Mapping Social Determinants of Health in Watauga County, NC Using Online GIS

INTERNSHIP WITH THE WESTERN YOUTH NETWORK

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Introduction

As a transfer student to Appalachian State University, my experiences within the Department of Geography and Planning have brought more opportunities to expand my Geographic Information Systems (GIS) knowledge and to gain work experiences that have made me a better individual. The internship with the Western Youth Network (WYN) developed through my professors within the Department as well as the Community Health Director at WYN, Gretchen Summerville, contacting for assistance. Upon recommendation by my professors, I was honored for the recognition and accepted the available intern position. As a first work experience for myself, I was welcomed by WYN and supported by the encouragement of my professors to embark on this internship experience.

WYN's Community Health Department requested for GIS work to be completed compiling and creating maps in reference to the web-based, interactive map made by the North Carolina Department of Health and Human Services. Additionally, WYN partnered with MAPSCorps previously to map resources within Watauga County.

The WYN has a current and ongoing project called Community Behavioral Health Integration Initiative (CBHII) focusing on Social Determinants of Health (SDOH) and their distribution throughout the county. The focus is to evaluate the factors that contribute to physical and ultimately, behavioral health that affects not only an individual within the community but also the community as a whole. Past projects have been completed examining the SDOH within Watauga County and Vulnerability Indexes concentrating on MAPSCorps resources. Based on the CBHII and the priorities of WYN, this internship focused on creating an interactive, web-based map examining SDOH within Watauga County.

Within this report, it will discuss the WYN organization and its mission, as well as my responsibilities. I will further discuss the outcomes and experiences of the internship. In concluding the report, I will detail what I have learned from working with WYN. Additionally, the appendix will illustrate the maps that I have created, as well as further details included in the weekly log reports.

Host Organization: Western Youth Network

WYN is located in Boone, North Carolina off Junaluska Road. WYN is passionate about helping the youth of Watauga County and adjoining counties through multiple programs and making an impact on the community by bettering the health (mental, physical, emotional, and behavioral) of the community. Mentoring, Afterschool, High School Success, and Summer Camp programs help to improve the lives of the children within Watauga County and surrounding counties to promote healthier communities and lives. WYN services Watauga, Ashe, Avery, Wilkes, and Alleghany counties of Northwestern North Carolina through these youth programs and the community health programs ("Our Work", n.d.). WYN's Mission is to ensure that children in the community have quality support and guidance as they grow and continue in their childhood education ("Our Values, n.d.).

The Executive Director is Jennifer Warren, and my supervisor for the internship was the Community Health Director, Gretchen Summerville. Each group is involved in their current and ongoing projects. As I worked in the Community Health Team the most, I also interacted with all departments and enjoyed hearing the progress of the Mentorship program, Summer Camp programs, and the fundraising project of the yearly gala.

Community Health Group at WYN

Community Health focuses on the lives and livelihood of the counties through advocating mental health awareness and public health awareness. Adverse Childhood Experiences (ACE's) are a fundamental aspect of WYN currently, mainly to express the concern and need for the public to understand them and address them appropriately ("Community Health", n.d.). There are numerous programs that WYN's Community Health group is working with to ensure better health in the serviced counties. Ongoing initiatives through the Community Health Team are programs such as Substance Abuse Prevention and Treatment, Underage Drinking Prevention, Health Equity Initiatives, and the program concerning the internship, Community Behavioral Health Integration Initiative (CBHII) ("Community Health", n.d.). In working with the Community

Health Team at WYN, I saw how it is focusing on evaluating the community and helping the community by educating the public.

Responsibilities

As an intern at WYN, I reported to Gretchen Summerville for directions and project-related questions. Since the project focused on the health of Watauga County and involved SDOH, which before this project I was unfamiliar with, I met with Gretchen frequently at the beginning of the project to affirm that what data I collected was aligned with the project goal. I was in contact with Gretchen frequently and would meet with her to discuss the status of the project. In some instances, I directed questions and contacted Jennifer Warren, Executive Director. If I asked a question that required further information and guidance, Gretchen reported to Jennifer as Executive Director. I interacted with all employees at WYN and with all department groups. Any visitors to WYN, I was introduced to or assisted them in finding the appropriate employee.

My daily schedule consisted of reporting to WYN each morning, and I started working on what needed to be completed. I kept a record of my daily work and would consult that list each morning as to what I needed to do next. Within the first week of the project, I made daily and weekly goals to target what to complete on the project. Since this internship was through May and June, I made a monthly goal in May in order for me to plan the direction of the project for June. Each day was different and brought its challenges: technically based within ArcGIS Online (AGO), ArcMap, or Excel, data-based with collecting data, or learning workplace environment skills. WYN as an organization is filled with support and encouragement for each other and each group department. I managed my time and kept a daily log of my hours. One of WYN's requirements was a personal timesheet that I would turn in bi-weekly to Gretchen.

Projects and Tasks

From the initial meeting with Gretchen, I first had to determine what was wanted and what data needed to be collected. Additionally, meeting with Lauren Andersen and Dr. Elizabeth Shay, along with Gretchen, helped tremendously in guiding me on this initial internship

experience. From the maps that Gretchen presented and with direction from my professors, I had a better understanding of what maps needed to be created.

Learning about SDOH

In order to know what data to collect, I read background information and SDOH information provided and suggested by Gretchen. I read the "State of the Community's Health Watauga County 2018" Report from the Appalachian District Health Department and the "2017 Community Health Report Watauga County" in by the Appalachian District Health Department and in partnership with county health care systems. These focused on the SDOH factors that needed to be addressed the most within Watauga County.

"State of the Community's Health Watauga County 2018" Report

The factors most evident within this 2018 report most relevant to SDOH were health equity, the focus on mental and behavioral health in children, and substance misuse prevention. Health Equity is essential to SDOH because of SDOH factors hinging on the effects of multiple factors such as income, transportation access, housing, health care, mental health, and other influences. Additionally, the focus on mental and behavioral health is important because of the increasing awareness and knowledge of Adverse Childhood Experiences (ACE's) and implementing programs and informing schools and the public. A factor that most Watauga County residents mentioned within the surveys of this report was the need for Substance Misuse Prevention to stop misuse, but Watauga County is continuing to work on measures that address what is the cause.

"2017 Community Health Report Watauga County"

This detailed report emphasized several factors that contribute to the health of Watauga County and also influence SDOH factors. By reading this report, in connection with the 2018 report, I was able to understand what data needed to be found within Census data.

According to Appalachian District Health Department, characteristics of SDOH that are present with this report were socioeconomic factors such as Poverty Rate, Income Rates, and Unemployment Rates because "social and economic determinants…play and important role in the health of each individual." (2018, p. 7) Income and education were significant variables that the report emphasized as well as poverty. Employment is another factor that the report notes as being important and necessary for healthy individuals within a community. Watauga County is one that focuses on the community cohesion and community access; therefore, transportation access is a variable that is important within Watauga.

Previous Mapping Project for WYN

With knowing these SDOH factors and patterns starting to emerge in what was necessary to study, I was also directed to a previous project report completed for WYN by The North Carolina Institute for Public Health. By reading this report, I was able to determine which factors have already been studied and analyzed within Watauga County. Further, this project focused on Vulnerability Indexes, which can create discrepancies in the data as it may not be representative of the actual values since it is a mathematical measure. This project further reported that Block Groups by the U.S. Census Bureau could be too small and thus show data that is not accurate for a region; therefore, I used Census Tracts for my study.

Data and Data Organization

U.S. Census Data (SDOH Data)

Data acquisition was the first process that I had to complete. Since the suggested map was from the NCDHSS, the data presented there seemed to be Census data. From this, I used American FactFinder and began searching for data that reflected SDOH factors searching for Watauga County Census Tract level data. I searched through all available options and downloaded 13 different tables from American FactFinder. From the 13 tables, I selected 27 variables that related to SDOH that were vital to include. Each downloaded file was saved as an Excel, Comma-separated values (CSV) file. The goal was to make one Excel CSV file with all data simplified and edited. The data that was for each category and normalizing data values to

generate percentages rather than using the generated percentages from American FactFinder nor using the Margin of Error values.

One shapefile that has all Census data joined was completed, and this allowed for choropleth maps to be created. In the process of this internship, I used ArcMap and later used AGO to create the web-based maps. Within AGO, I had to create a new shapefile of the SDOH variables that had the values as percentages. In all, I created three shapefiles, utilizing the final one for the maps in AGO. To create a shapefile, I followed the process listed in Figure 1; I completed this process multiple times based on the different issues that occurred or because of new data presented. The original shapefile had all the data correct, but to be able to use with AGO, the data had to already be normalized. Within ArcMap, the option to normalize the data is available in the Properties/Symbology option; however, this option is not possible in AGO. I had to complete steps 2 and 3 listed in Figure 1 to create this second shapefile using edited and normalized data. Normalized data was created taking the data value and dividing it by a Normalizing value (Total Population, Total Number of Households, or Total Number of Occupied Housing). I then saved and exported this shapefile (step 4). The third and final shapefile for SDOH variables was created to have the normalized data as percentages. For the legend options and pop-up information options within AGO, the data was not showing as percentages correctly. In this instance, I used the field calculator first to create new fields as well as editing the CSV file to have this data updated. Within ArcMap Table Options, I added a New Field and used the Field Calculator to set the new field as the Normalized data multiplied by 100 to be able to have it show as a percentage in AGO. I then completed Step 4 listed in Figure 1, and I was able to have the map formatted correctly in AGO.
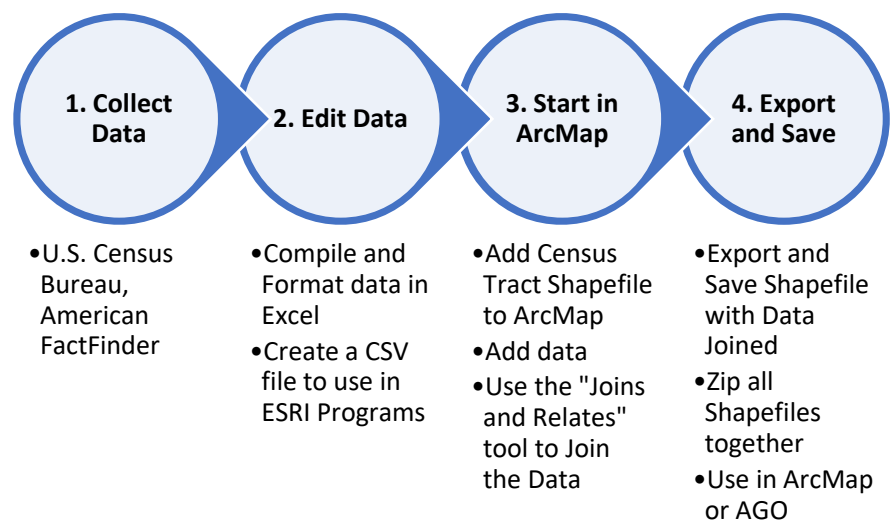

