. A lower value is associated with high risk.	Very High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Percent_Exercise_Access	Percentage of population with adequate access to locations for physical activity.	A higher value is associated is low risk	Lower physical exercise increases health risks with age. A lower value is associated with high risk	Low
PrimaryCare_Physicians_Rate	Ratio of population to primary care physicians.	A higher value is associated is low risk	A lower proportion of physicians indicates that community members may not have access to medical help during disasters and have to rely on external support. A lower value is associated with high risk	Very Low
MentalHealth_Providers_Rate	Ratio of population to mental health providers.	A higher value is associated is low risk	A lower proportion of physicians indicates that community members may not have access to mental health resources during disasters. A lower value is associated with high risk	Low
Percent_Vaccinated	Percentage of Households vaccinated against Covid-19 and other diseases	A higher value is associated is low risk	A high proportion of vaccination indicates that the community is safe against the Covid-19 pandemic. A lower value is associated with high risk	High
Social_Association_Rate	Number of membership associations per 10,000 population.	A higher value is associated is low risk	A high rate of social associations indicates healthy relationships and community life. A lower value is associated with high risk	Very Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Violent_Crime_Rate	Number of reported violent crime offenses per 100,000 population.	A Lower value is associated with low risk	A high of crimes indicates safety issues within the community. A higher value is associated with high risk	Very Low
Inadequate_Facilities	Percentage of households with inadequate infrastructure within their housing unit	A Lower value is associated with low risk	Inadequate infrastructure within the household lowers quality of life and residents' health. A higher value is associated with high risk	Low
COVID-19_death_rate	All deaths occurring between January 1, 2020 and December 31, 2020 due to COVID-19, per 100,000 population (age-adjusted).	A Lower value is associated with low risk	A greater number of deaths owing to Covid-19 indicates pre-existing health conditions and comorbidities within the community. A higher value is associated with high risk	Moderate
Percent_Food_Insecure	Percentage of population who lack adequate access to food.	A Lower value is associated with low risk	Access to food indicates community health. A higher value is associated with high risk	High
Percent_Limited_Access_to_Healthy_Foods	Percentage of population who are low-income and do not live close to a grocery store.	A Lower value is associated with low risk	Persons who are low income lack access to healthy food, especially if they live away from grocery stores and lack transportation. A higher value is associated with high risk	Very High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Percent_Disconnected_Youth	Percentage of teens and young adults ages 16-19 who are neither working nor in school.	A Lower value is associated with low risk	Teens and young adults need to either be in school, or part of the workforce, to be able to cultivate a healthy, self-sufficient lifestyle, involved hopeful and forward looking endeavours. Disconnected youth have been positively associated with poverty, unempoyment and crime. A higher value is associated with high risk	Very Low
Percent_rural	Percentage of population living in rural areas	A Lower value is associated with low risk	Rural areas often lack access to resources and are geogrpahically isolated. A higher value is associated with high risk	Low
Agro_Percent	Percentage Employment in Agriculture and related Sectors	A lower percentage of workers in the agricultural sector indicates a greater economic diversity, lower dependence on weather conditions, higher resilience and lower risk	Agricultural sector is most directly affected by natural disasters and extreme weather events such that their productivity goes down drastically. Therefore a predominantly agrarian economy represents lower economic resilience and greater disaster risk	Moderate

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
LowIncome_Percent	Percentage Low Income Population	A lower proportion of low income families indicates a greater access to resources for preparation and recovery from disasters and is hence a low disaster risk	A higher proportion of low income households lack of adequate access to resources to prepare for and recover from disasters, contingency funds, personal vehicles and abilities to arrange for alternate housing arrangements during disasters. It is therefore a high risk.	High
poverty	Percentage Below Poverty Line	A lower poverty indicates less exposure to disaster risks and greater accessibility to exigency funds. It is therefore a low risk	Poverty can be both a cause and consequence of disaster risk. A greater poverty is associated with a higher risk	Moderate
Unemployment_percent	Percentage of Unemployed Persons	A lower rate of unemployment indicates a more stable and resilient economic environment and is therefore associated with lower disaster risks	A high rate of unemployment could indicate a range of socio-economic vulnerabilities and political struggles. It indicates lower economic resilience during disasters and is therefore associated with high risk	High
WorkNearby_percent	Percentage Workers who live near their place of work	A greater proportion of persons who live near their place of work indicates a lower dependence on commute and transportation networks and a more robust resilient economy. Therefore it is a low risk	A lower proprotion of persons who live near their place of work indicates a high dependence on transportation networks for economic activities and a greater risk of disruption during disasters. It is therefore a high risk	Low

