Unlocking SNAP Participation Patterns in the United States

Around the globe low-income families need support to supplement their grocery budget so they can afford nutritious food essential to health.

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The Supplemental Nutrition Assistance Program (SNAP) is a federal program in the United States that helps families buy nutritional food to maintain their health and well-being. Although this program is provided based on the family size, income and expenses, it requires the household to recognize they may qualify and complete the required processes to apply.

The goal was, to run an Emerging Hot Spot Analysis and Local Outlier Analysis tools to enable the evaluation of how SNAP

participation rates have changed over time in the contiguous United States for 2019.

This information can help decision makers distribute resources more efficiently and equitably, ensuring that healthy food is accessible to all SNAP recipients.

The Hot Spot Analysis and Outlier Analysis tools use statistics to detect spatial patterns in data.

Each provides slightly different information about these patterns.

The **Hot Spot Analysis tool** uses the *Getis-Ord Gi* statistic* to identify statistically significant spatial clusters of high values (hot spots) and low values (cold spots).

The **Outlier Analysis tool** uses the *Anselin Local Moran's I statistic* to identify statistically significant clusters of high and low values and to detect spatial outliers, or features with values that are significantly dissimilar from their neighbors.

Space-time pattern mining tools use statistics to incorporate the spatial and temporal aspects of your data.

It help in understanding the data spatiotemporal trends.

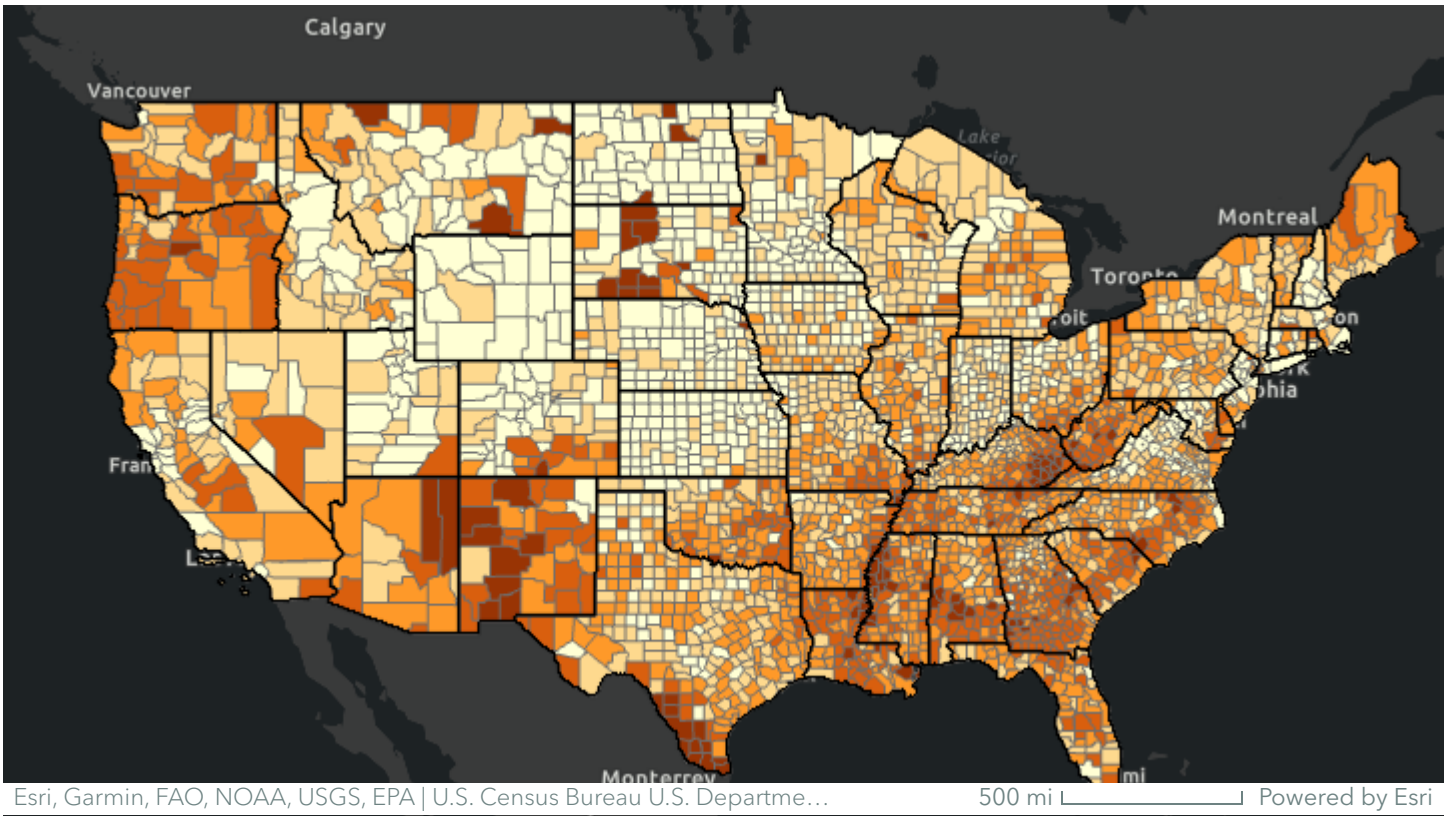
The initial step in space-time pattern mining is creating a space-time cube. A space-time cube aggregates the data into a multidimensional cube data structure (netCDF). The cube aggregates the data into space-time bins with the x and y dimensions representing space and the t dimension representing time.

