



Mid Journey V4 prompt: a street view. windows on the buildings arranged like a spread sheet, sunny, 8k, photo by Nikon --ar 16:9

Lecture 7-1: Application Programming Interface

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What Is API?

API 2

Amazon
AWS

<https://aws.amazon.com/what-is/api/>

APIs are mechanisms that enable two software components to communicate with each other using a set of definitions and protocols. For example, the weather bureau's software system contains daily weather data. The weather app on your phone "talks" to this system via APIs and shows you daily weather updates on your phone.

IBM

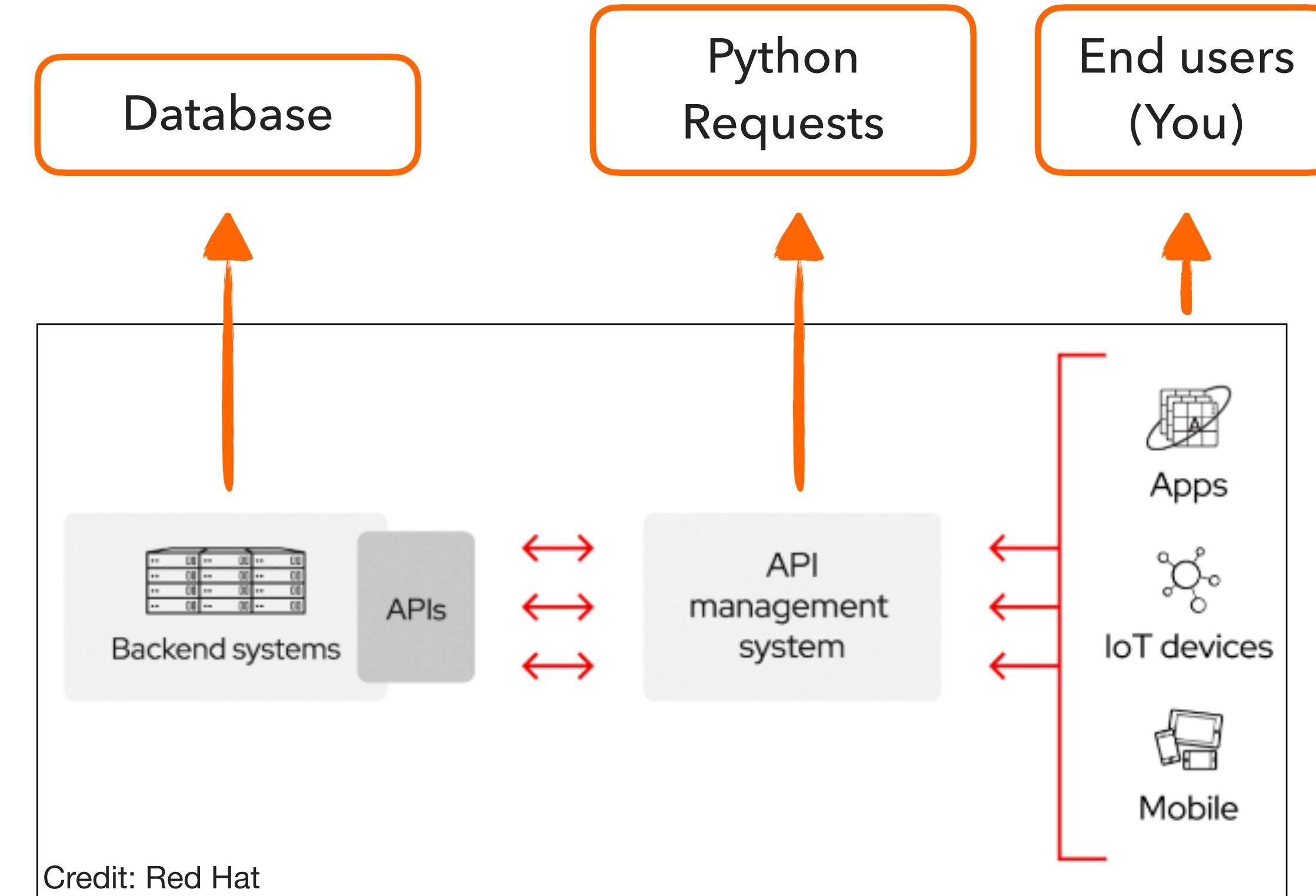
<https://www.ibm.com/topics/api>

An API, or application programming interface, is a set of defined rules that enable different applications to communicate with each other. It acts as an intermediary layer that processes data transfers between systems, letting companies open their application data and functionality to external third-party developers, business partners, and internal departments within their companies.

Red Hat

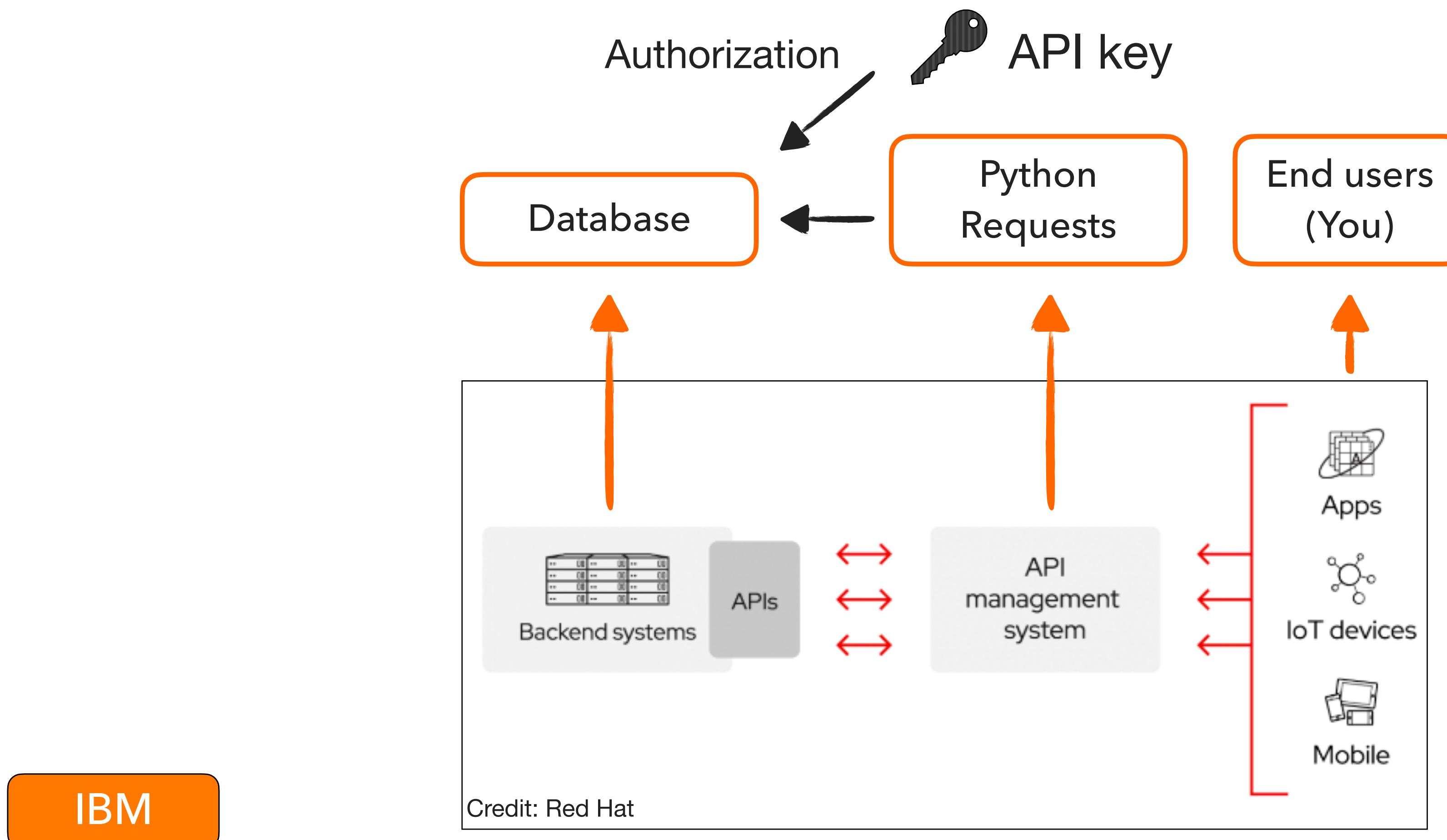
<https://www.redhat.com/en/topics/api/what-are-application-programming-interfaces>

API stands for application programming interface, which is a set of definitions and protocols for building and integrating application software.



What Are User API Keys?

API 3



The API key inherits all assigned access for the user identity for which it is created, and the access is not limited to just the account where the API key is created because it inherits any policies that are assigned to the user.

USDA API - Local Food Directories

API 4

 USDA Local Food Directories

Home Directories Data Sharing Contact Us Sign in Sign up

Agritourism

Total: 29 Listings
Visit a farm or ranch for recreation and tourism ...
[Find a farm](#)

CSA

Total: 991 Listings
Find programs, shares and subscriptions near you ...
[Find a CSA](#)

Farmers Market

Total: 1,441 Listings
Looking for local/seasonal food from nearby farmers markets?
[Find a market](#)

Food Hub

Total: 230 Listings
Search food hubs that aggregate and distribute local source-identified food
[Find a food hub](#)

On-Farm Market

Total: 1,694 Listings
Discover farms selling agricultural/horticultural products directly to consumers?
[Find a market](#)

<https://www.usdalocalfoodportal.com/#directories>

Farmers Market Directory [Download Directory Data](#)

blackburg, VA Within 30 miles [Search](#) More Filters +

Salem Farmers Market 20 miles
Salem, Virginia [Get Direction](#)
Open: April to December; January to March;
Available Products: Fresh ...
[Be a contributor](#) [Report Problems](#) [Details](#)

Showing 1 to 1 of 1 entries First Previous 1 Next Last



USDA API - Get Started

API 5



1. Download directories data

The USDA local food directories' data can be downloaded here. Information on how to utilize the endpoints is detailed below.

The CSV endpoint allows users to download the entire collection of data from the USDA local food directory. The separator for the dataset is `|`. Please choose a directory to download.

Select a directory ▾

 Download Selected Directory Data

2. Data sharing API

2.1 Apply an API Key

To use the API service, please apply an API [here](#).

 Create your API key

2.2 Endpoint information to obtain specific data

The data sharing endpoint is a basic rest endpoint that allows developers to retrieve data from the USDA local food directory. Information can be retrieved using a `GET` request. The endpoint also supports query parameters, listed below. To obtain access to the API, please contact the USDA to apply for an access key.

The endpoint can be accessed at the following URL:

`https://www.usdalocalfoodportal.com/api/{directory name}/`

There are five APIs for you to obtain directory data

Agritourism Business Directory: <https://www.usdalocalfoodportal.com/api/agritourism/>

CSA: <https://www.usdalocalfoodportal.com/api/csa/>

Farmers Market: <https://www.usdalocalfoodportal.com/api/farmersmarket/>

Food Hub: <https://www.usdalocalfoodportal.com/api/foodhub/>

On-farm Market: <https://www.usdalocalfoodportal.com/api/onfarmmarket/>

 Available databases

USDA API - Get API Key

API 6

Get API Key

Our platform requires an API key to make the use of API secure. We would like to understand a little more about you before you get the API key. **Please answer all the questions below.**

E-mail*

Phone Number*

Contact Name*

Address*

Types of your association *

Please describe your purpose to use the API *

Name of your App if applicable

Website of your App or project

Please solve this equation.*

1 + 2 =

* (required fields)

The API Key you request is oof █ offS

Get an API Key

Your API key

What if we use the URL directly?

