

**BEFORE THE STORM**



**DURING THE STORM**



**AFTER THE STORM**



**BOUNCING BACK**



# Guidebook *of the* Community Resilience Assessment Online Tool

# Guidebook of the Community Resilience Assessment Online Tool

## Introduction

No community is completely immune from disasters. Over the last ten years, the world has experienced more natural disasters, acts of terrorism, pandemics, civil unrest, and economic crisis than ever before, resulting in innumerable losses of resources and human lives.

Communities all over the world are facing a difficult situation as to determine the best strategies to reduce the impact of disasters. One effective approach is to build community resilience. Building resilience works by strategically preparing a community to take greater leverage out of existing resources while working systematically to improve upon areas of weakness, thus building a stronger more resilient community over time.

Working to strengthen community resilience makes fiscal sense, too. According to the Multihazard Mitigation Council (2005), every dollar spent on pre-disaster mitigation will **save about four dollars in post-disaster losses and expenditures spent on response and recovery**. Just as a person regularly doing physical exercise helps to build a strong immune system, so too can building resilience strengthen a community to better withstand and quickly heal from disaster.

FEMA even has placed a greater emphasis on community preparedness with the goal to build “a secure and resilient nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk” (Homeland Security, 2015). Under this framework the work of preparedness (or resiliency building) is divided into five mission areas:

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### Mission Areas

- Prevention
- Protection
- Mitigation
- Response
- Recovery

Community resilience then focuses on the capacity of a community to adapt to changing conditions, withstand disruption, and rapidly recover from emergencies (MitFLG, 2016).

**Mitigation** is pre-disaster risk management action to avoid or reduce risks through well-prepared protection, prevention, response, and recovery activities. Or simply put, mitigation is creating resilient communities that can withstand disasters with the least loss (Homeland Security, 2016).

## 7

### The seven core capabilities of mitigation are:

- 🎯 Threats & hazards identification
- 🎯 Risk & disaster resilience assessment
- 🎯 Community resilience
- 🎯 Long-term vulnerability reduction
- 🎯 Planning
- 🎯 Operational coordination
- 🎯 Public information & warning

**Efficient recovery** starts from pre-disaster preparation for recovery, including coordination of the whole community, risk mitigation, resource identification, developing capacity of recovery management, and a collaborative planning process (Homeland Security, 2016).

## 8

### The eight core capacities of recovery are:

- 🎯 Economic recovery
- 🎯 Health & social services
- 🎯 Housing
- 🎯 Infrastructure systems
- 🎯 Natural & cultural resources
- 🎯 Planning
- 🎯 Operational coordination
- 🎯 Public information & warning

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### *Categories of Community Resilience Capacity*

*All over the country, programs and resources that help build community resilience capacity can generally be divided into three categories (MitFLG, 2016):*

- 1.** Build up inherent community functions, such as community coherency, public health, economic development, transportation and infrastructure, natural resources and environment, that help communities function adequately on a daily basis and thus will rebound quickly to the new normal after an emergency.
- 2.** Risk management through mitigation activities that incorporate risk information into public policy making and implementation, such as reducing the vulnerabilities of at-risk infrastructure, or identifying the major types of disasters the community will likely face.
- 3.** Disaster recovery through the identification and implementation of high-priority redevelopment projects that could generate the most public benefit in future hazard mitigation.

*This community resilience tool, developed by the University of Missouri's Institute of Public Policy through funding from the National Science Foundation, is an online tool designed to aid local community leaders and planners in benchmarking their current community resilience status. It does this by cataloging relevant and up-to-date resilience indicators at the county level against state and national levels according to the three aspects above.*

**Community Resilience:** The ability of a community to mitigate hazards, contain the effects of hazards, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future hazards (Miller & Dabson, 2015).

**Community Vulnerability:** The flip side of resilience. It's the potential for harm caused by hazards to a community and the sensitivity of a community to hazards and disruptions (National Research Council, 2012).

*Community leaders can make use of this free assessment tool to identify high priority areas in resilience building -- find areas they are perhaps doing better than they thought, compare their status to that of the state and nation, and hopefully use this insight to inform better budgeting and planning for the future.*

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## How This Works

- Step One:** Determine your Community Assessment
- Step Two:** Determine your Resource Assessment
- Step Three:** Formulate a Strategic Action Plan



*The Resilience Assessment is divided into two parts:*

**A Community Assessment** —An assessment of the integrated and collaborative social and economic indicators that foster resilience. Looking specifically at the social and economic indicators that research has shown to be characteristic of resilient communities. The assessment will therefore be conducted from the social and economic perspectives.

**A Resource Assessment** —An assessment of the natural and physical environment of a community – especially the existing infrastructure that are critical in disaster mitigation and recovery. Looking at indicators such as medical facilities, at-risk housing structures, and high potential loss facilities like dams. The assessment will be conducted from the infrastructure and environmental perspectives.

## Community Assessment

Building resilience requires the participation of the whole community, including individuals, families, public partners, private enterprises, non-profit organizations, and local governments. Collaboration of all these sectors throughout the resilience building process, from inclusive planning to project implementation, can ensure the best use of knowledge, resources, and efforts, thus achieving the best outcome.

### Components

The Community Assessment seeks to gauge the current community resilience status through evaluating the performance of the five sectors above. The answers to the following questions will be sought through data analysis based on relevant indicators cataloged on the building regional resilience website. Data for all the indicators are found there with a few clicks.

#### ***1. Are the individuals and families in the community prepared for hazards?***

As the smallest unit of a community, a resilient individual or family is the foundation of a resilient community. A person or family that enjoys good education, overall health, and financial well-being usually has higher awareness of disaster preparation and is less dependent on external resources in disaster response and recovery, thus they are more likely to better withstand, absorb, and recover from the disruptive impacts of hazards.

The preparedness of individuals and families is measured by *education, life expectancy, cost burdened households, and vulnerability characteristics such as disability, uninsured, elderly, children, linguistic isolation, and poverty.*

#### ***2. How coherent is the community as a whole? How engaged is the community in civic issues?***



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A resilient community is a unified group with shared goals, a collaborative network, and high levels of civic capacity that promotes information sharing, public participation, inclusive planning, and collective mitigation implementation. A secure community with a large group of permanent residents has more sustained communication of neighbors and higher community involvement in proactive planning and long-term mitigation actions of the whole community.

Therefore, in this assessment the coherency of a community is measured by *stable residents*, *owner-occupied housing units*, and *crime rate* with community engagement measured by *voter participation*.