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Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
MBS	Percentage Employed in Management, Business and Science Occupations	Management, Business and Science jobs are invariably correlated with greater incomes, social mobility and lower dependence on place-based work. Therefore they are more resilient during disasters and higher employment in these sector represent lower risks	A lower proportion of employees in Management, Business and Science professions indicates lower incomes and a low skill economy and is therefore indicative of higher disaster risks	Low
MBS_LQ	Location Quaotient of Managemnt, Business and Science Occupations	A high Location Quotient for Management, Business and Science professions indicates a more specialized, high income economy. It is indicative of low disaster risk	A low LQ for Management, Business and Science professions indicates a less specialized economy and is therefore indicative of lower economic diversity, lower incomes and high risk	Moderate
Service	Percentage Employed in Service	Service sector is a huge contributor to the economic productivity and bolsters the primary and secondary economic sectors as well and provides a huge source of employment. A higher employment in the service sector signals greater economic resilience and lower risk.	A lower proportion of workers in the service sector indicates a less developed and resilient economy with greater dependence on place-based work. It is therefore an area of high risk.	Low
Service_LQ	Location Quotient of Service Occupations	A higher LQ for the service sector indicates a high risk	A lower LQ for the service sector indicates a lower resilience and higher risk	Very High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Sales	Percentage Employed in Sales Occupations	Employment in sales is associated with higher pay greater skills and organizational support. It signals greater economic resilience and low risk	A lower employment in sales industries could indicate a less entrepreneurial economy, lower resilience and therefore higher disaster risk	Low
Sales_LQ	Location Quotient of Service Occupations	A higher LQ for the service sector indicates a low risk	A lower LQ for sales industries is associated with high risk	Very High
construction	Percentage Employed in Construction Occupations	Construction and allied industries represent possibilities for robust economic growth and government investment. A greater employment in the construction industry also signals potential for development of local infrastrcuture. A higher employment in this sector is therefore a low risk	Lower employment in the construction sector indicates lower investment in built environment and infrastructure and high disaster risks	Low
construction_LQ	Location Quotient of Construction Occupations	A higher LQ for the construction industry indicates a low disaster risk	A lower LQ for the construction industry indictes a high disaster risk	High
PT	Percentage Employed in Production and Trans-portation Occupations	A lower concentration of production and transportation industries indicates a lower dependence of the economic base on land, location and natural resources. It is therefore more economically resilient and a low risk	Both production and transportation industries are dependent on avaibality of local natural resources and are therefore more susceptible to natural disasters. A higher employment in such industries signals greater disater risk.	High

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Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
PT_LQ	Location Quotient of Production and Transportation Occupations	A lower concentration of the production and transportation idnustry indicates a low risk	A higher LQ for the Production and Transportation Industry indicates a high risk	Low
Agri	Percentage Employed in Agricultural Occupations	A lower percentage of workers in the agricultural sector indicates a greater economic diversity, lower dependence on weather conditions, higher resilience and lower risk	Agricultural sector is most directly affected by natural disasters and extreme weather events such that their productivity goes down drastically. Therefore a predominantly agrarian economy represents lower economic resilience and greater disaster risk	High
Agri_LQ	Location Quotient of Agricultural Occupations	A lower LQ for the Agricultural Sector indicates a low risk	A higher LQ for Agricultural Businesses indicates a higher risk	Moderate
Manufacturing	Percentage Employed in Manufacturing Occupations	A lower concentration of manufacturing industries/employment indicates lower chances of disruption during disasters. It is therefore an area of low risk	Manufacturing industries are directly affected by natural disasters. Extreme events cause great damage to the manufacturing units and their associated supply chains. A higher concentration of Manufacturing Industries is associated with high risk	High
Manufacturing_LQ	Location Quotient of Manufacturing Occupations	A lower LQ for manufacturing industries indicates a low risk	A higher LQ for manufacturing industries indicates a high risk	High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Wholesale	Percentage Employed in Wholesale Trade	A lower employment in wholesale businesses signals a greater economic resilience and low risk	Wholesale and retail businesses are more vulnerable to natural disasters and are more likely to close after disasters. They are also more likely to be low mitigators. A higher proportion of employment in the wholesale industry signals a high disaster risk	High
Wholesale_LQ	Location Quotient of Wholesale Trade Occupations	A lower LQ in wholesale industries is associated with low risk	A higher LQ is wholesale industries is associated with high risk	Low
Retail	Percentage Employed in Retail Occupations	Although prone to natural disasters, retail industries generally show a higher resilience to natural disasters than wholesale industries. This is because they are less likely to be low mitigators and often associated with having a plan unlike wholesale industries. Thus a higher employment in retail industries is associated with low risk.	A lower employment in retail industries signals lower economic resilience and is associated with higher risk	Low
Retail_LQ	Location Quotient of Retail Occupations	A higher LQ in retail industries is associated with low risk	A lower LQ in retail industries is associated with high risk	Moderate

