Understanding and Using American Community Survey Data

What Users of Data for Rural Areas Need to Know

Issued October 2020

United States® Census Bureau

U.S. Department of Commerce
U.S. CENSUS BUREAU
census.gov

Acknowledgments

Linda A. Jacobsen, Vice President, U.S. Programs, Population Reference Bureau (PRB), and **Mark Mather**, Associate Vice President, U.S. Programs, PRB, drafted this handbook in partnership with the U.S. Census Bureau's American Community Survey Office. Other PRB staff who assisted in drafting and reviewing the handbook include: **Lillian Kilduff**, **Kelvin Pollard**, and **Paola Scommegna**.

American Community Survey data users who provided feedback and case studies for this handbook include: **Susan Brower**, **John Cromartie**, **Lillie Greiman**, **Jason R. Jurjevich**, and **Keith Wiley**.

Nicole Scanniello and **Gretchen Gooding**, Census Bureau, contributed to the planning and review of this handbook.

The American Community Survey program is under the direction of **Albert E. Fontenot Jr.**, Associate Director for Decennial Census Programs, **Deborah M. Stempowski**, Assistant Director for Decennial Census Programs, and **Donna M. Daily**, Chief, American Community Survey Office.

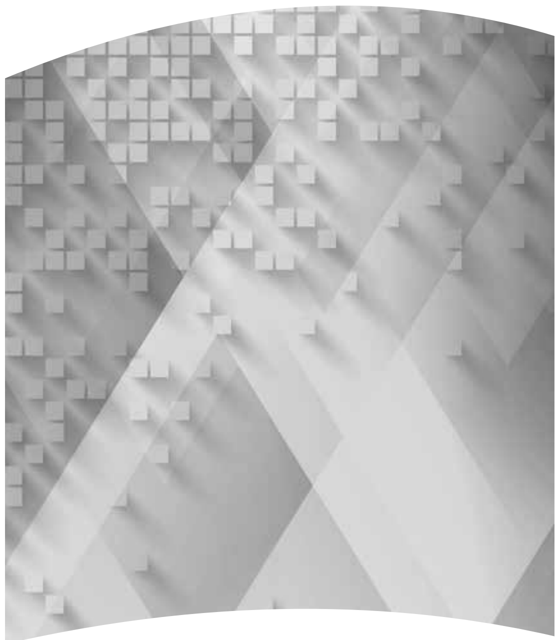
Other individuals from the Census Bureau who contributed to the review and release of these handbooks include: **Joshua Comenetz**, **Ashley Edwards**, **James Fitzsimmons**, **Doug Hill**, **Paul Mackun**, **Michael Ratcliffe**, **Michael Starsinic**, **Janice Valdisera**, and **Ellen Wilson**.

Faye Brock, **Linda Chen**, and **Christine Geter** provided publication management, graphic design and composition, and editorial review for print and electronic media under the direction of **Janet Sweeney**, Chief of the Graphic and Editorial Services Branch, Public Information Office.

Understanding and Using American Community Survey Data

What Users of Data for Rural Areas Need to Know

Issued October 2020



U.S. Department of Commerce
Wilbur Ross,
Secretary

Karen Dunn Kelley,
Deputy Secretary

U.S. CENSUS BUREAU
Steven Dillingham,
Director

Suggested Citation

U.S. Census Bureau,
Understanding and Using American Community Survey Data: What Users of Data for Rural Areas Need to Know,
U.S. Government Publishing Office,
Washington, DC, 2020.

Contents

This page is intentionally blank.

UNDERSTANDING AND USING AMERICAN COMMUNITY SURVEY DATA: WHAT USERS OF DATA FOR RURAL AREAS NEED TO KNOW

Suppose a state office on aging wants to gauge the potential need for a "healthy aging" initiative in rural communities. Or an entrepreneur in a small Midwestern town is interested in opening an auto parts business but needs to know more about local commuting patterns and how they have changed over time. Or a local government official wants information about the number of vacant housing units in a sparsely populated county.

Where would they go to find the necessary information?

The U.S. Census Bureau's American Community Survey (ACS) is designed to answer these types of questions and meet the needs of policymakers, business leaders, planners, and others who need good data to make informed decisions. The ACS provides a detailed portrait of the social, economic, housing, and demographic characteristics of America's communities—including the characteristics of people and households in rural areas.

This guide provides an overview of what data users need to know about working with ACS data for rural areas. For example:

- How is "rural" defined and what levels of geography are available to study population and housing issues in rural areas?
- Most ACS estimates for rural communities are based on data that have been pooled over a 5-year period. What are the implications for measuring trends in rural areas over time?
- Working with data for rural areas can also present challenges in terms of the reliability of the data. What strategies can people use to produce reliable estimates for their communities?
- Where can data users access ACS estimates for rural areas?
- How are different communities using ACS data for decision-making in rural America?

This guide also includes some recent case studies that show how ACS data are being used to help address important policy and program issues in rural America.

What Is the ACS?

The ACS is a nationwide survey designed to provide communities with reliable and timely social, economic, housing, and demographic data every year. A separate annual survey, called the Puerto Rico Community Survey (PRCS), collects similar data about the population and housing units in Puerto Rico. The Census Bureau uses data collected in the ACS and the PRCS to provide estimates on a broad range of population, housing unit, and household characteristics for states, counties, cities, school districts, congressional districts, census tracts, block groups, and many other geographic areas.

The ACS has an annual sample size of about 3.5 million addresses, with survey information collected nearly every day of the year. Data are pooled across a calendar year to produce estimates for that year. As a result, ACS estimates reflect data that have been collected over a period of time rather than for a single point in time as in the decennial census, which is conducted every 10 years and provides population counts as of April 1 of the census year.

ACS 1-year estimates are data that have been collected over a 12-month period and are available for geographic areas with at least 65,000 people. Starting with the 2014 ACS, the Census Bureau is also producing "1-year Supplemental Estimates"—simplified versions of popular ACS tables—for geographic areas with at least 20,000 people. The Census Bureau combines 5 consecutive years of ACS data to produce multiyear estimates for geographic areas with fewer than 65,000 residents. These 5-year estimates represent data collected over a period of 60 months.

For more detailed information about the ACS—how to judge the accuracy of ACS estimates, understanding multiyear estimates, knowing which geographic areas are covered in the ACS, and how to access ACS data on the Census Bureau's Web site—see the Census Bureau's handbook on *Understanding and Using American Community Survey Data: What All Data Users Need to Know*.[1]

[1] U.S. Census Bureau, *Understanding and Using American Community Survey Data: What All Data Users Need to Know*, <www.census.gov/programs-surveys/acs/guidance/handbooks/general.html>.

1. DEFINING "RURAL" AREAS

What does it mean for an area to be classified as "rural?"

Federal agencies, researchers, and other analysts use two main classification systems to define rural areas: (1) the U.S. Census Bureau's urban and rural definitions, and (2) the Office of Management and Budget's (OMB's) Metropolitan and Micropolitan Statistical Area standards.

TIP: Some analysts use the OMB standards to classify areas outside of metropolitan statistical areas as "nonmetropolitan." But nonmetropolitan is not synonymous with rural and was not designed for that purpose.

This section describes these two classification systems and how they relate to each other, so that American Community Survey (ACS) data users can choose the appropriate geographic areas for their analysis.

Rural/Urban Areas

The Census Bureau does not actually define "rural." Rather, rural areas include all geographic areas that are not classified as urban. Data from the ACS indicate that about 63 million people, or 19 percent of the population, lived in rural areas of the United States in 2018. Although less than one-fifth of the U.S. population lives in rural areas, these areas encompass about 97 percent of the total land area in the United States. Figure 1.1 shows a sample image of rural areas in Texas.

Geographic areas that are not rural are, by definition, urban. The Census Bureau defines "urban areas" as either:

- Urbanized areas, which contain 50,000 or more people.
- Urban clusters, which have at least 2,500 people but fewer than 50,000 residents.

Figure 1.1. **Rural Areas in Texas: 2018**

Source: U.S. Census Bureau.

Both urbanized areas and urban clusters are delineated primarily on the basis of population density—or the extent to which areas are built-up and densely settled. The Census Bureau also uses land use/land cover and distance criteria in assessing whether to include territory in an urban area.

The Census Bureau defines urban areas after each decennial census. After the 2010 Census, the Census Bureau delineated 3,573 urban areas nationwide, including 486 urbanized areas and 3,087 urban clusters. About 264 million people, or 81 percent of the population, lived in urban areas in 2018, according to ACS data. Figure 1.2 shows a sample image of urbanized areas and urban clusters in Pennsylvania.

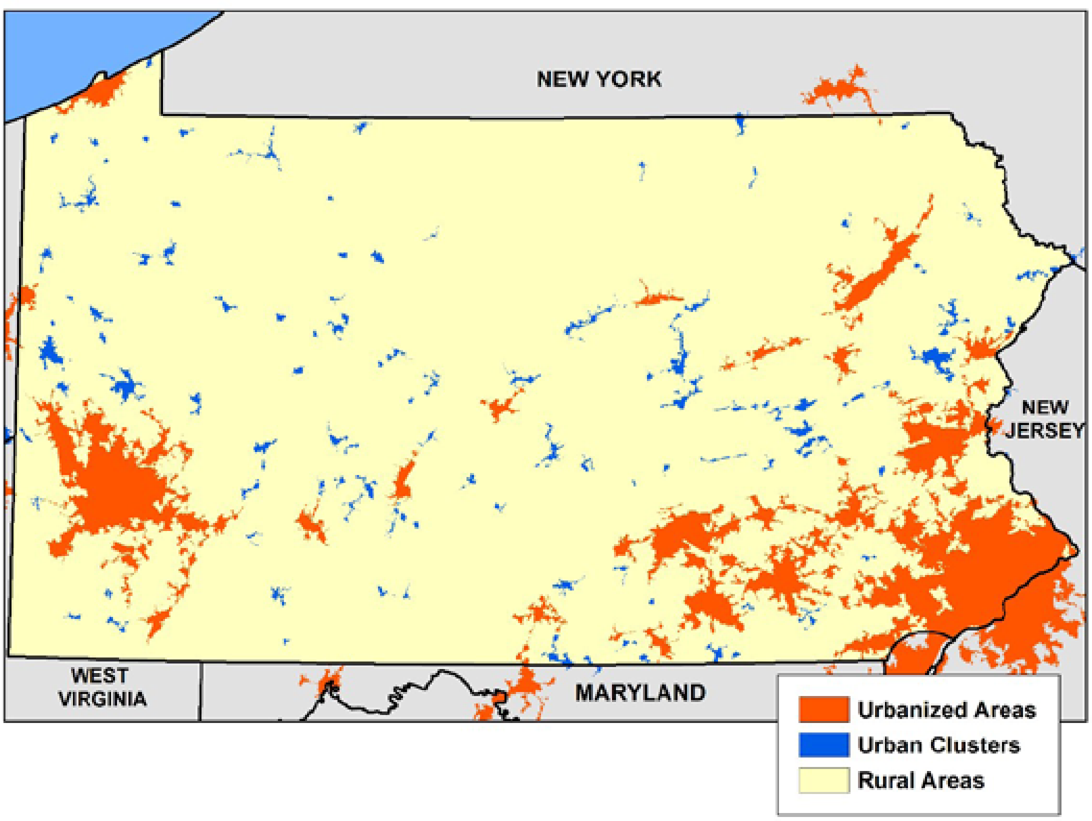
The Census Bureau's data.census.gov Web site includes ACS estimates for rural and urban portions of the nation, regions, divisions, each of the 50 states, and Puerto Rico. Information about how to access estimates for urban/rural areas is included in the section on "Accessing ACS Data."

TIP: While the Census Bureau releases ACS data for urban and rural areas each year, the boundaries for urban areas are delineated based on decennial census results and do not change through the decade. Given that urban and rural area definitions are not updated between censuses, data for urban and rural areas from the ACS (and other sources) do not necessarily reflect the results of ongoing urbanization.

As the decade progresses, data for rural areas from the ACS may include densely settled population that will be defined as urban in the next round of delineations. For more information about urban/rural area definitions, see the Census Bureau's brief on Defining Rural.[2]

[2] Michael Ratcliffe, Charlynn Burd, Kelly Holder, and Alison Fields, Defining Rural at the U.S. Census Bureau, ACSGEO-1, 2016, <www.census.gov/library/publications/2016/acs/acsgeo-1.html>.

Figure 1.2. **Urban Areas in Pennsylvania: 2018**



Source: U.S. Census Bureau.

Other federal agencies and programs use different classification systems to define rural and urban areas (see Box 1.1). For example, the U.S. Department of Agriculture's Economic Research Service (ERS) uses Rural-Urban Commuting Area (RUCA) codes to classify census tracts based on measures of population density, urbanization, and commuting patterns. The Census Bureau does not publish ACS estimates based on these RUCA codes, but data users could merge tract-level ACS estimates with the ERS codes to compare population and housing patterns across rural and urban communities.

Office of Management and Budget (OMB) Delineations

OMB designates counties as metropolitan or micropolitan—collectively known as core-based statistical areas. Counties that do not fall into either of these categories are classified as being "outside metropolitan and micropolitan statistical areas."

OMB delineates metropolitan statistical areas as agglomerations of one or more counties (or county equivalents) that contain at least one urbanized area of at least 50,000 people. Metropolitan statistical areas include the county or counties containing the core urbanized area, as well as adjacent counties that, through commuting patterns, are highly integrated economically and socially with the central county.[3] Dallas-Fort Worth-Arlington, Texas, is an example of a metropolitan statistical area.

Beginning in 2003, OMB also delineated "micropolitan" statistical areas. Micropolitan statistical areas consist of at least one urban cluster of at least 10,000 but fewer than 50,000 residents. Like metropolitan statistical areas, micropolitan statistical areas consist of the county or counties containing the core area, plus adjacent counties integrated socially and economically with that main county through commuting patterns.[4] Del Rio, Texas, is an example of a micropolitan statistical area.

The August 2017 OMB classification includes 383 metropolitan statistical areas and 550 micropolitan statistical areas (excluding Puerto Rico). Collectively, these areas accounted for 94 percent of the U.S. population in 2018, according to ACS data. They also make up about 48 percent of the total land area in the United States. Figure 1.3 shows a sample image of counties classified as metropolitan, micropolitan, and

[3] U.S. Office of Management and Budget, Bulletin No. 17-01, Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas, <www.census.gov/programs-surveys/metro-micro/about/omb-bulletins.html>.

[4] U.S. Office of Management and Budget, Bulletin No. 17-01, Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas, <www.census.gov/programs-surveys/metro-micro/about/omb-bulletins.html>.

Box 1.1. ***How Federal Agencies Define Rural and Urban Areas***

Federal agencies do not have a standard definition of "rural." Definitions differ in terms of minimum population thresholds that are applied to distinguish urban areas from rural areas (for instance, fewer than 2,500 people, 5,000 people, or 10,000 people) and different geographic building blocks (census blocks, census tracts, ZIP Code Tabulation Areas, places, or counties).

In some classifications, "rural" represents one category among many—as in the U.S. Department of Agriculture's Rural-Urban Commuting Areas or the National Center for Education Statistics' School Locale Codes. In other classifications, rural is one of two categories, the other is "urban." In both multilevel and two-level ("dichotomous") classifications, rural may be simply a residual category—that is, whatever is left over after the other categories are defined.

Rural (and urban) definitions may also differ in terms of the kinds of areas or landscapes they represent. Some definitions are based on political or administrative units; for example, a city or town of fewer than 10,000 people may be defined as rural. Other definitions, like the Census Bureau's urban and rural classification, may refer to settlement patterns that are based on measures of population density.

Finally, definitions may refer to social and economic relationships, often defined based on a measure of interaction between an urban center and surrounding territory. The Office of Management and Budget's Metropolitan and Micropolitan Statistical Areas classification, described below, is an example of this type of classification.

The U.S. Department of Agriculture's Economic Research Service offers a variety of materials to help data users navigate these various definitions on its Rural Classifications Web page.*

* U.S. Department of Agriculture, Rural Classifications: Overview, <www.ers.usda.gov/topics/rural-economy-population/rural-classifications/>.

outside metropolitan and micropolitan statistical areas in Oregon. There are only three states—Delaware, New Jersey, and Rhode Island—where all the counties are classified as metropolitan. The District of Columbia is also entirely metropolitan.

