Getting Started with the Census Data API in R Using *Tidycensus*

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Visit Catherine's GitHub repo for the exercise files: https://github.com/cjtulley/PA_GeoDev_2022

Quick poll

Go to **www.menti.com** and use the code **7158 3051**

What brings you here today?

Mentimeter

1st	Old hat with the Summary File?
2nd	Used American FactFinder or data.census.gov?
3rd	Used ESRI's Census layers online?
4th	Just looking to learn more!

Today's Agenda

In this session, we will learn how to **query**, **download** and **format data** from the US Census Bureau's API (Application Programming Interface) in R, using Dr. Kyle Walker's 'tidycensus' library (plus a few other helper packages).

We will save the results to a CSV, to a formatted Excel file and to a shapefile – all using R!

Pt. 1: Intro to the Census API

Covering the 5 W's: **W**hat, **W**here, **W**ho, **W**hen, & **W**hy
(We'll get to the 'how' in a bit…)

Find out *what* you need to know…

Always a GOOD IDEA to start with the USCB's Developers page:
https://www.census.gov/data/developers.html

1. API Gallery – "Is there an API for my dataset?"
   https://www.census.gov/data/developers/data-sets.html
2. Refer to the API User Guide:
   https://www.census.gov/data/developers/guidance.html

   Tip: Scroll to the bottom for Video Tutorials & Webinars
   (great guided intros to using the APIs)
3. Sign up for your API key ->

Need an API key?
Request it here:
https://api.census.gov/data/key_signup.html

…to get to what *you* need: the data!

Where can I find help? *Who* can help me?

A few suggestions:

- Check out good ol' **Stack Exchange!** https://stackexchange.com/
  - Tags: R, Census
- Join the **US Census Bureau's Slack Channel** (*see Resources slides*)
- Contact the **US Census Bureau's CEDSCI Division** (Center for Enterprise Dissemination Services and Consumer Innovation) for API support by email:
  - cedsci.feedback@census.gov (CB staff generally respond quickly)
- **ACS Data Users Group Forums:**
  - https://acsdatacommunity.prb.org/

What are we doing & *why* are we doing it?!

1. WHEN you need more efficient means to access Census data!
   - If you've ever spent WAY too long trying to download data from AFF (old) or data.census.gov (new)…and then reformatting it for Excel or GIS. 😭
   - If ESRI's Living Atlas layers aren't what you need
   - If you need to create custom summary tables AND maps to go with them…
2. Send a query to the API
3. Get the data returned to you in a format that you can easily slice, dice and manipulate in R…
4. …and output into any format that you might need, all from the same interface! 😍

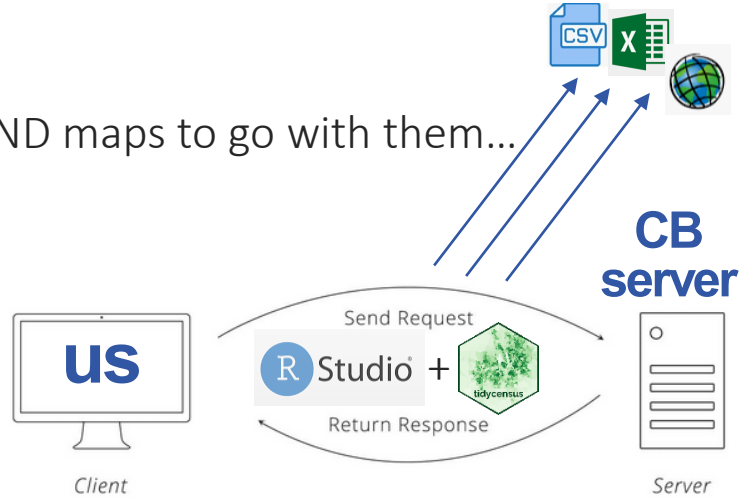


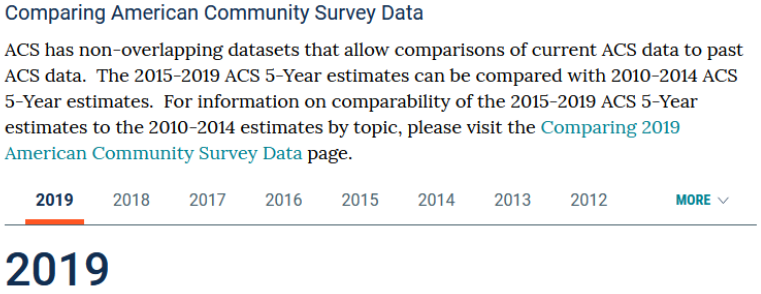
Figure 1. The Request-Response Cycle.

