Mapping Charitable Food Data in Arizona: Business Intelligence for St. Mary's Food Bank

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A practicum to fulfill the graduation requirements for M.S. Applied Geospatial Sciences in the Northern Arizona University Department of Geography, Planning and Recreation

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Introduction

The USDA (and likewise Feeding America) defines food insecurity as "a lack of consistent access to enough food for an active, healthy life." According to Feeding America, there were an estimated 38 million food insecure people in the United States in 2018. Within the American landscape, Arizona's food insecurity is particularly difficult to understand and address because the state's food insecure individuals live in both highly varied cultural contexts and an Urban-Rural continuum often constrained by desert environment and infrastructure. The Urban-Rural continuum has at one extreme sprawling populous cities and at the other extreme, arid, remote areas with little or no infrastructure. Food insecurity can reach estimated rates as high as 33% in both urban and rural areas. (Feeding America, n.d.)

Numerous federal and charitable programs exist to address hunger in the US. Federal programs like the National School Lunch Program (NSLP), Women, Infants and Children (WIC) and Supplemental Nutrition Assistance Program (SNAP) all serve as a consistent resource while charitable organizations fill in front-line gaps to address emerging hunger when other resources are not enough or are not timely.

Within the charitable food context, St. Mary's Food Bank is one of about 200 Feeding America food banks spread throughout the country in every US state. Many people think of food banks as small organizations that distribute food directly to the hungry, but the landscape of charitable food in the United States is more complex than this. Like St. Mary's Food Bank, "food banks" are usually large, intermediate food providers which procure bulk food through a variety of federal buying, corporate grocery rescue, public fruit gleaning and other programs. Food banks distribute this food for free or low cost to community partners who in turn distribute it to community members in need. Feeding America estimates there to be about sixty thousand community partners, or "pantries", in their nationwide.

St. Mary's holds a key position not only within the charitable food landscape but within the broader Arizona food network. As the second largest food bank in the Feeding America network and the fourth largest food bank in the country, they transport over one hundred million pounds of food yearly to over a million people in Arizona either directly or through community partners. They have a large and disparate network from a human and physical perspective.

For many years St. Mary's contracted out analysis to better understand food security and inform decisions about their distributions. These analyses were static, one-time products from large consulting firms that typically cost $50k-100k each. These analyses quantified the "Unmet Food Gap" at zip code level in the St. Mary's Arizona network by combining Feeding America food security and St. Mary's distribution data. They received this analysis back as a simple spreadsheet. Staff then combined this into what they called a *Needs Assessment*, a document which describes geographic areas that remain high need even after food assistance programs. St. Mary's reasonably had many frustrations with this process, some of which included high costs and the analysis being out of date almost as soon as it was generated.

The goal of this practicum was to create for St. Mary's a workable mapping solution that would serve as a *Living Needs Assessment* and in doing so, resolve their frustrations with expensive, out of date consulting products. This project resulted in an ArcGIS Online web application that allows staff to map and dynamically understand food security within Arizona as well as to extract and present this information in useful ways. Though the initial goal of this practicum was to create a single application, it led to St. Mary's holistic adoption of mapping and to many other products and simplified workflows to aid their organization. This work is ongoing. Though this paper speaks in the past tense for work conducted in 2019 and 2020, the current 2021 iteration of this project widens the scope of St. Mary's mapping to incorporate collaboration from other Arizona food banks. *FIND, the Food Impact and Needs Dashboard,* will include data from sister Feeding America food banks to visualize food insecurity, the combined charitable food from these organizations, and remaining food needs across the state.

Literature Review

There have been many GIS mapping studies and products over the past 20 years related to food geography. In the following review, I split a discussion of these resources into three primary time periods: 1999-2008, 2009-2015 and 2016-Current. The first two time frames correspond with existing academic literature reviews performed by researchers of this topic over the past twenty-five years. The last time frame is from independent review of current public platforms.

Academic literature generally regards food geographies as "food environments" (Sweeney et al., 2016; Charreire et al., 2010), which can encompass topics ranging from access and networks to emergency food aid and urban/rural food deserts. For continuity, I adopt the term food environment in this review when addressing food geography.

Charreire et al.'s 2010 review of GIS for food environments looked at GIS methodologies from 29 different academic studies from 1999 to 2008. It was the first published systematic literature review of this topic in existence at that time and focused on methods of spatial analysis using primarily desktop software. To give context on this time period, Google released Google Maps in 2005, PolicyMap would not come out until 2009 and Esri released ArcGIS Online in 2012: web mapping for demographic issues was in its infancy from 1999 to 2008. Furthermore, Charreire reported that twenty-two out of their twenty-nine reviewed studies occurred from 2006 to mid-2008. GIS study of food environments therefore burgeoned during the years roughly corresponding to the birth of demographic web mapping.

Sweeney et al.'s 2016 review of 2009-2015 platforms focused on online GIS and depicted the growing role of web mapping not only for demographics, but specifically for food environments. Their review covered thirty-four academic case studies and seventy public domain mapping resources which represented a variety of locations and scales. Of the thirty-four studies, twenty-one focused on US geographies ranging from national to neighborhood scales: ten of them were from the Northeast and seven were from the Midwest. Food access was the most common theme, comprising seventeen of the studies. They found however that there were no food mapping studies focusing on Southwestern US geographies (Sweeney et al., 2016).

Of the case studies from this period, several stand out in their applicability to modern mapping for food security and food banking. "Mapping Spatial Variation in Food Consumption"

(Morrison et al., 2011) linked demographic data to food consumption and mapped it in order to visualize the spatial variation by gender and age in British Columbia, Canada. "Towards the Development of a GIS Method for Identifying Rural Food Deserts" (McEntee and Agyeman, 2010) contributed to an up-and-coming body of knowledge on rural hunger by identifying low food access areas in Vermont. It simultaneously described a mapping model for rural communities throughout the U.S. Finally, in "Integrating Publicly Available Web Mapping Tools for Cartographic Visualization of Community Food Insecurity" (Hwang and Smith, 2012) Hwang described a framework to identify potential locations of community kitchens using publicly available mapping software, thereby showing that food security mapping could be undertaken at minimal cost.

In 2008, America's Second Harvest became Feeding America, and they completed the first MMG study in 2011 for 2009. The first reported crawl of their web mapping interface for food insecurity rates occurred that year according to Internet Archive (Internet Archive, 2021). Many of the web maps reviewed by Sweeney have been abandoned or are no longer available: Feeding America's MMG mapping exists as one of the few original interfaces reviewed by Sweeney which remains and has been expanded. Figures 1 and 2 below show how Feeding America has modernized this custom mapping interface over time.

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Figure 1. *2011 Map the Meal Gap Web Map.* http://feedingamerica.org/hunger-in-america/hunger-studies/map-the-meal-gap.aspx.

Figure 2. *2021 Map the Meal Gap Web Map* https://map.feedingamerica.org.

A year later in 2012 Esri released ArcGIS Online (AGOL) and public health mappers flocked to it, generating countless web maps including many about food environments. Of the seventy web maps Sweeney reviewed for the 2009-2015 period, ten of them were from the AGOL platform and seven of those occurred in the first two years.

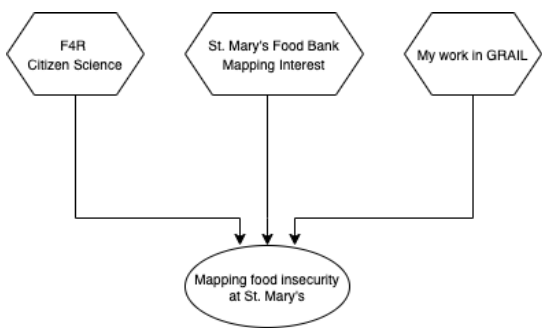
In the time since Sweeney released their review, ArcGIS Online has only gained greater traction with food non-profits. At the undertaking of this practicum, Capital Area Food Bank in Washington D.C. (Capital Area Food Bank, 2021), the Atlanta Community Food Bank (Atlanta Community Food Bank, 2021) and Feeding America Riverside San Bernardino (Lehman, 2021) were all examples of Feeding America food banks employing ArcGIS Online to represent their data, better fulfill business processes and understand food insecurity.

Screenshots of food bank AGOL examples

The rich history of ArcGIS Online for non-profit, public health and food mapping coupled with its ease of usability in mapping secondary and custom data made it an ideal choice for this practicum. In this, the products that came out of this project are part of an ever-growing body of mapping knowledge around local and U.S. national food insecurity. Like with many other regional food banks, the purpose of St. Mary's mapping with ArcGIS Online was to better understand and respond to these issues locally. This project offered a unique perspective into local food insecurity by incorporating Feeding America data with food bank distribution data across a large portion of Arizona.

