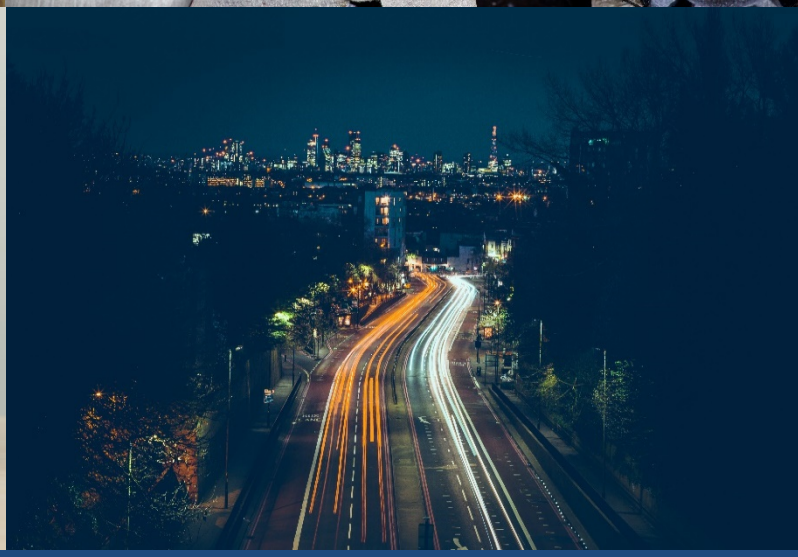

Community Resilience Indicator Analysis:

County-Level Analysis of Commonly Used Indicators From Peer-Reviewed Research

December 2018

Homeland Security

Argonne NATIONAL LABORATORY

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Community Resilience Indicator Analysis:

County-Level Analysis of Commonly Used Indicators from Peer-Reviewed Research

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Argonne National Laboratory's work was supported by the U.S. Department of Homeland Security, Federal Emergency Management Agency, via interagency agreement through U.S. Department of Energy contract DE-AC02-06CH11357.

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Executive Summary

The Federal Emergency Management Agency (FEMA) National Integration Center (NIC) Technical Assistance (TA) Branch tasked Argonne National Laboratory (Argonne) with analyzing current community resilience research to provide a data-driven basis to prioritize locations for TA investment and to inform community resilience TA content. This paper presents Argonne's methodology and findings.

First, the Argonne research team conducted a literature review to identify meta-analyses of peer-reviewed community resilience assessment methodologies published within the past five years, which resulted in six relevant meta-analyses. Next, the research team reviewed the six meta-analyses to catalog each distinct assessment methodology they referenced, ultimately identifying 73 distinct methodologies. Argonne then reviewed these 73 methodologies and retained those that met the following criteria: used a unit of analysis that corresponded to U.S. county-level data, applied to multiple hazards, had a pre-disaster focus, used quantitative measures, used a publicly available methodology, and used publicly available data sources. Applying these criteria narrowed the pool of methodologies to eight.

The research team then identified more than 100 quantitative indicators used within these eight methodologies and selected only those indicators cited in three or more methodologies. This process resulted in 20 indicators, 11 with a population focus and 9 with a community focus. Using common statistical methods and data structuring, the research team created five bins of data for each indicator and produced choropleth maps of the U.S. showing county-level data for each indicator. The analysis of each indicator revealed consistent regional trends across indicators.

Finally, the research team developed a method to aggregate county-level data from all 20 indicators and sorted each U.S. county into five bins. Using this aggregated data, Argonne created the "Aggregated Commonly Used Community Resilience Indicators" choropleth map. This analysis identified 30 counties in the lowest bin that are facing the greatest challenges to resilience, with 16 of these counties in Puerto Rico. A total of 302 counties sorted into the next bin. Many counties in this category are also within Puerto Rico, while others are primarily within the southeast and southwest of the United States and in Alaska.

Although county-level analysis can mask more granular issues within a county, this analysis serves as a starting point to prioritize areas of the country to receive TA support from FEMA. It is important to note that this analysis is a relative assessment. There is no absolute measurement of resilience, and all areas of the country can improve their readiness as we continue to build a culture of preparedness.

Based on the geographical concentration of counties with aggregated data in the two lowest bins, Argonne identified the following regional areas as potential priority areas for receiving community resilience TA:

- The Lower Mississippi Delta region in the states of Louisiana, Mississippi, and Arkansas
- Tribal areas, particularly in North Dakota, South Dakota, and New Mexico

- South Texas, western New Mexico, and northeastern and northwestern Arizona
- Southwestern Georgia
- Southwestern Alabama
- Southeastern Kentucky
- Puerto Rico
- The central area of Alaska.

While Puerto Rico has the most counties in the lowest two bins of aggregated data, consideration for providing community resilience TA in Puerto Rico should take into account this area's continued need to focus on recovery from the significant destruction of Hurricane Maria.

Although this analysis was conducted for the FEMA NIC TA Branch, the findings have relevance for many FEMA program areas, as well as for state, local, territorial, and tribal (SLTT) emergency managers and other whole community partners. By reviewing county data for these 20 indicators, emergency managers can gain insights for targeted outreach strategies and for adapting emergency operations plans to community characteristics.

Community Resilience Indicator Analysis:

County-Level Analysis of Commonly Used Indicators from Peer-Reviewed Research

Introduction

As disasters continue to increase in frequency and cost,[1] researchers across academic disciplines, including ecology, engineering, sociology, and psychology, have attempted to identify and quantify features that make a community more resilient to disasters. The Federal Emergency Management Agency (FEMA) National Integration Center (NIC) Technical Assistance (TA) Branch asked Argonne National Laboratory (Argonne) to review this body of research to provide a data-driven basis to prioritize locations for TA investment and to inform community resilience TA content.

FEMA NIC TA Collaborative Technical Assistance

The FEMA NIC TA Collaborative TA program is an interactive in-person and distance learning process that supports cohorts of jurisdictions over 10–12 months to build capability on a focused topic. FEMA NIC TA support includes:

- In-person and distance learning formats
- Project management, research support, and coaching from subject matter experts
- Peer-to-peer learning
- Use and ownership of sample plans, templates, and modeling tools
- A starter kit for tabletop exercises
- Technical review and feedback.

In addition to working with cohorts of jurisdictions through Collaborative TA, FEMA NIC TA shares tools and templates on the FEMA website to support self-guided analysis and community resilience strategies for any jurisdiction.

[1] NOAA National Centers for Environmental Information, 2018, *Billion-Dollar Weather and Climate Disasters: Overview*, https://www.ncdc.noaa.gov/billions/, downloaded June 26, 2018. Office of the Director of National Intelligence, 2018. *Worldwide Threat Assessment of the US Intelligence Community,* https://www.dni.gov/files/documents/Newsroom/Testimonies/2018-ATA---Unclassified-SSCI.pdf, downloaded June 26, 2018.

Process to Identify and Map Commonly Used Indicators of Community Resilience

The research team followed a five-step process to identify commonly-used indicators from current community resilience research. For the purpose of this study, indicators are quantitative data sets describing the inherent characteristics of a community that contribute to disaster resilience.[2] The team:

1. Conducted a literature review to identify peer-reviewed meta-analyses of different methodologies that measure community resilience to disasters.
2. Cataloged the distinct methodologies cited within the meta-analyses.
3. Created and applied a set of criteria to support NIC TA's goal of prioritizing locations for TA.
4. Identified commonly used indicators (i.e., the indicators cited in three or more methodologies) and their associated measures.
5. Grouped county-level data for each indicator into five bins denoting relative resilience and produced choropleth maps.

Step 1: Identify Peer-Reviewed Meta-Analyses

To begin the process of identifying commonly used community resilience indicators, the research team conducted a literature review of electronically available peer-reviewed meta-analyses from the past five years that focused on measuring resilience to disasters. Because community resilience research is an emerging field, the last five years is a sufficient timeframe and a reasonable boundary condition for a comprehensive review. To establish a wide-ranging view of the field, the research team included both domestic and international community resilience studies and reviewed each meta-analysis for mentions of additional literature.

The literature review produced the following six meta-analyses:

- Cutter, Susan L., "The Landscape of Disaster Resilience Indicators in the USA," *Natural Hazards* 80 (2015): 741–758. Accessed April 6, 2018; available at https://link.springer.com/article/10.1007%2Fs11069-015-1993-2.
- Koliou, Maria, John W. van de Lindt, Therese P. McAllister, Bruce R. Ellingwood, Maria Dillard, and Harvey Cutler, "State of the Research in Community Resilience: Progress and Challenges," *Sustainable and Resilient Infrastructure,* 2017, 1–21. Accessed April 6, 2018; available at http://dx.doi.org/10.1080/23789689.2017.
- Lavelle, Francis M., Liesel A. Ritchie, Alexis Kwasinki, and Brian Wolshon, "Critical Assessment of Existing Methodologies for Measuring or Representing Community Resilience of Social and Physical Systems," *NIST GCR 15-1010*. 2015. Accessed April 6, 2018; available at http://dx.doi.org/10.6028/NIST.GCR.15-1010.
- Ostadtaghizadeh, Abbas, Ali Ardalan, Douglas Paton, Jossain Jabbari, and Hamid Reza Khankeh, "Community Disaster Resilience: A Systematic Review on Assessment Models and Tools," *PLoS Currents*. 2015. Accessed April 6, 2018; available at http://dx.doi.org/10.1371/currents.dis.f224ef8efbdfcf1d508dd0de4d8210ed.

[2] Susan L. Cutter, Christopher G. Burton, and Christopher T. Emrich, 2010, "Disaster Resilience Indicators for Benchmarking Baseline Conditions," *Journal of Homeland Security and Emergency Management*, 7: Issue 1, Article 51. DOI: 10.2202/1547-7355.1732. Available at https://www.degruyter.com/abstract/j/jhsem.2010.7.1/jhsem.2010.7.1.1732/jhsem.2010.7.1.1732.xml, accessed April 6, 2018.

- Sharifi, Ayyoob, "A Critical Review of Selected Tools for Assessing Community Resilience," *Ecological Indicators* 69 (2016): 629-647. Accessed April 6, 2018; available at http://dx.doi.org/10.1016/j.ecolind.2016.05.023.
- Winderl, Thomas, "Disaster Resilience Measurements: Stocktaking of Ongoing Efforts in Developing Systems for Measuring Resilience," *United Nations Development Programme.* 2014. Accessed April 6, 2018; available at https://www.preventionweb.net/files/37916_disasterresiliencemeasurementsundpt.pdf.

The definitions of community resilience used by these methodologies can be found in Appendix A.

Step 2: Catalog Distinct Methodologies, Assessments, and Studies

Reviewing the six meta-analyses, the research team found citations for 72 unique studies, assessments, or methodologies. In addition, although not found in the meta-analysis literature, the following five recently developed methodologies were also reviewed by the research team: The Centers for Disease Control and Prevention's (CDC's) Social Vulnerability Index (SVI) and FEMA's National Risk Index, as well as others currently in development, including the Mitigation Framework Leadership Group's (MitFLG's) Draft Interagency Concept for Community Resilience Indicators and National-Level Measures (published for stakeholder comment), the Alliance for National and Community Resilience's (ANCR's) Community Resilience Benchmarks, and the Johns Hopkins Bloomberg School of Public Health's (JHSPH's) Composite of Post-Event Well-being (COPEWELL). Of these, the research team determined that the CDC's SVI was sufficiently developed to be included in the final list of methodologies, bringing the total to 73.[3]

As additional methodologies are finalized, they can be added to the list for analysis.

Step 3: Create and Apply Inclusion Criteria

The research team established the following inclusion criteria to select the methodologies most relevant to the needs of FEMA NIC TA—a data-driven strategy to prioritize community resilience TA delivery. Specifically, the team used the following criteria:

- **County-level unit of analysis.** The team included studies where the unit of analysis was or could be easily adapted to a U.S. county. Although more granularity offers greater clarity, many datasets are not available below the county level, and county level is the best for initial national analysis. Methodologies where the unit of analysis was at the level of countries, specific infrastructure assets, or households were excluded.
- **Generalized risk focus.** The NIC provides TA relative to a wide range of hazards, and therefore the inclusion criteria retained methodologies that applied to multiple hazards, eliminating measurement methodologies that focused on one specific risk, such as on earthquakes, food security, poverty, or public health.
- **Pre-disaster focus.** NIC TA supports communities with building resilience prior to a disaster, so the research team included pre-disaster assessments of resilience rather than methods designed to assess how well a community rebounded after a disaster.
- **Quantitative measures.** To ensure that indicators could be easily compared across methodologies, the team included only methodologies that used quantitative measures.

[3] CDC's SVI is finalized and all indicators used are publicly available. The National Risk Index incorporates other indices rather than establishing a unique methodology. The methodologies used by the MitFLG, ANCR, and JHSPH are in development and publicly available information is currently insufficient to include them.

- **Publicly available methodology.** For the analysis and findings to be transparent, the team included only methodologies that were publicly available and excluded any proprietary methodologies.
- **Public data source.** To ensure transparency, replicability, and updates over time, indicator data had to be from publicly available secondary sources, such as the U.S. Census and the Bureau of Labor Statistics.

Appendix B, Community Resilience Methodologies, lists all 73 methodologies and includes the meta-analysis sourcing, the date of publication, a link to the methodology report or developer, and a determination for each inclusion criterion.

Through this analysis, the research team identified eight community resilience assessment methodologies that met all of the established inclusion criteria. These eight are the set of community resilience methodologies used for the TA analysis:

- Australian National Disaster Resilience Index (ANDRI)[4]
- Baseline Resilience Indicators for Communities (BRIC)[5]
- Community Disaster Resilience Index (CDRI)[6]
- Community Resilience Index (CRI2)[7]
- Disaster Resilience of Place (DROP)[8]
- Resilient Capacity Index (RCI)[9]
- Social Vulnerability Index (SVI)[10]
- The Composite Resilience Index (TCRI).[11]

Step 4: Identify Commonly Used Indicators

Next, the research team reviewed the set of eight community resilience methodologies and cataloged all the indicators used in these methodologies, which came to more than 100 unique indicators. The team then

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[4] Phil Morley, Melissa Parsons, and Sarb Johal, 2017, "The Australian Natural Disaster Resilience Index: A system for assessing the resilience of Australian communities to natural hazards," Bushfire & Natural Hazards CRC. Available at https://www.bnhcrc.com.au/research/hazard-resilience/251, accessed March 27, 2018.

[5] Susan L. Cutter, Kevin D. Ash, and Christopher T. Emrich, 2014, "The Geographies of Community Disaster Resilience," *Global Environmental Change* 29, 65–77.

[6] Walter Gillis Peacock, et al., 2010, "Advancing Resilience of Coastal Localities: Developing, Implementing, and Sustaining the Use of Coastal Resilience Indicators: A Final Report," *Hazard Reduction and Recovery Center*, December. Available at https://pdfs.semanticscholar.org/ea56/1b67fb9fa11964a32e99c4da14ad32dd39de.pdf, accessed April 6, 2018.

[7] Kathleen Sherrieb, Fran H. Norris, and Sandro Galea, 2010, "Measuring Capacities for Community Resilience," *Social Indicators Research* 99: 227–247.

[8] Susan L. Cutter, Christopher G. Burton, and Christopher T. Emrich, 2010, "Disaster Resilience Indicators for Benchmarking Baseline Conditions," *Journal of Homeland Security and Emergency Management* 7. Available at https://www.degruyter.com/abstract/j/jhsem.2010.7.1/jhsem.2010.7.1.1732/jhsem.2010.7.1.1732.xml, accessed April 6, 2018.

[9] Kathryn A. Foster, 2014, "Resilience Capacity Index," *Disaster Resilience Measurements: Stocktaking of Ongoing Efforts in Developing Systems for Measuring Resilience, United Nations Development Programme,* https://www.preventionweb.net/files/37916_disasterresiliencemeasurementsundpt.pdf, 38.

[10] Barry E. Flanagan, et al., 2011, "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Management* 8. Available at https://svi.cdc.gov/Documents/Data/A%20Social%20Vulnerability%20Index%20for%20Disaster%20Management.pdf, accessed April 6, 2018.

[11] Perfrement, T. and T. Lloyd, 2015, "The Composite Resilience Index: The Modelling Tool to Measure and Improve Community Resilience to Natural Hazards," *The Resilience Index*.

identified those indicators that met the inclusion criteria and were found in three or more of the eight methodologies (commonly-used indicators). The appearance of an indicator in three or more methodologies denotes areas where researchers have coalesced on an indicator's importance relative to resilience. This process identified 20 indicators: 11 that are population focused and 9 that are community focused.

Population-focused measures describe attributes that influence an individual's ability to cope with disasters (e.g., age, income, employment). Community-focused measures are qualities inherent to the local community environment that enhance or detract from the community's ability to prepare for, respond to, or recover from a disaster (e.g., the presence of civic associations, hospitals, mobile homes).

While several methodologies grouped indicators or measures into sub-indexes, or domains, the domains used and the composition of the domains were inconsistent. For example, CRI2 grouped measures into four community capacities (economic development, social capital, information and communication, and community competence), whereas BRIC grouped measures into six community capitals (social, economic, community, institutional, housing/infrastructure, and environmental). Therefore, the Argonne team did not examine domains in this analysis and instead analyzed the individual indicators.

Table 1 lists the Commonly Used Community Resilience Indicators identified through this analysis. Indicators are grouped as population focused and community focused, in descending order of the number of citations in the methodologies (highest to lowest).

Table 1. Commonly Used Community Resilience Indicators

Population-Focused Indicators (11)	Number of Methodologies in Which the Indicator Is Used
Educational Attainment	7
Unemployment Rate	7
Disability	6
English Language Proficiency	6
Home Ownership	6
Mobility	6
Age	5
Household Income	5
Income Inequality	4
Health Insurance	4
Single-parent Household	3
Community-Focused Indicators (9)	**Number of Methodologies in Which the Indicator Is Used**
Connection to Civic and Social Organizations	6
Hospital Capacity	5
Medical Professional Capacity	5
Affiliation with a Religion	4
Presence of Mobile Homes	4
Public School Capacity	4
Population Change	4
Hotel/Motel Capacity	3
Rental Property Capacity	3

Appendix C includes additional information on each indicator: its metric, data source, which of the eight community resilience methodologies used the indicator, and citations from the methodologies to explain the indicator's connection to resilience.

Step 5: Group County-Level Data for Each Indicator into Five Bins Denoting Relative Resilience and Produce Choropleth Maps

To map the data for each indicator, the research team used two approaches to group the data into five bins:

- **Jenks Natural Breaks Classification Method.** For ten indicators,[12] the data were unevenly distributed, but not highly skewed toward either end of the number line. For these indicators, the research team used the Jenks Natural Breaks method[13] to group the data into bins that were mathematically determined by the largest "jumps" in value. Instead of making arbitrary cuts in the data, the Jenks Natural Breaks method allowed the research team to group counties that were close in value to each other and maximize the variance between bins.
- **Quantile Classification.** In the other ten indicator datasets,[14] the data tended to be tightly grouped together. To bin these datasets, the research team used quantile classification.[15] The quantile method rank-orders the data and assigns approximately equal numbers of observations to each bin. In some cases, because the data included many ties and other tightly grouped clusters, applying this method resulted in many counties being assigned to the same bins. In these cases, the research team made minor adjustments to the bins to better differentiate among groups and for ease of interpretation.

In addition to the binning methodology, the research team made adjustments to two datasets: population change and the Gini Index. These adjustments were needed to produce maps of these indicators consistent with the other maps. The population change dataset was provided by the U.S. Census as "net migration: total,"[16] which provided a positive (increase in population) or negative (decrease in population) number per 1,000 population. Large population changes in either direction could cause challenges to resilience, so the research team adjusted the dataset by finding the average net migration (−0.23) and then binning the results in terms of "percent change," or how far from the average each county fell, using standard deviation.

For the indicator Income Inequality, the U.S. Census provides the Gini index dataset[17] as a statistical calculation that resulted in a number between 0 and 1, with 1 indicating perfect inequality (one household having all the income), and 0 indicating perfect equality (all households have an equal share of income). For this analysis, the research team used the average Gini index result (0.45) as a useful dividing point and then created bins using standard deviations from that average to provide comparison of values that fall above (less equal) and below (more equal) the average.

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[12] The ten indicators using the Jenks Natural Breaks classification method: Educational Attainment, Disability, Mobility, Age, Household Income, Health Insurance, Single-parent Household, Medical Professional Capacity, Affiliation with a Religion, and Rental Property Capacity.

[13] Longley, P., M. De Smith, and M. Goodchild, 2015, Geospatial Analysis — A Comprehensive Guide. Available at http://www.spatialanalysisonline.com/HTML/?classification_and_clustering.htm, accessed March 20, 2018.

[14] The ten indicators using the Quantile Classification method: Unemployment Rate, English Language Proficiency, Home Ownership, Income Inequality, Connection with Civic and Social Organizations, Hospital Capacity, Presence of Mobile Homes, Public School Capacity, Population Change, and Hotel/Motel Capacity.

[15] Brewer, C.A., and L. Pickle, 2003, "Evaluation of Methods for Classifying Epidemiological Data in Choropleth Maps in Series." *Annals of the Association of American Geographers*, 92 (4).

[16] *U.S. Census Bureau*. https://www.census.gov/glossary/#term_Netmigration, accessed April 6, 2018.

[17] *U.S. Census Bureau*. https://www.census.gov/glossary/#term_GiniIndex, accessed April 6, 2018.

After binning all the indicator datasets into five bins, the research team created choropleth maps[18] (maps using color and shading to display data) with county-level data for each of the 20 indicators.

Limitations and Benefits of Analysis

Limitations

- **County-level analysis.** There are 3,141 counties (and county equivalents) in the United States.[19] While county-level is useful from a national perspective, county-level data may mask some local issues. For instance, a community showing very low rates of population change may, in fact, have significant changes in undocumented migrant populations that affect many areas of the community from housing availability to school enrollments.
- **Open source data.** For many of these indicators, more specific data may be available from proprietary sources. For example, a more specific indicator for determining healthcare capacity in a county would be the number of hospital beds. These data are available at a county level, although it must be purchased through the American Hospital Association. In addition, customized data on the hospitality industry, including hotel rooms by county, can be obtained from hospitality industry business intelligence companies who charge subscription fees for data access and analysis. The research team chose not to purchase any datasets to ensure that counties could find the data for their county at no cost.
- **Incomplete national datasets.** Some datasets did not include data for every county. The U.S. Census's primary datasets do not include results for many of the U.S. territories, including Guam, the U.S. Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands. Data for Puerto Rico, also a U.S. territory, were available within most Census datasets. In other datasets, data for Puerto Rico were provided separately, and in four cases[20] were not provided at all. Territories other than Puerto Rico may face some of the highest challenges to resilience in the U.S., but have not been assessed in this report because the data are not included in national datasets.[21]
- **Hazard risk not included.** Hazard risk was not a factor in this analysis. The research team focused on identifying pre-disaster conditions that serve to forecast resilience to a range of hazards and risks. To factor in hazard risk, many national, state, and local assessments of risk can easily be overlaid onto this analysis.
- **No assessment of community capacity.** This analysis does not include data on a community's capacity to respond to hazards relative to these indicators; for example, whether counties with relatively lower levels of hospitals per capita and lower levels of medical professions have developed surge capacity support for medical services by training the public, supporting volunteer programs, or investing in mobile clinics.