Figure 1. Process of Creating a Shapefile

1. Collect Data
- U.S. Census Bureau, American FactFinder

2. Edit Data
- Compile and Format data in Excel
- Create a CSV file to use in ESRI Programs

3. Start in ArcMap
- Add Census Tract Shapefile to ArcMap
- Add data
- Use the "Joins and Relates" tool to Join the Data

4. Export and Save
- Export and Save Shapefile with Data Joined
- Zip all Shapefiles together
- Use in ArcMap or AGO

MAPSCorps Data

After contacting MAPSCorps requesting for the data they had collected on Watauga County, I edited and simplified the data. The MAPSCorps data consisted of locations and resources that in ArcMap and AGO would show as points on the maps. The MAPSCorps data had to be Geocoded to be able to use it, which meant generating the coordinates for the locations and then ArcMap producing those coordinates as points. I had to set the Coordinate System in ArcMap and made it the same throughout all data and shapefiles; I used WGS84 throughout the project. I used the option Display XY Data for ArcMap to display the coordinates. There were issues in the Geocoding process, and I initially had to learn how to edit the table within ArcMap have the points displayed. I had to create a new field making it a Double type for the Display XY Data to be an available option. I utilized the Field Calculator to populate the new fields with the same coordinate data. The process I used for Geocoding can be seen in Figure 2.
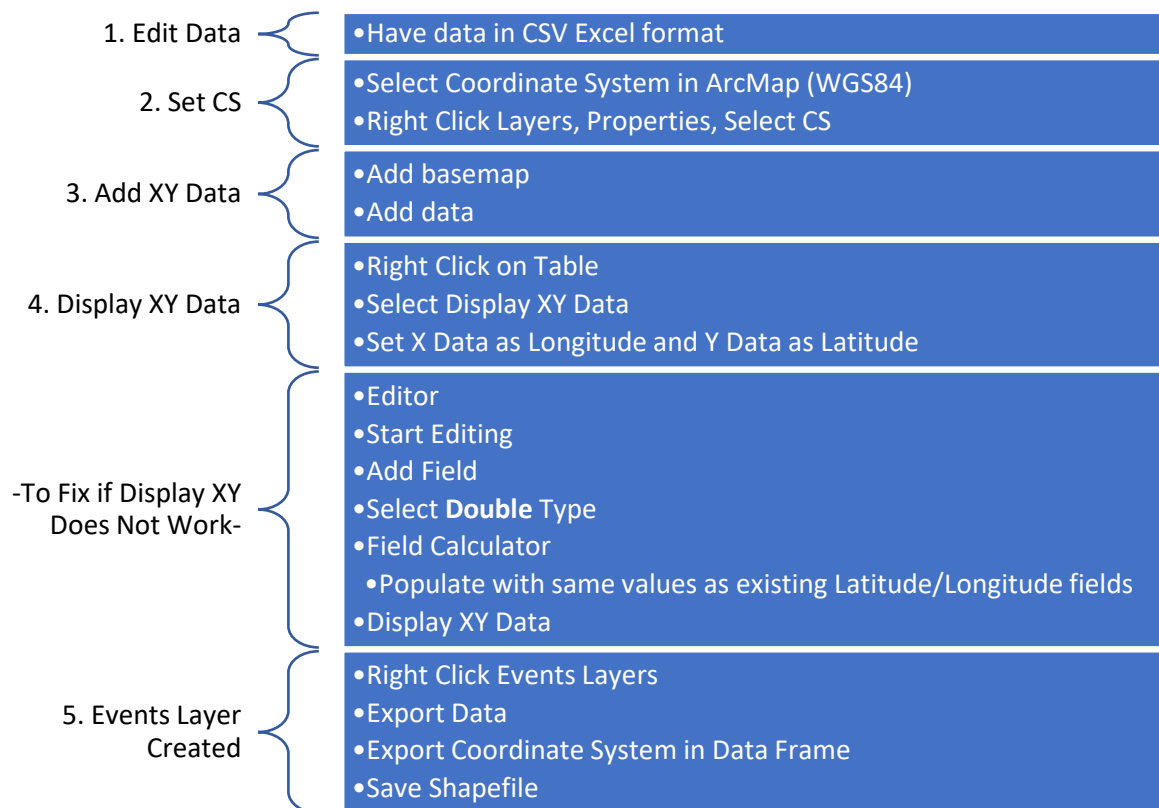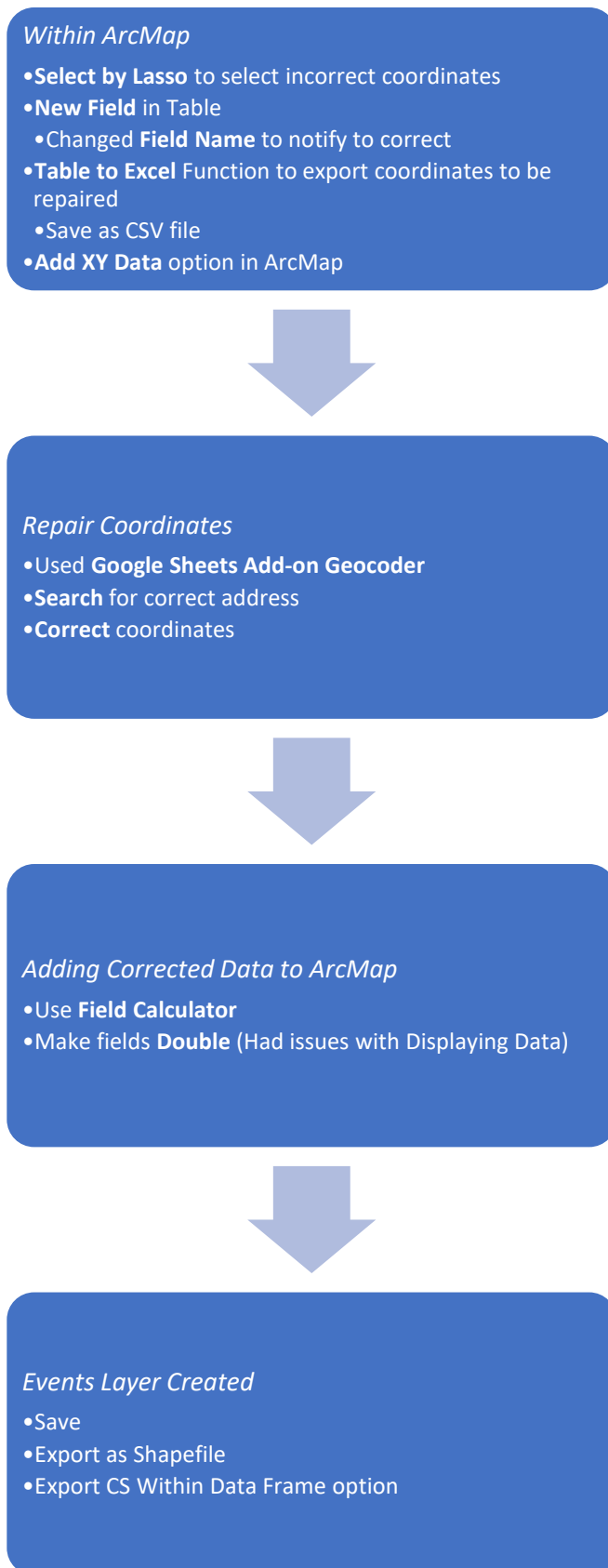
1. Edit Data	• Have data in CSV Excel format
2. Set CS	• Select Coordinate System in ArcMap (WGS84) • Right Click Layers, Properties, Select CS
3. Add XY Data	• Add basemap • Add data
4. Display XY Data	• Right Click on Table • Select Display XY Data • Set X Data as Longitude and Y Data as Latitude
-To Fix if Display XY Does Not Work-	• Editor • Start Editing • Add Field • Select **Double** Type • Field Calculator • Populate with same values as existing Latitude/Longitude fields • Display XY Data
5. Events Layer Created	• Right Click Events Layers • Export Data • Export Coordinate System in Data Frame • Save Shapefile

Figure 2. Geocoding Steps

Once the point locations were displayed, not all of them were within Watauga County due to errors in the original data from MAPSCorps. I could not use queries to select the incorrect locations because the points were listed as places within Watauga County, but with incorrect zip codes or addresses which resulted in incorrect coordinates. To fix this issue, I completed the process explained in Figure 3 to correct the MAPSCorps data.

Originally, all the MAPSCorps data was in one Excel file that I completed the process in Figure 2 with; however, for what was desired in this project, each Type created by MAPSCorps needed to be a separate CSV file. With assistance from my professor, Lauren Andersen, the Excel files were revised to fix the coordinate issues and in these individual files. I had created each Type as an Excel CSV file, with further editing by Professor Andersen it allowed for better ease within AGO. The coordinates throughout this process were batch geocoded. The coordinates not displaying properly in ArcMap were caused by issues within Excel of the columns of coordinates being shortened.

Within ArcMap
- **Select by Lasso** to select incorrect coordinates
- **New Field** in Table
  - Changed **Field Name** to notify to correct
- **Table to Excel** Function to export coordinates to be repaired
  - Save as CSV file
- **Add XY Data** option in ArcMap

Repair Coordinates
- Used **Google Sheets Add-on Geocoder**
- **Search** for correct address
- **Correct** coordinates

Adding Corrected Data to ArcMap
- Use **Field Calculator**
- Make fields **Double** (Had issues with Displaying Data)

Events Layer Created
- Save
- Export as Shapefile
- Export CS Within Data Frame option

Figure 3. Fixing Geocoding Issues

Once the Excel CSV files of each Type were created, the process listed in Figure 2 was completed again.

Within AGO, there were some minor issues with a few of the individual Type CSV files. By correcting the address and re-geocoded, I completed steps 3 through 5 in Figure 2.

Watauga Food Council Food Web Data

This was a list of resources that were intended to supplement the MAPSCorps data. I choose to use Hunger Relief resources and Farmers Markets to give users locations of healthy eating options and pantry options. I created new and separate CSV files for these resources with addresses that I found in order to Geocode these locations. I continued the process presented in Figure 2 (Steps 1 through 5) to create point location shapefiles for these resources.

By coming across news of Summer Feeding Programs in Watauga County in the Watauga Democrat, I acquired data from the USDA Food and Nutrition Service Summer Feeding Programs website that included an interactive map. There was only one location in all of Watauga County; therefore, I added this to the Hunger Relief CSV file.

AppalCart Data

After contacting AppalCart, I received data in an Excel file of the stops on each of the routes throughout Watauga County. Similarly, to the MAPSCorps and Food Web data, the AppalCart routes are shown by route stops, and I completed steps 1 through 5 in Figure 2 to create shapefiles of each route. Further, from the original Excel file, I created each route as separate CSV files to create the shapefiles.

Outcomes

From the data that I collected and created, three maps were created that are all web-based and interactive. The first map includes all data layers (Interactive Map). The second map is in an AGO tabbed format that includes SDOH factors, MAPSCorps, and Food Web data (SDOH Map). The third map is a series of Bivariate or Relationship maps that is in the same tabbed AGO format (Bivariate Map).

Interactive Map

Through a process of copying the SDOH shapefile, each SDOH variable is a separate layer within this Interactive Map. Additionally, based on themes in the SDOH variables, the color schemes are similar for variables that are related or have patterns. For instance, for Education, all SDOH are in similar color schemes. Each Census Tract can be selected, and a detailed pop-up appears giving information and percentages.

MAPSCorps, AppalCart, and Food Web data can be selected to show the point locations of these resources. When selecting the points, detailed pop-up information appears, giving addresses and contact information.

SDOH Map

Within this map are specific SDOH variables selected with detailed information to describe their importance to the health of the community. MAPSCorps resources such as Health Services and Food Web resources such as Hunger Relief and Farmers Markets are included in this map as well because of their association with the selected SDOH variables. Each Census Tract can be selected to receive further information. Additionally, the point locations of MAPSCorps and Food Web Resource data can be selected for location information.

SDOH factors included are Poverty Status, Households Receiving Social Security Income, Households Receiving Food Stamps/SNAP, Population Unemployed, Population Uninsured, and Population Insured, Women Working, Unmarried Mother Below Poverty, and Lack of Education.

Bivariate Map

From the SDOH variables, the Bivariate Map contains nine different relationship maps that are comparing two SDOH variables in each. The purpose is to show patterns between these health factors. Using the same format as the SDOH Map, this tabbed format, the web-based map contains descriptive information for each of the nine bivariate maps to inform the reader of what is being shown. Each map contains a 3x3 grid legend that illustrates the color scheming of each map. The Census Tracts can be selected for further data information.

The Bivariate Maps are: Poverty Status and Households Without Vehicles, Below Poverty Status and Population Unemployed, Households Receiving Social Security and Households Receiving Food Stamps, Population Unemployed and Households Without Vehicles, Population Insured and Population Uninsured, Housing with Plumbing and Poverty Status, Rented Housing and Households Without Vehicles, Rented Housing and Employed Population, and Employed Population and Poverty.

Additional Map Features

To ease the use of the Interactive Map, I created a video tutorial that is linked within the pop-up or splash screen information that appears when the map is first opened.

Within the SDOH Map and the Bivariate Map, the first tabs on both maps include a video that I created that plays SDOH diagrams to help illustrate the idea of SDOH to the public.

I also created Rack Cards for WYN that can be used to distribute to the public with a brief description of the map and a link to the map that the user can enter into a browser.

Evaluation and Conclusion

In the process of this internship, I created maps that were in a format that WYN requested. The initial and Interactive Map can be added to the Community Health section of WYN's website, as discussed with Gretchen. The maps have a shareable link that can be passed among community leaders and individuals. Having data in a format to share the health of Watauga County and the impact of SDOH was wanted with these maps as well. By creating the maps, I obtained data that WYN can use in the future and with additional projects. The MAPSCorps and Food Web data can be updated and changed by updating the Excel CSV file, creating a shapefile, and uploading to AGO.