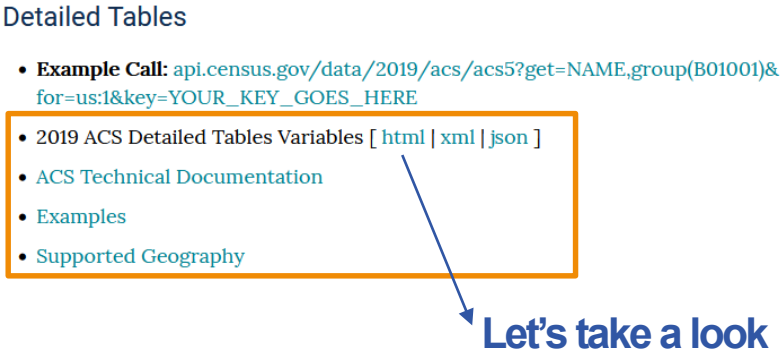
Graphics by Zapier, R Studio, Walker Data, Microsoft, ESRI, Twitter & Flaticon

API Basics – How to use the ACS API

1. We need to understand how it works before we dive into R
   - Visit: https://www.census.gov/data/developers/data-sets.html
   - Example: **5-year ACS data** -> Click the 5-year link to get here:
   - https://www.census.gov/data/developers/data-sets/acs-5year.html

2. Decide which vintage you want to use:





Detailed Tables: Variables

1. You will need to understand these variables, because we'll be sending these to the API through Tidycensus.
2. Variables list: https://api.census.gov/data/2019/acs/acs5/variables.html
3. Example variables table – let's say we are looking at broadband availability:

VARIABLE	VARIABLE NAME	TABLE NAME
B28002_001E	Estimate!!Total:	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD
B28002_002E	Estimate!!Total:!!With an Internet subscription	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD
B28002_003E	Estimate!!Total:!!With an Internet subscription!!Dial-up with no other type of Internet subscription	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD
B28002_004E	Estimate!!Total:!!With an Internet subscription!!Broadband of any type	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD
B28002_005E	Estimate!!Total:!!With an Internet subscription!!Cellular data plan	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD

The "E" stands for Estimate
An "M" would stand for MOE

The first part before the "_" is the table ID.

TIP: Always review the latest ACS Technical Documentation page to check for updates to the data between vintages (data release years). link

What does this look like from the Summary File? (think "Table Shells")

TABLE ID:	B28002
SEQ NUM:	013500000000
CONTENTS:	2015-2019: 5-YR ESTIMATES FOR PENNSYLVANIA
	(CENSUS TRACTS AND BLOCK GROUPS)
TITLE:	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD
UNIVERSE:	Households

FILEID	FILETYPE	STUSAB	CHARITER	SEQUENCE	LOGRECNO	Geography ID	Geography Name	B28002_001	B28002_002	B28002_003	B28002_004	B28002_005	B28002_006	B28002_007	B28002_008	B28002_009	B28002_010	B28002_011	B28002_012	B28002_013
								PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%I	PRESENCE AND TYPES OF INTERNET SUBSCRIPTIONS IN HOUSEHOLD%Households%Total%
								Total:	With an Internet subscription	Dial-up with no other type of Internet subscription	Broadband of any type	Cellular data plan	Cellular data plan with no other type of Internet subscription	Broadband such as cable, fiber optic or DSL	Broadband such as cable, fiber optic or DSL with no other type of Internet subscription	Satellite Internet service	Satellite Internet service with no other type of Internet subscription	Other service with no other type of Internet subscription	Internet access without a subscription	No Internet access

Supported Geographies (think “Sum Levels”)

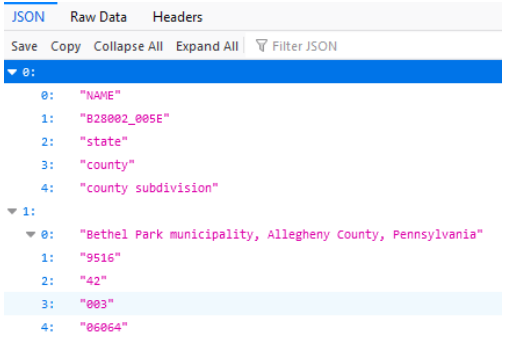
1. List of supported geographies for the ACS endpoint: https://api.census.gov/data/2019/acs/acs5/geography.html
2. We will also supply these to the API through Tidycensus. (You can use the code *or* the keyword.)

