

EÖTVÖS LORÁND UNIVERSITY
FACULTY OF INFORMATICS
INSTITUTE OF CARTOGRAPHY AND GEOINFORMATICS

**Developing a methodology for using web map services
to assist and support the work of international
organizations in Syria**

Yesser Jarkas

Student of Cartography MSc

Dr. José Jesús Reyes Nunez

Associate Professor

ELTE Institute of Cartography and Geoinformatics



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MASTER'S THESIS SUBMISSION FORM

Name: Yesser Jarkas

Neptun code: AFPLDU

Programme: **Cartography MSc**

Name of the supervisor: José Jesús Reyes Nunez

Name and address of workplace: Institute of Cartography and Geoinformatics

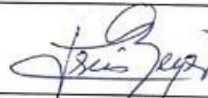
1117, Budapest, Pázmány Péter sétány 1/A

Position and qualification: Associate Professor

Title of the master's thesis: Developing a methodology for using web map services to assist and support the work of international organizations in Syria.

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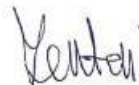
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(signature of the student)

I approve the topic.

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(signature of the head of department)

Abstract

Starting in 2011, the Syrian civil war has caused the world's largest refugee and displacement crisis of the 21st century, this has led to many international organizations guiding their efforts to support projects and activities in various field of work.

The reality of the use of web map services for international organizations operating in Syria has been studied and was found to be under-regulated. Some of these organizations do not use these services at all, while others use web map services in a way that does not achieve their intended purpose. For example, if the reader is not specialist, he does not care about the detailed data in the map, but rather cares about easy public data and the smooth display of the map that is far from complex.

Research idea focus on Developing a methodology that allows international organizations to deal efficiently with web map services, that gives specific recommendations and guidelines for the use of web map services by international organizations to provide information and data on the activities of this organization, in the form of different interactive maps according to the different users (Public and Professional users).

There are several sites and platforms for creating and managing web maps data, and after visiting several websites that offer web map services ArcGIS Online was selected, which provides most of the services we need in our project for free and provides very great possibilities in creating and modifying the display of map layers, and distinctive interactive web applications.

The methodology will be summarized in several stages, starting with preparing the data, designing the database, joining it with the base layers, uploading the layers, commence designing interactive maps for the activities of organizations and humanitarian data in Syria, and terminate with publish these maps through the available applications.

The practical application will include data from several international organizations which provide fairly similar grants, and two maps will be presented to the organization's activities, the first map for Syria's data (the level of Syria's governorates) and the second map to specialists for Aleppo governorate data (the level of sub-districts of the governorate, and the settlements or villages), as well as displaying humanitarian data that supports decision-making in Organizations on the map of the provinces of Syria.

This thesis provides a detailed workflow methodology, useful advice, and future development suggestions for organizations as well as public and private agencies that are interested in using web map services to display their work and activities properly.

Dedication

Dedicating this modest work to the people of my country, my family in Syria, my friends, and my lovely wife and life partner **Hala Badawi**

And to the former workmates in the livelihoods team (SARC)

Acknowledgement

all my gratitude and appreciation to my supervisor

Dr. José Jesús Reyes Nunez

Acronyms Used in the Document:

ACSAD	Arab Center for Dry and Arid Land Studies
AKDN	Aga Khan Development Network
API	Application Programming Interface
CRS/ CCRS	Common risk segment mapping
CSS	Cascading Style Sheets
FAO	United Nations Food and Agriculture Organization
GeoJSON	simple geographical features, based on the JSON
GIS	Geographic Information System
GPS	Global Positioning System
GSC	Global Shelter Cluster
HDX	Humanitarian Data Exchange
HTML	HyperText Markup Language
IASC	Inter-Agency Standing Committee
ICRC	International Committee of The Red Cross
IDP	Internally Displaced Person
IFRC	International Federation of Red Cross and Red Crescent Societies
JPG/ JPEG	Joint Photographic Experts Group
JSON	JavaScript Object Notation
NFI	Non-Food Item
NRC	Norwegian Refugee Council
ODP	Operational Data Portal
OGC	Open Geospatial Consortium
OSM	Open Street Map
PDF	Portable Document Format
PiN	People in Need
PNG	Portable Network Graphics
SARC	Syrian Arab Red Crescent
SVG	Scalable Vector Graphics
UNDP	United Nations Development Program
UNHCR	United Nations High Commissioner for Refugees
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
URL	Uniform Resource Locators
WFP	World Food Program
WGS 84	World Geodetic System 1984
WMS	Web Map Service
WoS	Whole of Syria
XLSX	Microsoft Excel Open XML Spreadsheet
ZIP	Zone Improvement Plan

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1. Introduction

1.1 Syrian Arab Republic (study area)

Syria, (officially the Syrian Arab Republic, capital city is Damascus) is an Arabic country in Western Asia at the center of three continents: Asia, Africa, and Europe, bordered by Lebanon and the Mediterranean Sea to the west, Turkey to the north, Iraq to the east, Jordan to the south, and shares maritime borders with Cyprus. The country occupies an area of 185,180 km². It is divided administratively into governorates: Damascus, Aleppo, Homs, Hama, Lattakia, Tartous, Idlib, Hasaka, Deir ez-Zor, Raqqa, Daraa, As-Suwayda, and Quneitra. The length of its beaches on the Mediterranean Sea is 183 km between the countries of Turkey and Lebanon. The Euphrates River is one of the most famous and largest rivers in Syria and the only navigable river in the country, followed by the Orontes River and the Tigris River.

According to official statistics for the year 2013, Syria has a population of 22.5 million people, with a population growth rate of 0.15%. The official language is Arabic, which is the most spoken language, followed by Kurdish, Armenian, and Assyrian. There are many ethnic and religious groups scattered throughout Syria, such as mosaics, but the population of Syria predominantly Muslim and Christianity. Therefore, there are many mosques, churches, monasteries and shrines in Syria.

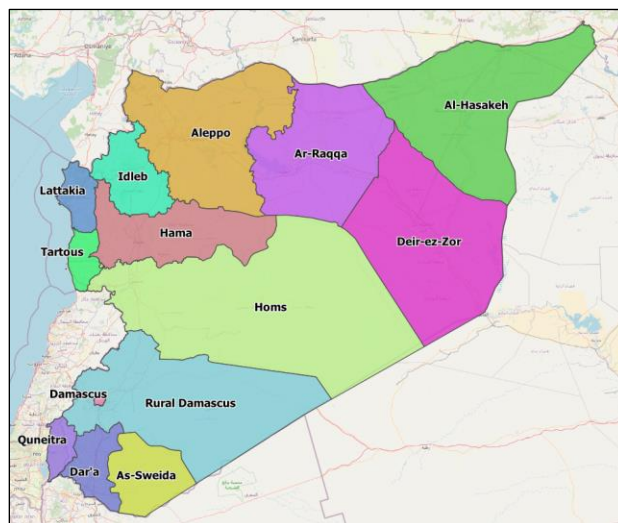


Figure 1: Map of the Syrian Arab Republic with administrative governorates¹

¹ Layers of the Syrian Arab Republic map downloaded from HDX website: [Syrian Arab Republic - Subnational Administrative Boundaries](#) The background map is from the OSM website: [OpenStreetMap](#) .

1.2 The civil war in Syria

The Syrian civil war began more than ten years ago and is one of the most devastating and deadly wars in the twenty-first century. The country was divided according to the party controlling it, and the Syrian regime controls nearly 70% of the Syrian territory. This war has produced a huge humanitarian crisis for a large number of displaced people and refugees. Those who have been displaced from their country and homes.

The Syrian refugee crisis remains the world's largest refugee and displacement crisis of our time, by 2021, about half of those affected by the refugee crisis are children. Families have suffered under a horrific warfare that has killed hundreds of thousands of people and pushed the standard of living back decades since the Syrian civil war began on March 15, 2011. According to UNHCR² More than 6.6 million Syrians have been forced to flee their country since 2011, nearly 5.5 million refugees have found refuge in neighboring countries, particularly Turkey, Lebanon, Jordan, Iraq, and Egypt. Furthermore, 6.7 million people remain internally displaced. According to World Vision³, in 2021, 13.5 million Syrians in total are between displaced within Syria, refugees and asylum-seekers, this means more than half of the country's population in total are forcibly displaced.

The civil war has led to the collapse of the Syrian economy and a decrease in the standard of living and health. With the imposition of international sanctions, most families have lost the ability to buy food, medicine, and the basics of life, and 90% of the population lives below the poverty line. According to the UN Office⁴ for the Coordination of Humanitarian Affairs (UNOCHA), the number of people in need of humanitarian assistance increased by 21% in 2021, reaching 13.4 million people, with 1.48 million in catastrophic need. According to UNOCHA⁵ in 2022 report a 14.6 million people need humanitarian assistance, an increase of 1.2 million from 2021.

According to the World Food Program (WFP)⁶ in 2022, 12.4 million Syrians are suffering from food insecure the increase of 4.5 million from 2021, including 1.3 million people severely food insecure.

² Source: [UNHCR- Syria Refugee Crisis Explained](#)

³ Source: [world Vision- Syrian refugee crisis](#)

⁴ Source: [Human Rights Watch- Syria Events 2021](#)

⁵ Sources from OCHA 2022 report under the name [HUMANITARIAN NEEDS OVERVIEW](#) P.8

⁶ Source: [Syrian Arab Republic | World Food Programme \(wfp.org\)](#)

1.3 International organizations working in Syria

Presently, there are many international organizations in Syria that work in various fields, and among the most effective and widespread are listed in the Table 1.