### **3. Is there a strong private sector that could provide resources and support for collaborative resilience building? Is there a strong economic base that makes quick recovery possible?**

Private sector entities (e.g., local businesses, large corporations, healthcare providers, infrastructure operators, and other service providers) are important stakeholders of the community, as they provide employment opportunities for the community and are major contributors of local tax revenue. A community benefits from resilient private sector entities in disaster response and recovery through their support of goods and services and quickens restoration of local economic vitality. The long-term vulnerability reduction efforts are also made more effective with the participation of the private sector through collaborative plan making, strategic investment, goods provision, volunteer services, and infrastructure protection. For these reasons, the contribution the private sector could make is measured by *business vacancy*, *establishment birth rate*, *employment diversity*, and *nonfarm employment vs. resource intensive employment*. The firmness of the economic situation is measured by the *labor force participation rate*, *unemployment*, and the *Gini index*.

### **4. Is there a strong non-governmental and non-profit community that could support community resilience building?**

Nongovernmental and nonprofit organizations play an essential role in facilitating resilience across the whole community as they know well about the community and are passionate about making it better by serving vulnerable populations. Many of them are either first responders or professional service providers that play a critical role in community reconstruction, emotional recovery, and disaster education. They are also representatives of the community and can help include minority groups in mitigation policy making. They can supplement efforts and provide support for the government and private sector.

The indicators selected to measure the impact of social entrepreneurship on community in the resilience building process are *501(c)3 organizations and associations*.

### **5. Is the local government efficient in facilitating community resilience building?**

Local governments bear the responsibility of planning for, coordinating, and facilitating resilience building activities in economic issues, housing, health and social service issues, infrastructure, and even environmental issues. Besides making the connections among the community, the private sector, and non-profit organizations, public agencies also need to collaborate with each other in the resilience building process. An integrated political system that encourages good communication and collaboration between agencies is critical to community resilience. The indicator used to measure political fragmentation and government efficiency is the *total amount of all levels of jurisdictions in a county*.

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Find your assessment using the website: ([www.BuildingRegionalResilience.org](http://www.BuildingRegionalResilience.org))

*The Community Assessment, which highlights the overall performance of a county in building their social and economic resilience, can be found online for any county or group of counties in the US using the online resilience data tools on the Building Regional Resilience website. Step-by-step instructions can be found in Appendix A.*

Essentially, if you find your report county in red, the county is at high risk for disasters having a more dramatic impact for the county in terms of the resilience category you are looking at (Social, Economic, Infrastructure, Environmental). If coded in green, the county is above the national median in that category with higher levels of resilient indicators and lower levels of vulnerability indicators. If blue, the county has a high vulnerability but is also highly resilient. If yellow, the county has a low vulnerability but also has a lower resiliency so although the county might be less vulnerable in general, if disaster were to strike they are also considered to be less resilient in potentially coping with said disaster.

Take social factors as an example. In red counties, the social equilibrium is easily broken by disasters and the return to the new normal could take more time and effort than other counties with greater resilience. In yellow counties, the social cohesion may be able to withstand some disasters. However, once destructed, the recovery process would be slow and difficult. If in blue, your county is generally socially adaptable to crisis, although there are still many social indicators that make your county vulnerable. So although you may be well adept to handle recovery, you may be more vulnerable to disasters in the first place because of relative high vulnerability indicators. If you find your report county in green, congratulations, your county is fairly strong enough to resist unexpected disasters and also recover quickly to social stability after disaster strikes.

Similarly, one can obtain the community assessment of a county in terms of economic resilience by switching to “Economics” in the panel of “Resilience & Vulnerability Quadrants.” See the instructions in **Appendix A**. This time click on “Economics” instead of “Social Factors.” The map display and its relevant description will be similar to the social factors as explained above.

This overall Community Assessment is important because it enables a community to assess its relative strengths and weakness in the social and economic dimensions. For example, Callaway County, Missouri, has low resilience and low vulnerability in both the social and economic categories. This means that although both its social and economic vulnerabilities are low, once disaster happens, it could take more to bounce back to normal levels of social and economic life conditions they enjoyed before the disaster, due to low resilience in regards to its social and economic indicators. Therefore, for Callaway County, more financial and human resources could be spent to strengthen its social and economic adaptability of the county to be better prepared.

Besides the overall assessment result displayed in the resilience and vulnerability matrix, the online tool also uncovers what the underlying issues are, which we call indicators. Users could click on “Resilience Indices” or “Vulnerability Indices” in the panel of “Data Category” and are able to see the scores of the indicators and compare their levels to those at the state and nation to better gauge how they stack up regionally, state-wide or even nationally. Users will also be able to check the underlying data for each of the indicators to narrow down the problem to a specific census tract or a certain population group. This aids local governments in building their social and economic resilience by concentrating their resources in the most needed communities or population groups. How to do this is explained in **Appendix B**.

*Bottom line:*

**Use the website to build your community assessment (determine your Social and Economic indicators). Then build your Resource Assessment (determine your Infrastructure and Environmental indicators).**

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## *A Quick Note:*

Indicators are listed as factors that are good (increase resilience) or bad (increase vulnerability). You fall on the matrix depending on your relative high or low levels of good (resilient) and bad (vulnerable) indicators.

## **Resource Assessment**

This section approaches community resilience by assessing the risks and resources from the natural and physical environment in the community. The answers to two simple questions will be sought—what are the risks to community resilience, and what are the resources that a community could make use of to strengthen its resilience? In this section, critical community assets will be reviewed and vulnerable ones will be identified and given high priority in long-term risk reduction efforts.

### **Components**

The Resource Assessment measures the current risk and resources of a community in disaster mitigation and recovery by assessing the quality of both the natural and manmade environment of the community. The answers to the following questions will be sought through data analysis based on relevant environmental and infrastructure indicators from the research.

#### **1. What are the risks to community resilience?**

The risks to community resilience are primarily from at-risk infrastructure, infrastructure that generates evacuation challenges for users, high potential loss facilities, and the potential for severe disasters. At-risk infrastructure increases risk to resilience as it is susceptible to the impacts of hazards (such as old houses) or could not provide reliable services during disasters (such as an unsecure drinking water system). Infrastructure that generates evacuation challenges, such as insufficient transportation infrastructure or housing units without cars, also increases risks to community resilience because in urgent situations when evacuation is necessary, such lack of reliable transportation will delay resident evacuation or delay first responders from reaching areas in need. High potential loss facilities (e.g. nuclear power plants, dams, and military installations) increase risk to community resilience, as these facilities are like dormant volcanoes and expose the communities to risks all year round, let alone when other disasters occur that can substantially increase risk. In addition, the historic high frequency or severity of certain types of disasters in some communities can increase their vulnerability as such communities are more likely than other communities, all other things equal, to experience disasters and thus should be even more prepared.