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Transport	Percentage Employed in Transportation Occupations	Like retail, transportation businesses are often associated with having business plans, more structurally sound and meets standards. Thus a higher employment in transportation indicates a low risk	A lower employment in transportation business could mean that the businesses are not widely spread out and less economically resilient. It is interpreted as a high risk.	Low
Transport_LQ	Location Quotient of Transportation Occupations	A higher LQ in transportation industries is associated with low risk	A lower LQ in transportation industries associated with high risk	Low
Info	Percentage Employed in Information-based Occupations	Information industries are positively associated with mitigation planning and have the ability to shift to remote working during a disaster. Therefore, such a higher employment in such industries poses a low risk	A lower employment in infirmation industries signals a less diverse economic base and a higher susceptibility to natural disasters. It is therefore associated with higher disaster risks	Low
Info_LQ	Location Quotient of Information-based Occupations	A lower LQ in the information sector signals a low risk	A lower LQ in information sector signals a high risk	Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Finance	Percentage Employed in Finance Occupations	Finance, realestate, etc. jobs are positively correlated with high incomes, job security and high economic resilience during disasters. Therefore a greater employment ins uch industries poses a low risk and indicates a diverse economic base. A higher employment in such industries is associated with a low risk	A lower employment in finance, real estate etc. signals lower incomes and less resilient jobs. Therefore, a lower employment in this sector is associated with high risk	Low
Finance_LQ	Location Quotient of Finance Occupations	A high LQ in finance, real estate, etc. signals a low risk	A low LQ in finance, real estate, etc. signals a high risk	Low
Management	Percentage Employed in Management Occupations	Management, Business and Science jobs are invariably correlated with greater incomes, social mobility and lower dependence on place-based work. Therefore they are more resilient during disasters and higher employment in these sector represent lower risks	A lower proportion of employees in Management, Business and Science professions indicates lower incomes and a low skill economy and is therefore indicative of higher disaster risks	High
Management_LQ	Location Quotient of Management Occupations	A higher LQ in management, business, or science indicates a low risk	A lower LQ in Management, business or science indicates a high risk	High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Edu	Percentage Employed in Education-related Occupations	A higher employment in the education sector signals a more skilled economy, which is typically more resilient to natural disasters. It is therefore a low risk	A lower employment in the education sector signals a less resilient, less skilled economy, and is therefore associated with high risk	Very Low
Edu_LQ	Location Quotient of Education-related Occupations	A high LQ in the education sector signals a higher economic resilience and low risk	A lower LQ in education sector signals a lower economic resilience and high risk	Low
Arts	Percentage Employed in Arts Occupations	A lower employment in the arts sector could indicate higher resilience to economic shocks and higher incomes and is therefore associated with lower risk	Although a higher proportionof artists could signal a greater economic diversity, arts occupations are highly susceptible to natural disasters. Therefore a greater employment in arts industries could signal a higher disaster risk.	High
Arts_LQ	Location Quotient of Arts Occupations	A low LQ in the arts sector is associated with low risk	A high LQ in the arts sector is associated with higher risk	Low
Others	Percentage Employed in Other Occupations	Employment across other sectors represents diversification of the economic base and is therefore positively correlated with economic resilience. It is therefore a low risk	A lower employment in other sectors represents a less diverse and creative economy. It is therefore associated with high risks	Moderate
Others_LQ	Location Quotient of Other Occupations	A higher LQ in other industries is associated with low risk	A lower LQ in other industries is associated with high risk	High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
CommuteTime	Time it takes from home to go to work in minutes	A Lower value is associated with low risk	Time spent in commute is associated with lack of productivity and extra expenses. A lower commute time is assocatied with a health local economy. A higher value is associated with high risk	Moderate
Walkability_Score	Walkability score (ordinal)	A higher value is associated is low risk	High walkability scores indicate greater community vitality and economic accessibility. A lower value is associated with high risk	Low
Vice_related_business_rate	Rate of vice-related businesses per county as proportion of total businesses	A Lower value is associated with low risk	Greater proportion of vice-related business indicate hightened economic instability during disasters. A higher value is associated with high risk	Low
Civic_related_business_rate	Rate of civic-related business per county	A higher value is associated is low risk	Civic-related businesses indicate a strong, built-environment and development industry. A lower value is associated with high risk	Very Low
Education_related_business_rate	Rate of education-related business per county	A higher value is associated is low risk	Education-related businesses enable a community to obtain access to education and child development resources. A lower value is associated with high risk	Very Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Healthcare_related_business_rate	Ratio of healthcare-related businesses per county	A higher value is associated is low risk	Availability of health care businesses indicate access to medical resources during disasters. A lower value is associated with high risk	High
Recreation_related_business_rate	Ratio of recreation-related businesses per county	A lower value is associated with low risk	Greater proportion of recreation-related business indicate hightened economic instability during disasters. A higher value is associated with high risk	High
Total	Total Housing Stock	A lower number of housing units indicates less damage during a disaster and is associated with low risk	A higher number of housing units indicates the possibility of greater risk during disasters	High
Homewownership	Perecentage Homewowners	A higher percentage of homeownership is associated with greater income and family stability and greater access to relief during a disaster. It is therefore a low risk	A lower percentage of homeownership signals lower incomes and support during disasters. It is therefore a higher risk.	High
OldHomes	Percentage of Old Homes as part of Total Housing Stock	A lower proportion of old homes signals new construction that is more structurally resilient to natural disasters. It is therefore associated with low disaster risk	A higher proportion of houses that are built more than 30 years ago signals an old housing stock in need of repair and reconstruction. It is therefore associated with high disaster risk.	Very Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
NewHomes	Percentage of New Homes as part of Total Housing Stock	A higher proprotion of new homes indicates a greater structural resilience to natural disasters and is associated with a low risk	A lower porportion of new homes indicates the possibility of greater structural damage during disasters. It is therefore associated with a high risk	Very Low
Rented	Percentage Renters	A lower proportion of renters signals greater homeownership, higher incomes and access to resources. This is therefore an area of low risk	Renters are associated with higher vulnerability during disasters owing to lower incomes, and lesser accessibility to disaster relief. A high proportion of renters is therefore associated with a higher risk	Very High
Vacancy	Percentage Vacant Units	A lower proportion of vacant units signals greater utilization of available built environment resources, greater maintenance and lower probability of structural damage. It is therefore associated with low risk	A high proportion of vacant units signals a weak economic base and possibilities of blight and structural damage. It is therefore associated with a high risk	Low
Units_SingleFamily	Percentage of Single Family Units	A lower porportion of single family units signals greater housing mix, affordability and greater housing resilience. It is therefore associated with low risk	A greater proportion of single family homes signals lesser housing diversity and therefore higher risks for low income populations. It is associated with higher risk	Low
MobileHomes	Percentage of Mobile Homes as part of Total Housing Stock	A lower proportion of mobile homes indicates greater structural resilience of the housing sector and more stable economy	A greater proportion of mobile homes is associated with greater risk owing to structural problems and lower incomes.	High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Overcrowding	Percentage of Overcrowded Homes as part of Total Housing Stock	A lower proportion of vercrowded units signals higher incomes and well-maintained, structurally sound housing units which are resilient to disasters. It is therefore associated with low risk	In an overcrowded housing unit, available resources are distributed among a higher than average number of individuals which could lead to familial, socio-economic and structural inadequacies over a period of time. It is therefore associated with high risk.	Very Low
Rental_Overcrowding	Percentage of Rental Units that are Overcrowded	A lower proportion of overcrowded rental units indicates a more affordable rental housing stock, and a more resilient rental population. It is a low risk	A higher proportion of rental units which are overcrowded signals lower incomes, structural and maintenance issues associated with the rental housing stock. It indicates that the rental stock is inadequate and unaffordable and is therefore associated with high risk	Low
Cost_IncomeRatio	Ratio of Housing Cost to Household Income	A lower cost to income ratio indicates that households are successfully able to meet their financial demands and are more resilient to disasters. It is therefore a low risk.	A higher cost to income ratio indicates that households are unable to meet their financial needs and are more likely to suffer adversely during disasters. It is therefore associated with high risk.	High