Methods

This practicum precipitated from three major synergies: 1.) the FEWsion for Community Resilience, or F4R, citizen science project, 2.) St. Mary's curiosity and interest in mapping to improve their practices, and b.) my work in the Geospatial Research and Information Lab on campus at Northern Arizona University.



I began mapping work with St. Mary's in 2019 after meeting Ceara Chirovsky from St. Mary's Food Bank at an F4R citizen science meeting in Flagstaff. Ceara brought questions and interest about mapping to the F4R meetings, namely she wanted to understand how her organization could contribute to discourse around food systems in Northern Arizona while exploring how food mapping could also benefit St. Mary's.

To give some background on F4R, it is a Food-Energy-Water (FEW) systems thinking project which brings community stakeholders together and generates dialogue and solutions to better understand how these systems operate in their communities. As its name implies, the larger goal of F4R is to increase community resilience.

While there exists large-scale open data for food systems, for example commodity input and output at state levels, transportation infrastructure systems and other related data, F4R and FEWSION generates collection and discourse for data that has historically low availability. Namely, at the meso-scale and "last mile" levels. By meso-scale, this means at county and lower levels, and by "last mile" it means the transportation and terminus of food to communities and the individual. The F4R process has two significant outcomes related to food. First, it facilitates the relationships necessary to collect and map this data and second, it generates localized physical data and mapping products that can be joined with large-scale data. (F4R Citation)

At the time Ceara and I both participated in the Spring 2019 F4R cohort study, I was working as a graduate researcher in the Geospatial Research and Information Lab (GRAIL) at Northern Arizona University. GRAIL is a GIS research lab in NAU's Department of Geography, Planning and Recreation. It provides the technological resources to accomplish a variety of mapping projects while pairing student researchers with applied professional research needed in the community and university.

Ceara came to F4R with concerns about existing consulting products for which St. Mary's had paid. These products, designed to provide food insecurity analysis and identify areas of high food need in Arizona, were immediately out of date from the consultant, poorly documented yet extremely expensive. Ceara, Sean Ryan, a facilitator from F4R, and I discussed options for creating a web mapping application that would resolve these concerns, provide a dynamic picture of food insecurity across Arizona, and help identify areas of high need where St. Mary's could focus on distributing food. Because I already had access to mapping platforms in the GRAIL lab, we believed it would provide an ideal environment to bootstrap a mapping project.

GRAIL was an important synergy for this practicum in many ways. First, it provided initial funding for ArcGIS Online research and training to help get the practicum going. Second, it informed the technology choices for mapping with the practicum, and third but most importantly it provided an incubator environment for us to house and test mapping solutions for St. Mary's. This provided a much-needed opportunity for them to experiment with mapping projects and determine mapping effectiveness for their organization.

This paper describes three important time periods for mapping with St. Mary's. In "2019: Creating the Initial St. Mary's Web Mapping Application" I detail the 2019 creation of the mapping product which catalyzed further mapping work in the organization. This product, which was incubated in the GRAIL ArcGIS Online organization, I simply called *St. Mary's Food Bank*. In "2020: Migrating the Agency Explorer" I describe the second stage of mapping wherein I configured an ArcGIS Online organization for St. Mary's and migrated content from the GRAIL organization. During this stage I updated the application and renamed it to the *Agency Explorer*. Finally, in "2021 and Beyond: Creating FIND, the Food Impact and Need

Dashboard" I discuss coming on full time with St. Mary's, current mapping projects and the collaboration with sister food banks across Arizona to transform the *Agency Explorer* into *FIND: Food Impact and Needs Dashboard*.

Note:
Throughout the following methods sections I refer to a business analysis I completed for St. Mary's in 2020. I include this document to indicate how I and St. Mary's interpreted this project during 2020 as it evolved from a citizen science project to a formalized business product for their organization. However, it also depicts the project as it was envisioned at a static moment in 2020 and therefore does not address the ongoing nature of the project. This business analysis is provided in Appendix A.

2019: Creating the initial St. Mary's Web Mapping Application

Sitting down with Ceara and documenting her visions for mapping were the first step in this practicum. My previous experience as a software developer informed my approach to this step. To formalize this process I used the *Requirements Gathering* and *Feasibility* stages described by traditional software engineering [Software citation?]. I used these methods simply because they fit well with identifying what St. Mary's would require in a mapping experience. These steps can be used for many types of product development or business analysis and do not require custom software development to be applicable.

In software engineering, Requirements Gathering refers to the process of sitting down with a potential product owner to discuss with them the fundamental tasks they need or expect to accomplish with a program. Feasibility analysis follows from requirements gathering and involves determining which platforms will satisfy these criteria. I eventually incorporated the functional requirements determined in this stage into the May 2020 business analysis I wrote for St. Mary's. These requirements are covered in the "Business Needs" section of Appendix A: Business Analysis; once I determined St. Mary's requirements for a mapping interface, I explored the feasibility of creating a suitable interface in ArcGIS Online. Because this was an experimental project for the organization to try out mapping and because I had access to ArcGIS Online through the GRAIL lab, I pre-selected ArcGIS Online to some degree for the project. Some considerations for this included the goal to simplify the project by not custom developing a mapping interface and to provide a low cost and well documented platform. In this case, the Feasibility analysis helped determine the *extent* to which St. Mary's functionality needs could be answered using the ArcGIS Online platform.

After determining functional needs and feasibility, I had follow-up conversations with St. Mary's to determine acceptable data formats for mapping. In early stages of this project data consisted of two datasets: a.) food insecurity rates from Feeding America Map the Meal Gap studies called *Feeding America Food Insecurity 2018* and b.) St. Mary's partner locations with food distributed to each location in pounds called *Food Bank Programs*. Because St. Mary's and many other food banks report at the zip code level, they sent me Feeding America data at the zip code level for the most recently completed 2018 MMG study. Because an MMG study uses data from two years prior, we were actually examining metrics from 2016.

I discussed with them the types of data they were collecting in their organization; namely, did they have reliable addressing information associated to their partner organizations. Understanding that they had access to this and were tracking food pounds sent to each partner, I determined an example data format with headers and provided this to their IT department. This example data structure is provided in Appendix B for reference. IT then crafted a report that would generate this data for a requested time period. This simplified the process of pulling the needed data from within St. Mary's and cut down on processing errors. This proved to be significant: I planned to simplify staff updating the mapping application by using a simple layer *overwrite* option in ArcGIS Online for their layer depicting partner poundage. The consistent data format enabled this and made the application much easier to maintain.

I uploaded each of the finalized layers above as CSV to ArcGIS Online and converted them to a feature layer with the Feeding America food insecurity data depicted as zip code polygons and St. Mary's partner locations displayed as a series of points (symbolized by program type and poundage amounts). I combined these layers in a map with partner locations overlaying zip codes and selected a basemap that included transportation and city/building infrastructure. By default, the map focused on partner locations with the ability to toggle food insecurity layers as needed.

As this part of the project materialized, St. Mary's requested an editable layer called *Agency Prospects* which would allow them to mark potential collaboration partners in areas of interest. I created an editable point layer that allowed them to mark a place on the map and enter pertinent details.

Figure 3 below shows the default loading state of the St. Mary's Food Bank mapping interface with the *Food Bank Programs* (colored circles) and *Agency Prospects* (X's) layers. Figure 4 depicts a zoomed in view where *Feeding America Food Insecurity 2018* is also visible, to easily visualize how they overlap.

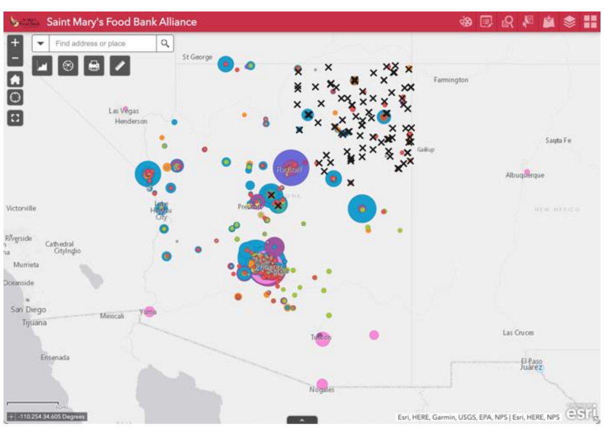


Figure 3. *Loading view of the St. Mary's Food Bank application*

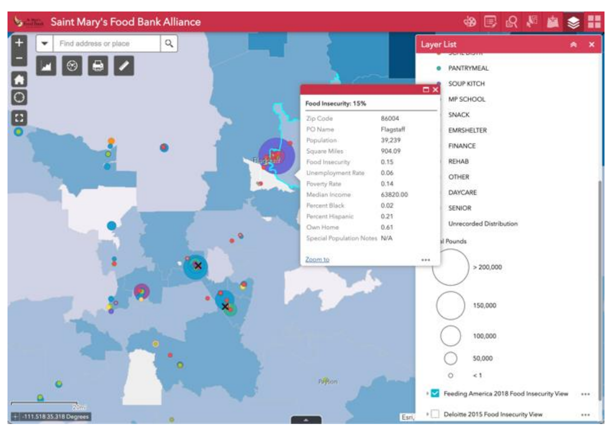


Figure 4. *Zooming in to look examine zip code food insecurity with food bank programs*

ArcGIS Online contained several types of mapping interfaces you could use to create a mapping experience in 2019, some of which were dashboards, webapp builder applications and story maps. As part of the feasibility analysis and based on St. Mary's functional requirements I chose to implement this mapping project as a Web AppBuilder (WAB) App. WAB offered a series of customizable and extensible widgets so that in the event St. Mary's wanted to build the interface out with custom developed functionality, they would have choices. The WAB interface's widgets would allow users to textually query the application's layers through the Query widget and export results in common formats like CSV as well as afford users the ability to interactively drag shapes over the map to summarize information about areas of interest. Additionally, it enabled me to pick and choose simple, high-value spatial analysis tasks with the Analysis widget without overwhelming a user with too many options.