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[18] Longley, P., M. De Smith, and M. Goodchild, 2015, "Classification and Clustering," *Geospatial Analysis — A Comprehensive Guide*. Available at http://www.spatialanalysisonline.com/HTML/?classification_and_clustering.htm, accessed March 20, 2018.

[19] USGS (U.S. Geological Survey), *How Many Counties Are There in the United States?*, https://www.usgs.gov/faqs/how-many-counties-are-there-united-states, accessed April 6, 2018.

[20] Educational Attainment, Hospital Capacity, Affiliation with a Religion, and Population Change.

[21] U.S. Census Bureau, *Island Areas*. Available at https://www.census.gov/history/www/programs/geography/island_areas.html, accessed April 6, 2018.

Benefits

- **Existing peer-reviewed research.** Rather than positing a new model for community resilience, the analysis in this paper draws exclusively from the current body of research on community resilience. All of the community resilience research used in this analysis was peer-reviewed by experts before being published. The peer review process helps to ensure that the research methodologies are valid.
- **Commonly used indicators suggest some research agreement.** By identifying the commonly used indicators across multiple community resilience methodologies, this analysis identifies areas where researcher approaches have coalesced, indicating some agreement on community resilience indicators.
- **Focus on individual indicators.** Rather than using a construct of community functioning with domains or categories, this analysis focuses on the individual indicators. This approach may help pinpoint specific areas for improvement.
- **Relative assessment.** This analysis provides a relative assessment of community resilience indicators. While this analysis allows FEMA to identify priority jurisdictions for intervention, all communities can take steps to improve their resilience.
- **Broad application of findings.** In addition to helping to prioritize FEMA NIC TA deliveries for community resilience, this analysis can be used by many FEMA program areas and SLTT partners.
- **Framework for further analysis.** Counties can use this analysis as a framework for obtaining more detailed analysis using census tract or political-jurisdiction-level data. Counties can baseline data points and assess the impact of tailored approaches to improve resilience.

Community Resilience Indicators

Correlation Analysis

The research team conducted a correlation analysis to measure and describe the strength and direction of the relationships among the 20 commonly used community resilience indicators. Correlation analysis shows how individual indicators may be related to each other. Understanding which indicators may be related to each other will help NIC TA support communities in designing resilience strategies that take these relationships into account.

The Pearson Correlation Coefficient[22] is a numerical measure of linear correlation from −1 to 1. A coefficient that is closer to 1 indicates a strong positive correlation (variable A increases as variable B increases). A coefficient of 0 means there is no correlation. A coefficient closer to −1 indicates a negative correlation (variable A increases as variable B decreases). The results of this analysis are presented in Appendix D, Indicator Correlation Table. In the table, darker green indicates stronger correlation, both negative and positive.

As counties consider strategies to address those indicators that reveal less resilience in their communities, they should also consider other indicators where the correlation relationship is strong and therefore indicates that the population may be facing these challenges as well. For example, campaigns focusing on individuals without a high school diploma should also take into consideration the likelihood that these individuals may be single parents, live in mobile homes, have lower income levels, may not speak English well, and may also face a lack of health insurance and unemployment.

[22] Stangroom, J, 2018, "Pearson Correlation Coefficient Calculator," *Social Science Statistics*. Available at http://www.socscistatistics.com/tests/pearson/, accessed April 6, 2018.

Highlights of the correlation analysis include the following:

- Concerning the indicator *Educational Attainment,* a population without a high school diploma is positively correlated with lack of *Health Insurance* (r = 0.68), a higher *Unemployment Rate* (r = 0.53), populations with lower levels of *English Language Proficiency* (r = 0.53), more *Single-Parent Households* (r = 0.48), *Mobile Homes* (r = 0.45), and individuals with a *Disabilit*y (r = 0.36). Populations with lover levels of *Educational Attainment* have less access to healthcare and lower levels of household income (negatively correlated with *Medical Professional Capacity* [r = −0.56], and *Household Income* [r = −0.49]).
- The indicator *Unemployment Rate* is positively correlated with *Single-Parent Households* (r = 0.62), population with a *Disability* (r = 0.54), and lower levels of *Educational Attainment* (r = 0.53). It is negatively correlated with *Household Income* (r = −0.53) and *Medical Professional Capacity* (r = −0.47).
- The indicator *Disability* is positively correlated with *Unemployment Rate* (r = 0.54), *Single-Parent Households* (r = 0.54), and *Age* (r = 0.51). It is negatively correlated with *Household Income* (r = −0.71).
- The indicator of lower levels of *English Language Proficiency* is positively correlated with lower levels of *Educational Attainment* (r = 0.53), lack of *Health Insurance* (r = 0.39), and lower levels of *Mobility* (r = 0.35). It is negatively correlated with *Home Ownership* (r = −0.46).
- The indicator *Mobility* (lack of access to a vehicle*)* is positively correlated with *Income Inequality* (r = 0.47), and *Single-Parent Households* (r = 0.43). It is negatively correlated with *Home Ownership* (r = −0.56).
- The indicator *Age* (more adults over 65) is positively correlated with *Disability* (r = 0.51).
- Counties where the indicator *Income Inequality* is higher may also see a population with lower levels of *Mobility* (r = 0.47) and a greater number of *Single-Parent Households* (r = 0.46). These counties may also have lower levels of *Home Ownership* (r = −0.6) and *Household Income* (r = −0.31) in a negative correlation.
- The lower levels of the *Health Insurance* indicator is positively correlated with lower levels of *Education Attainment* (r = 0.68), *Presence of Mobile Homes* (r = 0.46), *Single-Parent Households* (r = 0.41), and limited *English Language Proficiency* (r = 0.39). It is negatively correlated with *Medical Professional Capacity* (r = −0.47), and *Household Income* (r = −0.46).
- The indicator *Single-Parent Households* is positively correlated with higher levels of *Unemployment Rate* (r = 0.62), *Disability* (r = 0.54) and lower levels of *Educational Attainment* (r = 0.48), and *Health Insurance* (r = 0.41) and is negatively correlated with *Household Income* (r = −0.69) and *Home Ownership* (r = −0.44).
- The indicator *Presence of Mobile Homes* is positively correlated with *Disability* (r = 0.56) and *Unemployment Rate* (r = 0.38), as well as a lack of *Health Insurance* (r = 0.46) and *Educational Attainment* (r = 0.45), It is negatively correlated with *Household Income* (r = −0.49), and *Medical Practitioner Capacity* (r = −0.39).

County-level Maps

The research teams created national choropleth maps (Figure 1–Figure 20), divided by counties for each indicator. For each indicator, every county is shaded based on a five-color scale (Table 2). The scale uses cooler colors to indicate potentially higher relative levels of resilience, with blue at the top of the scale followed by green, and warmer colors to indicate potentially lower relative levels of resilience, with yellow in the middle of the scale, followed by orange, and red at the bottom. Gray counties indicate that no data were available for that indicator within the dataset used for that indicator. These maps show areas of the country that have high or low relative data points for that specific indicator.

Table 2. Color Scale for Choropleth Maps

Blue	Potentially high disaster resilience
Green	
Yellow	
Orange	
Red	Potentially low disaster resilience

Each indicator page includes the map, indicator data source, binning method, number of counties in each bin (shown in the parenthesis in the legend), the national average value for the indicator, and findings. Unless otherwise noted, the data source for the indicators is the U.S. Census Bureau American Community Survey (ACS) five-year estimates for 2012–2016, which is updated annually. The primary advantage of using multiyear estimates is the increased statistical reliability of the data compared with that of single-year estimates, particularly for small geographic areas and small population subgroups.

All maps and data can be found within an interactive map viewer on FEMA's geospatial portal https://disasters.geoplatform.gov. Enter Community Resilience Indicator Analysis in the search window on the homepage or go to http://bit.ly/CommunityResilienceIndicatorAnalysis.

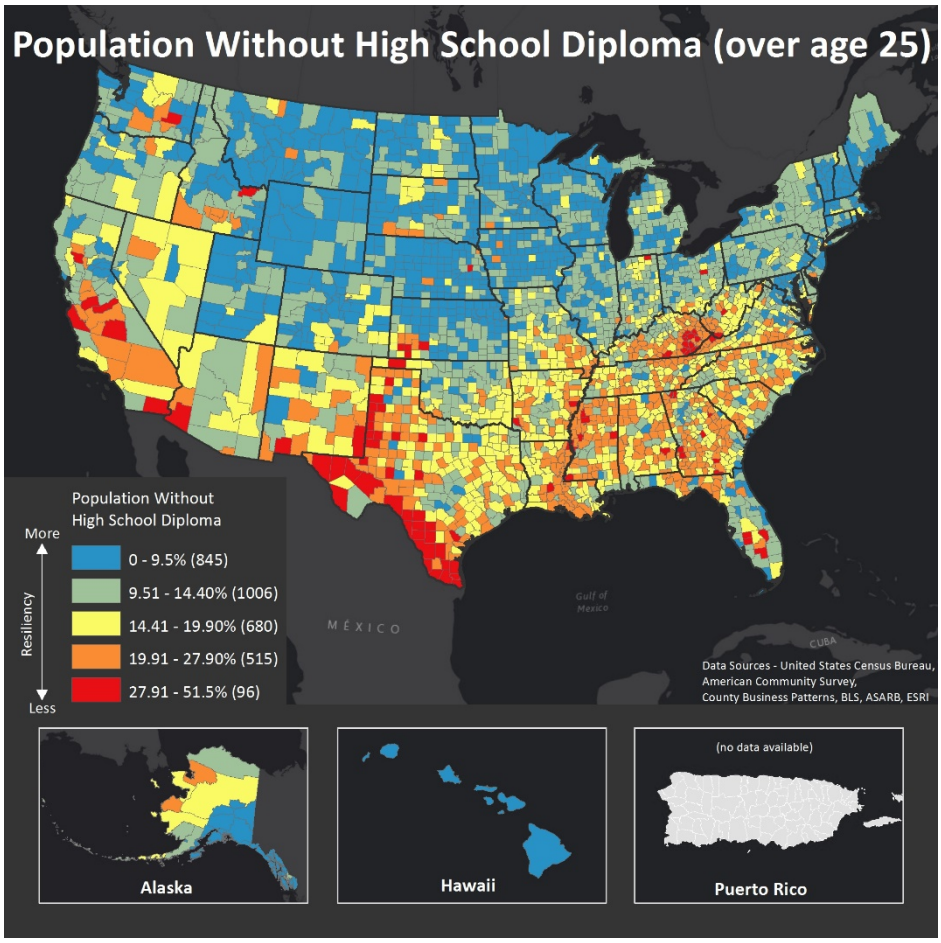

Figure 1. *Educational Attainment*: Lack of High School Diploma in Adults over Age 25

Data Source: ACS 2012–2016 five-year estimates, Table 21501.

Binning Method: Jenks Natural Breaks.

National Average: 13 percent of U.S. adult population does not have a high school diploma.

Findings:

- In 41 percent of U.S. counties, the percentage of adults without a high school diploma is higher than the national average of 13 percent.
- About half of all counties in Kentucky and Mississippi have 20 percent or higher adult populations without a high school education.
- Clusters of counties across the Southeast, Texas, Nevada, and California are below the national average.
- Most of the counties in Texas that border Mexico have populations where between 28 and 51 percent of adults have not completed high school.

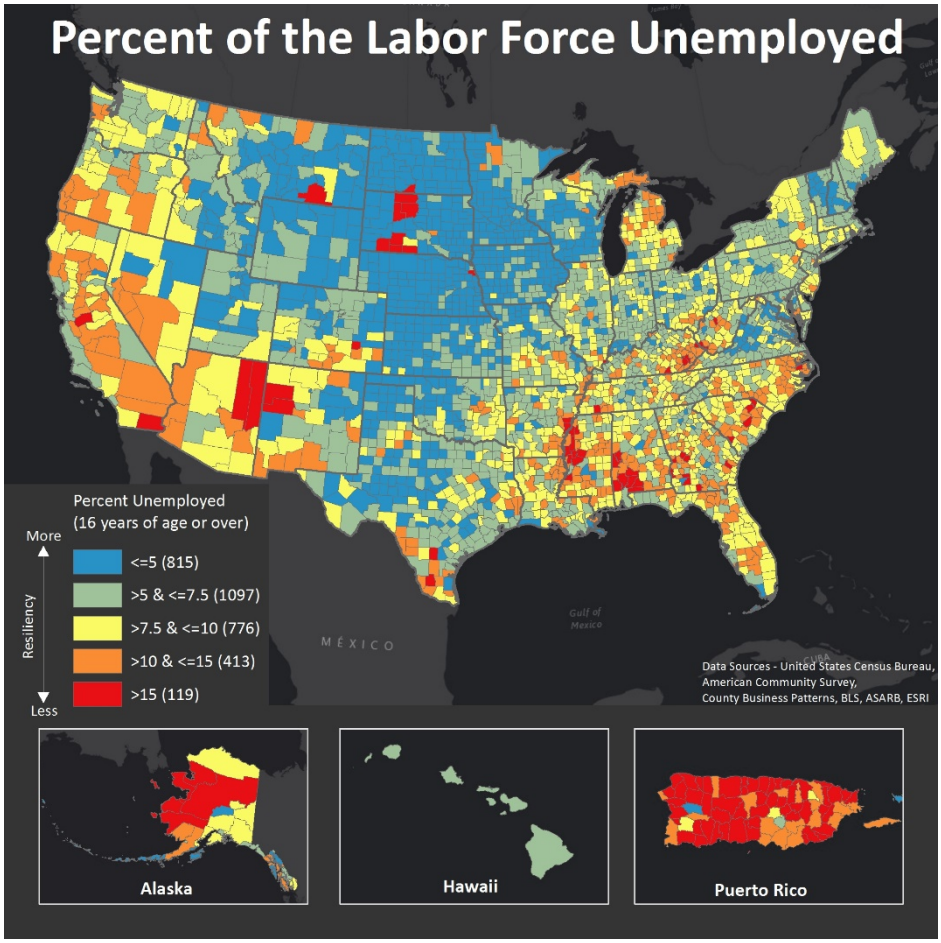

Figure 2. *Unemployment Rate*: Percent of the Labor Force That Is Unemployed

Data Source: ACS 2012–2016 five-year estimates, Table S2301.

Binning Method: Quantile Classification.

National Average: 7.4 percent of the employable U.S. population over 16 years of age is unemployed.

Findings:

- Unemployment is generally low in the Midwest, although a few counties in South Dakota report high levels of unemployment at 25 percent.
- Puerto Rico and Alaska are facing overall high unemployment with 72 of Puerto Rico's 78 municipios having 10 percent or greater unemployment and 14 having 25 percent or greater unemployment. In Alaska, 10 of 29 counties have 10 percent or greater unemployment.
- Several states in the Southeast also have many counties facing unemployment greater than 10 percent, including Mississippi (40 of 82), Alabama (25 of 67), and South Carolina (18 of 46).
- California also has 25 of 58 counties reporting relatively high unemployment rates of 10–18 percent.

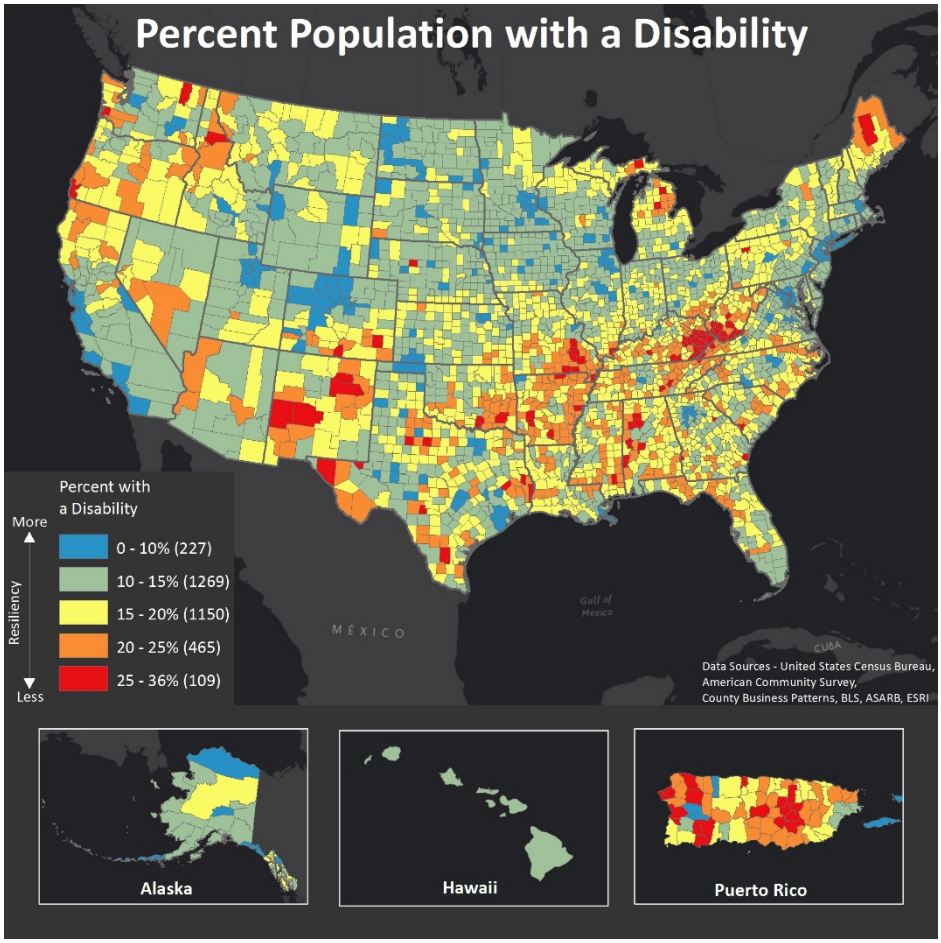

Figure 3. *Disability*: Percent of the Population with a Disability

Data Source: ACS 2012–2016 five-year estimates, Table S1810.

Binning Method: Jenks Natural Breaks.

National Average: 12.5 percent of the U.S. population has a disability.

Findings:

- Populations with a relatively high proportion of individuals with disabilities (20 percent of the population or higher) are in Mississippi, Texas, and New Mexico, and particularly high clusters are in Arkansas (46 of 75), Kentucky (54 of 120), Missouri (32 of 113, but highly concentrated in the southeast corner of the state), New Mexico (13 of 33), and West Virginia (27 of 55).
- More than 20 percent of the population in four large northern counties in Maine and in 10 out of 36 counties in Oregon has a disability.
- Forty-nine of 78 counties in Puerto Rico reported populations with disabilities of 20 percent or greater.

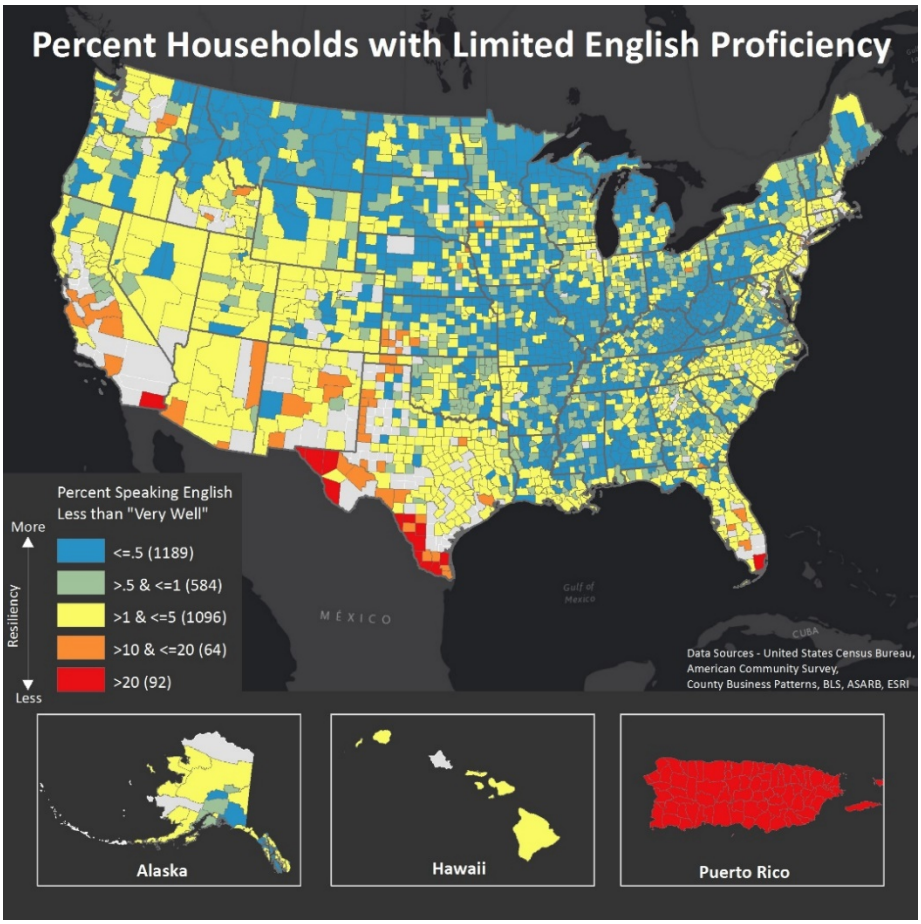

Figure 4. *English Language Proficiency*: Percent of Households with Limited English Proficiency

Data Source: ACS 2012–2016 five-year estimates, Table S1602. Note: Counties in gray have no data for this dataset.

Binning Method: Jenks Natural Breaks.

National Average: 4.5 percent of U.S. households are considered "limited English proficiency."

Findings:

- Puerto Rico stands out in this dataset, with 58–88 percent of households reporting limited English proficiency. In 1991, Spanish was declared the official language of Puerto Rico.[23]
- The Southwest, particularly Texas and California, have significantly less-proficient populations.
- In Texas, 16 percent of counties have more than 10 percent limited English-speaking households.
- California has 8 of 58 counties (14 percent) reporting more than 10 percent limited English-speaking households, with the highest concentration at 21 percent in Imperial County.
- Florida has a concentration of less proficient households, with Miami-Dade County at 25 percent.

[23] *The Washington Post*, 1991, "Puerto Rico Makes Spanish Official Language," April 6. Available at https://www.washingtonpost.com/archive/politics/1991/04/06/puerto-rico-makes-spanish-official-language/50b6c2a9-563e-4f8b-a00e-1b65b80a0a6e/?utm_term=.ac67c869cb48, accessed April 6, 2018.