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
Renters_Cost_Income_Ratio	Ratio of Renter Housing Cost to Household Income	A lower cost to income ratio for renters indicates that rental households are successfully able to meet their financial demands and are more resilient to disasters. It is therefore a low risk.	A higher cost to income ratio for renters indicates that rental households are unable to meet their financial needs and are more likely to suffer adversely during disasters. It is therefore associated with high risk.	Low
Rental_CostBurden_Below20000	Housing Cost Burden on renters whose incomes are below 20,000 USD	A lower proportion of cost-burdened low income households indicates greater economic resilience among low-income renters. This is an asset during natural disasters and is a low risk area	A higher proportion of low income rental households who are housing cost burdened signals a higher concentration of highly vulnerable households in the community. This is an area of high risk, structurally, financially and socially	High
Renter_MHHI	Monthly Household Income of Renters	A higher income indicates greater capacity to cope with disasters. It is therefore associated with low risk.	A lower income indicates a lower capacity to cope with disasters and is associated with high risk	Moderate
MedianHomeValue	Median Home Value	A higher home value indicates higher incomes, higher accessibility to funds during disaster and is therefore associated with low risk	A lower home value indicates lower incomes and is therefore associated with high risk	Low
NoVehicle_Pop	Percentage of Households without a Vehicle	A lower percentage of households without a vehicle indicates greater socio-economic stability within the community and is therefor associated with low risk	Vehicles count as additional economic assets which add to household mobility. A higher percentage of households without a vehicle is therefore associated with a high risk	Low