Some examples of high-value analysis tasks that St. Mary's wanted to perform with the application included calculating drive times between partner locations, selecting geographic areas, locating how many partners might be within a certain distance of a partner of interest, and summarizing data to understand totals. The WAB Analysis and Query widgets accomplished this needed functionality.

To augment searching in the application, I used the Query widget to configure a series of spatial and attribute-based searches for zip codes and food bank programs. These queries searched the Feeding America Food Insecurity 2018 and Food Bank Programs layers respectively. Figure 5 shows the different types of available searches: using one of the a.) select queries (blue square icons) they could physically interact with the map to drag a shape and manually return data in a given area or b.) text queries (purple circle icons) they could perform either a spatial or field-based search. In this example, the user chose to search for "Organization names that contained the text 'Knight'", Figure 6 displays the results and the automatically zoomed map when a user chooses a result.

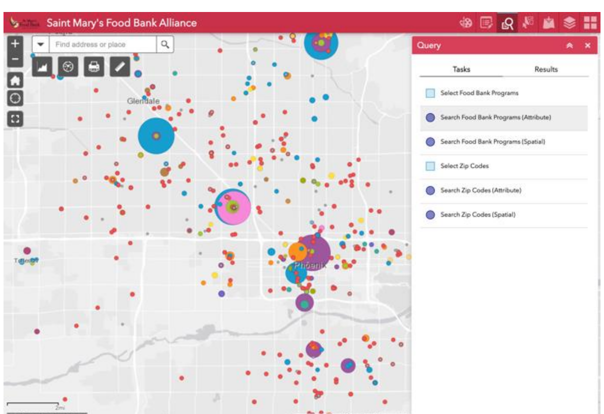


Figure 5. *Choosing a text search for food bank programs with "Query"*

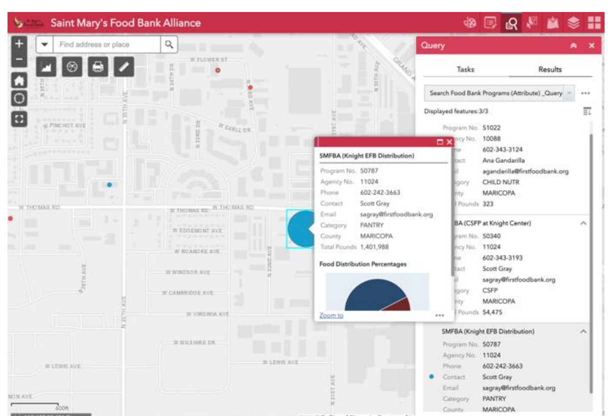


Figure 6. *Results from a search looking for organization names that contained the text "Knight"*

The image below depicts the process to create a new Agency Prospect. The interface is like Arc Desktop: the Edit widget allows a user to click on the map to make a new point. However, we discovered early on that the process for completing this was not as simple as first planned. Although I created the Agency Prospects layer by initially geocoding a list of example locations with addresses, the map saved a new point according to where the person had clicked, not according to the address fields. We worked around this issue by emphasizing using the clicked locations as the true location and using address fields for note purposes.

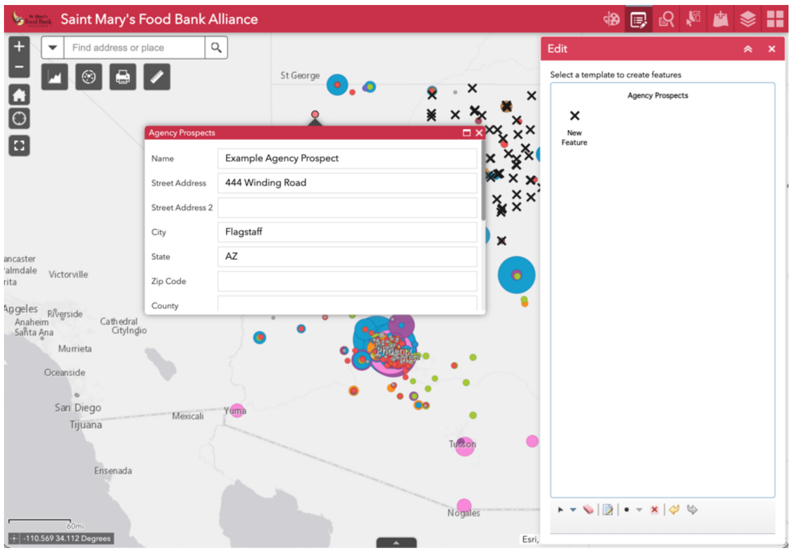


Figure 7. *Creating a new Agency Prospect with "Edit"*

For a detailed demo of the St. Mary's Food Bank Alliance web mapping application, please visit: site.site

During late Spring, Summer and early Fall of 2019 I tested the application with Ceara Chirovsky, conducted training sessions, and presented the application to St. Mary's staff.

2020: Formalizing ArcGIS Online and Web Mapping

Several things happened in the beginning of 2020 to move this project forward and further catalyze mapping at St. Mary's. After testing and presenting the application, St. Mary's wanted to formalize the implementation and bring it into their organization. Simultaneously, COVID-19 gained traction and they had questions about other mapping options to benefit the community. These interests necessitated setting up an ArcGIS Online organization of their own. Although the focus of this section is the continuation of the St. Mary's web application as the *Agency Explorer*, I also describe other interfaces I created with St. Mary's during this time to aid the community during COVID-19.

In May 2020 I drafted the business analysis in Appendix A. Shortly after completing this, St. Mary's established non-profit licensing with Esri for ArcGIS Online. We deviated from the recommendations in the business analysis and implemented about twenty-four accounts, four of which enabled content creation. I moved the application over using the AGO Assistant, an Esri web tool that allows you to log into more than one ArcGIS Online organization at once and move content between the organizations (Esri, 2021). Figure 8 below shows some of the options in the AGO assistant; it even includes a function to view and edit an item's JSON configuration.

This figure shows me logged into the GRAIL organization as my primary organization with me selecting the function at the top to copy content. After clicking this option, the application prompts the user to log into a second organization. Figure 9 shows me secondarily logged into the new SMFBA organization, dragging content from GRAIL to SMFBA. Items highlighted in light blue are eligible to copy over.