For these reasons, the infrastructure and environmental indicators are selected as *mobile homes, group quarters, housing units with no car available, old houses, high detour or high traffic bridges, closeness of a community to dams, levees, or nuclear facilities, polluted water systems, and disaster occurrences of storms, earthquakes, or droughts.*

#### **2. What are the resources that a community could make use of to strengthen its resilience?**

The major resources that strengthen community resilience include adequate medical capacity, well-maintained transportation infrastructure, a developed emergency response system, food security, and a diverse natural environment. Adequate medical facilities and physician capacity, together with food security, increase community resilience by improving public health so that the community residents are better able to withstand disasters in the first place. The medical sector also plays an important role in disaster response and recovery.

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Sufficient transportation infrastructure is also important for community resilience as it not only provides evacuation routes in disasters, but also promotes recovery after disasters and promotes long-term economic development. A well-developed and well-maintained emergency response system supported by well-trained first responders and financial resources, is of critical importance in building community resilience. Lastly, a diverse ecosystem is better able to absorb risk and recover to the pre-disaster condition, thus being an important indicator of community resilience. A community with diversified assets is flexible enough that if one or two are completely gone due to a disaster, there exists other viable assets to provide support.

Because of all these considerations, the selected indicators of community resources in resilience building include *medical facilities, physicians, transportation infrastructure, first responders, investment in public safety, accessible grocery stores, and a diverse ecosystem.*

**Complete Your Resource Assessment Online ([www.BuildingRegionalResilience.org](http://www.BuildingRegionalResilience.org))**

The Resource Assessment of a county could also be easily compiled using the online resilience tools. The Resource Assessment evaluates the overall performance of a county in building infrastructure and environmental resilience through the indicators mentioned above. For example, Callaway County, Missouri is in red (low resilience and high vulnerability) for the infrastructure category and in blue (high resilience and high vulnerability) for the environmental category, which means it has vulnerable facilities (such as the nuclear plant) while the current capacity of critical facilities is likely not enough during a serious emergency response. Therefore, Callaway County could consider more financial and human resources to be invested in strengthening their infrastructure and environmental adaptability of the county.

Similarly, the website also allows users to compare their local county values for each indicator mentioned above to state and national levels, thus identifying areas where perhaps they are doing well and those on which they fall behind. Knowing how you compare to your region, state and even nationally can serve as a valuable guide in justifying decisions about how best to plan and use limited local resources. Users can also find underlying data for each indicator for even more specific detail in community resilience planning.

## ***The Community Resilience Assessment Online Tool***

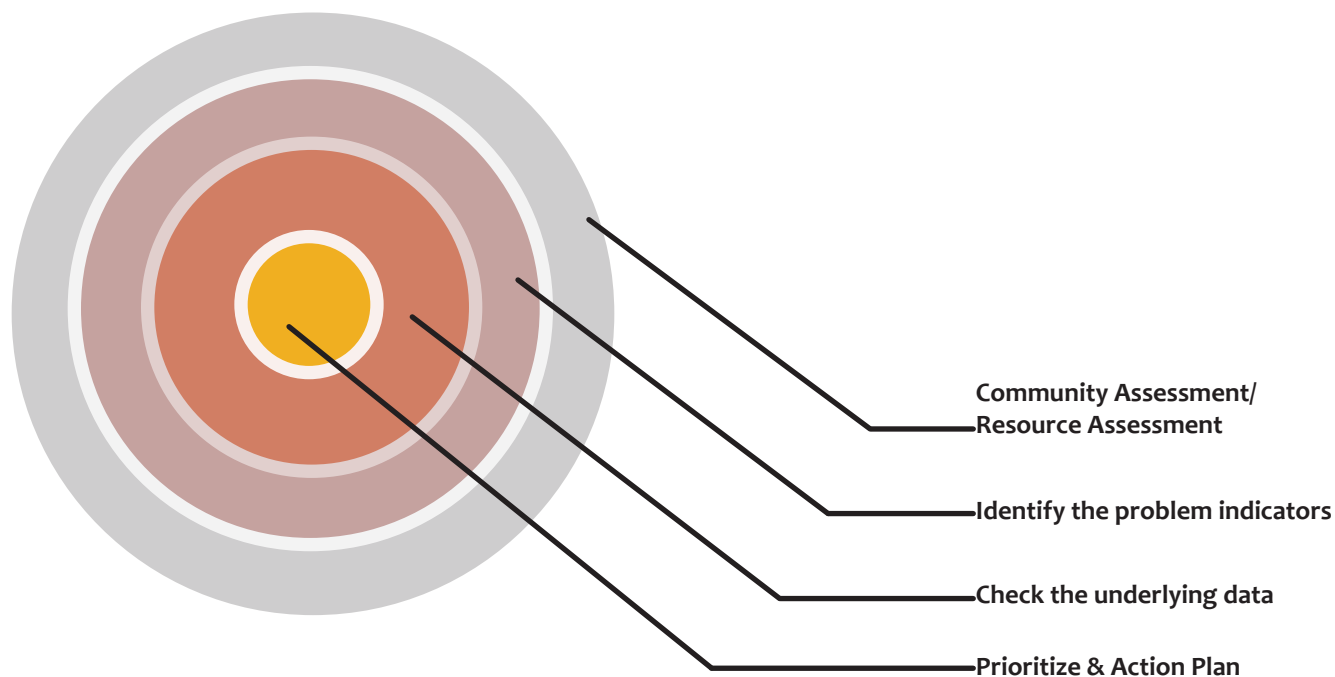
***The goal of this resilience tool is to help localities identify the specific problems in improving the resilience of their communities, thus making them able to prioritize and concentrate their efforts and financial resources in a more strategic fashion. A recommended thought process for using the resilience online tool is outlined in the diagram below.***





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## *A Process Diagram of Identifying Resilience Problems Using the Online Tool*



The first step is the big-picture diagnosis of the whole community in resilience building as it pertains to **social, economic, infrastructure, and environmental** categories. The information above, in conjunction with **Appendix A**, explains how to do the Community Assessment and Resource Assessment for your selected area of interest. Take Callaway County, Missouri as an example. The overall assessment shows that Callaway is red (low resilience and high vulnerability) in regards to infrastructure indicators, yellow (low resilience and low vulnerability) in regards to both social and economic indicators, and blue (high resilience and high vulnerability) in regards to their environmental indicators. Therefore, it could be suggested that the first priority in improving resilience of the county should be to improve its infrastructure security and capacity due to its red distinction of low resilience coupled with high vulnerability.