(continued)

Indicator	Definition	Low Risk Interpretation	High Risk Interpretation	Risk Level
GroupQuarters	Percentage of GroupQuarters as part of Total Housing Stock	A lower concentration of group quarter residents is a low risk owing to greater access to recovery resources and social support	Group quarters consist of unrelated persons sharing a living space, either in institutionalized or non-institutionalized settings. Thus they lack the social support of a family and a high percentage of group quarter population is associated with high risk	Very Low
Percent_Section8	Rate of low-rent + section-eight units in county	A Lower value is associated with low risk	Greater proportion of low income housing indicates poverty and declining housing quality. A higher value is associated with high risk	High

Appendix B

High Risk and Low Risk Areas at Rural, Urban and Census Place Levels

Indicator	Risk Level (Rural)	Risk Level (Urban)	Risk Level (Places)
Population	Very High	Moderate	High
Young_percent	Very Low	Very High	Low
Old_percent	Very High	High	Low
NonWhite_Percent	Very High	Low	Very High
Females_Percent	Very High	Very Low	Very Low
NotMarried_Percent	Very High	Moderate	High
Disabled_Percent	Very High	Very High	Very High
FemaleHeaded_HHs_Percent	Very Low	Moderate	Moderate
LargeFam_Percent	Very Low	Moderate	Low
SingleParent_Percent	High	High	High
Educated_percent	High	High	Moderate
Skilled_Percent	Very Low	Moderate	Low
Elderly_growth_percent	Moderate	Very Low	Low
Working_Nonworking_ratio	Low	Very Low	Very Low
HelperPool	Low	Very Low	Very Low
FemaleLaborforce_percent	Very Low	Moderate	Low
PrimeWorkingAge_percent	Very Low	Moderate	High
Avg_HHsize	Low	Low	Low
Percent_BachelorsDegree	Very Low	Moderate	Low
Percent_LanguageBarrier	Moderate	Very Low	Very Low
Percent_AssistanceNeed	Very High	Low	High
Percent_Commuters	Very Low	Very Low	Very Low
Percent_NoHealthIns	Very High	Very High	Very High
Physically_Unhealthy_Days	Low	Very High	Moderate
Food_Environment_Index	Very High	Very High	Very High
Percent_Exercise_Access	Low	High	Low
PrimaryCare_Physicians_Rate	Very Low	Low	Very Low
MentalHealth_Provider_Rate	Low	Low	Low
Percent_Vaccinated	High	Very High	High
Social_Association_Rate	Very Low	Very Low	Very Low