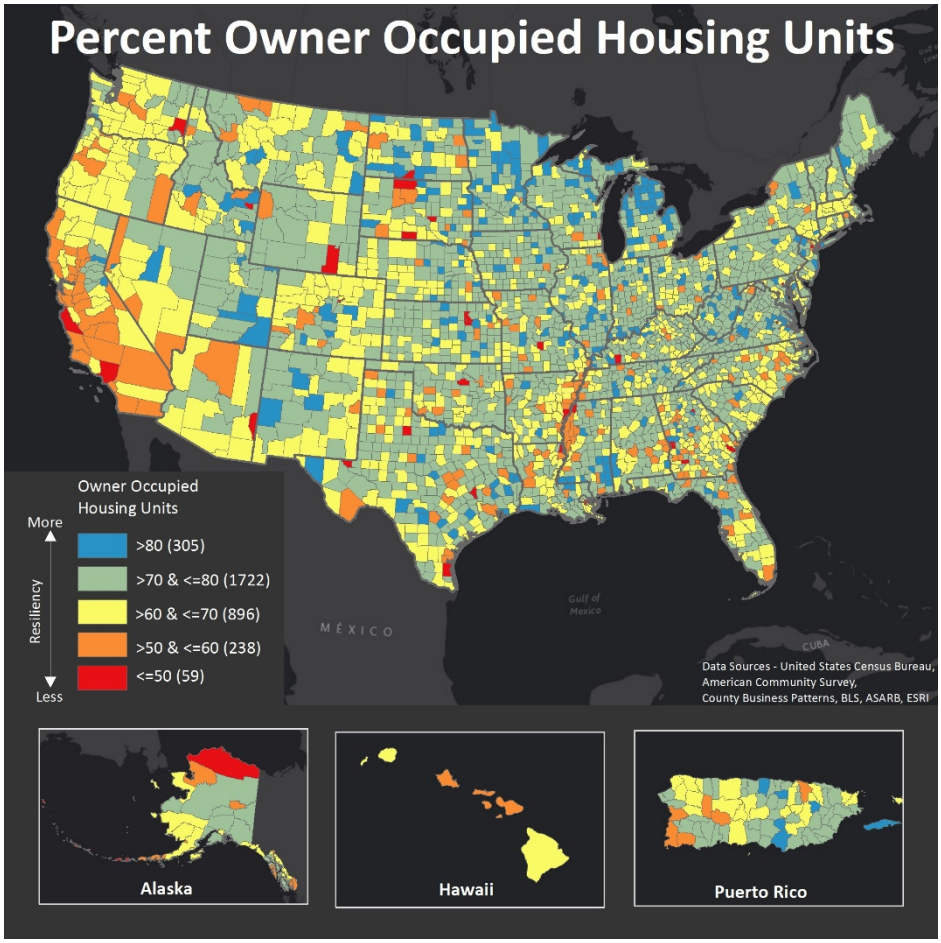

Figure 5. *Home Ownership*: Percent of Owner-Occupied Housing Units

Data Source: ACS 2012–2016 five-year estimates, Table DP04.

Binning Method: Quantile Classification.

National Average: 63.6 percent of homes in the United States are occupied by the owner.

Findings:

- More than 50 percent of housing units are owner occupied in a majority of U.S. counties.
- Several counties making up the City of New York fall in the lower ranges of home ownership, including Bronx County (19.1 percent), New York County (23.1 percent), Kings County (29.4 percent), and Queens County (43.8 percent).

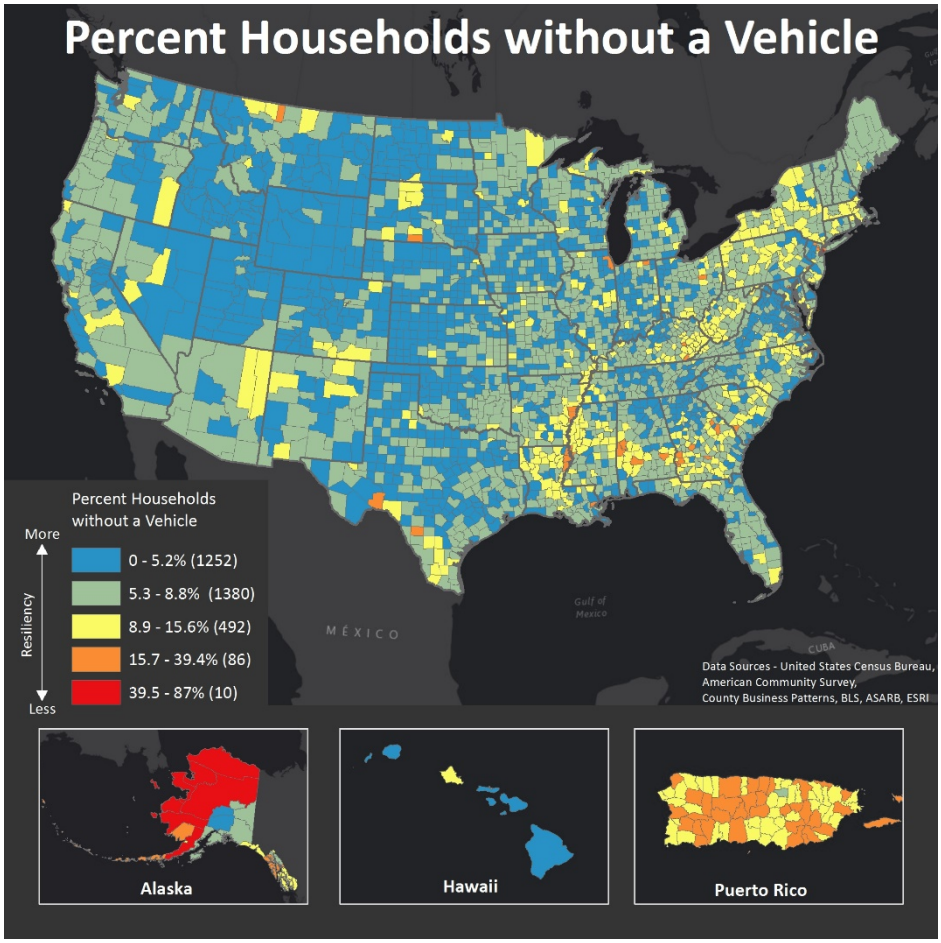

Figure 6. *Mobility*: Percent of Households without a Vehicle

Data Source: ACS 2012–2016 five-year estimates, Table DP04.

Binning Method: Jenks Natural Breaks.

National Average: 9 percent of U.S. households do not own a vehicle.

Findings:

- Forty-three percent of U.S. counties have households where 8.8 percent or less do not have access to a car—potentially a significant number in the event of an evacuation.
- Certain states have relatively high numbers of counties where 8.9 percent of households or higher do not have access to a vehicle. These include some states in the Northeast, including Massachusetts (7 of 14 counties), New York (33 of 62), and Pennsylvania (24 of 67), and others in the Southeast, including Georgia (48 of 159) and Louisiana (26 of 64).
- In Puerto Rico, the data shows 77 municipios (all but 1) reporting 8.9 percent or higher households without access to a vehicle and 36 municipios with rates of 15.7 percent of households and higher lacking access to a vehicle.
- Of the 10 U.S. counties where about 40 percent or more households are without access to a vehicle, 7 are in rural Alaska and 3 are in the extremely urban counties that make up the City of New York: New York County, Kings County, and Bronx County.

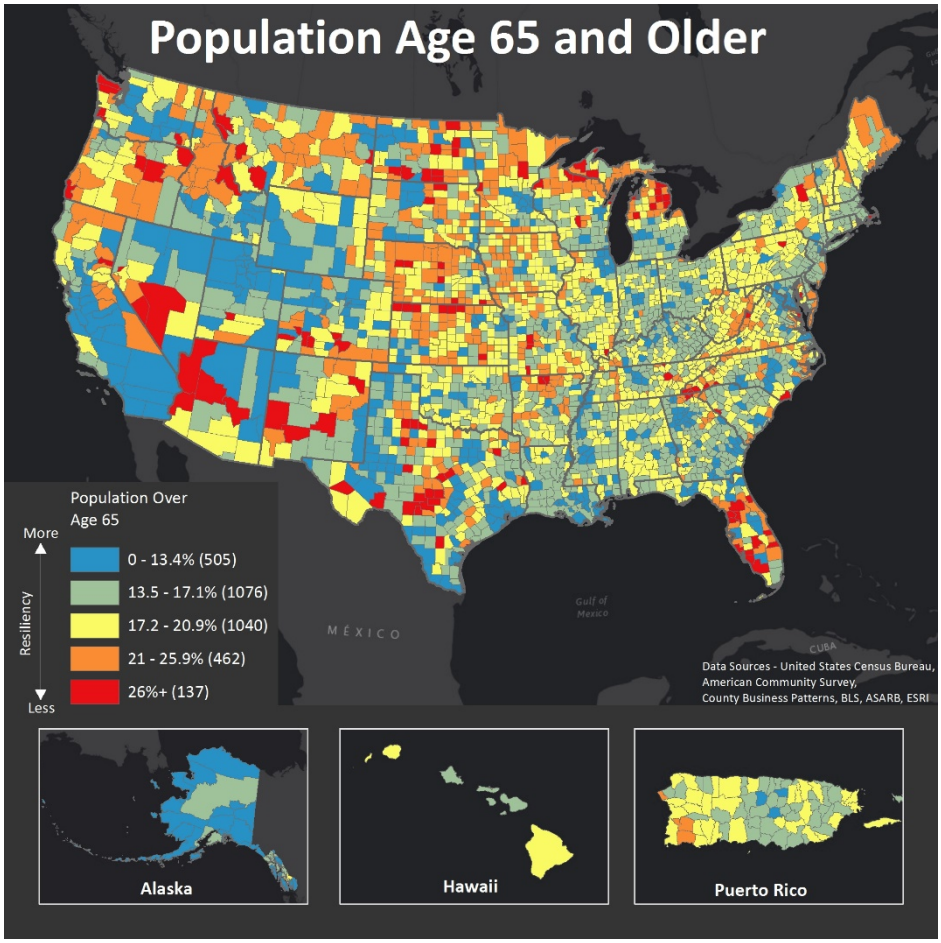

Figure 7. *Age*: Population Age 65 and Older

Data Source: ACS 2016–2016 five-year estimates, Table S0103.

Binning Method: Jenks Natural Breaks.

National Average: 14.5 percent of the U.S. population is more than 65 years of age.

Findings:

- Twenty-four of Florida's 67 counties have populations where 21 percent or more of the residents are 65 or older.
- Other states where more than one-quarter of counties have 21 percent or more of the population 65 or older include Iowa (26 of 99), Kansas (35 of 105), Maine (6 of 16), Michigan (30 of 83), Minnesota (24 of 87), Montana (25 of 56), Nebraska (30 of 93), North Dakota (23 of 53), Oregon (15 of 36), and South Dakota (19 of 66).
- Of the 254 counties in Texas, 32 have populations where 21–26 percent of the residents are 65 and older and 22 counties have populations where 26 percent of residents are 65 and older.

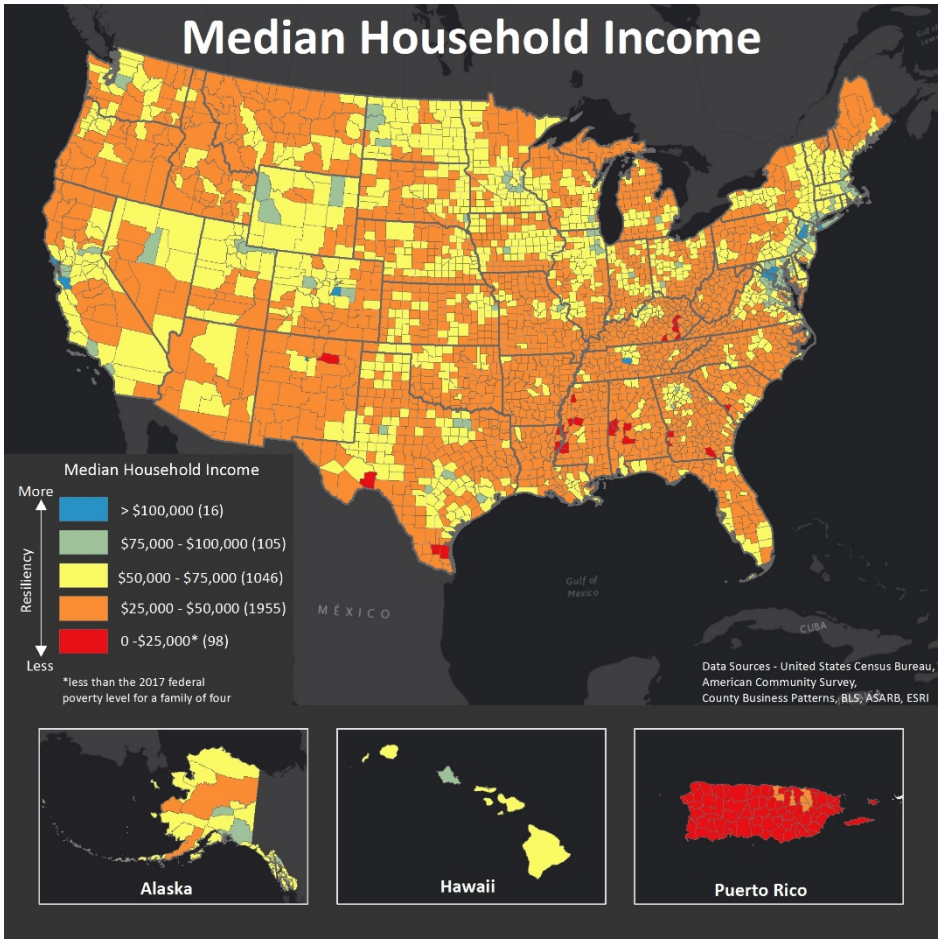

Figure 8. *Household Income*: Median Household Income

Data Source: ACS 2012–2016 five-year estimates, Table S1903.

Binning Method: Jenks Natural Breaks.

National Average: The median household income in the United States is $55,322.

Findings:

- Puerto Rico has a particularly low median household income. Nearly all municipios within Puerto Rico are in the lowest bin (0–$25,000).
- Generally lower median incomes can be seen across the Southeast. In Kentucky, 111 of 120 counties (92 percent) are below the U.S. median.
- Alabama has 60 of 67 counties (89 percent) below the U.S. median.

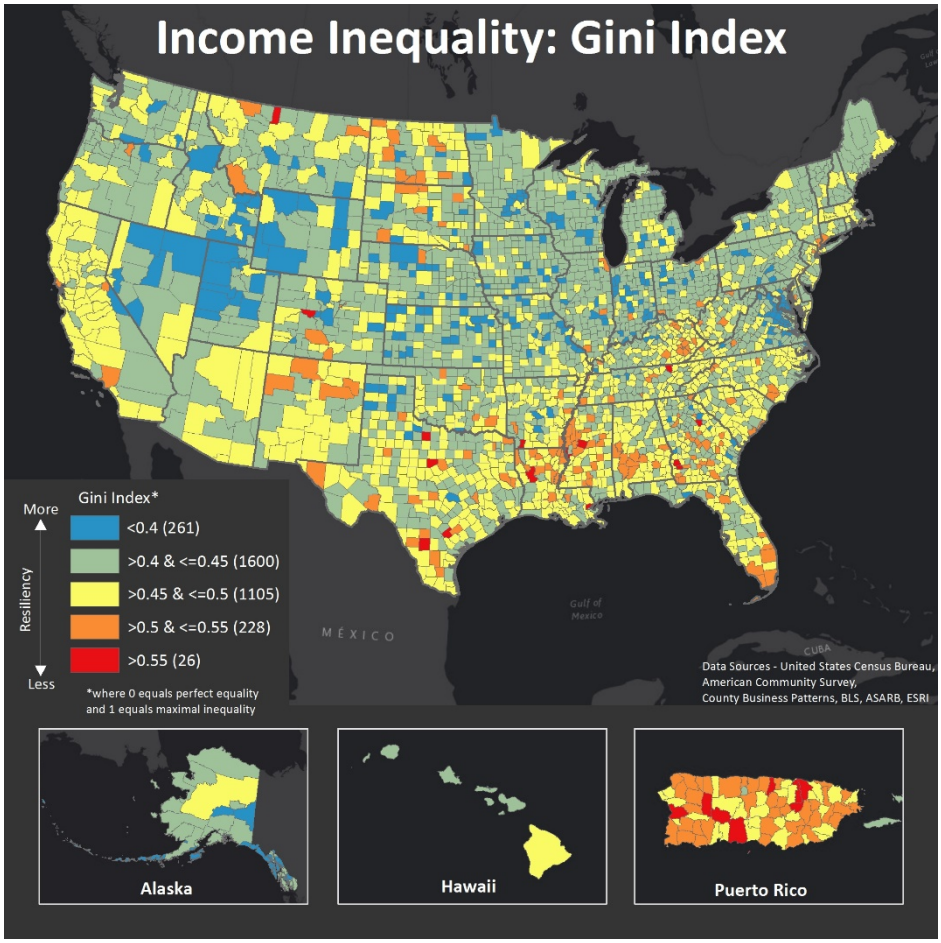

Figure 9. *Income Inequality*: Gini Index

Data Source: ACS 2012–2016 five-year estimates, Table B19083.

Binning Method: Quantile Classification.

National Average: The average Gini score in the United States is 0.48. "Perfect" income equality is 0, and "perfect" income inequality is 1.

Findings:

- Much of the country is in the middle of the Gini Index (0.4 to 0.5). States with 15 percent of counties with Gini Index rates over 0.5 include Alabama (10 of 67), Georgia (24 of 159), Louisiana (16 of 64), Mississippi (22 of 82), and North Dakota (9 of 53).
- Twenty-six counties have a Gini Index above 0.55, with concentrations in Puerto Rico (8), Texas (4), Georgia (3), and Mississippi (2).
- Puerto Rico is the most concentrated area of income inequality where 47 of 78 counties (60 percent) have index numbers of 0.5 or higher.

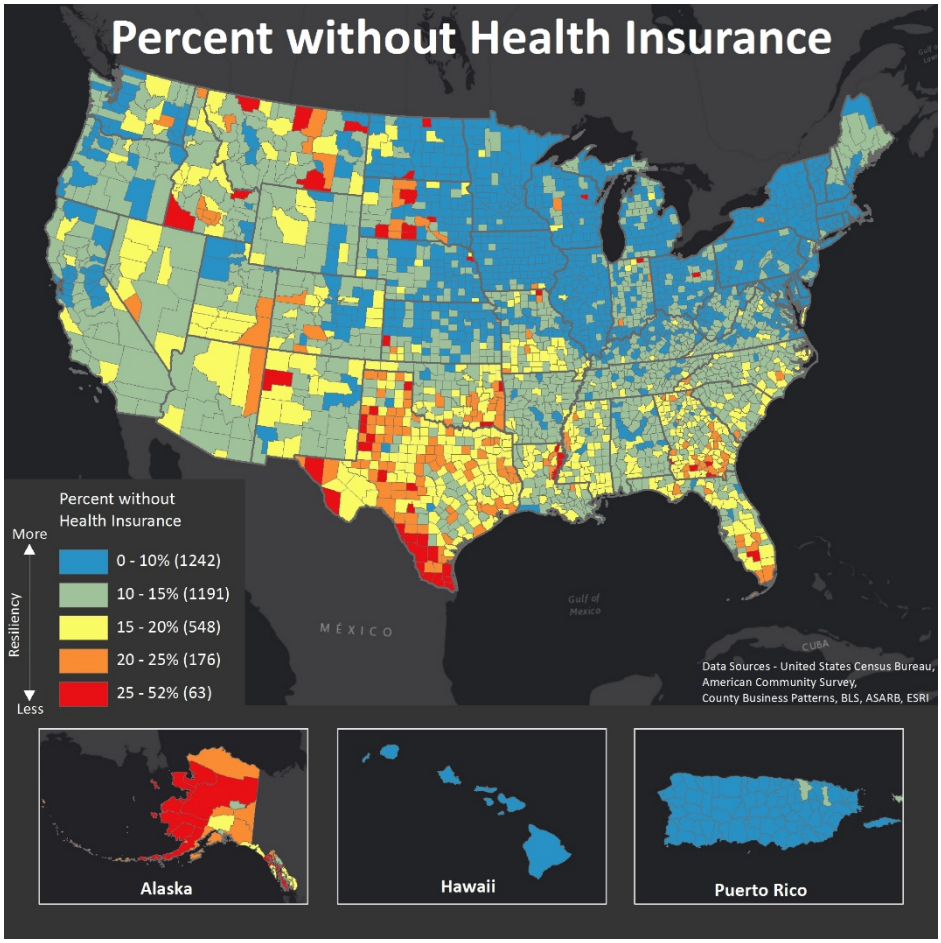

Figure 10. *Health Insurance*: Percent without Health Insurance (Public or Private)

Data Source: ACS 2012–2016 five-year estimates, Table S2701.

Binning Method: Jenks Natural Breaks.

National Average: 11.7 percent of the U.S. population does not have health insurance.

Findings:

- Health insurance coverage is most prevalent in the Northeast and Midwest, with many counties achieving coverage rates of 90 percent or higher. Hawaii and Puerto Rico also have notably high coverage rates.
- Lower rates of coverage (15 percent or higher without coverage) are found in counties in the Southeast, including Florida (37 of 67 counties), Georgia (109 of 159), Louisiana (30 of 64), and Mississippi (45 of 82).
- A total of 216 of Texas's 254 counties have 15 percent or more residents who lack health insurance; and of those, 23 counties have populations where 25 percent or more lack coverage.
- Alaska has the lowest rates of coverage overall with 26 of 29 counties reporting 15 percent of the population without coverage, and 10 counties where a quarter or more of the population lacks coverage.