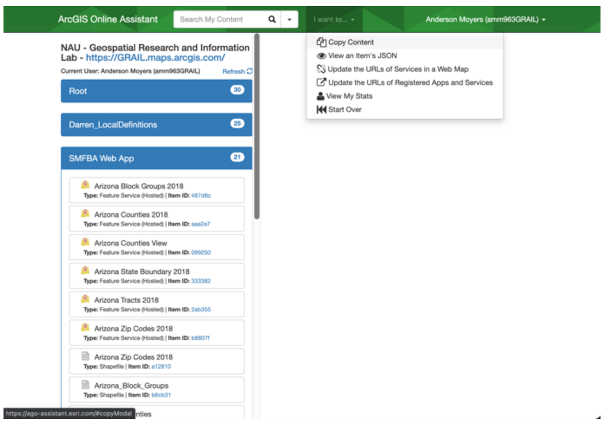


Figure 8. *After logging into a home organization, available functions.*

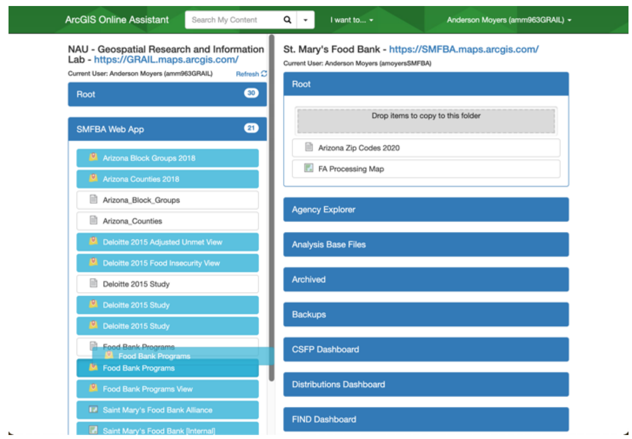


Figure 9. *After logging into a secondary organization, dragging a feature layer to copy it over.*

The process to migrate content between the two organizations turned into a larger and more complicated task than I anticipated. I ran into difficulties moving content between GRAIL and the new St. Mary's organization. To preserve symbologies from some of the layers in the web application that we were having difficulties with, I exported the files from the GRAIL org as a shapefile and imported them to the St. Mary's org. This tended to transfer attribute types better than transferring as an FGDB (for instance when importing an FGDB, ArcGIS Online sometimes recognized zip codes as integer types and not strings though they had been strings in our previous layer in the GRAIL organization). The largest issue I ran into was that the migrated web application would not properly recognize the underlying map after many attempts to sync them and edit JSON references in the application to properly recognize the map. This required me to manually recreate the map and re-configure the queries in the Query widget after moving everything over.

Once the application was successfully configured in the SMFBA organization, I renamed it the *Agency Explorer* to better fit with naming paradigms as we built out more products. For the most part, the implementation remained the same although we continued to update the data in it. I refreshed the food insecurity layers when the yearly MMG study came out and updated the partner location poundages on a quarterly basis using IT's automated export.

Configuring a home page and determining naming conventions for content was important for the organization as many staff had difficulty finding the content they were looking for. To simplify this I created subsections on the homepage for different content categories. Some of these categories included "Applications", "St. Mary's Food Bank Data", "Feeding America Data" and "Demographic and Boundary Data". Having low exposure to mapping software, many staff preferred to stick to pre-configured experiences like applications or dashboards, so I put these together in the Applications category at the top.

Figure 10 shows the freshly configured and organized St. Mary's ArcGIS Online organization at smfba.maps.arcgis.com:

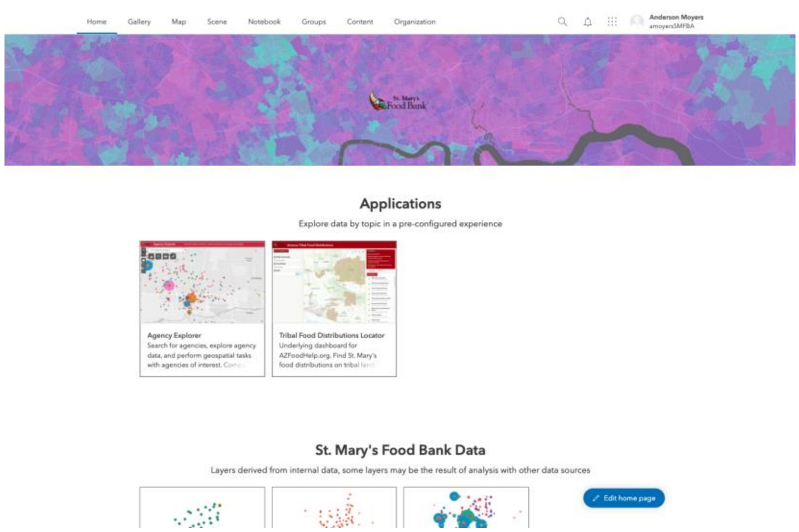


Figure 10. *St. Mary's freshly configured SMFBA organization with data organized for easy use.*

Around the time that I helped St. Mary's configure their ArcGIS Online organization, we worked on a product called the *Tribal Food Distributions Locator*. Figure 10 depicts this as the second option in the Applications category. This is an example of how interest for web mapping with ArcGIS Online continued to grow within their organization. COVID-19 caused mapping efforts and interest to change quickly from the original business analysis I wrote in May, and we discussed building out a public interface that would help people in tribal communities locate St. Mary's food distributions. Some of the important functional requests that Ceara had from St. Mary's for this was a.) to have a mobile friendly dashboard and b.) to allow people to search by time period and view results on a map. This turned into a significant project of its own; it is now publicly available at *azfoodhelp.org.*

As it is internally called, the *Tribal Food Distributions Locator* was significant for many reasons. First, creating it required consideration of tribal lands including land addressing issues and common time zone confusions. Second, it was the first public mapping interface that St. Mary's released, and we regarded it as a prototype for future expansion to include all of St. Mary's distributions in Arizona. Third, the process to implement it in a mobile friendly way turned out to be an interesting experiment. Finally, it marked the beginning of data automation with their projects.

Figure 11 depicts the general layout of the Tribal Distributions Food Locator. The left-hand side offers search filters for time and tribal community and the right side depicts locations, visit guidelines and a legend. Figure 12 shows the application in a mobile orientation. This orientation is triggered roughly for tablet and below screen ratios, meaning a display width of about 1000 pixels wide. Finding a way to implement this with mobile options in ArcGIS Online presented some challenges. This is a common design goal for web application development but achieving this in the AGOL platform required building two separate dashboards (desktop and mobile) which I then embedded in a *Web Experience.* Web experiences are another type of display option in AGOL alongside Web AppBuilder apps and dashboards. They differ in that they allow differentiated views between desktop, tablet and phone screen ratios. Though I could have implemented parts of the Locator directly as a web experience, the display option lacked the robust date filtering that dashboards offered at the time. This necessitated building them separately to achieve the filtering then embedding to achieve the adaptive layout.

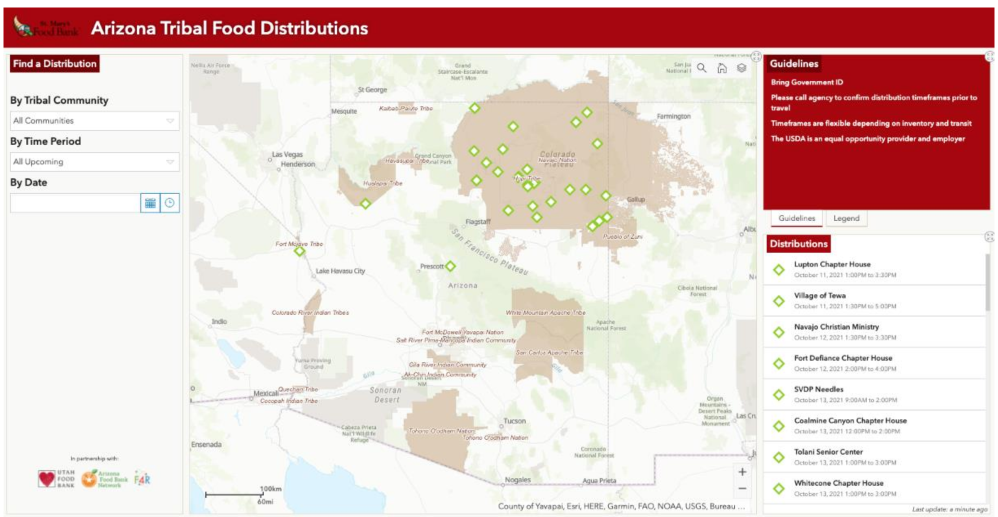


Figure 11. *The Tribal Food Distributions Locator in a standard desktop orientation. Display is horizontal for ease of use.*

