

Story 6

November 28, 2025

0.1 Story - 6 : What Is The State of Food Security and Nutrition in the US

Instructions The United Nations Food and Agriculture Organization publication, The State of Food Security and Nutrition in the World 2022 (<https://www.fao.org/documents/card/en/c/cc0639en>) might lead one to the conclusion that it's an elsewhere problem. That the people who are suffering malnutrition and starvation are "elsewhere", not in our backyard. For this assignment you will need to take a closer look here at home (the US)

Notes:

- You will need to locate and source data that reflects food security and nutrition by state broken down by men, women, children and by age groups
- Your analysis should demonstrate correlations that exist between level of poverty and food insecurity, malnutrition and starvation.
- Your data and analysis should also indicate what happens to the children as they mature into adults. Will they become fully functional citizens or will they require continued support?
- Your data visualizations need to tell the story for a political audience that you were lobbying to address the issue of food insecurity in the US
- This assignment is due at the end of the week twelve of the semester.

```
[1]: import io
import zipfile
import requests
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib.ticker import FormatStrFormatter
import numpy as np
```

```
C:\Users\johnf\AppData\Roaming\Python\Python311\site-
packages\pandas\core\arrays\masked.py:61: UserWarning: Pandas requires version
'1.3.6' or newer of 'bottleneck' (version '1.3.5' currently installed).
  from pandas.core import (
```

```
[2]: #ERS Food Security Data
ERS_ZIP_URL = "https://www.ers.usda.gov/media/799/food-security-csv-data-files.
˓→zip"
resp = requests.get(ERS_ZIP_URL)
```

```

resp.raise_for_status()

zip_bytes = io.BytesIO(resp.content)

with zipfile.ZipFile(zip_bytes) as z:
    csv_files = [name for name in z.namelist() if name.lower().endswith(".csv")]
    print("Files in ERS archive:")
    for name in csv_files:
        print("  ", name)

    # State Level Data
    state_like = [name for name in csv_files if "state" in name.lower()]
    if not state_like:
        raise RuntimeError(
            "Could not auto-detect a 'state' CSV. ")
    state_csv = state_like[0]
    print("\nUsing state-level file:", state_csv)

    with z.open(state_csv) as f:
        state_df = pd.read_csv(f, encoding="cp1252")

    # Mostly National All households data
    all_hh_like = [name for name in csv_files if "all_households" in name.lower()]
    if not all_hh_like:
        raise RuntimeError("Could not auto-detect an 'all households' CSV. ")
    all_hh_csv = all_hh_like[0]
    print("Using all-households file:", all_hh_csv)

    with z.open(all_hh_csv) as f:
        all_households_df = pd.read_csv(f, encoding="cp1252")

```

Files in ERS archive:

- foodsecurity_csv_datafiles/foodsecurity_all_households_2023.csv
- foodsecurity_csv_datafiles/foodsecurity_child_trends_2023.csv
- foodsecurity_csv_datafiles/foodsecurity_educ_emp_dis_2023.csv
- foodsecurity_csv_datafiles/foodsecurity_hh_w_children_2023.csv
- foodsecurity_csv_datafiles/foodsecurity_readme_2023.csv
- foodsecurity_csv_datafiles/foodsecurity_state_2023.csv

Using state-level file: foodsecurity_csv_datafiles/foodsecurity_state_2023.csv
Using all-households file:
foodsecurity_csv_datafiles/foodsecurity_all_households_2023.csv

[3]: ## From the state level, they are 3 year data points. Taking the 2021 - 2023 points in order to have more recent State by State info
only keeping the Food Insecurity Prevalents percent info

```

## Minimalist Latest for state level
latest_state_df = state_df[["State", "Food insecurity prevalence", "Very low food security prevalence"]][state_df['Year']=='2021-2023']
latest_state_df['year'] = 2023
latest_state_df = latest_state_df.rename(columns={"State": "state",
                                                 "Food insecurity prevalence": "Very low food security",
                                                 "Very low food security prevalence": "very_low_food_security"})
                                                 
## Over Time State Level Simple - Only Food Insecure Not any other categories
latest = state_df[["Year", "State", "Food insecurity prevalence"]][state_df["Year)=='2021-2023']
latest = latest.rename(columns={"Year": "year", "State": "state", "Food insecurity prevalence": "food_insecure_21_23"})
latest = latest.drop(columns=['year'])
earliest = state_df[["Year", "State", "Food insecurity prevalence"]][state_df["Year"]=="2006-2008"]
earliest = earliest.rename(columns={"Year": "year", "State": "state", "Food insecurity prevalence": "food_insecure_06_08"})
earliest = earliest.drop(columns=['year'])

## Merging
state_level_change = latest.merge(earliest, on=['state'])
state_level_change['food_insecure_change_0608_2123'] = state_level_change['food_insecure_21_23'] - state_level_change['food_insecure_06_08']

## Removing Country Level
state_level_change = state_level_change[state_level_change['state']!='U.S.']
state_level_change_0608_2123_final = state_level_change[["state", "food_insecure_change_0608_2123"]].sort_values(by=['food_insecure_change_0608_2123'], ascending=False)
state_level_change_0608_2123_final

## Putting together
state_level_snapshot = latest_state_df.
    merge(state_level_change_0608_2123_final, on =['state']).
    drop(columns=['year'])
# state_level_snapshot