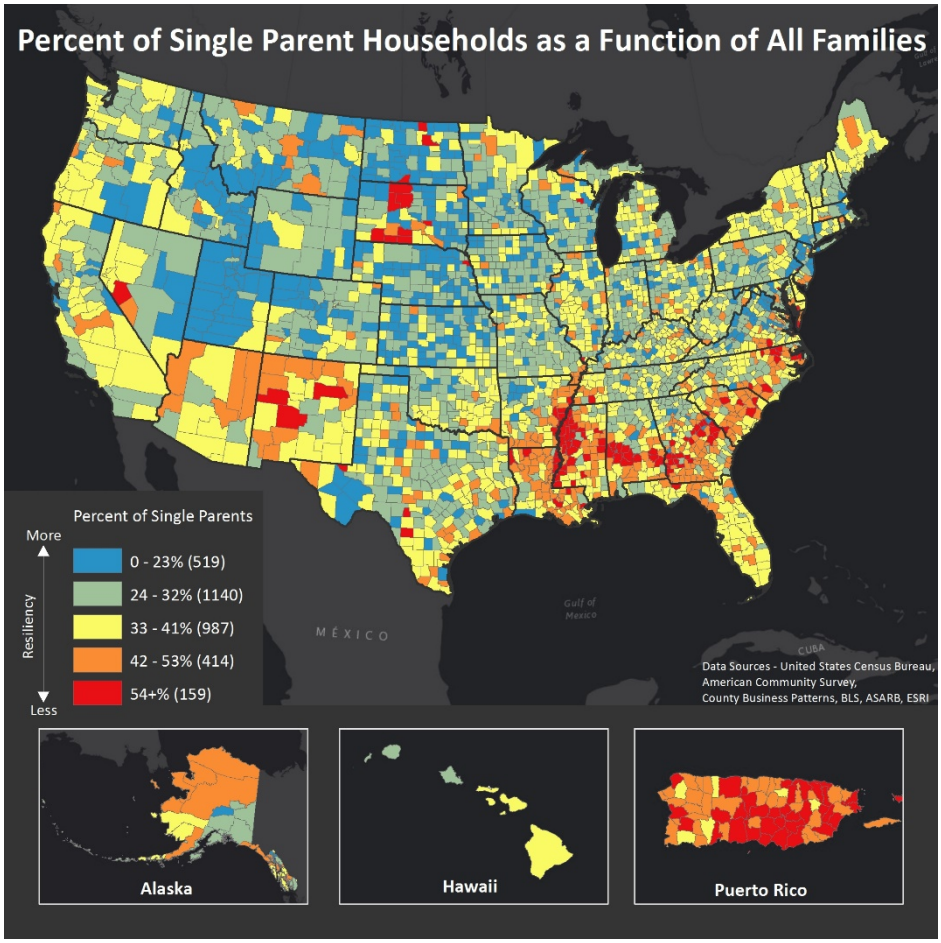

Figure 11. *Single-Parent Household*: Percent of Single-Parent Households as a Function of All Families

Data Source: ACS 2012–2016 five-year estimates, Table B09005.

Binning Method: Jenks Natural Breaks.

National Average: 33 percent of U.S. family households are single-parent households.

Findings:

- High percentages (42 percent or more of total family households) of single-parent households are found across the Southeast and in Puerto Rico.
- In Puerto Rico, 92 percent (72 of 78 municipios) have more than 42 percent of family households headed by a single parent.
- Other states with high rates of single-parent households include Mississippi at 57 percent (47 of 82 counties) and Alabama at 40 percent (27 of 67 counties).

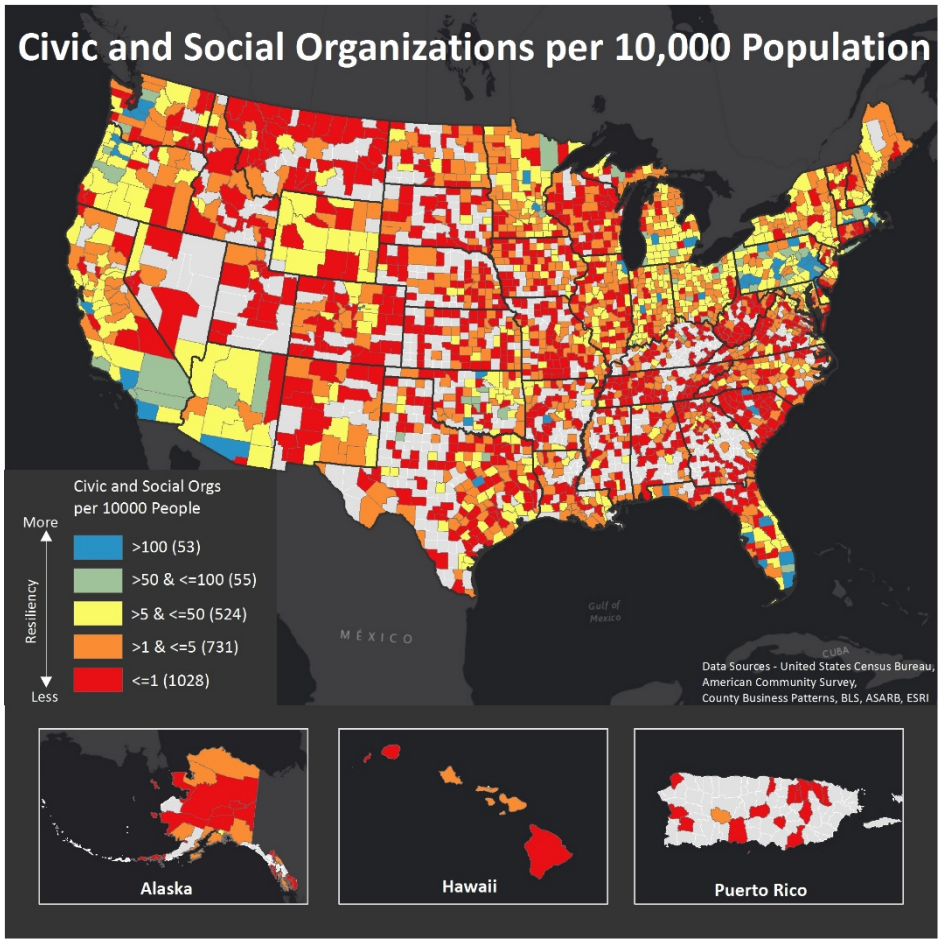

Figure 12. *Connection to Civic and Social Organizations*: Civic and Social Organizations per 10,000 Population

Data Source: U.S. Census Bureau, 2015 County Business Patterns, Table 00A1.

Binning Method: Quantile Classification.

National Average: The U.S. averages about 13 civic and social organizations per 10,000 population.

Findings:

- Lower concentrations of civic and social organizations appear across the Southwest and West, although the incomplete data prevents a comprehensive look.
- In Georgia, of the 86 counties reporting data, 61 have less than one organization per 10,000 population (70 percent).
- In Colorado, 31 of 48 reporting counties have less than one organization per 10,000 population (65 percent).
- The highest concentrations of civic and social organizations appear in Pennsylvania, which has an average of 140 civic and social organizations per 10,000 population statewide.

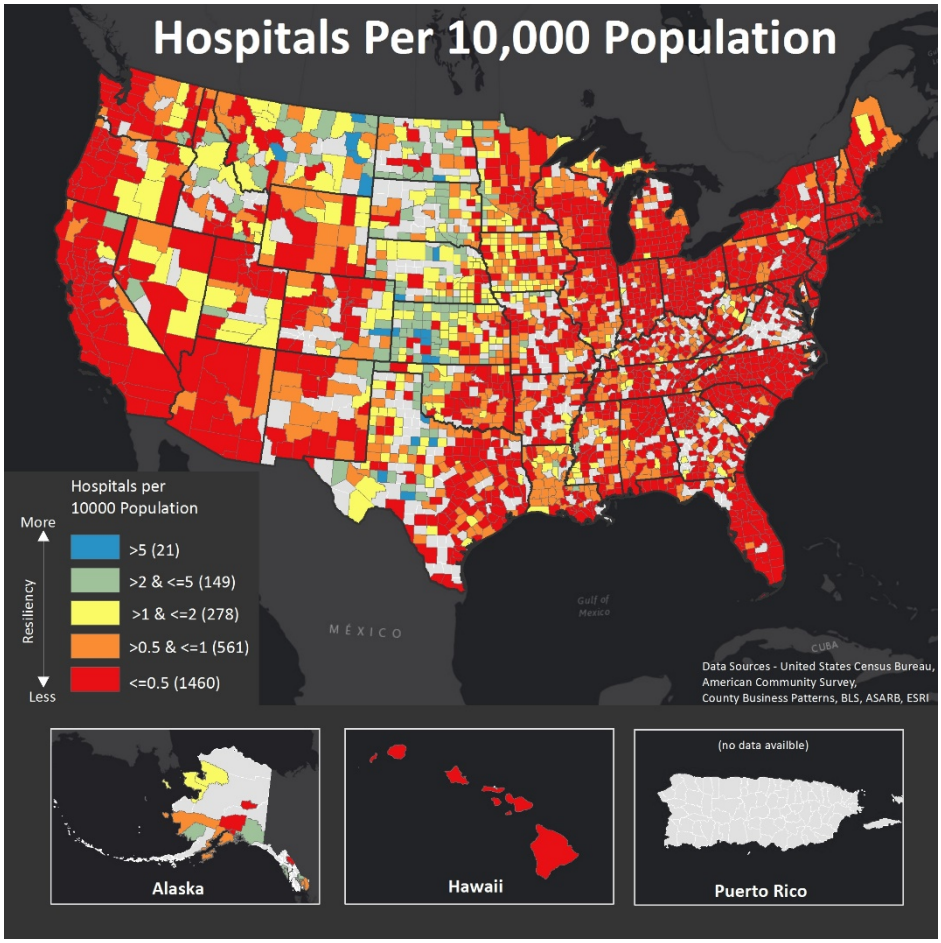

Figure 13. *Hospital Capacity*: Hospitals per 10,000 Population

Data Source: ACS 2016–2016 five-year estimates, Table DP05.

Binning Method: Quantile Classification.

National Average: The U.S. has an average of 2.8 hospitals per county. Note: This average is not per 10,000 population.

Findings:

- Generally, more populated areas seem to have lower numbers of hospitals per 10,000 population.
- In Virginia, 64 of 72 counties in the dataset have less than 1 hospital per 10,000 population, with Prince William County having the lowest number in the country (0.02 hospitals/10,000 population).
- Other counties in the population-dense National Capital Region have low hospital coverage, including Anne Arundel County, Maryland (0.03 per 10,000) and Arlington County, Virginia (0.04 per 10,000).
- All counties with data in Ohio reported having less than one hospital per 10,000, with 71 of 80 counties having less than 0.5 hospitals per 10,000.

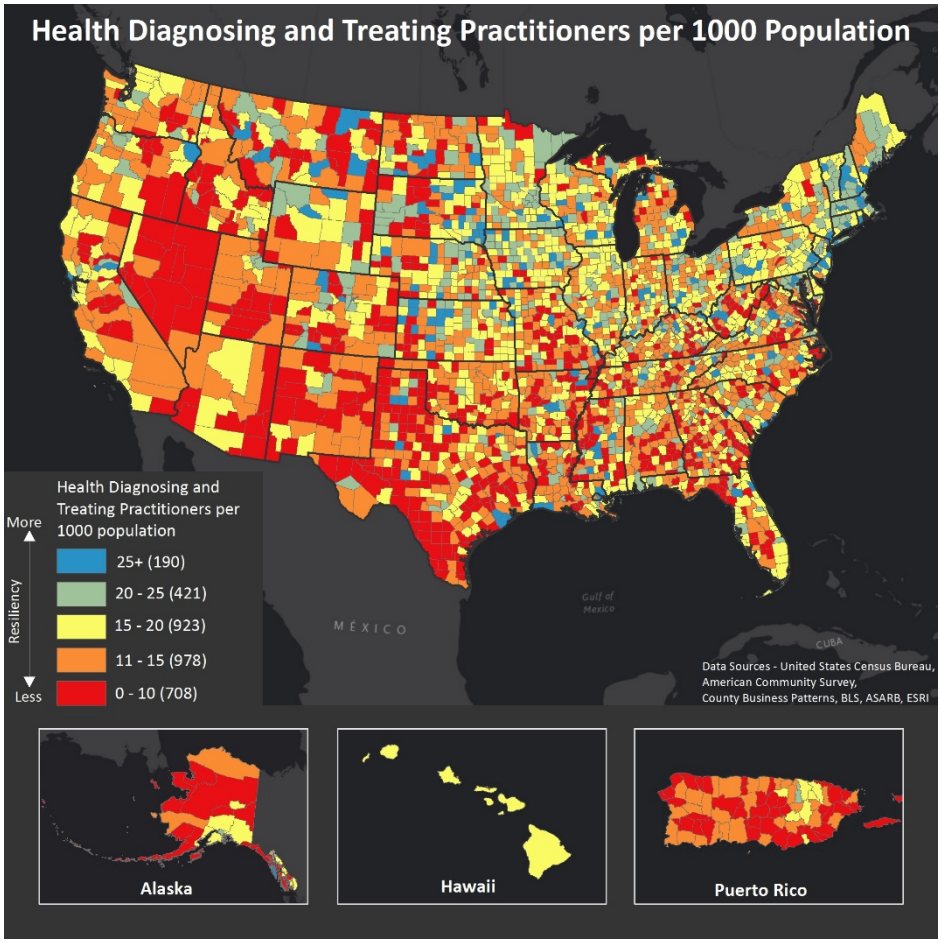

Figure 14. *Medical Professional Capacity*: Health Diagnosing and Treating Practitioners per 1,000 Population

Data Source: ACS 2012–2016 five-year estimate, Table S2401

Binning Method: Jenks Natural Breaks.

National Average: The U.S. averages 15 diagnosing and treating practitioners per 1,000 population.

Findings:

- The states in the Northeast and the eastern states of the Midwest (except Missouri) have relatively higher levels of health practitioners per 1,000 people.
- The Southeast and Southwest have higher numbers of counties with 15 and under practitioners per 1,000 population.
- Some states have counties with 10 or fewer practitioners per 1,000 population, including Alaska (15 of 29), Puerto Rico (40 of 78), Texas (118 of 254), New Mexico (14 of 33), and Nevada (14 out of 16).

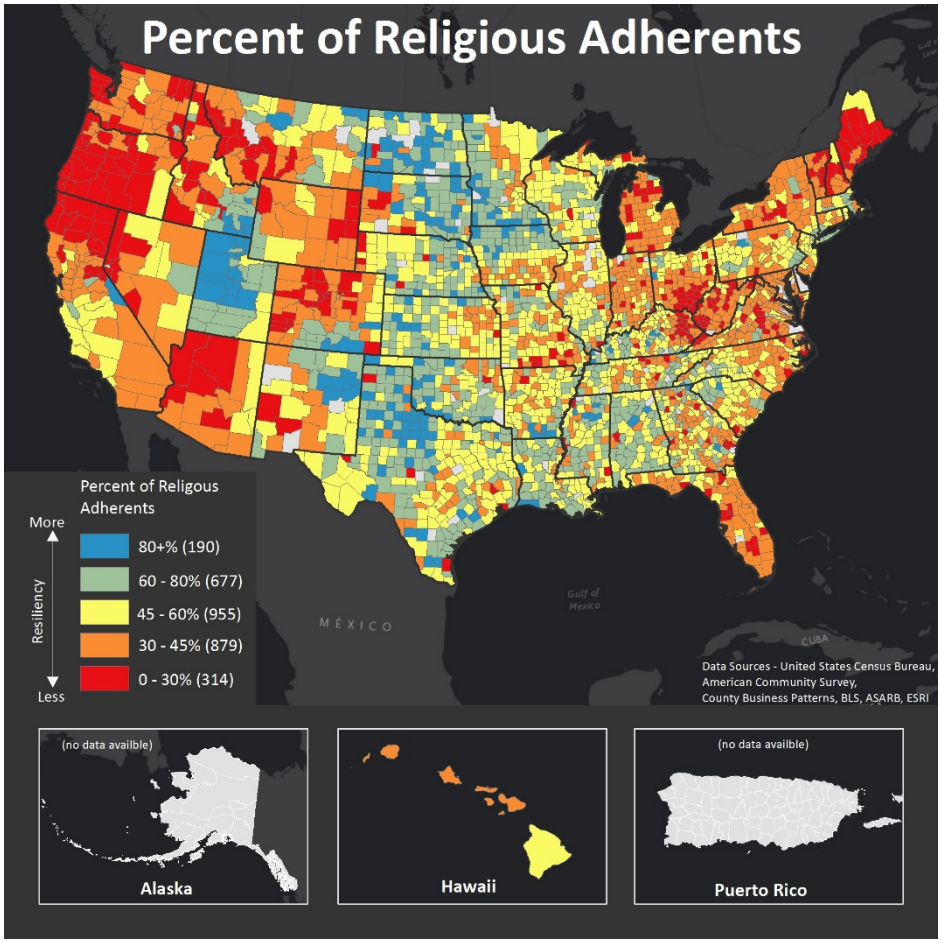

Figure 15. *Affiliation with a Religion*: Percent of Religious Adherents

Data Source: Association of Statisticians of American Religious Bodies, 2010 U.S. Religion Census.

Binning Method: Jenks Natural Breaks.

National Average: An average of 51.4 percent of a county's population are religious adherents.

Findings:

- The highest concentrations of religious adherents are in the central and southern United States, with lower concentrations along the two coasts as well as Florida.
- States with particularly low levels of religious adherents (30 percent and lower) include Oregon (25 of 36 counties), northern California (14 counties), western Montana (13 counties), Maine (12 of 16 counties), and the northwest corner of Arizona (6 counties).
- A cluster of counties with relatively low levels of religious adherents occurs where Ohio borders West Virginia and Kentucky.

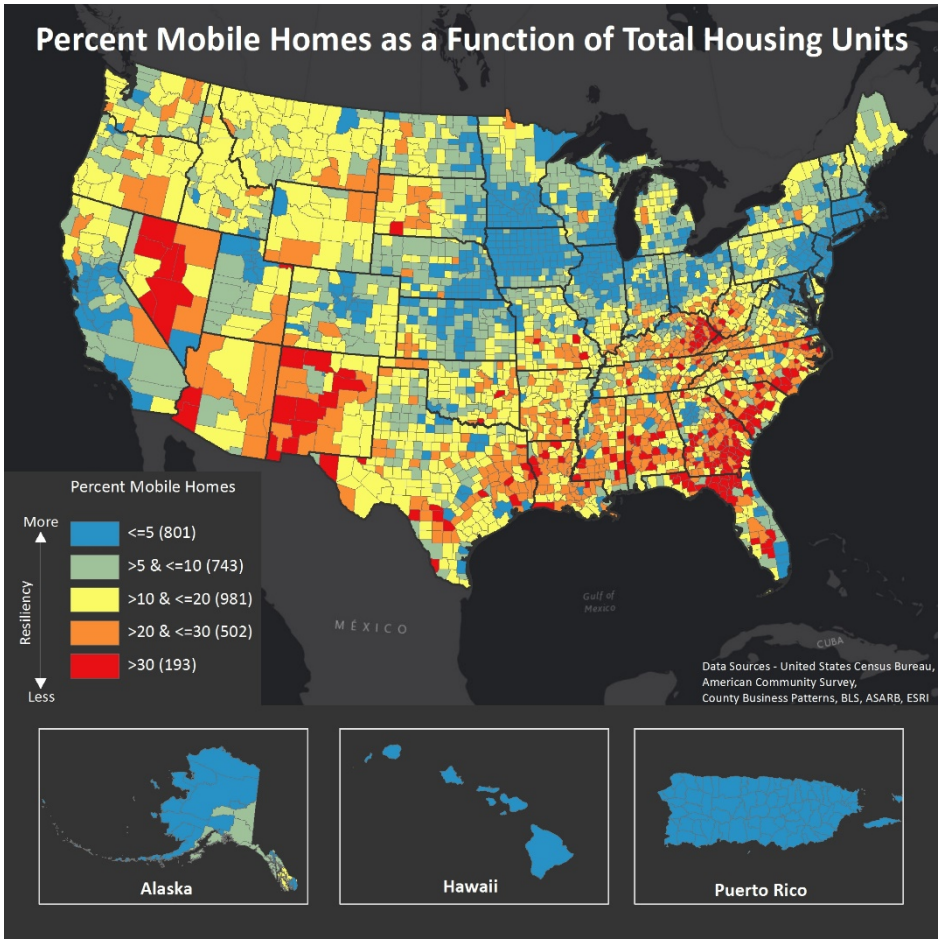

Figure 16. *Presence of Mobile Homes*: Percentage of Mobile Homes as a Function of Total Housing Units

Data Source: ACS 2012–2016 five-year estimates, Table DP04.

Binning Method: Quantile Classification.

National Average: 6.3 percent of housing units in the U.S. are mobile homes.

Findings:

- Higher concentrations (20 percent or more of total housing) of mobile homes are scattered across the Southeast, Southwest, and West.
- There are nine states where more than half of the counties have mobile homes representing 20 percent or more of the housing stock: Arizona (66 percent or 10 out of 15 counties), New Mexico (60 percent or 20 out of 33 counties), Alabama (58 percent or 39 out of 67 counties), Louisiana (58 percent or 37 out of 64 parishes), Georgia (57 percent or 92 out of 159 counties), Mississippi (56 percent or 46 out of 82 counties), South Carolina (56 percent or 26 out of 46 counties), North Carolina (53 percent of 53 out of 100 counties), and Kentucky (51 percent or 62 out of 120 counties).

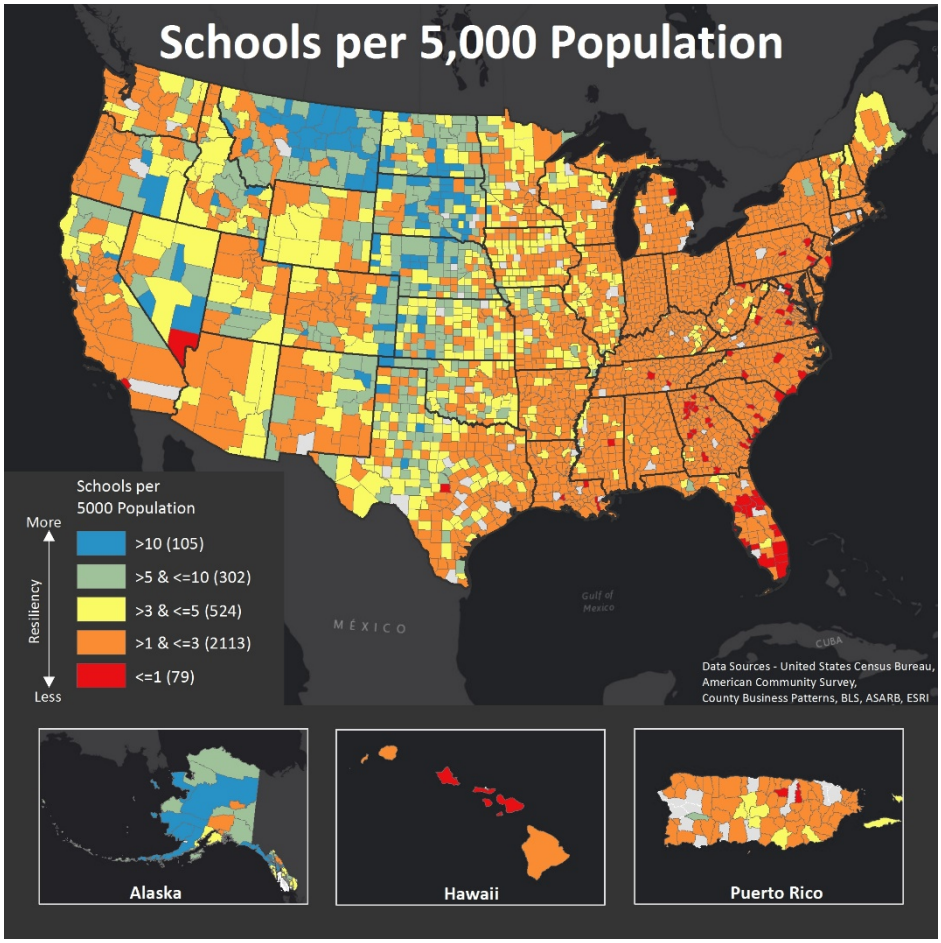

Figure 17. *Public School Capacity*: Schools per 5,000 Population

Data Source: U.S. Department of Education, National Center for Education Statistics, Elementary/Secondary Information System.