Some demographers, economists, and other researchers classify counties that are outside of metropolitan statistical areas (those in the micropolitan statistical area and "outside metropolitan and micropolitan statistical areas" categories) as "rural" or "nonmetropolitan." Researchers often use these terms interchangeably in their work on rural America because so much data for local areas are only available at the county level. The ERS report series, Rural America at a Glance, provides a good example of research on social, economic, and demographic trends in rural America based on county-level data.[5]

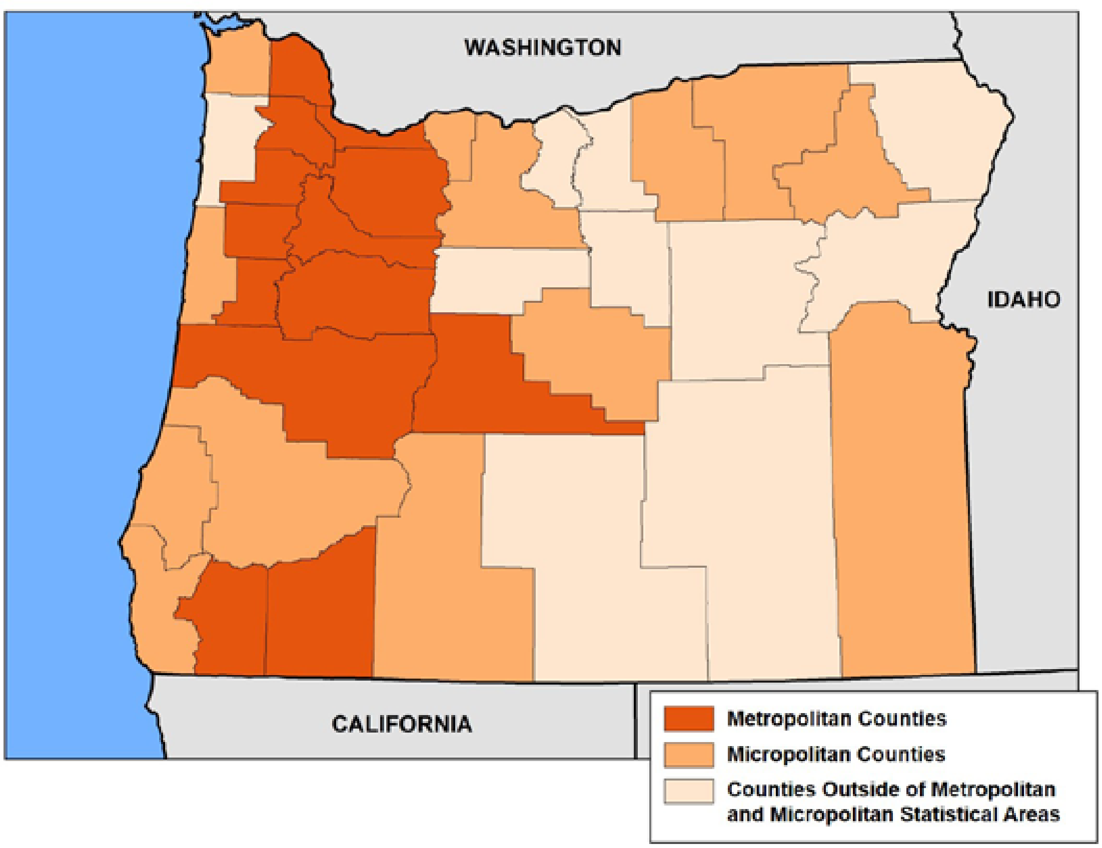
However, OMB notes that the county-based "metropolitan and micropolitan statistical area standards do not equate to an urban-rural classification; many counties included in metropolitan and micropolitan statistical areas, as well as those outside these areas, contain both urban and rural territory and populations."[6] Confusion over these concepts can lead to difficulties in analysis and program implementation.

Many counties classified as metropolitan include rural territory, while many counties outside of metropolitan and micropolitan statistical areas contain urban clusters. Rural areas within metropolitan counties encompass a wide variety of landscapes and settlement patterns—from sparsely populated desert lands within large metropolitan counties in the Southwest to small-town landscapes and "large-lot" (one-, three-, or five-acre) housing subdivisions on the fringes of large metropolitan statistical areas.

[5] John Cromartie, "Rural America at a Glance, 2017 Edition," 2017, <www.ers.usda.gov/publications/pub-details/?pubid=85739>.

[6] U.S. Office of Management and Budget, Bulletin No. 17-01, Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas, <www.census.gov/programs-surveys/metro-micro/about/omb-bulletins.html>.

Figure 1.3. **Metropolitan Counties, Micropolitan Counties, and Counties Outside of Metropolitan and Micropolitan Statistical Areas in Oregon: 2017**



Source: U.S. Office of Management and Budget, August 2017 delineations.

Figure 1.4 shows an image of urban areas (shown in dark grey) in the Dallas-Fort Worth-Arlington, Texas Metropolitan Statistical Area. While large portions of Dallas, Tarrant, Collin, Denton, and Rockwall Counties are classified as urban, the surrounding counties are predominantly rural (areas shown in blue). Thus, it would not be appropriate to classify population and territory in Wise County—a predominantly rural county on the fringe of a metropolitan statistical area—as "urban." The challenges posed by metropolitan counties that include rural territory are not new, and researchers have proposed various ways of modifying classifications—as through the U.S. Department of Agriculture's RUCA codes—to subdivide counties into urban and rural components.

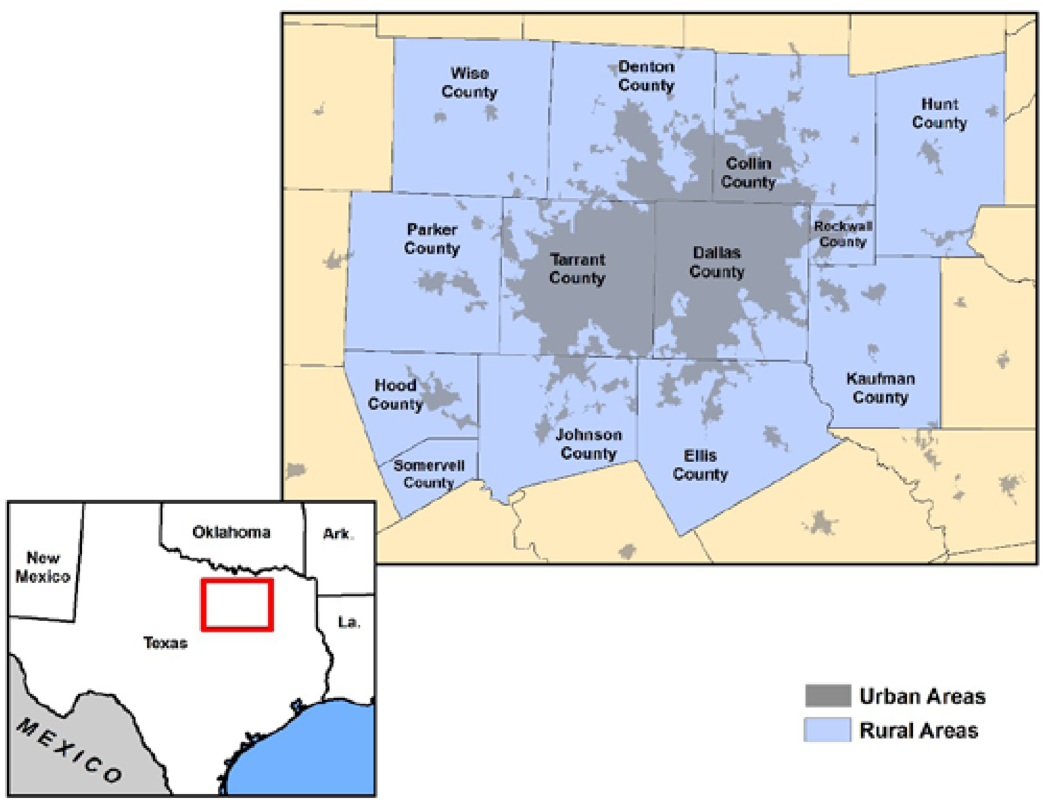
TIP: Because OMB's classifications are county-based, they are well suited for the ACS, which provides social, economic, housing, and demographic estimates for every county in the nation.

Information about how to access ACS estimates for metropolitan statistical areas, micropolitan statistical areas, and areas outside of metropolitan and micropolitan statistical areas is included in the section on "Accessing ACS data."

OMB reviews, and if warranted, revises the standards for delineating metropolitan and micropolitan statistical areas every 10 years, before each decennial census. Between censuses, the delineations are updated to reflect the Census Bureau's latest population estimates, resulting in changes in the portions of the United States identified as metropolitan, micropolitan, and outside of metropolitan and micropolitan statistical areas. Data users analyzing long-term trends with ACS or decennial census data need to be aware of these changes and adjust their analyses and interpretations accordingly. Current and historical delineations of metropolitan statistical areas and micropolitan statistical areas are available through the Census Bureau's Delineation Files.[7]

[7] U.S. Census Bureau, Delineation Files <www.census.gov/geographies/reference-files/time-series/demo/metro-micro/delineation-files.html>.

Figure 1.4. **Urban and Rural Areas in the Dallas-Fort Worth-Arlington, Texas Metropolitan Statistical Area**



Source: U.S. Census Bureau, U.S. Office of Management and Budget, August 2017 delineations.

2. CONSIDERATIONS WHEN WORKING WITH ACS DATA

Considerations When Working With ACS Data

Rural and other sparsely populated areas have unique characteristics that can lead to challenges for American Community Survey (ACS) data users.

Many micropolitan counties and counties outside of metropolitan and micropolitan statistical areas do not meet the 65,000-population threshold required for ACS 1-year estimates. In 2018, 114 out of 661 micropolitan counties (17.2 percent) and only 3 out of 1,321 counties outside of metropolitan and micropolitan statistical areas (0.2 percent) received 1-year estimates (see Table 2.1). By contrast, roughly three in five (58.2 percent) metropolitan counties received 1-year estimates. ACS 5-year estimates are available for all counties, regardless of population size or OMB classification.

Table 2.1. **Availability of ACS Estimates for Counties in Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Counties Outside of Metropolitan/Micropolitan Statistical Areas**

	All U.S. counties		Counties inside metropolitan statistical areas		Counties inside micropolitan statistical areas		Counties outside metropolitan and micropolitan statistical areas	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
5-year estimates available. . .	3,220	100.0	1,238	100.0	661	100.0	1,321	100.0
1-year Supplemental estimates available (20,000+ population).	1,910	59.3	1,050	84.8	548	82.9	312	23.6
1-year estimates available (65,000+ population).	838	26.0	721	58.2	114	17.2	3	0.2

Note: Data include Puerto Rico.
Source: U.S. Census Bureau, 2018 American Community Survey, Tables B01003 and K200101, <https://data.census.gov>; and August 2017 Delineation Files for core-based statistical areas, <www.census.gov/geographies/reference-files/time-series/demo/metro-micro/delineation-files.html>.

Most county subdivisions (such as townships, other types of minor civil divisions, and census county divisions) and places (cities and towns) also rely on 5-year estimates. As Table 2.2 shows, 97 percent of the nearly 37,000 county subdivisions only receive 5-year estimates annually, as do 92 percent of the almost 30,000 incorporated and census designated places.

Table 2.2. **Availability of ACS Estimates for County Subdivisions and Places**

	County subdivisions (townships and other minor civil divisions)		Places (incorporated places and census designated places)	
	Number	Percent	Number	Percent
5-year estimates available.	36,630	100.0	29,573	100.0
1-year Supplemental estimates available (20,000+ population)	1,186	3.2	2,323	7.9
1-year estimates available (65,000+ population).	226	0.6	630	2.1

Note: Data include Puerto Rico.
Source: U.S. Census Bureau, Areas Published, <www.census.gov/programs-surveys/acs/geography-acs/areas-published.html>.

ACS 5-year estimates require some considerations that 1-year estimates do not. For example, multiyear estimates released in consecutive years consist mostly of overlapping shared data. For example, ACS estimates from 2013–2017 and 2014–2018 share sample data for the years 2014, 2015, 2016, and 2017. As a result, it is best for users to work with nonoverlapping estimates (for example, comparing 2009–2013 estimates with those from the 2014–2018 period) to assess change over time in rural communities.

Five-year estimates also provide less current information because they are based on both data from the previous year and data that are 2 to 5 years old. For rural areas undergoing minimal change, using the "less current" multiyear estimates may not have a substantial influence on the estimates. However, in areas experiencing major changes over a given time period, the multiyear estimates may be quite different from the single-year estimates for any of the individual years.

ACS estimates have a degree of uncertainty associated with them, called sampling error, because they are based on a sample. In general, the larger the sample, the smaller the level of sampling error. Rural communities tend to have smaller samples than large cities, so the "margin of error"—a measure of the precision of an estimate at a given level of confidence—likely will be larger for rural areas. The U.S. Census Bureau provides margins of error at the 90 percent level of confidence for each published ACS estimate. (For more information about sampling error, see the section on "Understanding Error and Determining Statistical Significance" in the Census Bureau's handbook on *Understanding and Using American Community Survey Data: What All Data Users Need to Know*.[8])

Suppose a data user is interested in homeownership rates for Pike and Martin Counties in eastern Kentucky. While both 1-year Supplemental and 5-year estimates are available for Pike County (population 58,000), only ACS 5-year estimates are available for Martin County (population 11,000).[9] As Table 2.3 shows, the margin of error for the percentage of owner-occupied units in 2014–2018 was 1.8 in Pike County but was more than twice that in Martin County (5.2). By comparison, the margin of error for the homeownership rate was just 0.5 for Jefferson County, Kentucky, which had a population of more than 750,000.

Yet, there are strategies that data users can use to improve estimates for rural areas—either by combining

[8] U.S. Census Bureau, *Understanding and Using American Community Survey Data: What All Data Users Need to Know*, <www.census.gov/programs-surveys/acs/guidance/handbooks/general.html>.

[9] U.S. Census Bureau, Population Division, 2018 Population Estimates. The estimated 2018 population for Pike County was listed as 58,402, while Martin County's estimated 2018 population stood at 11,323.

Table 2.3. **Percentage of Owner-Occupied Housing Units in Pike, Martin, and Jefferson Counties in Kentucky: 2014–2018**

	Pike County, Kentucky	Martin County, Kentucky	Jefferson County, Kentucky
Estimate	72.6	72.3	61.7
Margin of error (+/-)	1.8	5.2	0.5
Confidence interval (90% level)	70.8 to 74.4	67.1 to 77.5	61.2 to 62.2

Source: U.S. Census Bureau, 2014–2018 American Community Survey, 5-Year Estimates, Table DP04, <https://data.census.gov>.

data across geographic areas or by consolidating data for population subgroups. For example, Table 2.4 shows homeownership levels in the five-county Big Sandy Area Development District in eastern Kentucky—a region that includes Pike and Martin Counties from the previous example (also see Figure 3.4 for an image of the area). As Table 2.4 shows, the margin of error for the five-county area (1.3) is lower than the error margins for any of the five individual counties (ranging from 1.8 to 5.2).

Table 2.4. **Percentage of Owner-Occupied Housing Units in Big Sandy Area Development District, Kentucky: 2014–2018**

	Estimate	Margin of error (+/-)
Floyd County	70.4	2.3
Johnson County	72.3	3.3
Magoffin County	71.2	3.8
Martin County	72.3	5.2
Pike County	72.6	1.8
Combined five-county area (Big Sandy Area)	**71.9**	**1.3**

Source: U.S. Census Bureau, 2014–2018 American Community Survey, 5-Year Estimates, Table DP04, <https://data.census.gov>.

When producing such custom estimates by combining data across geographic areas, the user must calculate the associated margins of error for those new estimates, as described in the section on "Calculating Measures of Error for Derived Estimates" in the Census Bureau's handbook on *Understanding and Using American Community Survey Data: What All Data Users Need to Know*.[10]

[10] U.S. Census Bureau, *Understanding and Using American Community Survey Data: What All Data Users Need to Know*, <www.census.gov/programs-surveys/acs/guidance/handbooks/general.html>.

Special Considerations for Areas With Large Seasonal Populations

TIP: The fact that the ACS collects data throughout the calendar year and counts residents at their "current residence" (provided their stay exceeds, or will exceed, 2 months) can present additional challenges for rural (and other) communities that have large seasonal populations—in particular, college towns and resort areas. Users need to exercise caution when analyzing data for such areas—especially when looking at estimates for such characteristics as housing vacancy or income/poverty status.

For example, Appalachian State University is located in Boone, North Carolina—a town of about 20,000 people.[11] As Table 2.5 shows, Boone's poverty rate for people aged 3 and over was approximately 56 percent in 2014–2018—more than four times the national average. A closer look, however, shows that about eight in 10 poor people in Boone were enrolled in college, graduate, or professional school. Removing the university student population reduces the town's poverty rate to less than 24 percent—much closer to the national average.

[11] U.S. Census Bureau, Population Division, 2018 Population Estimates. The town of Boone is part of the Boone, North Carolina Micropolitan Statistical Area.

Table 2.5. **Poverty Status of People Aged 3 and Over in Boone, North Carolina, and the United States by School Enrollment Status: 2014–2018**

	Boone, North Carolina		United States	
	Estimate	Margin of error (+/-)	Estimate	Margin of error (+/-)
All people aged 3 and over for whom poverty status is determined	13,154	376	303,463,789	19,661
Number below poverty level	7,363	513	41,756,137	259,564
Percent below poverty level	56.0	3.6	13.8	0.1
People (aged 3 and over) enrolled in college, graduate, or professional school	6,852	601	19,769,916	58,240
Number below poverty level	5,855	531	4,259,802	19,121
Percent below poverty level	85.4	2.0	21.5	0.1
People (aged 3 and over) NOT enrolled in college, graduate, or professional school	6,302	593	283,693,873	198,706
Number below poverty level	1,508	356	37,496,335	162,730
Percent below poverty level	23.9	5.2	13.2	0.1

Source: U.S. Census Bureau, 2014–2018 American Community Survey, 5-Year Estimates, Table B14006, <https://data.census.gov>.

Nantucket County, Massachusetts (population 11,198 in 2018), provides another example.[12] ACS 5-year data for 2014–2018 show that 69.5 percent of Nantucket's housing was vacant, compared with just 12.2 percent of housing nationwide (see Table 2.6). Further examination, however, reveals that more than 90 percent of Nantucket's vacant units were designated for seasonal or occasional use, reflecting the county's status as a vacation hub. Nationwide, almost one-third (32.8 percent) of vacant units were designated for such use. As in the previous example, it is important to pay attention to the circumstances of small geographic areas when using ACS data.

[12] U.S. Census Bureau, Population Division, Vintage 2019 Population Estimates.

Table 2.6. **Vacancy Status of Housing Units in Nantucket County, Massachusetts, and the United States: 2014–2018**

	Nantucket County, Massachusetts		United States	
	Estimate	Margin of error (+/-)	Estimate	Margin of error (+/-)
Total housing units	12,191	60	136,384,292	6,639
Number of vacant housing units	8,469	246	16,654,164	226,286
Percentage of all housing units that are vacant	69.5	2.0	12.2	0.2
Number of vacant housing units designated for seasonal, recreational, or occasional use	7,677	267	5,465,886	40,538
Percentage of vacant housing units designated for seasonal, recreational, or occasional use	90.6	1.7	32.8	0.5

Source: U.S. Census Bureau, 2014–2018 American Community Survey, 5-Year Estimates, Tables DP04 and B25004, <https://data.census.gov>.