```

[4]: ## All households over time

```

nation_yearly_food_insec = all_households_df[["Year", "Food insecure-percent", "Low food security-percent", "Very low food security-percent"]]

```

```

        ]][((all_households_df["Category"]=="All households")
            &(all_households_df["Subcategory"].isnull())))
nation_yearly_food_insec['Year'] =nation_yearly_food_insec['Year'].astype(int)
nation_yearly_food_insec = nation_yearly_food_insec.rename(columns={"Year":
    "year",
    "Food\u2014
    \u2192insecure-percent":"food_insecure_pct",
    "Low food\u2014
    \u2192security-percent":"low_food_security_pct",
    "Very low\u2014
    \u2192food security-percent":"very_low_food_security_pct"
})
# print(nation_yearly_food_insec.head())

## Regional Insec Over Time
regional_overtime = all_households_df[["Year","Subcategory","Food\u2014
    \u2192insecure-percent","Low food security-percent",
    "Very low food\u2014
    \u2192security-percent"]][all_households_df["Category"]=="Census geographic\u2014
    \u2192region"]
regional_overtime['Year'] =regional_overtime['Year'].astype(int)
regional_overtime = regional_overtime.rename(columns={"Year":
    "year","Subcategory":"region",
    "Food\u2014
    \u2192insecure-percent":"food_insecure_pct",
    "Low food\u2014
    \u2192security-percent":"low_food_security_pct",
    "Very low\u2014
    \u2192food security-percent":"very_low_food_security_pct"
})
# print('----')
# print(regional_overtime.head())

```

[5]:

```

ne_reg =_
    \u2192regional_overtime[['year','food_insecure_pct']][regional_overtime["region"]=="Northeast"].
    \u2192rename(columns={"food_insecure_pct":"northeast_food_insecure_pct"})
mw_reg =_
    \u2192regional_overtime[['year','food_insecure_pct']][regional_overtime["region"]=="Midwest"].
    \u2192rename(columns={"food_insecure_pct":"midwest_food_insecure_pct"})
so_reg =_
    \u2192regional_overtime[['year','food_insecure_pct']][regional_overtime["region"]=="South"].
    \u2192rename(columns={"food_insecure_pct":"south_food_insecure_pct"})
we_reg =_
    \u2192regional_overtime[['year','food_insecure_pct']][regional_overtime["region"]=="West"].
    \u2192rename(columns={"food_insecure_pct":"west_food_insecure_pct"})

```

```

regions = ne_reg.merge(mw_reg, on='year').merge(so_reg, on='year') .
    ↪merge(we_reg, on='year')
# regions.head()

```

[6]:

```

elderly_children_overtime = [
    ↪all_households_df[["Year", "Category", "Subcategory", "Total",
                        "Food insecure-percent", "Low",
                        "Food security-percent",
                        "Very low food",
                        "Security-percent"]][(
        (all_households_df["Category"]== 'Household composition')
        &((all_households_df["Subcategory"].isin(["With elderly"]))
           |
           ↪&all_households_df["Sub-subcategory"].isnull())))
        |(all_households_df["Subcategory"].isin(["With children < 18 years"])
           &(all_households_df["Sub-subcategory"].isnull()))]
children = [
    ↪elderly_children_overtime[elderly_children_overtime["Subcategory"]== "With children < 18 years"]]
children = children.rename(columns={"Year": "year",
                                    "Food insecure-percent": "hh_w_und_18_food_insec_pct"})
elderly = [
    ↪elderly_children_overtime[elderly_children_overtime["Subcategory"]== "With elderly"]]
elderly = elderly.rename(columns={"Year": "year",
                                    "Food insecure-percent": "hh_w_elder_food_insec_pct"})
child_eld = children[["year", "hh_w_und_18_food_insec_pct"]].
    ↪merge(elderly[["year", "hh_w_elder_food_insec_pct"]], on=["year"])
nation_yearly_food_insec = [
    ↪nation_yearly_food_insec[["year", "food_insecure_pct"]].
    ↪rename(columns={"food_insecure_pct": "national_food_insecure_pct"})]
national_overtime_snapshot = child_eld.
    ↪merge(nation_yearly_food_insec, on=['year'])
national_overtime_snapshot['year']=national_overtime_snapshot['year'].
    ↪astype(int)

# All together
overtime_all = national_overtime_snapshot.merge(regions, on = 'year')