The endpoint can be accessed at the following URL:

<https://www.usdalocalfoodportal.com/api/{directory name}/>

There are five APIs for you to obtain directory data

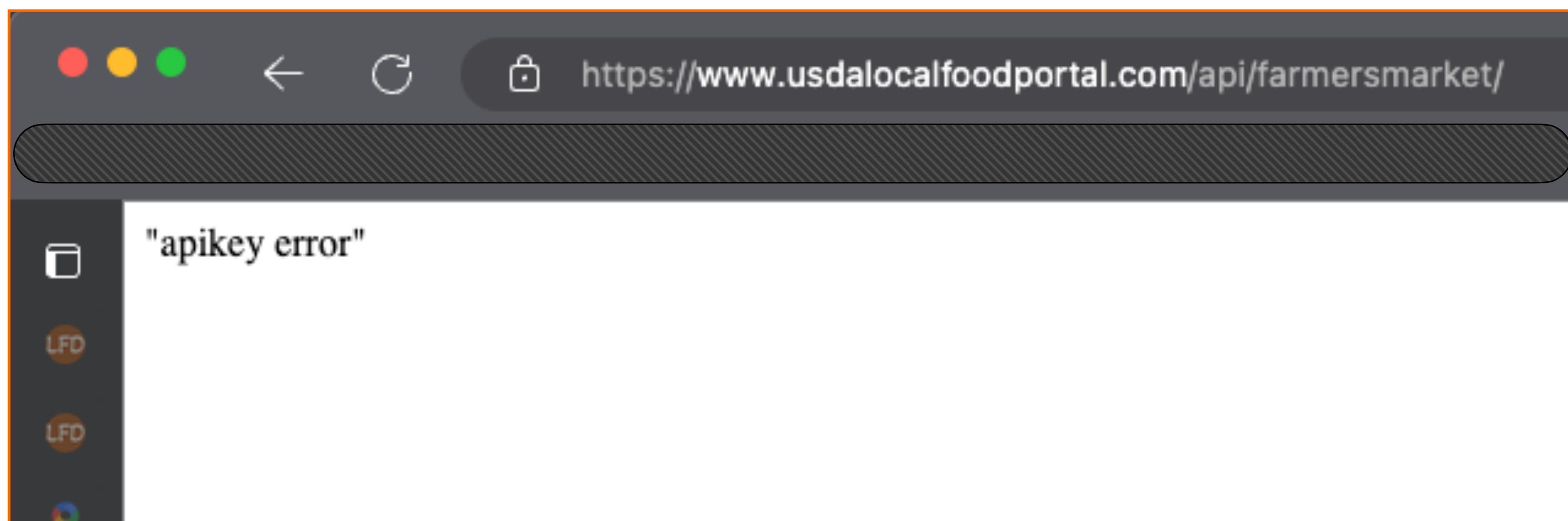
Agritourism Business Directory: <https://www.usdalocalfoodportal.com/api/agritourism/>

CSA: <https://www.usdalocalfoodportal.com/api/csa/>

Farmers Market: <https://www.usdalocalfoodportal.com/api/farmersmarket/>

Food Hub: <https://www.usdalocalfoodportal.com/api/foodhub/>

On-farm Market: <https://www.usdalocalfoodportal.com/api/onfarmmarket/>



Actually, it would work if we provided all the required information.

```
{
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      "listing_desc": null,
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      "Available Products: Fresh vegetables;Baked goods;Eggs;Honey;Maple products;Red\\other non-poultry meat and products;",
      "mydesc": "",
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      "contact_email": "farmersmarket@salemva.gov",
      "contact_phone": "+540-375-4098",
      "media_website": "market.salemva.gov",
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      "media_twitter": "https://twitter.com/SalemVaMarket",
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      "media_facebook": "facebook.com/grandinvillagecommunitymarket",
      "media_twitter": "@leapforlocal",
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      "media_pinterest": null,
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      "media_blog": null,
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      "contact_email": "farmersmarket@galaxva.com",
      "contact_phone": "+276.733.4145",
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      "location_street": "206 North Main Street",
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      "brief_desc": "Open: May to September",
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    }
  ]
}
```

The first part of the URL

<https://www.usdalocalfoodportal.com/api/farmersmarket/>

The second part of the URL

?apikey=oof... IfS&x=-80.423857&y=37.221508&radius=100

Parameters

USDA API - Python Interface: Requests

API 9

```
import requests
API = "oofS"
headers = {
    "User-Agent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/96.0.4664.110 Safari/537.36",
    "Referer": "https://www.google.com/",
}
params = {"apikey": API, "y": 37.221508, "x": -80.423857, "radius": 100}
base_url = "https://www.usdalocalfoodportal.com/api/farmersmarket/"
response = requests.get(base_url, headers=headers, params=params)
```

→ Your device identifier

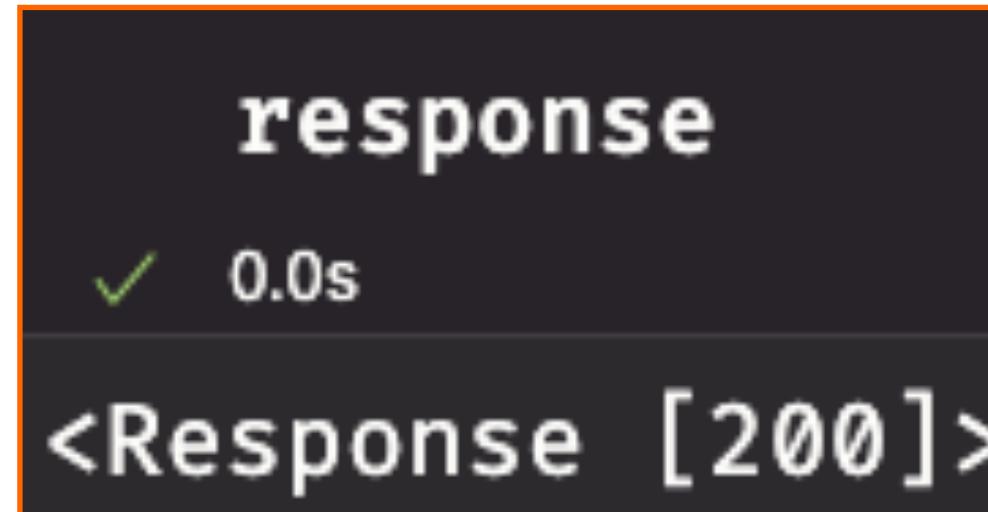
Y: latitude

→ X: longitude

Radius: by miles

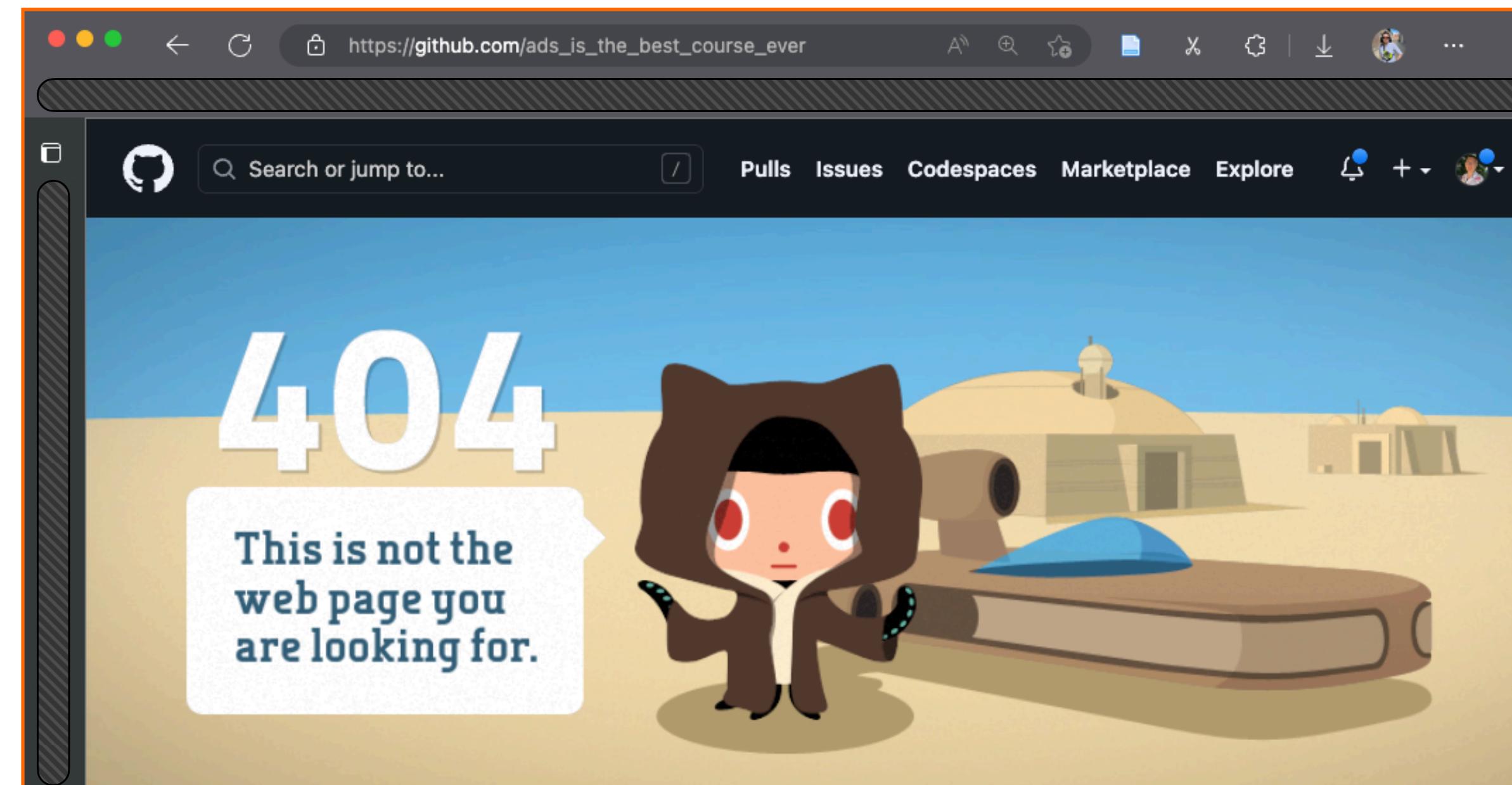
response
✓ 0.0s
<Response [200]>

Different types of responses from an API request



- *1xx informational response* – the request was received, continuing process
- *2xx successful* – the request was successfully received, understood, and accepted
- *3xx redirection* – further action needs to be taken in order to complete the request
- *4xx client error* – the request contains bad syntax or cannot be fulfilled
- *5xx server error* – the server failed to fulfil an apparently valid request

https://en.wikipedia.org/wiki/List_of_HTTP_status_codes



USDA API - Dataframe

API 11

Turn JSON format to tabular format

JSON (JavaScript Object Notation)