3. ACCESSING ACS DATA

Data.census.gov is the U.S. Census Bureau's primary tool for accessing population, housing, and economic data from the American Community Survey (ACS), the decennial census, and many other Census Bureau data sets.[13] Data.census.gov provides access to ACS data for a wide range of geographic areas including states, cities, counties, American Indian and Alaska Native areas, census tracts, and block groups. Data users interested in accessing data for these geographic areas are encouraged to refer to the section on "Accessing ACS Data" in the Census Bureau's handbook on *Understanding and Using American Community Survey Data: What All Data Users Need to Know*.[14]

Data users can access pretabulated data for urban/rural areas as well as metropolitan statistical areas, micropolitan statistical areas, and areas outside of metropolitan and micropolitan statistical areas through the "Geographic Components" option in data.census.gov. A geographic component is the portion of a geographic area that meets certain criteria such as "in a metropolitan statistical area" or "in a rural area." Geographic components are available for the nation, regions, divisions, and for each of the 50 states, the District of Columbia, and Puerto Rico.

ACS data are tabulated for 15 different geographic components, including urban, rural, in metropolitan statistical area, in micropolitan statistical area, in metropolitan or micropolitan statistical area, not in metropolitan or micropolitan statistical area, and several others.

In the example below, we use the geographic components in data.census.gov to compare the median value of owner-occupied housing in urban and rural areas in Alabama in 2018.[15]

[13] U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

[14] U.S. Census Bureau, Understanding and Using American Community Survey Data: What All Data Users Need to Know, <www.census.gov/programs-surveys/acs/guidance/handbooks/general.html>.

[15] For more tips on how to select geographic components and for quick links for collections of geographies (e.g., rural areas for all states in the United States), visit the "How do I select geographic components such as urban/rural FAQ" at <https://ask.census.gov/prweb/PRServletCustom?pyActivity=pyMobileSnapStart&ArticleID=KCP-5943>.

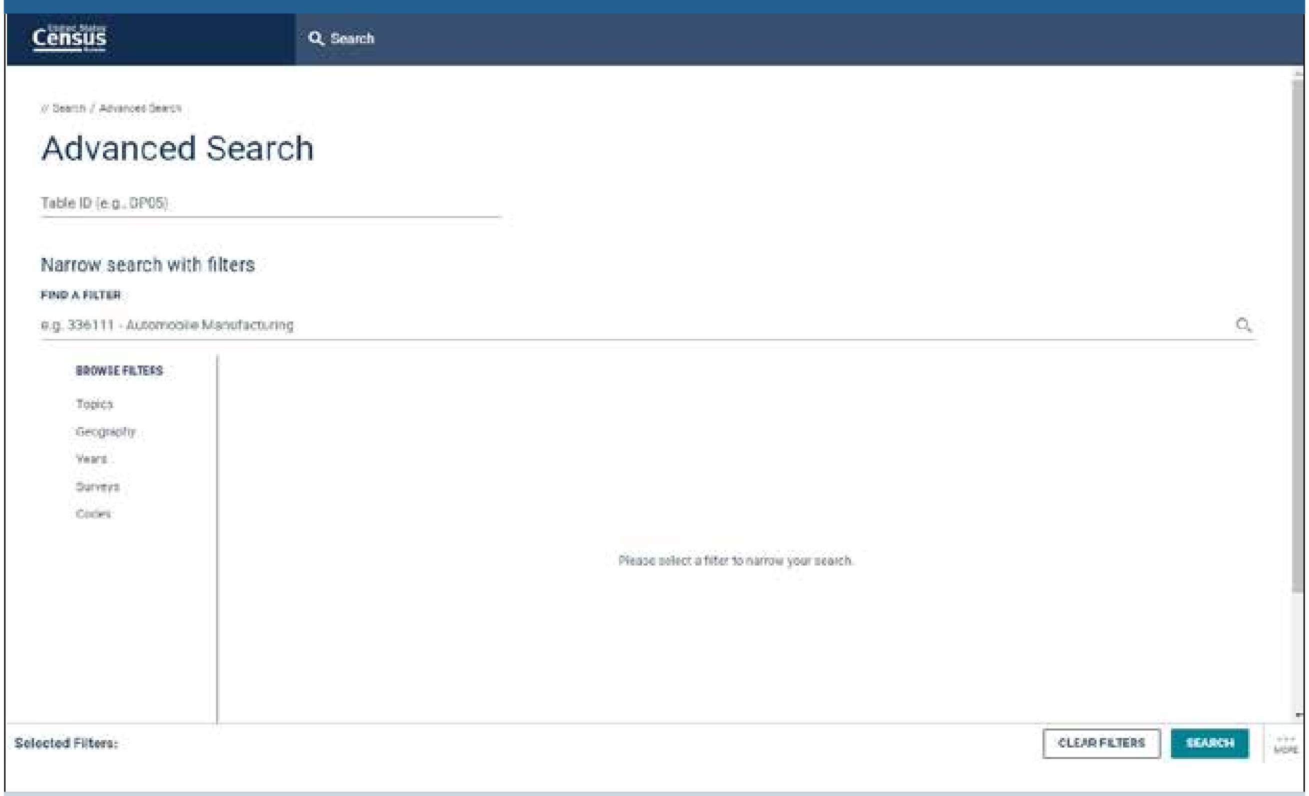
To select a geographic component:

- Click on "Advanced Search" under the search bar. This brings you to the Advanced Search window (see Figures 3.1 and 3.2).

Figure 3.1. **Starting an Advanced Search in Data.census.gov**

Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

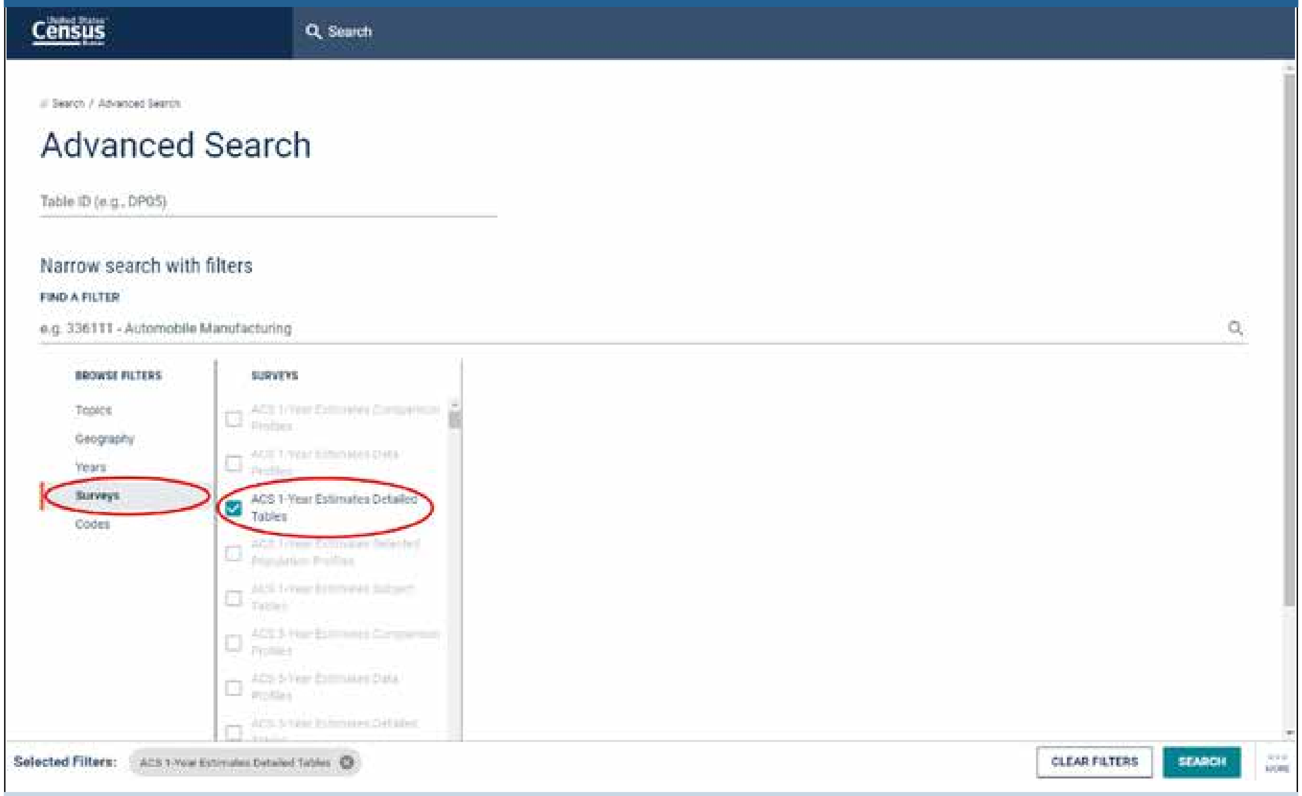
Figure 3.2. **Starting an Advanced Search in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Click on “Surveys” to display a list of available data products. Then, select “ACS 1-Year Estimates Detailed Tables” (see Figure 3.3). By selecting the survey first, it's easier to select the geography later because data.census.gov will only display the geographic components available for the selected survey.

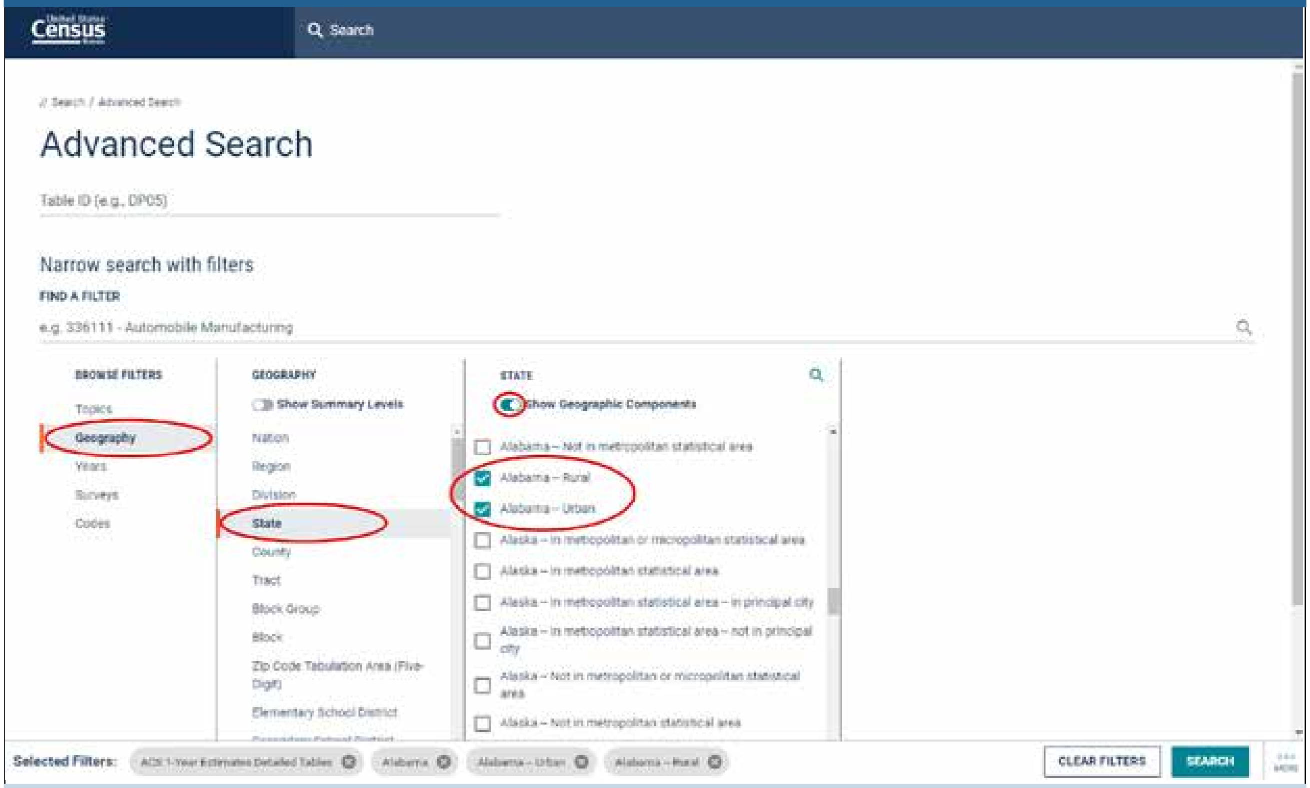
Figure 3.3. **Selecting a Survey in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- To find information for rural and urban areas, select the “Geography” filter and click “State.” Then turn on the “Show Geographic Components” toggle switch and scroll to select “Alabama,” “Alabama - Rural,” and “Alabama - Urban.”
- Verify that your survey and geography selections appear in the “Selected Filters” at the bottom of the window (see Figure 3.4).

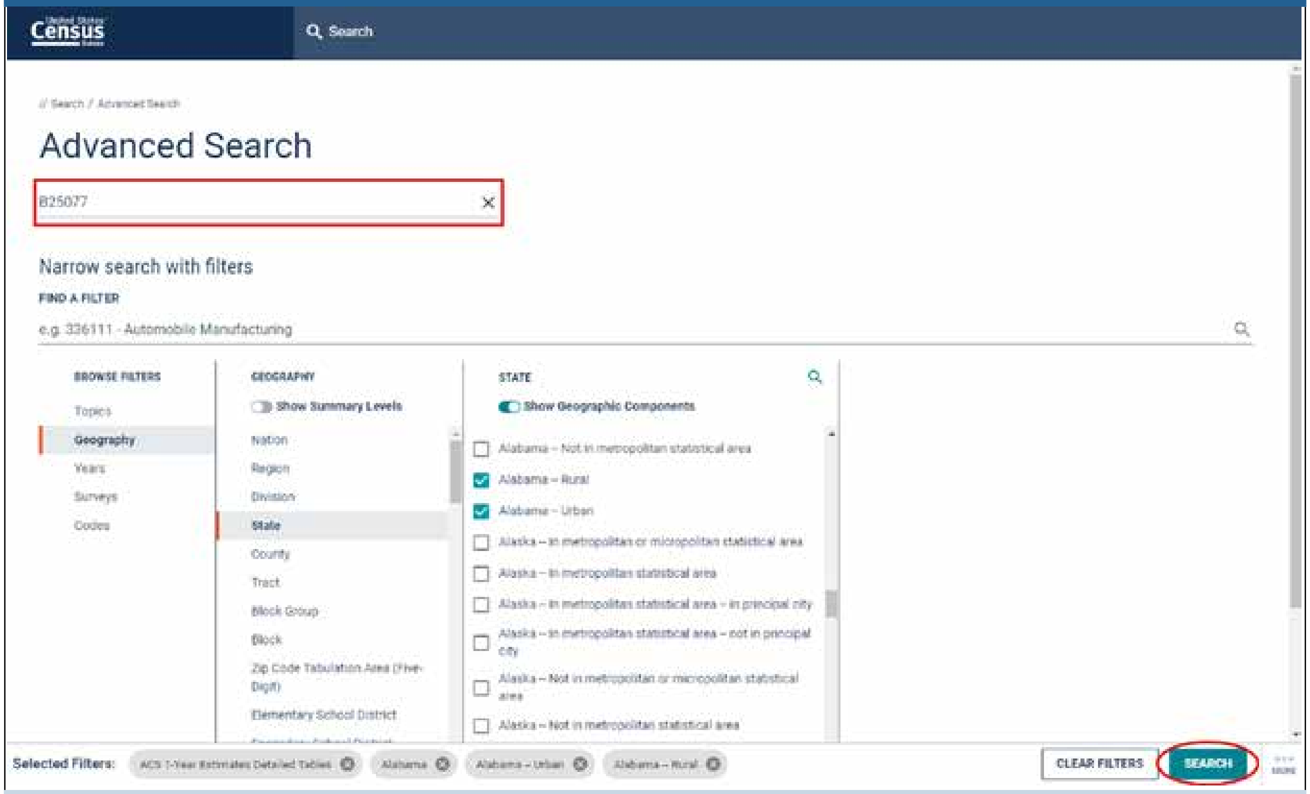
Figure 3.4. **Selecting Geographic Components in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- For this example, we already know the desired table ID: Table B25077: "Median Value (Dollars)."
- Type "B25077" into the first text box directly under the Advanced Search heading. Then click "Search" in the lower right corner (see Figure 3.5).

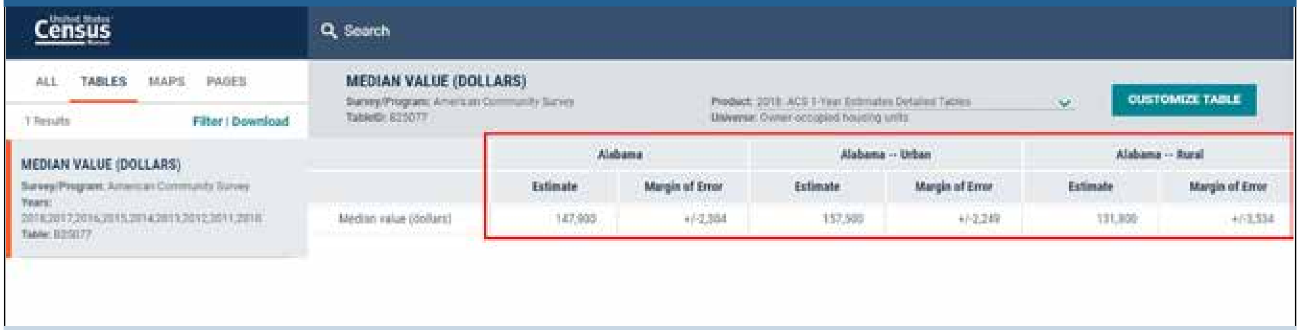
Figure 3.5. **Selecting Tables in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Click on the table title corresponding to Table B25077 and select it to view the results.
- The results indicate that in Alabama, the median value of owner-occupied housing units in 2018 was higher in urban areas ($157,500) than rural areas ($131,800) (see Figure 3.6).