With this internship, I acquired workplace skills such as better communication skills by interacting with all daily. I will continue to improve these skills as I will share the maps at a Watauga Compassionate Community Initiative in August. This internship also allowed me to learn how to discuss maps with individuals that may not understand maps or the processes of

GIS. I also developed stronger GIS skills and learned more about how to use ArcMap and AGO. I learned about fixing issues within Excel and how to format column or field names properly. For instance, within ArcMap, there is specific formatting such as character lengths required for field names that I learned. Within my courses, I learned about Geocoding, but I further learned how to apply what I learned by the data that I was presented with. I learned how to troubleshoot issues and how to display coordinates correctly within ArcMap.

If I could have done something differently, it would have been going into this internship with better knowledge of SDOH and Watauga County, and possibly more knowledge of AGO. However, I understand that this internship would not have been as rewarding if I already had this knowledge.

My expectation was to create one map as requested, and in the process, I made three interactive maps with multiple maps within each. My expectation and initial expectation for what I would get accomplished were minimal compared to what I got accomplished. My working expectations were reasonable as I continued to work on the project. The goals that I set for each week and myself motivated me to continue with the assignments.

My coursework did prepare me for this internship because it allowed me to know where to start and how to get to the result. Geospatial Data and Technology introduced me to ArcMap and AGO to where I knew how to navigate within the programs and how to create shapefiles. I was introduced to Geocoding with this course and knew the process with lab assignments. My GIS skills stemmed from this course as it is the first course I have taken thus far that has dealt explicitly with GIS. Cartographic Design and Analysis taught me about map elements and proper placement as well as color theory, which I took the principles of it in consideration of each choropleth map and the bivariate maps. Choropleth maps were also first introduced to me during this course, so I had an idea of what I could make for WYN. Town, City, and Regional Planning allowed me to see the "bigger picture" of how these SDOH factors influence the community and how these factors can determine future developments within the community. For instance, when examining SDOH factors such as Renter-Occupied and Owner-Occupied Housing, I could see patterns within the county and where Renting density is highest. I also

realized that decisions that have been made about the county had influenced the community. Even though at times, I felt that my GIS skills were lacking, my supervisor and WYN, as an organization, appreciated the work that I completed for them. As an internship experience, I learned more about GIS and a workplace environment, gained more exceptional GIS skills, and troubleshooting skills. I also gained the ability to understand what is desired and create a map in a specific format as well as integrate multiple layers of data.

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Appendix Index

Log of Weekly Reports
Week 1

- Learning about the Social Determinants of Health (SDOH) and how these factors of the community health are interconnected.
- Reading the State of the County Health Report of Watauga County (SOCH) (2018) and the Watauga County Community Health Report (2017)
- Reading the report and comparing the data and maps already created
- Comparing the reports read to the data available through the Census Bureau's American FactFinder
  - Downloading data
- Used Vulnerability Index (VI) topics for ideas and direction
- Read further information about Social Vulnerability Indexes (SoVI) and a report from the CDC on SoVI
- Started simplifying the multiple Excel files from the Census Bureau
- Submitted data request to MAPSCorps for their data of Watauga County
  - Received data – edited and simplified
- Learned when looking at Census data that the Percentages that are pre-calculated need to be calculated to understand what they are representing
  - If it is dealing with the population/people/humans, it is better to use Total Population data and the "raw" number data than the pre-determined percentage.
- Creating a description table of the data and the variables for future reference and to help guide the process
- Realized that the topics that I considered did align with SoVI and SDOH variables
  - Creating 1 Excel file with all data variables interested in collecting to eliminate problems with joining multiple files in a GIS
- Plan is to start Geocoding first – working on the MAPSCorps data
- Learned more about faster/more efficient ways to delete, rename, organize data in Excel

Week 2

- Geocoding the MAPSCorps data
  - Some of the data had the wrong Latitude and Longitude Coordinates
  - Step 1: Displaying the data from MAPSCorps into ArcMap
    - Learned how to Display XY Data in ArcMap by first setting a Coordinate System, Using ArcMap Editor Settings to create new fields in the Attribute Table (using the Field Calculator to set it to the Latitude and Longitude Coordinates), Displaying the data, Exporting this data as a Shapefile that can be used in AGO
  - Step 2: Once I completed these steps, the Locations were distributed throughout the U.S. instead of just within Watauga County – this led to learning how to find the wrong coordinates and locations and fixing them by these steps:
    - Select the wrong points by using the Select by Lasso in ArcMap

- Creating new fields labeling them as the points that need to be fixed
- Exporting this data to Excel using the Table to Excel tool in ArcMap; Selecting these locations in Excel - looking at the problem locations specifically; Repairing these coordinates by searching for the correct address and replacing the incorrect address with the correct address in Excel; Saving the file
- Using and Learning how to use a Batch Geocoder such as Google Sheets Add-On "Geocoder"
- Uploading the repaired Geocoded data in ArcMap
  - ○ Step 3: Using the Symbology Properties in ArcMap
    - Setting the Symbology as Qualitative by Type
  - ○ File created: Event layer
    - Exported as Shapefile Format can be uploaded online to AGO to make it an interactive layer
  - ○ For issues with Displaying the XY Data, had to follow an ESRI step-by-step; learning how to add XY data when there are issues
    - Using Editor settings, Creating New Field, Using the Field Calculator
- Joining the Census Variables (Excel CSV file) to the Census Tract Shapefile
  - ○ Issues Fixed by learning ESRI/ArcMap field name requirements (<10 Characters length) as well as going into the CSV file formatting the GeoID fields to a Number format and to decrease the decimal spacing to match the Census Tract attributes
- Going through and with each variable and making a "layer"
  - ○ Copying the shapefile with the joined data and changing the Symbology features to show the variable
  - ○ Learned that Layer files will not upload to AGO, only shapefiles
  - ○ Going through each variable in a way of making a "layer" is to see if the variables present a necessary pattern
- Learned that by not having layers that can export to AGO, that the data in the Attribute Table needs to be Normalized
  - ○ Normalizing is taking the variable and dividing it by another variable that is a Total Number/Representation of the Population (Variables such as Total Population, Total Number of Households, Total Number of Occupied Housing)
- By meeting with Gretchen – confirmed that data is representative of SDOH – as it is the object of the study
- By meeting with Lauren – realized to choose one classification method and use throughout, to double-check the data on American FactFinder to ensure about what is really being measured (in this choosing what data is best to normalize and which variables are best to normalize with)
  - ○ Re-evaluated some of the variables; the variables that are percentages are not going to be used
  - ○ The topics are still going to be used, and the variables that are going to be used are the "raw" data values – these are more representative than percentages.

- I am going to make a final shapefile of all the joined data and a finalized Excel CSV of the data that was joined. This will ease the process in AGO.
- In ArcMap used skills of knowing about symbology and color schemes, Used ColorBrewer as well to get ideas of color ramps to use for the project, Applying the symbology creating a choropleth map of the data allows for a pattern to be seen
- Classification method that is best for representing Social Vulnerabilities and represents the data well is the Quantile classification method, the number of classes varies based on the variable (number of classes, determines the "number" of colors/hues that will be shown in each map
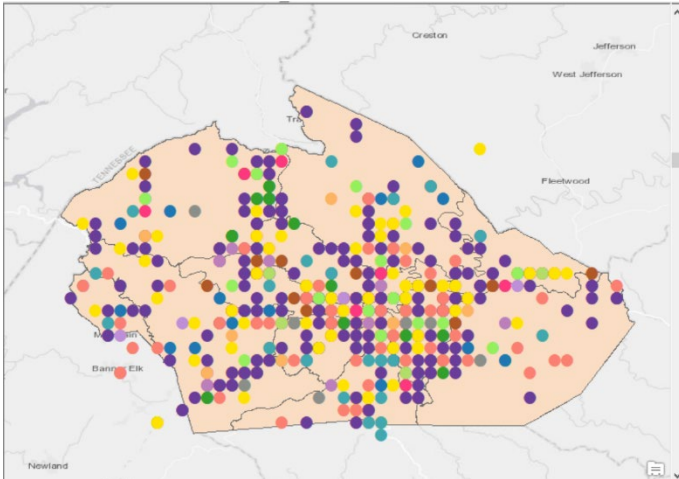
Figure 1. First time Geocoding the MAPSCorps data
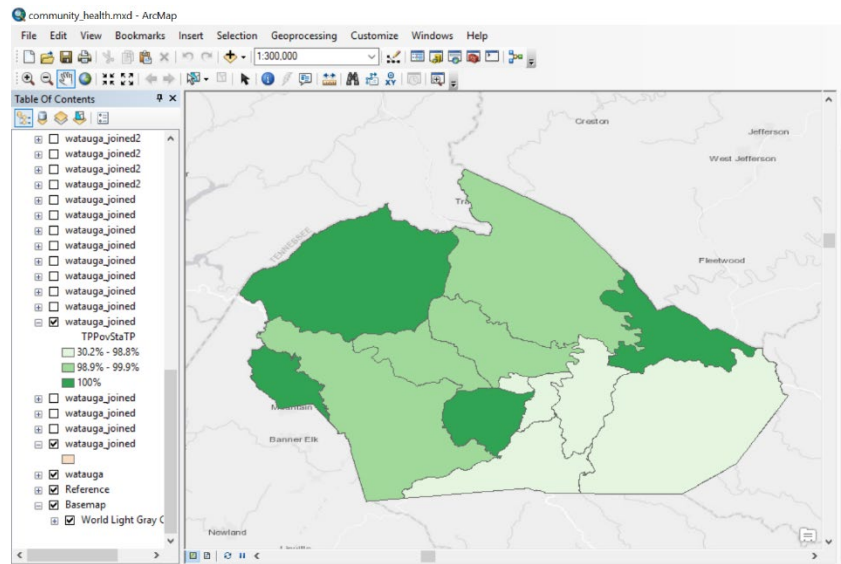
Figure 2. Shapefile of data Joined to Census Tracts of Watauga County. Showing Total Population given Poverty Status normalized by the Total Population

Week 3

- Double-checking completed data and working on making the Excel files more compatible with AGO
- Read about Bivariate mapping for analysis
  - Re-examined variables to determine which variables would be best
- Tried Georeferencing AppalCart Route Map in ArcMap
  - Learned the Georeferencing tool in ArcMap – lookup steps of how to use ArcMap / Georeferencing
  - Found it better to contact AppalCart
  - Great skill to learn how to Georeference in ArcMap rather than QGIS (used QGIS in GHY2812 – interesting to see how another program can do the same functioning)
- Read more and read about what can be uploaded into AGO
  - CSV files (Excel files) that have been exported as Shapefiles for each individual category of the MAPSCorps, AppalCart, and Watauga Food Web data
  - Took completed MAPSCorps data separated into individual CSV files
  - After edits from Lauren Andersen - had the correct formatting for the Excel files
  - Applied this formatting to all CSV files of AppalCart data and Food Web data