Three tools in the Space Time Pattern Mining toolbox can be used to create a space-time cube. Based on the data available

and spatial question, we used the ***optimized statistical cluster analysis tools*** to explore spatial patterns in the data.

Discovering the Hidden Patterns

Imagine being able to decipher the unspoken patterns of need. Through the lens of advanced pattern detection analysis, we embarked on a journey to uncover these invisible threads.



Pattern Detection ahamandrew 10/6/2023

The map illustrates the counties in the contiguous United States. Each county is symbolized by the rate of the population that participated in SNAP during 2019. Darker colors represent higher participation.

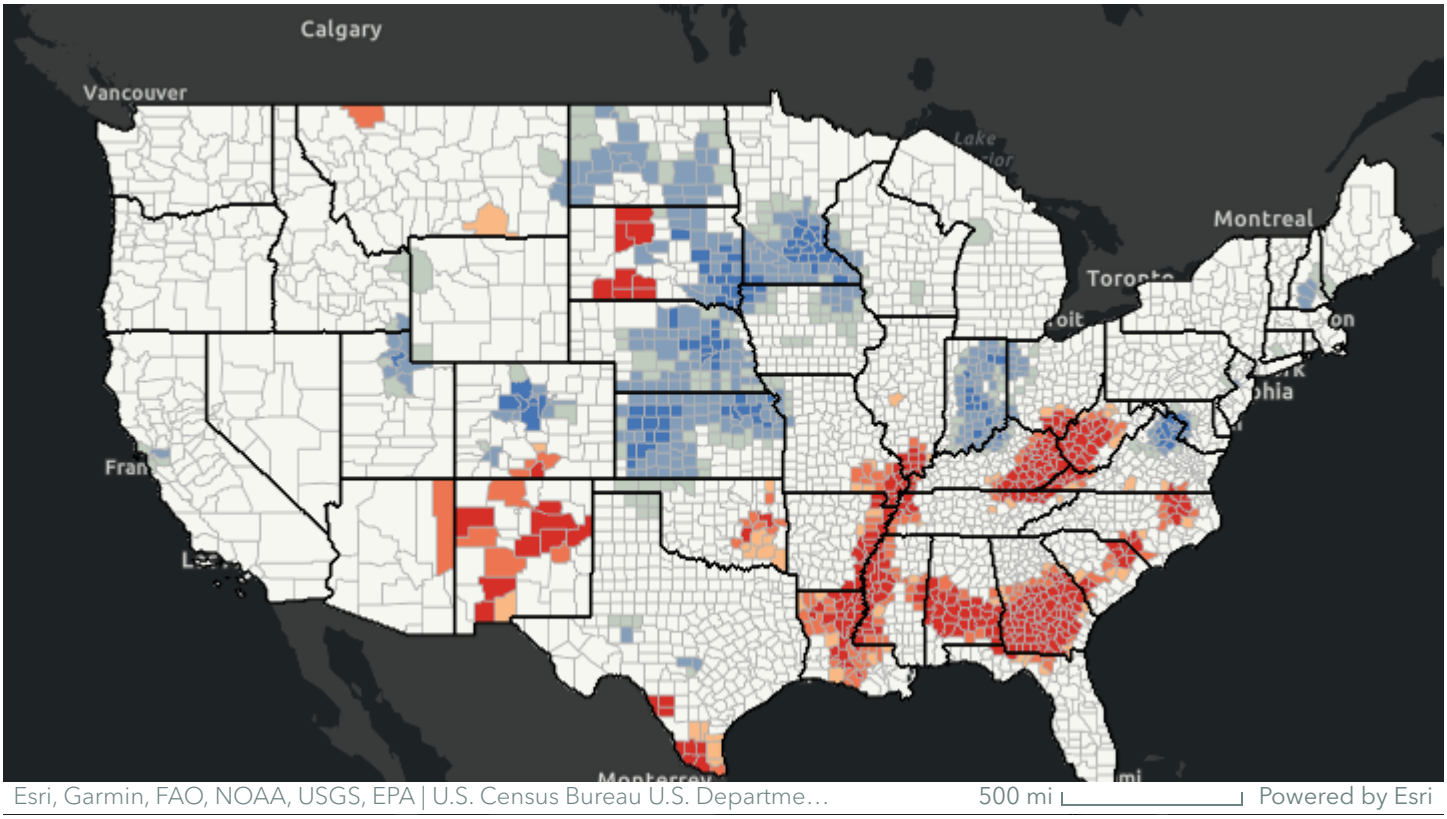
This map is our treasure map, unveiling clusters of people seeking aid through SNAP. It's provides a general perspective of where the need is most pronounced and where efforts can