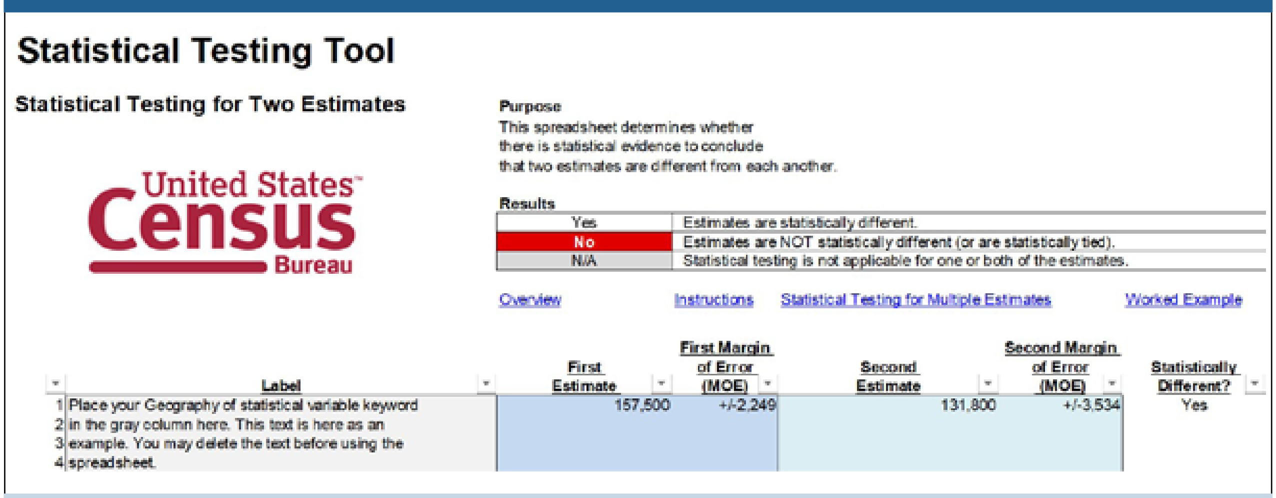
Figure 3.6. **Viewing Results in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

However, data users need to conduct a test to determine whether this difference is statistically significant. The Census Bureau's Statistical Testing Tool consists of an Excel spreadsheet that will automatically calculate statistical significance when data users are comparing two ACS estimates or multiple estimates. The results are calculated automatically. In this example, the result "Yes" indicates that the median household income estimates are statistically different (see Figure 3.7).

Figure 3.7. **Conducting a Statistical Significance Test**



Source: U.S. Census Bureau, American Community Survey (ACS), Statistical Testing Tool, <www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>.

Public Use Microdata Areas

Data users interested in custom ACS estimates for rural areas often use the Census Bureau's Public Use Microdata Sample (PUMS) files, which contain a sample of individual records of people and households that responded to the survey (stripped of all identifying information). In general, the PUMS files are more difficult to work with than published tables from data.census.gov because data users need to use a statistical package to access the data. Also, the responsibility for producing estimates from PUMS and judging their statistical significance is up to the user.

The main advantage of the PUMS files is that they permit analysis of specific population groups and custom variables that are not available through the pretabulated tables in data.census.gov. For example, PUMS data users could compare the poverty status of veterans and nonveterans by level of education, which is not available in the Census Bureau's published tables.

PUMS data are available for regions, divisions, states, and Public Use Microdata Areas, or PUMAs—geographic areas with a minimum population of 100,000. In addition to the 100,000-population threshold, PUMAs are constructed based on census tract or county boundaries.[16] PUMAs do not cross state lines. PUMAs are updated after each decennial census.

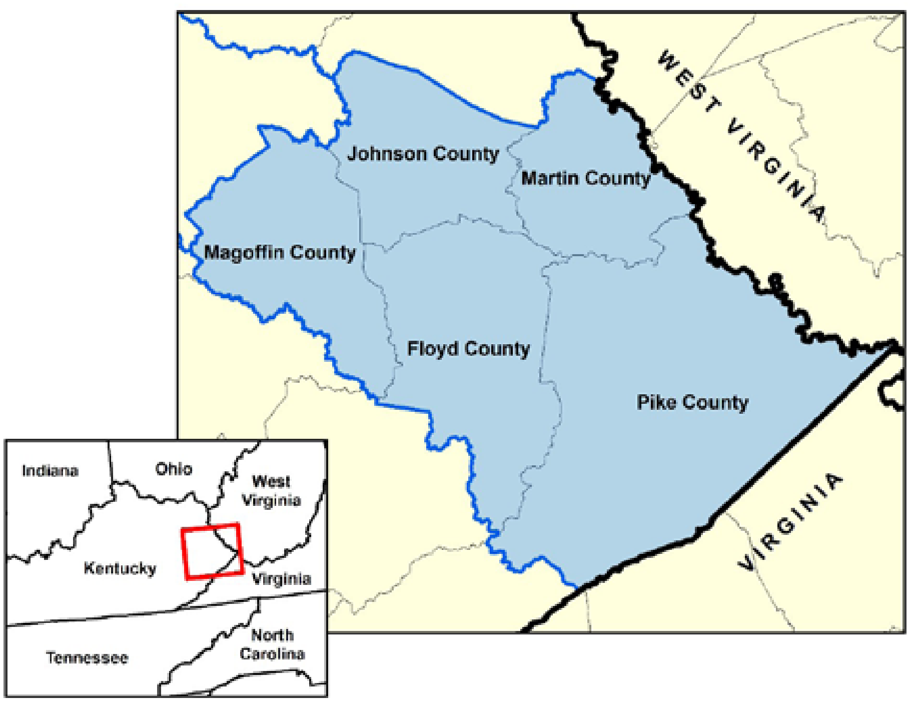
[16] U.S. Census Bureau, Geography, Public Use Microdata Areas (PUMAs), <www.census.gov/programs-surveys/geography/guidance/geo-areas/pumas.html>.

TIP: PUMAs are especially useful for looking at characteristics in rural areas because, unlike many of the geographic units in these areas (such as small towns), PUMAs all surpass the 65,000-population threshold that is needed to provide ACS 1-year estimates.

Counties with populations greater than 200,000 are generally subdivided into multiple PUMAs, while less populous counties are grouped with adjacent counties to form PUMAs. On the other hand, because of the requirement that each PUMA encompass at least 100,000 people, few are predominantly rural. (For more information about ACS population thresholds, see the section on "Considerations When Working With ACS Data").

Figure 3.8 shows an example of a PUMA consisting of five adjacent counties in eastern Kentucky that comprise the Big Sandy Area Development District (Kentucky PUMA 01100). In this case, all of the counties making up the PUMA are outside of metropolitan and micropolitan statistical areas, but other PUMAs may be located entirely within metropolitan statistical areas, or include combinations of metropolitan counties, micropolitan counties, and counties outside of metropolitan and micropolitan statistical areas.

Figure 3.8. **Big Sandy Area Development District (Kentucky PUMA 01100)**



Source: U.S. Census Bureau.

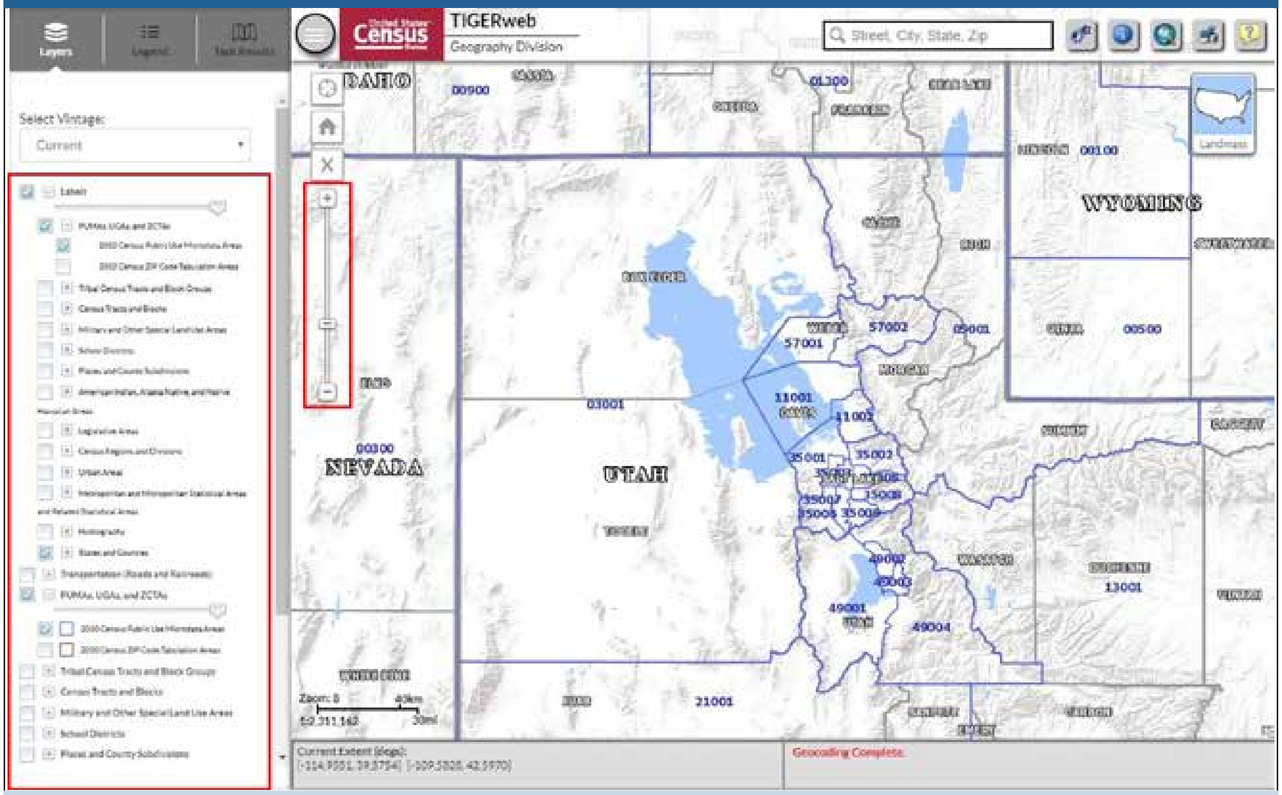
Data users can visualize PUMAs online using the Census Bureau's TIGERweb application.[17]

- Go to the TIGERweb Web site at <https://tigerweb.geo.census.gov/tigerweb/>.
- Use the Zoom In feature on the map—by clicking on the individual plus sign or using the slide bar—to display a geographic area of interest.
- Then use the "Layers" menu to select "2010 Census Public Use Microdata Areas." Figure 3.9 shows a TIGERweb map of PUMA boundaries in portions of Utah and other states in the Mountain West.

For more information about using TIGERweb, see the Census Bureau's TIGERweb User Guide.[18]

[17] U.S. Census Bureau, Geography Division, TIGERweb, <https://tigerweb.geo.census.gov/tigerweb/>.
[18] U.S. Census Bureau, TIGERweb User Guide, <https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_User_Guide.pdf>.

Figure 3.9. **Map of PUMAs in Portions of Utah, Nevada, Idaho, and Wyoming**



Source: U.S. Census Bureau, TIGERweb, <https://tigerweb.geo.census.gov/tigerweb/>.

User-Defined Areas

Beyond the standard legal and statistical geographic entities created by the Census Bureau, there are instances where analysts might want to show data for a custom, user-defined geographic area. For example, many states have regional planning commissions designed to foster cooperation among contiguous counties with similar needs. Figure 3.10 shows an image of the Eastern Upper Peninsula Regional Planning and Development Commission, 1 of 14 regional agencies in Michigan that serves the needs of the three easternmost counties of the state's Upper Peninsula (Luce, Chippewa, and Mackinac Counties).

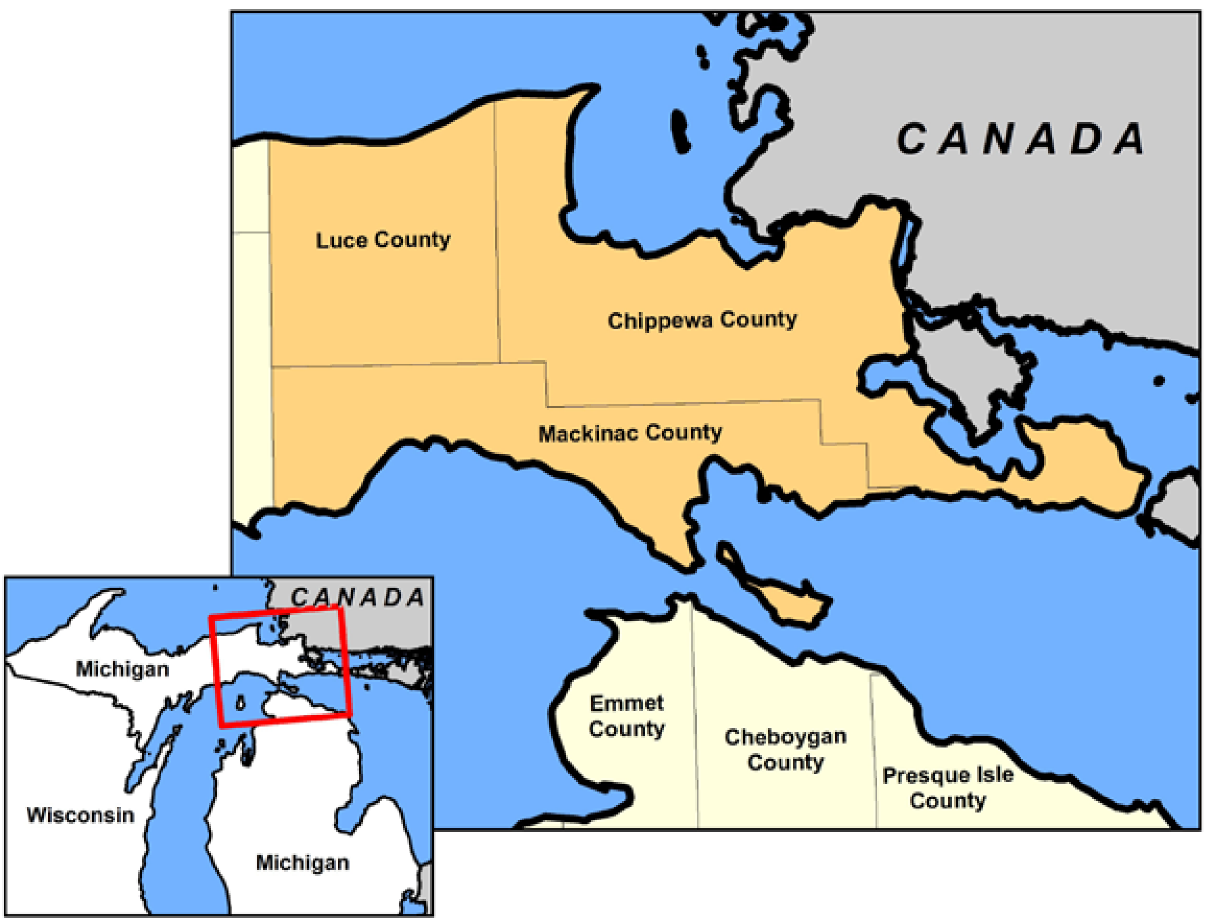
Examples of multistate agencies with similar aims are the Appalachian Regional Commission, consisting of more than 400 counties in 13 states, and the Delta Regional Authority, which serves the needs of residents of 252 counties in 8 states.[19]

[19] Appalachian Regional Commission, <http://arc.gov>; and Delta Regional Authority, <http://dra.gov>.

When aggregating ACS estimates across different geographic areas or population subgroups, data users should avoid combining ACS single-year estimates with ACS 5-year estimates. That is, 1-year estimates should only be combined with other 1-year estimates, and 5-year estimates should only be combined with other 5-year estimates. When such derived estimates are generated, the user must also calculate the associated margins of error. For more information about creating ACS estimates for custom geographic areas, see the section on "Calculating Measures of Error for Derived Estimates" in the Census Bureau's handbook on Understanding and Using American Community Survey Data: What All Data Users Need to Know.[20]

[20] U.S. Census Bureau, Understanding and Using American Community Survey Data: What All Data Users Need to Know, <www.census.gov/programs-surveys/acs/guidance/handbooks/general.html>.

Figure 3.10. **Eastern Upper Peninsula Regional Planning and Development Commission, Michigan**



Source: Eastern Upper Peninsula Regional Planning and Development Commission.

4. CASE STUDIES FOR RURAL AREAS

Today, the American Community Survey (ACS) puts up-to-date information about important social issues at the fingertips of people who need it, including local government officials and planners, program directors and managers, businesses, federal policymakers, researchers, nongovernmental organizations, journalists, teachers and students, and the public.

Here are some examples of how ACS data are being used for decision-making:

- The Kaiser Family Foundation published a 2017 issue brief examining how changes to Medicaid coverage would affect health care access of rural residents.[21]
- Researchers used ACS data to assess the availability of services in rural areas with aging populations.[22]
- The U.S. Department of Veterans Affairs used ACS data to examine the characteristics of the veteran population in rural areas.[23]
- The Appalachian Regional Commission (ARC) uses ACS data to assess the status of both metropolitan and nonmetropolitan (in micropolitan statistical areas or outside metropolitan and micropolitan statistical areas) counties in the Appalachian Region on a host of social and economic measures, which in turn enables the ARC to develop strategies to improve conditions in Appalachia.[24]
- U.S. News and World Report used ACS 5-year data (2011–2015) to show that disability rates were noticeably higher outside of metropolitan statistical areas than within them.[25]

The case studies below provide some more detailed examples of how ACS data are being used to highlight issues in rural (and other) areas.