```

[7]: # overtime_all

[8]: ### Need state name to abrv df

```

states_data = {
    "state": [
        "Alabama",
        "Alaska",

```

```
"Arizona",
"Arkansas",
"California",
"Colorado",
"Connecticut",
"Delaware",
"District of Columbia",
"Florida",
"Georgia",
"Hawaii",
"Idaho",
"Illinois",
"Indiana",
"Iowa",
"Kansas",
"Kentucky",
"Louisiana",
"Maine",
"Maryland",
"Massachusetts",
"Michigan",
"Minnesota",
"Mississippi",
"Missouri",
"Montana",
"Nebraska",
"Nevada",
"New Hampshire",
"New Jersey",
"New Mexico",
"New York",
"North Carolina",
"North Dakota",
"Ohio",
>Oklahoma",
>Oregon",
>Pennsylvania",
>Rhode Island",
>South Carolina",
>South Dakota",
>Tennessee",
>Texas",
>Utah",
>Vermont",
>Virginia",
>Washington",
>West Virginia",
```

```
"Wisconsin",
"Wyoming",
],
"state_abbrev": [
    "AL",
    "AK",
    "AZ",
    "AR",
    "CA",
    "CO",
    "CT",
    "DE",
    "DC",
    "FL",
    "GA",
    "HI",
    "ID",
    "IL",
    "IN",
    "IA",
    "KS",
    "KY",
    "LA",
    "ME",
    "MD",
    "MA",
    "MI",
    "MN",
    "MS",
    "MO",
    "MT",
    "NE",
    "NV",
    "NH",
    "NJ",
    "NM",
    "NY",
    "NC",
    "ND",
    "OH",
    "OK",
    "OR",
    "PA",
    "RI",
    "SC",
    "SD",
    "TN",
```

```

    "TX",
    "UT",
    "VT",
    "VA",
    "WA",
    "WV",
    "WI",
    "WY",
],
}
states_abbrev_df = pd.DataFrame(states_data)

```

[9]: *Enriching the processed State dfs*

```

state_level_change_0608_2123_final = state_level_change_0608_2123_final.
    ↪rename(columns={"state":"state_abbrev"})
state_level_change_0608_2123_final = state_level_change_0608_2123_final.
    ↪merge(states_abbrev_df,on=["state_abbrev"])
state_level_change_0608_2123_final = state_level_change_0608_2123_final.
    ↪rename(columns={"food_insecure_change":"food_insecure_change_08_23"})

latest_state_df = latest_state_df[latest_state_df['state']!='U.S.']..
    ↪rename(columns={"state":"state_abbrev"})
latest_state_df = latest_state_df.merge(states_abbrev_df,on=["state_abbrev"])

```

[10]: *----- 1. Poverty by state (ACS 2023 1-year, subject table S1701) -----*

```

ACS SUBJECT_URL = "https://api.census.gov/data/2023/acs/acs1/subject"

# S1701_C03_001E = Percent of population below poverty level (all persons)
poverty_params = {"get": "NAME,S1701_C03_001E", "for": "state:*",}
poverty_resp = requests.get(ACS_SUBJECT_URL, params=poverty_params)
poverty_resp.raise_for_status()
poverty_data = poverty_resp.json()

poverty_cols = poverty_data[0]
poverty_rows = poverty_data[1:]

poverty_df = pd.DataFrame(poverty_rows, columns=poverty_cols)

# Convert to numeric and clean column names
poverty_df["S1701_C03_001E"] = pd.to_numeric(
    poverty_df["S1701_C03_001E"], errors="coerce"
)
poverty_df = poverty_df.rename(columns={
    "NAME": "state",
    "S1701_C03_001E": "poverty_rate_pct",
    "state": "state_fips",
})

```

```

poverty_df = poverty_df[["state", "state_fips", "poverty_rate_pct"]]

print("Poverty data (first 5 rows):")
print(poverty_df.head())

```

Poverty data (first 5 rows):

	state	state_fips	poverty_rate_pct
0	Alabama	01	15.6
1	Alaska	02	10.4
2	Arizona	04	12.4
3	Arkansas	05	15.7
4	California	06	12.0

[11]: *## merging the poverty df with the food insecurity to show correlation*
`poverty_food_sec_states_2023 = latest_state_df.merge(poverty_df, on=['state'])`
poverty_food_sec_states_2023