be amplified. As the patterns come alive on the map, we begin to see places that need immediate attention.

I completed a hot spot analysis and an outlier analysis to identify areas with statistically significantly high SNAP participation

Hotspot:

The statistical analysis provided a measure of confidence that can helped us identify areas with clusters of high SNAP participation. We used this information to investigate these areas and their access to stores that accept SNAP and carry healthy foods.



Hot Spot Map Showing Counties that have high and low participation - Pattern Detection ahamandrew 10/6/2023

The result of our analysis is a layer displaying hot spots in three shades of red and cold spots in three shades of blue. The varying shades correspond to three confidence intervals,

indicating how confident we can be that these patterns are not the result of random chance.

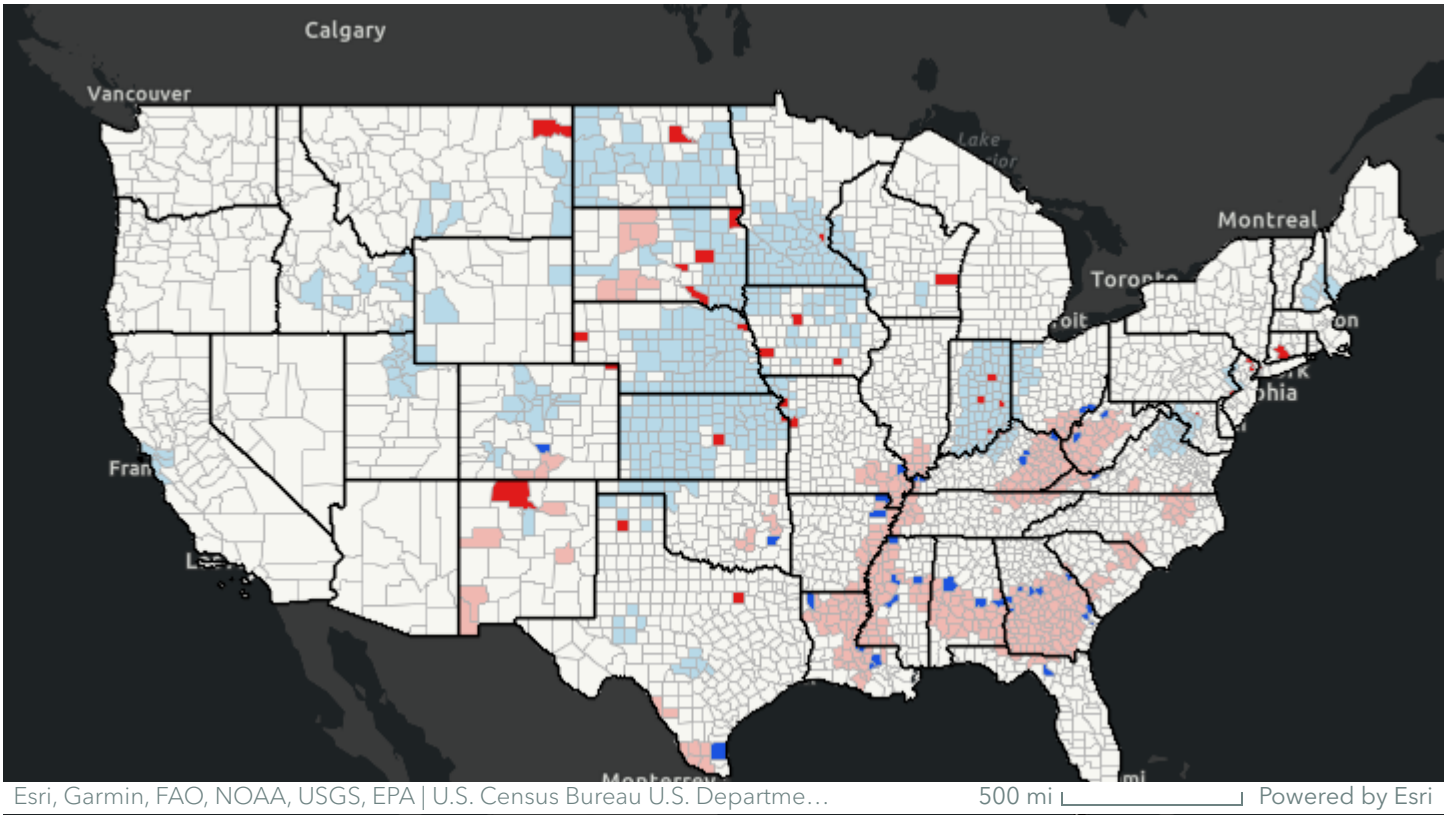
The map above shows a strong concentration of southeastern states with high SNAP participation rates. Louisiana, Mississippi, Alabama, and Georgia are clusters of states in the southeastern region and are hotspots for SNAP participation rates.