---

[21] Julia Foutz et al., "The Role of Medicaid in Rural America," 2017, <www.kff.org/medicaid/issue-brief/the-role-of-medicaid-in-rural-america/>.

[22] Brian C. Thiede et al., "Access to Services Diminishes in Rural America as Populations Age," Brief No. 04-16, December 2016, <https://w3001.apl.wisc.edu/b04_16>.

[23] National Center for Veterans Analysis and Statistics, U.S. Department of Veterans Affairs, "Characteristics of Rural Veterans: 2014," August 2016, <www.va.gov/vetdata/docs/SpecialReports/Rural_Veterans_ACS2014_FINAL.pdf>.

[24] The Appalachian Regional Commission, "The Appalachian Region: A Data Overview from the 2014-2018 American Community Survey," June 2020, <www.arc.gov/report/the-appalachian-region-a-data-overview-from-the-2014-2018-american-community-survey/>.

[25] Brian Thiede et al., "The Divide Between Rural and Urban America, in 6 Charts," U.S. News and World Report, March 20, 2017, <www.usnews.com/news/national-news/articles/2017-03-20/6-charts-that-illustrate-the-divide-between-rural-and-urban-america>.

Case Study #1: RTC: Rural Disability Counts Data Finder

Skill Level: Introductory/Intermediate
Subject: Disability
Type of Analysis: Comparison of American Community Survey (ACS) data across counties
Tools Used: Data.census.gov, spreadsheets, computer programing tools
Author: Lillie Greiman, Project Director/Research Associate, RTC: RURAL

The RTC: Rural at the University of Montana is a research and training center, funded by the National Institute on Disability, Independent Living and Rehabilitation Research (NIDILRR) to improve the ability of people with disabilities to engage in rural community living.[26] We conduct research across the focus areas of health, employment, and independent living. Our work has led to the development of health promotion programs, disability and employment policy and support, and education for providers who serve people with disabilities.

We developed the Disability Counts data lookup tool to provide accessible data about disability in rural areas and communities across the nation.[27] This site uses data from the ACS matched with information about rural definitions to provide a one-stop shop for downloading disability data for every county across the United States and Puerto Rico.

We pull a range of disability data tables from the ACS 5-year estimates (using data.census.gov) to feed the data lookup tool. (Due to the small population size of many rural counties, we must use ACS 5-year estimates for our analysis.) In addition, we bring in county-level classifications from the Office of Management and Budget's (OMB's) metropolitan statistical area designations. These designations classify counties as metropolitan or micropolitan (classified as core-based statistical areas), or outside of metropolitan and micropolitan statistical areas. Table 4.1 shows the data.census.gov tables we use to produce the county-level estimates.

Table 4.1. **List of Disability Tables Downloaded From Data.census.gov**

Variable	Table	Data set
Disability estimates and rates	S1810: General Disability Characteristics	ACS 5-year estimates
Disability types	S1810: General Disability Characteristics	ACS 5-year estimates
Disability and poverty	C18130: Age by Disability by Poverty Status	ACS 5-year estimates
Veterans with disabilities	C21007: Age by Veteran, Poverty and Disability Status	ACS 5-year estimates
Disability and employment	C18120: Employment by Disability Status	ACS 5-year estimates

Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

[26] University of Montana, RTC: Rural, <http://rtc.ruralinstitute.umt.edu/>.
[27] University of Montana, Disability Counts: Disability Data Lookup, <http://rtc.ruralinstitute.umt.edu/geography/>.

To build the data look-up tool, we first download data from data.census.gov using the Advanced Search option.

Step 1. Use the data.census.gov "Advanced Search" option, as follows:

- Go to the data.census.gov Web site at <https://data.census.gov>.
- Select "Advanced Search" below the search bar (see Figure 4.1).

Figure 4.1. **Selecting Advanced Search in Data.census.gov**

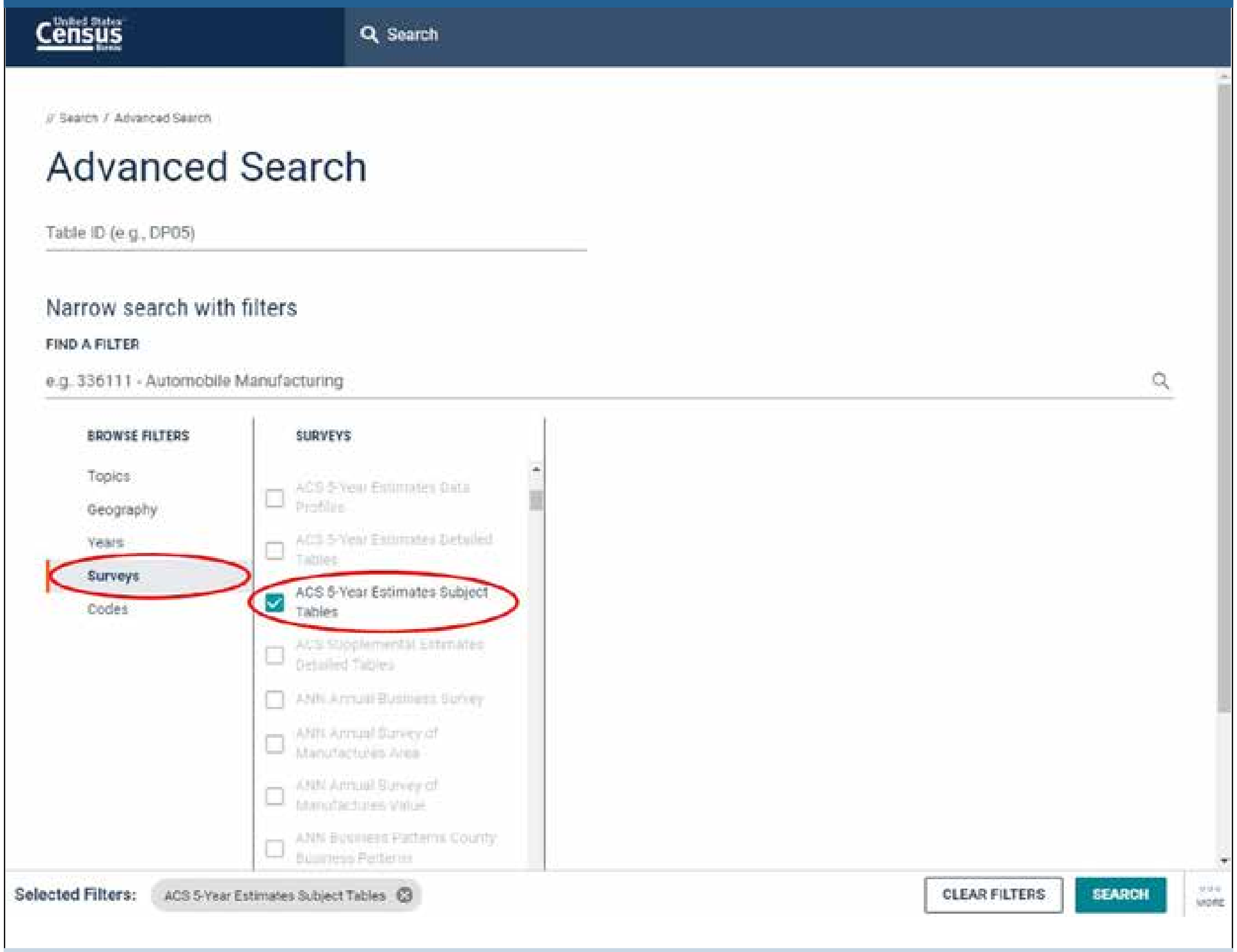
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 2. Select your data set

In order to ensure that you are accessing the most current data, you must first specify the data set.

- Select "Surveys" in the navigation pane on the left side of the screen to display a list of available surveys.
- Select "ACS 5-Year Estimates Subject Tables." This survey should appear in the "Selected Filters" at the bottom of the page (see Figure 4.2).

Figure 4.2. **Selecting a Survey in Data.census.gov**

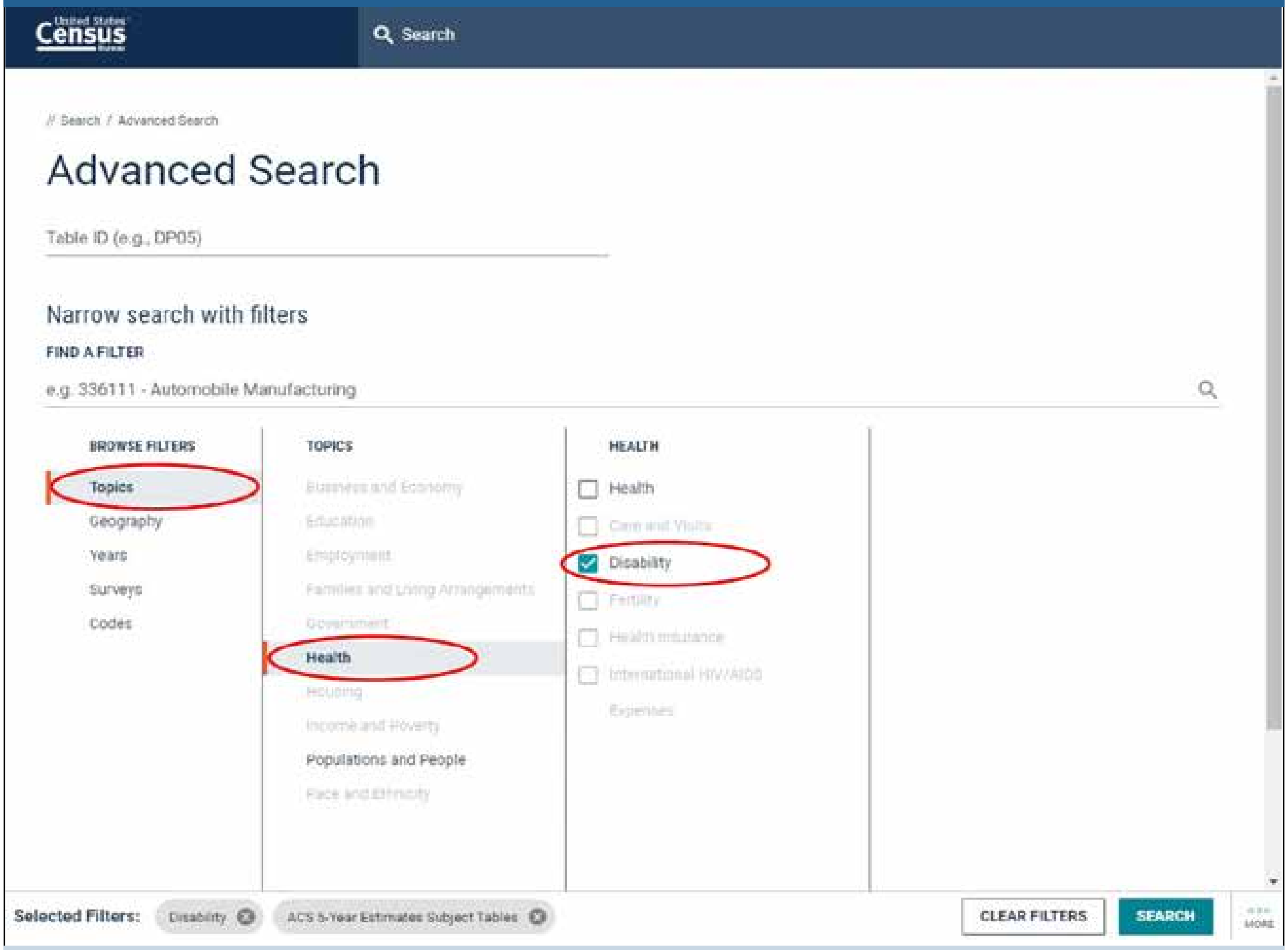


Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 3. Select disability topic

- Select “Topics” in the navigation pane on the left side of the screen. Then click on “Health” and “Disability” (see Figure 4.3).

Figure 4.3. **Selecting a Topic in Data.census.gov**



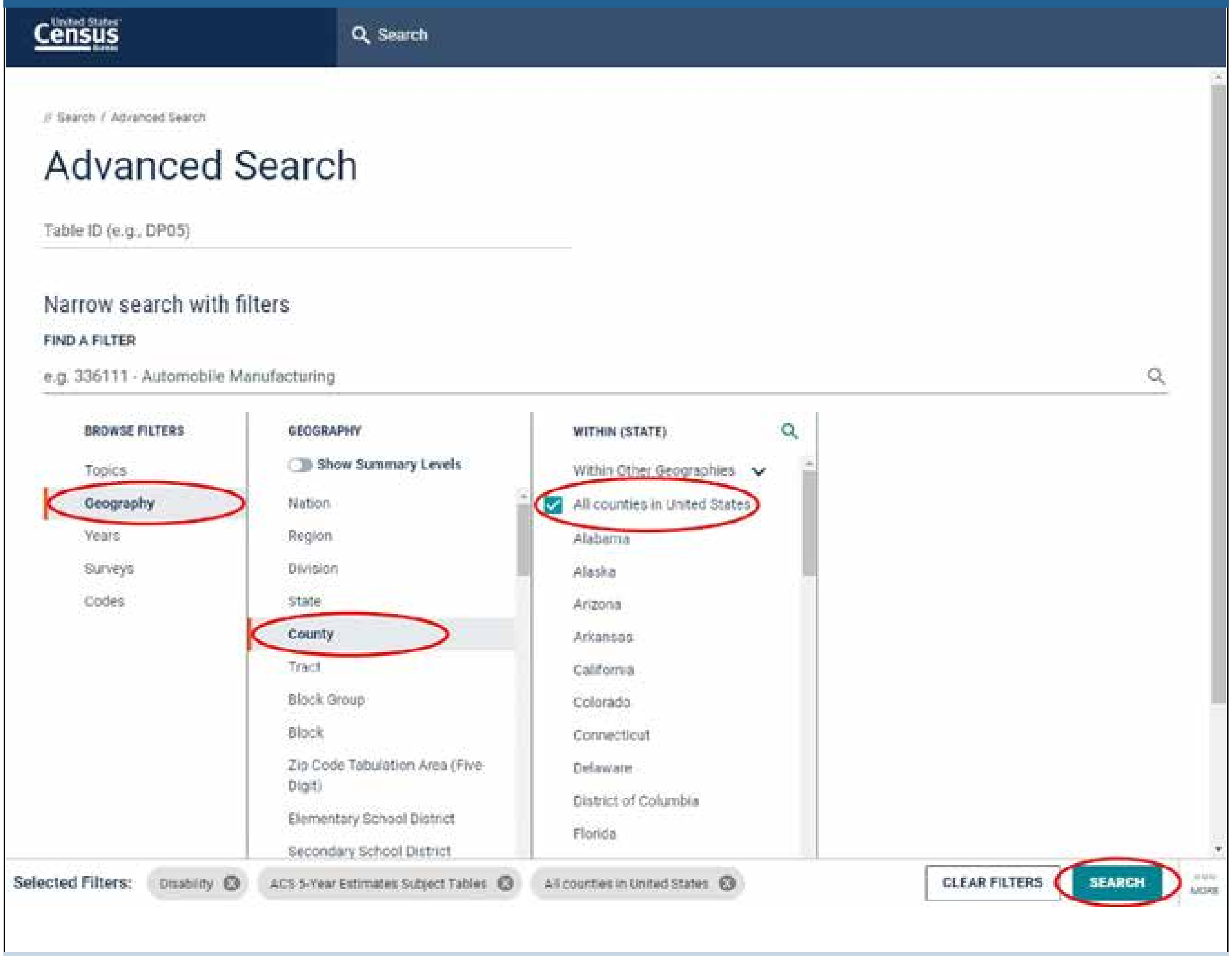
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 4. Select geographic areas

This is where you specify that you want county-level data.

- Select "Geography" in the navigation pane on the left side of the screen to display a list of available geographies.
- Then, select "County" and "All counties in United States." This geographic selection should appear in the "Selected Filters" at the bottom of the page. Then, click "Search" in the lower right corner (see Figure 4.4).

Figure 4.4. **Selecting Geographic Areas in Data.census.gov**



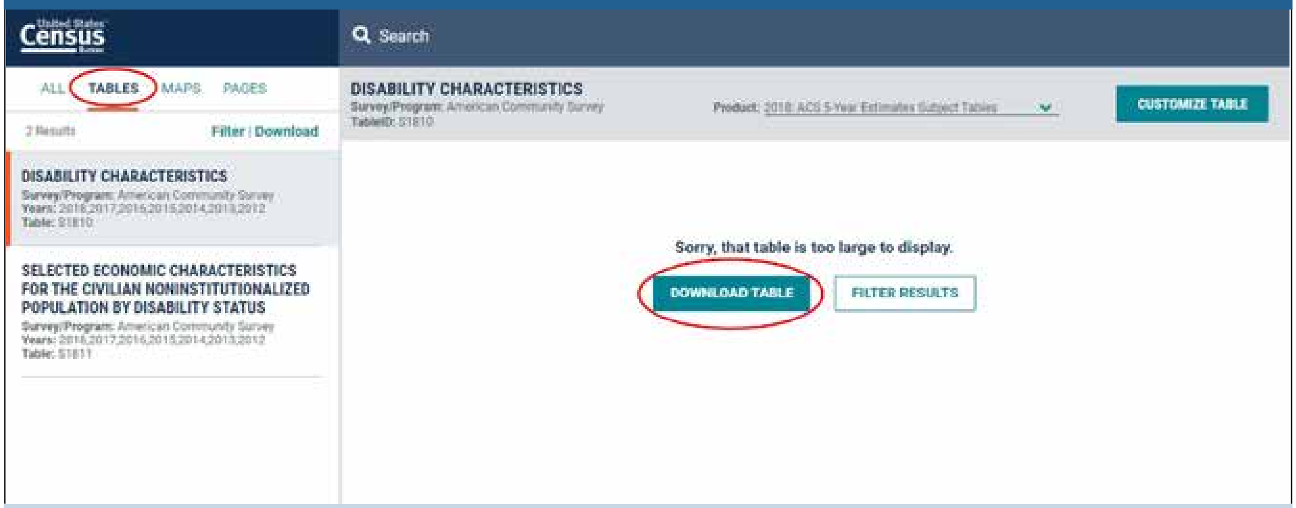
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 5. Select your data table(s)

Now that you have specified all the relevant parameters for the data, you can download the specific data table(s) that meet(s) your needs.