[12]: *# Use the detailed ACS 1-year dataset, not the subject dataset*
`ACS_DETAILED_URL = "https://api.census.gov/data/2023/acs/acss1"`

```

# C22001_001E = Total households
# C22001_002E = Households that received Food Stamps/SNAP in the past 12 months
snap_params = {
    "get": "NAME,C22001_001E,C22001_002E",
    "for": "state:*",
}

snap_resp = requests.get(ACS_DETAILED_URL, params=snap_params)
snap_resp.raise_for_status()
snap_data = snap_resp.json()

snap_cols = snap_data[0]
snap_rows = snap_data[1:]

snap_df = pd.DataFrame(snap_rows, columns=snap_cols)
snap_df["C22001_001E"] = pd.to_numeric(snap_df["C22001_001E"], errors="coerce")
snap_df["C22001_002E"] = pd.to_numeric(snap_df["C22001_002E"], errors="coerce")

# Compute percent of households receiving SNAP
snap_df["snap_households_pct"] = (snap_df["C22001_002E"] /
    ↪snap_df["C22001_001E"] * 100)
snap_df = snap_df.rename(columns={"NAME": "state",
                                  "C22001_001E": "households_total",
                                  "C22001_002E": "households_snap",
                                  "state": "state_fips",
})

```

```
snap_df = snap_df[["state", "state_fips", "households_total",
                   "households_snap", "snap_households_pct"]]
```

```
[13]: #Pulling in the Other State-level data 2023
state_level_2023 = snap_df.merge(poverty_food_sec_states_2023, □
    ↪on=['state', 'state_fips']).rename(columns={"food_insecure_pct_21_23": □
    ↪"food_insecure_pct"})
state_level_2023 = □
    ↪state_level_2023[["state", "households_total", "households_snap", "snap_households_pct", "food_"
# state_level_2023
```

0.1.1

0.1.2 Visualization 1 - The current State of Food Insecurity (Breakdown of Demographics Impacted)

```
[14]: import matplotlib.pyplot as plt
from matplotlib.ticker import FormatStrFormatter # changed from □
    ↪PercentFormatter

# ----- Data prep -----
snap_df = overtime_all[[
    "year",
    "hh_w_und_18_food_insec_pct",
    "hh_w_elder_food_insec_pct",
    "national_food_insecure_pct",
]].copy()

snap_df["year"] = pd.to_numeric(snap_df["year"], errors="coerce")
snap_df = snap_df.sort_values("year")

# ----- custom colors -----
color_all = "#3C91E6"      # Bright Ocean
color_children = "#FA824C" # Coral Glow
color_elder = "#A2D729"    # Yellow Green
bg_color = "#FAFFFD"      # Porcelain
text_grey = "#342E37"      # Shadow Grey
# ----- 

fig, ax = plt.subplots(figsize=(12, 6))

fig.patch.set_facecolor(bg_color)
ax.set_facecolor(bg_color)

title_text = "Food Insecurity Changed for U.S. Households"
subtitle_text = (
```

```

    "With the recent dialogue around SNAP benefits in the U.S amid the\u
    \tumultuous government shutdown, the question arises how\n"
    "common is food insecurity among U.S. households. Particularly, amongst\u
    \tthe more vulnerable populations. Below highlights the\n"
    "percentage of households experiencing food insecurity for all households\u
    \tnationwide, all households that have children under 18,\n"
    "and those households that have elderly members."
)

# Title
fig.suptitle(
    title_text,
    fontsize=20,
    weight="bold",
    color=text_grey,
    x=0.5,
    y=0.98,
)

# Subtitle (slightly larger & a bit farther from title)
fig.text(
    0.5,
    0.92,           # moved down a bit for better spacing
    subtitle_text,
    ha="center",
    va="top",
    fontsize=12,   # larger
    color=text_grey,
)

# ----- Lines -----
ax.plot(
    snap_df["year"],
    snap_df["national_food_insecure_pct"],
    label="All Households",
    linewidth=2.2,
    color=color_all,
)

ax.plot(
    snap_df["year"],
    snap_df["hh_w_und_18_food_insec_pct"],
    label="Households with children <18",
    linewidth=2.2,
    color=color_children,
)