- - MAPSCorps data was saved as individual files separated by type determined by MAPSCorps (16 CSV files, 16 SHP files)
    - AppalCart data was saved as individual files separated by Route in AppalCart data (15 CSV files, 15 SHP files)
    - Watauga Food Web data was saved into two individual files: one of Hunger Relief and one of Farmers Markets (2 CSV files, 2 SHP files)
    - Census Variables/SDOH data was joined to a Census Tract shapefile of Watauga; Data all joined together exported from ArcMap to a Shapefile (1 Shapefile that can be uploaded into AGO; copying this Shapefile layer can result in the different Census variables being visible)
- Received new information/data from Gretchen: Watauga Food Council, Watauga Food Web (http://www.wataugafoodcouncil.org/watauga-food-web)
- Attended WYN Staff Meeting
- Took edited Excel CSV files and completed same steps for adding XY data to ArcMap as before with MAPSCorps (re-completed the steps for MAPSCorps, completed the first time for AppalCart and Food Web data)
  - Steps in ArcMap to take CSV files into a Shapefile:
    - Add basemap
    - Add data (add CSV files)
    - Select Display XY Data
    - Creates Event Layer
    - From Event Layer – Export Data as Shapefile
    - Edit symbology and saved as MXD file (ArcMap Document)
- Received Excel Workbook file from AppalCart (.xlsx file)
  - Saved each Route tab in the Excel Workbook as a CSV file
    - Edited/formatted for Excel
- Went through Watauga Food Web website
  - Went through and decided which places would fit for the goal of showing access to Food Resources
  - Made a CSV file following the file formatting of MAPSCorps data/Correct formatting
    - Made a CSV file
    - Find addresses: copy/paste from MAPSCorps data if address was the same
    - Geocode to obtain Latitude/Longitude coordinates
    - Uploaded to ArcMap
      - Completed steps of a CSV file to Shapefile
- Edited Data Descriptions Excel file to show these updates of Shapefiles, CSV and MXD files
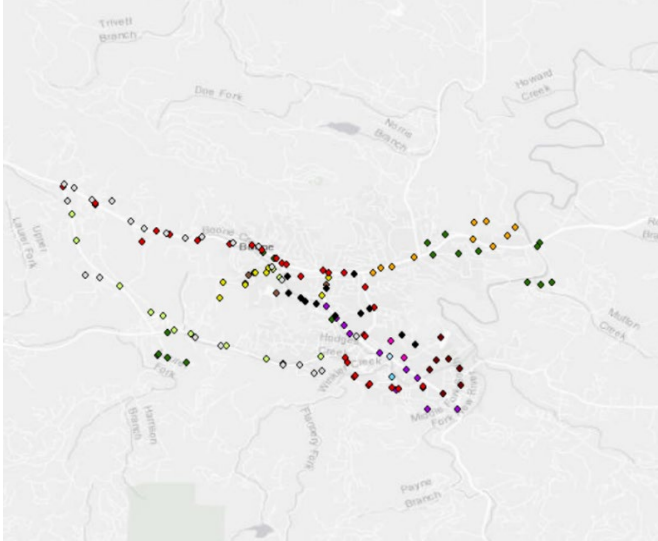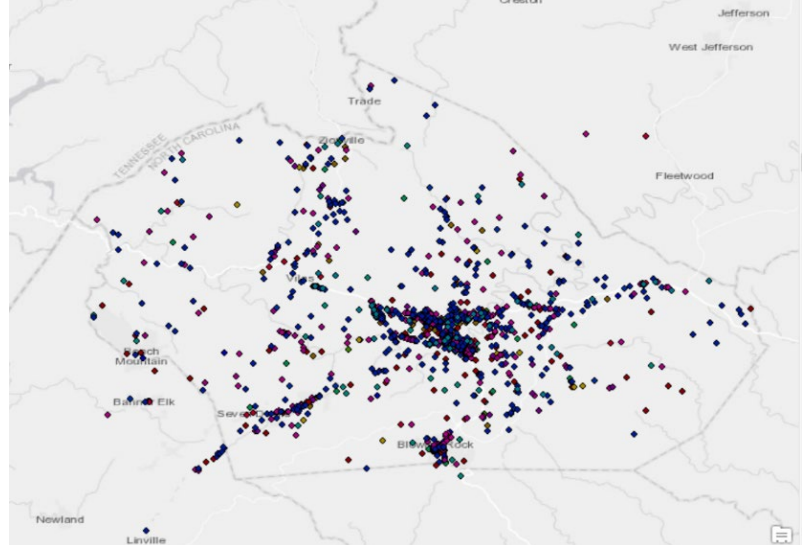
Figure 3. AppalCart Stops in ArcMap

Figure 4. MAPSCorps Location in ArcMap with Correct Geocoding
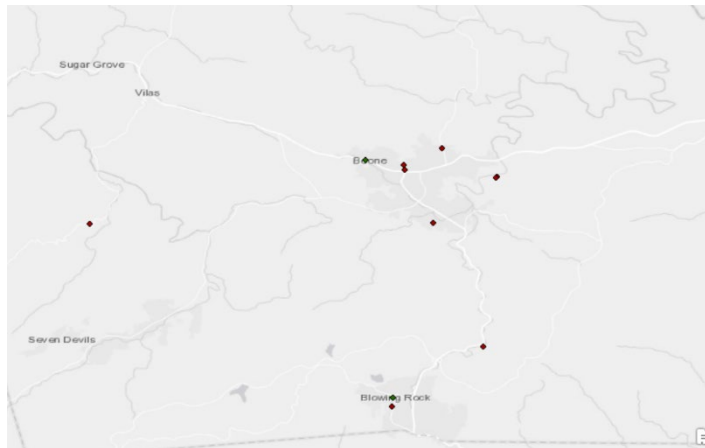

Figure 5. Food Web Resource Locations in ArcMap

Week 4
- Made Google Account to use for creating AGO
- Started to build Web Map in AGO
  - Started to add the Watauga shapefile (with Census Variables/SDOH) into AGO
  - Started to change symbology settings and configuring pop-ups for variables
    - Encountered issue with trying to have the variables display as a percentage
      - The variables were Normalized (Normalized = Variable/Total Population, for example) and were made a percentage in decimal form but not in percentage
      - Had to go back into ArcMap and edit Attribute Table
        - Create new field (column) and then use Field Calculator: Normalized Field * 100 = New Field as a Percent

- o Updated Data Descriptions Excel file (.xlsx) made new tab "Normalized Variables Percentage" listing variable names
        - o Updated Data CSV file, saved as new file as well (made note of file location in Data Descriptions Excel file
    - Saved as new Shapefile (SHP) file to now be uploaded and used in AGO
- Started in AGO with new Shapefile
    - o All layers are classified as Quantile with different number of classes depending on the data for each variable
    - o Purpose is that having all variables the same classification helps with comparisons between variables
    - o Symbology: Each category are different colors
        - Example: Variables with Household Public Assistance Income Types are one symbology color ramp whereas Education Levels are a different symbology color ramp
        - Used the color theory in deciding which ones; choose colors that are Ascending (Light to Dark) to show how the data values go from Low values to Higher values
        - The latest shapefile used was copied for all layers and each layer is renamed titling what it is showing – edited for conciseness and simplicity
- Imported MAPSCorps, AppalCart, and Watauga Food Web Data
    - o MAPSCorps data – issues with 4 different layers/categories
        - After Geocoding the data two weeks ago, some points (about one each one of these four layers) showed an incorrect location outside of Watauga County.
            - Had to go back into ArcMap
                - o Open SHP and CSV files for each one
                - o Re-geocode – find correct address and used Google Sheet Add-On Geocoder
                - o Corrected Coordinates in CSV files
                - o In ArcMap, added CSV file back – Display XY Data, Exported Events Layer as SHP file
                - o Uploaded new SHP file to AGO to use in Web Map
- Issues with AGO: Not letting symbology changes be saved: Learned to Logout, Close Browser, Reopen Browser, and Login
    - o Seemed to be a "temporary bug" in AGO
- Added AppalCart Data to AGO
- Symbology for MAPSCorps and Watauga Food Web Data: Symbology for each layer, Different colors for each Subcategory of each layer
    - o Example: Childcare and Schools, each type (Elementary, Public Schools, etc.) are a different color
- Symbology for AppalCart data: Symbology for each layer, Same color for all points on each route

- o Example: Pink Route, all Stop Points are Pink (Route Color Name=Color)
- Made 1 Story Map (Template: Story Map Basic)
  - o Tried additional template briefly (Story Map Series) does not allow layers to be turned on and off – all layers are together
- Can make additional story map of this kind soon by studying which variables correspond
- Data (Zip files) on WYN GIS Google Account Google Drive
- Edited Story Map for ease of user
  - o Created image labeling button functions in Story Map
  - o Uploaded image onto AGO contents and into Story Map
    - ▪ Added to Splash Screen Option (pop-up when open map)
    - ▪ Added to Information Button
- Note: When adding layers realized that variable Women who had given birth, are Married, and Below the Poverty Line Compared to the Total Population did not show any kind of pattern when loaded to Web Map – all values as percentages showed as zero
  - o Made note and explained reason in Data Descriptions Excel file: in the tab "Variables No Longer Used"
    - ▪ Not going to delete the variable – it is still in the Attribute Table of the Shapefile and can be accessed; studied but not used in AGO

Week 5

- Creating online (AGO) web map – Bivariate (Relationship) maps
  - o Examining variables of what would be best to show a pattern and relationship
  - o Learning how to do Bivariate mapping in AGO
    - ▪ Classification methods for all bivariate maps are Quantile – the same classification method as the Census Variable/SDOH factors
    - ▪ AGO – option for "focus" determines layout/orientation of legend
      - • Deciding what would be best based on the data
    - ▪ Edit/configure Pop-Up's for Bivariate Story Map
- Creating a Story Map of the Bivariate Maps
  - o Adding tabs and descriptions
  - o Arranging settings of the Bivariate maps
  - o Using (latest) updated Bivariate Web Map
  - o Tried other Story Map formats that are available within AGO; Story Map Series is the best to display all map information and all legend information
    - ▪ Other Story Map formats limited Legend information; Not as accessible/easy to use as Story Map Series (Story Map with Tabbed Layout)
- Edited original Web Map
  - o Change "Visibility Range" of AppalCart Routes so that they would show up (all routes) at the same "zoomed out" level as the MAPSCorps/Food Web data points
  - o Update first Story Map (Interactive one – selectable layers, no tabs) based on change

- o Change Hunger Relief Data (Food Web Data) – Edit Excel CSV file, and repeat process to create shapefile and take steps to be able to upload to AGO
  - ▪ Re-configure pop-ups – Updated Story Map 1 (Interactive, Turn On/Off Layers)
    - • Will updated Story Map 2 (Tabbed, Single Variables)
- Editing "splash screen" (pop-up window) of the first Story Map (Interactive one – selectable layers, no tabs) – Continuing this process now and will into next week per suggestions and necessary changes to explain how to use—
- Made YouTube video (brief – just of SDOH diagrams)
  - o Best option because a picture in the Story Map for Bivariate Maps was limited and would not fit correctly within the tab
  - o Can add to another Story Map (Tabbed) next week to make SDOH more descriptive and easier to understand
- Suggestions from meeting with Gretchen / Latest News:
  - o #1 thing to fix is a Tutorial/Descriptive "How to Use" to map with layers that can be turned on/off
    - ▪ Will possibly make video next week to explain things
    - ▪ Further, will add descriptive information how to use to this map pop-up that first comes up (splash screen)
  - o Suggestion: Add titles to differentiate between MAPSCorps, AppalCart, Food Web, and Census Data
  - o Adding to Terms of Use in AGO Overview Description and to the Story Maps – making a Contact information spot with a WYN email address
  - o Formulating a list/descriptive information for email or further information that has a brief description of each with links
  - o Figuring what would be best to have when opening Story Map 1 (Interactive, Turn on/off layers)
    - ▪ Currently have it with a single shapefile, no-pop-ups
  - o Going to do Grammar checks of all text written
  - o News: Gretchen invited me to Watauga Compassionate Community Initiative Meeting in August to explain completed maps for WYN
  - o For future information distribution and to help explain information at meeting: Want to create an Infographic/Flyer/Hand-out that has the brief description of the maps and somehow having a link stated to where they can be accessed.

