University of Maryland Extension:

Rural and Urban Agriculture Census Data GIS Story Map

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Background/client research (Vanessa)

Maryland is experiencing increasing urbanization, with certain counties growing at faster rates than others (U.S. Census Bureau, n.d.). From 1974 to 2024, the number of farms in MD, particularly small farms, has steadily declined due to factors such as saltwater intrusion, rising input costs, farm consolidation, increased regulations, urbanization, the industrialization of agriculture, labor shortages, fluctuating commodity prices, droughts, and the repurposing of agricultural land for development (U.S. Census Bureau, n.d.). In recent years, the aging farming population has contributed to the sale of farmland (U.S. Census Bureau, n.d.).

Despite the number of farms decreasing, both urban and rural agriculture continue to develop. For the purpose of this project, we will use the U.S. Census definition to distinguish between rural and urban agriculture. According to the U.S. Census, an area is considered urban if it has at least 4,000 housing units or a population of at least 10,000 (U.S. Census Bureau, n.d.). The University of Maryland Extension (UME), a state-wide research and education initiative, focuses on four key areas: 4-H Youth Development, Agriculture and Food Systems, Environment, Natural Resources & Sea Grant Extension, and Family & Consumer Sciences, including the Supplemental Nutrition Assistance Education Program (University of Maryland Extension, n.d.). UME seeks to develop a GIS story map to more effectively illustrate and communicate the significance and impact of both urban and rural agriculture.

Purpose of the project (Mukund)

As touched on before, urbanization in the state of Maryland has led to devaluation of farms and agriculture in general in the area. Such a devaluation has the potential to negatively affect individuals who have a great stake in the success of the agricultural field in Maryland, primarily farmers and organizations invested in agricultural research and development, such as

the University of Maryland Agricultural Extension. Thus, a primary purpose of this project is to showcase the importance of agriculture to Maryland and how it continues to, in this day and age, to stay an integral part of the state's successful functioning in an increasingly urban society. The hope is to disband the pretense of an "aging farming population" and reduce the amount of farm land sold to more modern and urban sectors/fields.

Beyond highlighting the integrity of agriculture in Maryland, another important purpose of the project is to serve as an educational piece for individuals who are not as informed but interested in learning more about the farming sector in Maryland. As mentioned before, the field of agriculture has split into two types: rural and urban. The goal of this project is to showcase the distinction between the two types of agriculture and how they have seemed to develop over the past 50 years in the state. Specifically, using metrics like land usage and number of farms, it is the goal of the project to assess the inherent growth, or decline, each discipline has accumulated over the last 5 decades. In this way, we hope to showcase how significant urban and rural agricultural practices have been for Maryland, and educate individuals on the nuanced differences between the two, as well as where they seem to manifest themselves in the states.

Project significance (Antoine)

With a GIS (Geographic Information System) map needed, we developed an arcGIS map that would highlight the number of farms, average farm size (acres), and land in farms (acres). With the census data, we were able to go back as far as 50 years with the data for each Maryland county.

- Value proposition
- Overview of agriculture census data

- arcGIS map of farm count, average size of farms, and land in farms from each Maryland county from 1974 to 2022
- GIS Storyboard

Finding data (Antoine)

We obtained data from the U.S. Cenus with a focus on MD.

Data

USDA Agriculture Census Data Conversion

Our data was sourced from the USDA Agriculture Census, a count of U.S farms once every five years documenting land use and ownership, producer characteristics, production practices, income, and expenditures. To show the progression of Maryland agriculture we use three statistics:

- Number of Farms
- Land in Farms (acres)
- Average Size of Farm (acres)

The USDA documents were formatted as PDFs, so we converted the data to an Excel spreadsheet in preparation for analysis in ArcGIS. The Excel spreadsheet has all the statistics for each county by year from 1974-2022, a span of 50 years.

Agriculture Census & CropScape Data with ArcGIS

To visualize the statistics in the Excel workbook, we used a shapefile of Maryland county boundaries from the Maryland Department of the Environment. This shapefile was important as it combined Baltimore City and Baltimore County as one to match the USDA Census Data which does the same. In ArcGIS Pro, we performed three joins with the USDA Excel data to the county boundaries shapefile on the county names attribute. When the symbology for this layer is active, it can show a choropleth map using light and dark colors that represent high or low numbers. This layer was converted as a JSON file which can be opened in ArcGIS Online as a web map for ease of access.

We also used CropScope Data from the USDA, a raster map using remote sensing data from satellites to classify land use across the country. It maps out each type of crop as well as developed areas. After importing this data in ArcGIS Pro, for 2013 and 2023 we used image classification to combine all crop types in Maryland for each year as one layer to show a ten-year change in agriculture. Together with a Maryland Census Designated Urban Areas shapefile, you can visualize exactly where crops are being grown in the state of Maryland and if it is in a rural or urban area.