With this big picture in mind, users can continue to discover which aspects of infrastructure in Callaway County could use attention. Though this tool cannot tell a locality specifically what to do about findings it may reveal, it does serve to put the very large topic of resilience into perspective thus aiding in how best to tackle resiliency problems. **Appendix B** provides step-by-step instructions on how to identify problems. By using this resilience tool, local leaders could prioritize and incorporate how best to work toward improving their community resilience.

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## *Best Practices*

The examples provided below are to spur creative ways in thinking about how localities could tackle various vulnerabilities they may have identified following their community and resource assessments. Readers will find that many problems cannot be separated entirely from each other and oftentimes are even interconnected. Therefore, even the benefits arising from risk-reducing efforts are also often interwoven together, such that all efforts contribute together to building community resilience.

### **Improving Social and Economic Resilience**

As the timber industry began to decline in the 1980s, many rural communities in Oregon experienced an economic crisis, which later increased their social and economic vulnerability. To improve their community's resilience, local leaders initiated the Rural Development Initiative (RDI) to help rural communities revitalize their economy and rebuild social cohesion.

RDI's initial work included the renovation of former mill sites, facilitating community and regional strategic planning, business consultation, entrepreneurship assistance, network building, and community leadership training. Over the years, it has developed into a professional non-profit consultation organization that provides professional training for all stakeholders in the community; including business owners, entrepreneurs, county commissioners, non-profit leaders, and volunteers. RDI also assists with on-going network support as well as funding and expert guidance to increase the community's social capital. With help from RDI, county commissioners started to revitalize the local economy systematically. Non-profit organizations improved their management and increased their social capital more efficiently. Residents had their passion for the public good reignited and begin to have a positive impact in their communities. Many entrepreneurs started their own businesses which also contributed to the local economy.

*To know more about this initiative, go to their website <https://www.rdiinc.org>.*

### **Improving Infrastructure Resilience**

In 2014, the Rural Economic Development Division of North Carolina decided to increase the resilience of infrastructure in rural communities through critical infrastructure maintenance, renovation of vacant buildings, and through the expansion of local health care facilities. They believed that infrastructure resilience would not only prepare their communities for emergency response, but would also create more job opportunities, thus benefiting the local economy and the overall resilience of their community. These infrastructure building efforts were supported by grant programs and planning services and turned out to be efficient in increasing their community's resilience.

*To know more about this initiative, go to their website <https://www.nccommerce.com/rd>*

### **Improving Environmental Resilience**

In 2012, faced with a serious stormwater runoff problem that resulted in pollution and unfishable waterways in the area, the county of Prince George in Maryland decided to initiate a comprehensive urban stormwater retrofitting program. To maximize social benefits, the county adopted a Public-Private Partnership (P3) approach to leverage the strengths of both the public and private sectors and encouraged local businesses to participate in the program. The partnership resulted in innovative runoff management practices that helped control runoff and flooding, prevented stream erosion, and reduced pollutants.

*To know more about this initiative, read the "EPA Local Government Advisory Committee's Best Practices for Local Government" here: [https://www.epa.gov/sites/production/files/2015-10/documents/2015\\_best\\_practices\\_for\\_local\\_government.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/2015_best_practices_for_local_government.pdf)*

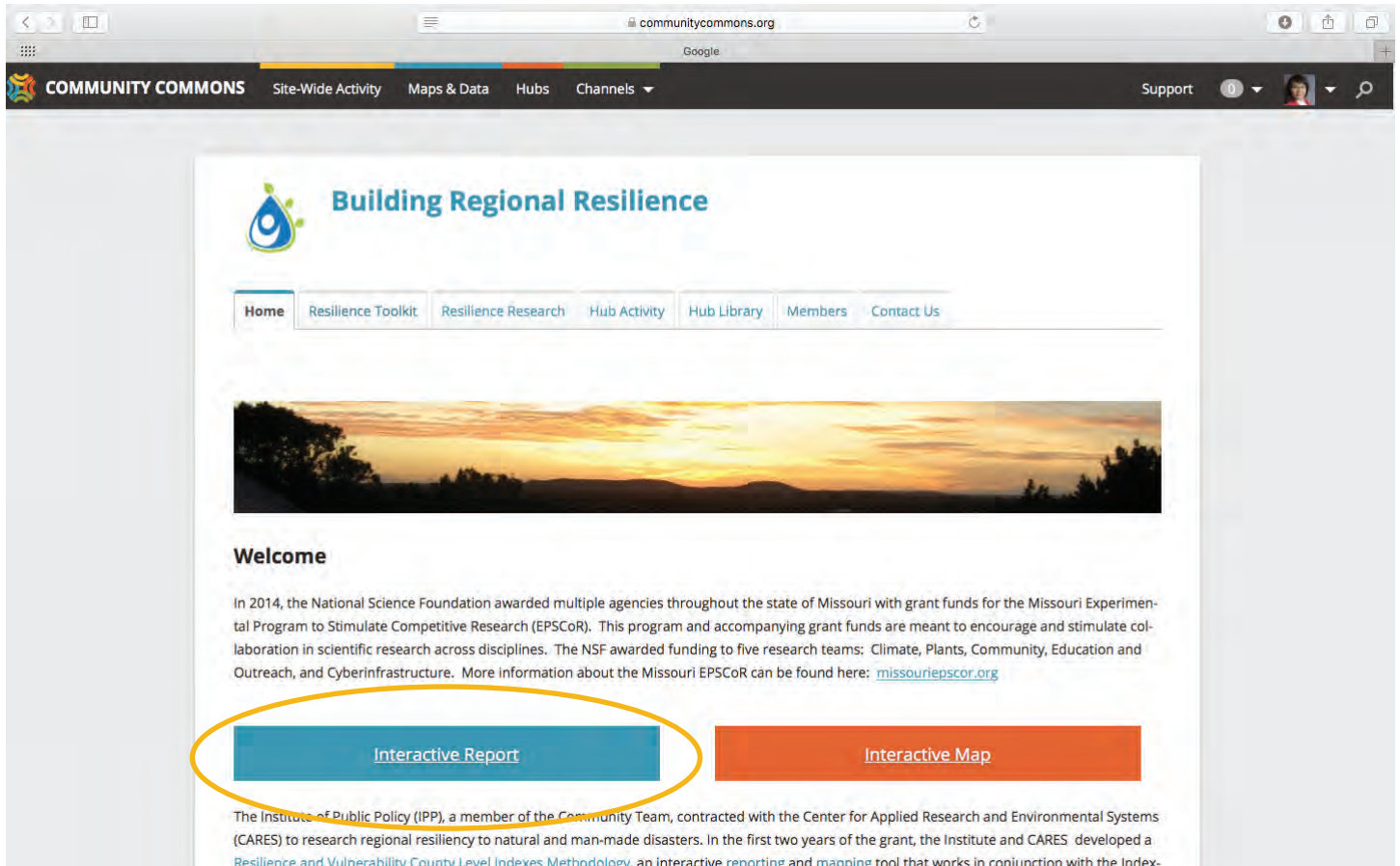
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## Appendix A