Week 6
- This week consisted of making edits and correcting the maps from discussing things with Gretchen last week → working on list of things to do
- One of the main things that I completed was editing the Hunger Relief data from the Watauga Food Council data
  - o Re-examined what was listed on the Hunger Relief page by the Food Council
  - o Added to it because of discovering an article by the *Watauga Democrat* about Summer Feeding programs
    - ▪ Added this one location to the Hunger Relief data

- ▪ *Watauga Democrat* referenced the USDA Food and Nutrition Service's Summer Food Feeding Program
      - ▪ Edited the Hunger Relief CSV file – adding locations from FNS Summer Food and additional places from the Watauga Food Council
          - • Added Hours and URL's for contact information
    - o Once I completed editing the CSV file, I had completed the process of exporting a shapefile again (Upload to ArcMap → Export as Shapefile → Upload to AGO)
- Learned from uploading this newest shapefile to AGO how to get a URL to show in the pop-ups; URL was a new field (column) in the table of the shapefile – Configure pop-up by setting text and the URL option to the field name
- Checked "Terms of Use" for each item in AGO
    - o Set text is: For use, contact info@westernyouthnetwork.org
- Checked information within each of the maps
    - o Set text within the map to say: For use or questions, please contact: info@westernyouthnetwork.org
      Western Youth Network (WYN – with link to WYN website)
      Made in Partnership with the Department of Geography and Planning at Appalachian State University
- Grammar checked all Story Map text by Grammarly
- Added and organized the WYN GIS Gmail Google Drive
    - o Project files added here and will need to be backed up to hard drive as well
- Evaluated variables to add to Bivariate/Relationship Map and the Choropleth Map (Single SDOH Factors Map)
    - o From the original papers that I read and from this project, seeing patterns and how these factors relate to each other
    - o These are especially highlighted in the Story Maps
- Created Video Tutorial of how to use the Interactive Map
    - o Used the program Zoom
      - ▪ Learned how to make a video within this
      - ▪ Made a video tutorial – speaking through the steps and uploaded to YouTube to be able to use in Story Map
          - • AGO only accepts YouTube video links
      - ▪ Link is in the Pop-Up screen (Splash Screen) of the Interactive Map below the screenshots and directions
      - ▪ Note: all videos used within all story maps are through my account through ASU
- Added Choropleth maps and Bivariate maps
    - o Bivariate maps – added by going to the Web Map – adding and editing the map then going to the Story Map, adding a tab and selecting the variable
    - o Choropleth maps – add a tab within the story map – uses the SDOH maps from the original Web Map

- o Added corresponding text – (edited; grammar check)
- From the suggestions from everyone last week to rename or categorize the layers within the Interactive Map
  - o Unfortunately, there is not an option to do so within AGO in either the original Web Map nor in the Story Map format for the Interactive Map
    - ▪ Renamed all layers
    - ▪ Layers are as such:
      - AppalCart –
      - Food Resource –
      - Community Rsrc. – (had to shorten Resource to Rsrc. for the reader – less text to read)
      - SDOH –
- The added shapefile of the county that was all green when the Interactive Map was opened; changed so that all the point locations of the AppalCart, Food Resource, and Community Resource could be seen
  - o Wanted to change to just an outline of the county
  - o With the existing shapefile (of the county) included all the Census Tract subdivisions
    - ▪ Had to download new shapeline file from TIGER/Line
    - ▪ County download was of the whole U.S.
      - Opened ArcMap to export for just Watauga County
      - Had to use the Reproject tool in ArcMap to change to the same coordinate system as the rest of the other files (WGS 84)
      - Selected Watauga County, Exported this one as a shapefile
      - Saved the ArcMap file
      - Zipped shapefile to be able to use in AGO
- Read information about Infographics
- Chose online program – Canva (free to use, using WYN GIS Gmail for account)
  - o Made 2 Rack Card templates
    - ▪ Rack cards are a simpler format than a brochure, and I was (so far) able to get all the information on there
      - Have brief information about SDOH, what data is included and then screenshot pictures of the maps and a brief description of what is in each map
- Checked the Data Descriptions Excel file – this file has all the corrected and detailed information about where the data is in (within all the folders) and about what data is included; Made brief Excel file explaining descriptive files and the folders

Week 7
- Final edits and transferring data on department laptop to external hard drive for WYN
- Wrapping up projects

- Assuring that links work and that all formatting is correct

Index of Maps

Interactive Map (https://arcg.is/1Pua5m)
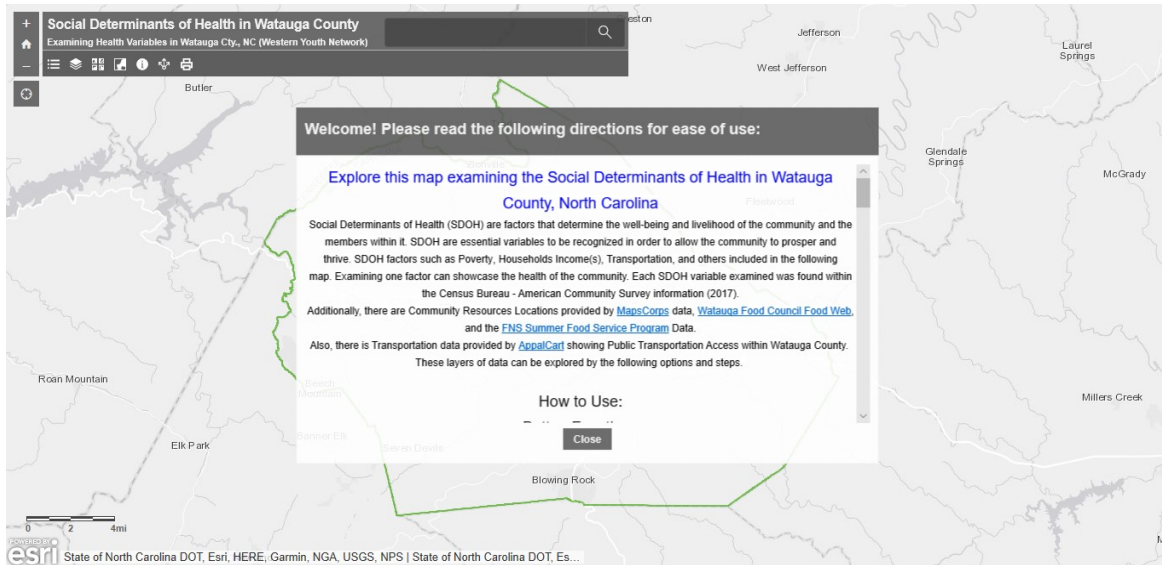
Image 1. Opening pop-up window (splash screen) of the Interactive Map.
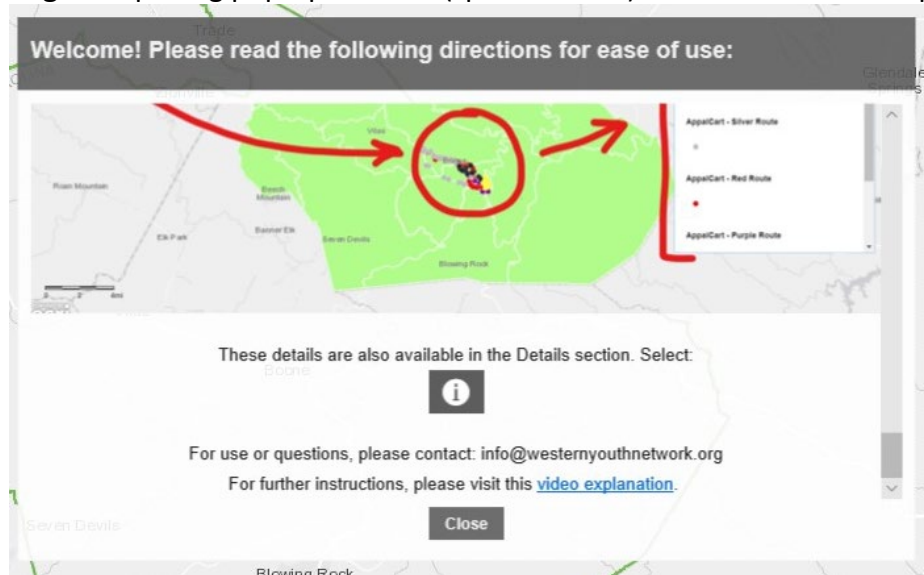
Image 2. Opening pop-up window of the Interactive Map. Including link to video tutorial.
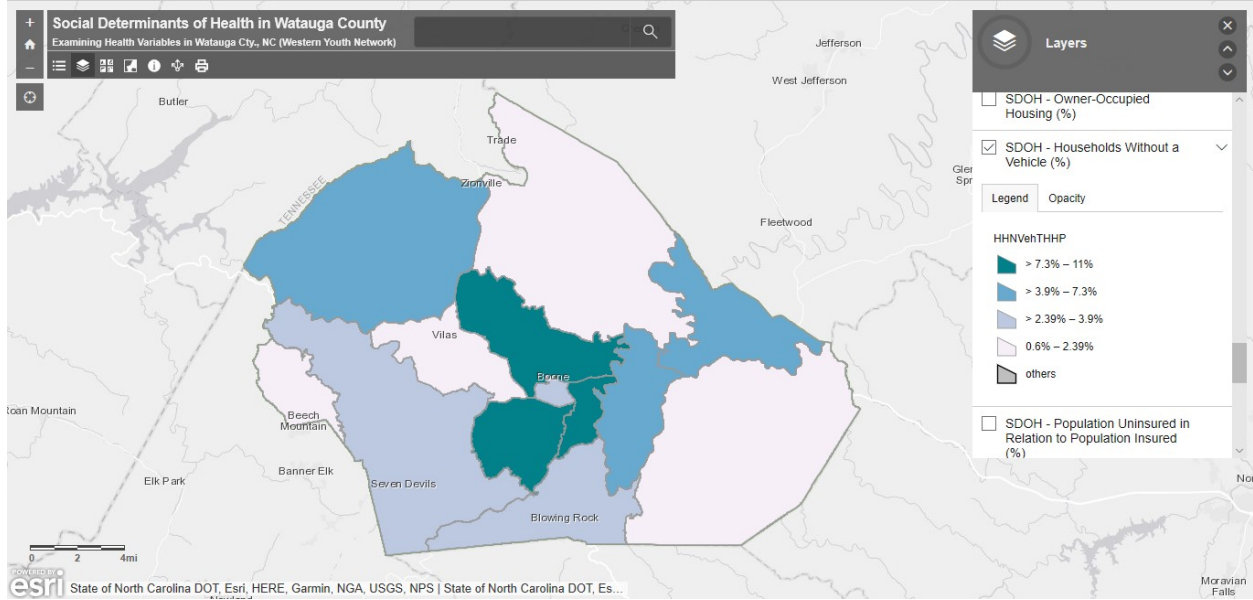
Image 3. Selected SDOH Variable appears on map and within the Layers section is an option to view the legend as well as the Legend option.
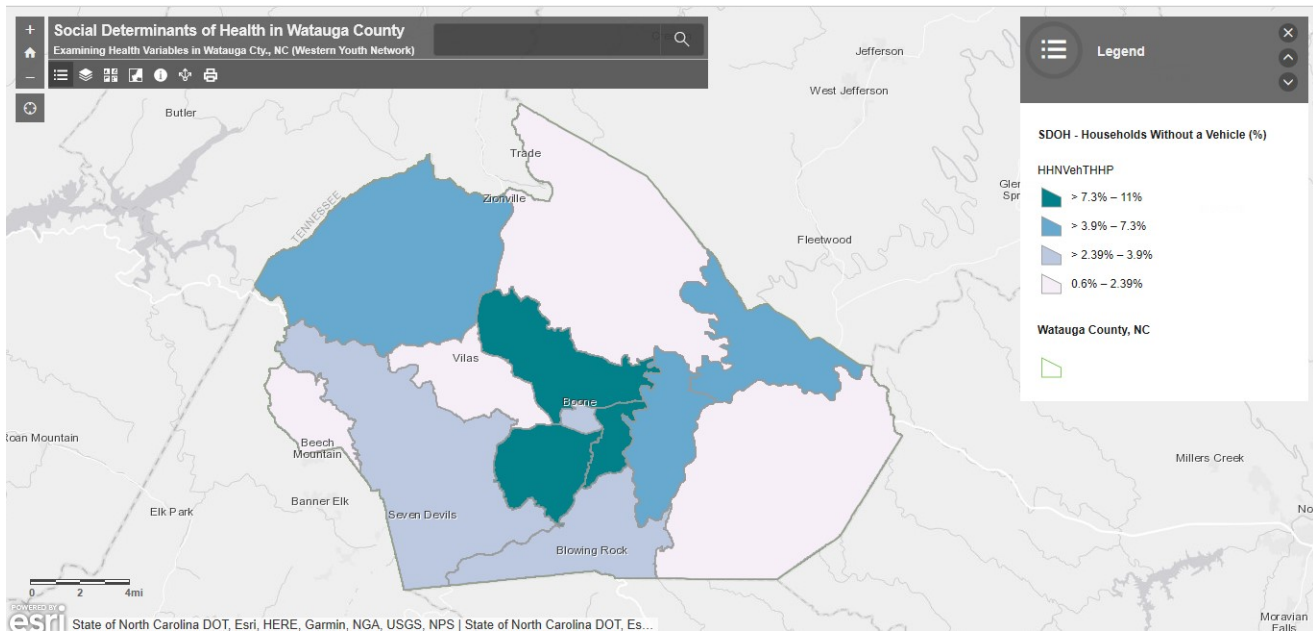