Organisations in Syria
International Organisation working in Syria

ID	Name	Short Name	Type	Web Services
1	The International Committee of The Red Cross	ICRC	Humanity	https://www.icrc.org/en/where-we-work/middle-east/syria
2	International Federation of Red Cross and Red Crescent Society	IFRC	Humanity	https://www.ifrc.org/taxonomy/term/6512
3	World Food Programme	WFP	Food	https://www.wfp.org/countries/syrian-arab-republic
4	Food and Agriculture Organisation of the United Nations	FAO	Food	https://www.fao.org/countryprofiles/index/en/?iso3=SYR
5	The UN Refugee Agency	UNHCR	Humanity	https://www.unhcr.org/sy/
6	United Nations Children's Fund	UNICEF	Education	https://www.unicef.org/syria/
7	United Nations Development Programme	UNDP	Reconstruction	https://www.sy.undp.org/
8	Aga Khan Development Network Akdn-Syria	AKDN	Reconstruction	https://www.akdn.org/where-we-work/middle-east/syria
9	Norwegian Refugee Council	NRC	Reconstruction	https://www.nrc.no/countries/middle-east/syria/
10	Sos Kinderdorp International Regional Office Middle East	Sos	Education	https://www.sos-syria.org/about-us/our-mission
11	Premier Urgency International	PUI	Education	https://www.premiere-urgence.org/en/mission/syria/
12	Food Security Cluster	FSC	Food	https://fsccluster.org/syria
13	Association of Volunteers in International Service	AVSI	Humanity	https://www.avsi.org/en/country/syria/5/
14	Junior Chamber International	JCI	Education	https://www.icc-syria.com/JCI/En

Table 1: List of the most effective organizations in Syria with their main fields of work⁷

The International Committee of The Red Cross (ICRC):

The International Committee of the Red Cross (ICRC) is assisting those inside Syria who are living in extraordinarily horrifying circumstances as a result of the civil war, as well as the hundreds of thousands of Syrian refugees in Lebanon, Jordan, and Iraq. The Red Cross are providing food assistance and other needs, restoring water supplies, and assisting medical services in collaboration with the Syrian Arab Red Crescent (SARC).

⁷ The researcher visited the organizations' websites and compiled the data in a table on the Excel sheet, available in google drive: [List of the most effective organizations in Syria](#)

World Food Program (WFP):

WFP provides families with food assistance and livelihood projects to support families and help them build their lives, after years of conflict and relocation have added to the stress on families which are now unable to meet their basic necessities and are experiencing historic levels of food insecurity. WFP provides lifesaving food to 5.6 million people each month across all 14 governorates of Syria, it includes distributing food assistance to help most vulnerable families in Syria and meet their pressing needs during the crisis.

The Food and Agriculture Organization (FAO):

The Food and Agriculture Organization (FAO) is a United Nations specialized agency in charge of international hunger relief initiatives. FAO works in over 130 countries around the world to help those in need achieve food security and to ensure that people have regular access to enough high-quality food to maintain healthy lives.

United Nations Development Program (UNDP):

Since the outbreak of the crisis in Syria in 2011, UNDP has responded to the huge needs that support the Syrian people. UNDP promotes positive coping mechanisms, encouraging them to become self-reliant and rebuild their livelihoods, rather than continuing to depend on humanitarian and food assistance. UNDP's initiatives are focused on the restoration of basic and social infrastructures, providing livelihoods support, improving economic recovery and social inclusion, and strengthening social cohesion as part of the UN Humanitarian Response Plan (HRP).

Aga Khan Development Network (AKDN):

The Aga Khan Development Network (AKDN) is working in six governorates. Since 1999 it has been operating in Syria, in the past, its work was limited to the restoration of archaeological buildings (such as the Citadel of Aleppo). But during the conflict and given the current situation in Syria, its activities included education, microfinance, and cultural and economic development.

The Aga Khan Development Network (AKDN) is concentrating its efforts on responding to the humanitarian catastrophe, which includes providing emergency health care and food supplies, as well as restoring cultural heritage. AKDN has a long-term perspective to assisting Syrians in improving their quality of life.

Norwegian Refugee Council (NRC):

The NRC meets the needs of internally displaced persons, refugees, their hosts, and assists the returnees and those affected by the violence. NRC teams ensure that education for children and youth is prioritized even in the most difficult circumstances. They work alongside communities, and give emergency, transitional, and long-term help in the face of harsh conflict, economic difficulties, and Covid-19, as in the Figure 2.



Figure 2: Numbers of People those NRC helped them if 2020⁸

SOS Children's Villages: "a loving home for every child"⁹

SOS Children's Villages is a non-profit and independent social development organization in Syria. It is a branch founded in 1975 of the International Federation of Children's Villages, which is based in Austria and has 136 locations around the world. The organization assists orphans and children without parental care who have lost their families, homes, and security. The first village in Syria was opened in 1981, providing safe homes for children in need and orphans.

⁸ Source of Figure 2 from NRC's website: [NRC in Syria](#)

⁹ Source: [SOS Children's Villages in Syria](#)

1.4 Web Map Service (WMS)

Web Map Service: defines an interface that enables a client to obtain geospatial data maps as well as detailed information on specific features displayed on the map. WMS allows users to exchange and display spatial data in the form of a map or image in the web browsers. The term “map” refers to a visual representation of geospatial data, not the data itself, which enables the visualization of geographic data on the Internet. This standard does not provide the actual geospatial data; instead, it just provides a georeferenced image. A web mapping service (WMS) is a type of internet-based geospatial data that adheres to the Open Geospatial Consortium's standards (OGC).

The main functions of the web map service:

- a- Create a map as a picture, a series of graphical elements, or a bundled collection of geographic feature data.
- b- Answer basic queries about the content of a map.
- c- Inform a client about the maps that can be created, and which ones can be queried further.

Web maps types:

Currently there are many types of web maps:

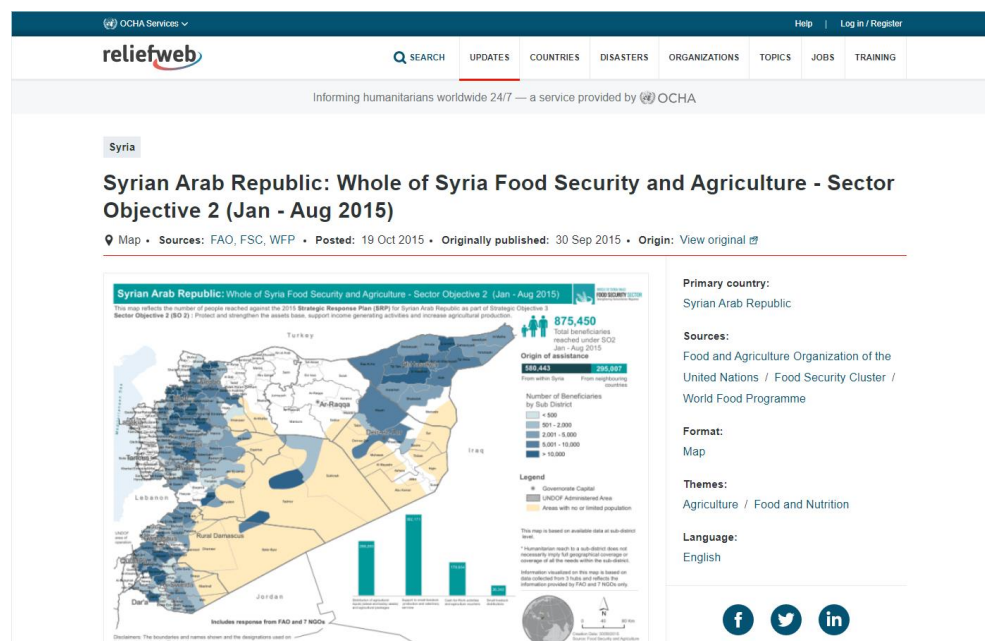
- 1- Static web maps: there is no animation or interactivity on static web pages using formats such as PDF, PNG, etc.
- 2- Interactive web maps: interactivity enables users to explore maps, modify map parameters, browse, and interact with the map, disclose new information, link to other resources, and even more, while also compensating for the drawbacks of screen and online maps.
- 3- Dynamically changed web maps: it is the map created each time a user reloads the web pages.
- 4- Distributed web maps: these maps are made of data from several sources, and the WMS protocol establishes standardized means for accessing maps stored on other servers.
- 5- Animated web maps: by animating one of the graphical or temporal variables, you may display how the map changes over time.
- 6- Realtime web maps: display the current state of a phenomenon in near-real time (only a few seconds or minutes delay). Like traffic maps, the maps are generated or updated at regular intervals or on demand.

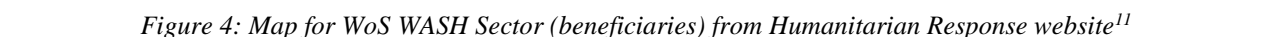
- 7- Personalized web maps: the ability for the map user to apply his or her own data filtering, chosen content, customized styling, and map symbolization.
- 8- Customizable web maps: provide APIs for use in other people's websites, this type is more complex, such as Google Maps.
- 9- Analytic web maps: GIS analysis is available through these web maps.
- 10- Online atlases.
- 11- Collaborative web maps: groups of people work together to build and update online maps; it is immature and complex to implement.

1.5 The use of web map services by international organizations in Syria (status quo)

International organizations operating in Syria suffer from the lack of proper regulation and indications of appropriate use of web map services. Some of these organizations do not use these services at all, while others use static web map services in PDF or image format. Interactive web map services are used in a very limited range, sometimes in a way that does not achieve the goal for which they were created (providing GIS data to the user quickly, with basic querying, and publishing maps with maintain styles).

One example is the case of UNOCHA (ReliefWeb website), ReliefWeb is a humanitarian information service provided by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), which is a static web mapping service using images or PDF files. ReliefWeb monitors and collects information from many sources, including humanitarian agencies, governments, the media and research institutions. From this website the user can download reports and statistics dedicated to a project containing more precise geographical data, which is represented on maps and infographics in PNG or JPG format that can be downloaded on this site (Figure 3).