### *Step-by-step Instructions on How to do a Community Assessment*

1. Access the Resilience Tool at [www.BuildingRegionalResilience.org](http://www.BuildingRegionalResilience.org).
2. Create a log in and register to gain access the site. Remember this login to gain future access.
3. Click on “Interactive Report”



The screenshot shows the homepage of the Building Regional Resilience website. The browser address bar displays "communitycommons.org". The navigation bar includes "COMMUNITY COMMONS", "Site-Wide Activity", "Maps & Data", "Hubs", "Channels", "Support", and a user profile icon. The main content area features the "Building Regional Resilience" logo and a navigation menu with "Home", "Resilience Toolkit", "Resilience Research", "Hub Activity", "Hub Library", "Members", and "Contact Us". A large banner image shows a sunset over a landscape. Below the banner, a "Welcome" section contains text about the 2014 NSF grant and a link to "missouriepscor.org". Two buttons are visible: "Interactive Report" (circled in yellow) and "Interactive Map".

**Building Regional Resilience**

Home Resilience Toolkit Resilience Research Hub Activity Hub Library Members Contact Us

**Welcome**

In 2014, the National Science Foundation awarded multiple agencies throughout the state of Missouri with grant funds for the Missouri Experimental Program to Stimulate Competitive Research (EPSCoR). This program and accompanying grant funds are meant to encourage and stimulate collaboration in scientific research across disciplines. The NSF awarded funding to five research teams: Climate, Plants, Community, Education and Outreach, and Cyberinfrastructure. More information about the Missouri EPSCoR can be found here: [missouriepscor.org](http://missouriepscor.org)

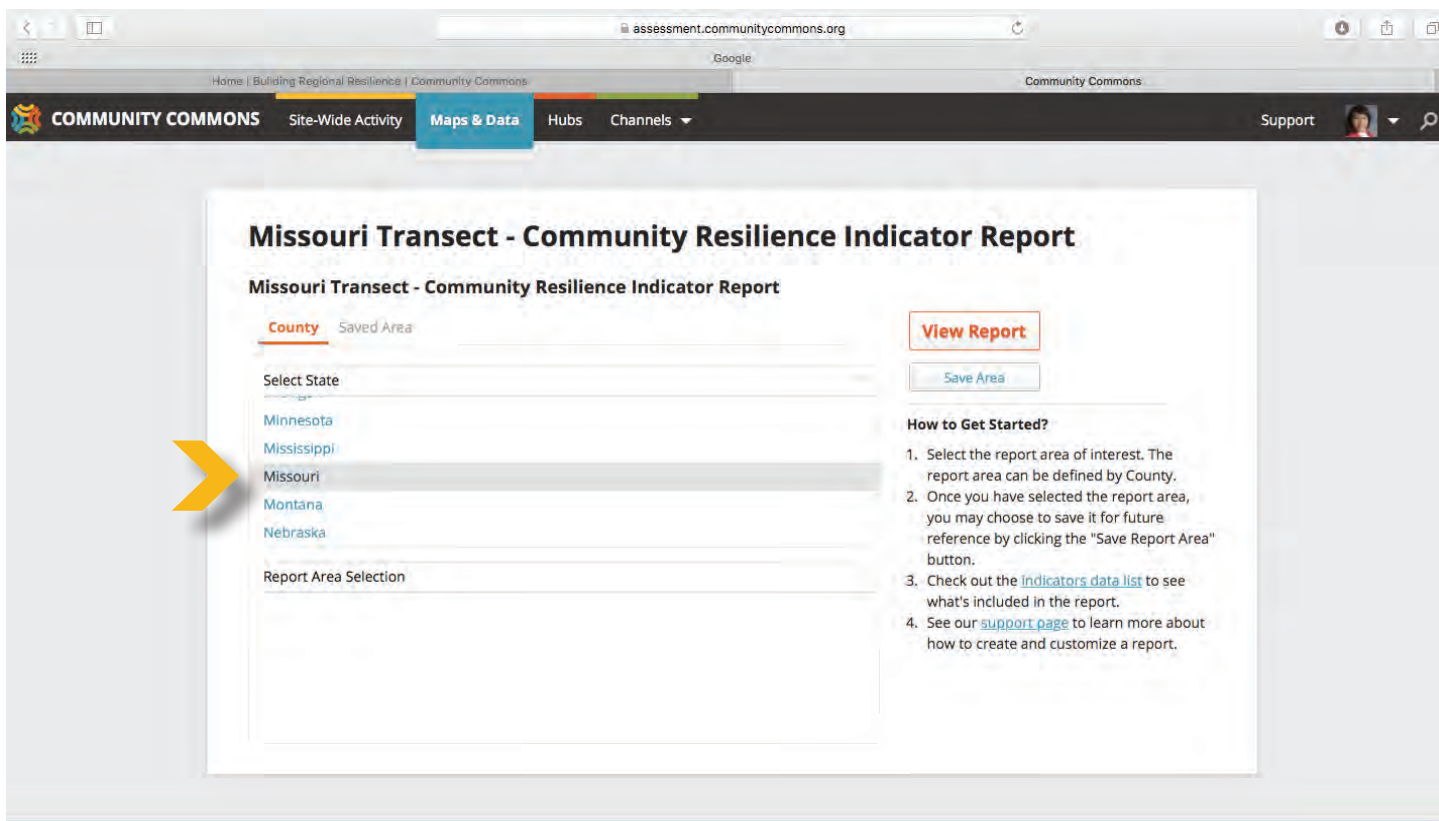
[Interactive Report](#) [Interactive Map](#)