Pandas Dataframe

{ "data": [{"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Jan 26th, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "300156", "listing_name": "Salem Farmers Market", "listing_desc": null, "brief_desc": "Open: April to December; January to March; Available Products: Fresh vegetables;Baked goods;Eggs;Honey;Maple products;Red/other non-poultry meat and products;"}, {"mydesc": "", "contact_name": "Market Manager", "contact_email": "farmersmarket@salemva.gov", "contact_phone": "540-375-4098", "media_website": "market.salemva.gov", "media_facebook": "https://www.facebook.com/SalemVaMarket", "media_twitter": "https://twitter.com/SalemVaMarket", "media_instagram": null, "media_pinterest": null, "location_state": "Virginia", "location_city": "Salem", "location_street": "3 East Main Street", "location_zipcode": "24153", "location_x": "-80.058606", "location_y": "37.292997", "distance": "20.684638895041772", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Feb 1st, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "300469", "listing_name": "Grandin Village Farmers Market", "listing_desc": null, "brief_desc": "Open: April to November; November to March; Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Coffee/tea;Crafts/woodworking items;Cut flowers;Dairy products.;Dry beans;Eggs;Fish/seafood;Fresh/dried herbs;Grains/flour;Honey;Juices/non-alcoholic ciders;Maple products;Mushrooms;Nursery stock;Nuts;Pet food;Poultry/fowl meat and products;Prepared foods;Red/other non-poultry meat and products;Soap/body care products;Wild harvested forest products;"}, {"mydesc": "", "contact_name": "Sam Lev", "contact_email": "markets@leapforlocalfood.org", "contact_phone": "540-632-1360", "media_website": "www.leapforlocalfood.org/grandin", "media_facebook": "facebook.com/grandinvillagecommunitymarket", "media_twitter": "@leapforlocal", "media_instagram": null, "media_pinterest": null, "location_state": "Virginia", "location_city": "Roanoke", "location_street": "2080 Westover Ave SW", "location_zipcode": "24015", "location_x": "-79.978064", "location_y": "37.265053", "distance": "24.703908391067827", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Sep 27th, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "301601", "listing_name": "The Historic City Market", "listing_desc": null, "brief_desc": "Open: Year-round Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Coffee/tea;Crafts/woodworking items;Cut flowers;Eggs;Fresh/dried herbs;Honey;Poultry/fowl meat and products;Red/other non-poultry meat and products;Soap/body care products;"}, {"mydesc": "", "contact_name": "Eric L Pendleton", "contact_email": "ericp@downtownroanoke.org", "contact_phone": "5403422028", "media_website": "Downtownroanoke.org", "media_facebook": "The Historic City Market", "media_twitter": null, "media_instagram": null, "media_youtube": null, "media_blog": null, "location_address": "213 Market St SE 3rd Floor, Downtown Roanoke Inc., Roanoke, Virginia 24011", "location_state": "Virginia", "location_city": "Roanoke", "location_street": "213 Market St SE 3rd Floor, Downtown Roanoke Inc.", "location_zipcode": "24011", "location_x": "-79.939064", "location_y": "37.271606", "distance": "26.88770808513208", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Aug 23rd, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "301590", "listing_name": "Rocky Mount Farmers Market", "listing_desc": null, "brief_desc": "Open: April to December; Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Crafts/woodworking items;Dairy products.;Eggs;Honey;Juices/non-alcoholic ciders;Poultry/fowl meat and products;Prepared foods;Red/other non-poultry meat and products;Soap/body care products;"}, {"mydesc": "", "contact_name": "Paul Cauley", "contact_email": "farmersmarket@rockymountva.org", "contact_phone": "540-488-2023", "media_website": null, "media_facebook": null, "media_twitter": null, "media_instagram": null, "media_pinterest": null, "media_youtube": null, "media_blog": null, "location_address": "435 Franklin St, Rocky Mount, Virginia 24151", "location_state": "Virginia", "location_city": "Rocky Mount", "location_street": "435 Franklin St", "location_zipcode": "24151", "location_x": "-79.888073", "location_y": "36.994866", "distance": "33.41846778835633", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Jan 7th, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "300467", "listing_name": "Wytheville Farmers Market", "listing_desc": null, "brief_desc": "Open: Year-round Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Crafts/woodworking items;Cut flowers;Dairy products.;Eggs;Fresh/dried herbs;Honey;Poultry/fowl meat and products;Prepared foods;Red/other non-poultry meat and products;Soap/body care products;"}, {"mydesc": "", "contact_name": "Joanne McNulty", "contact_email": "wythevillefarmersmarket@live.com", "contact_phone": "276-620-4095", "media_website": "www.wythevillefarmersmarket.com", "media_facebook": "Wytheville Farmers Market", "media_twitter": null, "media_instagram": null, "media_youtube": null, "media_blog": null, "location_address": "210 W. Spring Street, Wytheville , Virginia 24368", "location_state": "Virginia", "location_city": "Wytheville", "location_street": "210 W. Spring Street", "location_zipcode": "24368", "location_x": "-81.083367", "location_y": "36.9486397", "distance": "40.94927484093051", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Jan 31st, 2023", "listing_image": "farmersmarket_301790_14483_20230131154833.png", "listing_id": "301790", "listing_name": "Galax Farmers Market", "listing_desc": "We have a bi-weekly farmers market on Thursday evenings and Saturday morning. Our market supports local farmers, artisans and other agricultural related businesses.", "brief_desc": "Open: 05V11V2023 to 10V28V2023; Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Crafts/woodworking items;Cut flowers;Dairy products.;Eggs;Fresh/dried herbs;Grains/flour;Honey;Mushrooms;Nuts;Pet food;Poultry/fowl meat and products;Red/other non-poultry meat and products;Soap/body care products;Wild harvested forest products;"}, {"mydesc": "", "contact_name": "Jordan Shaw", "contact_email": "farmersmarket@galaxva.com", "contact_phone": "276.733.4145", "media_website": "https://visitgalax.com/", "media_facebook": "https://www.facebook.com/search/top?q=galaxfarmersmarket", "media_twitter": "", "media_instagram": "https://www.instagram.com/farmersmarketgalaxva/", "media_pinterest": "", "media_youtube": "", "media_blog": "", "location_address": "206 North Main Street, Galax, VA, USA", "location_state": "VA", "location_city": "Galax", "location_street": "206 North Main Street", "location_zipcode": "24333", "location_x": "-80.925742", "location_y": "36.6632146", "distance": "47.49823471075515", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Jan 26th, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "300024", "listing_name": "Forest farmers market", "listing_desc": null, "brief_desc": "Open: April to October; November to December; Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Crafts/woodworking items;Cut flowers;Dairy products.;Eggs;Fish/seafood;Fresh/dried herbs;Honey;Mushrooms;Nuts;Pet food;Poultry/fowl meat and products;Prepared foods;Red/other non-poultry meat and products;Soap/body care products;Wild harvested forest products;"}, {"mydesc": "", "contact_name": "Dorothy McIntyre", "contact_email": "forestfarmersmarket221@gmail.com", "contact_phone": "434-665-5475", "media_website": "www.forestfarmersmarket.com", "media_facebook": "https://www.facebook.com/pages/Forest-farmers-market/193117547377111", "media_twitter": "https://twitter.com/FFM221", "media_instagram": null, "media_pinterest": null, "media_youtube": null, "media_blog": null, "location_address": "15583 Forest Road, Forest, Virginia 24551", "location_state": "Virginia", "location_city": "Forest", "location_street": "15583 Forest Road", "location_zipcode": "24551", "location_x": "-79.285443", "location_y": "37.3643700", "distance": "63.3484440388215", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Jan 17th, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "300317", "listing_name": "King Farmers' Market", "listing_desc": null, "brief_desc": "Open: May to September; Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Crafts/woodworking items;Cut flowers;Eggs;Fresh/dried herbs;Honey;Nursery stock;Poultry/fowl meat and products;Red/other non-poultry meat and products;Soap/body care products;Wild harvested forest products;"}, {"mydesc": "", "contact_name": "Deb Fox", "contact_email": "kingfarmersmarket@zoho.com", "contact_phone": "336-618-1086", "media_website": "www.kingfarmersmarket.com", "media_facebook": "www.facebook.com/KingFarmersMarket", "media_twitter": "https://twitter.com/KingFarmersMkt", "media_instagram": null, "media_pinteres Moore Road, King , North Carolina 27021", "location_state": "North Carolina", "location_city": "King", "location_street": "105 Moore Road", "location_zipcode": "27021", "location_x": "-80.341178", "location_y": "36.276367", "distance": "65.46298076090864", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Jan 5th, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "301146", "listing_name": "Lynchburg Community Market", "listing_desc": null, "brief_desc": "Open: Year-round Available Products: Fresh fruits;Fresh vegetables;Baked goods;Bedding plants;Canned or preserved fruits/vegetables;Crafts/woodworking items;Cut flowers;Dairy products.;Eggs;Fish/seafood;Fresh/dried herbs;Grains/flour;Honey;Juices/non-alcoholic ciders;Maple products;Mushrooms;Nursery stock;Poultry/fowl meat and products;Prepared foods;Red/other non-poultry meat and products;Soap/body care products;"}, {"mydesc": "", "contact_name": "Ricky Kowalewski", "contact_email": "ricky.kowalewski@lynchburgva.gov", "contact_phone": "434.455.3962", "media_website": "http://lynchburgcommunitymarket.com/", "media_facebook": "https://www.facebook.com/Ly Main St, Lynchburg, Virginia 24504", "location_state": "Virginia", "location_city": "Lynchburg", "location_street": "1219 Main St", "location_zipcode": "24504", "location_x": "-79.140379", "location_y": "37.411517", "distance": "71.73760308173523", "term": ":"}, {"directory_type": "farmersmarket", "directory_name": "farmers market", "updatetime": "Jan 20th, 2021", "listing_image": "default-farmersmarket-4-3.jpg", "listing_id": "301159", "listing_name": "The Market at Second Stage", "listing_desc": null, "brief_desc": "Open: May to October; November to April; Available Products: Fresh fruits;Fresh vegetables;Baked goods;Canned or preserved fruits/vegetables;Crafts/woodworking items;Eggs;Fresh/dried herbs;Grains/flour;Nuts;Pet food;Poultry/fowl meat and products;Prepared foods;Red/other non-poultry meat and products;"}, {"mydesc": "", "contact_name": "Mary Hurst", "contact_email": "SecondStageMarket@gmail.com", "contact_phone": "434.941.0997", "media_website": "https://secondstageamherst.org/markets", "media_facebook": "https://www.facebook.com/The-Market-at-Second-Stage-994201827398686", "media_twitter": null, "media_instagram": null, "media_pinterest": null, "media_youtube": null, "media_blog": null, "location_address": "194 Second St., Amherst, Virginia"}] }

```
son_data = response.json()
f = pd.DataFrame(json_data["data"])
```

0s

f

0s

directory type directory name updatetime

[farmersmarket](#) [farmers market](#) [Jan 26th,](#)

farmersmarket **farmers market** **Feb 1st,
2021**

farmersmarket **farmers market** **Sep 27th, 2021**

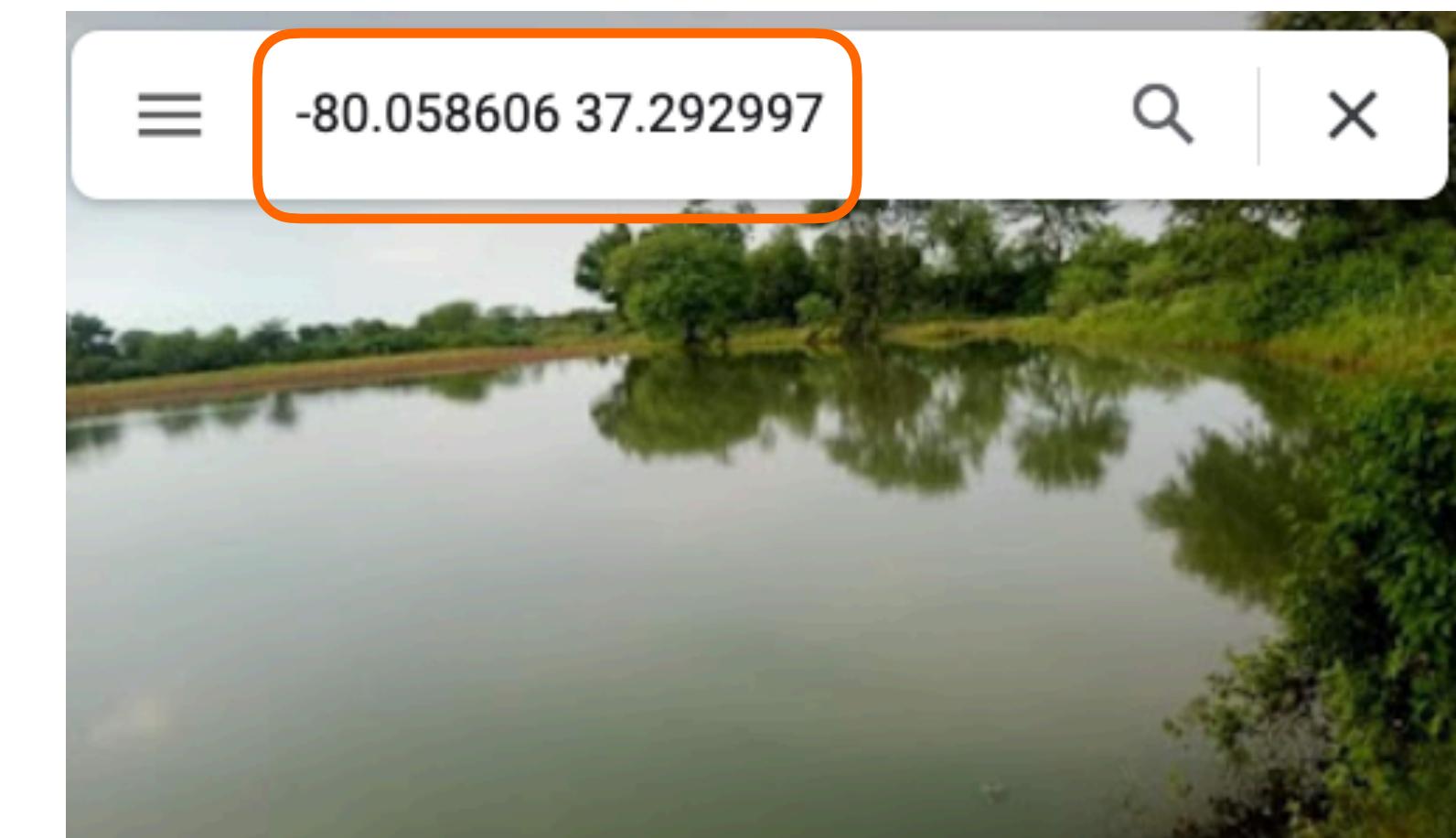
farmersmarket **farmers market** **Jan 7th,
2021**

listing_image	listing_id	listing_name
default-farmersmarket-4-3.jpg	300156	Salem Farmers Market
default-farmersmarket-4-3.jpg	300469	Grandin Village Farmers Market
default-farmersmarket-4-3.jpg	301601	The Historic City Market
default-farmersmarket-4-3.jpg	301590	Rocky Mount Farmers Market
default-farmersmarket-4-3.jpg	300467	Wytheville Farmers Market