Image 4. Same SDOH Variable as that selected in the image above (Image 3), the legend also allows for the information of the colors to show.
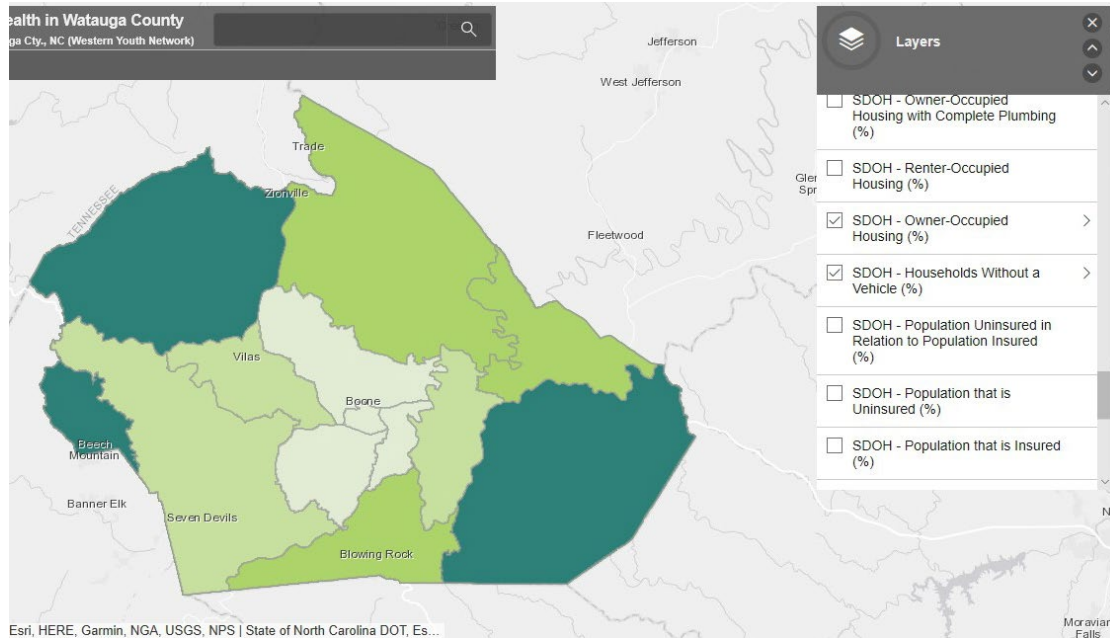
Image 5. Layers within this map are stacked, which means that the layer that is the lowest one selected will not show unless the one above it is selected.
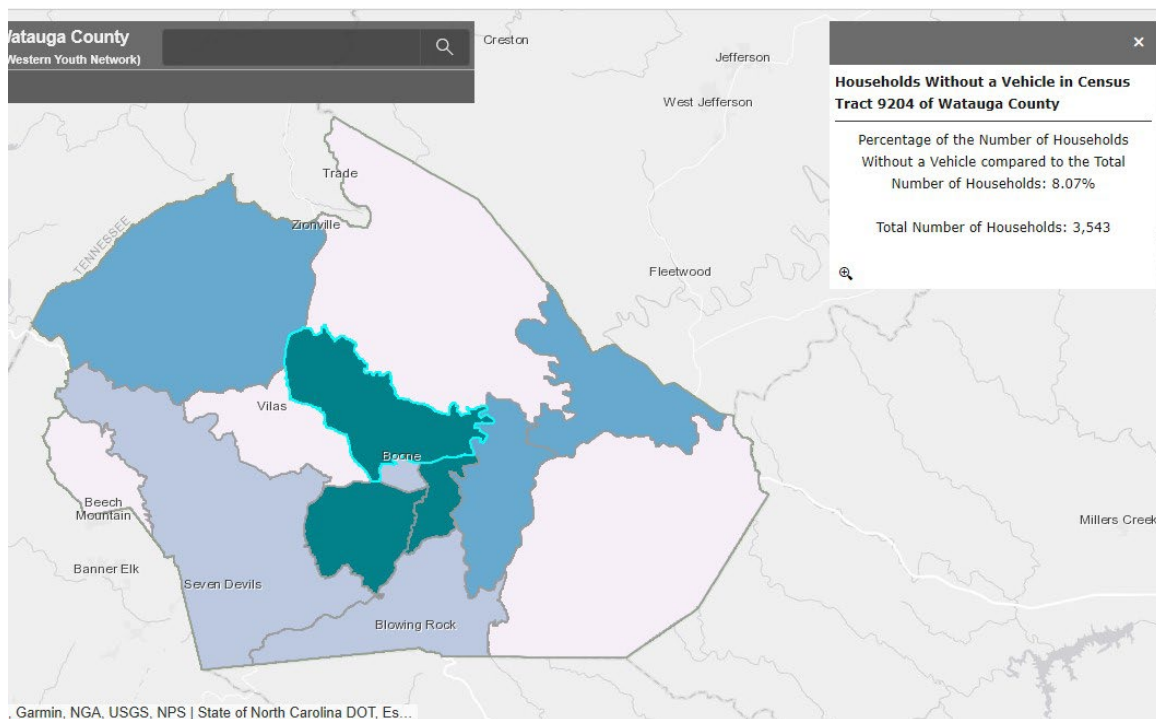
Image 6. Descriptive Pop-up Window appears when selecting a Census Tract. For the SDOH Variables, it gives information of what the Percentage is and the Normalizing Value.

Image 7. SDOH Variable selected and all AppalCart Routes selected. This Interactive Map allows for multiple data layers to be combined.

Image 8. Multiple data layers can be combined, such as multiple MAPSCorps data layers labeled as Community Rsrc. (Resources).
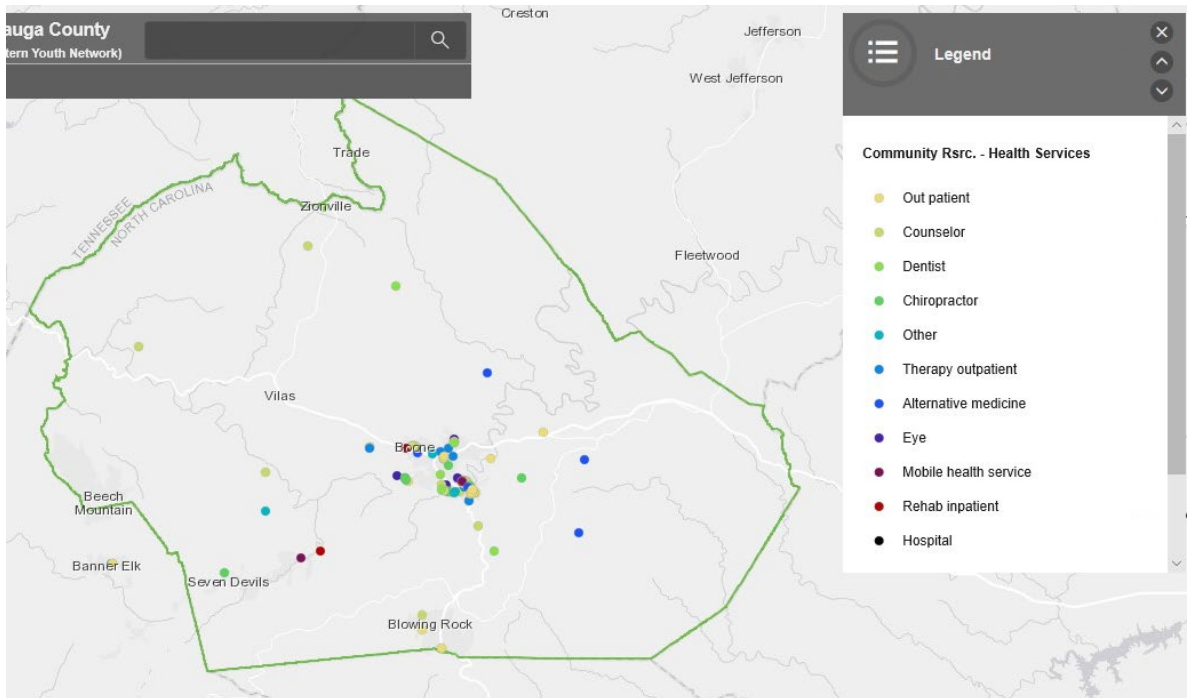
Image 9. MAPSCorps Data selected as Community Rsrc. – Health Services with the Legend showing what the colors represent.
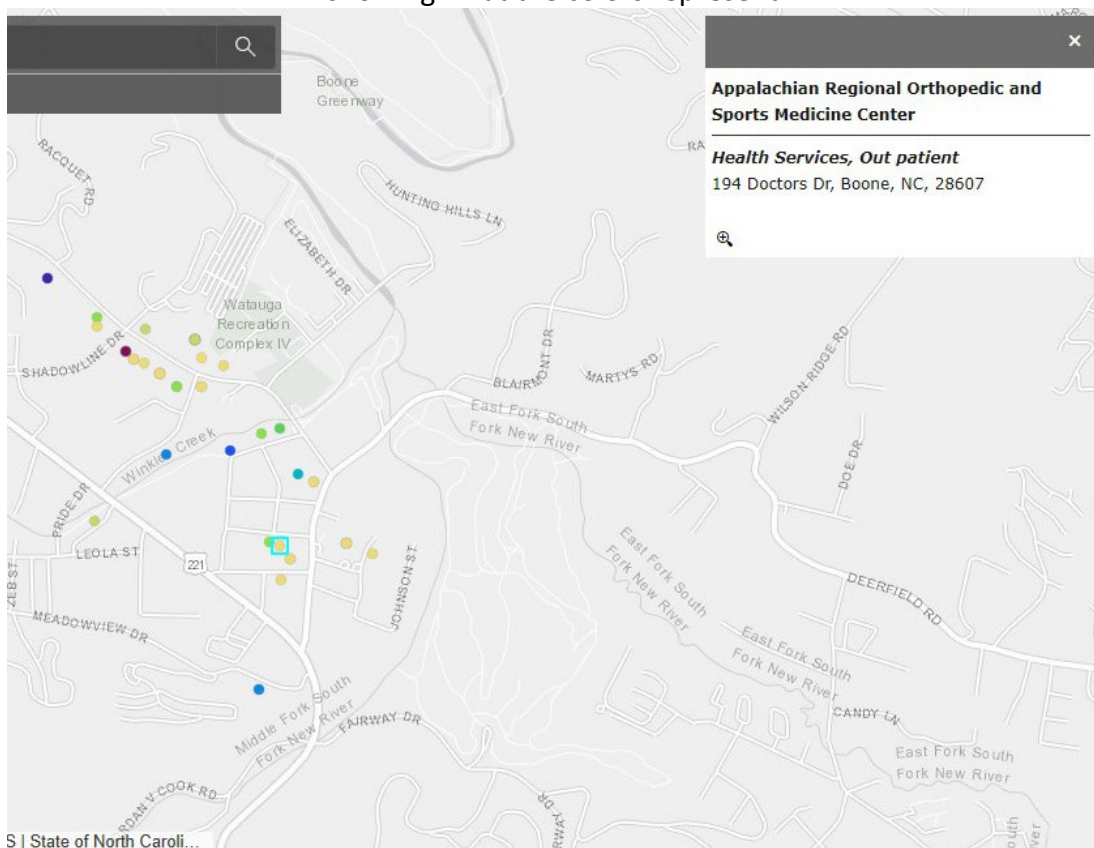
Image 10. When a location point is selected (teal box), the location information is displayed in the pop-up window.