The Institute of Public Policy (IPP), a member of the Community Team, contracted with the Center for Applied Research and Environmental Systems (CARES) to research regional resiliency to natural and man-made disasters. In the first two years of the grant, the Institute and CARES developed a [Resilience and Vulnerability County Level Indexes Methodology](#), an interactive [reporting](#) and [mapping](#) tool that works in conjunction with the Index-

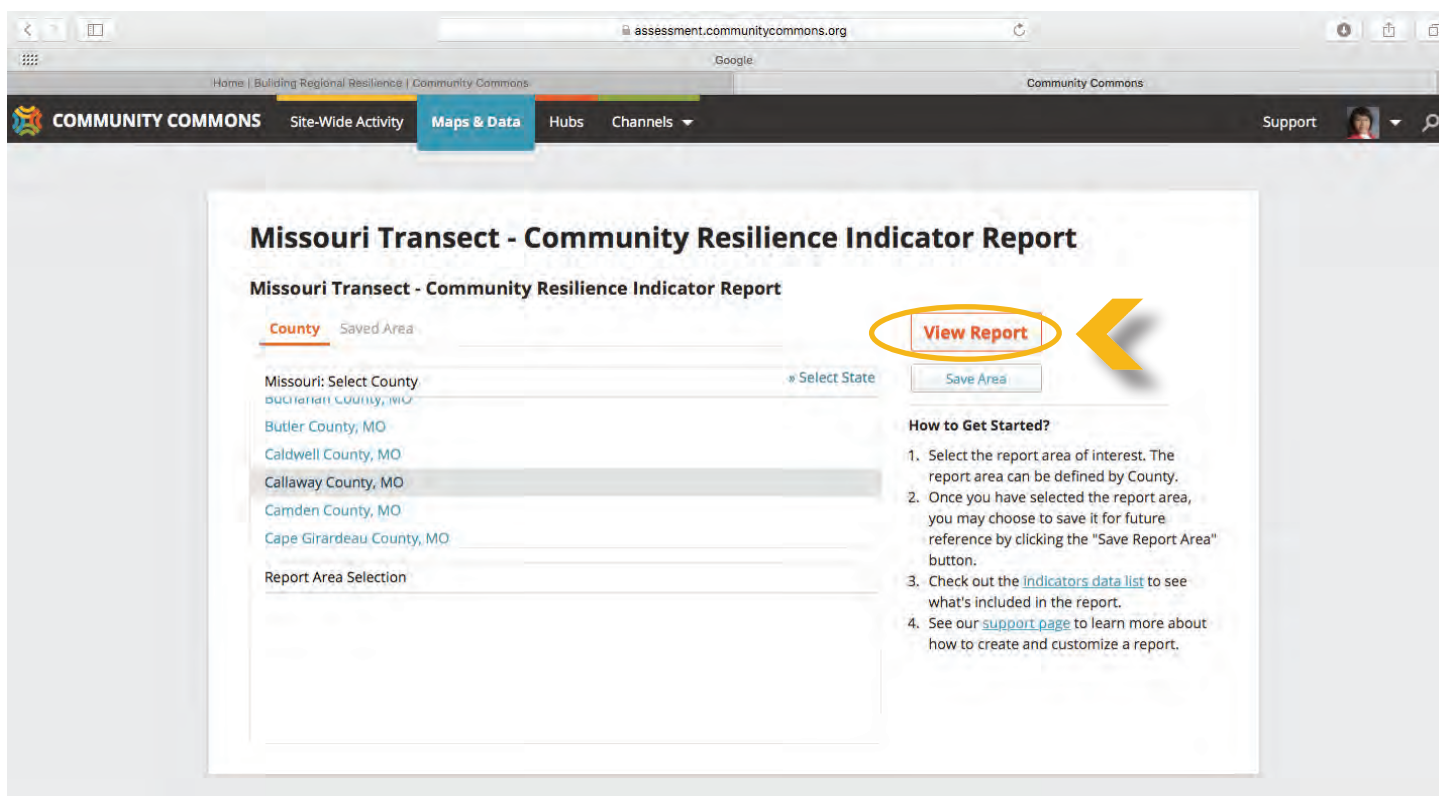


4. Select your State of interest (e.g. Missouri).

5. Select your county or counties of interest (e.g. Boone, Callaway, and Miller).



6. Once all your counties of interest are selected click “view report”.



7. On the page that pops up, you will see your interest county/ies as they compare in the social aspect as the default. Under “Data Indicators” the resiliency categories are listed (social, economic, infrastructure, environment). Whichever category is in bold is the current selected aspect for which you are seeing data.

8. Below the data indicators you will see a brief summary of your selected counties of interest. A summary in chart format details the selected area and how many counties fall into what quadrant on the resiliency matrix. There is even an option to “download data” to export this information for use outside of the website.

**Resilience & Vulnerability Quadrants**

Data Indicators

- Social Factors
- Economics**
- Infrastructure
- Environment

**Economics**

This indicator describes the position of report area counties along the economic resilience-vulnerability matrix. In the report area, 0 counties are classified as having low resilience and high vulnerability, 1 county is classified as having low resilience and low vulnerability, 0 counties are classified as having high resilience and high vulnerability, and 0 counties are classified as having high resilience and low vulnerability. Of 115 counties in the state, 20 counties are classified as having low resilience and high vulnerability, 25 counties are classified as having low resilience and low vulnerability, 22 counties are classified as having high resilience and high vulnerability, and 48 counties are classified as having high resilience and low vulnerability.