USDA API - Need To Reformat the Table

API 12

	location_address	location_state	location_city	location_street	location_zipcode	location_x	location_y	distance	ter
one	3 East Main Street, Salem, Virginia 24153	Virginia	Salem	3 East Main Street	24153	-80.058606	37.292997	20.684638895041772	
one	2080 Westover Ave SW, Roanoke, Virginia 24015	Virginia	Roanoke	2080 Westover Ave SW	24015	-79.978064	37.265053	24.703908391067827	
one	213 Market St SE 3rd Floor, Downtown Roanoke I...	Virginia	Roanoke	213 Market St SE 3rd Floor, Downtown Roanoke Inc.	24011	-79.939064	37.271606	26.88770808513208	
one	435 Franklin St, Rocky Mount, Virginia 24151	Virginia	Rocky Mount	435 Franklin St	24151	-79.888073	36.994866	33.41846778835633	
one	210 W. Spring Street, Wytheville , Virginia 24368	Virginia	Wytheville	210 W. Spring Street	24368	-81.083367	36.9486397	40.94927484093051	
one	206 North Main Street, Galax, VA, USA	VA	Galax	206 North Main Street	24333	-80.925742	36.6632146	47.49823471075515	
one	15583 Forest Road, Forest, Virginia 24551	Virginia	Forest	15583 Forest Road	24551	-79.285443	37.3643700	63.3484440388215	



80°03'31.0"S 37°17'34.8"E

-80.058606, 37.292997



Directions



Save



Nearby



Send to
phone



Share

Antarctic Ice shield, Antarctica

2GFVW7RV+H5

Add a missing place

Add your business

Add a label

USDA API - Need To Reformat the Table

API 13

Rearrange the table: Change the order of columns

```
cols = ["listing_name", "brief_desc", "contact_name", "contact_phone",
        "media_website", "media_facebook", "media_twitter",
        "location_city", "location_state", "location_y", "location_x"]
```

```
df.loc[:, cols]
```

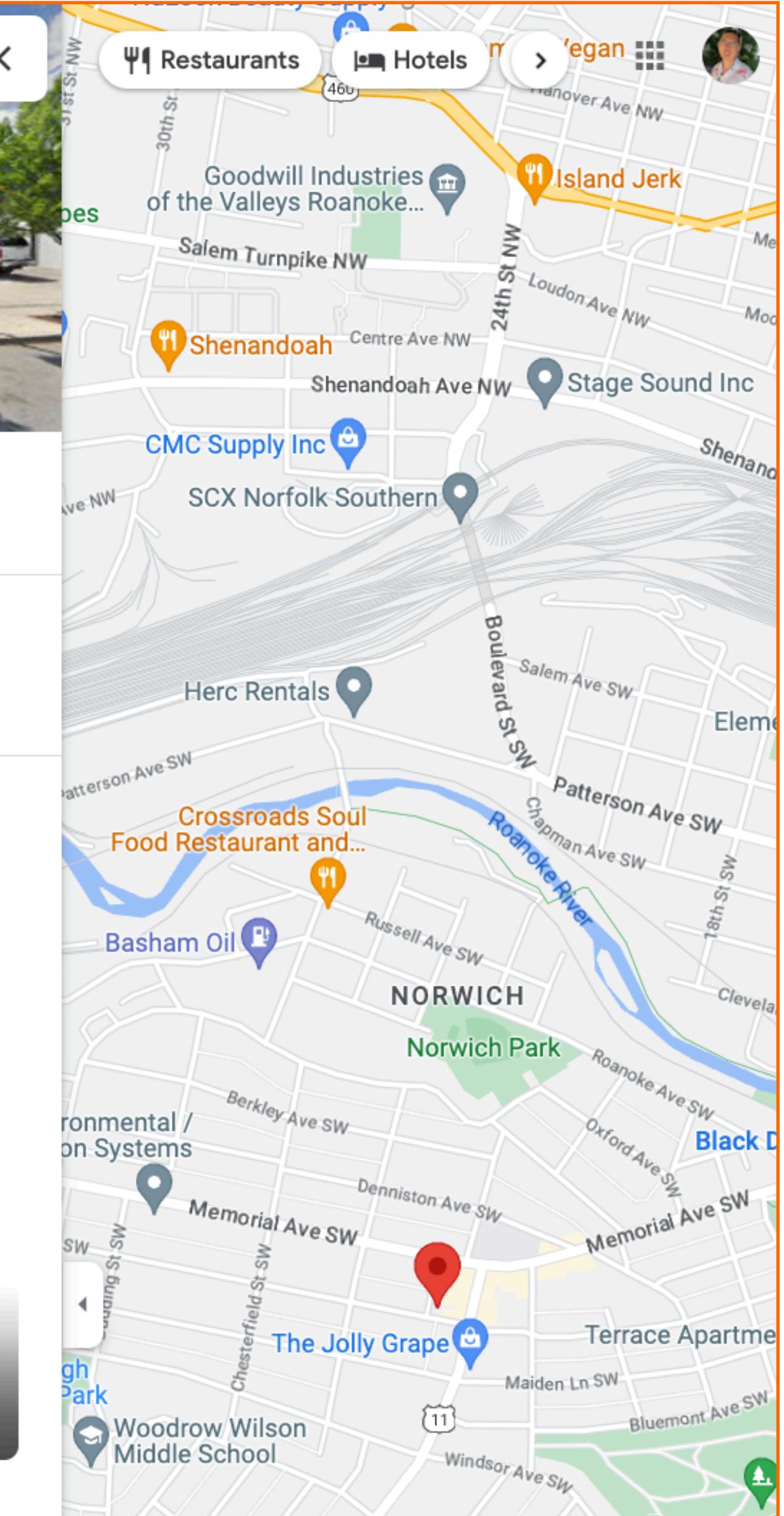
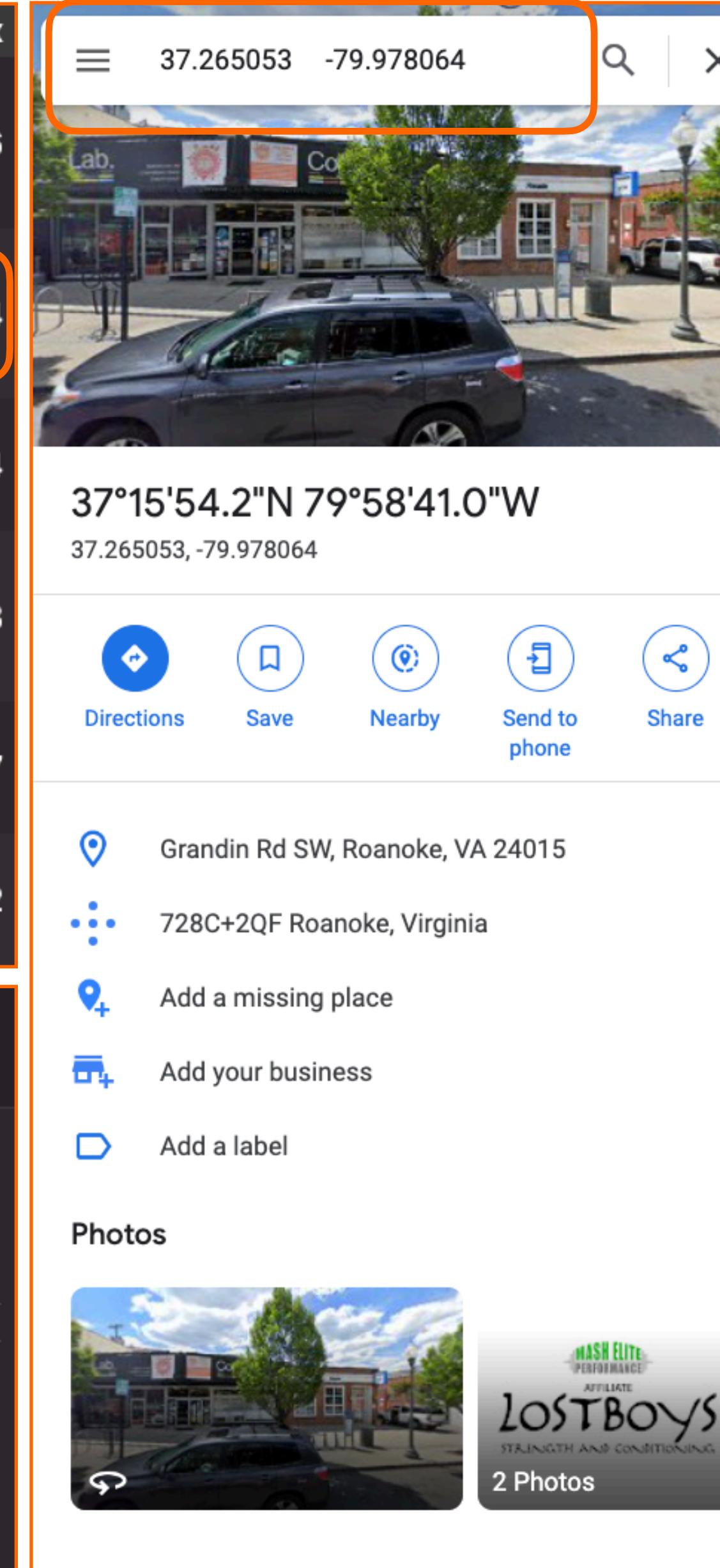
	listing_name	brief_desc	contact_name	contact_phone	media_website
0	Salem Farmers Market	Open: April to December; January to March; <br...>	Market Manager	540-375-4098	market.salemva.gov
1	Grandin Village Farmers Market	Open: April to November; November to March; <br...>	Sam Lev	540-632-1360	www.leapforlocalfood.org/grandin
2	The Historic City Market	Open: Year-round Available Products: Fresh ...	Eric L Pendleton	5403422028	Downtownroanoke.org
3	Rocky Mount Farmers Market	Open: April to December; Available Product...	Paul Cauley	540-488-2023	None
4	Wytheville Farmers Market	Open: Year-round Available Products: Fresh ...	Joanne McNulty	276-620-4095	www.wythevillefarmersmarket.com
5	Galax Farmers Market	Open: 05/11/2023 to 10/28/2023; Available ...	Jordan Shaw	276.733.4145	https://visitgalax.com/

USDA API - Need To Reformat the Table

API 14

location_city	location_state	location_y	location_x
Salem	Virginia	37.292997	-80.058606
Roanoke	Virginia	37.265053	-79.978064
Roanoke	Virginia	37.271606	-79.939064
Rocky Mount	Virginia	36.994866	-79.888073
Wytheville	Virginia	36.9486397	-81.083367
Galax	VA	36.6632146	-80.925742

```
df.loc[1, cols]  
0.0s  
  
listing_name          Grandin Village Farmers Market  
brief_desc           Open: April to November; November to March; <b>...</b>  
contact_name          Sam Lev  
contact_phone         540-632-1360  
media_website         www.leapforlocalfood.org/grandin  
media_facebook        facebook.com/grandinvillagecommunitymarket  
media_twitter         @leapforlocal  
location_city          Roanoke  
location_state         Virginia  
location_y            37.265053  
location_x             -79.978064  
Name: 1, dtype: object
```



USDA API - Exercise 1

API 15

Find the nearest On-Farm Market

The screenshot shows the USDA Economic Research Service website. At the top, there's a navigation bar with links for Home, Topics, Data Products, Publications, Newsroom, Calendar, and Amber Waves Magazine. Below this is a secondary navigation bar with links for About ERS, Careers at ERS, FAQs, Contact Us, and a search bar. The main content area is titled "ARMS Data API". It includes sections for "1. Introduction", "2. Getting Started with the API", and "2.1 Registration". The "2.1 Registration" section contains fields for First Name, Last Name, Email, and a question about how the user will use the APIs. A "Signup" button is at the bottom.