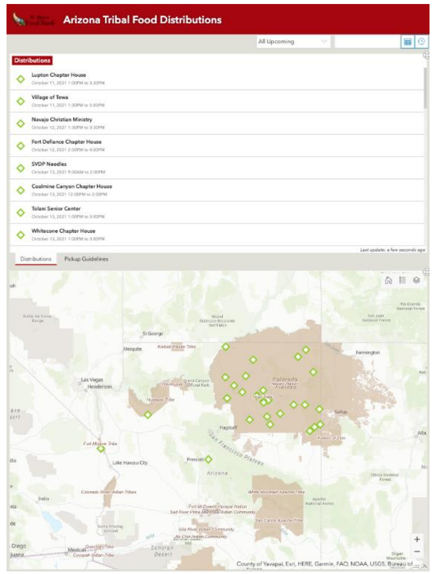


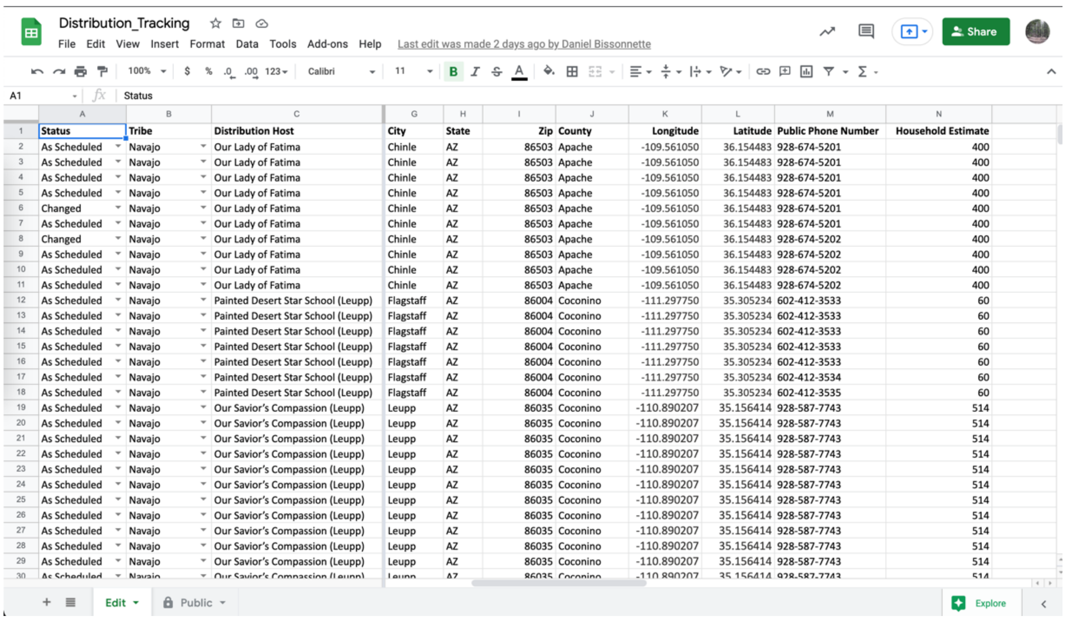
Figure 12. *The Tribal Food Distributions Locator in a mobile orientation. Display is horizontal for ease of use.*

Like with the *Agency Explorer*, I spoke with St. Mary's about their data processes to come up with a workable data structure for the dashboard. This data structure is provided in Appendix C for reference. Many places in tribal areas lack street addressing and we knew that we would need to implement geocoding with latitude/longitude. St. Mary's staff derived these coordinates by taking waypoints in the field with GPS or by visually pinpointing them within Google Maps. We collected latitude/longitude coordinates for each distribution location, assigned each to its appropriate tribal group and determined a timestamp for the distribution in Mountain Standard Time (MST).

Timestamping became an important issue for this implementation. While creating a custom application would have provided more choices about representing time, working within ArcGIS Online constraints meant I could not dynamically represent time according to a given user's local time. This was complicated by the disparate time zones across Arizona: while Arizona generally does not follow Daylight Savings, the Navajo Nation does. The Hopi are situated within the Navajo land area and do not follow Daylight Savings. I decided that a static representation of time, rather than a relative one which represented time according to a user's locality would be the simplest approach. I created a timestamp for beginning and end which described what the time would be at the given distribution for the given distribution, in MST.

As we collaborated on this interface I worked externally from St. Mary's. We needed to determine an easy workflow to update the distribution layer in the Locator knowing that updating individual distributions in ArcGIS Online would not be the most user friendly way for St. Mary's staff. Also, there was the problem of me being able to access the data when I did not work within their organization. To resolve these questions, I created a shared spreadsheet in Google Sheets with the needed data format. St. Mary's staff updated certain columns in the spreadsheet while locked columns performed intermediate field calculation to turn the distribution timestamps into a human readable format. I was able to further reduce errors by categorizing some of the columns with dropdowns (for instance, when assigning the appropriate tribal group for a distribution) and creating syntax rules for data entry. Google Sheets automatically transferred the data from this spreadsheet to a second, non-editable spreadsheet that was publicly shared by URL as a CSV. This enabled us to collaborate on the spreadsheet but serve it in a way that facilitated data automation.

Figure 13 shows part of the editable google sheet layout to update the Locator. I configured *Status* and *Tribe* fields as categorized dropdowns to reduce data entry errors. Status indicates whether a given distribution is operating as expected. Staff manually inputted *Longitude* and *Latitude* to be geocoded later. The spreadsheet has two sheets: the public version which is later ingested into ArcGIS Online is available online at: *[URL here]*



Status	Tribe	Distribution Host	City	State	Zip	County	Longitude	Latitude	Public Phone Number	Household Estimate
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5201	400
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5201	400
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5201	400
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5201	400
Changed	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5201	400
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5201	400
Changed	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5202	400
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5202	400
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5202	400
As Scheduled	Navajo	Our Lady of Fatima	Chinle	AZ	86503	Apache	-109.561050	36.154483	928-674-5202	400
As Scheduled	Navajo	Painted Desert Star School (Leupp)	Flagstaff	AZ	86004	Coconino	-111.297750	35.305234	602-412-3533	60
As Scheduled	Navajo	Painted Desert Star School (Leupp)	Flagstaff	AZ	86004	Coconino	-111.297750	35.305234	602-412-3533	60
As Scheduled	Navajo	Painted Desert Star School (Leupp)	Flagstaff	AZ	86004	Coconino	-111.297750	35.305234	602-412-3533	60
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As Scheduled	Navajo	Painted Desert Star School (Leupp)	Flagstaff	AZ	86004	Coconino	-111.297750	35.305234	602-412-3534	60
As Scheduled	Navajo	Painted Desert Star School (Leupp)	Flagstaff	AZ	86004	Coconino	-111.297750	35.305234	602-412-3535	60
As Scheduled	Navajo	Our Savior's Compassion (Leupp)	Leupp	AZ	86035	Coconino	-110.890207	35.156414	928-587-7743	514
As Scheduled	Navajo	Our Savior's Compassion (Leupp)	Leupp	AZ	86035	Coconino	-110.890207	35.156414	928-587-7743	514
As Scheduled	Navajo	Our Savior's Compassion (Leupp)	Leupp	AZ	86035	Coconino	-110.890207	35.156414	928-587-7743	514
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As Scheduled	Navajo	Our Savior's Compassion (Leupp)	Leupp	AZ	86035	Coconino	-110.890207	35.156414	928-587-7743	514
As Scheduled	Navajo	Our Savior's Compassion (Leupp)	Leupp	AZ	86035	Coconino	-110.890207	35.156414	928-587-7743	514
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As Scheduled	Navajo	Our Savior's Compassion (Leupp)	Leupp	AZ	86035	Coconino	-110.890207	35.156414	928-587-7743	514
As Scheduled	Navajo	Our Savior's Compassion (Leupp)	Leupp	AZ	86035	Coconino	-110.890207	35.156414	928-587-7743	514

Figure 13. *The Distribution_Tracking Google Sheet used to manage data for the Tribal Food Distributions Locator*

A significant part of getting this interface up and running was to show proof of concept for automating and ingesting data into ArcGIS Online. Figures 14 and 15 show Google Sheets *Publish to the Web* functionality which allows a user to "serve" their data in a low-cost way. Figure 15 shows the option, at the bottom of the window, to automatically update the published CSV when data is changed.

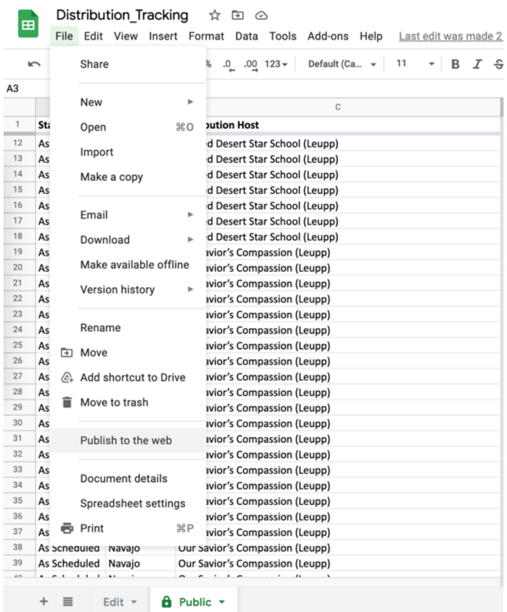

Figure 14. *Google Sheets "Publish to the Web" functionality*

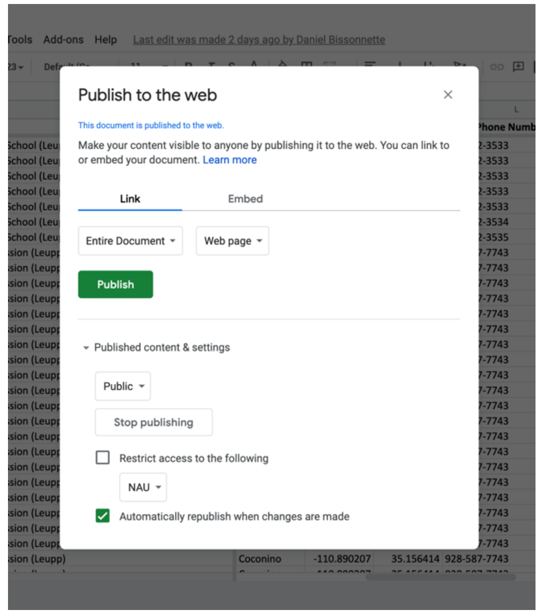

Figure 15. *Options to publish sheets in Google Sheets.*

With the data served to the web as CSV, I could then automate a script to access it and update the layer in the Locator. I opted to script it with the ArcGIS API for Python and schedule this as a Windows Scheduler task with a Powershell script. The code to update the dataset was extremely simple: it was a basic *overwrite* layer task. Setting up the environment and scheduling required the most time and code. Appendix D includes a simplified code example with two files: the first, `auth.py` prompts a user for ArcGIS Online credentials when it runs and caches them to run subsequent updates without having to manually enter them; the second, `update.py` runs the update and performs cleanup. `update.py` contains supporting code to output logs and perform minor data checking/archiving.