[Download Data](#)

Report Area	Low Resilience, High Vulnerability	Low Resilience, Low Vulnerability	High Resilience, High Vulnerability	High Resilience, Low Vulnerability
Callaway County, MO	0	1	0	0
Missouri	20	25	22	48

Data Source: [Missouri EPSCoR, 2017](#). Source geography: County

**Economics, Resilience / Vulnerability Quadrant by County, EPSCOR 2017**

- High Resilience / Low Vulnerability
- High Resilience / High Vulnerability
- Low Resilience / Low Vulnerability
- Low Resilience / High Vulnerability
- Report Area

[View larger map](#)

9. At the bottom is more about the methodology used to determine each county's placement in the resiliency matrix.

The screenshot shows a web browser window with the URL [assessment.communitycommons.org](http://assessment.communitycommons.org). The page content includes:

- FOOTNOTES** (with a **HIDE** button)
- Infrastructure**
- Data Background**
  - The Missouri Experimental Program to Stimulate Competitive Research (EPSCoR) is an initiative of the National Science Foundation meant to encourage and stimulate collaboration in scientific research across disciplines. NSF awarded funding to three research teams: Climate, Plants and Community.
  - National Science Foundation funding over the course of the past two years has allowed members of the Community Team within Missouri EPSCoR to develop the County Level Resilience and Vulnerability Indexes to better inform leaders of their preparedness for future disasters. A Resilience Toolbox is also in the works and is being designed for use in conjunction with the Indexes. These tools have been developed for use by community leaders and regional planning commissions.
  - More information about Missouri EPSCoR can be found here: <http://missouriepscor.org/>
- Methodology**
  - This indicator describes the position of report area counties along the resilience-vulnerability matrix. The matrix was created for each set of resilience and vulnerability indexes in the social, economic, infrastructure, and environmental dimensions.
  - Counties were assigned to one of four quadrants based on its average resilience and vulnerability scores relative to the median resilience and vulnerability scores across all US counties. Counties scoring above the median value were labelled "high resilience" or "high vulnerability," while counties below the median value were labelled "low resilience" or "low vulnerability." The comparison of values for resilience and vulnerability, then, place the county in one of four quadrants, illustrated below.

The four quadrants are illustrated in a 2x2 grid:

High Vulnerability Low Resilience	High Vulnerability High Resilience
Low Vulnerability Low Resilience	Low Vulnerability High Resilience

For more information, please refer to [WORKING PAPER IPP/07: Measuring Resilience and Vulnerability in U.S. Counties.](#)

At the bottom right, there are three buttons: **Customize Report**, **Start Over**, and **Save & Download**.



## Appendix B

### Step-by-step Instructions on How to Identify Problems

1. Going back to the top under “Data Category” you can see information about the data used to determine resilience (select “Resilience Indices”) and vulnerability (select “Vulnerability Indices”). By comparing the county value to the state or national value, you can identify the fields in which a county has poor or adequate performance. Indicators are coded on a scale ranging from zero (lowest resilience) to one (highest resilience).

Report Area: Callaway County, MO

Data Category: Resilience & Vulnerability Quadrants • **Resilience Indices** • Vulnerability Indices • Underlying Data

Resilience Indices

Data Indicators:
 

- Resilience Index - Social Factors
- Resilience Index - Economics
- Resilience Index - Infrastructure**

**Resilience Index - Infrastructure**

This indicator displays the infrastructure resilience index and the rescaled indicators that comprise the score. Values are coded into a scale ranging from zero (lowest resilience) to one (highest resilience).  
 Note: State-level values are population-weighted averages. The United States value is the median value for all counties.

Report Area	Emergency Response Occupations Score	Grocery Store Access Score	Emergency Facility Access Score	Evacuation Routes - Lane Miles Score	Medical Professional Access Score	Police and Fire Protection Score	Infrastructure Resilience Index Score
Callaway County, MO	0.58	0.23	0.69	0.08	0.21	0.28	0.34
Missouri	0.34	0.54	0.78	0.04	0.46	0.41	0.43
United States	0.46	0.39	0.66	0.16	0.32	0.30	0.35

Data Source: Missouri EPSCoR, 2017. Source geography: County

**Note: For resilience indices, a higher value indicates a desired outcome.**

Report Area: Callaway County, MO

Data Category: Resilience & Vulnerability Quadrants • Resilience Indices • **Vulnerability Indices** • Underlying Data

Vulnerability Indices

Data Indicators:
 

- Vulnerability Index - Social Factors
- Vulnerability Index - Economics
- Vulnerability Index - Infrastructure**

**Vulnerability Index - Infrastructure**

This indicator displays the infrastructure vulnerability index and the rescaled indicators that comprise the score. Values are coded into a scale ranging from zero (lowest vulnerability) to one (highest vulnerability).  
 Note: State-level values are population-weighted averages. The United States value is the median value for all counties.

Report Area	Older Homes Score	High-Detour Bridges Score	Major Dam Proximity Score	Mobile Homes Score	No Motor Vehicle Score	Nuclear Power Facility Proximity Score	Unsafe Drinking Water Score	Infrastructure Vulnerability Index Score
Callaway County, MO	0.18	0.18	0.42	0.36	0.26	0.38	0.00	0.28
Missouri	0.37	0.46	0.28	0.15	0.37	0.00	0.09	0.24
United States	0.39	0.49	0.30	0.33	0.36	0.31	0.22	0.22

Data Source: Missouri EPSCoR, 2017. Source geography: County

**Note: For vulnerability indices, a higher value indicates a pressure point.**



2. You can look at the underlying data of some indicators (not all) by clicking “Underlying Data”. Take Medical Professional (Callaway County) as an example. The time series chart shows that access to primary care has been a historic problem since 2004.

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Data Category

Resilience & Vulnerability Quadrants • Resilience Indices • Vulnerability Indices • **Underlying Data**

Underlying Data

Data Indicators

- Economic Resilience - Labor Force Participation
- Economic Resilience - Proprietor Employment
- Economic Vulnerability - Business Vacancies
- Economic Vulnerability - Cost Burdened Housing
- Economic Vulnerability - Unemployment
- Environmental Vulnerability - Drought
- Infrastructure Resilience - Grocery Store Access
- Infrastructure Resilience - Medical Professionals**
- Infrastructure Vulnerability - Drinking Water Violations
- Infrastructure Vulnerability - Mobile Homes
- Infrastructure Vulnerability - Older Homes
- Infrastructure Vulnerability - Vehicle Access
- Social Resilience - Educational Attainment
- Social Resilience - Home Ownership
- Social Resilience - Place Attachment
- Social Resilience - Voter Participation
- Social Vulnerability - Dependent Population (Children)
- Social Vulnerability - Dependent Population (Disabled)
- Social Vulnerability - Dependent Population (Elderly)
- Social Vulnerability - Income Inequality
- Social Vulnerability - Linguistic Isolation
- Social Vulnerability - Poverty Rate
- Social Vulnerability - Uninsured Population
- Social Vulnerability - Violent Crime

Infrastructure Resilience - Medical Professionals

This indicator reports the number of primary care physicians per 100,000 population. Doctors classified as "primary care physicians" by the AMA include: General Family Medicine MDs and DOs, General Practice MDs and DOs, General Internal Medicine MDs and General Pediatrics MDs. Physicians age 75 and over and physicians practicing sub-specialties within the listed specialties are excluded. This indicator is relevant because a shortage of health professionals contributes to access and health status issues.