3. Reports

ARMS reports are a collection of financial data points about U.S.-based farms that can be sorted and viewed in a variety of ways, including at the national level or State level, and by farmer type or farmer age.

The ARMS team has created some commonly used tailored reports from the ARMS dataset. Currently, the following tailored reports are available on the web tool and through the API:

- Farm Business Balance Sheet
- Farm Business Income Statement
- Farm Business Financial Ratios
- Structural Characteristics
- Farm Business Debt Repayment Capacity
- Government Payments
- Operator Household Income
- Operator Household Balance Sheet

USDA API - Check the Available State and Year

API 17

REST Methods

The REST API supports POST and GET methods for calling data, except where noted.

Each endpoint also supports the OPTIONS method that returns the endpoint schema and details on input fields and requirements, such as format, whether the field allows

/arms/state

This API resource gets all States and the metadata and variables available for each of the States.

Input fields: not needed

Method: supports GET only

```
GET https://api.ers.usda.gov/data/arms/state?api_key=YOUR_API_KEY
```

/arms/year

This API resource gets all available years for which data are available.

Input fields: not needed

Method: supports GET only

```
GET https://api.ers.usda.gov/data/arms/year?api_key=YOUR_API_KEY
```

```
params = {"api_key": API}
url = "https://api.ers.usda.gov/data/arms/year"
response = requests.get(url, headers=headers, params=params)
json_data = response.json()
json_data
✓ 0.8s

Output exceeds the size limit. Open the full output data in a text editor
{'status': 'ok',
 'info': {'timing': {'executing': 110, 'unit': 'ms'},
           'result_coverage': 'total',
           'total': {'record_count': 26}},
 'data': [2021,
          2020,
          2019,
          2018,
          2017,
          2016,
          2015,
          2014,
          2013,
          2012,
          2011,
          2010,
          2009,
          2008,
          2007,
          2006,
          2005,
          2004,
          2003,
          2002,
          2001,
          ...
          2000,
          1999,
          1998,
          1997,
          1996]}}
```

USDA API - Read the Error Message

API 18

/arms/surveydata

Input fields: "Year" is a required field; at least one of the two input fields ("report" or "variable") is also required.

Method: supports GET and POST

OPTION: returns the schema for the survey data REST resource

```
POST https://api.ers.usda.gov/data/arms/surveydata?api_key=YOUR_API_KEY
{
  "year": [2011, 2012, 2013, 2014, 2015, 2016]
  "state": "all"
  "variable": "igcfi"
  "category": "NASS Regions"
  "category2": "Collapsed Farm Typology"
}
```

The above retrieves "Gross Farm Income" for years 2011 through 2016 for "All States" and broken by Category = NASS regions and Category2 = Collapsed Farm Typology.

```
GET https://api.ers.usda.gov/data/arms/surveydata?api_key=YOUR_API_KEY&year=2015,2016&state=all&rep
```

This GET request returns income statements for years 2015 and 2016 of commercial farms across all States.

Note: Multiple values for fields that allow multiple values are separated by "commas" (,), and names of fields exceeding more than one word are separated by a "plus" sign (+).

Different query parameters such as year, State, report, etc., are separated by an "ampersand" (&).

```
params = {"api_key": API, "Year": 2019}
url = "https://api.ers.usda.gov/data/arms/surveydata"
response = requests.get(url, headers=headers, params=params)
json_data = response.json()
json_data
✓ 0.4s

{'status': 'ERROR',
 'info': None,
 'message': 'The request does not meet the requirements of this resource.',
 'detail': [{'message': 'Call this resource using the method OPTIONS to get input requirements and more information.'}],
 'errors': {'report': 'The report field is required.', 'variable': 'The variable field is required.'}}
```

Sometimes, we need to check the error message to get the correct spelling or syntax

USDA API - Check the Available Report

API 19

```
params = {"api_key": API}
url = "https://api.ers.usda.gov/data/arms/report"
response = requests.get(url, headers=headers, params=params)
js = response.json()
js.keys()
df = pd.DataFrame(response.json()["data"])
df
```

✓ 1.2s

	id	name	desc
0	1	Farm Business Balance Sheet	None
1	2	Farm Business Income Statement	None
2	3	Farm Business Financial Ratios	None
3	4	Structural Characteristics	None
4	5	Farm Business Debt Repayment Capacity	None
5	6	Government Payments	None
6	7	Operator Household Income	None
7	8	Operator Household Balance Sheet	None

USDA API - Check the Available Report

API 20

```
params = {"api_key": API}
url = "https://api.ers.usda.gov/data/arms/report"
response = requests.get(url, headers=headers, params=params)
js = response.json()
js.keys()
df = pd.DataFrame(response.json()["data"])
df
✓ 1.2s
```

	id	name	desc
0	1	Farm Business Balance Sheet	None
1	2	Farm Business Income Statement	None
2	3	Farm Business Financial Ratios	None
3	4	Structural Characteristics	None
4	5	Farm Business Debt Repayment Capacity	None
5	6	Government Payments	None
6	7	Operator Household Income	None
7	8	Operator Household Balance Sheet	None

```
params = {
    "api_key": API,
    "Year": 2018,
    "report": "Farm Business Income Statement",
}

url = "https://api.ers.usda.gov/data/arms/surveydata"
response = requests.get(url, headers=headers, params=params)
json_data = response.json()
data = pd.DataFrame(json_data["data"])
data
✓ 1.6s
```

	year	state	report	farmtype	category	category_value	category2	category2_value
0	2018	All survey states	Farm Business Income Statement	All Farms	Operator Age	55 to 64 years old	All Farms	TOTAL
1	2018	All survey states	Farm Business Income Statement	All Farms	Farm Typology	Retirement farms (2011 to present)	All Farms	TOTAL
2	2018	All survey states	Farm Business Income Statement	All Farms	Farm Typology	Farming occupation/lower-sales farms (2011 to ...)	All Farms	TOTAL
3	2018	All survey states	Farm Business Income Statement	All Farms	Collapsed Farm Typology	Intermediate farms	All Farms	TOTAL
4	2018	All survey states	Farm Business Income Statement	All Farms	NASS Region	Atlantic region	All Farms	TOTAL
...
1483	2018	All survey states	Farm Business Income Statement	All Farms	Economic Class	Less than \$100,000	All Farms	TOTAL

USDA API - Farm Business Income Statement

API 21

5. Available Categories

Categories are meta tags that provide context for the data. The available categories are listed below with their short IDs inside the parentheses.

- Residence farms
- Intermediate farms
- Commercial farms

Economic Class (sal)

- \$1,000,000 or more
- \$500,000 to \$999,999
- \$250,000 to \$499,999
- \$100,000 to \$249,999
- less than \$100,000

NASS region (n5reg)

- Atlantic region
- South region
- Midwest region
- Plains region
- West region

Production Specialty (spec)

- General cash grains
- Wheat
- Corn
- Soybean
- Tobacco, cotton, peanuts
- Other field crops
- Specialty crops (F, V, N)
- Cattle
- Dairy
- Hogs
- Poultry
- All other livestock

```
params = {
    "api_key": API,
    "Year": 2018,
    "report": "Farm Business Income Statement",
}
```

```
url = "https://api.ers.usda.gov/data/arms/surveydata"
response = requests.get(url, headers=headers, params=params)
json_data = response.json()
data = pd.DataFrame(json_data["data"])
data
```

✓ 1.6s

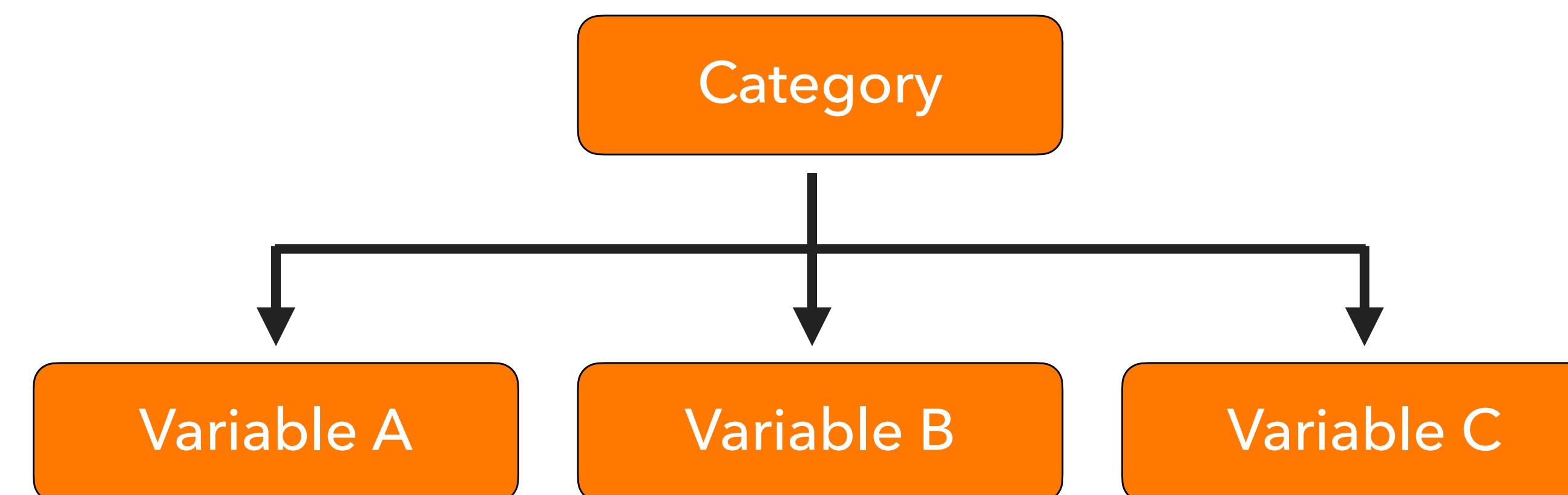
year	state	report	farmtype	category	category_value	category2	category2_value
0	All survey states	Farm Business Income Statement	All Farms	Operator Age	55 to 64 years old	All Farms	TOTAL
1	All survey states	Farm Business Income Statement	All Farms	Farm Typology	Retirement farms (2011 to present)	All Farms	TOTAL
2	All survey states	Farm Business Income Statement	All Farms	Farm Typology	Farming occupation/lower-sales farms (2011 to ...)	All Farms	TOTAL
3	All survey states	Farm Business Income Statement	All Farms	Collapsed Farm Typology	Intermediate farms	All Farms	TOTAL
4	All survey states	Farm Business Income Statement	All Farms	NASS Region	Atlantic region	All Farms	TOTAL
...
1483	All survey states	Farm Business Income Statement	All Farms	Economic Class	Less than \$100,000	All Farms	TOTAL