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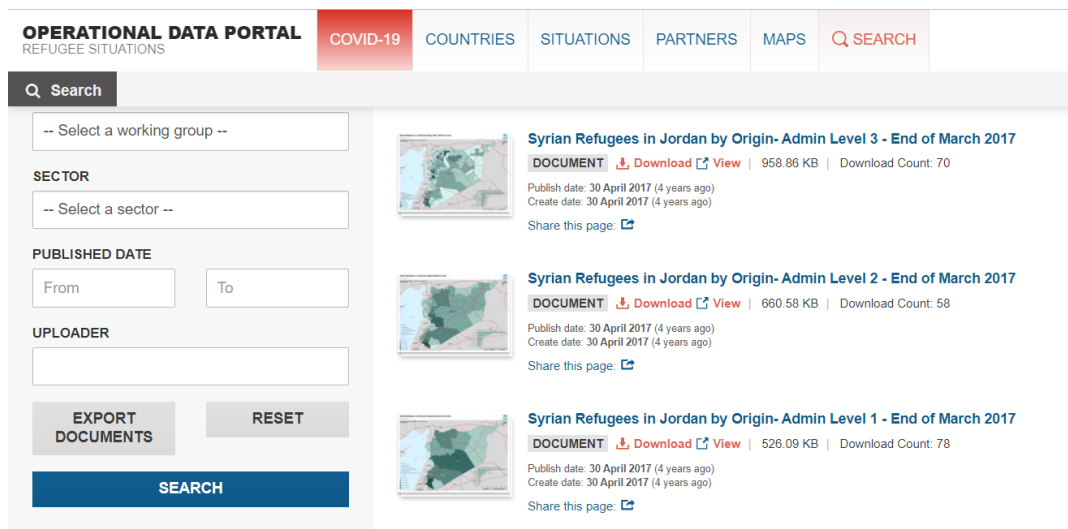


Figure 5: Maps available on The Operational Data Portal website¹²

World Food Program (WFP) has its own platform for sharing data and static maps. The platform is called WFP GeoNode (Figure 6), in which we can find maps of some of the program's work in Syria, and visitors don't need to have an account to download public data. [More details in Chapter 3.]

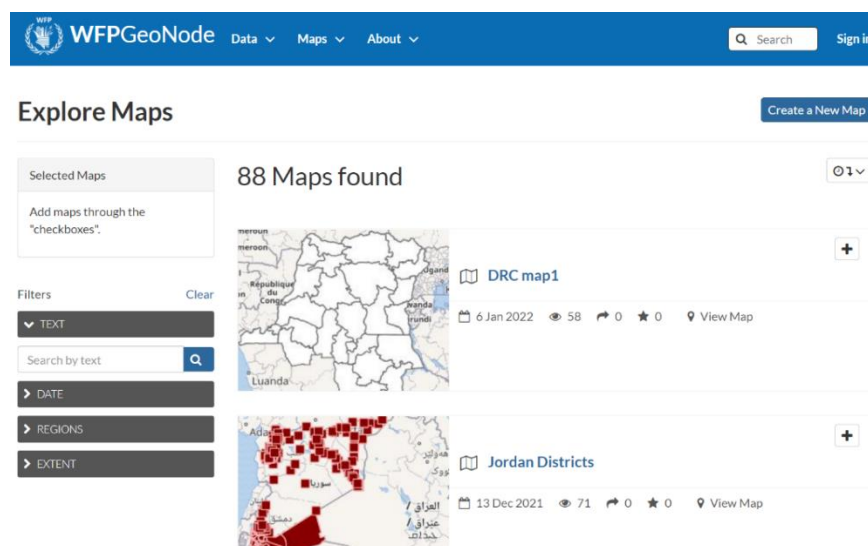


Figure 6: Maps and Data available on The GeoNode Website¹³

¹² Source: [Operational Data Portal Refugee Situations- Syria](#)

¹³ Source: [WFP GeoNode- Explore Maps](#)

In the case of the website used by SOS Children's Villages (Figure 7), users can find very simplified and ineffective interactive maps, because they only contain general information about the activities and beneficiaries of the organization in this governorate.

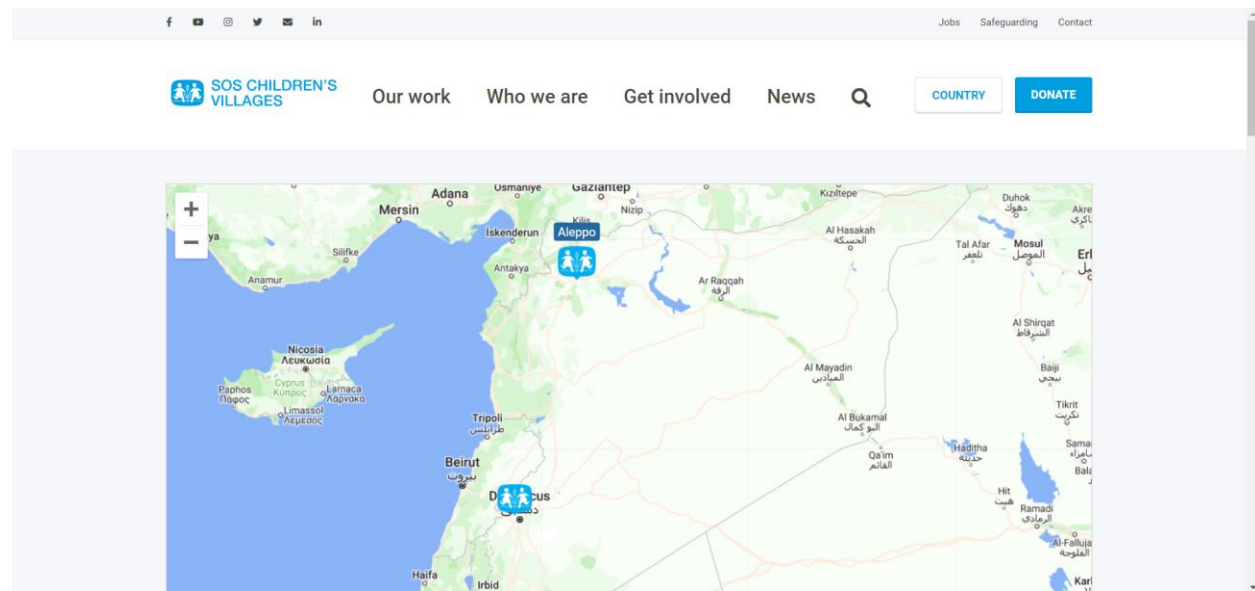


Figure 7: Interactive map on The SOS Children's Villages Website¹⁴

FAOSTAT is a data portal that offers access to agricultural and food data for over 245 nations and territories from 1961 to the most current year available, covering all FAO regional groups. FAOSTAT for the Syrian Arab Republic (Figure 8) provides a number of agricultural and food data (Demographics, Inputs, etc.) according to a timeline and in diagrams, but the interactive map is still empty without data (no data yet), and the data is not available for all topics.

¹⁴ Source: [SOS Children's Village](https://www.soschildrensvillages.org/)

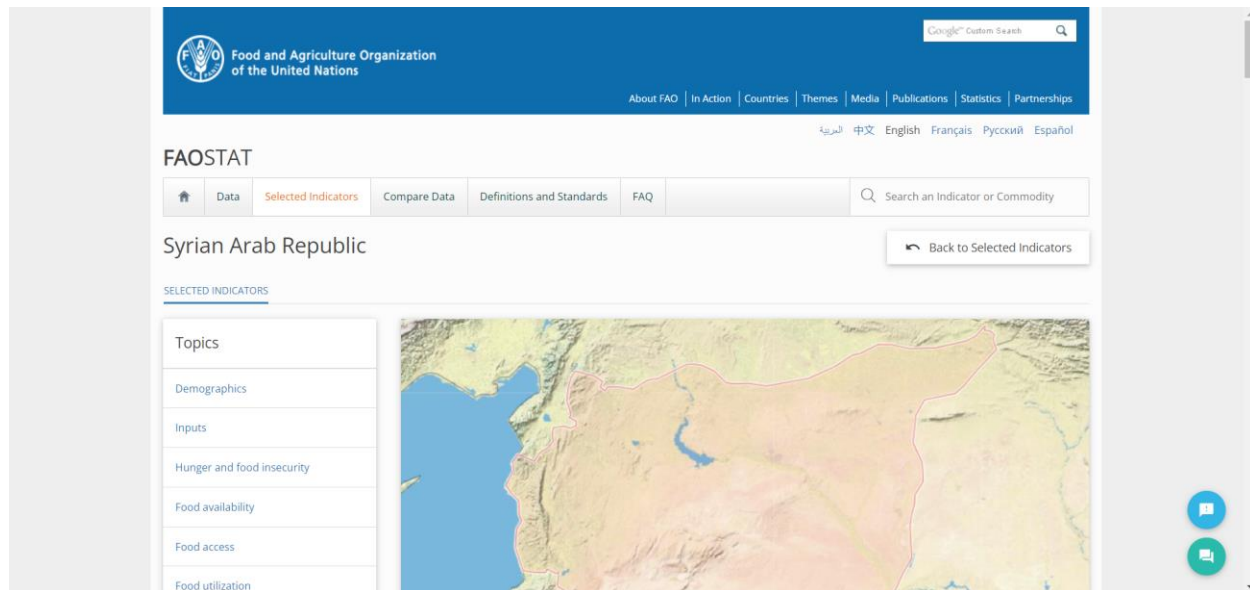


Figure 8: FAOSTAT website, Syrian Arab Republic Topics¹⁵

The United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) data site is one of the sophisticated websites for displaying humanitarian operations data (Figure 9). Data is displayed spatially on an interactive map, but this representation is very primitive with a simple pop-up that does not contain actual statistical data on the organization's activities. The site displays different statistics on humanity data by timeline path, displaying statistical data for several different sectors using line and pie charts, but the use of the interactive map in this site is not suitable to the idea of web mapping services to display this type of data.