Download Data

Report Area	Total Population, 2014	Primary Care Physicians, 2014	Primary Care Physicians, Rate per 100,000 Pop.
Callaway County, MO	44,750	17	37.99
Missouri	6,063,589	5,072	83.6
United States	318,857,056	279,871	87.8

Note: This indicator is compared with the state average.  
Data Source: US Department of Health & Human Services, Health Resources and Services Administration, [Area Health Resource](#)

Primary Care Physicians, Rate per 100,000 Pop.

Legend: Callaway County, MO (37.99), Missouri (83.6), United States (87.8)

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Jefferson City

View larger map

Access to Primary Care, Rate (Per 100,000 Pop.) by Year, 2004 through 2014

This indicator reports the rate of primary care physicians per 100,000 population by year.

Download Data

Report Area	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Callaway County, MO	35.64	44.66	44.11	41.45	39.11	38.88	38.35	38.27	38.37	38.32	37.99
Missouri	70.36	69.05	68.63	68.35	68.09	73.74	80.21	82.64	82.86	83.27	83.65
United States	80.76	80.94	80.54	80.38	80.16	82.22	84.57	85.83	86.66	87.76	87.77

Access to Primary Care, Rate (Per 100,000 Pop.) by Year, 2004 through 2014

Legend: Callaway County, MO, Missouri, United States

FOOTNOTES

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3. Further selecting the data indicators under your data category will automatically populate the information for your area based on the data indicator you select.

4. Repeat this process to determine underlying information impacting your area's classification on the resilience matrix. Take Mobile Homes as another example.

**Underlying Data**

**Data Indicators**

- Economic Resilience - Labor Force Participation
- Economic Resilience - Proprietor Employment
- Economic Vulnerability - Business Vacancies
- Economic Vulnerability - Cost Burdened Housing
- Economic Vulnerability - Unemployment
- Environmental Vulnerability - Drought
- Infrastructure Resilience - Grocery Store Access
- Infrastructure Resilience - Medical Professionals
- Infrastructure Vulnerability - Drinking Water Violations
- Infrastructure Vulnerability - Mobile Homes**
- Infrastructure Vulnerability - Older Homes
- Infrastructure Vulnerability - Vehicle Access
- Social Resilience - Educational Attainment
- Social Resilience - Home Ownership
- Social Resilience - Place Attachment
- Social Resilience - Voter Participation
- Social Vulnerability - Dependent Population (Children)
- Social Vulnerability - Dependent Population (Disabled)
- Social Vulnerability - Dependent Population (Elderly)
- Social Vulnerability - Income Inequality
- Social Vulnerability - Linguistic Isolation
- Social Vulnerability - Poverty Rate
- Social Vulnerability - Uninsured Population
- Social Vulnerability - Violent Crime

**Infrastructure Vulnerability - Mobile Homes**

This indicator reports the percentage of the total population living in single-unit housing structures. Detached single-family homes, and attached homes (row houses) are considered single-unit housing structures.

Report Area	Total Population in Housing Units	Population in Single-Unit Housing	Percent of Population in Single-Unit Housing
Callaway County, MO	40,651	31,519	77.54%
Missouri	5,870,934	4,725,740	80.49%
United States	308,459,400	226,940,351	73.57%

Data Source: US Census Bureau, *American Community Survey*, 2011-15. Source geography: Tract

The underlying data include information about single-unit housing and other types of housing. We can tell from the tables and charts that Callaway County has lower proportions of all types of housing structures except mobile homes. The GIS map also provides the geographic locations of all single unit housing structures.

**Population in Single Unit Housing Structures, Percent by Tract, ACS 2011-15**

Legend: Over 86.0%, 80.1 - 86.0%, 74.1 - 80.0%, Under 74.1%, No Data or Data Suppressed, Report Area

**Percent of Population in Housing by Structure Type**

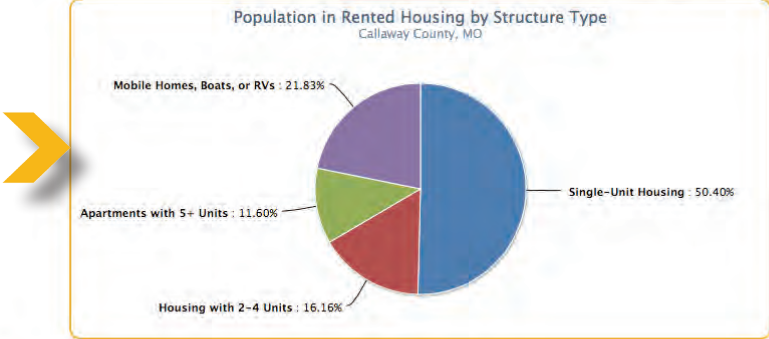
Report Area	Single-Unit Housing	Housing with 2-4 Units	Housing with 5+ Units (Apartment / Condominium)	Other Housing (Mobile Home, Boat, or RV)
Callaway County, MO	77.54%	4.11%	2.79%	15.57%
Missouri	80.49%	6.12%	7.56%	5.82%
United States	73.57%	7.28%	13.37%	5.78%

**Percent of Population in Housing by Structure Type**

**Population in Rented Housing by Structure Type**

[Download Data](#)

Report Area	Single-Unit Housing	Housing with 2-4 Units	Housing with 5+ Units (Apartment / Condominium)	Other Housing (Mobile Home, Boat, or RV)
Callaway County, MO	4,797	1,538	1,104	2,078
Missouri	940,489	326,514	412,047	107,115
United States	45,582,432	18,644,041	36,989,236	5,445,312



**FOOTNOTES**

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Infrastructure Vulnerability - Mobile Homes

**Data Background**

The American Community Survey (ACS) is a nationwide, continuous survey designed to provide communities with reliable and timely demographic, housing, social, and economic data. The ACS samples nearly 3 million addresses each year, resulting in nearly 2 million final interviews. The ACS replaces the long-form decennial census; however, the number of household surveys reported annually for the ACS is significantly less than the number reported in the long-form decennial census. As a result, the ACS combines detailed population and housing data from multiple years to produce reliable estimates for small counties, neighborhoods, and other local areas. Negotiating between timeliness and accuracy, the ACS annually releases current, one-year estimates for geographic areas with large populations; three-year and five-year estimates are also released each year for additional areas based on minimum population thresholds.