```

```

ax.plot(
    snap_df["year"],
    snap_df["hh_w_elder_food_insec_pct"],
    label="Households with older adults",
    linewidth=2.2,
    color=color_elder,
)

# ----- Minimalist axes -----
ax.grid(False)
for spine in ["top", "right", "left", "bottom"]:
    ax.spines[spine].set_visible(False)

ax.tick_params(axis="both", length=4, width=1, colors=text_grey)

ax.set_xlabel("", color=text_grey)
ax.set_ylabel(
    "Household Category Percentage",
    color=text_grey,
)
# Y-axis as whole numbers only
ax.yaxis.set_major_formatter(FormatStrFormatter('%.0f'))

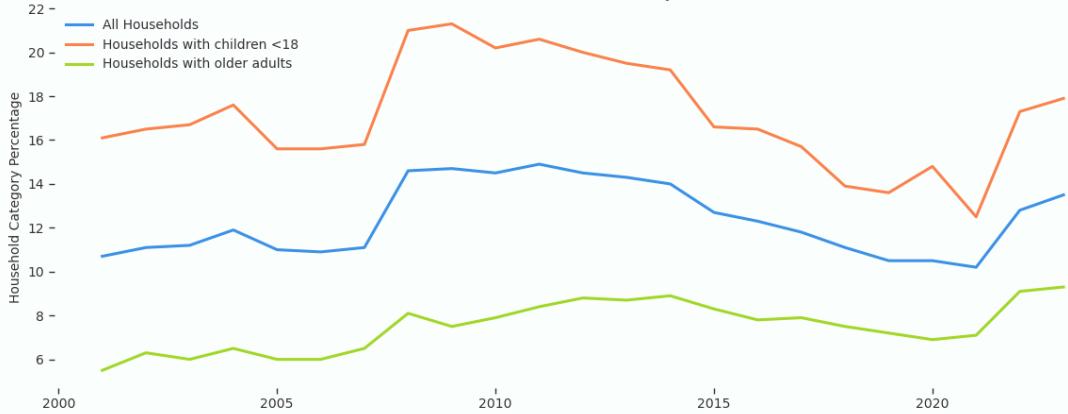
# Legend
legend = ax.legend(frameon=False, loc="upper left")
for text in legend.get_texts():
    text.set_color(text_grey)

# Source note
fig.text(
    0.01,
    0.02,
    "Source: USDA Economic Research Service, Food Security Supplement (CPS).",
    ha="left",
    va="bottom",
    fontsize=8,
    color=text_grey,
)
plt.tight_layout(rect=[0, 0.06, 1, 0.9])
plt.show()

```

Food Insecurity Changed for U.S. Households

With the recent dialogue around SNAP benefits in the U.S amid the tumultuous government shutdown, the question arises how common is food insecurity amongs U.S. households. Particularly, amongst the more vulnerable populations. Below highlights the percentage of households experiencing food insecurity for all households nationwide, all households that have children under 18, and those households that have elderly members.



Source: USDA Economic Research Service, Food Security Supplement (CPS).

0.1.3 visualization 2 - State-Level Change from 08 to 23

```
[15]: abbrev_to_name = dict(zip(states_abbrev_df["state_abbrev"],  
                             states_abbrev_df["state"]))  
bar_df = state_level_snapshot[["state", "food_insecure_change_0608_2123"]].  
        copy()  
bar_df["state_full"] = bar_df["state"].map(abbrev_to_name)  
bar_df = bar_df.sort_values("food_insecure_change_0608_2123", ascending=False)  
  
def bar_color(x):  
    return "#A2D729" if x < 0 else "#FA824C" # Yellow Green / Coral Glow  
  
bar_colors = [bar_color(x) for x in bar_df["food_insecure_change_0608_2123"]]  
  
bg_color = "#FAFFFD" # Porcelain  
text_grey = "#342E37" # Shadow Grey  
  
fig, ax = plt.subplots(figsize=(10, 12))  
fig.patch.set_facecolor(bg_color)  
ax.set_facecolor(bg_color)  
  
title_text = "Changes in Food Insecure Household Percentages by State (2008-2023)"  
subtitle_text = (  
    "We looked at nationwide trends over time, but how do individual states fare when it comes to resolving this issue.\n"  
    "This chart shows the difference in percentage points for households experiencing food insecurity in 2023 compared to\n"
```

```

    "2008. Washington, D.C. has performed the best at reducing food insecurity
    ↪households, with Kansas, Vermont, North Carolina\n"
    "and Maine rounding out the top five. While Louisiana fared the worst, with
    ↪Wyoming and Arkansas also at the bottom."
)

# ---- TITLE: same as Viz 1 ----
fig.suptitle(
    title_text,
    fontsize=20,      # same size as viz 1
    weight="bold",
    color=text_grey,
    x=0.5,
    y=0.98,          # centered, high on the figure
)

# Subtitle (you can adjust padding later)
fig.text(
    0.5,
    0.95,
    subtitle_text,
    ha="center",
    va="top",
    fontsize=12,
    color=text_grey,
)

# --- horizontal bar chart with full state names ---
ax.barh(
    bar_df["state_full"],
    bar_df["food_insecure_change_0608_2123"],
    color=bar_colors,
)

# zero reference line
ax.axvline(0, color=text_grey, linewidth=1)

# minimalist styling
for spine in ["top", "right", "left", "bottom"]:
    ax.spines[spine].set_visible(False)

ax.tick_params(
    axis="y",
    labelsize=11,
    length=0,
    colors=text_grey,
)