Conclusion

In May 2021, I came on full time with St. Mary's to manage and expand mapping products. We are now using the original motivation for the Agency Explorer to create a new iteration of the interface called FIND: the Food Impact and Needs Dashboard.

This product is the embodiment of some of St. Mary's longer range goals with mapping, namely to map and have a more robust understanding of what they call "unmet gap" across Arizona. There are four sister food banks in Arizona which have their own distribution networks. In some cases, different food banks may also partner with the same agency partner such that multiple food banks are providing food to a given area.

The goal of FIND is to collect distribution data from the four food banks in Arizona and aggregate it in a shared dashboard. Using Feeding America data about insecurity rates and food budget shortfalls at the zip code level, I plan to calculate the unmet gap and visualize this by zip code across the state. I have reached out to the four food banks and so far we have two out of four total datasets, organized on a yearly basis.

Rather than doing this as a web application as with the Agency Explorer, I plan to implement this as a simplified dashboard. This dashboard will offer functionality to explore the map, and filter/export the data.

The task of finding a rudimentary unmet gap is straightforward because it involves simply taking the total meal gap Feeding America estimates and then subtracting the meals that food banks are contributing to find the amount that isn't being served. While finding the rudimentary metric for this is possible, some of the larger questions about what exactly is a "meal" is much more difficult. Furthermore, understanding in a dynamic way how this food insecurity fluctuates is an ongoing question which is very difficult to answer. Therefore, we do not consider what we are trying to be mathematically correct per se or completely reflective of the real world. We are trying to come up with something that is "directionally correct" in identifying where food need remains in Arizona.

The evolution of this practicum demonstrates how mapping at St. Mary's started off with a citizen science project but morphed and took on a life of its own. F4R's catalyzing environment mixed with GRAIL's resources to house and test St. Mary's mapping products contributed a robust support system to bolster and ensure success of the project. St. Mary's saw the potential for mapping in their organization and over time they have gradually committed the resources to building it out. This demonstrates the potential for other successful mapping projects where citizen discourse coincides with technology-supported opportunities to map vital Food-Energy-Water infrastructure.

In effect, this practicum catalyzed a burgeoning data analysis at St. Mary's to empower decision making, improve distributions throughout their network and better understand food insecurity.

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Appendices

Appendix A: Business Analysis

SMFBA ArcGIS Online Mapping

Business Analysis

St. Mary's Food Bank®

ArcGIS Online

Anderson Moyers

May 8, 2020

Table of Contents

About

The Saint Mary's ArcGIS Online mapping project is a high impact project designed to bring the power of geospatial mapping, analysis and visualization to Saint Mary's Food Bank Alliance (SMFBA) business processes.

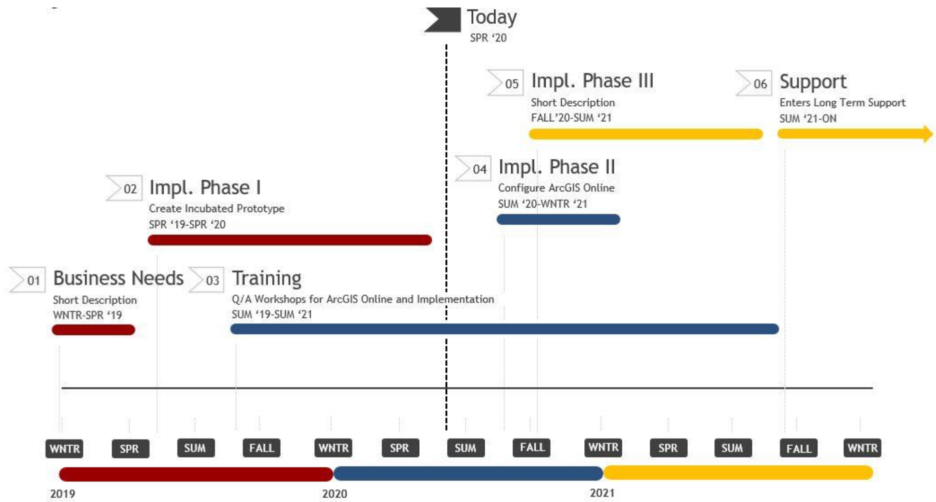
Main Goals of the Project

- Create an avenue for SMFBA to generate their own needs analyses
- Create a mapping interface to contextually view, find and make connections about partners and distribution across the SMFBA network
- Use respected and well supported technologies for a sustainable implementation
- Generate ideas and spark bigger questions using data visualization

Benefits of the Project

- Enables SMFBA to visualize their database data with geospatial, information-dense web layers as needed
- Data is shareable across the organization and the public where needed
- In-house mapping saves the costs of private consulting and generates higher quality datasets
- Public demographics and other data can be pulled from a variety of sources directly within AGO or imported for robust data analysis
- Functionality in AGO allows for easy visualization and comparison of datasets across years to see changes and trends
- Aids decision-making and supporting documentation in funding
- Mapping provides a fast, easy way for SMFBA members to collaborate about rapidly evolving conditions
- ArcGIS Online is a reputable and durable product-- the product's creator, ESRI, pioneered geospatial software in the 1960s and still defines the industry
- ArcGIS Online is an affordable and extensible product which offers substantial discounts to nonprofits

Project Timeline



3

Business Needs

Determining SMFBA's business needs occurred in Spring 2019. This was one of the first steps of the project, dictating which technologies we would eventually choose and defining the implementation. After several meetings to talk about SMFBA's business processes we decided to focus on the fundamental business needs below.

B1: Interface for finding, viewing and selecting locations

Ability to do all of the above in a single mapping interface. Initial discussions for this included a map that could be clicked on to select locations as well as a method of selecting locations within a user-drawn shape or given point radius.

B2: Ability to refresh/replace existing data

Any data layer that was uploaded to the mapping interface should be easily updatable in a standardized way. If possible, this data replacement should be "in place" in the sense that updating it would not disrupt any other part of the interface and the changes to the data would be reflected automatically.

B3: Granularly control changes to data (editability)

Interface should allow only people with editing permission to edit data. This editability should be configurable for different mapping layers and ideally, to named user accounts. Under this, the interface should also allow for user group levels such as outside the organization (public) vs. inside the organization (private).

B4: Granularly control viewing of data (privacy)

Interface should allow only people with viewing permission to view data. This viewability should be configurable to different mapping layers and ideally, to named user accounts. Similar to *B3: Granularly control changes to data*, interface should allow for user group levels such as outside the organization (public) vs. inside the organization (private).

B5: Incorporate needs assessment analysis equation

This is the base requirement to make the interface viable as a way to perform needs assessment. The equation should be configurable in the interface to accommodate policy changes over time. Because expediting and simplifying the needs assessment process is a main goal of the project, the equation should be applied to data in a standardized and automated way. This is so it can be used on large datasets and in workflows.

B6: Ability to use new data sets for analysis

Interface should afford the ability to easily create or use new datasets as needed for mapping, analysis and visualization. SMFBA members should be able to create new datasets by uploading widely accepted data formats. They should also be able to incorporate publicly available datasets pertinent to analysis (an example would be demographic data from the Census).

B7: Run distance, cost path, summary analyses

These are common, high-impact geospatial processes we decided would be particularly helpful to SMFBA. Distance analyses include the ability to find locations near other locations. Cost path analyses include determining ideal transportation (and other types of networks) routes based on selected criteria. Summary analyses include the ability to join data (by joining, this means the ways that databases traditionally join) based on geospatial relationships and perform basic statistics on groups of locations or geospatial areas.