(continued)

Indicator	Risk Level (Rural)	Risk Level (Urban)	Risk Level (Places)
Violent_Crime_Rate	Very Low	Very Low	Very Low
Inadequate_Facilities	Low	Moderate	Low
COVID-19_death_rate	Moderate	Moderate	Moderate
Percent_Food_Insecure	High	Very High	High
Percent_Limited_Access_to_Healthy_	Very High	Very High	Very High
Percent_Disconnected_Youth	Very Low	Very Low	Very Low
Segregation_index	Moderate	Moderate	Moderate
Percent_rural	Low	Very High	Low
Income	Very Low	Moderate	Moderate
Agro_Percent	Very Low	High	Low
UnstableEmployment_percent	Very High	High	Moderate
LowIncome_Percent	Moderate	Moderate	High
poverty	Very High	Moderate	Moderate
Unemployment_percent	Very High	Very High	High
WorkNearby_percent	Moderate	Moderate	High
MBS	Very Low	Moderate	Moderate
MBS_LQ	High	Very High	Moderate
Service	High	Moderate	Moderate
Service_LQ	Very High	High	Very High
Sales	Moderate	High	Moderate
Sales_LQ	Very High	High	Very High
construction	Very High	Low	Low
construction_LQ	Very High	Low	High
PT	Moderate	Low	Low
PT_LQ	Low	Low	Low
Agri	Very Low	High	Low
Agri_LQ	Very Low	High	Low
Manufacturing	Very High	Moderate	High
Manufacturing_LQ	Low	Moderate	High
Wholesale	High	Low	High
Wholesale_LQ	Low	Low	Low

(continued)

Indicator	Risk Level (Rural)	Risk Level (Urban)	Risk Level (Places)
Retail	Low	Moderate	Low
Retail_LQ	High	High	Moderate
Transport	Low	Moderate	Low
Transport_LQ	Moderate	Moderate	Moderate
Info	Very Low	Low	Moderate
Info_LQ	Moderate	Moderate	Low
Finance	Very Low	High	Low
Finance_LQ	Moderate	Very High	Low
Management	High	Moderate	Low
Management_LQ	Very High	High	Low
Edu	Very Low	Very Low	Moderate
Edu_LQ	Very Low	Very Low	Low
Arts	High	Moderate	High
Arts_LQ	Very Low	Very Low	Low
Others	Very High	High	High
Others_LQ	Very High	Moderate	High
Percent_Children_in_Poverty.x	Low	Very Low	Low
Gender_Pay_Gap.x	Moderate	Moderate	Moderate
Percent_income_required_for_childca	Low	Low	Low
CommuteTime	Moderate	High	Moderate
Walkability_Score	Low	Very Low	Low
Vice_related_business_rate	Low	Moderate	Low
Civic_related_business_rate	Very Low	Very Low	Very Low
Education_related_business_rate	Very Low	Very Low	Very Low
Healthcare_related_business_rate	High	High	High
Recreation_related_business_rate	High	Low	High
Total	Very High	Very High	High
Homewownership	Very Low	Moderate	High
OldHomes	Low	Low	Very Low
NewHomes	Low	Low	Very Low
Rented	Low	Moderate	High
Vacancy	Moderate	High	High

(continued)