```

```

ax.tick_params(axis="x", length=4, width=1, colors=text_grey)

ax.set_xlabel(
    "Percentage Points Change",
    color=text_grey,
    x=0.43
)
ax.xaxis.set_major_formatter(FormatStrFormatter('%.1f'))

from matplotlib.lines import Line2D
legend_elems = [
    Line2D([0], [0], color="#A2D729", lw=6, label="Improvement (lower food↳
↳insecurity)"),
    Line2D([0], [0], color="#FA824C", lw=6, label="Worsening (higher food↳
↳insecurity)"),
]
ax.legend(handles=legend_elems, frameon=False, loc="upper right")

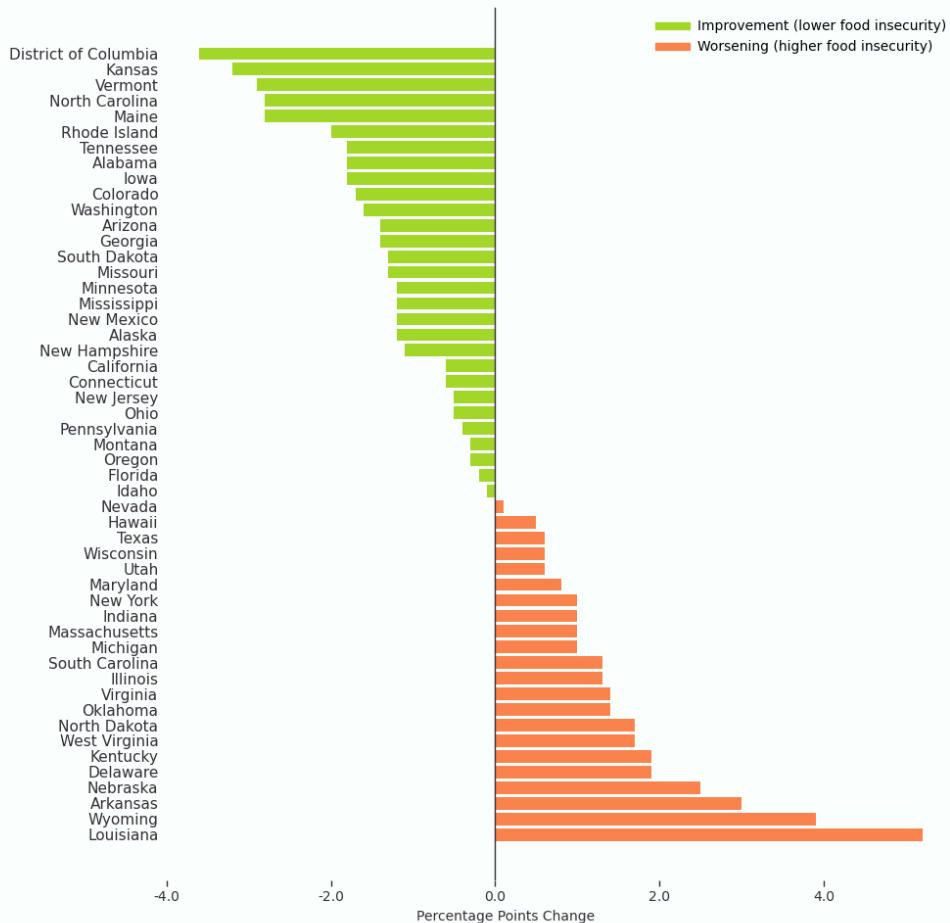
fig.text(
    0.01,
    0.02,
    "Source: USDA Economic Research Service, Food Security Supplement (CPS).",
    ha="left",
    va="bottom",
    fontsize=8,
    color=text_grey,
)

plt.tight_layout(rect=[0, 0.06, 1, 0.9])
plt.show()

```

Changes in Food Insecure Household Percentages by State (2008-2023)

We looked at nationwide trends over time, but how do individual states fare when it comes to resolving this issue. This chart shows the difference in percentage points for households experiencing food insecurity in 2023 compared to 2008. Washington, D.C. has performed the best at reducing food insecure households, with Kansas, Vermont, North Carolina and Maine rounding out the top five. While Louisiana fared the worst, with Wyoming and Arkansas also at the bottom.



Source: USDA Economic Research Service, Food Security Supplement (CPS).