Binning Method: Quantile Classification.

National Average: The U.S. averages 3.1 schools per 5,000 population.

Findings:

- Overall, the Southeast has the lowest coverage of public schools.
- In Florida, 25 percent of counties (17 of 67) have less than one public school per 5,000 population. This statistic may point to an important sheltering consideration for Florida, where the population tends to be transient with a higher level of tourists, and its hazard profile may require mass care shelters.
- In Georgia, 10 percent of counties (16 of 159) have less than one school per 5,000 population.
- In Virginia, 96 percent of counties (126 of 133) have less than three public schools per 5,000 population.

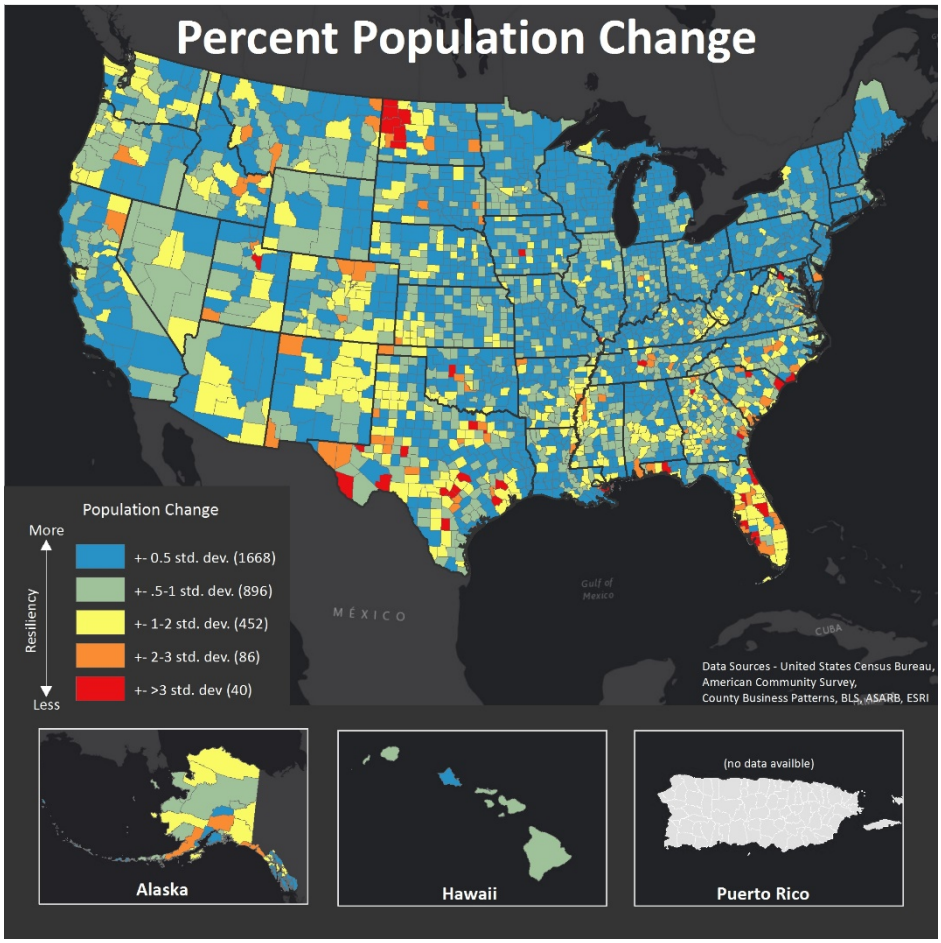

Figure 18. *Population Change*: Percent Population Change

Data Source: U.S. Census Bureau, Population Division, Table: Estimates of the Components of Resident Population Change: April 1, 2010, to July 1, 2016.

Binning Method: Quantile Classification.

National Average: The average population change in the U.S. is 1,859, meaning that on average, 1,859 people move into a county annually.

Findings:

- Population sizes are generally stable throughout most of the United States, although some areas of the country, particularly in the South along the coast and in the Midwest, have higher turnover.
- In Florida, 8 of 67 counties (11 percent) have turnover rates more than three standard deviations away from the mean, which indicates they are either gaining or losing population at a significantly higher rate than the average U.S. county.
- North Dakota also has 11 percent of counties (6 of 53) experiencing significant turnover rates (more than three standard deviations from the mean), with McKenzie County experiencing 19 standard deviations above the mean, which in its case is caused by drastic population increases.

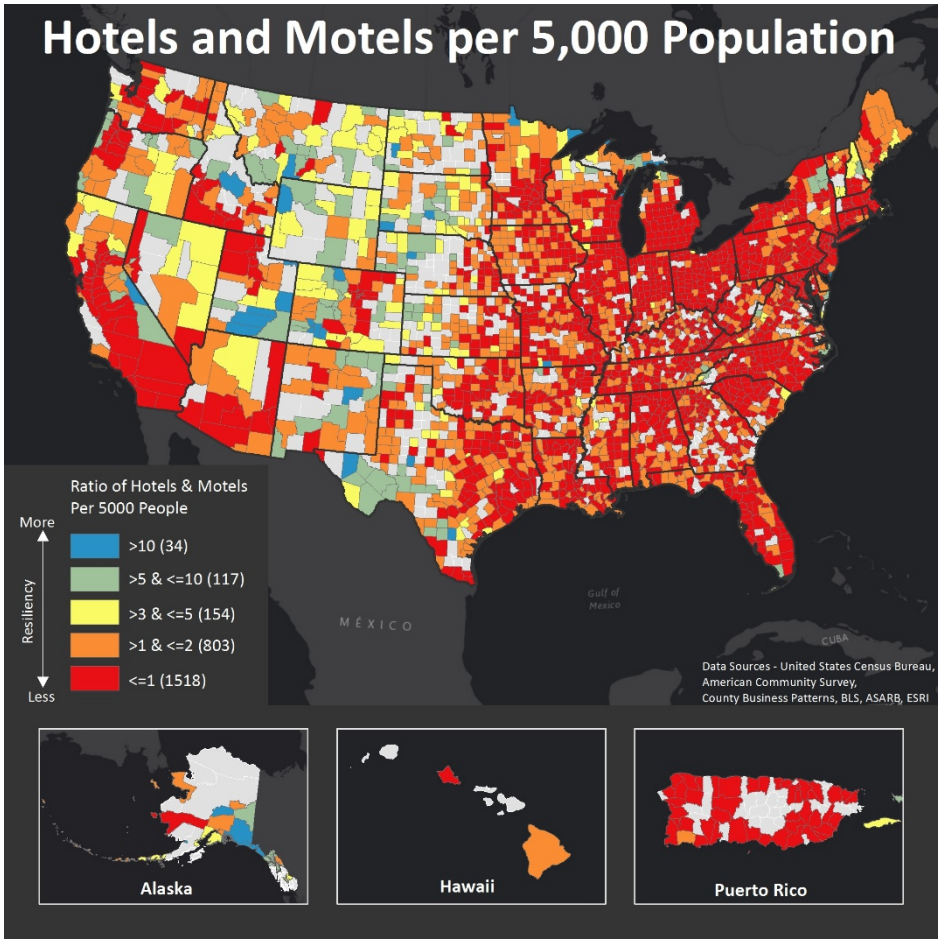

Figure 19. *Hotel/Motel Capacity*: Hotels and Motels per 5,000 Population

Data Source: U.S. Census Bureau, 2015 County Business Patterns, Table 00A1.

Binning Method: Quantile Classification.

National Average: The U.S. averages 1.6 hotels and motels per 5,000 people.

Findings:

- Just over half of the counties in this dataset (1,519/2,866) have less than one hotel per 5,000 population.
- Of the 48 municipios (60 percent of the total) reporting data in Puerto Rico, 34 (71 percent) have fewer than 0.5 hotels per 5,000 population.

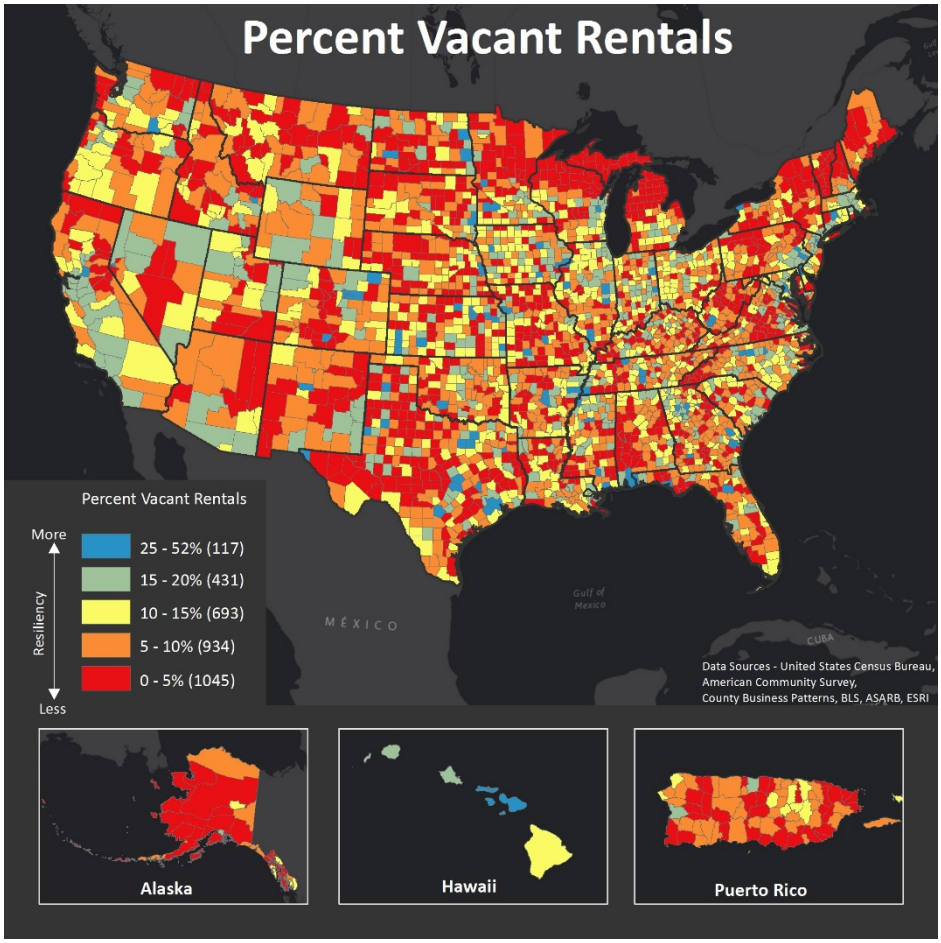

Figure 20. *Rental Property Capacity*: Percent Vacant Rentals

Data Source: ACS 2012–2016 five-year estimates, Table B25004.

Binning Method: Jenks Natural Breaks.

National Average: 13 percent of rental units are vacant on average in the United States.

Findings:

- The northeast and upper Midwest have some clusters of very low availability.
- In Alaska, 65 percent of counties (19 of 29) have rental vacancy rates below 10 percent.
- In Idaho, 52 percent of counties (23 of 44) have less than 10 percent of rental units vacant.
- In Nebraska, 55 percent of counties (51 of 93) are below that mark.
- In Puerto Rico, 66 percent of municipios (52 of 78) have rental vacancy rates under 10 percent.

Development of Aggregate Indicator

The research team developed a process to aggregate the county-level data from all 20 commonly used community resilience indicators to produce a choropleth map that shows relative resilience by county. The process to create this final aggregated-data map included four steps:

1. The team oriented all of the datasets in the same direction (a higher number equals higher resilience) by reversing the data for the indicators that were negatively correlated to resilience (higher numbers equaled less resilience).[24]

2. The research team then converted each county's data point to a standardized score value based on how many standard deviations above or below the indicator's national mean it was. For example, Crenshaw County in Alabama has a standardized score value for the indicator *Hospitals per 10,000 People* of 0.79, which means that this county has slightly more hospitals per 10,000 people than the national average (0.79 standard deviations above). For datasets where data for a specific county was missing, the mean for that indicator was used to ensure that the aggregate value for the country was not increased or reduced by the missing data. Appendix E provides the national mean for each indicator.

3. The team then averaged the 20 standardized score values for each county to create an aggregate indicator by county. Because there is no validated weighting scheme for resilience indicators, the research team did not weight individual indicators in developing the aggregate indicator.

4. Finally, the team sorted the county-level aggregate indicator score into five bins (Table 3). Inclusion in Bin 1 indicates that the county was far above the national average (at least 1 standard deviation above the average). Bin 2 indicates that the county fell within 1 standard deviation above the average. Bin 3 indicates that the county fell below, but very near the average (within 0.5 standard deviation). Bin 4 indicates that the county fell between 0.5 and 1 standard deviation below the average, and bin 5 indicates that the county fell at least 1 standard deviation below the average.

Table 3: Color Scale for Aggregate Maps

Blue	+1 standard deviation or more above the average
Green	Above 0 but <+1.0 standard deviation above average
Yellow	Below 0, but >-0.5 standard deviation below average
Orange	Between -0.5 and -1.0 standard deviation below average
Red	-1 standard deviation or more below the average

The research team used the same color scale for the aggregated-data map (Figure 21) as for the individual indicator maps (Figure 1–Figure 20), with blue indicating higher relative resilience levels and red indicating lower relative resilience levels. This aggregated-data map provides a data-driven basis for areas where FEMA NIC TA should offer community resilience Collaborative TA.

[24] Indicators were changed to "% population under 65," "% with HS diploma," "% without a disability," % speaking English fluently," "% with health insurance," "% own a vehicle," "% employed." % non-single family HH," "% housing not mobile homes," "reverse Gini index," and "population stability."

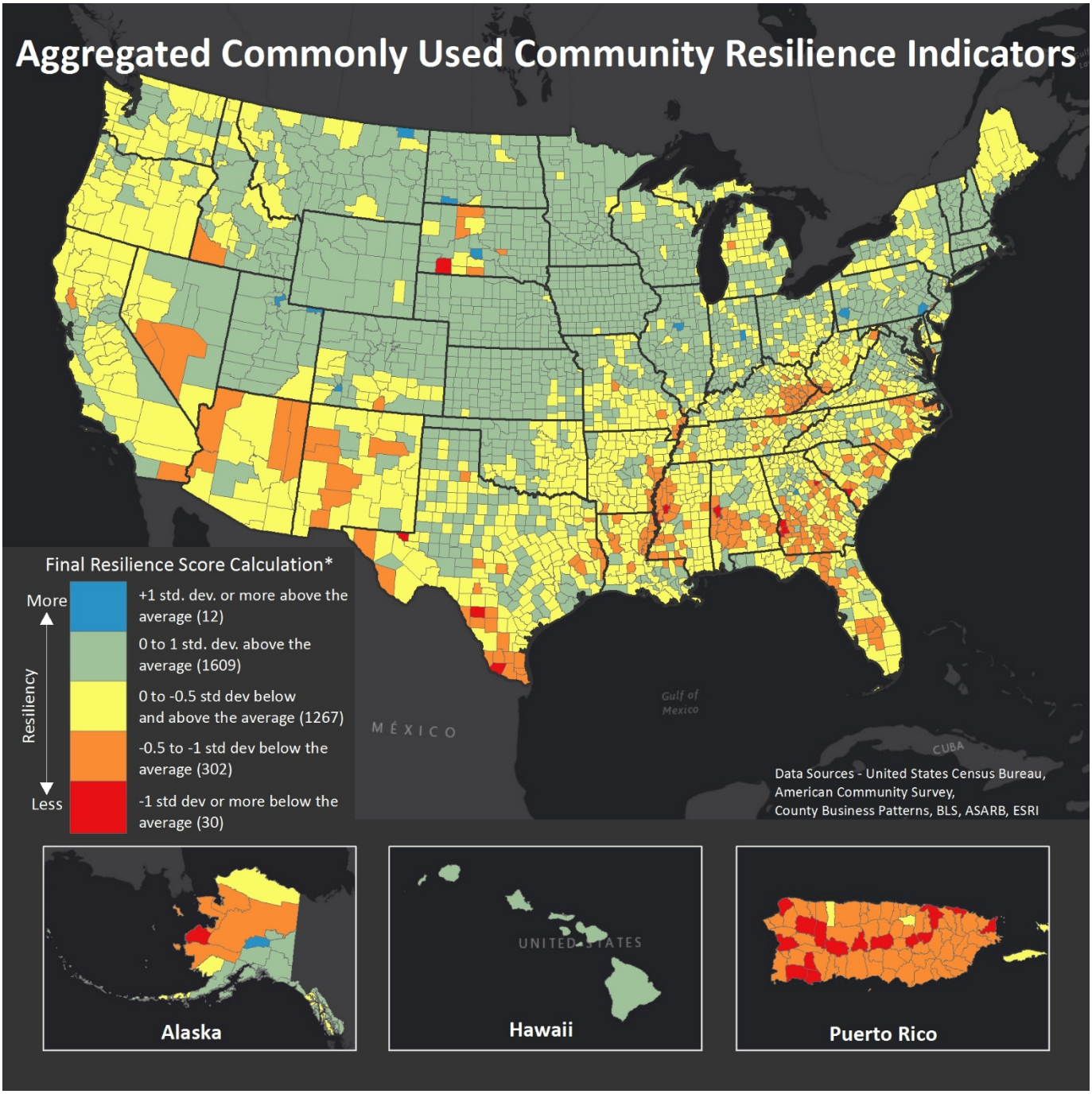

Figure 21. Aggregated Commonly Used Resilience Indicators

Regional Analysis of Aggregated Data

States in the Southeast: West Virginia, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas, and Louisiana

- Counties in southeastern states have populations with higher challenges to resilience based on indicators including lack of *Educational Attainment*, less *Household Income*, higher rates of *Single-Parent Households*, *Unemployment*, *Income Inequality*, population with a *Disability*, and lack of *Health Insurance*.
    - Georgia and Louisiana also have higher rates of households that lack *Access to a Vehicle*.
    - Florida has counties with some of the highest rates of *Age* – older adults, a population with fewer years living in the location and therefore less experience of local hazards, and a few counties with populations with *Limited English Proficiency*.
    - Several counties in the Southeast also have a concentration of *Mobile Homes*, making their housing more vulnerable to prevalent hazards such as flooding, hurricanes, and tornadoes. At the same time, these counties tended to have lower *Involvement with Civic Organizations* or *Religious Affiliation* (except Mississippi and Alabama), which could make it more difficult to mobilize communities either before or after a disaster.
- Counties in the Appalachian region of Ohio, West Virginia, and Kentucky fall into the least resilient bin for populations with lack of *Educational Attainment*, a *Disability*, and living in *Mobile Homes*.

States in the Southwest: Texas, Oklahoma, New Mexico, and Arizona

- Texas stands out, with many counties having populations facing relatively more challenges including; lack of *Educational Attainment* (below high school education), lower levels of *Household Income*, and lack of *Health Insurance*. In addition, counties in the southern part of the state and on the U.S./Mexican border have populations with *Limited English Proficiency*, higher *Unemployment*, and less *Access to Health Practitioners*.
- New Mexico has several counties with lower rates of resilience as related to populations with a *Disability*, lack of *Educational Attainment*, *Unemployment*, *Single-Parent Households*, less *Access to Health Practitioners*, and *Limited English Proficiency*. More than half the counties reported that *Mobile Homes* represented 20 percent or more of all housing units.
- For Arizona, the counties on the eastern border with Texas and the counties that border Mexico and California have populations with lower levels of *Household Income*, higher rates of *Single-Parent Households*, higher *Unemployment*, lack of *Health Insurance* (particularly in counties on the border with Texas), populations with a *Disability*, and *Age*. These counties also have high prevalence of *Mobile Homes*. Several Indian reservations lie within these counties, including the Hopi, Fort Apache, Navajo Nation, and Fort Mojave reservations.

States in the West: California, Nevada, Utah, Colorado, Wyoming, Oregon, Washington, Idaho, Montana, Alaska, and Hawaii

- The counties in the middle of and in northern California have indicators showing lower levels of resilience including lack of *Educational Attainment*, *Single-Parent Households*, lower *Household Income*, and *Unemployment* (across the entire state except for coastal counties). Northern California also has higher levels of *Age*, population with a *Disability*, and households living in *Mobile Homes*.
- Oregon has a number of challenges to resilience, including a high proportion of its population over age 65 (*Age*), facing *Unemployment*, and living with a *Disability*. There are also relatively high numbers of *Single-Parent Households* and individuals who live in *Mobile Homes*.

- Alaska, especially in the northwestern part of the state, has several counties that have lower levels of resilience including lack of *Educational Attainment* (below high school education), lower *Household Income* levels, higher *Single-Parent Households* and *Unemployment*, and very low rates of *Health Insurance*. Many households also are *Without a Vehicle*.
- Although Hawaii faces challenges in hospital coverage and number of schools, overall it is relatively resilient in the context of the indicators selected for this analysis. Distance from the mainland poses unique challenges for Hawaii, however, and should be considered when evaluating each indicator.

States in the Midwest: North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Michigan, and Ohio

- In general, counties in these states face fewer challenges to resilience, with relatively strong rates of *Educational Attainment* and *Health Insurance* coverage and lower levels of *Unemployment*, *Single-Parent Households*, and populations with a *Disability*.
- A few counties in South Dakota tend to overlap with several Indian reservations, including Cheyenne River and Standing Rock. These counties face severe *Unemployment*, lack of *Health Insurance*, more *Single-Parent Households*, and lower levels of *Household Income*.

States in the Northeast: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and Maryland

- Overall, the counties in this area show relatively high levels of resilience with Maine as an outlier.
- Compared to the rest of the states in the Northeast, counties in Maine have higher rates of *Single-Parent Households*, lower median *Household Income*, relatively high rates of populations with a *Disability*, and more adults over 65 (*Age*).

Puerto Rico: Puerto Rico faces high barriers to resilience on every indicator where data are available, except for healthcare; the population in Puerto Rico has relatively high rates of *Health Insurance* coverage.

National Analysis of Aggregated Data

It is important to remember that this analysis produced relative values to resilience only and that county-level data can mask highly challenged communities within a given county. As disasters continue to increase in frequency, all counties and communities must continue to invest in improving resilience, community functioning, and quality of life for all. Reviewing the aggregated-data map (Figure 21), this analysis suggests that those counties in the lower bins of aggregate indicators— that is, those counties in orange and red on the aggregated-data map — may face multiple and interrelated challenges to resilience.[50]

Thirty counties with the lowest aggregate indicators fall within the least resilient bin, which is red on the Aggregated Common Community Resilience Indicators Map (Figure 21). These counties are 1 or more standard deviations below the national average. Sixteen of these counties are in Puerto Rico; four are in Georgia; three are in Texas; two are in Mississippi; and one is located in each of New York, Arkansas, South Dakota, Alabama, and South Carolina.