¹⁵ Source: [Syrian Arab Republic Topics](#)

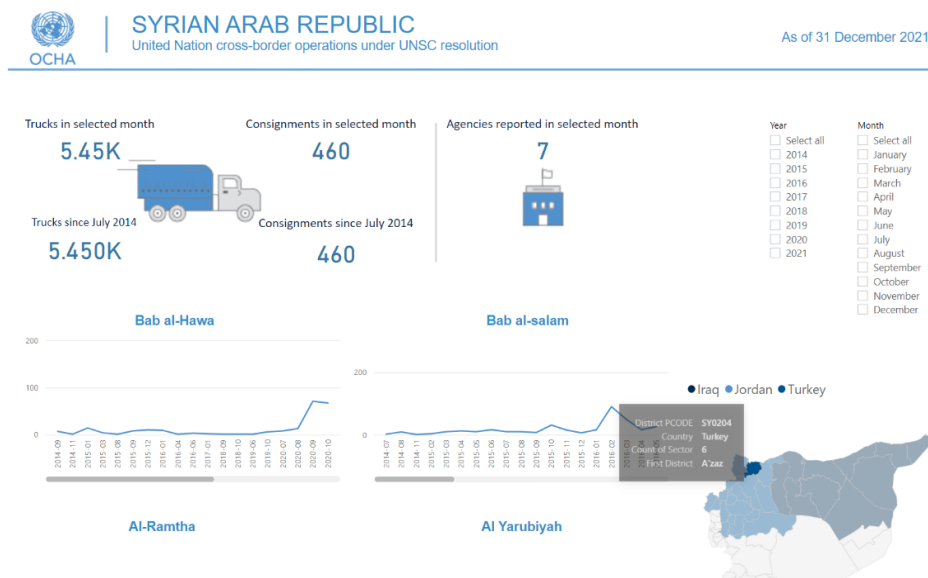


Figure 9: Interactive map and statistical data on The UNOCHA Website¹⁶

In addition to the **Humanitarian Data Exchange (HDX)** platform is another great resource site for sharing data related to humanitarian work (Figure 10). It contains geographic and non-geographic data, and the source of this data is the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). The platform is maintained by UN OCHA, and it has hundreds of layers ready to be downloaded and used in analysis.

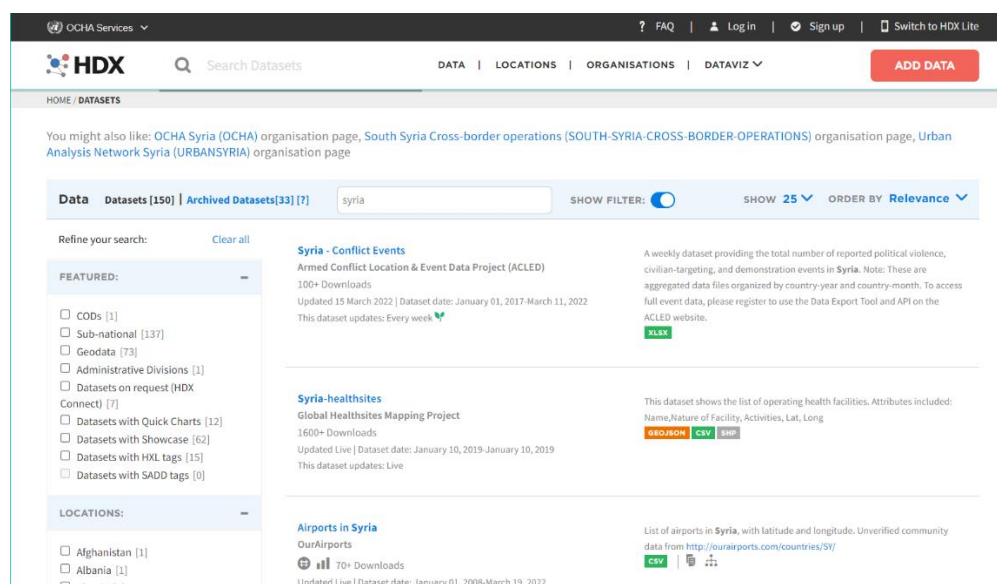


Figure 10: The Humanitarian Data Exchange (HDX) platform¹⁷

¹⁶ Source: [OCHA- Syria- United Nation cross-border operations under UNSC resolution](https://ocha-syria.org/)

¹⁷ Source: [Humanitarian Data Exchange Syria](https://data.humdata.org/)

A positive example from this website is the interactive maps (Story map series- Side Accordion) of education data: Schools in Syria 2018 - Edition 4, to highlight the impact of the Syrian conflict on education and the needs of students and school supplies. It contains several layers (the number of teachers and students, schools, etc) and you can also click on the symbols and spaces to get a label containing statistics and charts about the educational situation there, as well as visitors can download the database too (Figure 11), but the disadvantage of this website is that the amount of data displayed in a single map is not regulated.

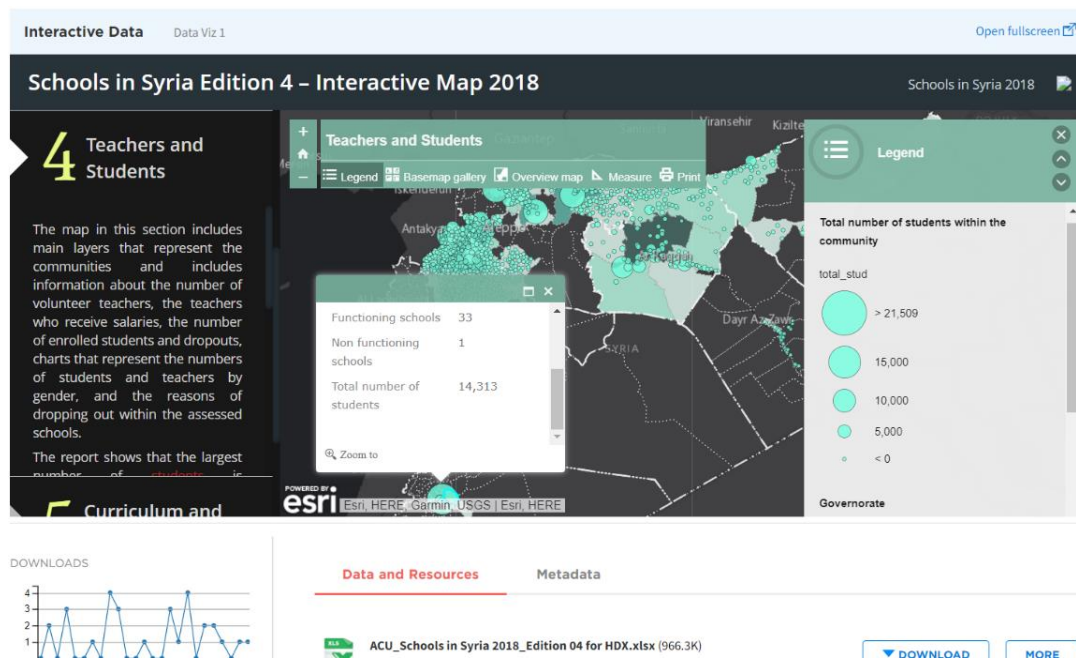


Figure 11: Interactive maps of education data in Syria 2018¹⁸

Finally, **The Global Shelter Cluster (GSC)** is a public platform co-chaired by IFRC and UNHCR at the global level, GSC is a mechanism, coordinating an Inter-Agency Standing Committee (IASC). In disasters, the International Federation of Red Cross and Red Crescent Societies (IFRC) is the convener of the Shelter Cluster, whereas the UN Refugee Agency (UNHCR) is in responsibility of the Shelter Cluster in conflict situations. The GSC allows for improved coordination among shelter actors, which helps disaster survivors and internally displaced individuals affected by armed conflict, so that those in need of shelter can live in a safe and appropriate environment, and they can receive assistance more quickly and with the proper support.

¹⁸ Source of Figure 9 from HDX platform: [Schools in Syria 2018- Edition 4](#)

The Global Shelter Cluster is a website dedicated to the sharing and exchange of shelter information in a specific region as well as globally, and it is a resource for real-time documents and materials (Figure 12) that can be used by humanitarian agencies operating in the Shelter and NFI sectors in the field during an emergency crisis.

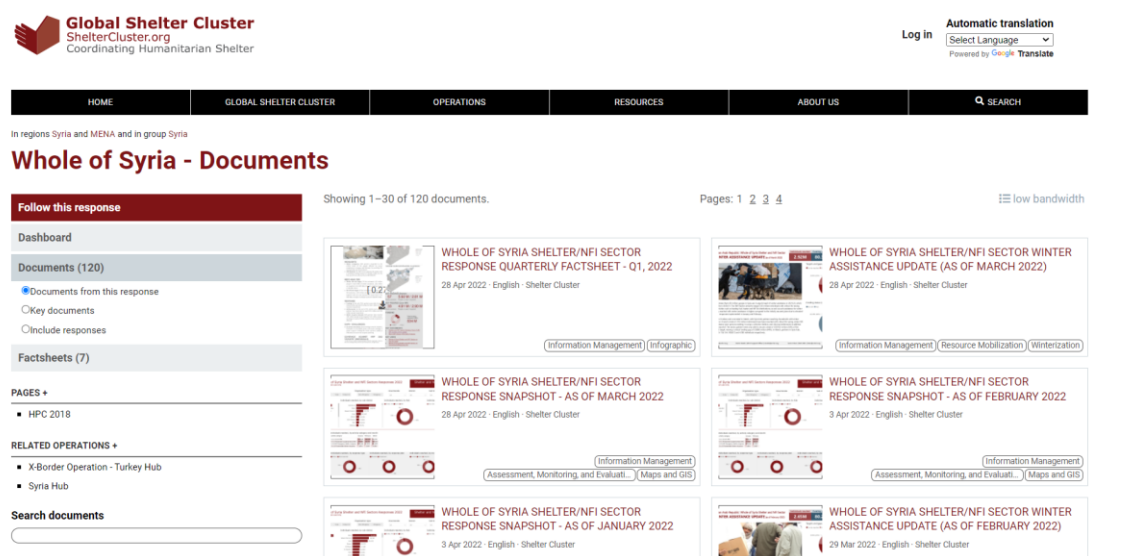


Figure 12: The Global Shelter Cluster (GSC) platform, documents page¹⁹

The Whole of Syria Shelter and Non-Food Items (NFI) Sectors Responses 2022 Dashboard (Figure 13) provides a variety of detailed information about shelter and NFI beneficiaries reached, interactive maps for shelter and NFI severity by sub-district, a lot of percentile data according to specific regions and specific seasons, as well as huge statistics about shelter responses, reached people and cash distribution. This dashboard provides the ability to search by a specific Hub, organization type and a specific location to access the available statistics, with the ability to share the dashboard.