- Click "TABLES" in the upper left corner.
- For standard disability data breakdowns, Table S1810: "Disability Characteristics" should suffice.
    - This table will likely be the first to appear in the list of data tables.
    - This table provides disability data broken down by age, sex, disability type, and race.
- Select "Download Table" under the message that the "table is too large to display" (see Figure 4.5).

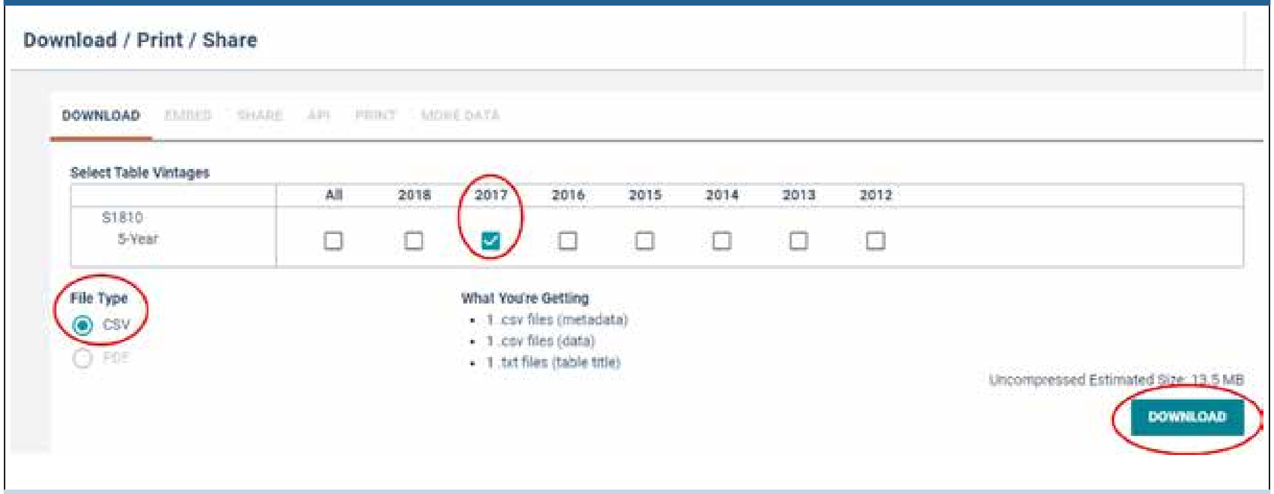
Figure 4.5. **Downloading a Table in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Use the Download Tables window to check the box for the 2017 ACS 5-year data (the most recent data available at the time of this analysis) (see Figure 4.6).
- Select "CSV" as the file type and click "Download." CSV files are compatible with spreadsheet programs such as Microsoft Excel.

Figure 4.6. **Selecting the Survey Year and File Type in Data.census.gov**



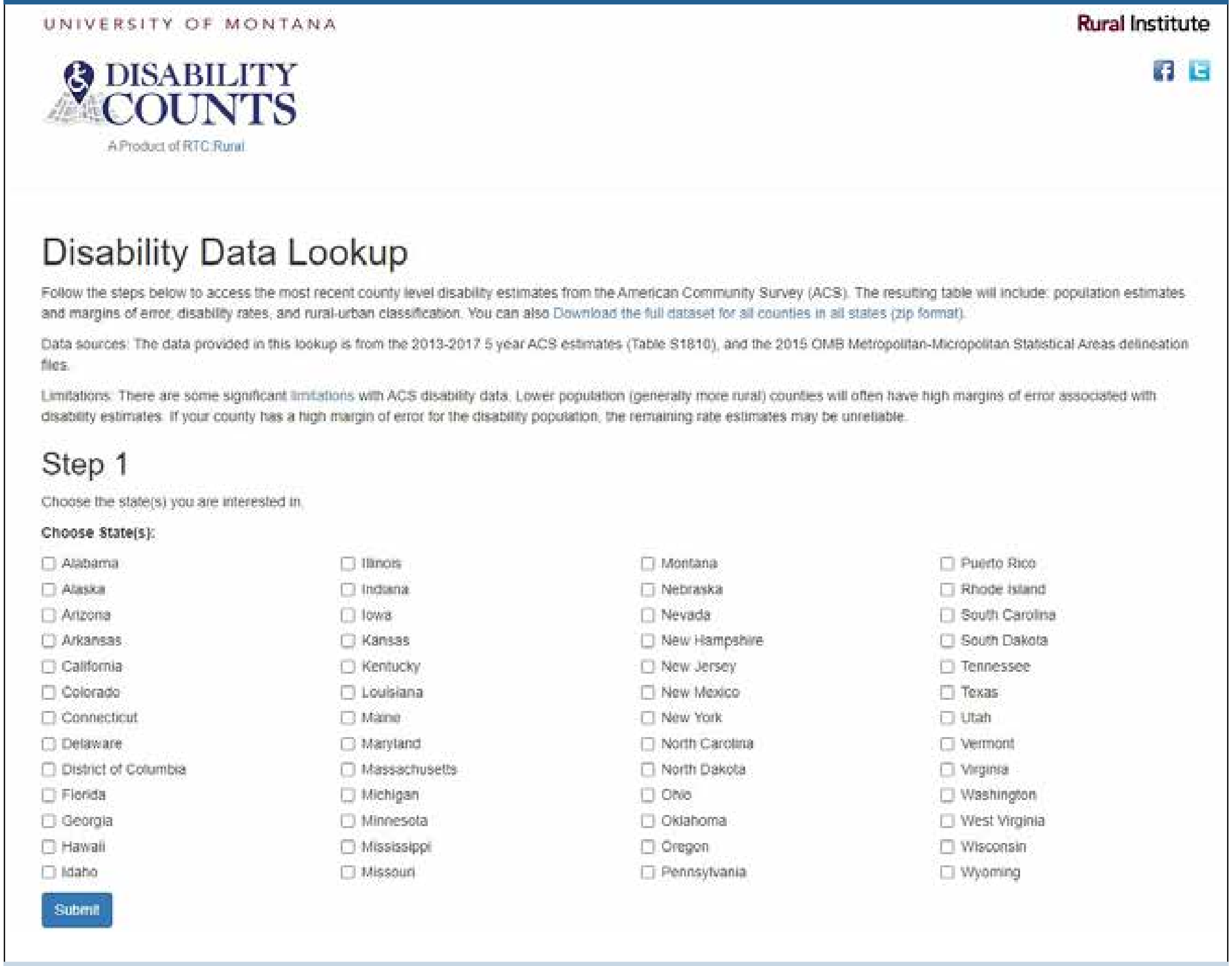
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

For the Disability Counts data lookup tool, we downloaded the data listed in Table 4.1. In many of the ACS tables we download, disability data are disaggregated by various categories (for example, data for veterans with disabilities are available by age and poverty status) and only the counts are reported. Therefore, for some variables (veterans, poverty, and employment) we needed to calculate our own rates. We did these calculations in Excel by summing across the appropriate categories and then calculating rates for our variables of interest (poverty, veteran status, and employment).

We did not recalculate margins of error for these variables. However, margins of error are a concern for disability estimates. Counties with small populations often have large margins of error associated with disability estimates. This can make the resulting estimates and rate calculations less reliable. We include this as a disclaimer on the site and link to a more detailed report we have compiled on the issue of margins of error and county-level disability data.

After we compiled our master data sheet, including all the relevant disability data estimates, rates, and rural indicators, we worked with our programmer to create a data lookup platform where users can identify states and counties of interest (see Figure 4.7). The resulting customized table is downloadable into a CSV file.

Figure 4.7. **Disability Counts Data Lookup Tool**



Source: University of Montana, Disability Counts: Disability Data Lookup, <http://rtc.ruralinstitute.umt.edu/geography/>.

This tool provides two main benefits to data users. First, like data.census.gov, it is screen reader accessible, meaning that someone who is blind or visually impaired can access the information using specialized technology. Second, the disability data presented have already been distilled into key variables of interest for disability service providers. The data provided help local service organizations—like Centers for Independent Living—advocate for the needs of people with disabilities at both the local and national level.

Case Study #2: Determining Eligibility for Grants in Rural Oregon

Skill Level: Intermediate/Advanced
Subject: Place-level socioeconomic data and accompanying statistical error
Type of Analysis: Analysis of place-level American Community Survey (ACS) data, including margins of error and calculating coefficients of variation
Tools Used: Data.census.gov, spreadsheet
Author: Jason R. Jurjevich, University of Arizona (formerly at Portland State University)

For mayors and community leaders of communities across rural America, attracting retail and other forms of economic development is often challenging. In addition to having small populations spread across vast landscapes, inadequate and/or nonexistent infrastructure—water, sewer, telecommunications, and transportation—are often key obstacles. In northern Klamath County, Oregon, residents of two neighboring communities, Gilchrist and Crescent, were interested in securing grant and loan funding from the U.S. Department of Agriculture (USDA) Rural Development to build water and sewer infrastructure to secure a small grocery store. Residents of both communities were traveling up to 25 miles to La Pine, Oregon—the closest place for groceries.

To promote and facilitate economic development in rural communities, USDA Rural Development offers a number of grants and loans, including the Water and Waste Disposal Loan and Grant Program. In Oregon, communities are eligible for these grants and loans if their maximum median annual household income (MHI) was $35,000 or less. USDA Rural Development determines eligibility for grants and loans based on ACS 5-year estimates; however, this approach does not consider the accompanying margins of error.

In late 2014, a resident from Gilchrist contacted our office at Portland State University, asking about the reliability of income estimates from the ACS. They wanted to know if they would be eligible to receive USDA Rural Development funds for their project.

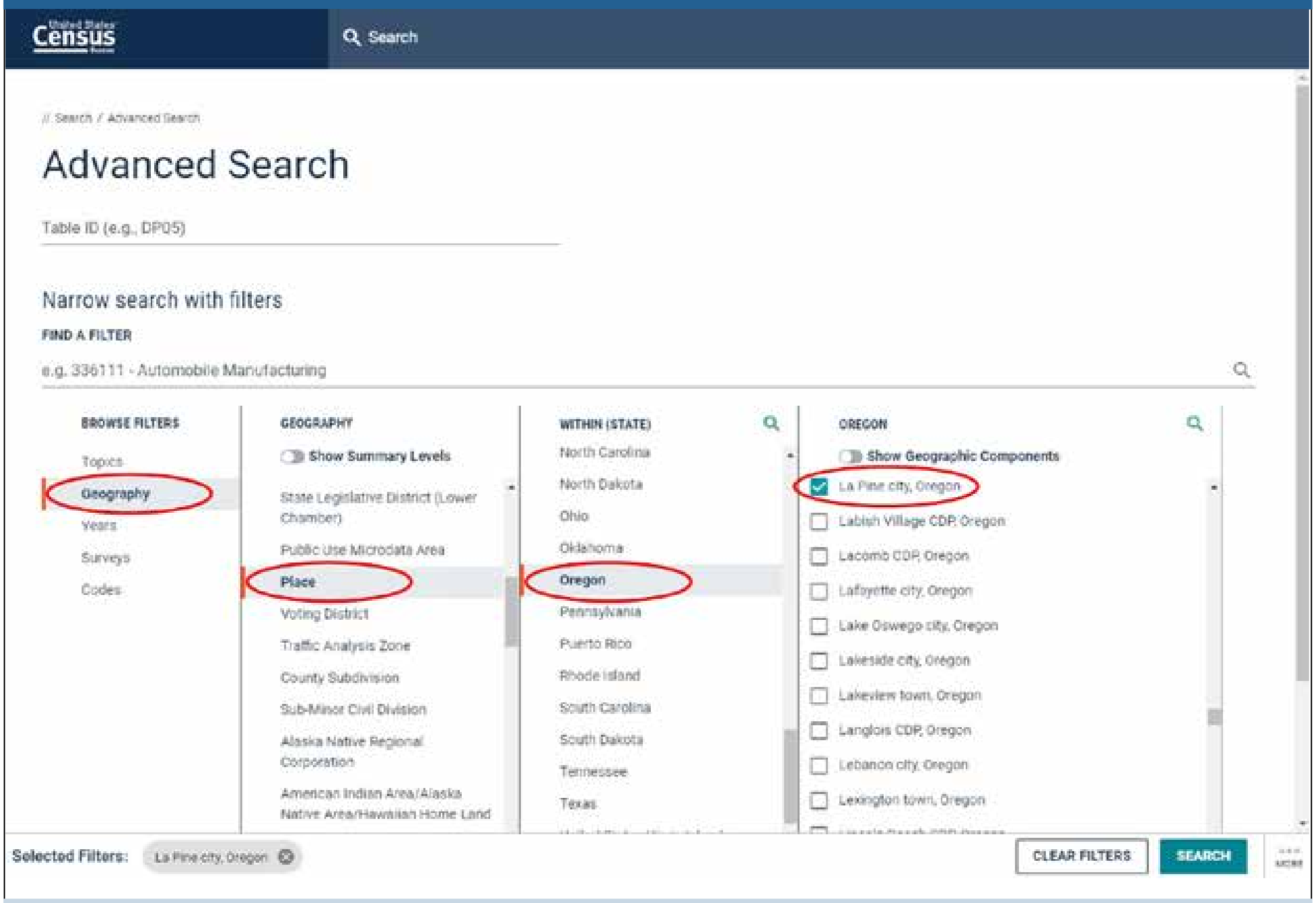
Gilchrist and Crescent, two neighboring communities of a few hundred individuals, are wholly contained in Census Tract 9701. Because these places are small unincorporated areas, the census tract is the smallest unit available for conducting geographic analysis. Given that residents of Gilchrist and Crescent often commute to the closest incorporated city—La Pine, Oregon—for basic necessities, La Pine is included for comparison purposes.

Downloading ACS Data

To download MHI data, use the data.census.gov Advanced Search tool, as follows:

- Go to the data.census.gov Web site at <https://data.census.gov/> and click on "Advanced Search" under the search bar.
- Start with the "Geography" filter and scroll to select "Place" as the geography. Then scroll to select "Oregon" from the "Within (State)" filter. Next, scroll to select "La Pine city, Oregon."
- "La Pine city" should appear as a selected filter at the bottom of the screen (see Figure 4.8).

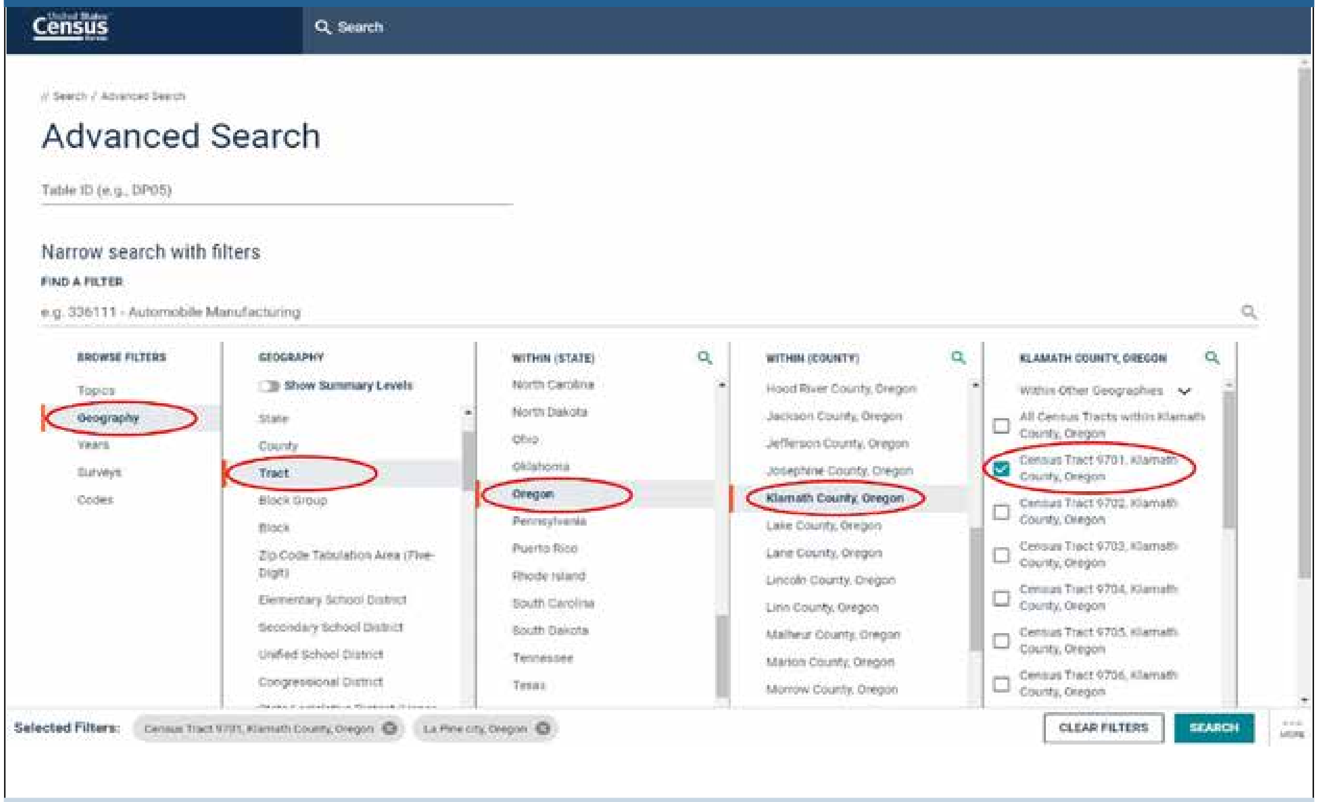
Figure 4.8. **Selecting a Geography (Place) in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Using the same "Geography" filter, scroll to select "Tract" (see Figure 4.9).
- Then select "Oregon," "Klamath County, Oregon," and "Census Tract 9701, Klamath County, Oregon."