A total of 302 counties fall between −0.5 and −1 standard deviation below the national average, indicating that they also face critical challenges to disaster resilience. These counties are shaded in orange on the map. Many of these counties also fall within Puerto Rico, while others are primarily within the Southeast and Southwest of the United States and Alaska.

Appendix F lists the specific counties in each of these lower bins.

The Aggregated Common Community Resilience Indicators Map also highlights clusters of counties in red and orange that appear to be appropriate priority areas for delivery of FEMA NIC Community Resilience TA. Many of these counties are also in areas of high risk to natural hazards. These areas include:

- The Lower Mississippi Delta region in the states of Louisiana, Mississippi, and Arkansas
- Tribal areas, particularly in North and South Dakota and New Mexico
- South Texas, western New Mexico, and northern Arizona
- Southwestern Georgia
- Southwestern Alabama
- Puerto Rico
- The central area of Alaska.

Implications for Emergency Managers

Understanding how these indicators relate to resilience has important implications for emergency managers and community leaders. Rather than attempting to influence the indicator metric (e.g., advocating for greater high school graduation rates or increasing the number of health diagnosing and treating practitioners), these indicators highlight areas where emergency managers should consider outreach strategies and emergency operations plans. Below are examples of how emergency managers can target preparedness outreach and update community response plans using this Community Resilience Indicator Analysis.

High Percentage of *Single-Parent Households*

The research community posits that *Single-Parent Households* are more vulnerable to a disaster because they tend to have lower socioeconomic status and fewer sources of social support than that of two-parent families. In addition, correlation analysis identifies that the indicator *Single-Parent Households* is positively correlated with higher levels of *Unemployment Rate*, *Disability* and lower levels of *Educational Attainment* and *Health Insurance*. *Single-Parent Households* is negatively correlated with *Household Income* and *Home Ownership*.

- **Preparedness Outreach:** Outreach to increase preparedness and resilience for *Single-Parent Households* should focus on partnering with social service agencies, community organizations, and schools that are already serving this population, to include the associated issues of *Unemployment*, *Disability*, lower *Household Income* and affordable *Rental* housing. For example, organizations like Supplemental Nutrition Assistance Program (SNAP), Head Start, and foodbanks currently assisting single parents can be a conduit for providing preparedness information and can help make sure these parents get needed support after a disaster. Because of the correlation with lower levels of *Educational Attainment* (below high school), outreach materials for this population should be plain language, use visual cues, and be written at the sixth-grade level.
- **Community Response Plans:** If there are geographic areas with greater numbers of *Single-Parent Households*, emergency managers should ensure community plans address their needs relative to evacuation transportation, sheltering, and child care.

High Presence of *Mobile Homes*

Communities with higher numbers of *Mobile Homes* face greater challenges to resilience because mobile homes are less secure than built housing. In addition, mobile homes are frequently found outside of metropolitan areas that may not be readily accessible by interstate highways or public transportation.

Correlation analysis identified that this indicator is positively correlated with *Disability* and *Unemployment*, as well as lack of *Health Insurance* and *Educational Attainment*. It is negatively correlated with *Household Income* and *Medical Professional Capacity*.

- **Preparedness Outreach:** Because of the construction and lower building heights of mobile homes, they are more vulnerable to high wind or flood disasters. Mobile home residents need to pay close attention to alerts and warnings, know protective actions, and practice going to safe locations near their mobile home community. Emergency managers should work with mobile home park managers to conduct trainings and drills and to promote home or rental insurance in these communities. Outreach materials for this population should be plain language, use visual cues and read at the sixth-grade level
- **Community Response Plans:** Plans that focus on the areas with higher numbers of *Mobile Homes* should also consider the higher incidence of *Unemployment* and *Disability* among this population. This group may need higher levels of evacuation support, especially to include access to public transportation, which may not normally be accessible in these locations.

Lower levels of *Hospitals per Capita* and lower *Access to Medical Professionals*

These indicators represent essential community infrastructure for resilience, both because they represent the capacity of the healthcare system to support residents' overall health and because they provide critical emergency medical care. Lack of this critical capacity negatively effects a community's ability to respond to and recover from disasters.

- **Preparedness Outreach:** To address lower levels of *Hospitals per Capita* and lower *Access to Medical Professionals*, emergency managers and community partners such as businesses, faith-based organizations, and homeowners associations can encourage community members to take first aid training or "You Are The Help until Help Arrives" training so that individuals can provide basic care in the immediate aftermath of a disaster. Preparedness campaigns should stress the importance of training and having adequate medical supplies on hand.
- **Community Response Plans:** Plans should address how to provide surge medical services; for example, making sure their community has an active Medical Reserve Corps and Community Emergency Response Teams (CERT) Program. Emergency Managers can also work with local public health agency to create mobile or pop-up medical care facilities.

Conclusion

Because resilience is a latent concept (generally measurable only *after* an impact), resilience is exceptionally challenging to measure or anticipate. Through this analysis, the Argonne team drew from the current body of community resilience research to provide a data-driven process for identifying potential participants for FEMA NIC TA in support of community resilience.

Argonne reviewed existing community resilience methodologies using a set of inclusion criteria and then identified commonly used indicators across those methodologies. Analysis of these 20 indicators provides insights for areas of the country that may benefit from community resilience-oriented TA.

In addition, this analysis provides important input for specific TA focus areas. For example:

- If a county is facing primarily population-centered challenges, such as *Age* (higher numbers of adults over age 65) and low *Household Income*, the TA may focus on programs that address **social issues** to build resilience.

- If a community challenge is a concentration of *Mobile Homes* and lack of *Vacant Rentals*, resilience-building programs may focus on addressing zoning issues.

The strong interrelationships between community resilience indicators demonstrate the need for a comprehensive view of community traits when considering community resilience initiatives. These interrelationships also underscore the need for a holistic, "whole community" approach to TA design and delivery.

This analysis is one element in a larger effort to create validated metrics of community resilience to disaster. Additional analysis could evaluate the usefulness of weighting the indicators and examining benefits or drawbacks to adding specific risks. In addition, principal component analysis, factor analysis, regression analysis, or structured sensitivity analysis could provide findings on the relative importance and weight of an indicator's contribution to overall resilience. Analysts could also conduct a comparative study to evaluate the analysis presented here with the others reviewed in the literature.

As the social science of community resilience continues to evolve, the findings presented in this paper offer a research-based lens to explore county-level community resilience. These results can help FEMA, SLTT emergency managers, and whole community partners begin to understand and improve those root community attributes that may contribute to lowered resilience when disasters occur.

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Appendix A: Community Resilience Definitions

The Community Resilience Indicator Analysis identified eight community resilience assessment methodologies that met the inclusion criteria established for this analysis. The below chart provides those methodologies' definitions of community resilience.

Methodology/Date	Date	Definition of Community Resilience
Australian National Disaster Resilience Index (ANDRI)[a]	2017	The Australian Natural Disaster Resilience Index focuses on community resilience to natural hazards. It is based on two sets of capacities: coping capacities and adaptive capacities. ▪ Coping capacity is defined as the means by which people or organizations use available resources, skills and opportunities to face adverse consequences that could lead to a disaster (IPCC 2012). Coping capacity captures the characteristics of a system that allow it to anticipate, act, achieve goals, and manage resources (Wisner et al. 2004) or which are associated with absorptive capacity and mobilization when a natural hazard event occurs (Cutter et al. 2008, Tierney 2014). In a practical sense, coping capacity relates to the factors influencing the ability of a community to prepare for, absorb, and recover from a natural hazard event. ▪ Adaptive capacity differs from coping capacity in that adaptive capacity focuses on the potential for the facilitation of adaptation by governance, institutional, management, and social arrangements and processes, whereas coping capacity focuses on the capacities of communities to anticipate and respond to hazards.
Baseline Resilience Indicators for Communities (BRIC)[b]	2014	As an ideal, BRIC views inherent community disaster resilience as a complex process of interactions between various social systems, each with their own form and function, but working in tandem to provide for the betterment of the whole community (US NRC, 2012).
Community Disaster Resilience Index (CDRI)[c]	2010	Community, for the purposes of this work, is defined as an ecological network of social systems. A resilient system implies robustness, rapidity, and enhancement in response to natural hazards/disasters. A resilient system is, relatively speaking, robust with respect to its ability to absorb and resist the impacts of a hazard agent's potential disaster impacts. Furthermore, having experience a disaster, a resilient system is able to bounce back quickly, reaching restoration levels in, relatively speaking, rapid fashion. Finally, as part of the recovery process, a resilient system enhances its capacities by improving its mitigation status, reducing pre-existing vulnerabilities, and improving its sustainability.
Community Resilience Index (CRI2)[d]	2010	In this theory, four sets of networked resources or capacities (Economic Development, Social Capital, Information and Communication, and Community Competence) define and shape the process of community resilience, i.e., the community's ability to ''bounce back'' from severe stress. These adaptive capacities are not specific strategies for emergency preparedness, but are a part of the social and economic fabric of the community.
Disaster Resilience of Place (DROP)[e]	2010	Resilience is a set of capacities that can be fostered through interventions and policies, which in turn help build and enhance a community's ability to respond and recover from disasters.

Methodology/Date	Date	Definition of Community Resilience
Resilient Capacity Index (RCI)[f]	2018	The way to assess a region's resilience is by its qualities to cope with future challenges and respond effectively to future stress, a concept labeled "resilience capacity."
Social Vulnerability Index (SVI)[g]	2011	Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities. Vulnerability is the extent to which persons or things are likely to be affected. [Note: resilience is not further defined].
The Composite Resilience Index (TCRI)[h]	2015	A combination of the four resilience environments (social, built, natural, and economic) presents a holistic overview of a community's resilience level. ▪ Social resilience allows individuals and communities to adapt to extreme circumstances and lessen their impact through mobility, individual-individual and individual-community interactions. ▪ Resilience in the built environment is enhanced through the provision of emergency services, essential infrastructure and access and evacuation potential. The natural environment encompasses flora and fauna (including humans) and their interaction with the natural landscape. The geographical location and natural features of a site have a significant impact on the vulnerability of a location. ▪ The economic environment of a community has a significant impact on its resilience. Herein, the economic environment is considered to include factors such as employment, income, productivity, wealth and inequality.

[a] ANDRI: Phil Morley, Melissa Parsons, and Sarb Johal, "The Australian Natural Disaster Resilience Index: A System for Assessing the Resilience of Australian Communities to Natural Hazards," *Bushfire & Natural Hazards CRC*. Accessed March 27, 2018, https://www.bnhcrc.com.au/research/hazard-resilience/251.

[b] BRIC: Susan L. Cutter, Kevin D. Ash, and Christopher T. Emrich, "The Geographies of Community Disaster Resilience," *Global Environmental Change* (2014): 29, 65–77.

[c] CDRI: Walter Gillis Peacock, et al., "Advancing Resilience of Coastal Localities: Developing, Implementing, and Sustaining the Use of Coastal Resilience Indicators: A Final Report," *Hazard Reduction and Recovery Center*, December 2010. Accessed April 6, 2018, https://pdfs.semanticscholar.org/ea56/1b67fb9fa11964a32e99c4da14ad32dd39de.pdf.

[d] CRI2: Kathleen Sherrieb, Fran H. Norris, and Sandro Galea, "Measuring Capacities for Community Resilience," *Social Indicators Research* 99 (2010): 227–247.

[e] DROP: Susan L. Cutter, Christopher G. Burton, and Christopher T. Emrich, "Disaster Resilience Indicators for Benchmarking Baseline Conditions," *Journal of Homeland Security and Emergency Management* 7 (2010). Accessed April 6, 2018, http://resiliencesystem.com/sites/default/files/Cutter_jhsem.2010.7.1.1732.pdf.

[f] RCI: Kathryn A. Foster, "Resilience Capacity Index," *Disaster Resilience Measurements: Stocktaking of Ongoing Efforts in Developing Systems for Measuring Resilience, United Nations Development Programme* (2014). https://www.preventionweb.net/files/37916_disasterresiliencemeasurementsundpt.pdf, 38.

[g] SVI: Barry E. Flanagan, et al., "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Management* 8 (2011). Accessed April 6, 2018, https://svi.cdc.gov/Documents/Data/A%20Social%20Vulnerability%20Index%20for%20Disaster%20Management.pdf.

[h] TCRI: T. Perfrement and T. Lloyd, "The Resilience Index: The Modelling Tool to Measure and Improve Community Resilience to Natural Hazards," *The Resilience Index*, 2015. https://theresilienceindex.weebly.com/our-solution.html.

Appendix B: Community Resilience Methodologies

This table lists the 73 unique methodologies identified in the meta-analyses as described in the chapter titled "Process to Identify and Map Commonly Used Indicators of Community Resilience. The first column is the short form of the methodology name, and the second column notes which of the meta-analyses referenced that specific methodology (the methodology corresponding to the referenced number appears at the end of the table). The third column lists the date of publication. The fourth column provides the full name of the methodology and a link to more information. The remaining columns provide an assessment of the methodology for each of the inclusion criteria.

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
AGIR	3	2015	European Commission *Global Alliance for Resilience Initiative (AGIR):Measuring and Monitoring Progress on Resilience Building for Food and Nutrition Security* http://ec.europa.eu/echo/files/policies/resilience/eu_resilience_compendium_en.pdf	Country	West Africa	Food Security	Pre	Mix	No	Yes
ANDRI	1	2015	Bushfire and Natural Hazards Cooperative Research Centre *The Australian Natural Disaster Resilience Index: Annual Project Report 2014* https://www.bnhcrc.com.au/file/4862/download?token=Al2J3m1F	Community	Australia	Natural	Pre	Mix	Yes	Yes
ASPIRE	4	2014	The World Bank *The Atlas of Social Protection Indicators of Resilience and Equity* http://datatopics.worldbank.org/aspire/documentation	Country	Global	Poverty	Pre	Yes	Yes	Yes

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
BCRD	1	2011	RAND *BCRD – Building Community Resilience to Disasters – A Way Forward to Enhance National Health Security* http://www.caloes.ca.gov/AccessFunctionalNeedsSite/Documents/Building%20Community%20Resilience%20to%20Disaster.pdf	Community	U.S.	Health	Pre	Mix	No	Mix
BRIC	1, 2, 3, 4, 5, 6	2014	Susan Cutter et al. BRIC: Baseline Resilience Indicators for Communities *The Geographies of Community Disaster Resilience* https://www.sciencedirect.com/science/article/pii/S0959378014001459	County	U.S.	Multiple	Pre	Yes	Yes	Yes
CARRI	1, 6	2008	Oak Ridge National Laboratory *Community and Regional Resilience Initiative* http://www.resilientus.org/wp-content/uploads/2013/03/FINAL_CUTTER_9-25-08_1223482309.pdf	Community	U.S.	Multiple	Pre	Yes	Yes	Not Identified

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
CART	1, 2, 4	2012	R.L. Pfefferbaum et al. Terrorism and Disaster Center, University of Oklahoma Health Sciences Center *CART: Communities Advancing Resilience Toolkit* https://www.ncbi.nlm.nih.gov/pubmed/24180095 https://www.oumedicine.com/docs/ad-psychiatry-workfiles/cart_online-final_042012.pdf?sfvrsn=2	Community	U.S.	Multiple	Pre	No	Yes	No
CCR/ IOTWS	1, 5	2007	USAID-Asia Community Coastal Resilience U.S. Indian Ocean Tsunami Warning System Program *A Guide for Evaluating Coastal Community Resilience to Tsunami/Other Hazards* https://www.crc.uri.edu/download/CCRGuide_lowres.pdf	Community	Southeast Asia	Tsunami	Pre	No	Yes	No
CCRAM	4, 5	2013	D. Leykin et al. *Conjoint Community Resilience Assessment Measure* https://www.ncbi.nlm.nih.gov/pubmed/24091563 http://in.bgu.ac.il/en/PREPARED/Pages/ccram.aspx	Community	Global	Multiple	Pre and post	Mix	No	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
CDR	1	2015	D. Keun et al. *A Measurement of Community Disaster Resilience in Korea* http://www1.cpij.or.jp/com/iac/sympo/13/ISCP2013-24.pdf	Community	South Korea	Natural	Pre	Yes	Yes	Yes
CDRI	1, 4, 5	2010	Coastal Services Center and NOAA Hazard Reduction and Recovery Center, Texas A&M *Development of a Community Disaster Resilience Framework and Index* https://pdfs.semanticscholar.org/ea56/1b67fb9fa11964a32e99c4da14ad32dd39de.pdf	Coastal	U.S. Coastal	Multiple	Pre	Mix	Yes	Yes
CDRI2	1, 5	2010	Kyoto University, UNISDR *CDRI2: Climate and Disaster Resilience Initiative; Capacity Building Program* http://lib.riskreductionafrica.org/bitstream/handle/123456789/625/climate%20and%20disaster%20resilience%20initiative%20capacity%20building%20program.pdf?sequence=1	City	Southeast Asia	Multiple	Pre	Mix	Yes	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
CDRST	1	2015	Torrens Resilience Institute *Developing a Model and Tool to Measure Community Disaster Resilience* http://www.flinders.edu.au/centres-files/TRI/pdfs/trireport.pdf http://www.emeraldinsight.com/doi/pdfplus/10.1108/IJDRBE-03-2015-0008	Community	Australia	Multiple	Pre	Mix	Yes	Mix
CERI	1	2010	Advantage West Midlands *Community Economic Resilience Index* http://webarchive.nationalarchives.gov.uk/+/http:/www.advantagewm.co.uk/Images/Community%20Economic%20Resilience%20Index_tcm9-33264.pdf	Community	U.K.	Recession	Pre	Yes	Yes	Yes
CoBRA	1, 3, 4	2014	UNDP/Drylands Development Centre *Community Based Resilience Analysis* http://www.undp.org/content/undp/en/home/librarypage/environment-energy/sustainable_land_management/CoBRA.html	Community	Kenya, Uganda	Drought	Pre	No	Yes	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
CRDSA	1, 5	2015	S.A. Alshehri et al. *Disaster Community Resilience Assessment Method: A Consensus based Delphi and AHP Approach* https://link.springer.com/article/10.1007%2Fs11069-015-1719-5	Community	Saudi Arabia	Multiple	Pre	Mix	No	No
CR-E	5	2015	Nasrullah et al. *Status of Community Resilience in Disaster Prone Districts of Pakistan* https://file.scirp.org/pdf/OJER_2015112714454948.pdf	District	Pakistan	Earth-quake	Pre	Yes	Yes	No
CREAT	4	2016	U.S. Environmental Protection Agency Climate Resilience Evaluation and Awareness Tool https://www.epa.gov/crwu/creat-risk-assessment-application-water-utilities	Water utilities	U.S.	Climate Risk	Pre	Mix	No	No
CRF	1, 4	2015	The Rockefeller Foundation, Arup *City Resilience Framework and City Resilience Index* https://assets.rockefellerfoundation.org/app/uploads/20140410162455/City-Resilience-Framework-2015.pdf	City	Global	Multiple	Pre	No	Yes	No
CRI	1, 2, 4	2010	Mississippi-Alabama Sea Grant Consortium *Coastal Resilience Index: A Community Self-Assessment* http://www.southernclimate.org/documents/Coastal_Resilience_Index_Sea_Grant.pdf	Community	U.S. – Coastal	Coastal Hazards	Post	No	Yes	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
CRI2	1, 4	2010	K. Sherrieb et al. *Measuring Capacities for Community Resilience* (Community Resilience Index) https://link.springer.com/article/10.1007%2Fs11205-010-9576-9	County	U.S.	Multiple	Pre	Yes	No	Yes
CRM	1	2000	Canadian Center for Community Renewal *Community Resilience Manual* https://communityrenewal.ca/sites/all/files/resource/P200_0.pdf	Community	Canada and U.S.A. – Rural	Recession	Pre	Mix	Yes	No
CRR	3	2013	World Economic Forum *Global Risks 2013* http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2013.pdf	Country	Global	Multiple	Pre	Yes	Yes	Yes
CRS	1, 2, 4	2014	Community and Regional Resilience Institute, Meridien *A Practical Approach to Building Resilience; Community Resilience System* http://journals.sagepub.com/doi/pdf/10.1177/0002764214550296	Community	U.S.	Multiple	Pre	Yes	No	No
CRT	1	2009	Bay Localize *Community Resilience Toolkit: Workshop Guide* http://www.baylocalize.org/files/Community_Resilience_Toolkit_v1.0.pdf	City or County	U.S.	Climate Change	Pre	No	Yes	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
CV	6	2013	Texas A&M University, Hazard Reduction and Recovery Center *Status and Trends of Coastal Vulnerability to Natural Hazards Project* http://www.glo.texas.gov/coastal-grants/_documents/grant-project/11-025-final-report.pdf	County	U.S.	Coastal Hazards	Pre	Yes	Yes	Yes (TX)
DFID	1, 4	2009	DFID Disaster Risk Reduction Interagency Coordination Group *Characteristics of a Disaster-Resilient Community* http://discovery.ucl.ac.uk/1346086/1/1346086.pdf	Community	Global	Multiple	Pre	Mix	Yes	No
DRLA	3	2012	Disaster Resilience Leadership Academy, Tulane University *Haiti Humanitarian Assistance Evaluation: Resilience Perspective* https://reliefweb.int/sites/reliefweb.int/files/resources/UEH%20Tulane%20DRLA%20Haiti%20Humanitarian%20Aid%20Evaluation%20ENGLISH%20May%202012.pdf	Household	Haiti	Natural	Pre	Mix	Yes	No
DROP	6	2010	S. Cutter et al. Disaster Resilience of Place *Disaster Resilience Indicators for Benchmarking Baseline Conditions* http://resiliencesystem.com/sites/default/files/Cutter_jhsem.2010.7.1.1732.pdf	County	U.S. – Southeast	None	Pre	Yes	Yes	Yes

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
FAO	3	2010	Food and Agriculture Organization of the UN *FAO Resilience Tool* http://www.fao.org/docrep/013/al920e/al920e00.pdf	Community	Global	Food Security	Pre	Yes	Yes	Yes
FAO-Livelihoods	4	2010	L. Alinovi et al., European Report on Development *Livelihoods Strategy and Household Resilience to Food Insecurity* http://www.technicalconsortium.org/wp-content/uploads/2014/05/Livelihoods-Strategies_Household-Res.pdf	Country	Kenya	Food Security	Pre	Yes	Yes	HH surveys
FCR	1	2014	International Federation of Red Cross *IFRC Framework for Community Resilience* http://www.ifrc.org/Global/Documents/Secretariat/201501/1284000-Framework%20for%20Community%20Resilience-EN-LR.pdf	Community	Global	Multiple	Pre	Mix	Yes	No
FSRI	4	2015	New Economics Foundation *Financial System Resilience Index* http://neweconomics.org/2015/06/financial-system-resilience-index/	Country	Global	Financial System	Pre	Yes	No	No
GFM	3		UN OCHA and Maplecroft *Global Focus Model* https://interagencystandingcommittee.org/system/files/legacy_files/Maplecroft_GFM_050412.pdf	Country	Global	Multiple	Pre	Yes	No	Mix