USDA API - Farm Business Income Statement

API 22

Check the unique variables

```
data["variable_name"].unique()
0.0s
array(['Farms', 'Gross cash farm income', 'Livestock income',
       'Crop sales', 'Government payments', 'Other farm-related income',
       'Total cash expenses', 'Variable expenses', 'Livestock purchases',
       'Feed', 'Other livestock-related', 'Seed and plants',
       'Fertilizer and chemicals', 'Utilities', 'Labor', 'Fuels and oils',
       'Repairs and maintenance', 'Machine-hire and custom work',
       'Other variable expenses', 'Fixed expenses',
       'Real estate and property taxes', 'Interest', 'Insurance premiums',
       'Rent and lease payments', 'Net cash farm income',
       'Nonmoney income', 'Value of inventory change', 'Depreciation',
       'Labor, non-cash benefits', 'Adjusted breeding livestock income',
       'Net farm income'], dtype=object)
```



category_value	category2	category2_value	variable_id	variable_name
55 to 64 years old	All Farms		TOTAL	kount
Retirement farms (2011 to present)	All Farms		TOTAL	kount
Farming occupation/lower-sales farms (2011 to ...)	All Farms		TOTAL	kount
Intermediate farms	All Farms		TOTAL	kount
Atlantic region	All Farms		TOTAL	kount
...
Less than \$100,000	All Farms		TOTAL	infi
Soybean	All Farms		TOTAL	infi
Tobacco, Cotton, Peanuts	All Farms		TOTAL	infi
Poultry	All Farms		TOTAL	infi
All other livestock	All Farms		TOTAL	infi

USDA API - Rearrange the Table

API 23

Get the variable “all gross cash income” across all categories

```
cols = ["year", "category", "category_value", "estimate", "median", "rse"]  
✓ 0.0s  
  
data.loc[:, cols]  
✓ 0.0s
```

	year	category	category_value	estimate	median	rse
48	2018	Operator Age	34 years or younger	212459.0	30102.0	11.8
49	2018	Operator Age	55 to 64 years old	188384.0	7140.0	4.0
50	2018	Operator Age	65 years or older	108034.0	8865.0	6.3
51	2018	Farm Typology	Farming occupation/lower-sales farms (2011 to ...)	27750.0	9800.0	4.1
52	2018	Farm Typology	Very large farms (2011 to present)	11634254.0	7404800.0	11.3
53	2018	Farm Typology	Nonfamily farms (2011 to present)	972226.0	80000.0	13.9
54	2018	NASS Region	Atlantic region	82234.0	6773.0	6.2
55	2018	NASS Region	Midwest region	182084.0	20136.0	2.4
56	2018	Farm Resource Region	Northern Crescent	142177.0	11476.0	4.3
57	2018	Farm Resource Region	Eastern Uplands	41110.0	5500.0	13.2
58	2018	Farm Resource Region	Southern Seaboard	72604.0	6000.0	9.5
59	2018	Farm Resource Region	Fruitful Rim	290985.0	5000.0	6.1
60	2018	Farm Resource Region	Basin and Range	106174.0	3200.0	13.6
61	2018	Economic Class	\$1,000,000 or more	2483630.0	1459666.0	4.2
62	2018	Economic Class	\$500,000 to \$999,999	684711.0	667841.0	1.5
63	2018	Economic Class	\$250,000 to \$499,999	371353.0	352900.0	1.4

Relative standard error

Relative standard error (RSE) A measure of an estimate's reliability. The RSE of an estimate is obtained by dividing the standard error of the estimate, SE(r), by the estimate itself, r. This quantity is expressed as a percentage of the estimate and is calculated as: $RSE = 100 \times [SE(r)/(r)]$

<https://www.cdc.gov/nchs/hus/sources-definitions/rse> :

Relative standard error (RSE) - Health, United States

```

datasub = data.loc[:, cols]
datasub["se"] = datasub["estimate"] * (datasub["rse"] / 100)
datasub["upper"] = datasub["estimate"] + datasub["se"] * 1.96 # 95% CI
datasub["lower"] = datasub["estimate"] - datasub["se"] * 1.96 # 95% CI

```

✓ 0.0s

datasub										
	year	category	category_value	estimate	median	rse	se	upper	lower	
48	2018	Operator Age	34 years or younger	212459.0	30102.0	11.8	25070.162	2.615965e+05	1.633215e+05	
49	2018	Operator Age	55 to 64 years old	188384.0	7140.0	4.0	7535.360	2.031533e+05	1.736147e+05	
50	2018	Operator Age	65 years or older	108034.0	8865.0	6.3	6806.142	1.213740e+05	9.469396e+04	
51	2018	Farm Typology	Farming occupation/lower-sales farms (2011 to ...)	27750.0	9800.0	4.1	1137.750	2.997999e+04	2.552001e+04	
52	2018	Farm Typology	Very large farms (2011 to present)	11634254.0	7404800.0	11.3	1314670.702	1.421101e+07	9.057499e+06	
53	2018	Farm Typology	Nonfamily farms (2011 to present)	972226.0	80000.0	13.9	135139.414	1.237099e+06	7.073527e+05	
54	2018	NASS Region	Atlantic region	82234.0	6773.0	6.2	5098.508	9.222708e+04	7.224092e+04	
55	2018	NASS Region	Midwest region	182084.0	20136.0	2.4	4370.016	1.906492e+05	1.735188e+05	
56	2018	Farm Resource Region	Northern Crescent	142177.0	11476.0	4.3	6113.611	1.541597e+05	1.301943e+05	
57	2018	Farm Resource Region	Eastern Uplands	41110.0	5500.0	13.2	5426.520	5.174598e+04	3.047402e+04	
58	2018	Farm Resource Region	Southern Seaboard	72604.0	6000.0	9.5	6897.380	8.612286e+04	5.908514e+04	

USDA API - Create a Wrap-Up Function: Query

API 25

What are the inputs and outputs in this section of code?

```
params = {  
    "api_key": API,  
    "Year": 2018,  
    "report": "Farm Business Income Statement",  
}  
url = "https://api.ers.usda.gov/data/arms/surveydata"  
response = requests.get(url, headers=headers, params=params)  
json_data = response.json()  
data = pd.DataFrame(json_data["data"])
```

USDA API - Create a Wrap-Up Function: Query

API 26

What are the inputs and outputs in this section of code?

```
params = {  
    "api_key": API,  
    "Year": 2018,  
    "report": "Farm Business Income Statement",  
}  
url = "https://api.ers.usda.gov/data/arms/surveydata"  
response = requests.get(url, headers=headers, params=params)  
json_data = response.json()  
data = pd.DataFrame(json_data["data"])
```

Default input
↑

```
def query_data(year, API, report="Farm Business Income Statement"):  
    # inputs  
    params = {  
        "api_key": API,  
        "Year": year,  
        "report": report,  
    }  
    headers = {  
        "User-Agent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/85.0.4183.122 Safari/537.36",  
        "Referer": "https://www.google.com/",  
    }  
    url = "https://api.ers.usda.gov/data/arms/surveydata"  
    # query  
    response = requests.get(url, headers=headers, params=params)  
    print("status code:", response.status_code)  
    json_data = response.json()  
    data = pd.DataFrame(json_data["data"])  
    # parse output  
    data = data.query("variable_name == 'Gross cash farm income'")  
    return data
```

USDA API - Create a Wrap-Up Function: Post-Processing

API 27

```
def post_process(data):
    cols = ["year", "category", "category_value", "estimate", "median", "rse"]
    datasub = data.loc[:, cols]
    datasub["se"] = datasub["estimate"] * (datasub["rse"] / 100)
    datasub["upper"] = datasub["estimate"] + datasub["se"] * 1.96 # 95% CI
    datasub["lower"] = datasub["estimate"] - datasub["se"] * 1.96 # 95% CI
    return datasub
```

USDA API - Wrap-Up Functions

API 28

Query

```
def query_data(year, API, report="Farm Business Income Statement"):  
    # inputs  
    params = {  
        "api_key": API,  
        "Year": year,  
        "report": report,  
    }  
    headers = {  
        "User-Agent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/85.0.4183.122 Safari/537.36",  
        "Referer": "https://www.google.com/",  
    }  
    url = "https://api.ers.usda.gov/data/arms/surveydata"  
    # query  
    response = requests.get(url, headers=headers, params=params)  
    print("status code:", response.status_code)  
    json_data = response.json()  
    data = pd.DataFrame(json_data["data"])  
    # parse output  
    data = data.query("variable_name == 'Gross cash farm income'")  
    return data
```

Post-processing

```
def post_process(data):  
    cols = ["year", "category", "category_value", "estimate", "median", "rse"]  
    datasub = data.loc[:, cols]  
    datasub["se"] = datasub["estimate"] * (datasub["rse"] / 100)  
    datasub["upper"] = datasub["estimate"] + datasub["se"] * 1.96 # 95% CI  
    datasub["lower"] = datasub["estimate"] - datasub["se"] * 1.96 # 95% CI  
    return datasub
```

Implementation

✓ 1.3s

status code: 200

year	category	category_value	estimate	median	rse	se	upper	lower
48	Operator Age	34 years or younger	212459.0	30102.0	11.8	25070.162	2.615965e+05	1.633215e+05
49	Operator Age	55 to 64 years old	188384.0	7140.0	4.0	7535.360	2.031533e+05	1.736147e+05
50	Operator Age	65 years or older	108034.0	8865.0	6.3	6806.142	1.213740e+05	9.469396e+04
51	Farm Typology	Farming occupation/lower-sales farms (2011 to ...)	27750.0	9800.0	4.1	1137.750	2.997999e+04	2.552001e+04
52	Farm Typology	Very large farms (2011 to present)	11634254.0	7404800.0	11.3	1314670.702	1.421101e+07	9.057499e+06
53	Farm Typology	Nonfamily farms (2011 to present)	972226.0	80000.0	13.9	135139.414	1.237099e+06	7.073527e+05
54	NASS Region	Atlantic region	82234.0	6773.0	6.2	5098.508	9.222708e+04	7.224092e+04
55	NASS Region	Midwest region	182084.0	20136.0	2.4	4370.016	1.906492e+05	1.735188e+05

USDA API - Loop Over Each Year

API 29

```
data = pd.DataFrame()
for year in range(2008, 2022): # only 2008-2021
    print("Loading data for year", year)
    data_query = query_data(year, API)
    data_query = post_process(data_query)
    data = pd.concat([data, data_query], axis=0)
    time.sleep(1)
```

Q 14.6s

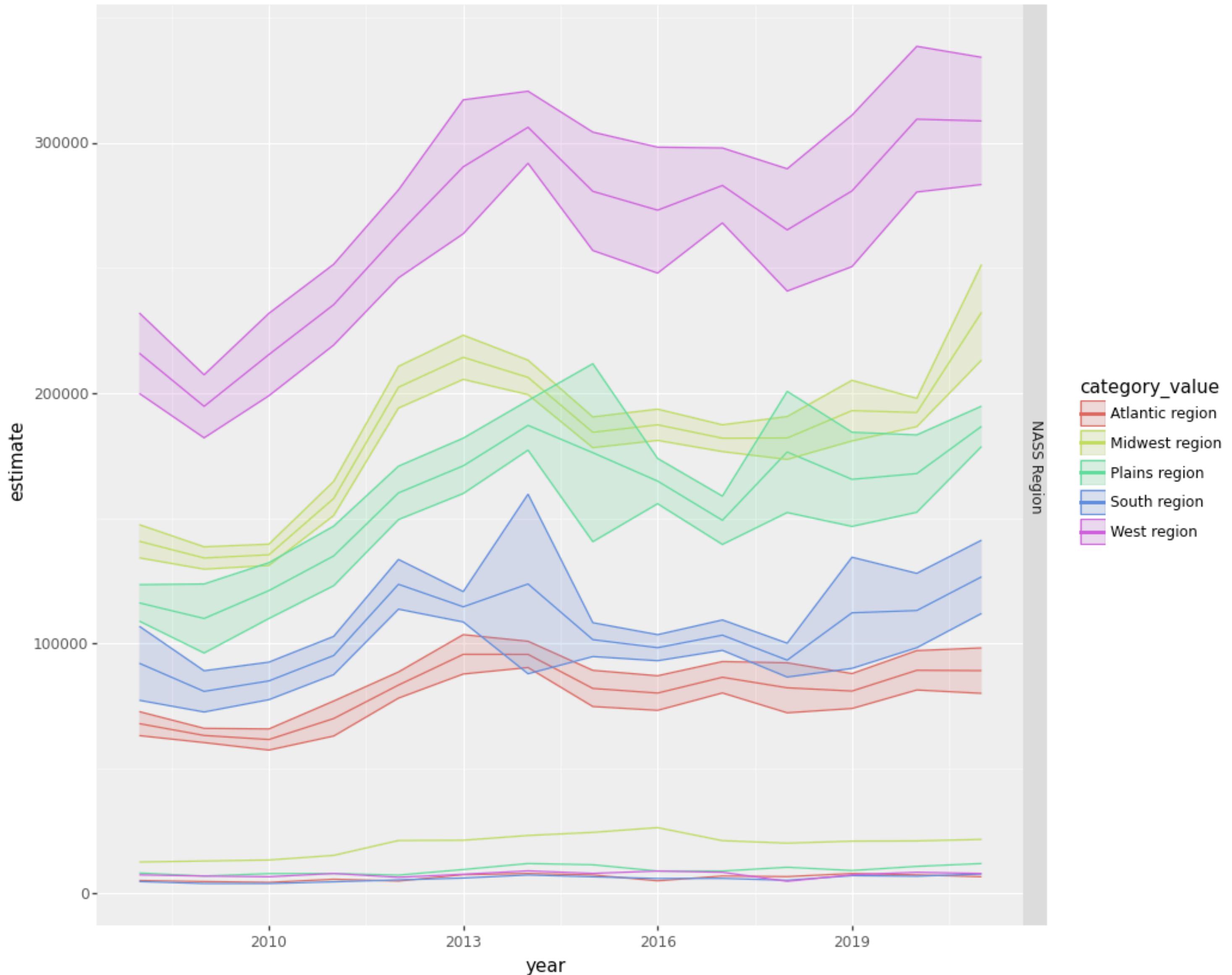
```
Loading data for year 2008
status code: 200
Loading data for year 2009
status code: 200
Loading data for year 2010
status code: 200
Loading data for year 2011
status code: 200
Loading data for year 2012
status code: 200
Loading data for year 2013
status code: 200
Loading data for year 2014
```