B8: Provide training and support

An important requirement of the project is to provide training to SMFBA members so they feel confident navigating ArcGIS Online as a technology and fully utilizing the mapping interface. Training should come in the form of hands-on question/answer sessions, technical documentation and topical workshops throughout development of the project. Capacity to support the application in the development phase and during long-term implementation should also be determined.

Implementation

After determining business needs, we started implementation. ArcGIS Online was an immediate technology choice for this project for several key reasons:

- It integrates functionality for both mapping data and managing it
- It offers a robust set of built-in geospatial analysis tools
- It is widely respected and supports many data formats
- NAU's GRAIL lab offered space to house the application in its ArcGIS Online organization, providing an opportunity to test the functionality for free

At time of this writing in Spring 2020, we have accomplished Phase I. We are currently examining ArcGIS Online licensing and moving to Phase II.

Phase I: Prototyping ArcGIS Online Web Application

Prototyping Process

Before beginning work inside ArcGIS Online, we drew out a rudimentary paper prototype for the interface, workflowing some of the business needs. This depicted a rough idea of symbolization and map representation. It also depicted drawing shapes on the map to determine food bank partner information within a given area and performing basic analysis and summary.

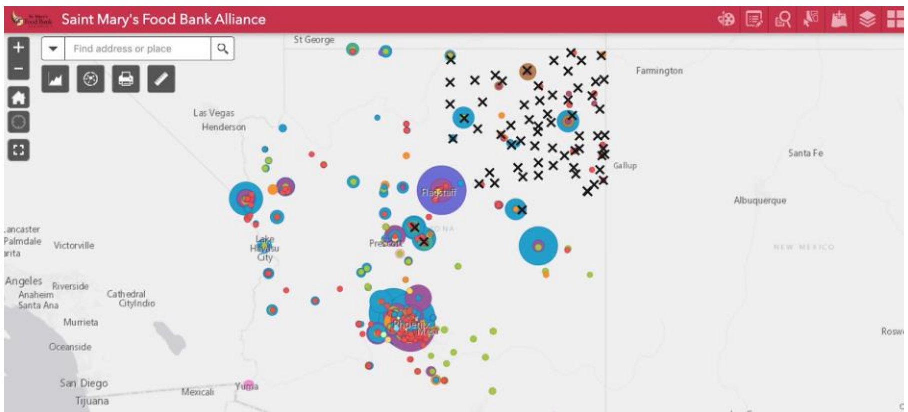
After paper prototyping, we moved to prototyping inside Northern Arizona University's GRAIL ArcGIS Online organization.. As the first step of this process, we conducted a data pull from SMFBA's CERES database for what would become the project's essential dataset, *Food Bank Programs*. We determined a consistent way to pull and format this dataset, making it easier to upload and manage it in the future.

We incorporated this content into a Web Mapping Application, one of many types of configurable interfaces in ArcGIS Online for data presentation. We chose to use this format because in addition to best satisfying business needs it: provides an application-like experience versus just a simple map, is highly customizable and extensible using widgets, incorporates cohesive branding to make it feel like an official SMFBA product.

Throughout late 2020 and early 2021we configured the web application as needed, adding datasets and widgets to satisfy business needs. Additions included the most recent Deloitte

Food Insecurity data for visualization, updated Feeding America data about food insecurity, and Food Bank Programs to depict recent distribution (poundage) information. There were many functionality additions including the ability to easily query food bank programs with useful, granular criteria and find food bank programs using radius from a point or drawing a shape on the map (this included various geometric shapes and a free form option).

The following image shows the default view of the current prototype:



The SMFBA Web Mapping Application in May 2020

The application symbolizes the *Food Bank Programs* layer as colored circles (size of circle for pounds distributed and color for the program code). The Black X's are *Agency Prospects,* potential food bank partners that SMFBA has identified. Functionality from widgets in the top right include drawing on the map, editing locations, searching for programs, changing basemaps to depict different types of contextual data, and adding data from a variety of sources (including self-owned, within the organization, or from ArcGIS Online's living atlas).

ArcGIS Online's functionalities and benefits are so robust that they cannot all be discussed in this document. We chose this interface to serve as a central hub for SMFBA to analyse and map but options are not limited to the SMFBA application depicted here. There are numerous interfaces within ArcGIS Online that we have already tested. SMFBA members have created datasets on the fly to examine partner closures and distribution changes during COVID-19 emerging conditions. We are in the process of creating a public map using partner location hours that SMFBA can embed in its website for visitors to find out when they can visit a nearby partner. Both of these employ a simple Map (another interface) outside of the application.

Business Needs Satisfied

B1: Interface for finding, viewing and selecting locations

B2: Ability to refresh/replace existing data

B6: Ability to use new data sets for analysis

B7: Run distance, cost path, and summary analyses

Phase II: Establishing ArcGIS Online for SMFBA

This phase of the project entails the cost and process of getting SMFBA set up with its own ArcGIS Online nonprofit organizational account.

ArcGIS Online has several organizational container levels-- At the top level there is an *organization*, this is the licensing that a nonprofit or company pays for to have its own ecosystem within the site. NAU GRAIL, SMFBA's incubator, exists at this level. Within this, people can be sectioned off into *groups* to control the way people access data. To incubate SMFBA's prototype and keep data private, GRAIL placed SMFBA in their own *group*.

The nature of SMFBA as a nonprofit however, really fits the *organization* level. We determined this based on business needs to provide differentiated user accounts and grant different levels of editing to users. While this is highly configurable at the organization level, it has very low configurability at the group level.

Benefits

- SMFBA will have its own *organization* within ArcGIS Online to fully author, organize, and maintain data
- Organization will come with administrative accounts to configure and maintain it.
- Participants will have their own user accounts to login (no password sharing, no persistent global account)
- Participants will have a more cohesive experience by communicating and collaborating within the org
- Viewability: SMFBA will be able to control who sees data in a granular way (not just public vs private but also by individual)
- Editability: SMFBA will be able to control who can edit data in a granular way, which in turn impacts speed performance of geospatial layers

Costs

ESRI offers steep nonprofit discounts for many of their products, including ArcGIS Online. Costs for named user accounts are at least halved from traditional pricing. Estimated pricing for SMFBA to procure ArcGIS Online:

Account type	Cost	Accounts Needed	Total
Creator/Editor Create and publish content. Includes 1000 service credits.	$100	2	$200
Viewer Simple access account	$50	40	$2000
		Total/Year	$2200

Steps

1	Set up an ESRI nonprofit account	done
2	**Establish licensing**	**in progress**
3	Configure organization	
4	Determine accounts and access	
5	Distribute accounts	
6	Test workflows with new organization	
7	Make changes to licensing if needed	

This phase of implementation overlaps with Phase III, the last phase. As we configure and test ArcGIS Online settings, we should be thinking about further implementation plans and what we can accomplish with Phase III to extend the prototype and finish the project.

Business Needs Satisfied

B3: Granularly control changes to data (editability)

B4: Granularly control viewing of data (privacy)

Phase III: Porting and Expanding Application

Honing and Formalizing the Implementation

This final phase of implementation is about tying up functionality of the web mapping application and solidifying SMFBA's new ArcGIS Online organization. To do this, we must first move over existing data from SMFBA's group within the NAU GRAIL organization, configure editability and access for those layers to perfect workflows, and lastly consider additional functionality we want to add in order to complete the project.

There are several ways to move the data, so this phase includes determining the simplest way to move it. There may be a way for ArcGIS Online to help us move everything over once. Web Mapping Applications include a way to easily package the application and move it as a unit, this will simplify the process if it must be done piecemeal.

Only one functional business need remains at this point of implementation, *B5: Incorporate needs assessment analysis equation*. There are several options for integrating this formula, including creating a customized widget which applies the formula and populates a report for needs analysis. Another way to achieve this is by applying the formula directly in the attribute table for one of the applicable geospatial datasets.

Other ideas for work during this time period include:

- finishing a public mapping interface for sharing certain SMFBA data
- customized basemaps which better depict road conditions in remote locations
- creation of story maps to depict food security or other information in interesting ways
- implementation of time lapse data inside a dataset
- automation of an additional geospatial process by creating a customized widget

Business Needs Satisfied

B5: Incorporate needs assessment analysis equation

Training

Training started in Spring 2019 and so far consists of documentation, videos and workshops. Main topic areas so far include the fundamentals of geospatial analysis, the ArcGIS Online ecosystem, and using the SMFBA web application. A common pitfall of development efforts in organizations is to spearhead development or technology among a few individuals in the organization with the risk that if people with the knowledge move on, the technology becomes obsolete. The approach of this project aims to avoid this pitfall by exposing as many SMFBA members as possible to the technology while demonstrating the power, ease of use and affordability of ArcGIS Online.