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
GRI	4	2017	FM Global *2018 FM Global Resilience Index* https://www.fmglobal.com/research-and-resources/tools-and-resources/resilienceindex	Country	Global	Multiple	Pre	Yes	Yes	No
Grosvenor	1	2014	Grosvenor *Resilient Cities Research Report* http://www.grosvenor.com/news-views-research/research/2014/resilient%20cities%20research%20report/	City	Global	Multiple	Pre	Mix	No	N/A
Hazus	2		FEMA Hazus Methodology https://www.fema.gov/hazus	Community	U.S.	Earthquake, Flood, Hurricane, Tsunami	Post (models losses)	Yes	Yes	Yes
Hyogo	1, 3	2008	International Strategy for Disaster Reduction *Indicators of Progress: Guidance on Measuring the Reduction of Disaster Risks and the Implementation of the Hyogo Framework for Action* http://www.unisdr.org/files/2259_IndicatorsofProgressHFA.pdf	City	Global	Natural	Pre and post	Mix	Yes	No
ICBRR	1, 5	2012	Canadian Red Cross *Measuring Disaster-Resilient Communities; Integrated Community Based Risk Reduction* https://www.ncbi.nlm.nih.gov/pubmed/22576136	Coastal Community	Indonesia	Coastal Hazards	Pre	Mix	No	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
IDRI	3	2013	United Nations Development Programme *Indonesia Disaster Recovery Index* http://www.id.undp.org/content/indonesia/en/home/presscenter/pressreleases/2013/11/27/launching-of-the-world-s-first-disaster-recovery-index.html	Community	Indonesia	Volcano/ Flood	Post	Mix	No	Yes
IDS	3	2013	Institute of Development Studies Towards a Quantifiable Measure of Resilience https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/2990/Wp434.pdf;jsessionid=FF9965C00C8A54822E41F9CCE56A5974?sequence=1	Multi-level	Global	Food Security	Pre	Yes	Yes	N/A
LCOT	3	2012	Tufts University *Livelihoods Change Over Time* http://fic.tufts.edu/research-item/livelihoods-change-over-time/	Household	Sudan, Ethiopia, Haiti	Multiple	Post	Yes	Yes	Yes
LDRI	1	2013	P.M. Orencio and M. Fujii Localized Disaster-Resilience Index http://www.sciencedirect.com/science/article/pii/S2212420912000428?via%3Dihub	Community	Philippines	Coastal Hazards	Pre	Mix	No	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
MCEER R4	3	2007	Multidisciplinary Center for Earthquake Engineering Research, Univ. of Buffalo Conceptualizing and Measuring Resilience http://onlinepubs.trb.org/onlinepubs/trnews/trnews250_p14-17.pdf	Community	Global	Infra-structure	Pre	N/A	Yes	N/A
NIST	1, 4	2016	National Institute of Standards and Technology (NIST) *Community Resilience Planning Guide for Building and Infrastructure Systems* (Volumes 1 and 2) https://www.nist.gov/topics/community-resilience/planning-guide	Community	Kenya/ Uganda	Infra-structure	Pre	No	Yes	No
ODI	3	2013	Overseas Development Inst. *Disaster Risk Management Potential Targets and Indicators* http://www20.iadb.org/intal/catalogo/PE/2013/11856.pdf	Community	Global	Multiple	Both	Yes	No	N/A
ORP	2	2013	Oregon Seismic Safety Policy Advisory Commission *The Oregon Resilience Plan Reducing Risk and Improving Recovery for the Next Cascadia Earthquake and Tsunami* http://www.oregon.gov/oem/Documents/Oregon_Resilience_Plan_Final.pdf	Regional	Oregon	Infra-structure	Post	Mix	Yes	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
OXFAM	4	2013	OXFAM *A Multidimensional Approach to Measuring Resilience* https://policy-practice.oxfam.org.uk/publications/a-multidimensional-approach-to-measuring-resilience-302641	Community	Global	Humani-tarian	Pre	Mix	No	No
PEOPLES	1, 3, 4, 5	2010	NIST, MCEER: Univ. of Buffalo *PEOPLES Resilience Framework* http://peoplesresilience.org/wp-content/uploads/2013/07/2010_Renschler_PEOPLES_Resilience.pdf	Community	U.S.	Multiple	Pre	Mix	No	Yes
PVI	3	2011	Inter-American Development Bank *Indicators of Disaster Risk and Risk Management; Prevalent Vulnerability Index* https://publications.iadb.org/handle/11319/5237	Country and Subnational	Latin America	Multiple	Pre	Yes	No	Yes
RASA	6	2008	B. Maguire and S. Cartwright *Assessing a Community's Capacity to Manage Change: A Resilience Approach to Social Assessment* http://www.tba.co.nz/tba-eq/Resilience_approach.pdf	Community	Australia (rural)	Water Scarcity	Pre	No	Yes	No
RCI	3		Network on Building Resilient Regions *Resilience Capacity Index* https://www.macfound.org/networks/research-network-on-building-resilient-regions/details/	Metropolitan Statistical Area	U.S.	Multiple	Pre	Yes	Yes	Yes

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
RCI2 – Regions	4	2008	Berkeley IURD Resilience and Regions: Building Understanding of the Metaphor https://iurd.berkeley.edu/wp/2007-12.pdf	Metro Regions	Global	Multiple	Pre	N/A	Yes	N/A
RELi	1	2015	Capital Markets Partnership *RELi Resilience Action Checklist* http://online.anyflip.com/zyqc/ojoi/mobile/index.html#p=14	Community	U.S.	Infra-structure	Pre	No	Yes	No
ResilUS	1, 3, 4, 6	2011	U.S. Resilience Institute, Western Washington University *ResilUS* https://huxley.wwu.edu/ri/resilus	Community	U.S.	Earthquake	Post	Yes	No	Yes
RIM	6	2016	N.S. Lam et al. Resilience Inference Measurement: Measuring Community Resilience to Coastal Hazards along the Northern Gulf of Mexico https://www.ncbi.nlm.nih.gov/pubmed/27499707	County	U.S.	Coastal Hazards	Post	Yes	Yes	Yes
RMI	4	2013	Argonne National Laboratory *Resilience Measurement Index: Indicator of Critical Infrastructure Resilience* http://www.ipd.anl.gov/anlpubs/2013/07/76797.pdf	Facility	U.S.	Infra-structure	Pre	Mix	No	Mix

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
RRI	3	2013	DARA *Risk Reduction Index* http://daraint.org/wp-content/uploads/2012/01/How_does_the_RRI_work.pdf	Territorial Units	West Africa	Multiple	Pre	No	Yes	No
RRI – Rural	1	2014	Rural Disaster Resilience Project *Rural Resilience Index* http://journals.sagepub.com/doi/pdf/10.1177/0002764214550297	Community – Rural	Global	Multiple	Pre	No	No	N/A
SERI	3	2013	Verisk Maplecroft Socio-economic Risk Index https://www.maplecroft.com/human-rights-political-environmental-economic-risk-indices	Country	Global	Multiple	Pre	Yes	No	N/A
SPUR	1, 2, 4, 6	2009	San Francisco Planning + Urban Research Association *The Resilient City: Defining What San Francisco Needs From Its Seismic Mitigation Policies* https://www.spur.org/sites/default/files/publications_pdfs/SPUR_Seismic_Mitigation_Policies.pdf	Community	U.S.A	Earthquake/ Infra-structure	Post	Yes	No	No
Surging Seas	4	2013	Climate Central Surging Seas Risk Finder https://riskfinder.climatecentral.org/	Community	U.S. Coast	Storm Surge/ Flood	Pre	Yes	Yes	Yes
SVI	7	2011	Agency for Toxic Substances & Disease Registry Social Vulnerability Index https://svi.cdc.gov/	County	U.S.A.	Multiple	Pre	Yes	Yes	Yes

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
TCRI	1	2015	T. Perfrement and T. Lloyd *The Composite Resilience Index* https://www.myresilient.city/concepts/17-composite-resilience-index-2.html	Community	Australia	Natural	Pre	Yes	Yes	Yes
THRIVE	1	2004	Prevention Institute *THRIVE Tool for Health & Resilience in Vulnerable Environments* https://www.preventioninstitute.org/tools/thrive-tool-health-resilience-vulnerable-environments	Community	U.S.	Health Disparity	Pre	Mix	Yes	No
TNC Coastal Resilience	4	2015	The Nature Conservancy *Coastal Resilience Mapping Tool* https://maps.coastalresilience.org/	Community	Global	Coastal Hazards	Pre	Yes	No	Yes
TRIAMS	3	2006	World Health Organization *Tsunami Recovery Impact Assessment and Monitoring System Risk Reduction Indicators* http://www.who.int/hac/crises/international/asia_tsunami/triams/risk_reduction_indicators_pro_vention.pdf?ua=1	Community	Indian Ocean	Tsunami	Post	Mix	Yes	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
UCR	1	2014	Rockefeller Foundation Urban Climate Resilience: A Review of Methodologies Adopted under the ACCCRN Initiative in Indian Cities https://www.researchgate.net/publication/275521843_Urban_Climate_Resilience_A_review_of_the_methodologies_adopted_under_the_ACCCRN_initiative_in_Indian_cities	City	India	Natural	Pre	No	No	No
UDRI	1	2015	Earthquakes and Megacities Initiative *A Guide to Measuring Urban Risk Resilience – the Urban Disaster Risk Index (UDRI)* https://www.cedim.de/download/Guidebook_URR_ME-July-2015.pdf	City	Global	Natural	Post	Mix	Yes	No
UNISDR	1, 2, 4	2014	UNISDR *Disaster Resilient Scorecard for Cities* http://www.unisdr.org/we/inform/publications/53349	City	Global	Multiple	Pre	No	Yes	No
USAID	1, 4	2013	Feed the Future *Community Resilience: Conceptual Framework and Measurement – Feed the Future Learning Agenda* https://agrilinks.org/sites/default/files/resource/files/FTF%20Learning_Agenda_Community_Resilience_Oct%202013.pdf	Community	Global	Poverty	Pre	Yes	No	No

Name	Meta-analysis Sources*	Date Published	Developer/ Title/Links	Unit of Analysis	Area of Focus	Risk Focus	Pre or Post Disaster	Quantitative?	Public Domain?	Public Data Source?
WISC	6	2014	WISC Well-being, Identity, Services and Capitals: Theorizing Community Resilience to Improve Computational Modeling https://ascelibrary.org/doi/pdf/10.1061/9780784413609.265	Community	U.S.	Multiple	Pre	Yes	No	Yes
WRI	3	2016	Institute for Environment and Human Security of the United Nations *World Risk Index* http://www.irdrinternational.org/2016/03/01/word-risk-index/	Country	Global	Multiple	Pre	Yes	Yes	Yes

*Meta-analysis key:

1. Ayyoob Sharifi, "A Critical Review of Selected Tools for Assessing Community Resilience," *Ecological Indicators* 69 (2016): 629–647. Accessed April 6, 2018. http://dx.doi.org/10.1016/j.ecolind.2016.05.023.
2. Francis M. Lavelle, Liesel A. Ritchie, Alexis Kwasinski, and Brian Wolshon, "Critical Assessment of Existing Methodologies for Measuring or Representing Community Resilience of Social and Physical Systems," *NIST GCR 15-1010* (2015). Accessed April 6, 2018. http://dx.doi.org/10.6028/NIST.GCR.15-1010.
3. Thomas Winderl, "Disaster Resilience Measurements: Stocktaking of Ongoing Efforts in Developing Systems for Measuring Resilience," *United Nations Development Programme.* 2014. Accessed April 6, 2018. https://www.preventionweb.net/files/37916_disasterresiliencemeasurementsundpt.pdf.
4. Susan L. Cutter, "The Landscape of Disaster Resilience Indicators in the USA," *Natural Hazards* 80 (2015): 741–758. Accessed April 6, 2018. http://dx.doi.org/10.1007/s11069-015-1993-2.
5. Abbas Ostadtaghizadeh, Ali Ardalan, Douglas Paton, Jossain Jabbari, and Hamid Reza Khankeh, "Community Disaster Resilience: A Systematic Review on Assessment Models and Tools," *PLoS Currents*. 2015. Accessed April 6, 2018. http://dx.doi.org/10.1371/currents.dis.f224ef8efbdfcf1d508dd0de4d8210ed.

6. Maria Koliou, John W. van de Lindt, Therese P. McAllister, Bruce R. Ellingwood, Maria Dillard, and Harvey Cutler, "State of the Research in Community Resilience: Progress and Challenges," *Sustainable and Resilient Infrastructure* (2017): 1–21. Accessed April 6, 2018. http://dx.doi.org/10.1080/23789689.2017.

7. Other methodologies identified outside of meta-analyses.

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Appendix C: Commonly Used Community Resilience Indicators

In the charts that follow, reference notes (lowercase letters) in the Connection to Resilience sections indicate which methodology provided the explanation cited for why the indicator is an effective measure of community resilience. A key for the references follows at the end of this Appendix.

Population Indicators

Educational Attainment								
Metric				Data Source				
Percentage of population over age 25 without a high school diploma				ACS 2012–2016 five-year estimates, Table 21501				
Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
7	X	X	X	X	X	X	X	
Connection to Resilience								
Higher levels of education are associated with health, as well as an improved ability to communicate and comprehend information.[b,g]								
Education is included as an input to economic resilience as higher levels of education is a characteristic of a strong labor force and supports individuals' ability to access community resources.[c,f]								
Higher levels of education can improve the capacity to prepare for, and respond to, the stress of disasters.[a,e,h]								
For individuals with lower levels of education, the practical and bureaucratic hurdles to cope with, and recover from, a disaster are much more difficult to navigate.[g]								

Unemployment Rate								
Metric				Data Source				
Percentage of the labor force unemployed				ACS 2012–2016 five-year estimates Table S2301				
Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
7	X	X	X	X	X		X	X
Connection to Resilience								
High levels of employment contribute to a healthy community economy, which supports community resilience.[a,b,d,e,h]								
Employment also provides residents with financial resources that contribute to their livelihoods.[c]								
Unemployed persons do not have the employee benefit plans that provide income and health cost assistance in the event of injury or death.[g]								
Counties with higher levels of unemployment may have fewer community resources to support residents' needs and a population that is both less prepared for a disaster and less able to cope with the aftermath.[h]								

Disability

Metric	Data Source
Percentage of the population with disabilities[25]	ACS 2012–2016 five-year estimates, Table S1810

Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
6	X	X			X	X	X	X

Connection to Resilience
Individuals with disabilities tend to be more vulnerable to physical, social, and economic challenges.[b,f]
Having functional, mobility, or access needs can make responding to disasters more challenging, including adapting to extreme circumstances and dealing with the increased stress.[a,f,h]
During an emergency, family members, neighbors, or a caretaker may be less able to provide support to individuals with special needs that require the assistance of others.[g]

English Language Proficiency

Metric	Data Source
Percentage of limited English-speaking households[26]	ACS 2012–2016 five-year estimates, Table S1602

Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
6	X	X	X		X		X	X

Connection to Resilience
Proficiency in English supports community resilience because of improved ability to communicate between individuals, as well as allowing individuals to better access community resources.[a,c,g]
Greater numbers of proficient English speakers can be vital for effective communication interactions in the event of a disaster.[b,h]
In communities where the first language is neither English nor Spanish, accurate translations of advisories may be scarce.[g]
Communities with fewer English-speaking residents may demonstrate lower levels of resilience.[e]

[25] Per ACS question wording, this would include individuals with the following conditions: serious difficulty hearing, seeing, walking, and/or dressing; serious difficulty because of a physical, mental, or emotional condition; serious difficulty concentrating, remembering, making decisions, or doing errands alone.

[26] A "limited English-speaking household" is one in which no member 14 years and older speaks only English or speaks a non-English language and speaks English "very well." In other words, all members 14 years and older have at least some difficulty with English (https://census.gov/library/visualizations/2017/comm/english-speaking.html.html), accessed August 7, 2018.

Mobility

Metric	Data Source
Percentage of occupied housing units with no vehicles available.	ACS 2012–2016 five-year estimates, Table DP04

Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
6	X	X	X		X		X	X

Connection to Resilience
Access to transportation helps individuals support their livelihoods and provides critical mobility to adapt to the extreme circumstances of a disaster.[c,e,h]
Communities where fewer individuals have access to a vehicle may have less resilience to a disaster.[b]
Lack of access to vehicle can be especially problematic in terms of evacuation in urban areas where automobile ownership is lower, especially among inner city poor populations.[g]

Home Ownership

Metric	Data Source
Percentage of owner-occupied housing units	ACS 2012–2016 five-year estimates, Table DP04

Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
6	X	X	X		X	X		X

Connection to Resilience
Home ownership is often included as a measure of a community's economic strength and thus is a marker of community resilience.[b,c,e,h]
Home ownership is also used to reflect residents' levels of place attachment to their communities.[c,f]
Low levels of home ownership can indicate a community with a faltering economy and a population with less long-term commitment to the community, which could hamper both individual and community mitigation actions to prepare for disaster as well as recovery efforts.[a,f]

Age

Metric	Data Source
Percentage of the population 65 years and older	ACS 2012–2016 five-year estimates, Table S0103

Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
5	X	X			X		X	X

Connection to Resilience
Several methodologies noted that the percentage of elderly adults in the population could affect resilience.[a,b,e]
Those over 65 tend to be less mobile.[h]
Those over 65 may find it more difficult to prepare for disasters and to adapt to extreme circumstances.[h]
Many people over 65 require assistance from family, neighbors, and others, which might not be available during a disaster.[g]

Household Income

Metric	Data Source
Median household income	ACS 2012–2016 five-year estimates, Table S1903

Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
5	X		X	X			X	X

Connection to Resilience
Research has shown that there is a strong relationship between individuals' financial resources and their resilience to a disaster.[b,c]
Low-income households are at greater risk because they tend to live in lower-quality housing situated in higher risk areas, are less likely to have prepared for a disaster, and have fewer resources to support recovery.[c]
The median household income of a community may also reflect its economic resilience and the community resources available to support recovery.[h]

Income Inequality

Metric	Data Source
Gini Index[27]	ACS 2012–2016 five-year estimates, Table B19083

Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
4		X		X	X	X		

Connection to Resilience
The economic environment is a major factor in a community's resilience and when income inequality is present, earnings tend to be distributed in a way that does not support broader community goals.[b,d,e]
Also, a skewed distribution of economic resources may negatively affect the cohesiveness of the residents' response to a disaster.[f]

[27] The Gini Index or coefficient uses a scale of 0–1 to measure the difference between the ideal distribution of income (perfect equality [0] where 50 percent of the population would receive 50 percent of the available income) and the actual distribution.[g] The closer the number is to 1, the greater the income inequality.

Health Insurance

Metric	Data Source
Percentage of the population without health insurance coverage	ACS 2012–2016 five-year estimates, Table S2701

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
4		X	X		X	X		

Connection to Resilience

Health is a critical component of community well-being as an unhealthy population has more difficulty accessing community support, or engaging in the process of building disaster resilience.[c,e]

Communities with more individuals covered by health insurance tend to have higher measures of physical and mental health.[b,e]

Health insurance coverage is one indication of individuals' capacity to effectively respond to and recover from a crisis, both mentally and physically.[f]

Communities with lower percentages of individuals with health insurance may have lower levels of resilience.[e]

Single-Parent Households

Metric	Data Source
Percentage of single-parent households	ACS 2012–2016 five-year estimates, Table B09005

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
3	X			X			X	

Connection to Resilience

Single-parent households are more vulnerable to a disaster because they tend to have lower socioeconomic status and fewer sources of social support than that of two-parent families.[d,g]

Single-parent households are also vulnerable as all daily responsibilities fall to one parent, making recovery more difficult.[g]

Community Indicators

Connection to Civic and Social Organizations

Metric	Data Source
Number of civic and social organizations per 10,000 people	U.S. Census Bureau, 2015 County Business Patterns, Table 00A1

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
6		X	X	X	X	X		X

Connection to Resilience

This measure indicates the level of community engagement by looking at the level of civic infrastructure through which residents support their communities.[b,d,e,f]

Participation in civic organizations provides a mechanism for residents to invest in and take from their community and also increases networking and trusted relationships.[c,f]

The availability of formal social networks can be critical during response and recovery to quickly mobilize resources and disseminate information.[b,c,d]

Residents who participate in local civic organizations can use them for help and provide mutually beneficial cooperation during a crisis.[b,d]

Hospital Capacity

Metric	Data Source
The number of hospitals per 10,000 people	ACS 2012–2016 five-year estimates, Table DP05

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
5	X	X	X		X			X

Connection to Resilience

This measure represents essential community infrastructure, both because it represents the capacity of the healthcare system to support residents' overall health and to provide critical emergency medical care.[a,b,c,e,h]

Lack of this critical capacity negatively affects a community's ability to respond to and recover from disasters.[c]

Medical Professional Capacity

Metric	Data Source
The number of health-diagnosing and treating practitioners per 1,000 population	ACS 2012–2016 five-year estimates Table S2401

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
5	X	X	X	X	X			

Connection to Resilience

Availability of physicians is linked with the overall physical and mental health of community residents.[b,c,d,e]

Lack of access to physicians is related to lower levels of overall community resilience as indicated by low birthweight and premature mortality.[d]

Physicians are a critical emergency resource in the response to and recovery from a disaster.[a]

Affiliation with a Religion

Metric	Data Source
Percentage of the population that are religious adherents	Association of Statisticians of American Religious Bodies. 2010 U.S. Religion Census. http://www.usreligioncensus.org/index.php

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
4		X	X	X	X			

Connection to Resilience

Affiliation with a religious organization or civic organization can be used as a proxy measure for social connectedness, and how much a community may be able to rely on the good will of other local citizens, leading to reciprocity and mutually beneficial cooperation.[b,d,e]

Religious adherents can access additional support beyond their family and neighbors. Religious organizations are often organized to actively provide physical and social support to their congregations and communities during times of individual and community crisis.[b,c,d]

Mobile Homes

Metric	Data Source
Percentage of mobile homes	ACS 2012–2016 five-year estimates, Table DP04

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
4	X	X			X		X	

Connection to Resilience

Higher numbers of mobile homes in a community are related to lower levels of resilience because of the lower-quality construction of these homes and lack of basements, which makes them particularly susceptible to damage from hazards.[b,e,g]

Mobile homes are frequently found outside of metropolitan areas that may not be readily accessible by interstate highways or public transportation.[g]

Population Change

Metric	Data Source
The percentage change in residents who have lived in the same county for more than five years	U.S. Census Bureau, Population Division. Table: Estimates of the Components of Resident Population Change: April 1, 2010, to July 1, 2016

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
4	X	X		X		X		

Connection to Resilience

Communities where large numbers of residents have lived for extended periods are likely to have strong place attachment, be invested in the well-being of the community before a disaster, and willing to respond to revitalize a community after a disaster.[b,f]

Familiarity can help individuals navigate a community during an acute crisis, as well as know how to access services after the crisis has passed.[f]

A rapid influx of new residents may result in lower levels of attachment to the community, less familiarity with local hazards and how to prepare for them, and fewer community connections that can provide support during a crisis.[b,d,f]

A reduction in population will reduce local tax income and community resources to respond to a disaster.[b]

Public School Capacity

Metric	Data Source
The number of public schools per 5,000 population	U.S. Department of Education. National Center for Education Statistics. Elementary/Secondary Information System. https://nces.ed.gov/ccd/elsi/

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
4		X	X		X			X

Connection to Resilience

Public schools are a measure of response and recovery capacity, as they represent the community's ability to provide safe shelter for individuals and facilitate evacuations.[b,c,e,h]

More availability of schools can increase the ability to maintain schooling after a disaster.[b]

Hotel/Motel Capacity

Metric	Data Source
The number of hotels/motels per 5,000 population	U.S. Census Bureau, 2015 County Business Patterns, Table 00A1

Community Resilience Methodologies

# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
3		X	X			X		

Connection to Resilience

Hotels and motels can provide important capacity to house individuals who have to leave their homes, either to find safe shelter from the disaster or as temporary housing during the recovery phase.[b,e]

Fewer local hotels and motels may mean that individuals have to leave an area, making recovery from a disaster more difficult.[a]

Rental Property Capacity								
Metric				Data Source				
Percentage of vacant rental housing units				ACS 2012–2016 five-year estimates, Table B25004				
Community Resilience Methodologies								
# of 8	ANDRI	BRIC	CDRI	CRI2	DROP	RCI	SVI	TCRI
3		X	X		X			
Connection to Resilience								
While low numbers of vacant housing units may seem to be a positive indicator of economic resilience, it does denote a lack of physical capacity to house individuals who have been displaced by a disaster.[b,e]								
A greater presence of vacant housing units provides immediately available housing stock so residents do not need to leave their communities because of a lack of housing stock.[b,e]								

Connection to Resilience Key:

[a] ANDRI: Phil Morley, Melissa Parsons, and Sarb Johal, "The Australian Natural Disaster Resilience Index: A System for Assessing the Resilience of Australian Communities to Natural Hazards," *Bushfire & Natural Hazards CRC*. Accessed March 27, 2018, https://www.bnhcrc.com.au/research/hazard-resilience/251.