North-Central states such as Nebraska and Kansas shows an opposite picture with participation in SNAP much lower compared to southeastern states.

Outliers:

Earlier states with high and low SNAP participation rates were described. However, within these states there are a few outliers compared to the surrounding region.

Programs utilized to expand SNAP access or expand job opportunities should take these counties into account.



Outliers of SNAP Participation Rates - Pattern Detection ahamandrew 10/6/2023

Completing an outlier analysis helped to identify features that have values that are statistically significantly different from neighbors' values. This analysis thus provide additional insight into the spatial patterns of the data.

The bright red and blue features represent spatial outliers. Features with high values surrounded by areas with low values are called High-Low outliers and are displayed in red. Features with low values surrounded by areas with high values are called Low-High outliers and are displayed in dark blue. The pink and light blue colors indicate clusters of features with statistically significantly high values (pink) and statistically significantly low values (light blue). These clusters typically align with the hot spots and cold spots from the Optimized Hot Spot Analysis tool.

Statewide efforts might be beneficial for states with high SNAP participation rates, but individual counties must be evaluated per basis to avoid allocating resources to outliers.

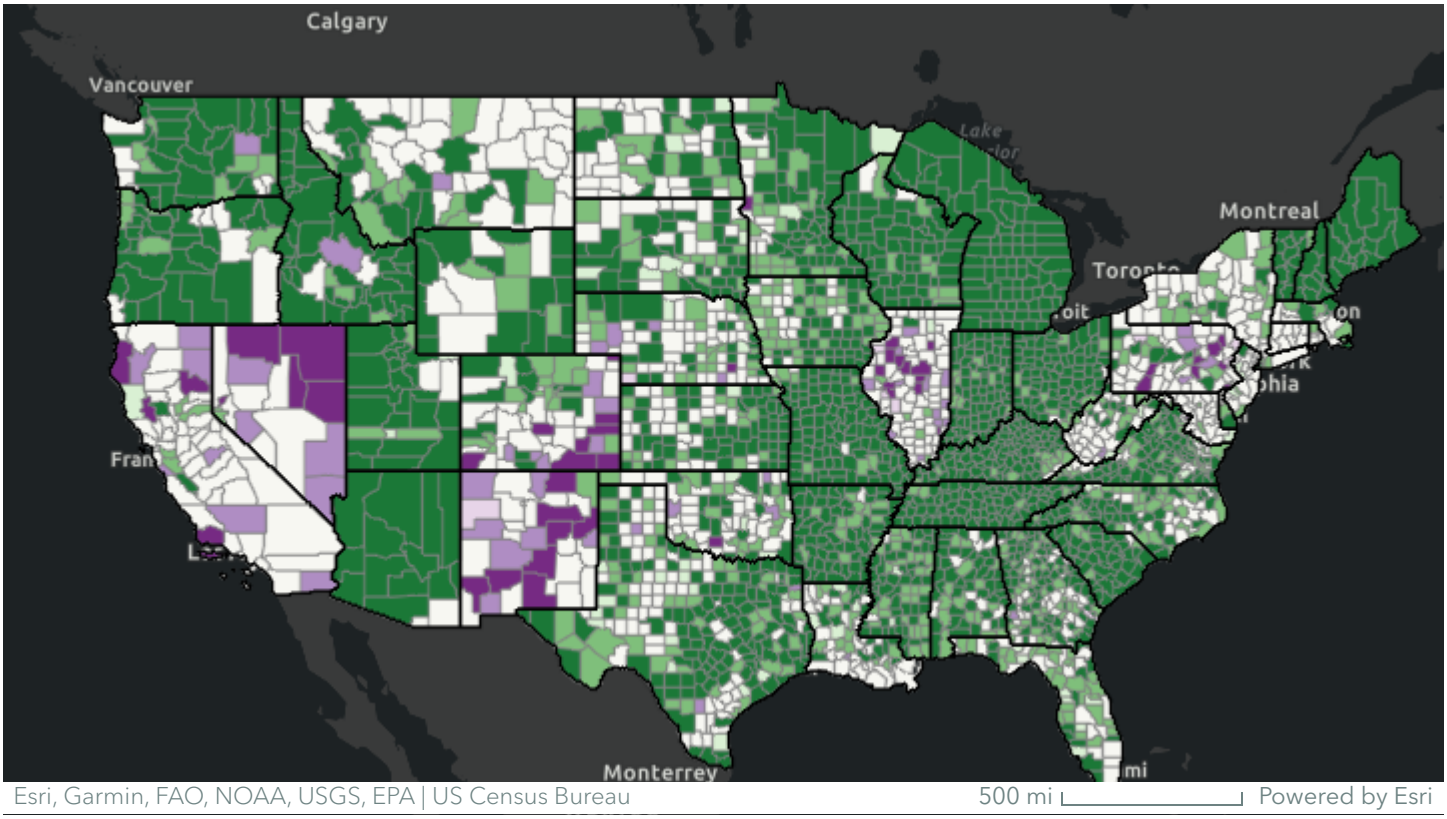
Using a hot spot analysis and an outlier analysis, we located statistically significant clusters of both high and low SNAP participations.

This information can help in the allocation of SNAP resources to areas of higher food insecurities and also help identify areas where eligible residents may be underutilizing or not enrolling in the SNAP program. The results can help drive the decision to distribute resources more efficiently and equitably

To continue our analysis, we used space-time pattern mining tools to determine how these participation rates have changed over time.

Trends:

It would be tempting to allocate resources based on SNAP participation hot spots, but without considering the annual trend, resources can be over allocated. Southeastern states are hotspots for SNAP participation but had a downward trend for 2019.



1-year Trend SNAP Participation Rate - Space_Time Pattern Mining 2D andrewaham 10/9/2023