What distinguishes this dashboard is the organization, but there are also disadvantages, as the complexity of the user interface display, the difficulty of understanding it at first sight and the lack of data display to an appropriate grade of detail according to the user's interest. Interactive, advanced and smooth, but it did not provide the information in an easy and clear way to the user.

¹⁹ Source of Figure 10: [Global Shelter Cluster- Whole of Syria - Documents](https://www.sheltercluster.org/whole-of-syria/documents)

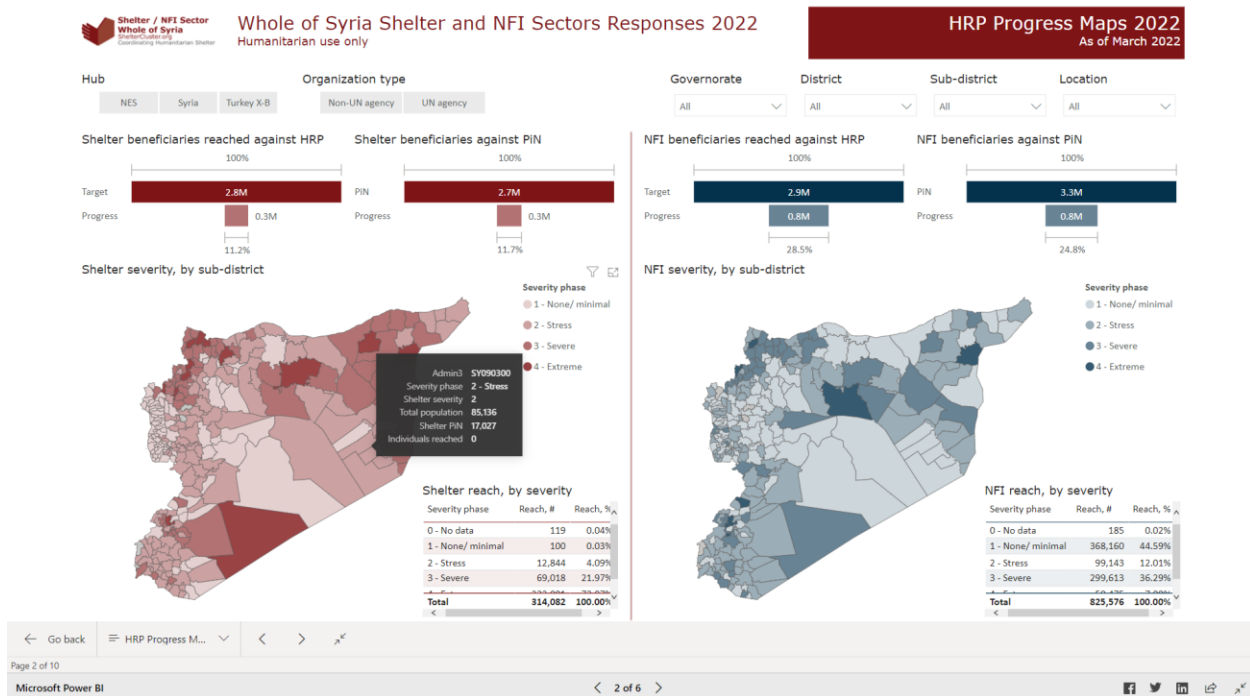


Figure 13: The Whole of Syria Shelter and NFI Sectors Responses 2022 Dashboard²⁰

After thorough consideration about the current situation of using web map services to view and disseminate the activities of organizations operating in Syria, the idea of research came to obtain a methodology that leads these organizations and directs them in an appropriate manner to represent their activities using web map services in order to achieve fast access to accurate information according to the type of users (specialists or public in general).

²⁰ Source of Figure 11: [WHOLE OF SYRIA SHELTER AND NFI SECTORS RESPONSES 2022](#)

2. Project Proposal

2.1 Research idea

The research project consists of several levels:

First level: creating a list of the names of associations operating in Syria and classifying them according to their activities.

Second level: after visiting and analysing their websites, as well as the data that can be obtained from them, two questions are raised: What types of maps use these organizations on their websites? Do the organizations use web map services?

Third level: testing of different solutions to represent data of these organizations using web map services.

Fourth level: Final level of the research, a methodology is proposed for the use of web map services by international organizations, which is divided into two sections: the professional use of these services to represent data for specialists and the general use for non-specialist users (public in general).

2.2 Project objective

Developing a methodology based on the use of web map services that allows international organizations to deal efficiently with these services to provide information and data on the activities of this organization, in the form of different interactive maps according to the different users.

2.3 Research importance

The development of a specialized methodology gives specific recommendations and guidelines for the use of web map services by international organizations, allowing these organizations to show their data within an appropriate and accurate geographical extension using interactive maps that vary according to users. At the same time, organizations can control the quality and quantity of data represented for the public and for specialists in interest of explaining their activities more effectively. It also helps the decision-makers in these organizations to make map-based decisions to support specific places in the future.

2.4 Expected practical results from the research

The results are the methodology that contains directions and steps for displaying and showing data related to the organization's activities according to its geographical extension within an interactive web map, which allows benefiting from and disseminating it in an appropriate manner according to the users. Main beneficiary institutions are the international organizations and humanitarian associations operating in Syria, as well as public and private agencies that are interested in using web map services to display their work and activities.

- ❖ Other possible beneficiaries can be the specialized users such as engineers and GIS specialists, and general users who are not interested in detailed information.

2.5 Research Plan

1- Preliminary study:

A- Create a list of the most important international organizations working in Syria and categorize them into groups according to their main field of work.

B- Studying these organizations in terms of the extent to which they use web map services to show their activities, and answering a question: does this organization use web map services?

C- Collecting data and searching for it through the available sources and organizing the data according to the aims explained previously in this chapter.

2- Testing the use of different web map services.

The test of web map services is explained in more detail in Chapter 4

3- Making of the methodology:

A methodology will be developed for the use of the selected web map service by two types of potential users:

A- The first section for specialists: detailed information about the organization's activities with the geographical distribution of this data. The possible use of infographics to display the statistical information will be also recommended and it should include the option of sharing data too.

B- The second section for the public: representation of more general information about the activities, using limited, simplified, and public data.

3. Data Collection

3.1 General Data

Many organizations operating in Syria have websites that contain general information about the activities of these organizations and their statistics within the areas in which they operate.

In this project, part of the general data published in these sites was relied on, for example, the **WFP GeoNode** website and the other part is from **Humanitarian Response**.

WFP GeoNode Platform is powered by GeoNode. It is a platform for the management and publication of geospatial data, integrated creation of data, metadata ,and map visualizations in a complementary manner (Figure 14), designed to be a flexible platform that software developers can modify. The platform has an easy-to-use interface allowing public users to share data in the system for public use or give permissions to specific users, while interactive maps can also be created.

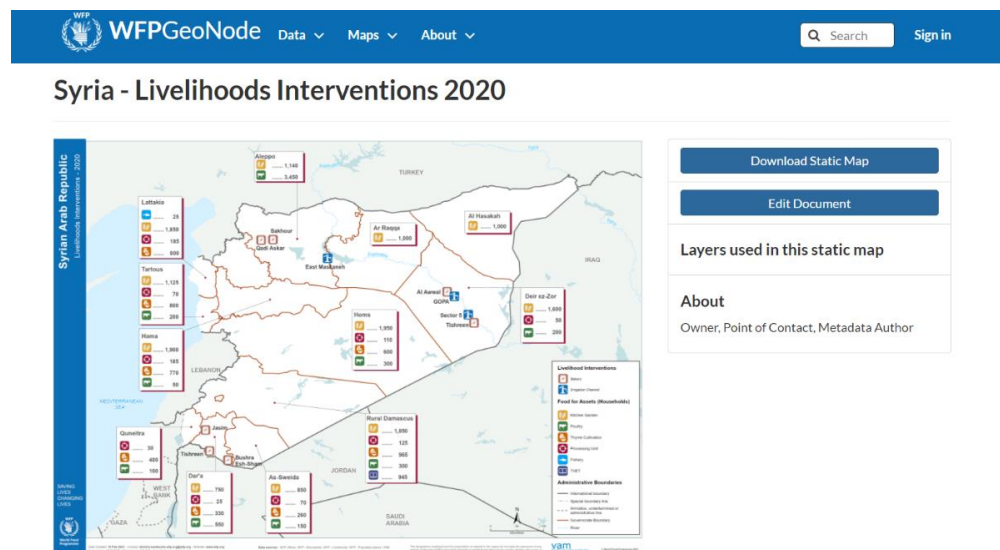


Figure 14: Map of Livelihoods Interventions 2020 available on The GeoNode website²¹

²¹ Source of Figure 12 from WFP GeoNode: [Syria - Livelihoods Interventions 2020](#)

Humanitarian Response is a humanitarian service provided by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA). Humanitarian Response provides information that helps the work of these organizations in times of emergency need. It operates on mobile platforms and is available in different languages. It provides basic capabilities to the user, such as information collection and sharing. Information available from multiple parties, such as national authorities and humanitarian organizations, is centrally managed on this platform and is tailored to the country or to respond to an emergency situation.