SDOH Map (https://arcg.is/0mSL1u)
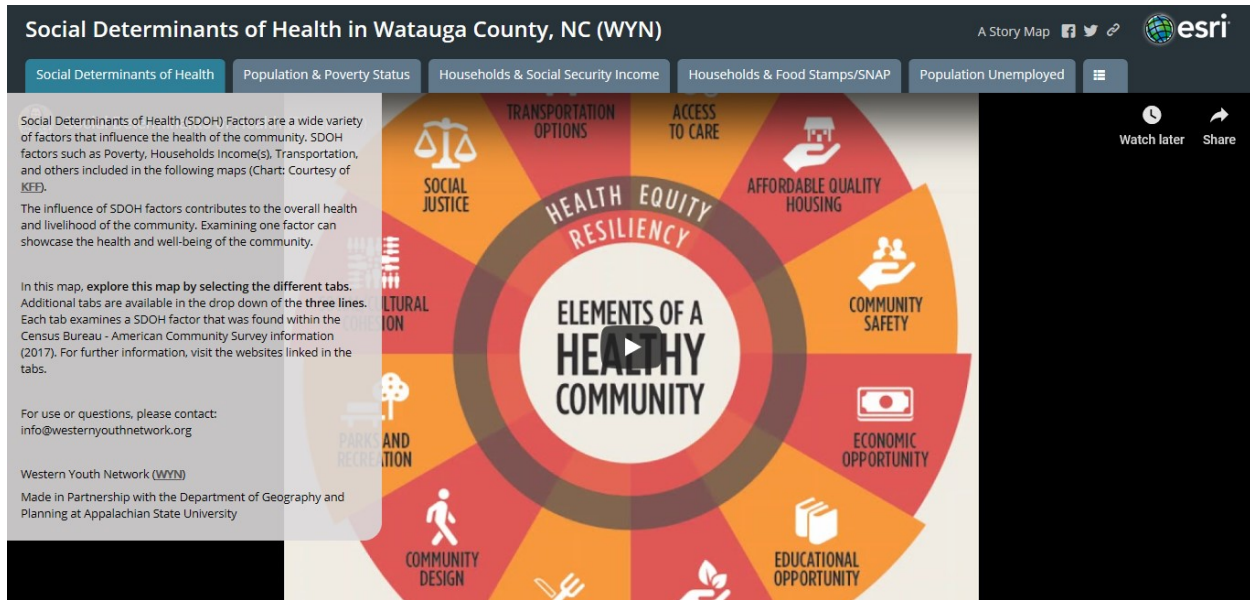
Image 11. The SDOH Map opens with an introductory page, and the background contains a video that will play diagrams of SDOH
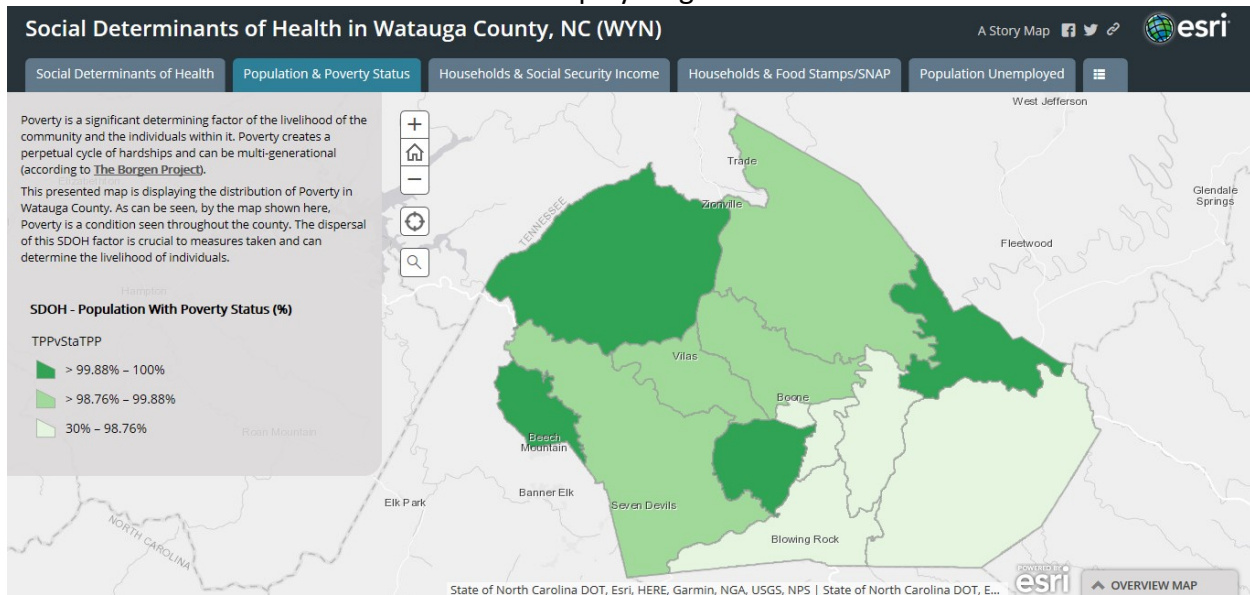
Image 12. Within this tabbed format, interactive map, the different tabs contain different maps of SDOH variables. This map displayed is showing the Population with Poverty Status. There is text information on each tab describing the variable and its importance to SDOH. The legend is included on each map.
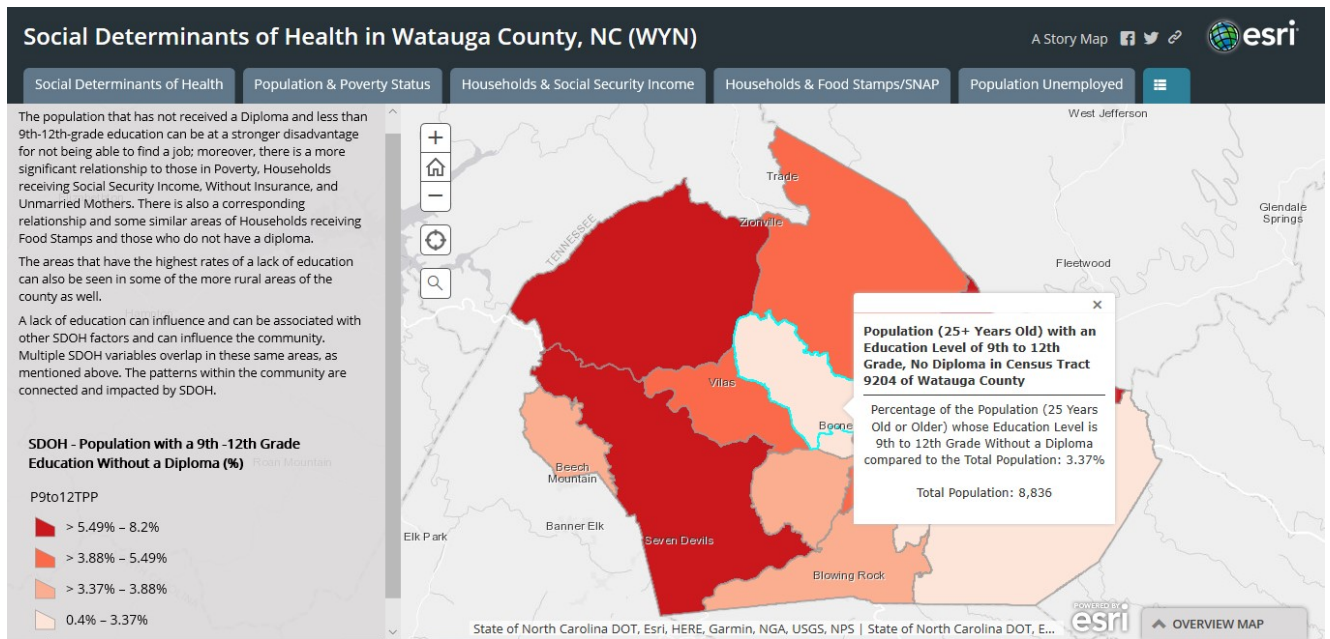
Image 13. This map displayed is showing SDOH Variable of Education Level, the Population with a 9th to 12th Grade Without a Diploma. On all the maps, when a Census Tract is selected a pop-up window appears containing SDOH Data Description with a Percentage for each Census Tract as well as the Percentage for the Normalizing Value.
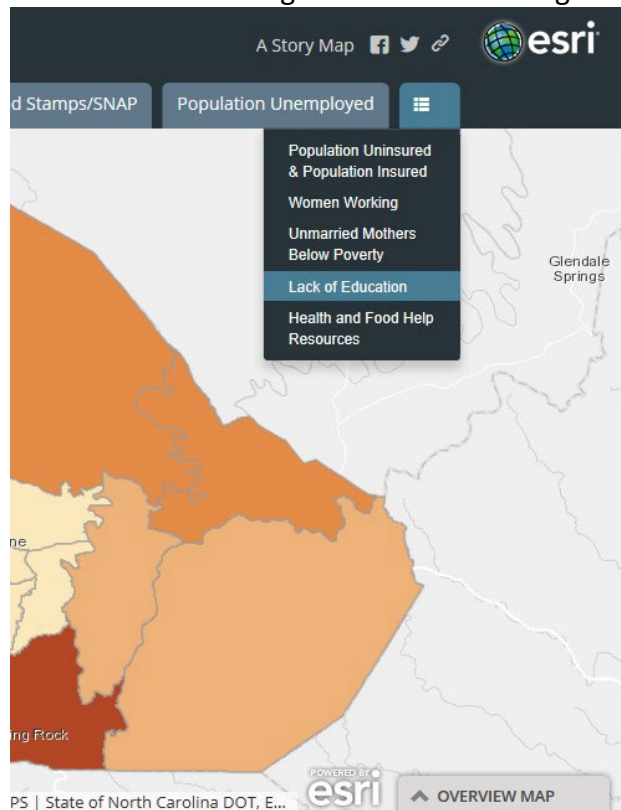
Image 14. The Drop-Down menu contains more maps that can be explored.
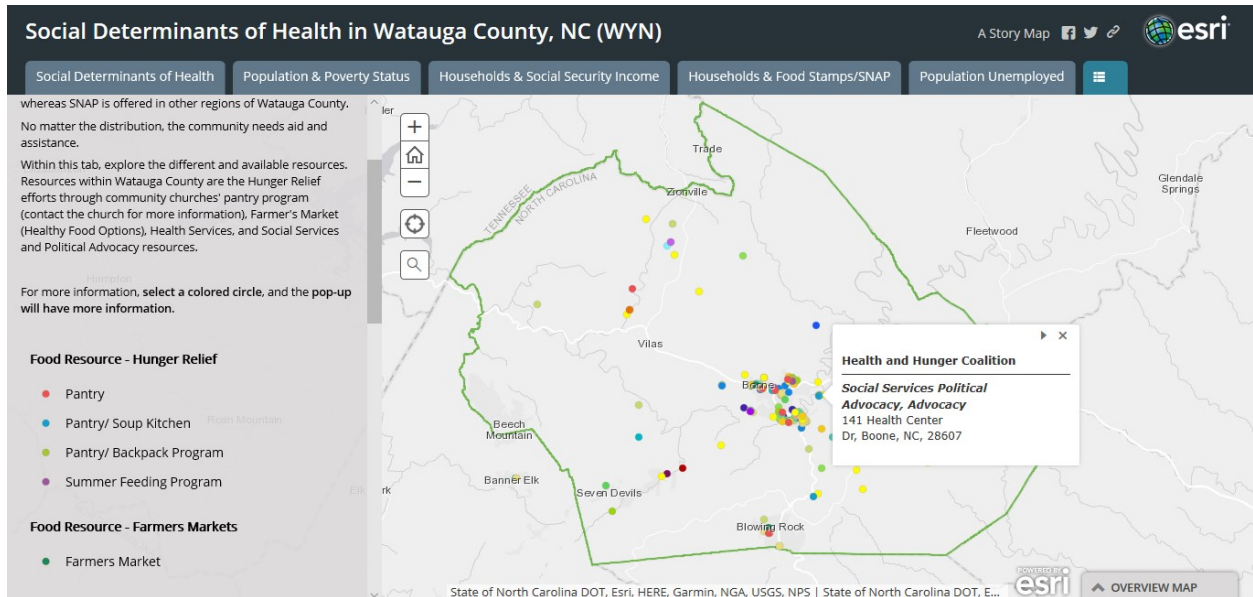
Image 15. Resources and Locations are shown in the last tab. There is MAPSCorps and Food Web Resource data included. When a point is selected, a pop-up window appears with location information.