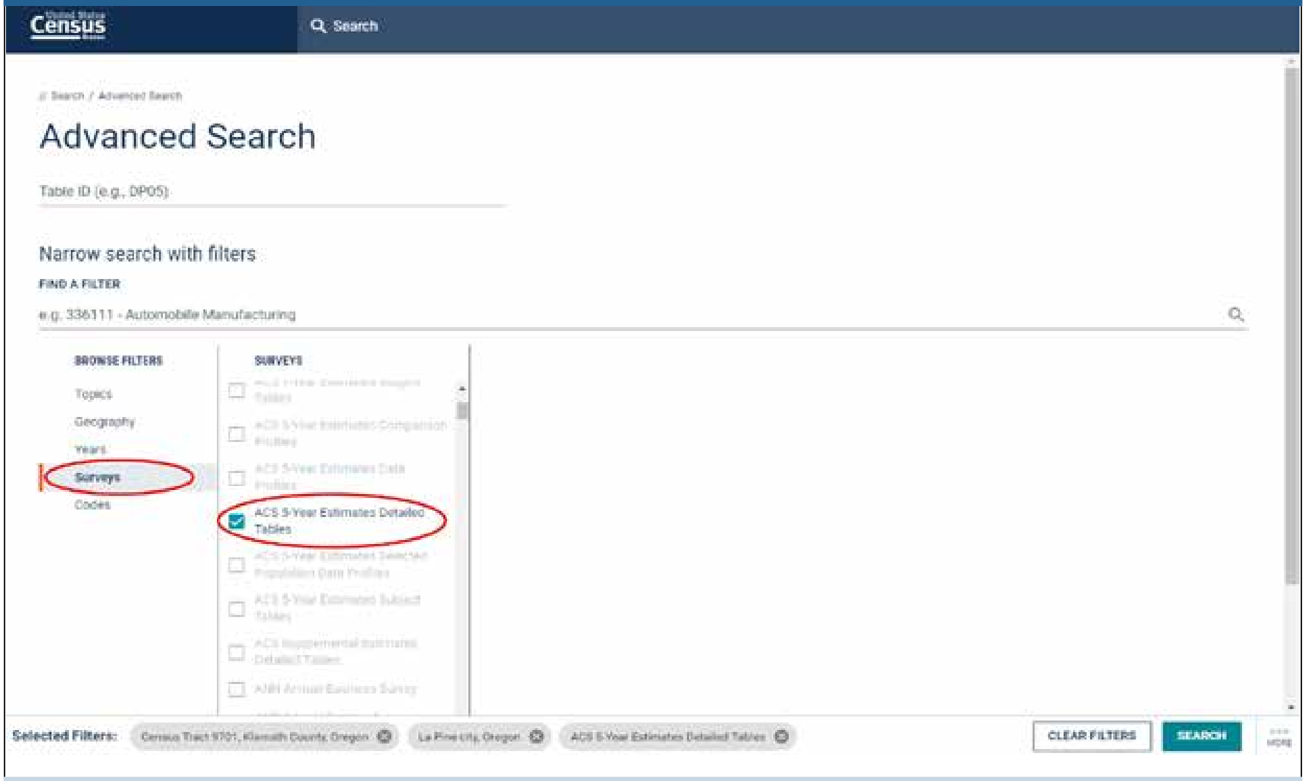
Figure 4.9. **Selecting a Geography (Census Tract) in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Next, select “Surveys” and “ACS 5-Year Estimates Detailed Tables” (see Figure 4.10).

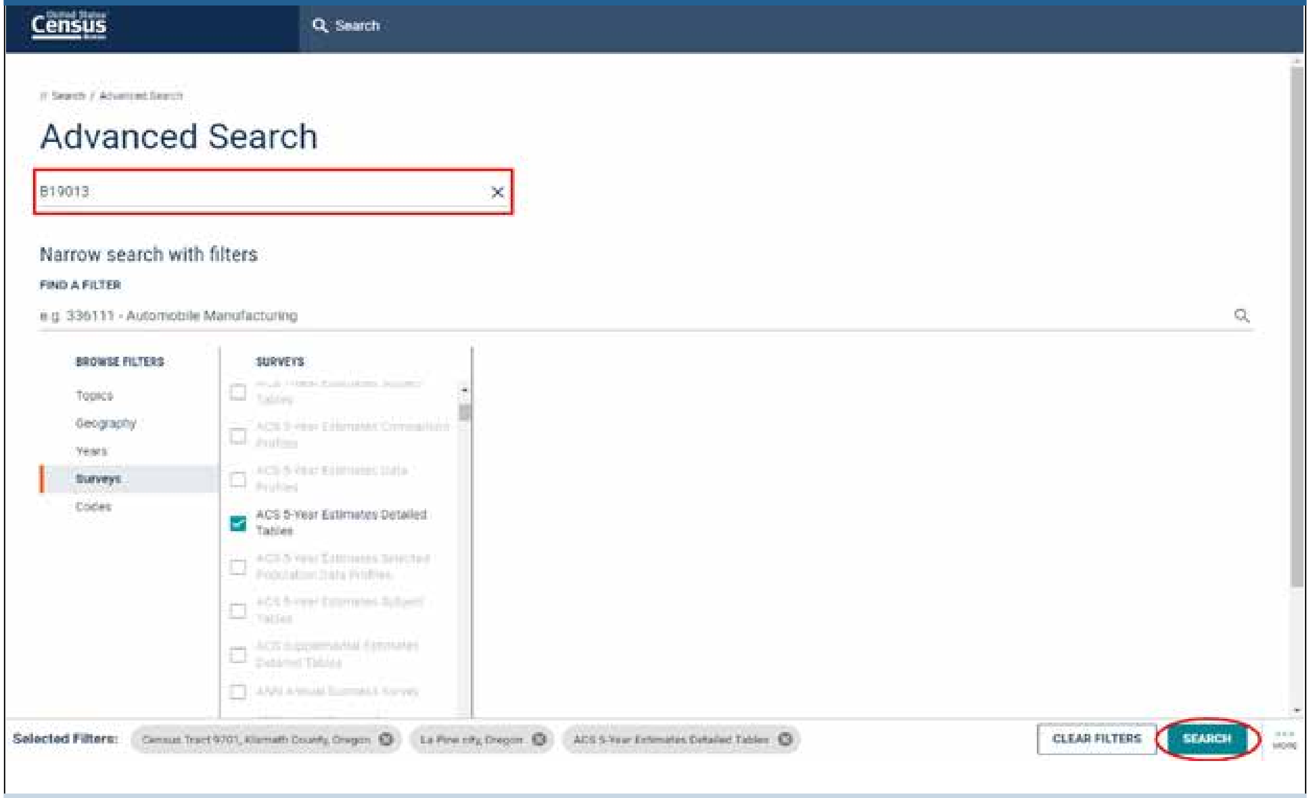
Figure 4.10. **Selecting a Data Set in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- To download the MHI, type “B19013” in the table ID search bar. This is the table corresponding to “Median Household Income in the Past 12 Months.” Then, click “Search” in the lower right corner (see Figure 4.11).

Figure 4.11. **Selecting a Table in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

According to ACS 5-year data, the MHIs were $37,028 (±6,447) and $27,388 (±$6,725) for Census Tract 9701 and La Pine during the 2006–2010 period, respectively (see Figure 4.12). To qualify for grant funding from the USDA, communities cannot have MHI figures greater than $35,000 (not considering margins of error), so communities in Census Tract 9701 (i.e., Gilchrist and Crescent) were declared ineligible.[28]

Figure 4.12. **Median Household Income Estimates for Census Tract 9701 and La Pine City, Oregon: 2006–2010**

Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

[28] If there is reason to believe that ACS data do not provide an accurate representation of MHI, the community can conduct their own income survey. However, the cost for conducting an income survey is borne by the community.

Assessing ACS Data Reliability

Correctly interpreting the ACS estimates for Census Tract 9701 and La Pine requires adding and subtracting the margins of error to/from the estimate to calculate upper and lower confidence intervals. This means the actual income figure for Census Tract 9701 is between $30,581 ($37,028 - $6,447) and $43,475 ($37,028 + $6,447), while the range for La Pine is $20,663 ($27,388 - $6,725) and $34,113 ($27,388 + $6,725). ACS estimates are reported at 90 percent statistical confidence, which means there is a 10 percent chance that the actual income figure lies outside of this range.

To determine whether or not an ACS estimate is reliable, the U.S. Census Bureau recommends calculating the coefficient of variation (CV) statistic. The CV is a relative measure of uncertainty and expresses uncertainty as a percentage of the census estimate. To calculate the CV, the first step involves calculating the standard error (SE), which is the margin of error divided by 1.645 (column F in Figure 4.13). The final step, dividing the SE value by the estimate and expressing the value as a percentage, yields the CV statistic (column G in Figure 4.13).

Figure 4.13. **Data.census.gov (Table B19013) Standard Error and Coefficient of Variation Calculations, 2006–2010 5-Year Estimates**

	A	B	C	D	E	F	G
1	GEO.id	GEO.id2	GEO.display-label	HD01_VD01	HD02_VD01		
2	Id	Id2	Geography	Estimate; Median household income in the past 12 months (in 2010 inflation-adjusted dollars)	Margin of Error; Median household income in the past 12 months (in 2010 inflation-adjusted dollars)	Standard Error (SE) [MOE/1.645]	Coefficient of Variation (CV) [SE/Estimate x 100]
3	1400000US41035970100	41035970100	Census Tract 9701, Klamath County, Oregon	37028	6447	3,919	10.6
4	1600000US4141050	4141050	La Pine city, Oregon	27388	6725	4,088	14.9

Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Lower CV values indicate greater reliability. A 2014 report from Esri (a company that provides GIS mapping software) proposes that CV values smaller than 12 percent indicate a high degree of reliability, values between 12 percent and 40 percent indicate moderate reliability, and CVs greater than 40 percent indicate low reliability.[29] Based on these guidelines, the MHI estimate for Census Tract 9701—with a CV of 11 percent—is reliable, while the estimate for La Pine (CV of 15 percent) is moderately reliable.

The principal reason for the difference in reliability between the two estimates is because statistical uncertainty is magnified for smaller geographic areas (for example, census tracts), subpopulations (e.g., poverty rate for children), and for cross-tabulations (e.g., race/ethnicity by income level). In this example, the City of La Pine is a smaller geographic area than the census tract and contains a smaller population. According to the 2006–2010 ACS 5-year data, the estimated population is 3,082 (±476) and 1,679 (±675) for Census Tract 9701 and La Pine, respectively.

This example shows some of the challenges in working with any data—from the ACS or other surveys—that are derived from a sample of the population. In this case, residents of Gilchrist, Crescent, and La Pine were not able to use ACS estimates to demonstrate eligibility for a USDA Rural Development grant or loan. But as the only source of detailed social, economic, housing, and demographic data for small communities, the ACS is the best place to start for determining program eligibility.

[29] Esri, American Community Survey (ACS), Understanding Margin of Error, <https://doc.arcgis.com/en/esri-demographics/data/acs.htm#ESRI_SECTION1_805FF6F174ED48059E26696F0A440571>.

Case Study #3: Minnesota State Demographic Center Analysis of the Age Distribution of Residents in Rural and Urban Areas

Skill Level: Advanced
Subject: Age Distribution, Rural-Urban Geographic Areas
Type of Analysis: Making comparisons across geographic areas and creating custom geographic areas from census tracts
Tools Used: Variance Replicate Tables, spreadsheet, Statistical Testing Tool
Author: Susan Brower, State Demographer of Minnesota

Susan is the State Demographer of Minnesota. She wants to study how the age distribution of residents differs across geographic regions of the state. To do this, she uses a rural-urban typology that corresponds to the characteristics of individual census tracts.

Susan uses Rural-Urban Commuting Area (RUCA) classification codes developed by the U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) to examine economic characteristics of Minnesota residents living in a range of settings—from remote, rural areas to dense, urban cities. RUCA codes classify census tracts using measures of population density, urbanization, and commuting patterns. She aggregates characteristics of residents across the state based on the RUCA code of the census tract in which they live. (More information about RUCA codes can be found on the ERS Web site.)[30]

Census tracts are roughly equivalent to neighborhoods. They contain between 2,500 and 8,000 people per tract. Since detailed American Community Survey (ACS) 1-year estimates are only available for geographic areas with at least 65,000 residents, Susan uses ACS 5-year estimates, which she downloads from <https://data.census.gov>.[31] There are approximately 1,300 census tracts in Minnesota. Susan aggregates these tracts into four RUCA-based areas—Rural, Small Town, Large Town, and Urban.

Susan also estimates how much uncertainty is associated with the new Rural, Small Town, Large Town, and Urban estimates she has created. The U.S. Census Bureau provides a number of formulas that can be used to estimate uncertainty—margins of error—for estimates that are aggregated from smaller geographic components. However, the Census Bureau cautions against using these formulas when the number of geographic components is greater than four.

Because she wants to aggregate a large number of census tracts together into her four geographic regions, she uses the Variance Replicate Tables that are made available on the Census Bureau's site for selected ACS data tables.[32] Using these tables allows her to calculate new margins of error for her estimates. Susan begins her analysis by reviewing the Documentation for the ACS Variance Replicate Tables.[33] She selects the 2015 data page because she has chosen to analyze data from the 2011–2015 ACS 5-year data set. These were the most current data available at the time of the analysis. The 2015 page has the information that she needs to find the most appropriate data table for her analysis and to calculate new margins of error for her custom geographic areas.

[30] U.S. Department of Agriculture, Economic Research Service, "Rural-Urban Commuting Area Codes," <www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>.
[31] Starting with the 2014 ACS, the Census Bureau is also producing "1-year Supplemental Estimates"—simplified versions of popular ACS tables—for geographic areas with at least 20,000 people.
[32] U.S. Census Bureau, American Community Survey, Variance Replicate Tables, <www.census.gov/programs-surveys/acs/data/variance-tables.html>.
[33] U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.html>.

- On the Variance Replicate Tables Documentation Web page, she first looks at the spreadsheet of Table Shells to select a table that contains age distribution data—preferably by 5-year age groups. She finds that table B01001 “SEX BY AGE” meets her needs. She then checks the 2011–2015 Variance Replicate Estimates Table and Geography List and sees that table B01001 is available at the census tract level. On the second page of the same spreadsheet, Susan sees that the geographic summary level code for census tracts is 140 (see Figure 4.14). This is important when she is looking to locate the data file she needs.

Figure 4.14. **2011–2015 Variance Replicate Estimates Table and Geography List**

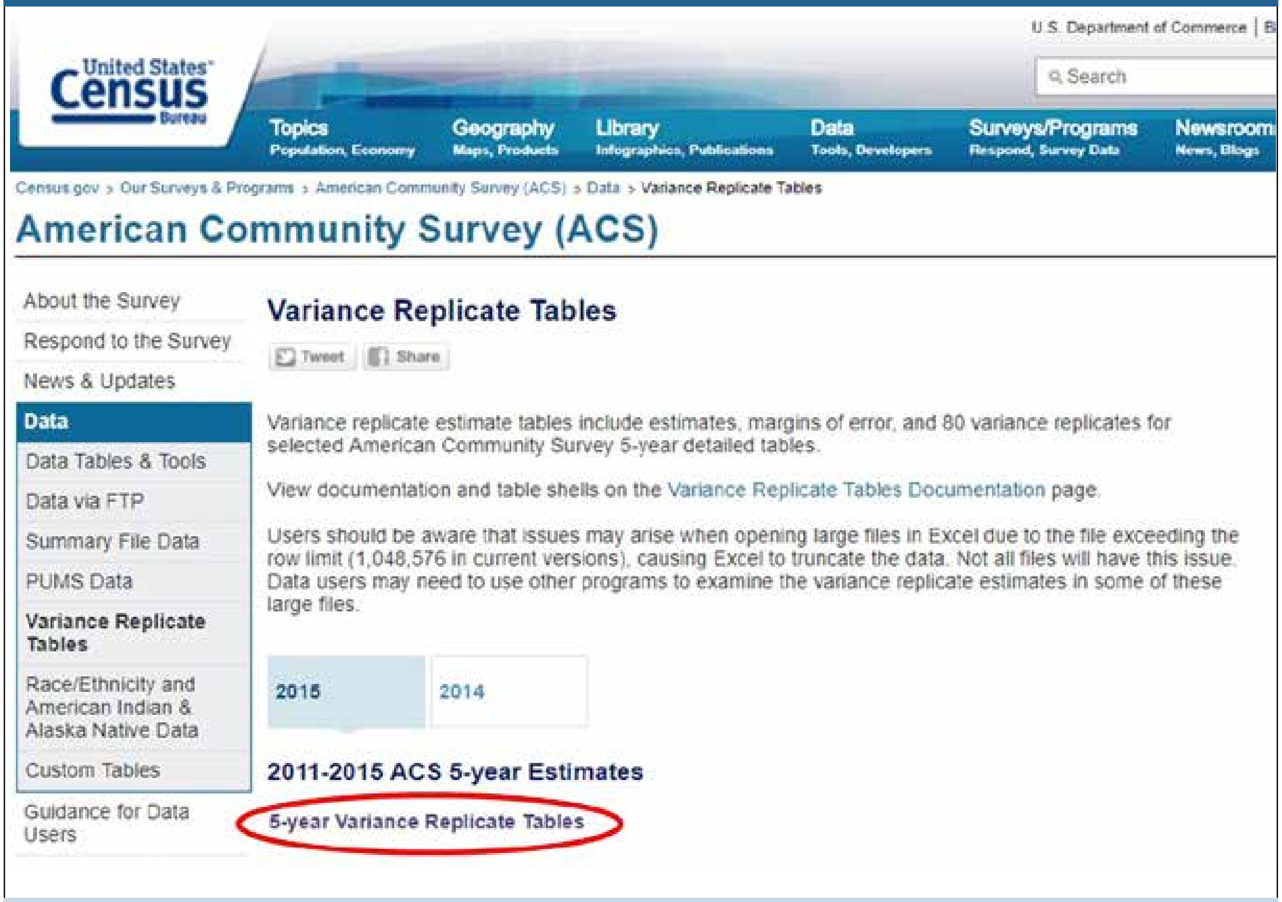
No.	Geographic Summary Level	Description
1	010	Nation
2	040	State
3	050	County
4	060	County Subdivision
5	140	Census Tract
6	150	Census Block Group
7	160	Place
8	250	American Indian Area/Alaska Native Area/Hawaiian Homeland
9	310	Metroplitan/Micropolitan Statistical Area
10	500	Congressional District
11	860	Zip Code Tabulation Area (ZCTA)

Table_List Geography_List

Source: U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

- From the Variance Replicate Tables Web page, Susan clicks on the 2011–2015 "5-year Variance Estimate Tables" link (see Figure 4.15). This takes her to a series of subfolders with names corresponding to the summary level of the data files they contain. Susan chooses folder 140, since this is the folder that contains variance tables at the census tract summary level. In this folder, she finds several zipped CSV files with names corresponding to the table number that she is looking for—B01001. She chooses table "B01001_27.csv.gz" because she knows that 27 is the FIPS code for Minnesota. She downloads this file, unzips it, and sees that it contains age data for all census tracts within her state.