[b] BRIC: Susan L. Cutter, Kevin D. Ash, and Christopher T. Emrich, "The Geographies of Community Disaster Resilience," *Global Environmental Change* (2014): 29, 65–77.

[c] CDRI: Walter Gillis Peacock, et al., "Advancing Resilience of Coastal Localities: Developing, Implementing, and Sustaining the Use of Coastal Resilience Indicators: A Final Report," *Hazard Reduction and Recovery Center*, December 2010. Accessed April 6, 2018, https://pdfs.semanticscholar.org/ea56/1b67fb9fa11964a32e99c4da14ad32dd39de.pdf.

[d] CRI2: Kathleen Sherrieb, Fran H. Norris, and Sandro Galea, "Measuring Capacities for Community Resilience," *Social Indicators Research* 99 (2010): 227–247.

[e] DROP: Susan L. Cutter, Christopher G. Burton, and Christopher T. Emrich, "Disaster Resilience Indicators for Benchmarking Baseline Conditions," *Journal of Homeland Security and Emergency Management* 7 (2010). Accessed April 6, 2018, http://resiliencesystem.com/sites/default/files/Cutter_jhsem.2010.7.1.1732.pdf.

[f] RCI: Kathryn A. Foster, "Resilience Capacity Index," *Disaster Resilience Measurements: Stocktaking of Ongoing Efforts in Developing Systems for Measuring Resilience, United Nations Development Programme* (2014). https://www.preventionweb.net/files/37916_disasterresiliencemeasurementsundpt.pdf, 38.

[g] SVI: Barry E. Flanagan, et al., "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Management* 8 (2011). Accessed April 6, 2018, https://svi.cdc.gov/Documents/Data/A%20Social%20Vulnerability%20Index%20for%20Disaster%20Management.pdf.

[h] TCRI: T. Perfrement and T. Lloyd, "The Resilience Index: The Modelling Tool to Measure and Improve Community Resilience to Natural Hazards," *The Resilience Index*, 2015. https://theresilienceindex.weebly.com/our-solution.html.

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Appendix D: Indicator Correlation Table

	Age	Educational Attainment	Disability	English Language Proficiency	Health Insurance	Mobility	Unemployment Rate	Household Income	Income Inequality	Home Ownership	Single-Parent Household	Presence of Mobile Homes	Public School Capacity	Medical Professional Capacity	Hospital Capacity	Hotel/Motel Capacity	Rental Property Capacity	Affiliation with a rRligion	Connection to Civic and Social Organizations	Population Change
Age*	1	-0.06	0.51	-0.24	-0.06	-0.03	0.15	-0.21	0.02	0.39	0.1	0.27	0	-0.02	0.09	0.11	-0.5	-0.15	0.02	0.17
Educational attainment*	-0.06	1	0.36	0.53	0.68	0.21	0.53	-0.49	0.25	-0.27	0.48	0.45	0.15	-0.56	0.08	-0.03	0	0.17	-0.06	-0.22
Disability*	0.51	0.36	1	-0.28	0.26	0.09	0.54	-0.71	0.07	0.07	0.54	0.56	0.26	-0.32	0.33	0.09	-0.34	-0.04	-0.01	-0.21
English language proficiency*	-0.24	0.53	-0.28	1	0.39	0.35	0.2	0.09	0.32	-0.46	0.09	-0.14	-0.05	-0.23	-0.15	-0.06	0.23	0.05	0.01	-0.02
Health insurance*	-0.06	0.68	0.26	0.39	1	-0.01	0.38	-0.46	0.3	-0.27	0.41	0.46	0.07	-0.47	0.11	0.15	0.11	0.12	-0.06	0.11
Mobility*	-0.03	0.21	0.09	0.35	-0.01	1	0.26	-0.18	0.47	-0.56	0.43	-0.15	-0.06	0	0.09	-0.03	0.1	0.05	0.07	-0.27
Unemployment rate*	0.15	0.53	0.54	0.2	0.38	0.26	1	-0.53	0.27	-0.27	0.62	0.38	0.08	-0.47	0.04	-0.01	-0.11	-0.13	-0.02	-0.27
Household Income	-0.21	-0.49	-0.71	0.09	-0.46	-0.18	-0.53	1	-0.31	0.29	-0.69	-0.49	-0.24	0.37	-0.33	-0.12	0.07	-0.04	0.02	0.25
Income inequality*	0.02	0.25	0.07	0.32	0.3	0.47	0.27	-0.31	1	-0.6	0.45	0.02	-0.1	0.12	0.2	0.14	0.17	0.19	0.04	-0.04
Home ownership	0.39	-0.27	0.07	-0.46	-0.27	-0.56	-0.27	0.29	-0.6	1	-0.44	0.17	0.07	0.1	-0.1	-0.12	-0.49	-0.01	-0.02	0.16
Single-parent household*	0.1	0.48	0.54	0.09	0.41	0.43	0.62	-0.69	0.45	-0.44	1	0.24	0.06	-0.27	0.31	0.09	0.09	0.07	0	-0.3
Presence of mobile homes*	0.27	0.45	0.56	-0.14	0.46	-0.15	0.38	-0.49	0.02	0.17	0.24	1	0.22	-0.39	0.13	0.11	-0.34	-0.08	-0.09	0.05
Public school capacity	0	0.15	0.26	-0.05	0.07	-0.06	0.08	-0.24	-0.1	0.07	0.06	0.22	1	-0.18	0.26	0.17	-0.2	-0.02	-0.1	-0.32
Medical professional capacity	-0.02	-0.56	-0.32	-0.23	-0.47	0	-0.47	0.37	0.12	0.1	-0.27	-0.39	-0.18	1	0.05	0.01	0.11	0.13	0.07	0.1
Hospital capacity	0.09	0.08	0.33	-0.15	0.11	0.09	0.04	-0.33	0.2	-0.1	0.31	0.13	0.26	0.05	1	0.15	0.01	0.19	0	-0.21
Hotel/motel capacity	0.11	-0.03	0.09	-0.06	0.15	-0.03	-0.01	-0.12	0.14	-0.12	0.09	0.11	0.17	0.01	0.15	1	-0.08	-0.01	-0.06	0.04
Rental property capacity	-0.5	0	-0.34	0.23	0.11	0.1	-0.11	0.07	0.17	-0.49	0.09	-0.34	-0.2	0.11	0.01	-0.08	1	0.18	-0.01	0.01
Affiliation with a religion	-0.15	0.17	-0.04	0.05	0.12	0.05	-0.13	-0.04	0.19	-0.01	0.07	-0.08	-0.02	0.13	0.19	-0.01	0.18	1	0.01	-0.17
Connection to civic and social organizations	0.02	-0.06	-0.01	0.01	-0.06	0.07	-0.02	0.02	0.04	-0.02	0	-0.09	-0.1	0.07	0	-0.06	-0.01	0.01	1	-0.02
Population change*	0.17	-0.22	-0.21	-0.02	0.11	-0.27	-0.27	0.25	-0.04	0.16	-0.3	0.05	-0.32	0.1	-0.21	0.04	0.01	-0.17	-0.02	1

* Reverse scale: lower values are associated with higher resiliency

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Appendix E: National Average by Indicator

The following chart provides the national mean for each indicator.

Indicator	Measure (All Positive)	National Average
Population Indicators		
Educational Attainment	Percentage with a High School Diploma	85.81
Unemployment Rate	Percentage Employed	92.62
Disability	Percentage without a Disability	84.05
English Language Proficiency	Percentage Speaking Fluent English	96.42
Home Ownership	Percentage of Owner-Occupied Housing	71.18
Mobility	Percentage with Access to a Vehicle	93.23
Age	Percentage under 65	82.45
Household Income	Median Household Income	$47,252.03
Income Inequality	Gini Index	0.45
Health Insurance	Percentage with Health Insurance	87.89
Single-Parent Household	Percentage of Two-Parent Households	66.85
Community Indicators		
Connection to Civic and Social Organizations	Organizations per 10,000 People	13.38
Hospital Capacity	Hospitals per 10,000 People	0.71
Medical Professional Capacity	Diagnostic Practitioners per 1,000 People	14.94
Affiliation with a Religion	Percentage of Religious Adherents	51.25
Presence of Mobile Homes	Percentage of Non-mobile Homes	87.32
Public School Capacity	Schools per 5,000 People	3.13
Population Change	Percentage Population Change	-0.23
Hotel/Motel Capacity	Hotels/Motels per 5,000 People	1.60
Rental Property Capacity	Percentage of Vacant Rentals	12.87

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Appendix F: Aggregated Community Resilience Indicators — Counties in Lowest Two Bins (Red and Orange)

The counties in each list are ordered from lowest to highest scores.

Red-coded Counties:

1. Adjuntas Municipio, Puerto Rico	2. Lares Municipio, Puerto Rico
3. Loving County, Texas	4. Cataño Municipio, Puerto Rico
5. Mayagüez Municipio, Puerto Rico	6. Stewart County, Georgia
7. Issaquena County, Mississippi	8. Bronx County, New York
9. San Sebastián Municipio, Puerto Rico	10. Orocovis Municipio, Puerto Rico
11. Comerío Municipio, Puerto Rico	12. Kusilvak Census Area, Alaska
13. Oglala Lakota County, South Dakota	14. Guánica Municipio, Puerto Rico
15. Loíza Municipio, Puerto Rico	16. San Juan Municipio, Puerto Rico
17. Greene County, Alabama	18. Aguas Buenas Municipio, Puerto Rico
19. Clay County, Georgia	20. Starr County, Texas
21. Aguadilla Municipio, Puerto Rico	22. Allendale County, South Carolina
23. Jayuya Municipio, Puerto Rico	24. Randolph County, Georgia
25. Sabana Grande Municipio, Puerto Rico	26. Humphreys County, Mississippi
27. Taliaferro County, Georgia	28. Fajardo Municipio, Puerto Rico
29. Zavala County, Texas	30. Lajas Municipio, Puerto Rico

Orange-coded counties:

1. Wolfe County, Kentucky	2. Zapata County, Texas
3. Luquillo Municipio, Puerto Rico	4. Yauco Municipio, Puerto Rico
5. Guayama Municipio, Puerto Rico	6. Quitman County, Georgia
7. Utuado Municipio, Puerto Rico	8. Patillas Municipio, Puerto Rico
9. Wilcox County, Alabama	10. Cayey Municipio, Puerto Rico
11. Isabela Municipio, Puerto Rico	12. Tensas Parish, Louisiana
13. Quebradillas Municipio, Puerto Rico	14. Ponce Municipio, Puerto Rico
15. Lee County, Arkansas	16. Todd County, South Dakota
17. Perry County, Alabama	18. Sumter County, Alabama
19. Holmes County, Mississippi	20. Yabucoa Municipio, Puerto Rico
21. Hormigueros Municipio, Puerto Rico	22. Ciales Municipio, Puerto Rico
23. Glades County, Florida	24. Vega Alta Municipio, Puerto Rico
25. New York County, New York	26. Claiborne County, Mississippi
27. Arecibo Municipio, Puerto Rico	28. Hudspeth County, Texas
29. Emporia City, Virginia	30. Macon County, Georgia
31. McDowell County, West Virginia	32. Leslie County, Kentucky
33. Aguada Municipio, Puerto Rico	34. Hendry County, Florida
35. Juncos Municipio, Puerto Rico	36. Presidio County, Texas
37. San Lorenzo Municipio, Puerto Rico	38. Maunabo Municipio, Puerto Rico
39. Cabo Rojo Municipio, Puerto Rico	40. Corozal Municipio, Puerto Rico
41. Bullock County, Alabama	42. Moca Municipio, Puerto Rico
43. Naranjito Municipio, Puerto Rico	44. Morovis Municipio, Puerto Rico
45. Northwest Arctic Borough, Alaska	46. Phillips County, Arkansas
47. Northampton County, North Carolina	48. Barceloneta Municipio, Puerto Rico

Orange-coded counties:

49. Claiborne Parish, Louisiana	50. Camuy Municipio, Puerto Rico
51. Monroe County, Alabama	52. Lee County, Kentucky
53. Echols County, Georgia	54. Luna County, New Mexico
55. Yazoo County, Mississippi	56. Canóvanas Municipio, Puerto Rico
57. Kings County, New York	58. Breathitt County, Kentucky
59. Vega Baja Municipio, Puerto Rico	60. Las Piedras Municipio, Puerto Rico
61. Lowndes County, Alabama	62. Washington County, North Carolina
63. Guayanilla Municipio, Puerto Rico	64. Caguas Municipio, Puerto Rico
65. Noxubee County, Mississippi	66. Buffalo County, South Dakota
67. Duval County, Texas	68. Cidra Municipio, Puerto Rico
69. Kenedy County, Texas	70. Juana Díaz Municipio, Puerto Rico
71. Tyrrell County, North Carolina	72. East Carroll Parish, Louisiana
73. Sharkey County, Mississippi	74. Wilkinson County, Mississippi
75. Santa Isabel Municipio, Puerto Rico	76. Washington County, Mississippi
77. Martin County, Kentucky	78. Jefferson Davis County, Mississippi
79. Dallas County, Alabama	80. Madison Parish, Louisiana
81. Barranquitas Municipio, Puerto Rico	82. Río Grande Municipio, Puerto Rico
83. Mitchell County, Georgia	84. La Paz County, Arizona
85. Calhoun County, Georgia	86. Villalba Municipio, Puerto Rico
87. Toa Baja Municipio, Puerto Rico	88. St. Helena Parish, Louisiana
89. San Germán Municipio, Puerto Rico	90. Taylor County, Georgia
91. Putnam County, Florida	92. Quitman County, Mississippi
93. Bayamón Municipio, Puerto Rico	94. Clay County, Kentucky
95. Corson County, South Dakota	96. Clinch County, Georgia
97. Warren County, North Carolina	98. Owsley County, Kentucky
99. McCreary County, Kentucky	100. Maricao Municipio, Puerto Rico
101. Bolivar County, Mississippi	102. Arroyo Municipio, Puerto Rico
103. Manatí Municipio, Puerto Rico	104. Bell County, Kentucky
105. San Augustine County, Texas	106. Magoffin County, Kentucky
107. Crisp County, Georgia	108. Dixie County, Florida
109. Twiggs County, Georgia	110. Jefferson County, Mississippi
111. Vance County, North Carolina	112. Añasco Municipio, Puerto Rico
113. Conecuh County, Alabama	114. Webster County, West Virginia
115. Rincón Municipio, Puerto Rico	116. Jefferson County, Georgia
117. Emanuel County, Georgia	118. Lafayette County, Arkansas
119. Clarendon County, South Carolina	120. Carolina Municipio, Puerto Rico
121. Maverick County, Texas	122. Lake County, Tennessee
123. Ben Hill County, Georgia	124. Marion County, South Carolina
125. Knott County, Kentucky	126. Willacy County, Texas
127. Harlan County, Kentucky	128. Mingo County, West Virginia
129. Hancock County, Georgia	130. Halifax County, North Carolina
131. Floyd County, Kentucky	132. Dillon County, South Carolina
133. Atkinson County, Georgia	134. McKinley County, New Mexico
135. Hamilton County, Florida	136. Marlboro County, South Carolina
137. Terrell County, Georgia	138. Peñuelas Municipio, Puerto Rico
139. Warren County, Georgia	140. Scotland County, North Carolina

Orange-coded counties:

141.Scott County, Mississippi	142.Grundy County, Tennessee
143.Coamo Municipio, Puerto Rico	144.Marengo County, Alabama
145.Barbour County, Alabama	146.Robeson County, North Carolina
147.Brooks County, Texas	148.Martinsville City, Virginia
149.Alexander County, Illinois	150.La Salle County, Texas
151.Okeechobee County, Florida	152.Williamsburg County, South Carolina
153.Coahoma County, Mississippi	154.Candler County, Georgia
155.Marion County, Georgia	156.Apache County, Arizona
157.Costilla County, Colorado	158.Tallahatchie County, Mississippi
159.Real County, Texas	160.Sunflower County, Mississippi
161.Salinas Municipio, Puerto Rico	162.Mississippi County, Missouri
163.Concordia Parish, Louisiana	164.Suwannee County, Florida
165.Sabine County, Texas	166.Duplin County, North Carolina
167.Nome Census Area, Alaska	168.Humacao Municipio, Puerto Rico
169.Imperial County, California	170.Dorado Municipio, Puerto Rico
171.Hall County, Texas	172.Ceiba Municipio, Puerto Rico
173.Dickenson County, Virginia	174.Edgecombe County, North Carolina
175.Lee County, South Carolina	176.McCormick County, South Carolina
177.Florida Municipio, Puerto Rico	178.Macon County, Alabama
179.Bethel Census Area, Alaska	180.Bladen County, North Carolina
181.San Miguel County, New Mexico	182.Letcher County, Kentucky
183.Wheeler County, Georgia	184.Bertie County, North Carolina
185.Elliott County, Kentucky	186.Aibonito Municipio, Puerto Rico
187.Mohave County, Arizona	188.Socorro County, New Mexico
189.Ziebach County, South Dakota	190.Fairfield County, South Carolina
191.Scott County, Tennessee	192.Pemiscot County, Missouri
193.Darlington County, South Carolina	194.Grady County, Georgia
195.Meriwether County, Georgia	196.Chicot County, Arkansas
197.Guaynabo Municipio, Puerto Rico	198.Philadelphia County, Pennsylvania
199.Knox County, Kentucky	200.Natchitoches Parish, Louisiana
201.New Madrid County, Missouri	202.Cibola County, New Mexico
203.Perry County, Kentucky	204.Wayne County, Missouri
205.Woodruff County, Arkansas	206.Yukon-Koyukuk Census Area, Alaska
207.DeSoto County, Florida	208.Menard County, Texas
209.Naguabo Municipio, Puerto Rico	210.Colquitt County, Georgia
211.Monroe County, Arkansas	212.Hale County, Alabama
213.Nye County, Nevada	214.Talbot County, Georgia
215.Jackson County, Kentucky	216.Petersburg City, Virginia
217.Brooks County, Georgia	218.Las Marías Municipio, Puerto Rico
219.Estill County, Kentucky	220.Lincoln County, Georgia
221.Mineral County, Nevada	222.Sierra County, New Mexico
223.Wayne County, Kentucky	224.Franklin Parish, Louisiana
225.Lake County, California	226.Trinity County, Texas
227.Levy County, Florida	228.Jenkins County, Georgia
229.Hidalgo County, Texas	230.Greene County, Georgia
231.Lauderdale County, Tennessee	232.Hardeman County, Tennessee

Orange-coded counties:

233.Jones County, North Carolina	234.Lake County, Michigan
235.Buchanan County, Virginia	236.Jim Hogg County, Texas
237.Cameron County, Texas	238.Bamberg County, South Carolina
239.Washington Parish, Louisiana	240.Morgan County, Missouri
241.Gurabo Municipio, Puerto Rico	242.Pike County, Kentucky
243.Amite County, Mississippi	244.Polk County, Texas
245.Early County, Georgia	246.Irwin County, Georgia
247.Berrien County, Georgia	248.Baltimore City, Maryland
249.Coffee County, Georgia	250.Webster County, Georgia
251.Bledsoe County, Tennessee	252.Highlands County, Florida
253.Desha County, Arkansas	254.Marion County, Texas
255.Barnwell County, South Carolina	256.Greene County, North Carolina
257.Bath County, Kentucky	258.Dooly County, Georgia
259.Dimmit County, Texas	260.Citrus County, Florida
261.Montgomery County, North Carolina	262.Leflore County, Mississippi
263.Jasper County, South Carolina	264.Anson County, North Carolina
265.Owyhee County, Idaho	266.Gadsden County, Florida
267.Pike County, Ohio	268.Cocke County, Tennessee
269.Trujillo Alto Municipio, Puerto Rico	270.Dougherty County, Georgia
271.Copiah County, Mississippi	272.Wyoming County, West Virginia
273.Brantley County, Georgia	274.Decatur County, Georgia
275.Hardee County, Florida	276.Red River Parish, Louisiana
277.Llano County, Texas	278.Baldwin County, Georgia
279.Sumter County, Georgia	280.Lafayette County, Florida
281.Sampson County, North Carolina	282.Frio County, Texas
283.Hampshire County, West Virginia	284.Choctaw County, Alabama
285.Charlotte County, Virginia	286.Madison County, Florida
287.Pickens County, Alabama	288.Tattnall County, Georgia
289.Newton County, Texas	290.Somerset County, Maryland
291.Campbell County, Tennessee	292.Lenoir County, North Carolina
293.Evangeline Parish, Louisiana	294.Walthall County, Mississippi
295.Navajo County, Arizona	296.Wise County, Virginia
297.Shelby County, Texas	298.Clarke County, Alabama
299.Worth County, Georgia	300.Catahoula Parish, Louisiana
301.Esmeralda County, Nevada	302.Jackson County, Tennessee

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