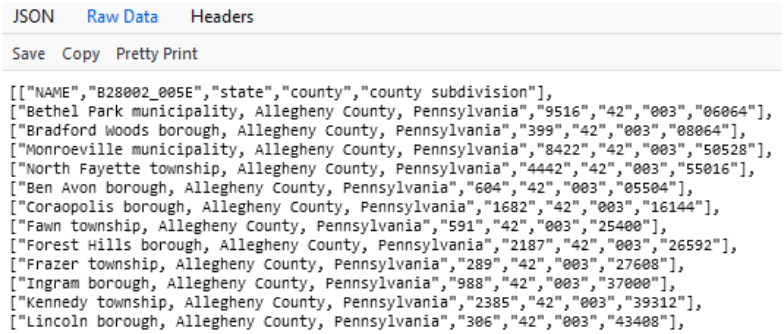
Census Data API: FIPS Geographies in /data/2019/acs/acs5/geography

Reference Date	Geography Level	Geography Hierarchy
2019-01-01	010	us
2019-01-01	020	region
2019-01-01	030	division
2019-01-01	040	state
2019-01-01	050	state› county
2019-01-01	060	state› county› county subdivision
2019-01-01	067	state› county› county subdivision› subminor civil division
2019-01-01	070	state› county› county subdivision› place/remainder (or part)
2019-01-01	140	state› county› tract
2019-01-01	150	state› county› tract› block group
2019-01-01	155	state› place› county (or part)
2019-01-01	160	state› place
2019-01-01	170	state› consolidated city
2019-01-01	172	state› consolidated city› place (or part)

Sample API call with results:

1. Sample call: view the EXAMPLES page to see different possible combinations: https://api.census.gov/data/2019/acs/acs5/examples.html
2. https://api.census.gov/data/2019/acs/acs5?get=NAME,B28002_005E&&for=county subdivision:*&in=state:42 & county:003&key=YOUR_KEY_HERE
3. Data is returned in JSON format (*JavaScript Object Notation*):





So why use *Tidycensus*?

1. Tidycensus takes care of the formatting & API calls for you

“**tidycensus** is an R package that allows users to interface with the US Census Bureau's decennial Census and five-year American Community APIs and return *tidyverse-ready data* frames, optionally with simple feature (“SF”) geometry included. **tidycensus** is designed to help R users get Census data that is **pre-prepared for exploration within the tidyverse**, and optionally spatially with **sf**. “

2. **What is the Tidyverse?**

“The tidyverse is a collection of open source R packages introduced by Hadley Wickham and his team that ‘share an underlying design philosophy, grammar, and data structures’ of tidy data. “

Graphics by Staples and the maintainers of the Tidyverse

Pt. 2: Dive into R & Tidycensus

Now for the fun part!

Let's move into R

1. Please open your RStudio Desktop or log into RStudio Cloud
2. Navigate to GitHub & copy the R code into a new script file:
   - https://github.com/cjtulley/PA_GeoDev_2022

Pt. 3: Resources + Q&A

Where you can learn more

Resources

1) Kyle Walker's website:

- eBook: "Analyzing US Census Data: Methods, Maps and Models in R" https://walker-data.com/census-r/index.html
- Tidycensus: https://walker-data.com/tidycensus/
- Tigris: https://github.com/walkerke/tigris

Kyle Walker: spatial data science research & consulting

LinkedIn | Twitter | GitHub | Email

Website:
https://walker-data.com/

TIP: Join Walker's email list or follow him on social media to learn about his upcoming workshops and other updates.

Resources

2) U.S. Census Bureau Developer resources:

- Slack channel: https://uscensusbureau.slack.com

slack

Developers' Forum

3) Developers landing page:

- https://www.census.gov/data/developers.html
  - Sign up for the Developers email list

Click here to join the Slack channel: https://bit.ly/3MDefaK

TIP: Check the Slack channel for assistance - your fellow users are available to help you!

Resources

4) Zapier: An Introduction to APIs
   - Free e-course: https://zapier.com/learn/apis/
   - PDF available
   - Table of Contents:

     Chapter 1: Introduction

     Chapter 2: Protocols

     Chapter 3: Data Formats

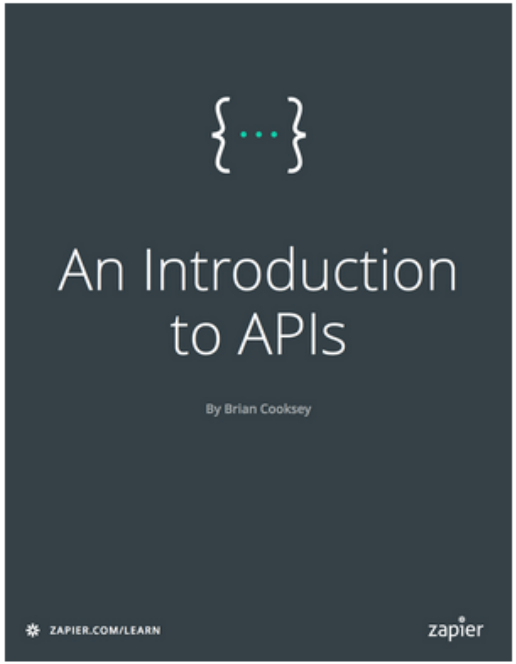
     Chapter 4: Authentication, Part 1

     Chapter 5: Authentication, Part 2

     Chapter 6: API Design

     Chapter 7: Real-Time Communication

     Chapter 8: Implementation



Thank you!

Regional Data Center
Southwestern Pennsylvania Commission
Data & Modeling

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