**Downloading and mapping Census data**

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| * *Note that there are no files to download for this exercise. You will be provided instructions on how to download census data from Social Explorer in later steps.* * *Also note that a professional subscription to the socialexplorer.com website may be needed to download the data. If you are on the UT network, you will have full access to socialexplorer.com.* |

In this exercise, you will learn how to query, download and map census data. You will use American Community Survey (ACS) five-year estimates. The ACS is a sample survey collected continuously between decennial censuses.

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1. Create a new ArcGIS project and open Social Explorer website

Create a new project in ArcGIS Pro to contain your work on this lab.

In a browser, navigate to the website <http://www.socialexplorer.com/>.

Note that certain services are only accessible via a subscription. UT Austin has a “professional access” subscription which offers unfettered access to census data.

Click on the **Tables**  tab.

Next, expand **American Community Surveys (5-Year Estimates)**.

Click on **Begin Report** link next to **American Community Survey (ACS) 2018—2022 (5-Year Estimates)**.

This places you in the *data query* environment.

1. Selecting the spatial extent

You will download educational attainment data for each **county** in the **US** in a tabulated form. In subsequent steps, you will join this table to a shapefile of the US counties. Note that you can download data aggregated down to the census block-group level with the ACS five-year data sets.

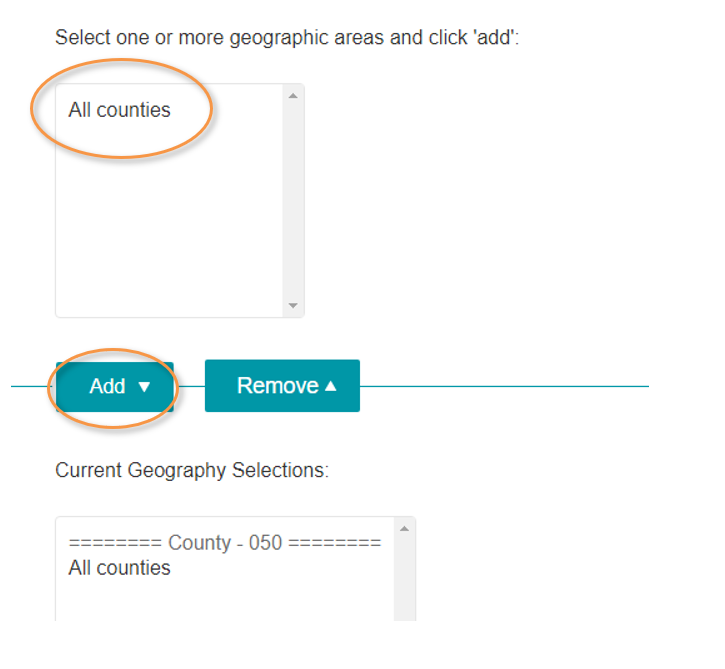
Under ***select a geographic type*** select **County**.

Do not change the ***select a state*** option. However, if you wanted to restrict the analysis to a single state, you would define the state in this step.

Graphical user interface, text, application, email

Description automatically generated

Under ***select one or more geographic areas***, select **All Counties** then click on the ***Add*** link just beneath the selection window.



Click on **Proceed to Tables** to proceed to the attribute selection step.

1. Selecting and downloading census attributes

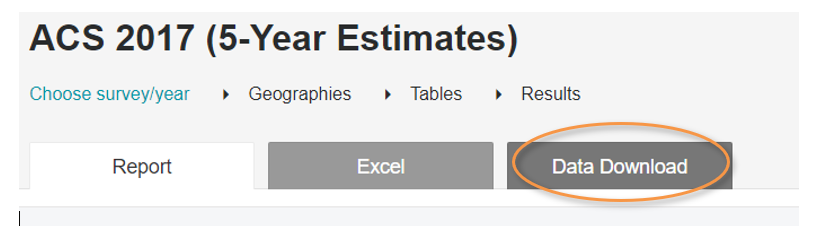
The Social Explorer website provides you with both the original census data tables and a ‘filtered’ version of these data tables. The census ACS dataset is based on sample surveys (not total enumeration) and therefore provides only *estimated* total counts.

The U.S. Census Bureau provides an estimate of the error along with its dataset. The filtered version of the tables excludes the margin of error (MoE) data. It’s always good practice to work with both the *estimate* and the *MoE* data, so in keeping with good practice you will choose to select the original census data table (note that this tutorial will *not* make use of the MoE).

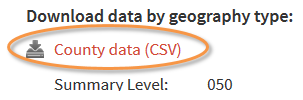
Search for table **B15002** (Sex by educational attainment for population 25 years and over) then add it to the **Table Selections** window.

Click on **Show Results** to proceed to the next page.

On the next page, select the **Data Download** tab.



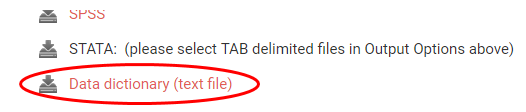
Click on the **County data (CSV)** link to download the data.