Previous Topics

Spring 2019	Workshop @GRAIL, Navigating ArcGIS Online
	Workshop @GRAIL, Navigating SMFBA Web App
	SMFBA Meeting @CSTL, Prototype Look
Spring 2020	Workshop @SMFBA, Data Layer Efficiency
	Workshop @SMFBA, Data Ownership

Future Topics

Training should cover the topics that SMFBA members feel are most valuable; getting SMFBA feedback on this is a welcome, continuing part of the project. With hands-on training throughout the course of implementation (coupled with documentation), we can slowly acclimate SMFBA members to ArcGIS Online functionality.

Going forward (Spring 2020 and on), it might be helpful to organize training materials in a standardized format and location, amplify the number of workshops through now and the end of project implementation, and explore low-cost or free avenues of training through ESRI's nonprofit agreement. Because the prototype precludes full user accounts or account control, some immediately helpful topics in the next stages of implementation might include:

- A first look for users with different account types (for instance creator, viewer) and piloting training for people who may have had limited exposure to the project before now
- How editability/viewability is configured and revisit its impacts on drawing efficiency for geospatial layers

Business Needs Satisfied

B8: Provide training and support

Support

This section addresses the long term picture for the SMFBA mapping project and how SMFBA will receive ongoing support with ArcGIS Online as a platform. Fall 2021is the estimated time period for this project to enter long term support. By that time, the scope of implementation described in the project should be accomplished. But this is really only the beginning-- in a sense, this project serves as a jumping off point to explore functionality and craft something with high value. It has a tangible product in the mapping application, but the larger long-term product is SMFBA's addition of ArcGIS Online to its toolbelt.

Support Simplification

A key way of addressing support is to anticipate support needs and reduce complexity of the implementation. Some ways this project reduces the need for specialized and/or costly support:

- Although widgets within the mapping application are highly customizable with JavaScript and other languages, this implementation avoids highly specific programming of functionality. This makes the widgets easily reconfigurable without expert intervention.
- Specific configurations or geospatial processes within the SMFBA mapping application are readily documented during implementation.
- ArcGIS Online has an inherently tiered functionality structure. For instance a Web Mapping Application displays a Map (which displays a Feature Layer, etc..) and adds functionality through widgets. Given this structure, if the mapping application temporarily

experiences problems the underlying Map will still be available as long as its underlying data maintains integrity.

- ArcGIS Online is SAAS (Software as a Service). ESRI hosts the ArcGIS Online environment, which means that SMFBA does not need to maintain servers, onsite infrastructure, or the software.
- ArcGIS Online includes ESRI's responsive product, configuration and licensing support through phone and other methods of communication. They can readily answer many questions about ArcGIS Online as a platform.
- ESRI provides extensive public online documentation, training and user forums on ArcGIS Online functionality -- this can aid in answering more specific geospatial analysis questions. Most of these resources, except for specialized courses, are free.

Business Needs Satisfied:

B8: Provide training and support

Appendix B: *Food Bank Programs* Layer

Field	Data Type	Description
Program Number	String	The dataset's unique identifier, An agency can be associated to multiple programs
Agency Number	String	
Organization Name	String	
Secondary Name	String	
Physical Address	String	Location information used to geocode *Food Bank Programs* points.
Physical City	String	
Physical State	String	
Physical Zip	String	
Phone	String	
Primary Contact	String	
Email	String	
Mailing Address	String	
Mailing City	String	
Mailing State	String	
Mailing Zip	String	
Agency Category Code	String	**Agency Category Codes** are symbolized by color
County	String	
Emergency Food	Integer	Different programs for which St. Mary's distributes food to agency partners. This helps them understand the pounds that may be going to different populations, for example CSFP is a program intended for seniors 65 and over. The data from these fields are summed to equal **Total Pounds**
TEFAP Bulk	Integer	
Shopping	Integer	
Source	Integer	
Grocery Rescue	Integer	
Clusters	Integer	
Mobile Pantry	Integer	
Back Pack	Integer	
Kids Café	Integer	
Community Distribution	Integer	
School Pantry	Integer	
CSFP	Integer	
Alternative Distribution	Integer	
Other	Integer	
Total Pounds	Integer	**Total Pounds** is symbolized by graduated circle sizes

Appendix C: *Distribution Tracking* Layer

Field	Data Type	Description

[Add Distribution Tracking Fields here]

Appendix D: Food-Help Update Code

auth.py

```
from arcgis.gis import GIS
import getpass

def login():
    """
        prompt for user credentials, create profile and cache credentials
    """
    try:
        smfbauser = input("Username: ")
        smfbapass = getpass.getpass()
        GIS(url = "https://smfba.maps.arcgis.com", username = smfbauser, password = smfbapass, profile = "smfba_org_profile")
        print("If local keychain permits caching, your credentials will be cached for future use..")
    except:
        print("Error logging in, please try again")
        login()

if __name__ == "__main__":
    print("Please sign in with your SMFBA ArcGIS Online credentials:")
    login()
```

update.py

```
import logging
import os
import requests
import shutil
import sys
from arcgis.gis import GIS, Item
from arcgis.features import FeatureLayerCollection
from datetime import datetime
from pathlib import Path

CSV_PATH        = 'https://docs.google.com/spreadsheets/d/e/2PACX-
1vRm1bMwQaV49_m_bwQCQ5vu54E_7FRtnd8dYEsCi_B_3Zi_ggL8mR04uXkg28rFh3KTyMQ7DU4pwOrP/pub?gid=760060200&single=true&output=csv'

DATA_DIR        = './data'
SNAPSHOT_DIR    = f'{DATA_DIR}/snapshots'
LOG_DIR         = f'{DATA_DIR}/logs'

LOG_FILE        = f'{LOG_DIR}/{datetime.now().strftime("%Y%m%d_%H%M")}_update.log'
LOG_LEVEL       = logging.INFO
LOG_FORMAT      = '%(asctime)s %(message)s'
LOG_DATEFORMAT  = '%m/%d/%Y %I:%M:%S %p'

def get_source(srcpath: str, destpath: str):
    """ get source data from srcpath and save it to destpath """
    message = f'Downloading source data from {srcpath}...'
    try:
        with requests.get(url = srcpath) as res:
            with open(destpath, mode="wb") as destfile:
                destfile.write(res.content)
        verify(destpath)
        logging.info(message + '[SUCCESS]')
        return True
    except:
        logging.info(message + '[ERROR]')
        return False

def archive_data(srcpath: str):
    """ add datetime to filename for archiving reference, keep original filename as reference to working copy """
    dirname, filename = os.path.split(srcpath)
    destpath = f'{dirname}/{datetime.now().strftime("%Y%m%d_%H%M")}_{filename}'
    message = f'Archiving source data to {destpath}...'
    try:
        shutil.copyfile(srcpath, destpath)
```

```
        verify(destpath)
        logging.info(message + '[SUCCESS]')
        return True
    except:
        logging.info(message + '[ERROR]')
        return False

def verify(path: str):
    """ verify a file exists and is not empty """
    if not os.path.exists(path):
        raise Exception
    if not os.path.getsize(path) > 700:
        raise Exception

def main():
    Path(DATA_DIR).mkdir(parents=True, exist_ok=True)
    Path(SNAPSHOT_DIR).mkdir(parents=True, exist_ok=True)
    Path(LOG_DIR).mkdir(parents=True, exist_ok=True)
    log_handlers = [logging.FileHandler(LOG_FILE), logging.StreamHandler()]
    logging.basicConfig(handlers = log_handlers, level = LOG_LEVEL, format = LOG_FORMAT, datefmt = LOG_DATEFORMAT)
    logging.info('Starting update')

    logging.info('Authenticating with the SMFBA org')
    smfba_org = GIS(profile = "smfba_org_profile")

    logging.info('Locating Distribution Tracking feature layer in the org')
    dt_item = Item(smfba_org, 'f29c3d6a87f64ec69184c49247afefd8')
    dt_flayercollection = FeatureLayerCollection.fromitem(dt_item)
    dt_flayer = dt_item.layers[0]

    logging.info(f'Distribution Tracking Pre-Update Count: {dt_flayer.query(return_count_only=True)}')
    new_csv = f'{SNAPSHOT_DIR}/Distribution_Tracking.csv'
    if get_source(CSV_PATH, new_csv):
        message = f'Updating Distribution Tracking feature layer...'
        try:
            dt_flayercollection.manager.overwrite(new_csv)
            logging.info(message + '[SUCCESS]')
            logging.info(f'Distribution Tracking Post-Update Count: {dt_flayer.query(return_count_only=True)}')
            if archive_data(new_csv):
                logging.info('Update Successful!')
        except:
            logging.info(message + '[ERROR]')
    else:
        logging.info('Could not get source CSV: exiting without update')


if __name__ == "__main__":
    main()
```