Figure 4.15. **Accessing the Variance Replicate Tables**



Source: U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

- Susan decides to use SPSS (statistical software) to aggregate and analyze the data. After some light editing of the CSV file to meet SPSS requirements, she imports the data into SPSS and saves it.

- Next, she creates a second SPSS data file that contains GEOID and RUCA codes. Susan merges the two SPSS files matching on GEOID as the unique census tract identifier. Now she has all the information she needs to create new custom RUCA geographies in one file.

- Susan analyzes the age data for a collapsed version of the RUCA codes. The USDA publishes ten primary RUCA codes that delineate census tracts.[34] She recodes the ten categories into four: "Urban" for RUCA codes 1-3, "Large Town" for codes 4-6, "Small Town" for codes 7-9, and "Rural" for code 10.

[34] U.S. Department of Agriculture, Economic Research Service, Rural-Urban Commuting Area Codes, <www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>.

- She uses the aggregate command in SPSS to sum age-sex estimates across census tracts within each of the four RUCA codes. This yields a new estimate for each age-sex category for Urban, Large Town, Small Town, and Rural areas. Susan exports the data into an Excel file (see Figure 4.16).

- She consults the 2011–2015 Variance Replicate Tables Documentation and follows the Census Bureau's guidance on calculating margins of error using the variance replicate estimates (see Figure 4.17).[35]

Figure 4.16. **Aggregated Estimates by Rural-Urban Category**

	A	B	C
1	ORDER	RUCA_SDC	estimate_sum
2	1	1	3,988,163
3	2	1	1,973,648
4	3	1	135,299
5	4	1	138,587
6	5	1	133,666
7	6	1	81,052
8	7	1	55,029
9	8	1	27,451
10	9	1	27,585
11	10	1	82,398

AggregatedEstimates

Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

Figure 4.17. **Guidance on Calculating the Margin of Error Using Successive Differences Replicate Methodology (Excerpt From Documentation)**

Calculating the Margin of Error Using the Successive Differences Replicate Methodology

As mentioned in the introduction, the variance and standard error of an estimate must be calculated before computing the MOE. The SDR variance is calculated using the official ACS estimate and the eighty variance replicate estimates (Var_Rep1 to Var_Rep80).[2] The variance is the sum of the squared differences between the estimate and each of the eighty variance replicate estimates, multiplied by 4/80. The MOE is calculated by multiplying the standard error (the square root of the variance) by the factor 1.645 which is associated with a 90 percent confidence level.

$$\text{Variance} = \frac{4}{80}\sum_{i=1}^{80}\left(\text{Var\_Rep}_i - \text{Estimate}\right)^2 \qquad (1)$$

$$\begin{aligned}\text{Margin of Error (90\% confidence level)} &= 1.645 \times \text{Standard Error} \qquad (2)\\ &= 1.645 \times \sqrt{\text{Variance}}\end{aligned}$$

Source: U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

[35] U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation,<www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

- She uses the aggregate command to sum the newly computed variables (i.e., the variance replicate estimates) across all census tracts within her four rural-urban groups. Then she sums across some of the age-sex categories (men and women, aged 65 and older) so that she has the ability to compare differences across geographic regions in the older adult population. Finally, she sums across the 80 variance replicate estimates and multiplies that total by 4/80.

- Next, Susan creates two new variables for each of her age-sex categories: the standard error (equal to the square root of the variance) and the margin of error at the 90 percent confidence level (equal to the standard error times 1.645) and exports them into Excel. She now has the calculated variance, standard error, and margin of error that correspond to each age group and sex by the four rural-urban geographic areas (see Figure 4.18).

Figure 4.18. **Example of Calculations in SPSS**

	A	B	C	D	E	F	G	H
1	Order	Age/sex group	RUCA	Geographic area	Estimate	Variance	Standard error	Margin of error
2	1	Total:	1	Urban	3,988,163	389,238	624	1,026
3	1	Total:	2	Large town	608,769	436,222	660	1,086
4	1	Total:	3	Small town	388,769	626,068	791	1,302
5	1	Total:	4	Rural	433,470	541,980	736	1,211
6	2	Male:	1	Urban	1,973,648	283,145	532	875
7	2	Male:	2	Large town	304,832	307,515	555	912
8	2	Male:	3	Small town	193,329	354,638	596	980
9	2	Male:	4	Rural	220,357	262,384	512	843
10	3	Under 5 years	1	Urban	135,299	62,505	250	411
11	3	Under 5 years	2	Large town	18,808	40,824	202	332
12	3	Under 5 years	3	Small town	11,637	46,254	215	354
13	3	Under 5 years	4	Rural	12,872	31,569	178	292
14	4	5 to 9 years	1	Urban	138,587	990,832	995	1,637
15	4	5 to 9 years	2	Large town	19,388	113,647	337	555
16	4	5 to 9 years	3	Small town	13,144	96,000	310	510
17	4	5 to 9 years	4	Rural	14,125	30,124	174	286
18	5	10 to 14 years	1	Urban	133,666	891,476	944	1,553
19	5	10 to 14 years	2	Large town	20,360	136,610	370	608
20	5	10 to 14 years	3	Small town	12,582	76,670	277	455

Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

- Susan then calculates the percent of adults aged 65 and older in each of the four geographic areas and uses the Variance Replicate Tables Documentation to calculate margins of error for these percentages.

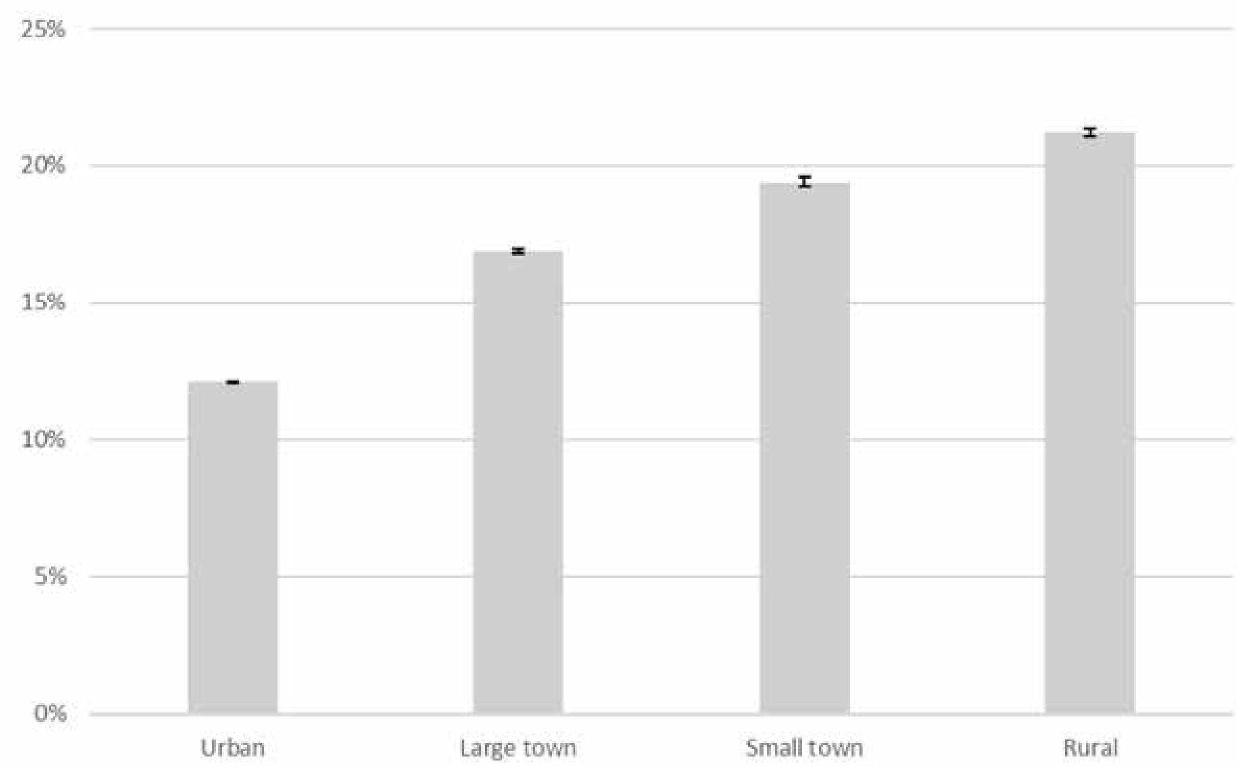
- Finally, Susan compiles the new estimates and margins of error into a single table in Excel and examines the differences in age distributions across RUCA regions. She notes that the rural areas of the state have the oldest age distribution. Twenty-one percent of all rural residents are aged 65 and older, compared with just 12 percent of urban residents (see Figures 4.19 and 4.20).

Figure 4.19. **Aggregated Estimates of Population by Age and Rural-Urban Area**

Geographic area	Estimate (total)	Estimate (65+)	Percent 65+	Standard error of percent	Margin of error of percent
Urban	3,988,163	483,396	12.121	0.009	0.014
Large town	608,769	102,756	16.879	0.053	0.087
Small town	388,769	75,460	19.410	0.110	0.180
Rural	433,470	91,917	21.205	0.089	0.147

Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

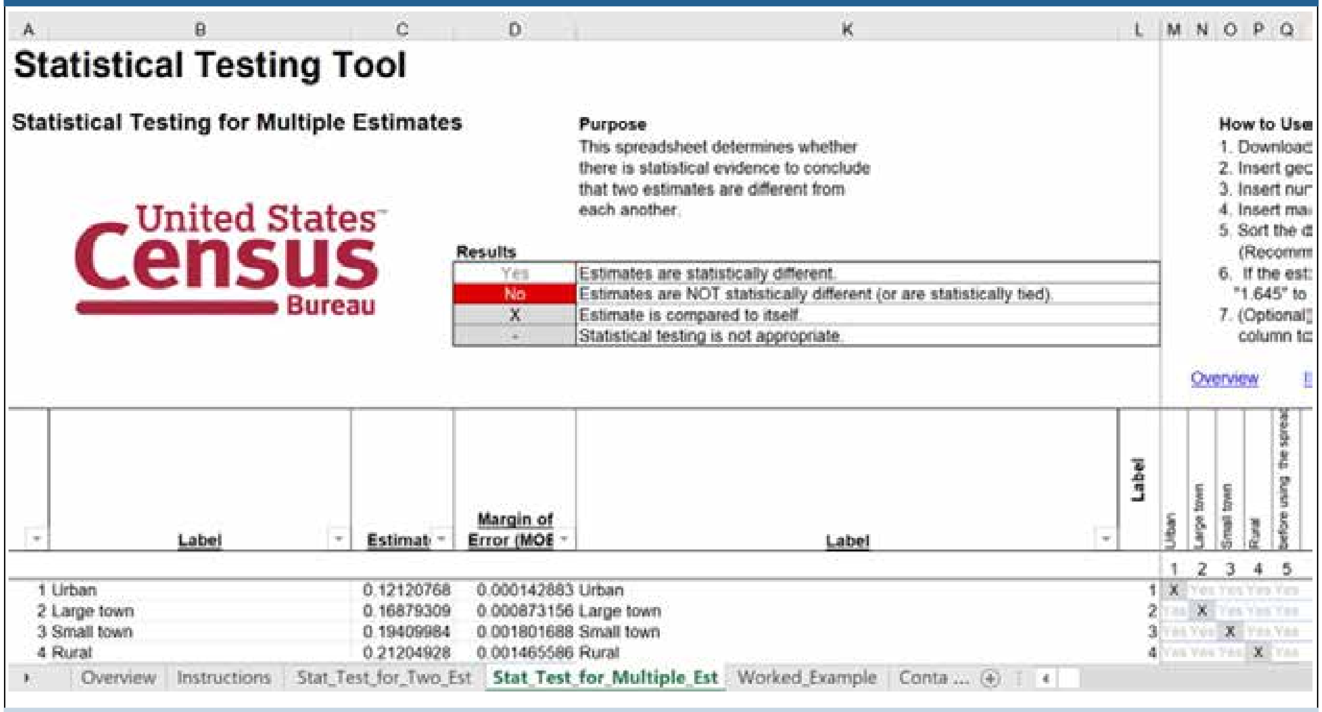
Figure 4.20. **Percentage of Population Aged 65 and Older by Rural-Urban Area (With Confidence Intervals), Minnesota: 2011–2015**



Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

- Susan then tests whether the observed differences in the percent aged 65 and older across geographic areas are statistically significant. She pastes the estimates and their associated margins of error into the Census Bureau's Statistical Testing Tool and finds that all of the differences across geographic areas are significant at the 99 percent confidence level.[36] She uses this information to convey her confidence that rural areas of the state have a significantly higher share of older adults than urban areas. She notes that as an area becomes more rural, the share of the older adult population in that area grows (see Figure 4.21).

Figure 4.21. **Testing for Significant Difference Using Statistical Testing Tool**



Source: U.S. Census Bureau, American Community Survey, Statistical Testing Tool, <www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>.

Susan uses this analysis to help her convey age differences of the residents of rural, small town, large town, and urban areas in reports that her office produces for state policymakers. While she does not always report the numeric results of statistical tests, knowing which differences are significant helps her know which differences she can highlight in her narrative. Conversely, knowing which differences are not statistically significant helps her know which differences she should downplay in her reporting. An example of a report that was informed by this type of analysis is Greater Minnesota: Refined and Revisited.[37] (This report was produced using 2010–2014 ACS 5-year estimates, and so the data are somewhat different, but the results are consistent with the results described here.) This report has been used by policymakers working on rural health care initiatives, on Equal Employment Opportunity activities, and by legislators working to create policies that align with current economic conditions in different areas of the state.

[36] U.S. Census Bureau, American Community Survey, Statistical Testing Tool, <www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>.

[37] Minnesota State Demographic Center, Greater Minnesota: Refined and Revisited, <https://mn.gov/admin/demography/reports-resources/greater-mn-refined-and-revisited.jsp>.

5. ADDITIONAL RESOURCES

U.S. Census Bureau, What Is the American Community Survey?
<www.census.gov/programs-surveys/acs/about.html>

U.S. Census Bureau, Understanding and Using American Community Survey Data: What All Data Users Need to Know
<www.census.gov/programs-surveys/acs/guidance/handbooks/general.html>

U.S. Census Bureau, ACS Data Releases
<www.census.gov/programs-surveys/acs/news/data-releases.html>

U.S. Census Bureau, Geography and the ACS
<www.census.gov/programs-surveys/acs/geography-acs.html>

U.S. Census Bureau, ACS Data Tables and Tools
<www.census.gov/acs/www/data/data-tables-and-tools/>

U.S. Census Bureau, Data.census.gov Resources
<www.census.gov/data/what-is-data-census-gov.html>

U.S. Census Bureau, State Data Center (SDC) Program
<www.census.gov/about/partners/sdc.html>

U.S. Census Bureau, Urban and Rural
<www.census.gov/programs-surveys/geography/about/glossary.html#par_textimage_29>

Alison Fields, Kelly Ann Holder, and Charlynn Burd, "Life Off the Highway: A Snapshot of Rural America" (Dec. 8, 2016)
<www.census.gov/newsroom/blogs/random-samplings/2016/12/life_off_the_highway.html>

Michael Ratcliffe, Charlynn Burd, Kelly Holder, and Alison Fields, "Defining Rural at the U.S. Census Bureau," American Community Survey and Geography Brief ACSGEO-1 (December 2016)
<www.census.gov/content/dam/Census/library/publications/2016/acs/acsgeo-1.pdf>

U.S. Department of Agriculture, Rural Classifications: Overview
<www.ers.usda.gov/topics/rural-economy-population/rural-classifications/>

ACS Online Community
<https://acsdatacommunity.prb.org/>