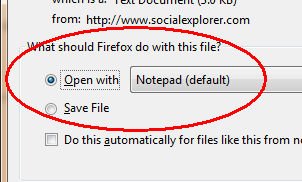
Note the file *name* you are downloading! You will need this information when locating the file in the Downloads Folder on your computer.

You will also want to download the **data dictionary** which provides descriptive information on the table’s attribute values.

Click on the **Data dictionary** link near the bottom of the page.



If prompted, select the **Open with Notepad** option.



The column (attribute) information for your dataset is defined in this file.

Make sure to save the data dictionary file in your project folder for future reference.

1. Modifying the census data table in ArcGIS Pro

The file you downloaded from the Social Explorer website is in the comma separated value (csv) file format. The filename is randomly generated so the filename shown in this tutorial will not necessarily match that of the file you downloaded.

A .csv file can be opened in either Excel or ArcGIS Pro. It is possible to accomplish any required data manipulation in either piece of software. But as we have learned, opening a .csv in Excel can be dangerous—especially when working with census data that can contain leading zeros.

Locate the .csv file you downloaded and add it to your ArcGIS Pro map. View the table. Make any adjustments to the schema.ini required to ensure that the “Geo\_FIPS” field imports as text. This will be the common field you define later on when you join the table to a shapefile.

You’ll note that the file has many columns (attributes). To decipher the column names, you will need to refer to the data dictionary file you downloaded in the previous step.

The data columns are broken down into three groups:

* Ancillary geographic data information (IDs and locations for the most part)
* Count data for each educational attainment/gender combinations
* Error estimates for each educational attainment/gender combinations

For this tutorial, we will focus solely on the count data for educational attainment. The error data will not be used.

Column **ACS22\_5yr\_B15002001** (or simply B15002001 in the data dictionary file) represents total population 25 years or older for each county. This value will be used to normalize the population having attained a bachelor’s degree or greater.

Using ArcGIS Pro’s field calculator, for each county, you will sum all members of the population having a bachelor’s degree or greater for both the male and female population, then divide this sum by the total population to generate the share of the population that has attained at least a bachelor’s degree.

You cannot directly edit a table in .csv format from within ArcGIS Pro. You’ll need to convert the .csv into a file geodatabase table first, before you can add a field.

Right click on the table 🡪 Data 🡪 Export Table. Ensure that the destination for the output table is a file geodatabase. (Hint: When you created a new project, a new file geodatabase was created with the same name as your project. Use that one.)

A screenshot of a computer

Description automatically generated

Add a new field to the table called frac\_bac (make sure there is no space in the field name). Use a data type that can contain a decimal value.

The new field will initially be populated with null values.

Use the field calculator to populate the new field with the share of the population in each county that has at least a bachelor’s degree or higher. (Hint: Right click on the new field and “Calculate Field.” The screenshot below shows what the field calculator will look like. You need to enter the correct formula into the box below “frac\_bac =”)

A screenshot of a computer

Description automatically generated

After you hit OK, all cells in the frac\_bac column should be populated.

In the following step, you will download the shape file that delineates the US county boundaries.

1. Downloading Census shapefile

In a web browser, navigate to the Census Bureau’s Tiger shapefiles website: <https://www.census.gov/cgi-bin/geo/shapefiles/index.php>.

From the ***Select year*** pull-down menu, choose 2022. (Note: The five-year ACS tables always match geographic data generated in the most recent year for which the ACS data are reported. In this case, that’s 2022.)

From the ***Select a layer type*** pull-down menu, select **Counties (and equivalent)**.

Click **submit**.

On the next web page, select **Download national file**.

**Unzip** and save the contents of the file to your project folder (the file is almost 80 MB in size and may take up to a minute or two to download).

1. Loading the census table and shapefile in ArcGIS

Add the **tl\_2017\_us\_county10** shapefile to a map.

Map

Description automatically generated

You’ll note that US territories (non-states) are also represented in the shapefile.

Zoom in on the 50 states.

In the next section, you will join the table you created in Step 4 to the counties shapefile.

1. Joining non-spatial census table to a spatial layer

The census table will be joined to the shapefile using a common attribute.

Identify the common attribute across the shapefile and your file geodatabase table.

Make any adjustments needed so that the common fields can be used in a table join.

Join the table to the shapefile using any method you deem appropriate.

1. Symbolizing the shapefiles by census data

In this last step, you will symbolize the counties shapefile using the Frac\_bac attribute you computed in the Excel file.

With the county layer selected, click the **Symbology** button in the **feature layer** tab**.**

Select **Graduated Colors** under primary symbology and **frac\_bac** as the field.

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The map should update immediately.

A map of the world

Description automatically generated with medium confidence

This map is pretty unsightly! Can you make its area and shape more closely represent the way it looks on the surface of the earth using techniques we learned earlier in the course? Experiment with other aesthetic improvements as well (e.g., try lightening/removing the county boundary outlines).

This ends this exercise.

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