This website contains reports, statistical data and maps that show general information about humanitarian needs in various sectors and some information dedicated to statistics that help the organizations implement its work in the future, As in Figures 15 and 16.

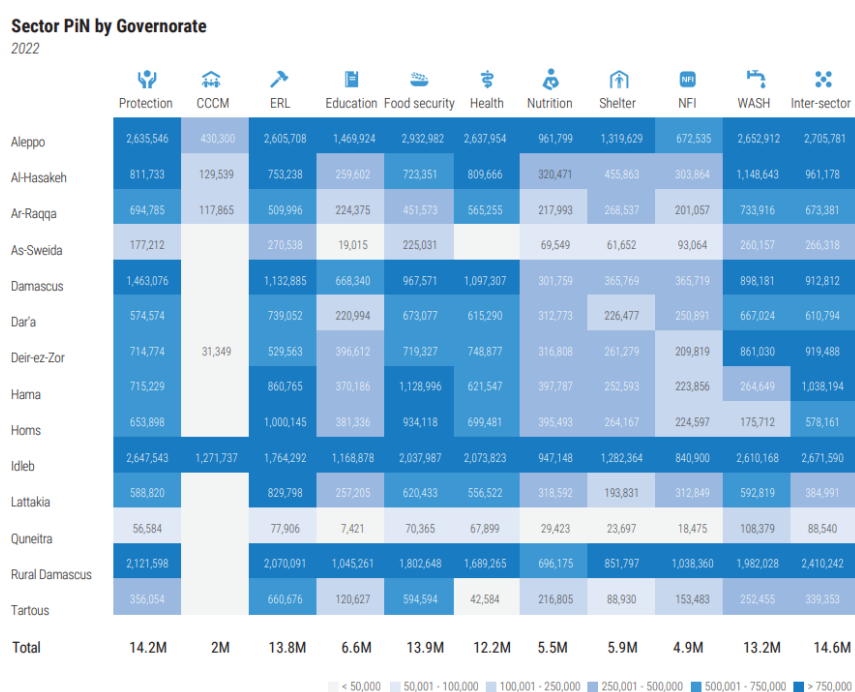


Figure 15: PiN datasheet 2022 available from document in Humanitarian Response website

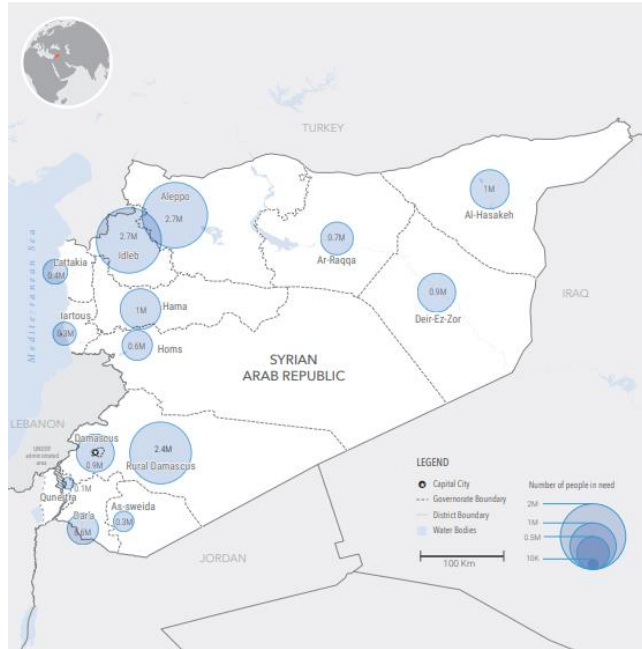


Figure 16: PiN thematic map 2022 available from document in *Humanitarian Response* website

3.2 Specific Data

International organizations usually do not publish any detailed data specifically related to a project or activity for the public. In this research, specific data was obtained from several organizations, and relied upon because the **Researcher** was working as a GIS specialist in the Syrian Arab Crescent Organization – the national partner for some organizations – which enabled me to obtain some more detailed data and use it in the templates of this research (Figure 17).

Furthermore, some specific data was obtained from **Humanitarian Response** website. It was statistical data that help the organization in making decisions in future projects (Figures 18 and 19).

district code	district_AR	district_EN	sub-district code	sub-district_AR	sub-district_EN	Organization	Households
SY0202	الباب	Al Bab	SY020206	عريمة	A'rima	ICRC	94
SY0202	الباب	Al Bab	SY020202	دير حافر	Dayr Hafir	ICRC	892
SY0205	منبج	Menbij	SY020500	مركز منبج	Menbij	ICRC	604
SY0202	الباب	Al Bab	SY020201	تادف	Tadaf	ICRC	473
SY0202	الباب	Al Bab	SY020205	رسم حرم الامام	Rasm Haram EHma	ICRC	117
SY0202	الباب	Al Bab	SY020200	مركز الباب	Al Bab	ICRC	226
SY0200	جبل سمعان	Jebel Saman	SY020000	مركز جبل سمعان	Jebel Saman	ICRC	330
SY0218	جبل سمعان	Jebel Saman	SY020002	تل الضمان	Tall Ed-daman	ICRC	317
SY0200	جبل سمعان	Jebel Saman	SY020006	الحاضر	Hadher	ICRC	255
SY0200	جبل سمعان	Jebel Saman	SY020005	الزربة	Zarbah	ICRC	18
SY0202	الباب	Al Bab	SY020204	كويرس شرقي	Eastern Kwaies	ICRC	135
SY0205	منبج	Menbij	SY020503	مسكنة	Maskana	ICRC	1273
SY0205	منبج	Menbij	SY020502	الخفسة	Al-Khafsa	ICRC	1266
Total							6000

district code	district_AR	district_EN	sub-district code	sub-district_AR	sub-district_EN	Organization	Households
SY0205	منبج	Menbij	SY020502	الخفسة	Al-Khafsa	IFRC	1145
SY0202	الباب	Al Bab	SY020201	تادف	Tadaf	IFRC	48
SY0202	الباب	Al Bab	SY020202	دير حافر	Dayr Hafir	IFRC	250
SY0202	الباب	Al Bab	SY020200	مركز الباب	Al Bab	IFRC	166
SY0205	منبج	Menbij	SY020503	مسكنة	Maskana	IFRC	391
Total							2000

Figure 17: Specific data for ICRC and IFRC Livelihood activity 2018²²

It should be noted as in the previous Figure, when we create these tables and data columns a special field must be added containing the sub-district codes corresponding to the codes in the base layer (sub-district layer), in order to make the join between the activities of organizations database and base layers easier (explained in more detail in sub-chapter 5.3).

²² These tables were created by the researcher with several other tables (ICRC, IFRC, WFP, FAO, and ACSAD- Home gardens grant 2018) after getting the data from the researcher's previous work with Syrian Arab Red Crescent Branch Aleppo Livelihoods team.

Estimated Population Composition, Inter-Sector Severity and People in Need
by sub-district