0.1.4 Visualization 3 SNAP Benefits and Food Security

```
[16]: df = state_level_2023.copy()

# Categorize states by SNAP participation (low/med/high)
q1, q2 = df["snap_households_pct"].quantile([0.33, 0.66])

def snap_group(p):
    if p <= q1:
        return "Low SNAP participation"
    elif p <= q2:
        return "Medium SNAP participation"
```

```

    else:
        return "High SNAP participation"

df["snap_group"] = df["snap_households_pct"].apply(snap_group)

# New palette:
# High SNAP      -> Green
# Medium SNAP   -> Brownish grey
# Low SNAP       -> Orange

snap_colors = {
    "High SNAP participation": "#A2D729", # green
    "Medium SNAP participation": "#342E37", # brownish grey (Shadow Grey)
    "Low SNAP participation": "#FA824C", # Coral Glow / orange
}

df["color"] = df["snap_group"].map(snap_colors)

# Fit a simple regression line (poverty -> food insecurity) -----
x = df["poverty_rate_pct"].values
y = df["food_insecure_pct"].values

m, b = np.polyfit(x, y, 1) # slope, intercept
line_x = np.linspace(x.min(), x.max(), 100)
line_y = m * line_x + b
bg_color = "#FAFFFD"
text_grey = "#342E37"

fig, ax = plt.subplots(figsize=(12, 8))
fig.patch.set_facecolor(bg_color)
ax.set_facecolor(bg_color)

title_text = "The Role of Poverty and SNAP Assistance"
subtitle_text = (
    "With poverty being the main driver behind food insecurity, direct\u202a"
    "government assistance via the Supplemental Nutrition Assistance Program, or\u202a"
    "SNAP,\n"
    "is one of the main ways we help those households experiencing food\u202a"
    "insecurity. Looking at three factors together it can help drive policy\u202a"
    "changes.\n"
    "With each state being a dot on the chart, the plot shows the direct\u202a"
    "correlation between poverty levels food insecurity. Additionally, the color\u202a"
    "of \n"
    "the dots show the level of SNAP participation for that state. SNAP\u202a"
    "participation tends to be highest in states where both poverty and food\u202a"
    "insecurity\n"
)

```

```

    "are most severe, reflecting how the program targets need. Among states
    ↵with similar poverty levels, those with higher SNAP participation often
    ↵exhibit\n"
    "slightly lower food insecurity, suggesting that SNAP helps mitigate hunger.
    ↵"
)

fig.suptitle(
    title_text,
    fontsize=20,
    weight="bold",
    color=text_grey,
    x=0.5,
    y=0.97,
)

# Nudge subtitle down just a bit for breathing room
fig.text(
    0.5,
    0.93,
    subtitle_text,
    ha="center",
    va="top",
    fontsize=12,
    color=text_grey,
)
# Scatter points
for group, sub in df.groupby("snap_group"):
    ax.scatter(
        sub["poverty_rate_pct"],
        sub["food_insecure_pct"],
        label=group,
        color=snap_colors[group],
        s=70,
        alpha=0.9,
    )

# Regression line (blue)
ax.plot(
    line_x,
    line_y,
    color="#3C91E6",    # Bright Ocean
    linewidth=2,
    label="Poverty v. Food Insecurity Fit Line",
)

```

```

# Minimalist styling
ax.grid(False)
for spine in ["top", "right", "left", "bottom"]:
    ax.spines[spine].set_visible(False)

ax.tick_params(axis="both", length=4, width=1, colors=text_grey)

ax.set_xlabel("Poverty rate (%)", color=text_grey)
ax.set_ylabel("Food Insecure Households (%)", color=text_grey)

ax.xaxis.set_major_formatter(FormatStrFormatter('%.0f'))
ax.yaxis.set_major_formatter(FormatStrFormatter('%.0f'))

# Legend
legend = ax.legend(frameon=False, loc="lower right")
for text in legend.get_texts():
    text.set_color(text_grey)

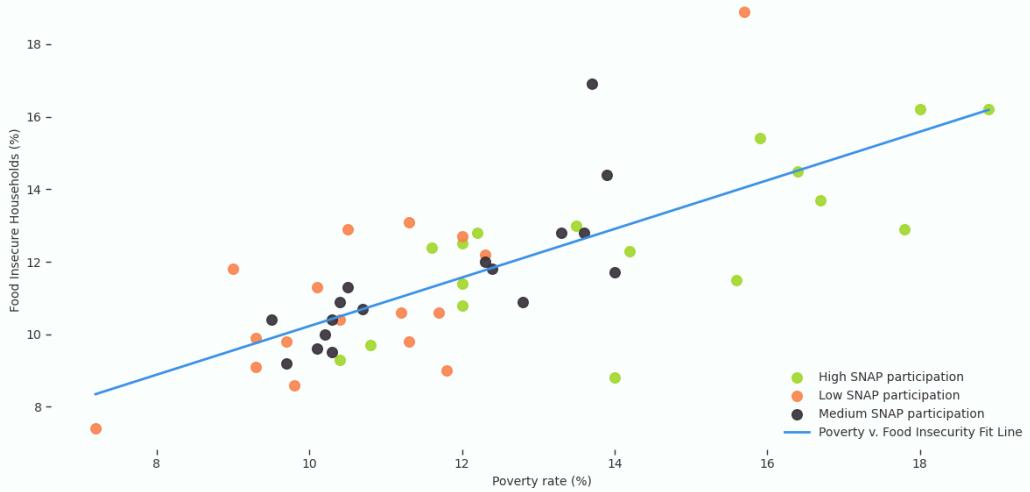
# Source note
fig.text(
    0.01,
    0.02,
    "Source: USDA Economic Research Service (food insecurity), U.S. Census\u2022Bureau ACS 2023 (poverty, SNAP).",
    ha="left",
    va="bottom",
    fontsize=8,
    color=text_grey,
)
# A bit more margin at top & bottom for text and legend
plt.tight_layout(rect=[0, 0.08, 1, 0.88])
plt.show()

```

The Role of Poverty and SNAP Assistance

With poverty being the main driver behind food insecurity, direct government assistance via the Supplemental Nutrition Assistance Program, or SNAP, is one of the main ways we help those households experiencing food insecurity. Looking at three factors together it can help drive policy changes.