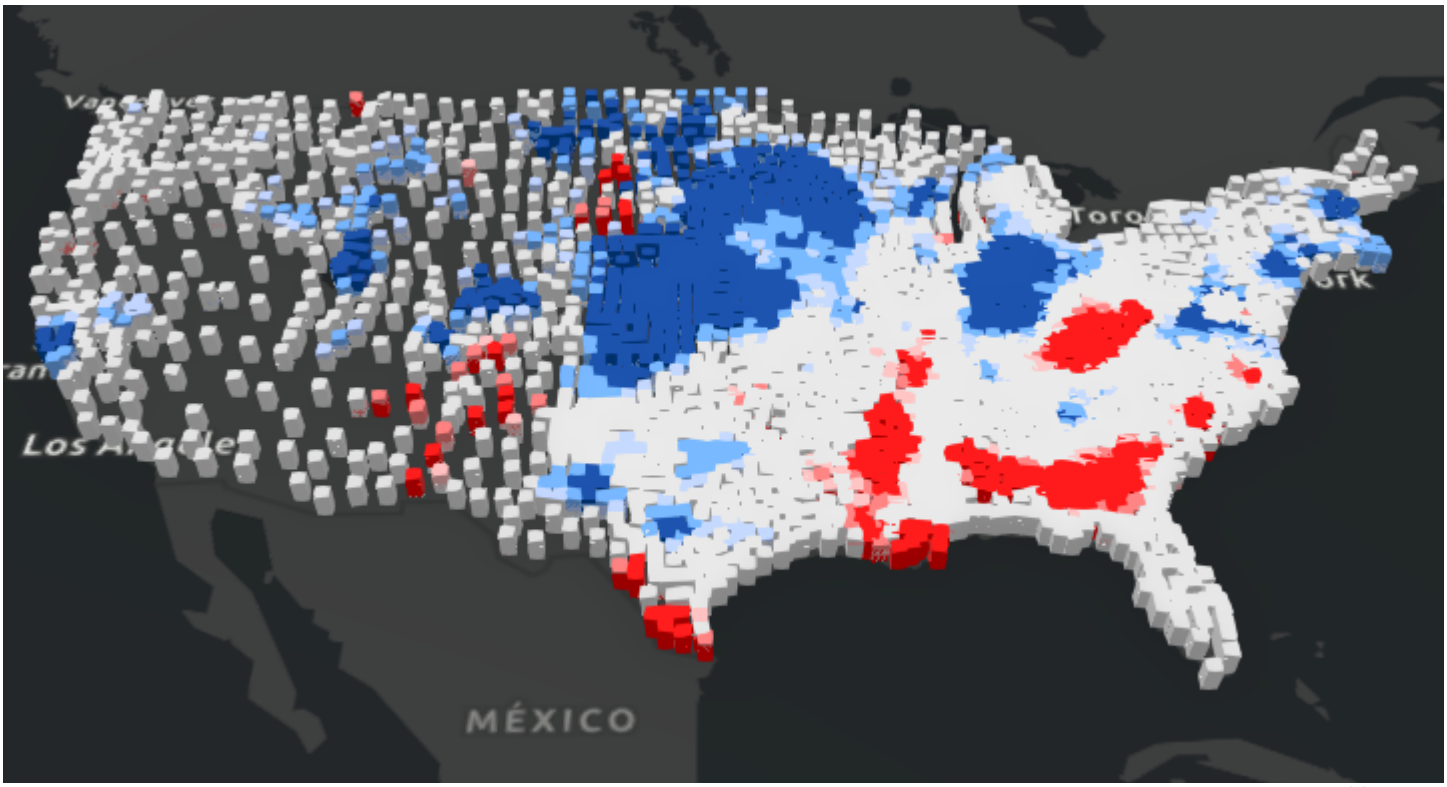
The Trends display theme uses the Mann-Kendall statistic to identify areas that have increased rates (purple) or decreased rates (green) of SNAP participation over time. The varying shades of these colors indicate how confident that you can be that these increased and decreased trends are not random and represent meaningful patterns.

New Mexico despite only having a few counties with high SNAP participation rate, had an increased trend for 2019, while Michigan continues to have a downward trend for 2019.

It might be tempting to examine SNAP participation rate for allocation of federal and state resources. However, as we have seen, outliers and the annual trend must be considered for SNAP participation rates to determine the full picture.

Space-Time Cube of Participation Trends adds a temporal aspect to the hotspot analyses, allowing us to see rates over time.