ADMIN INFORMATION			POPULATION ESTIMATES (AUGUST 2021, POPULATION TASK FORCE)					IDPS IN INFORMAL SETTLEMENTS, PLANNED, CAMPS, COLLECTIVE SHELTERS AND TRANSIT CENTERS			INTER-SECTOR SEVERITY AND PIN	
GOVERNORATE	DISTRICT	SUB-DISTRICT	RESIDENTS	IDPS	SPONTANEOUS-IDP-RE- TURNÉES	TOTAL POPULATION	% OF IDPS AND SPONTANEOUS IDP RETURNEES OF POPULA- TION	NUMBER OF SITES/ CAMPS	NUMBER OF IDPS IN SITES/ CAMPS (JAN/FEB 2021)	%OF IDPS IN SITES/ CAMPS	SEVERITY	PEOPLE IN NEED
Aleppo	Azaz	Azaz	65,357	235,939	-	301,296	78%	37	154,675	66%	4	271,166
Aleppo	Azaz	Aghtrn	48,676	47,213	240	96,129	49%	15	12,201	26%	4	86,516
Aleppo	Azaz	Tal Refaat	12,983	51,824	-	64,007	80%	-	-	-	3	34,763
Aleppo	Azaz	Marf	22,171	47,580	30	69,781	68%	5	4,992	10%	4	62,802
Aleppo	Azaz	Nabul	34,174	14,196	-	48,370	29%	-	-	-	3	11,782
Aleppo	Azaz	Suran	34,792	61,176	12	95,980	64%	13	20,850	34%	4	86,382
Aleppo	Afrin	Afrin	74,392	119,663	-	194,055	62%	57	33,698	28%	4	174,650
Aleppo	Afrin	Bubul	7,197	28,276	140	35,613	80%	-	-	-	4	20,143
Aleppo	Afrin	Jandaris	23,174	71,356	-	94,530	75%	21	14,533	20%	4	84,271
Aleppo	Afrin	Raju	21,937	27,324	90	49,351	56%	7	1,436	5%	4	44,415
Aleppo	Afrin	Sharan	9,106	43,462	-	52,568	83%	30	12,187	28%	4	47,311
Aleppo	Afrin	Sheikh El-Hadid	8,145	4,221	-	12,366	34%	-	-	-	4	11,129
Aleppo	Afrin	Maibali	15,107	12,692	-	27,799	46%	11	4,894	39%	4	25,019
Aleppo	Ain Al Arab	Ain al Arab	82,573	4,324	93	87,390	5%	-	-	-	3	6,908
Aleppo	Ain Al Arab	Lower Shyookh	16,064	-	-	16,064	0%	-	-	-	3	121
Aleppo	Ain Al Arab	Sarin	50,307	1,319	14	51,640	3%	-	-	-	3	7,981
Aleppo	Al Bab	Al Bab	92,672	97,869	-	190,541	51%	25	32,481	33%	4	171,487
Aleppo	Al Bab	Tadaf	19,242	448	187	19,877	3%	-	-	-	4	17,545
Aleppo	Al Bab	Dayr Hafir	18,773	168	2,044	20,985	11%	-	-	-	3	18,047
Aleppo	Al Bab	Ar-Rule	16,223	7,417	-	23,640	31%	-	-	-	4	21,071
Aleppo	Al Bab	Eastem Kwaireis	15,090	-	-	15,090	0%	-	-	-	3	12,024
Aleppo	Al Bab	Ram Haram El-Imam	17,790	-	1,255	19,045	7%	-	-	-	3	16,569
Aleppo	Al Bab	Al-Nima	31,666	10,689	406	42,761	26%	4	2,220	21%	4	38,485
Aleppo	As-Safra	As-Safra	38,498	521	-	39,019	1%	-	-	-	3	29,705
Aleppo	As-Safra	Khanaser	220	-	-	220	0%	-	-	-	3	176
Aleppo	As-Safra	Banan	2,155	-	-	2,155	0%	-	-	-	3	1,509
Aleppo	As-Safra	Hajeb	560	-	-	560	0%	-	-	-	3	392
Aleppo	Jarablus	Jarablus	45,212	36,943	-	82,055	45%	24	32,709	89%	4	73,850
Aleppo	Jarablus	Ghandorah	17,852	12,535	-	30,387	41%	8	7,926	63%	4	27,348
Aleppo	Jebel Saman	Jebel Saman	1,461,082	168,677	16,184	1,645,943	11%	3	485	0.3%	3	739,858
Aleppo	Jebel Saman	Atareb	96,353	87,061	265	183,679	48%	53	69,788	80%	5	183,679
Aleppo	Jebel Saman	Tal Ed-daman	4,288	52	-	4,340	1%	-	-	-	3	3,335
Aleppo	Jebel Saman	Haritan	2,512	120	360	2,992	16%	-	-	-	3	1,705
Aleppo	Jebel Saman	Damet Azza	38,152	29,515	275	67,942	44%	14	8,326	28%	4	61,148
Aleppo	Jebel Saman	Zarbah	1,842	-	120	1,162	10%	-	-	-	3	883
Aleppo	Jebel Saman	Hadher	3,562	188	30	3,780	6%	-	-	-	3	2,900
Aleppo	Menbij	Menbij	251,600	54,235	300	306,135	18%	44	11,240	21%	3	187,929
Aleppo	Menbij	Abu Qa'qal	53,260	5,245	-	58,505	9%	-	-	-	3	22,107
Aleppo	Menbij	Al-Khafsa	84,995	2,425	-	87,420	3%	-	-	-	3	67,270
Aleppo	Menbij	Maskana	39,250	-	-	39,250	0%	-	-	-	3	31,400
Al-Hasakeh	Al-Hasakeh	Al-Hasakeh	142,875	127,639	746	271,260	47%	58	28,871	23%	4	244,134
Al-Hasakeh	Al-Hasakeh	Tal Tamer	33,444	18,897	-	52,341	36%	50	11,509	61%	3	41,873
Al-Hasakeh	Al-Hasakeh	Shadadah	35,290	1,001	146	37,337	5%	-	-	-	3	29,870
Al-Hasakeh	Al-Hasakeh	Markada	15,531	536	40	16,107	4%	-	-	-	3	12,886
Al-Hasakeh	Al-Hasakeh	Bayr Al-Hulo Al-Wardeyyeh	8,524	383	-	8,907	4%	-	-	-	4	7,937
Al-Hasakeh	Al-Hasakeh	Aresteh	20,064	15,516	83	43,663	36%	2	14,720	95%	3	34,930
Al-Hasakeh	Al-Hasakeh	Hole	8,581	61,564	-	70,145	88%	1	58,747	95%	3	58,747
Al-Hasakeh	Al-Malkiyyeh	Al-Malkiyyeh	74,985	13,333	125	88,443	15%	3	6,349	48%	4	79,599
Al-Hasakeh	Al-Malkiyyeh	Jawadiyah	24,990	2,580	-	27,570	9%	-	-	-	3	22,553
Al-Hasakeh	Al-Malkiyyeh	Ya'robayh	26,801	1,015	-	27,816	4%	-	-	-	3	22,553
Al-Hasakeh	Qamishihi	Qamishihi	237,883	62,547	321	300,751	21%	-	-	-	3	240,601

Figure 18: Specific PiN datasheet 2022 available from a document in Humanitarian Response website²³

Distribution of People in Need
by sub-district (in 2022)

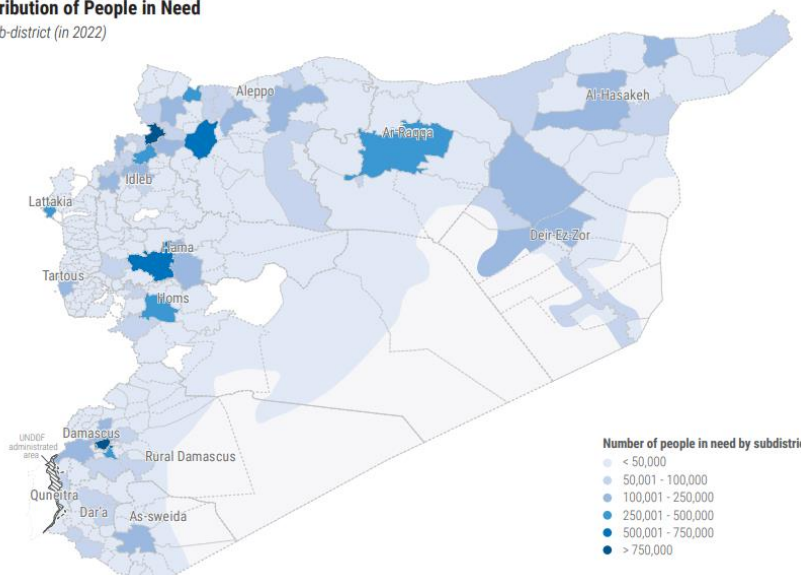


Figure 19: PiN by subdistrict thematic map 2022 available from document in Humanitarian Response website

²³ Sources: [HUMANITARIAN NEEDS OVERVIEW](#) Figure 15 P.49, Figure 16 P.3, Figure 18 P.100, Figure 19 P.48

4. Available Web Map Services

There are several sites and platforms including online map services and dashboard services, creating web maps, managing their data and representing data with different map- and diagram-based solutions (Table 2). I decided, after visiting several sites that provide these services, that the most relevant sites related to the current research project are:

Web Map and Dashboard Services	Account type
iMapBuilder Online	Free Map Editor account
ArcGIS Online	Free Public account
Datawrapper	Free account
Google My Maps	Totally Free
mapbox	Free Developer account
MapMe	Free 7-Day Trial
Carto	Free 14-day trial
MapHub	Free basic account

Table 2: Web Map and Dashboard Services and possible free accounts

4.1 iMapBuilder Online

iMapBuilder Online is easy to use and rich in features suitable for different users. Users can create interactive maps based on the cloud and import their map data and copy the maps in their presentation, through the platform directly without installing or downloading the application and no coding or API knowledge are required (Figure 20). User's maps can be accessed everywhere on different types of devices, and maps can be shared online. It creates Custom Image Maps by importing your own images and inserts images and adding markers, lines, labels, and rectangles (URL), as well as enabling the Category Legend function, and enabling Heat maps, for example to show population density, and traffic accidents.

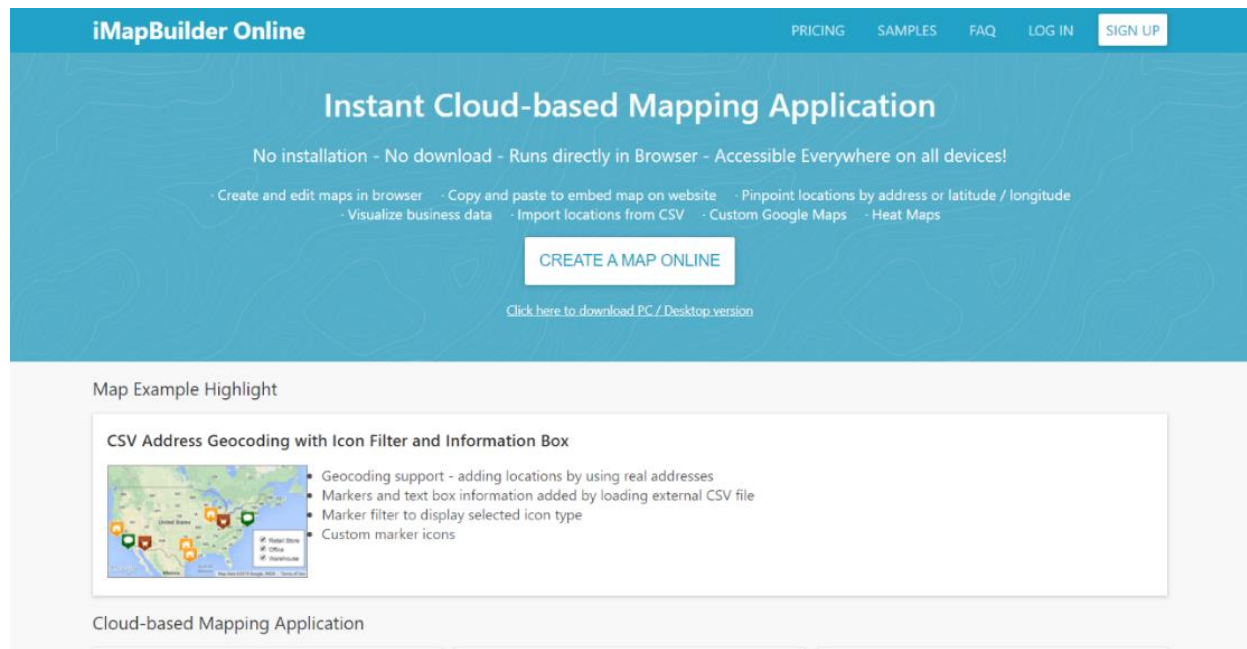


Figure 20: iMapBuilder Online website, Homepage²⁴

The user must create an account on the website, after that he can start creating maps, and also complete or modify a previous map project, and choose if he wants to download the software for Personal computer (Figure 21).