With each state being a dot on the chart, the plot shows the direct correlation between poverty levels food insecurity. Additionally, the color of the dots show the level of SNAP participation for that state. SNAP participation tends to be highest in states where both poverty and food insecurity are most severe, reflecting how the program targets need. Among states with similar poverty levels, those with higher SNAP participation often exhibit slightly lower food insecurity, suggesting that SNAP helps mitigate hunger.



Source: USDA Economic Research Service (food insecurity), U.S. Census Bureau ACS 2023 (poverty, SNAP).

0.2 ——————SCRAP BELOW—————

0.2.1 Visualilzation 2 - Change Over Time by Region (Line Chart)

```
[17]: # import matplotlib.pyplot as plt
# from matplotlib.ticker import FormatStrFormatter

# # ----- Data prep -----
# region_df = overtime_all[[
#     "year",
#     "northeast_food_insecure_pct",
#     "midwest_food_insecure_pct",
#     "south_food_insecure_pct",
#     "west_food_insecure_pct",
# ]].copy()

# region_df["year"] = pd.to_numeric(region_df["year"], errors="coerce")
# region_df = region_df.sort_values("year")

# # ----- custom colors -----
# color_ne = "#3C91E6"          # Bright Ocean
# color_mw = "#FA824C"          # Coral Glow
# color_s  = "#A2D729"          # Yellow Green
# color_w  = "#342E37"          # Shadow Grey
```

```

# bg_color = "#FAFFFD"      # Porcelain
# text_grey = "#342E37"      # Shadow Grey
# # -------

# fig, ax = plt.subplots(figsize=(12, 6))

# fig.patch.set_facecolor(bg_color)
# ax.set_facecolor(bg_color)

# title_text = "How Has Food Insecurity Changed Across U.S. Regions?"
# subtitle_text = (
#     "Share of households that are food insecure in each Census region, 2001-"
#     "2023.\n"
#     "Each line shows the percent of households in that region that report"
#     "food insecurity."
# )

# # Title
# fig.suptitle(
#     title_text,
#     fontsize=20,
#     weight="bold",
#     color=text_grey,
#     x=0.5,
#     y=0.97,
# )

# # Subtitle (slightly larger with extra spacing)
# fig.text(
#     0.5,
#     0.92,
#     subtitle_text,
#     ha="center",
#     va="top",
#     fontsize=12,
#     color=text_grey,
# )

# # ----- Lines -----
# ax.plot(
#     region_df["year"],
#     region_df["northeast_food_insecure_pct"],
#     label="Northeast",
#     linewidth=2.2,
#     color=color_ne,
# )

```

```

# ax.plot(
#     region_df["year"],
#     region_df["midwest_food_insecure_pct"],
#     label="Midwest",
#     linewidth=2.2,
#     color=color_mw,
# )

# ax.plot(
#     region_df["year"],
#     region_df["south_food_insecure_pct"],
#     label="South",
#     linewidth=2.2,
#     color=color_s,
# )

# ax.plot(
#     region_df["year"],
#     region_df["west_food_insecure_pct"],
#     label="West",
#     linewidth=2.2,
#     color=color_w,
# )

## ----- Minimalist axes -----
# ax.grid(False)
# for spine in ["top", "right", "left", "bottom"]:
#     ax.spines[spine].set_visible(False)

# ax.tick_params(axis="both", length=4, width=1, colors=text_grey)

# ax.set_xlabel("Year", color=text_grey)
# ax.set_ylabel(
#     "Households experiencing food insecurity by region (%)",
#     color=text_grey,
# )

## Y-axis as whole numbers only
# ax.yaxis.set_major_formatter(FormatStrFormatter('%.0f'))

## Legend
# legend = ax.legend(frameon=False, loc="upper left")
# for text in legend.get_texts():
#     text.set_color(text_grey)

## Source note
# fig.text(

```

```
#      0.01,
#      0.02,
# "Source: USDA Economic Research Service, Food Security Supplement (CPS).",
# ha="left",
# va="bottom",
# fontsize=8,
# color=text_grey,
# )

# plt.tight_layout(rect=[0, 0.06, 1, 0.9])
# plt.show()
```