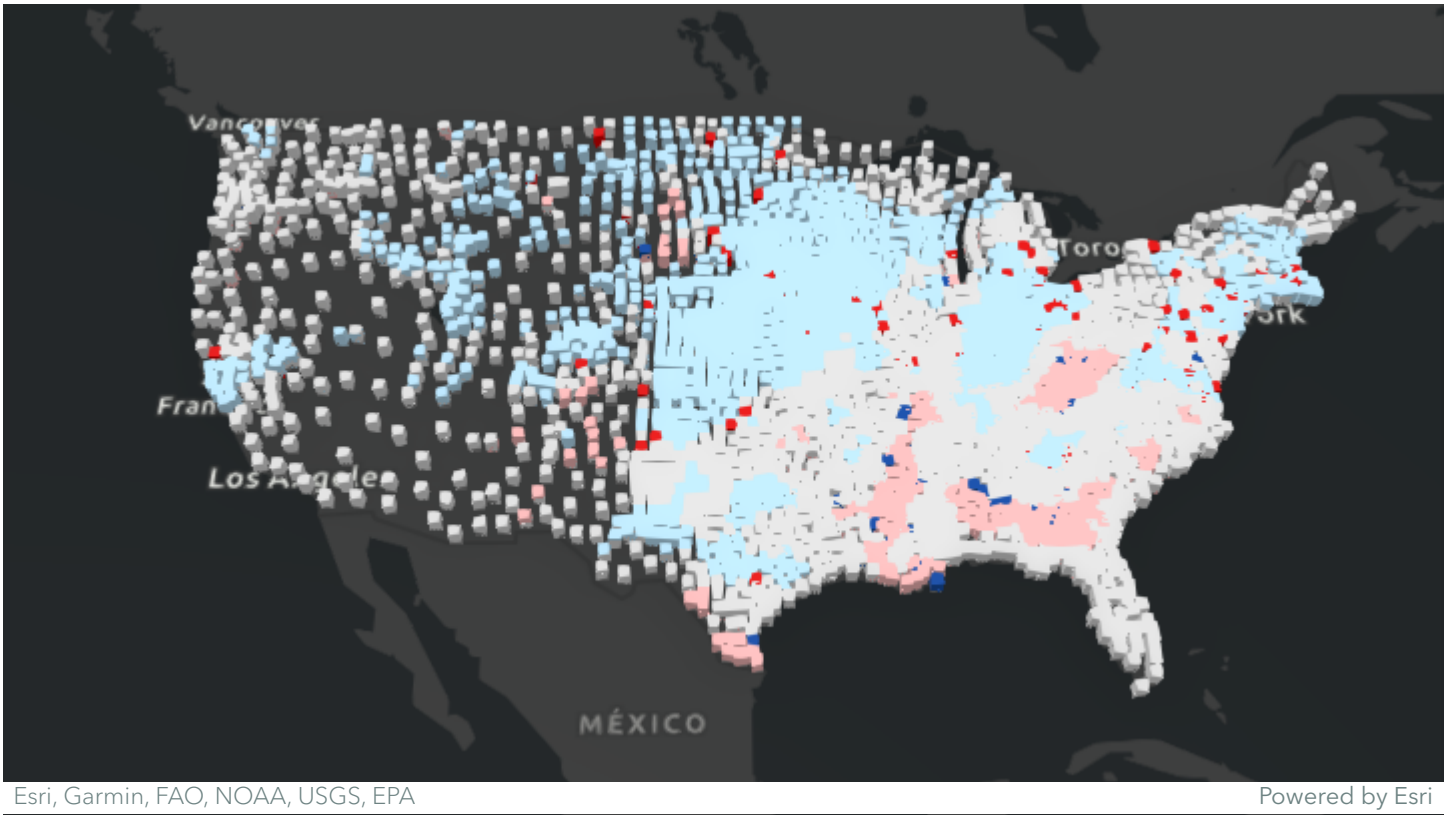
we introduced 3D space-time pattern mining, elevating our understanding of SNAP participation.



Space_Time Pattern Mining 3D by EsriTrainingSvc andrewaham 10/9/2023

Adding the temporal aspect to this analysis helped determine how certain areas of interest have changed over time. Investigating if these changes are caused by any specific legislation or region specific changes to the federal program may help determine if they were good choices and should be applied in more counties.

Adding the 2D Local Outlier Analysis result layer to the 3D Local Outlier Analysis layer



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This helped us gain a better understanding of the yearly trends that contributed to each category. This information provides more insight into our data.

For example, we may want to investigate these outliers in further detail to determine whether they are the result of environmental factors, socioeconomic changes, outreach efforts, or a combination of the three. Which will provide more insight to better planning and distribution.

Conclusion

Map has been a very important and valuable asset throughout this analysis, presenting detailed patterns that extend across counties in the contiguous United States. Through our exploration, we have discovered pathways towards a well-feed and healthy nation, paved with empathy, data-driven insights, and a commitment to change. By integrating time, space, and participation rates into a 3D visualization, we gain

a deeper understanding of the complex dynamics at play, offering valuable insights for the targeted policy interventions.

Additional resources can be found on the United States Government website for SNAP - https://www.fns.usda.gov/snap/supplemental-nutrition-assistance-program