USDA API - Visualization

API 30

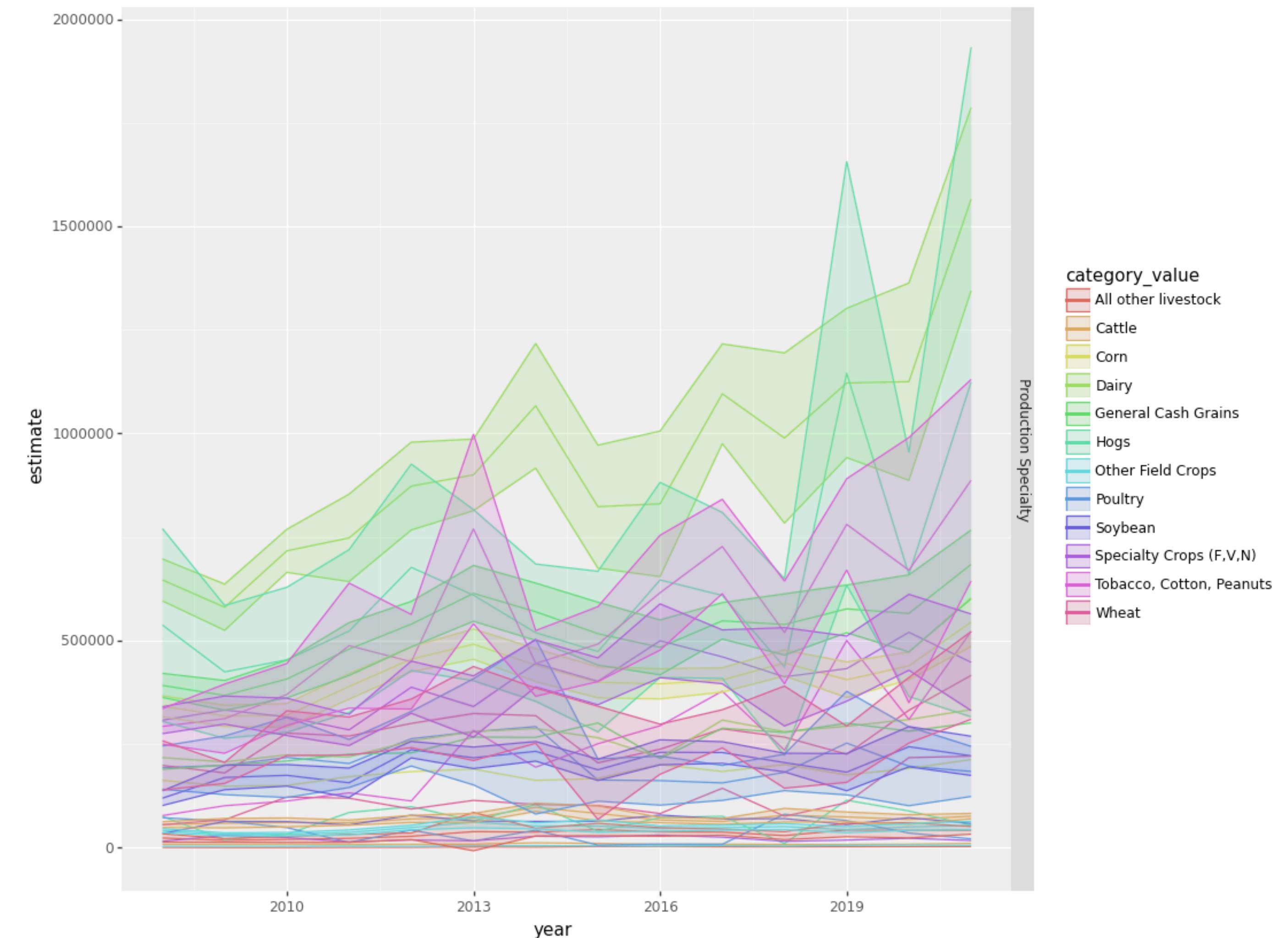
By region

```
(  
  ggplot(  
    dataplot.query("category == 'NASS Region'"),  
    aes(x="year", color="category_value", group="group"),  
  )  
  + geom_line(aes(y="estimate", color="category_value"))  
  + geom_line(aes(y="median", color="category_value"))  
  + geom_ribbon(aes(ymin="lower", ymax="upper", fill="category_value"),  
    alpha=0.2)  
  + facet_grid("category ~ .", scales="free")  
  # figure size  
  + theme(  
    figure_size=(10, 10),  
  )  
)
```



By Product

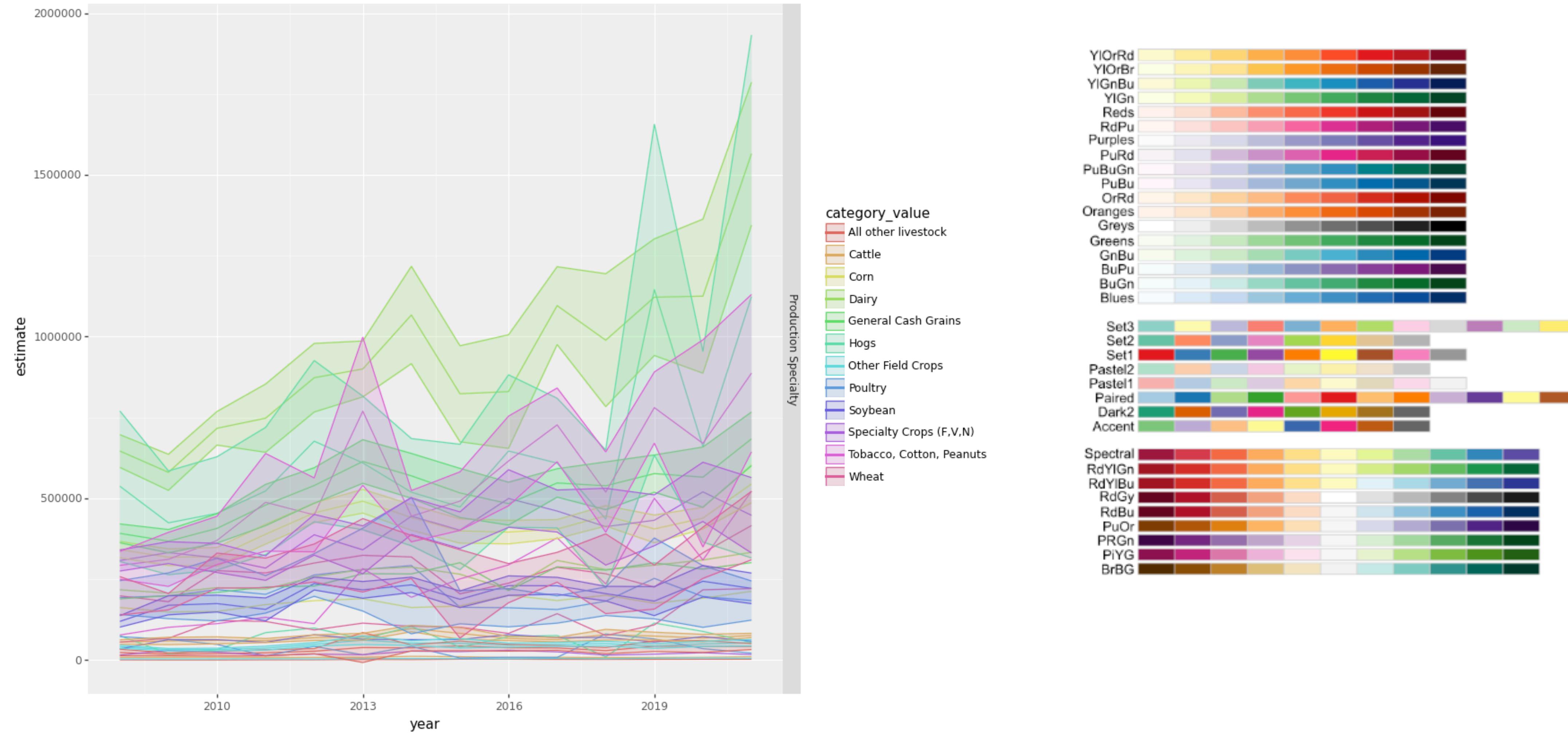
```
(ggplot(
  dataplot.query("category = 'Production Specialty'"),
  aes(
    x="year",
    color="category_value",
    fill="category_value",
    group="category_value",
  )),
  + geom_line(aes(y="estimate"))
  + geom_line(aes(y="median"))
  + geom_ribbon(aes(ymin="lower", ymax="upper"), alpha=0.2)
  + facet_grid("category ~ .", scales="free")
# color theme
  + scale_color_brewer(type="qual", palette="Paired")
  + scale_fill_brewer(type="qual", palette="Paired")
  + theme(
    figure_size=(10, 10),
)
)
```