Indicator	Risk Level (Rural)	Risk Level (Urban)	Risk Level (Places)
Units_SingleFamily	Moderate	Low	Low
MobileHomes	High	Very High	Very High
Overcrowding	Low	High	Very Low
Rental_Overcrowding	Very Low	Very Low	Very Low
Cost_IncomeRatio	Very High	High	High
Renters_Cost_IncomeRatio	Moderate	Low	Low
Rental_CostBurden_below20000	High	Moderate	Very High
Renter_MHHI	High	High	Very High
MedianHomeValue	Low	High	Low
NoVehicle_Pop	Low	Moderate	Moderate
GroupQuarters	Very Low	Very Low	Very Low
Percent_Children_in_Poverty.y	Low	High	Low
Gender_Pay_Gap.y	Moderate	High	Moderate
Percent_income_required_for_childca	Moderate	High	Moderate
Percent_Section8	High	Very High	High
Pubtrans_Dependent	Low	High	Very Low
Pubtrans_heavilyDependent	Very Low	Moderate	Very Low
No_Pubtrans	High	Low	Very Low
No_CommunicationSources	Very Low	High	High
Protective_Services	Low	Very Low	Very Low
Percent_BroadbandAccess	Moderate	Very High	Moderate
pm10	Low	Low	Moderate
pm25	Low	Low	Low
o3	Very Low	Very Low	Very Low
so2	High	High	Very High
nox	Moderate	High	High
co	Moderate	Moderate	Moderate
PCT_IRRIGATED_ACRES	High	Very High	High
pct_nematode_acres	Very High	Very High	Very High
pct_manure_acres	Very High	High	Very High
pct_disease_acres	Very High	Very High	Very High
pct_defoliate_acres	Very High	High	Very High

(continued)

Indicator	Risk Level (Rural)	Risk Level (Urban)	Risk Level (Places)
pct_harvested_acres	Very High	High	Very High
pct_au	Low	Low	Low
fungicide	Very High	Very High	Very High
herbicide	Very High	High	Very High
insecticide	Very High	Very High	Very High
std_coal_prim_pop	Very Low	Very Low	Very Low
std_metal_prim_pop	Very Low	Very Low	Very Low
std_nonmetal_prim_pop	Low	Moderate	Low
std_sandandgravel_prim_pop	High	Very High	High
std_stone_prim_pop	Moderate	Moderate	Moderate
Radon	Very Low	Very Low	Very Low
Facilities_Rate	High	Low	High
Pct_BS	Low	High	Low
Pct_Unemp_total	Very Low	Low	Very Low
Pct_Fam_Pov	Very Low	Very Low	Very Low
Per_TotPopSS	Very Low	Very Low	Very Low
Per_PSWithSW	Very Low	Very Low	Very Low
D303_Percent	Very Low	Very Low	Very Low
ALLNPDESperKM	Very Low	High	Low
CaAve	Very High	Very High	Very High
Kave	Moderate	High	High
NO3Ave	Very High	Very High	Very High
ClAve	Very Low	Very Low	Very Low
SO4Ave	High	High	High
HgAve	Very Low	Very Low	Very Low
AvgOfD3_ave	Low	Moderate	Low
W_As	High	High	High
W_Ba	Moderate	High	High
W_Cd	Moderate	High	High
W_Cr	Moderate	High	High
W_CN	Moderate	High	Moderate

(continued)

Indicator	Risk Level (Rural)	Risk Level (Urban)	Risk Level (Places)
W_FL	Moderate	High	High
W_HG	Very Low	Very Low	Very Low
W_NO3	High	Very High	High
W_NO2	High	Very High	High
W_SE	Moderate	High	High
W_SB	Moderate	High	Moderate
W_ENDRIN	High	Very High	High
W_METHOXYCHLOR	High	Very High	High
W_DALAPON	Very Low	Very Low	Very Low
W_DEHA	Very Low	Very Low	Very Low
W_SIMAZINE	Very Low	Very Low	Very Low
W_DEHP	High	Very High	High
W_PICLORAM	Very Low	Very Low	Very Low
W_DINOSEB	Very Low	Very Low	Very Low
W_ATRAZINE	Very Low	Low	Very Low
W_24D	Very Low	Very Low	Very Low
W_BENZOAP	High	Very High	High
W_PCP	Very Low	Very Low	Very Low
W_PCB	High	Very High	High
W_DBCP	High	Very High	High
W_EDB	High	Very High	High
W_XYLENES	Low	High	Moderate
W_CHLORDANE	High	Very High	High
W_DCM	Very Low	Very Low	Very Low
County_GEOID_ref	Very Low	Very Low	NA