Bivariate Map (https://arcg.is/1mOO5G)
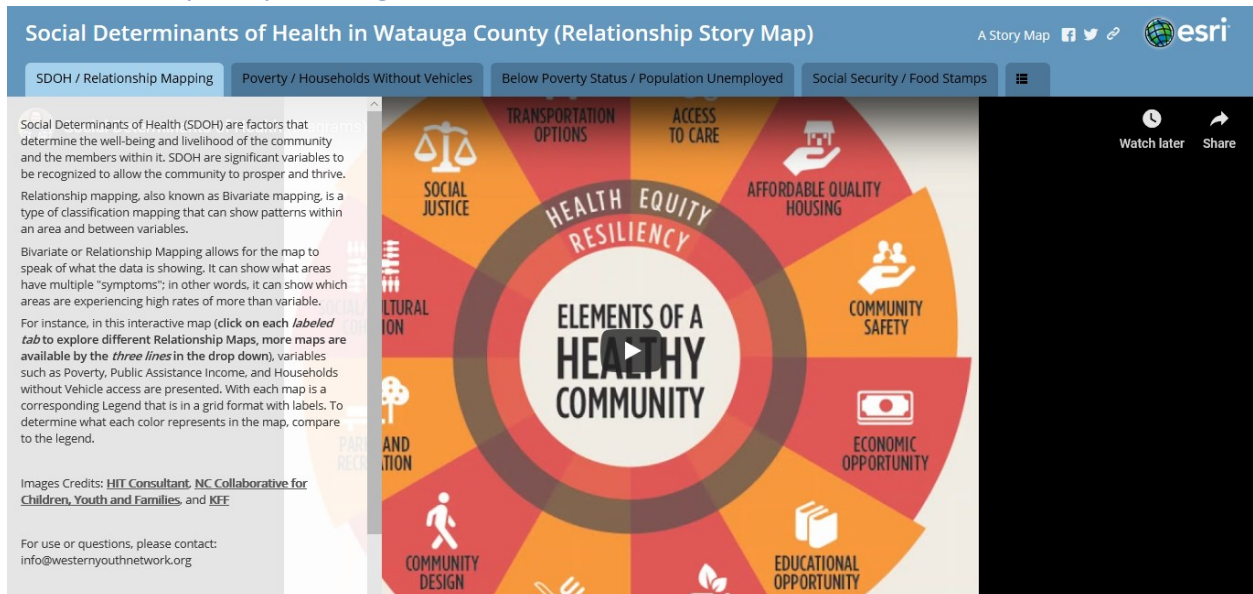
Image 16. Introductory page of the Bivariate Map includes text information describing Bivariate maps and also includes the same SDOH Diagrams video.
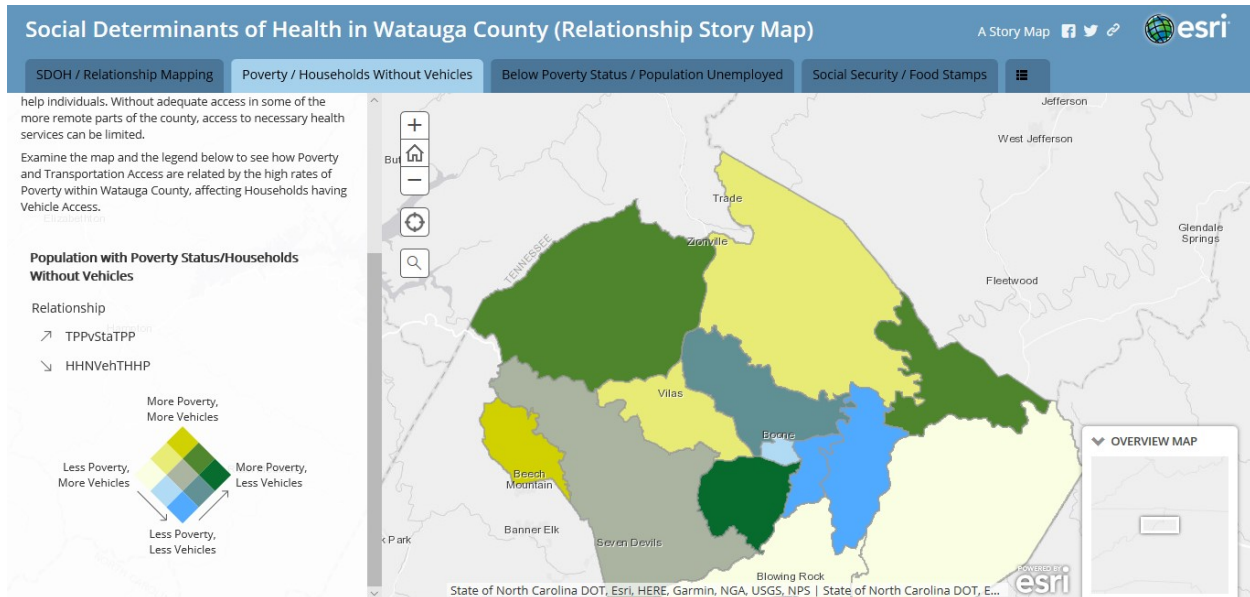
Image 17. This Bivariate Map is exploring patterns between the Data of: Population with Poverty Status and Households without Vehicles. There is text information for all maps, and a corresponding legend as that shown.
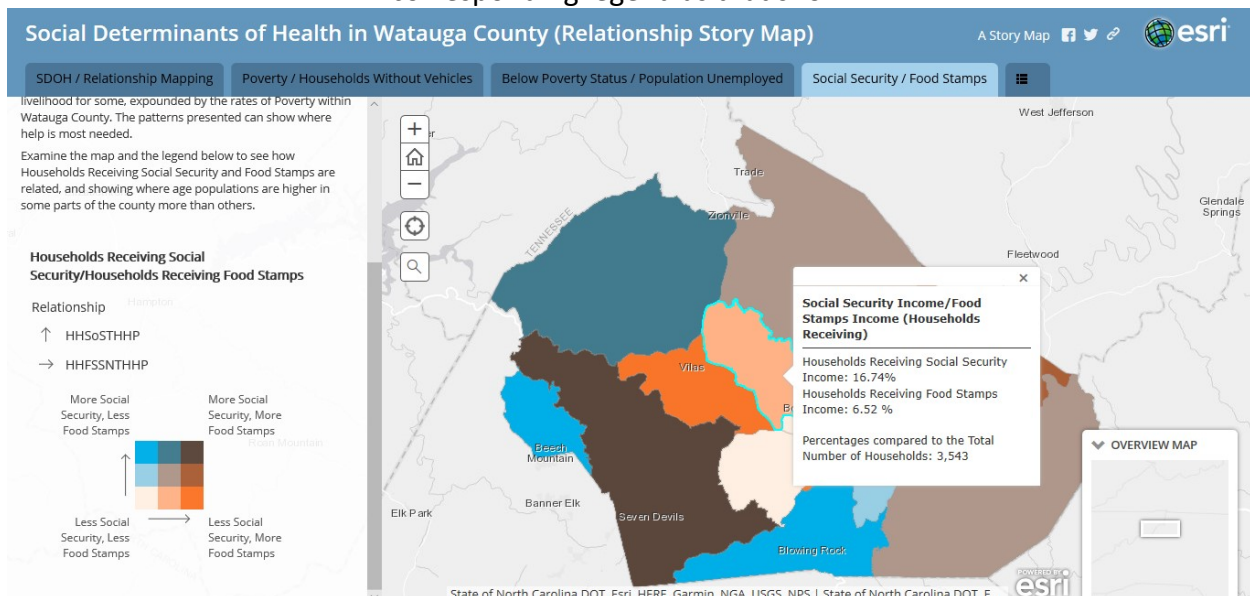

Image 18. This Bivariate Map of Households Receiving Social Security and Households Receiving Food Stamps is showing the patterns associated with these two SDOH variables. The legend is displayed to the left. When a Census Tract is selected a pop-up, window appears of the percentages for both variables and the Normalizing Value.
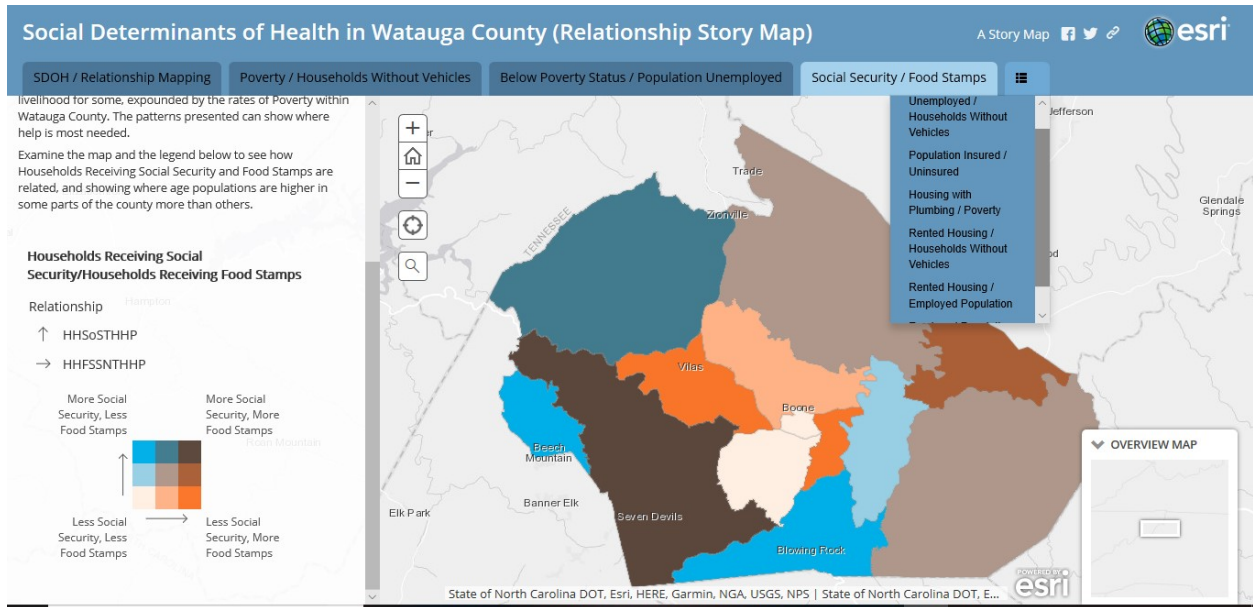
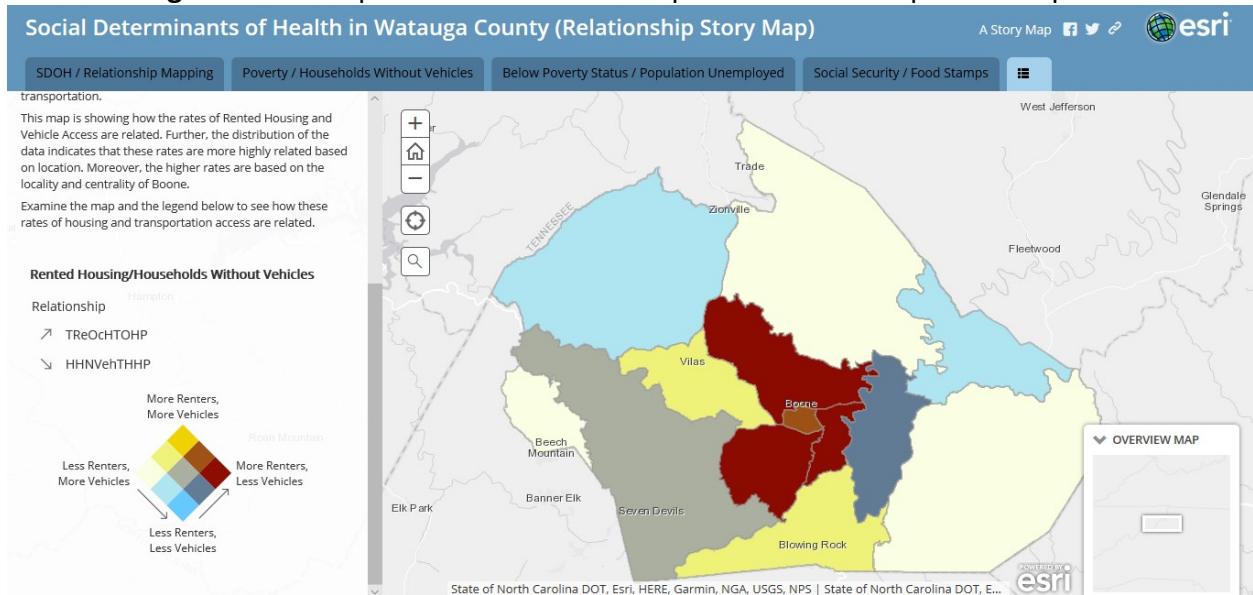**Image 19.** The Drop-Down Menu has the option for more maps to be explored.

Image 20. Another Bivariate Map that is included in this tabbed, interactive web map that is illustrating the patterns between Rented Housing and Households Without Vehicles.

Rack Cards

Image 21. Rack Cards that I created for WYN that can be used to distribute to the public. I created two different formats that have a description and image of the maps with links that can be easily entered into a browser.