USDA API - Visualization

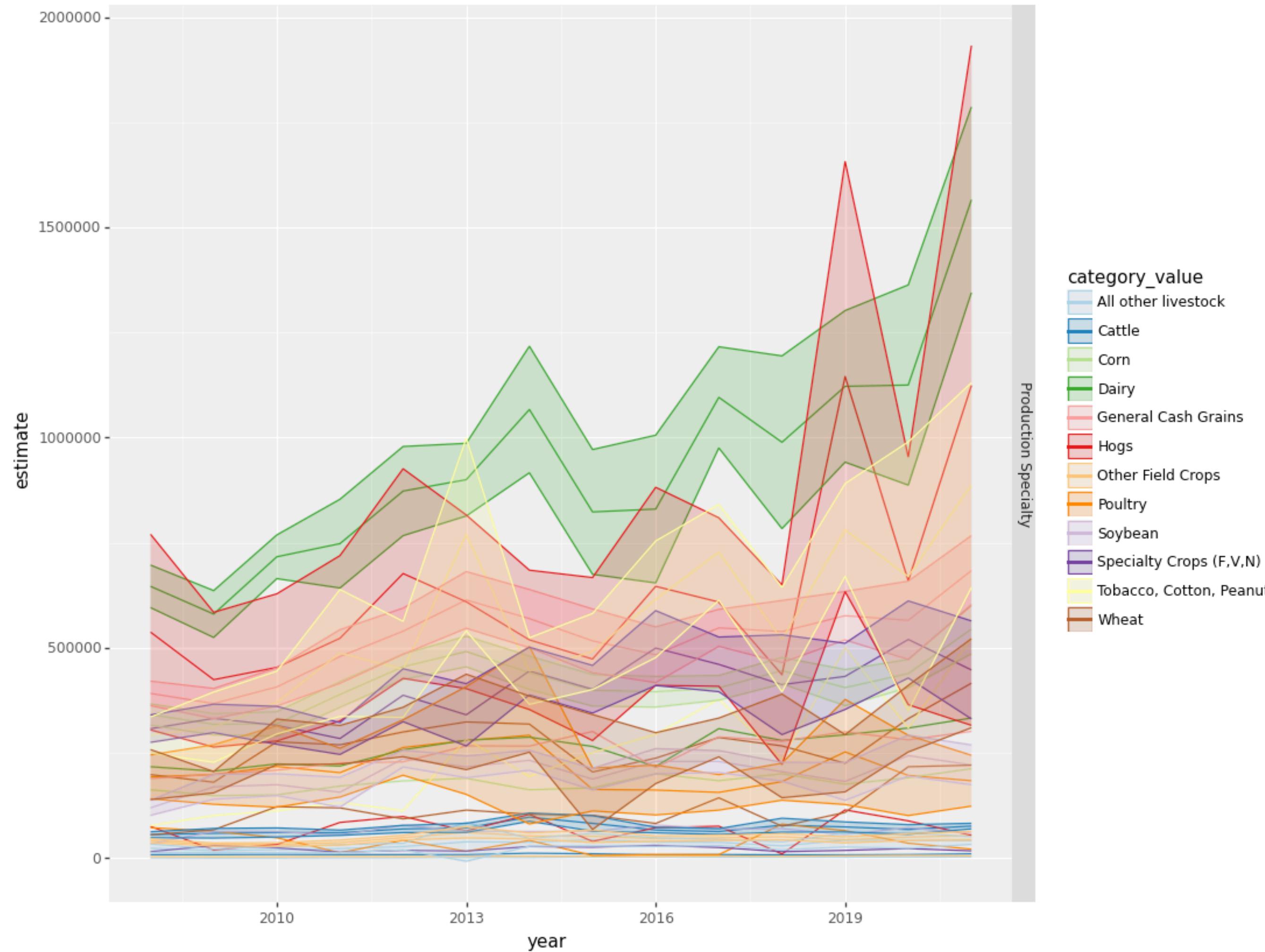
API 32

The contrast is weak... we can change the color set



<https://r-graph-gallery.com/38-rcolorbrewers-palettes.html>

The contrast is weak... we can change the color set

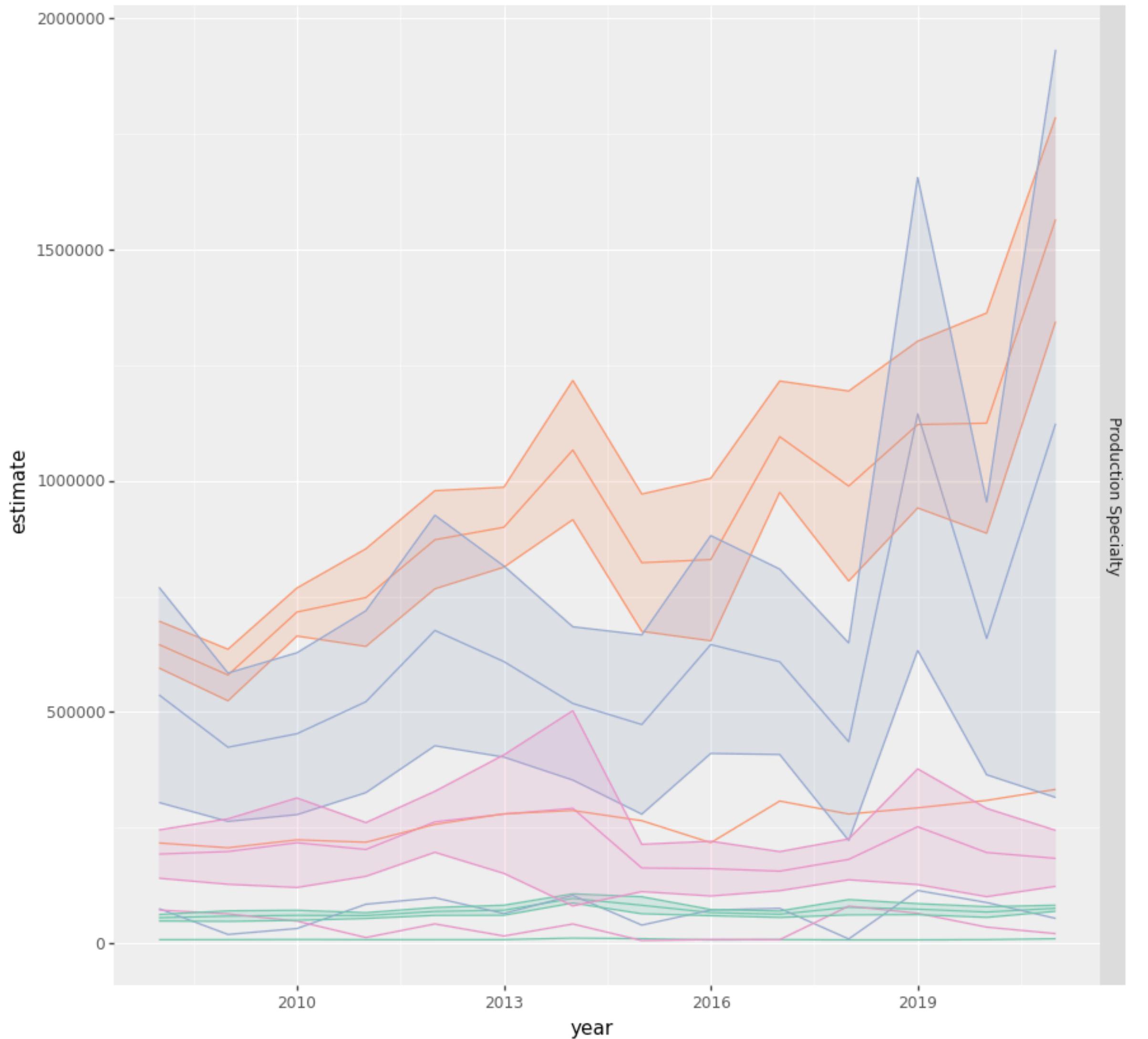


```
( ggplot(
  dataplot.query("category = 'Production Specialty'),
  aes(
    x="year",
    color="category_value",
    fill="category_value",
    group="category_value",
  ),
  +
  geom_line(aes(y="estimate"))
  +
  geom_line(aes(y="median"))
  +
  geom_ribbon(aes(ymin="lower", ymax="upper"), alpha=0.2)
  +
  facet_grid("category ~ .", scales="free")
  # color theme
  +
  scale_color_brewer(type="qual", palette="Paired")
  +
  scale_fill_brewer(type="qual", palette="Paired")
  +
  theme(
    figure_size=(10, 10),
  )
)
```

USDA API - Visualization

API 34

Or we can reduce the displayed items

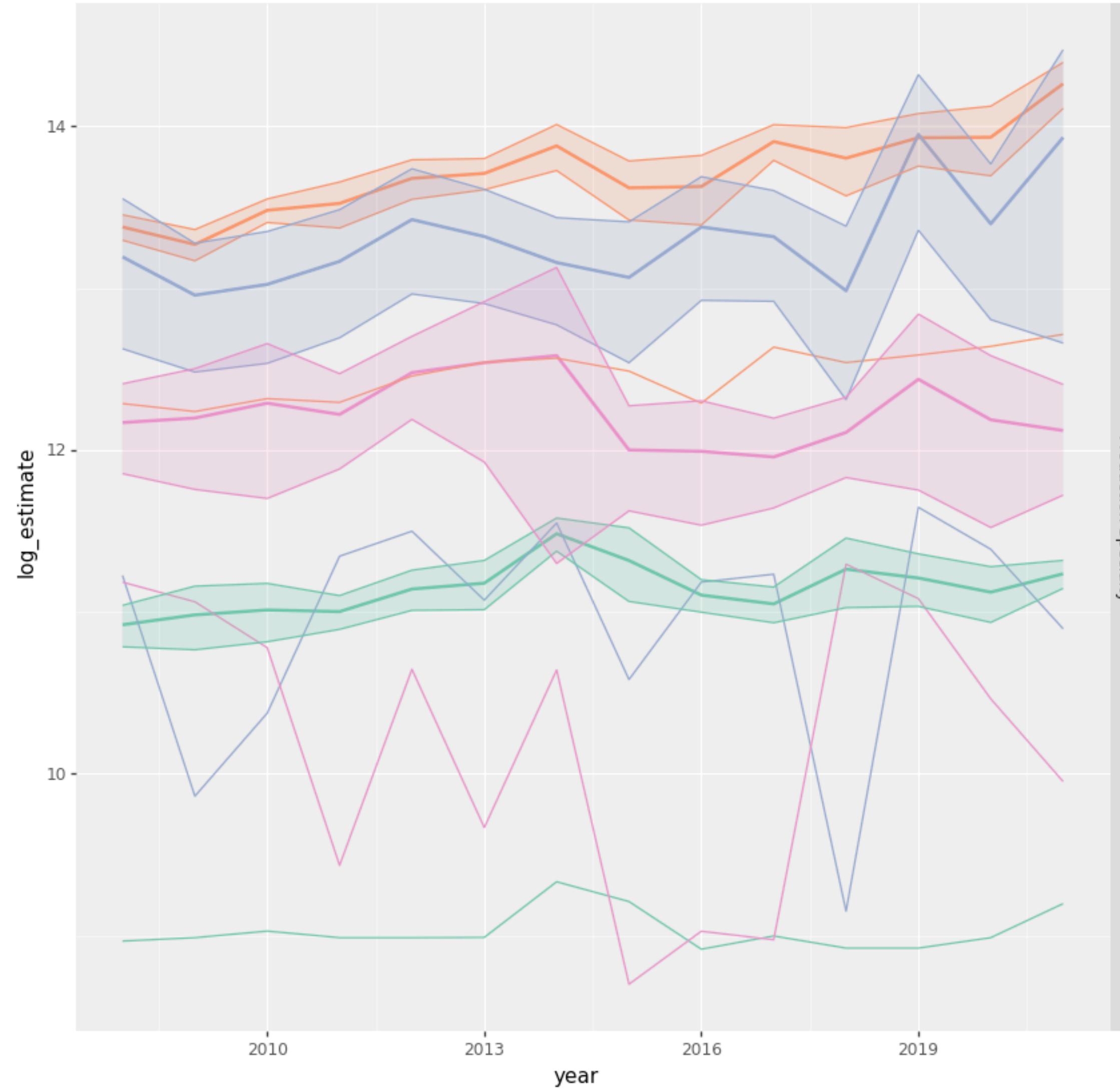


```
(ggplot(
  dataplot.query(
    category == 'Production Specialty' and category_value in ['Dairy', 'Cattle', 'Hogs', 'Poultry']
  ),
  aes(
    x="year",
    color="category_value",
    fill="category_value",
    group="category_value",
  )
) +
  geom_line(aes(y="estimate"))
  + geom_line(aes(y="median"))
  + geom_ribbon(aes(ymin="lower", ymax="upper"), alpha=0.2)
  + facet_grid("category ~ .", scales="free")
# color theme
  + scale_color_brewer(type="qual", palette="Set2")
  + scale_fill_brewer(type="qual", palette="Set2")
  + theme(
    figure_size=(10, 10),
))
```

USDA API - Visualization

API 35

And apply a log-transformation



```
import numpy as np
dataplot["log_estimate"] = np.log(dataplot["estimate"])
dataplot["log_upper"] = np.log(dataplot["upper"])
dataplot["log_lower"] = np.log(dataplot["lower"])
dataplot["log_median"] = np.log(dataplot["median"])

(
    ggplot(
        dataplot.query(
            "category == 'Production Specialty' and category_value in
            'Cattle', 'Hogs', 'Poultry'"
        ),
        aes(
            x="year",
            color="category_value",
            fill="category_value",
            group="category_value",
        )
    )
    + geom_line(aes(y="log_estimate"), size=5)
    + geom_line(aes(y="log_median"))
    + geom_ribbon(aes(ymin="log_lower", ymax="log_upper"), alpha=0.2)
    + facet_grid("category ~ .", scales="free")
    # color theme
    + scale_color_brewer(type="qual", palette="Set2")
    + scale_fill_brewer(type="qual", palette="Set2")
    + theme(
        figure_size=(10, 10),
    )
)
```