All layers were converted to JSON files which can be opened in ArcGIS Online as web maps. We used these web maps to create an ArcGIS StoryMap. With historical research of Maryland agriculture and the ArcGIS map layers, the ArcGIS StoryMap shows the change, significance, and importance of agriculture in the state.

Final Map Layers & Attributes

Combined Census Tract and USDA layer

- # of Farms 20XX: Number of Farms for a given year in select county
- AVG Farm Size 20XX: Average size of farms in acres for a given year in select county
- Total Land in Farms 20XX: Total acreage of farms for a given year in select county
- ACRES: Total acreage of census tract
- FIPS: Federal Information Processing Standard
- HU100: number of households in a census tract
- POP100: population of census tract
- PSQM: person per square mile
- ALAND10: Census Area Land (m)
- AWATER10: Census Area Water (m)
- SQMILES: Square Miles

2023 Farm Polygons: Agriculture in the state of Maryland in 2023 using USDA CropeScape
2013 Farm Polygons: Agriculture in the state of Maryland in 2013 using USDA CropeScape
MD Census Designated Urban Areas: Maryland designated urban areas in 2020

Results

The results from the USDA Agriculture Census data and USDA CropeScape data show that Maryland has seen a reduction in the number of farms, total acreage of farms, and average size of farms from 1974 to 2022. Counties in central Maryland like Prince George's, Montgomery, and Howard Counties have seen an overall reduction in agriculture which can be attributed to urbanization. The Eastern Shore remains an integral area for Maryland agriculture with the largest total land in farms and average size of farms. However, when analyzing CropeScape vector data and comparing 2013 with 2023 some existing agricultural areas have increased in size. This correlates with recent census data that shows a slight increase of land in farms and number of farms in specific counties after 2012.

Limitations/obstacles (brandon)

Throughout the course of the project, a variety of obstacles were encountered. These internal and external challenges brought many setbacks that the team had to overcome before progressing the project. By conducting an internal risk assessment, we were able to properly plan

and mitigate these setbacks before actually encountering them. These obstacles not only included the project work itself but also project dependencies and factors within the team.

With the goal of the project being to analyze the US Agricultural Census data, the first obstacle we faced was the vast datasets and records of agricultural data. The census data holds an abundance of data pertaining to the agricultural statistics of the entirety of Maryland. We found that we were unable to fully analyze the data to its entirety within the census data while being able to visualize every component of the census in a productive manner. Therefore, after discussion, we decided to emphasize our visualization on three main components of the census data, being the number of farms, land in farms, and average size of farms within Maryland and its counties.

Another obstacle we faced was the establishment of a working definition of the terms rural and urban agriculture. With limited background knowledge on agricultural details, we were unable to comprehensively visualize our data in such a way that displayed these two components. However, we were able to receive resources and find similar definitions that aided us in establishing the information we needed to visualize our data. Using these resources, we were able to find additional data that suited our needs and manipulate it to display what we needed.

Additionally, we found that analyzing all available census data would not be feasible within the timeframe of the project. We also believed that we would be able to effectively communicate our findings and significance without analyzing all records. Therefore, we decided to restrict our project to visualize the past 50 years which would give us a clear picture of trends while also being a substantial time frame.

While there were many surmountable challenges, there were also many outstanding obstacles that we encountered. These obstacles included elements of the project that we were unable to complete due to the time constraints of the project or currently unattainable resources. These obstacles included our inability to find and visualize more granular data within Maryland's counties, being able to analyze the Agricultural census data as a whole, and finding usable maps of Maryland's urban and rural areas.

Future of the project (Mukund)

The project, as it has been currently constructed, has served as a great introduction and educational piece on the continued importance of agriculture in Maryland, as well as the differences between rural and urban agriculture in the state. But, in its current state, the project could be further developed and expanded to relay more nuanced differences between urban and rural agriculture, painting a better picture of the growth each field has seen and the varied impact they have on the proper functioning of Maryland. Specifically, the project currently displays information regarding number of farms, land in farms, as well as average farm size in each Maryland county. While this information has been crucial as an educational piece regarding the importance of agriculture in the state, it is seemingly basal in its ability to distinguish between rural and urban agriculture. In order to create a more nuanced and in-depth comparison between

- draft (need rewording): future team will be able to use the map for future years

Conclusion (brandon)

Citations

University of Maryland Extension. (n.d.). About. University of Maryland. Retrieved December 3, 2024, from https://extension.umd.edu/about/

U.S. Census Bureau. (n.d.). Maryland profile. U.S. Census Bureau. https://data.census.gov/profile/Maryland?g=040XX00US24