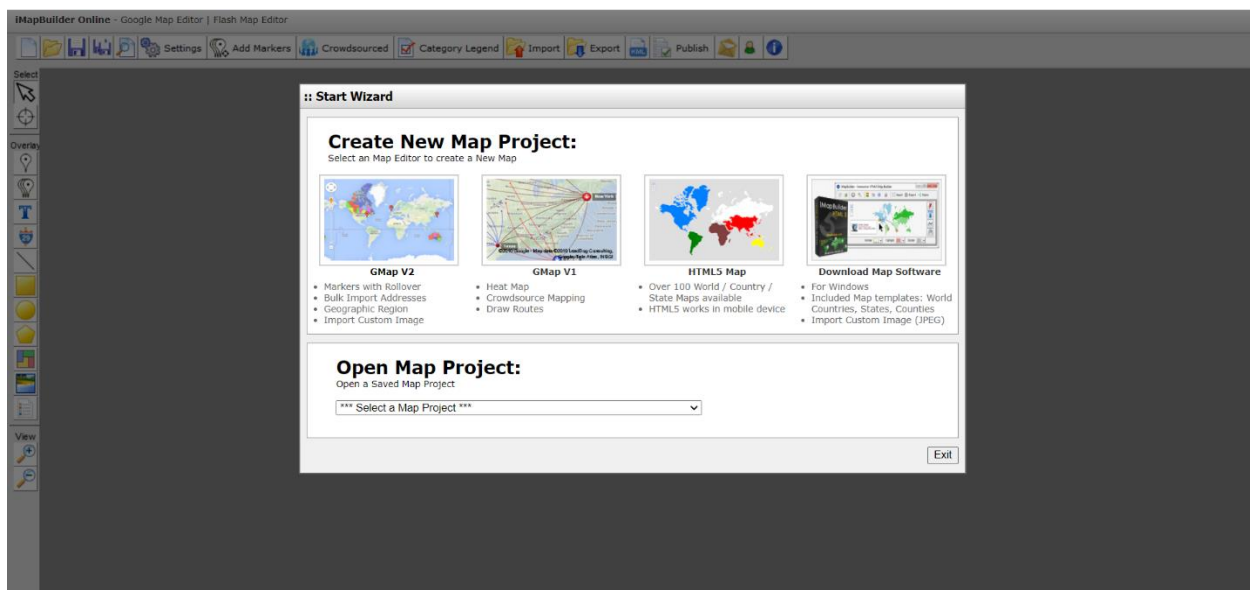


Figure 21: iMapBuilder Online website, Start Wizard window to open and begin the map project

²⁴ Source: [iMapBuilder Online](http://www.imapbuilder.com/)

Users can import their own Excel files, choose the geographical area or the country of which the user wish to create a map, and create customized Google Maps using your imported dataset and use the available tools as locations, points, annotations, popup windows, and icons (Figure 22).

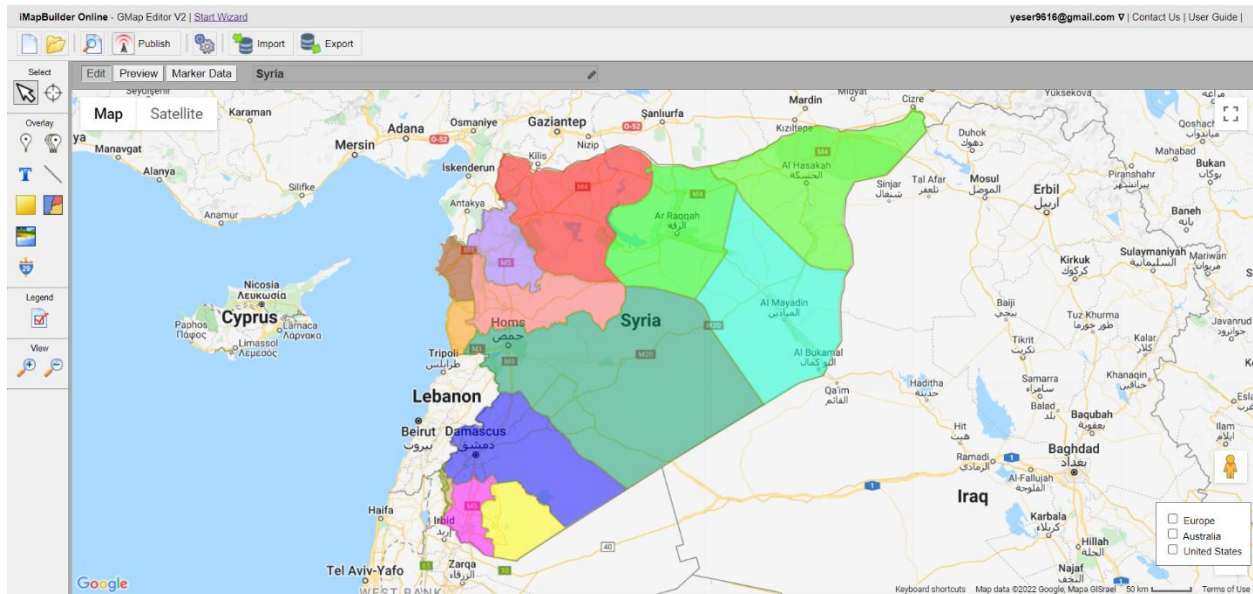


Figure 22: Mapping page on the iMapBuilder Online website²⁵

4.2 ArcGIS Online

ArcGIS Online is a cloud-based service for creating maps and analysing data. Users need to create their own accounts to be able to create maps, analyze data, and also create many specialized applications. This data and maps are stored in a private and secure infrastructure, users can keep their maps and data privately or share them with their colleagues anywhere, also access to all the data, maps, and applications available to users around the world (Figure 23).

²⁵ Source: [Map of Syria](#)



Figure 23: ArcGIS Online website²⁶

ArcGIS Online includes practically all the options that users need to create web maps, 3D web scenes, and notebooks. Users can access a gallery of base maps and smart styles for exploring and displaying their data using new Map Viewer or Map Viewer Classic (Figure 24), and 3D Scene Viewer. Users also have access to templates and widgets for creating web applications that they can publish on ArcGIS Online. Final products can be completed with texts, multimedia elements and interactive solutions that are saved as story maps. Additionally, ArcGIS Notebooks and Python resources are available to perform analysis, automate workflows, and visualize data.

²⁶ Source: [ArcGIS Online](https://www.arcgis.com/home/index.html)

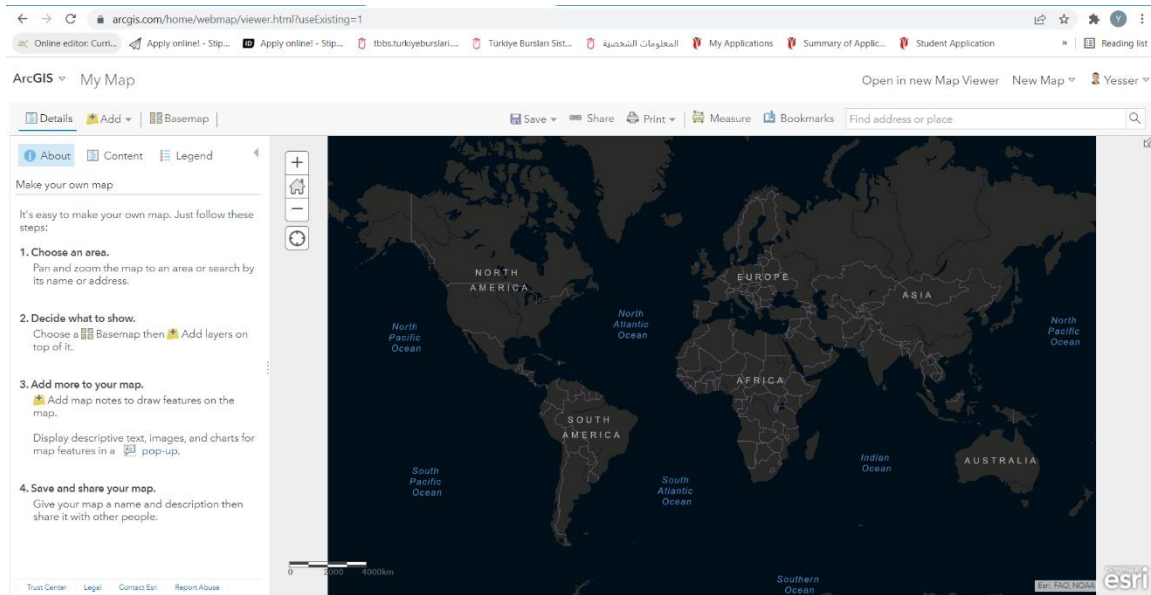


Figure 24: ArcGIS Online website, My Map page

ArcGIS Online can be used through web browsers and mobile devices, also it can be directly accessed through other elements of ArcGIS, including ArcGIS apps.

4.3 Datawrapper

Datawrapper is a platform (Figure 26) specifically developed for journalists (newsrooms), finance companies, and government institutions, but can be also accessed by any interested user. After uploading your data to the platform, you can use it to build three different sorts of visualizations, shown in Figure 25.

Maps	Charts	Tables
<ul style="list-style-type: none"> • Choropleth maps • Symbol maps • Locator maps 	<ul style="list-style-type: none"> • Simple bar charts • Line charts • Column charts • Arrow charts • Scatterplots • Population pyramids 	<ul style="list-style-type: none"> • Mini line charts • Bar charts • Images • Markdown

Figure 25: The diversified capabilities of Datawrapper platform

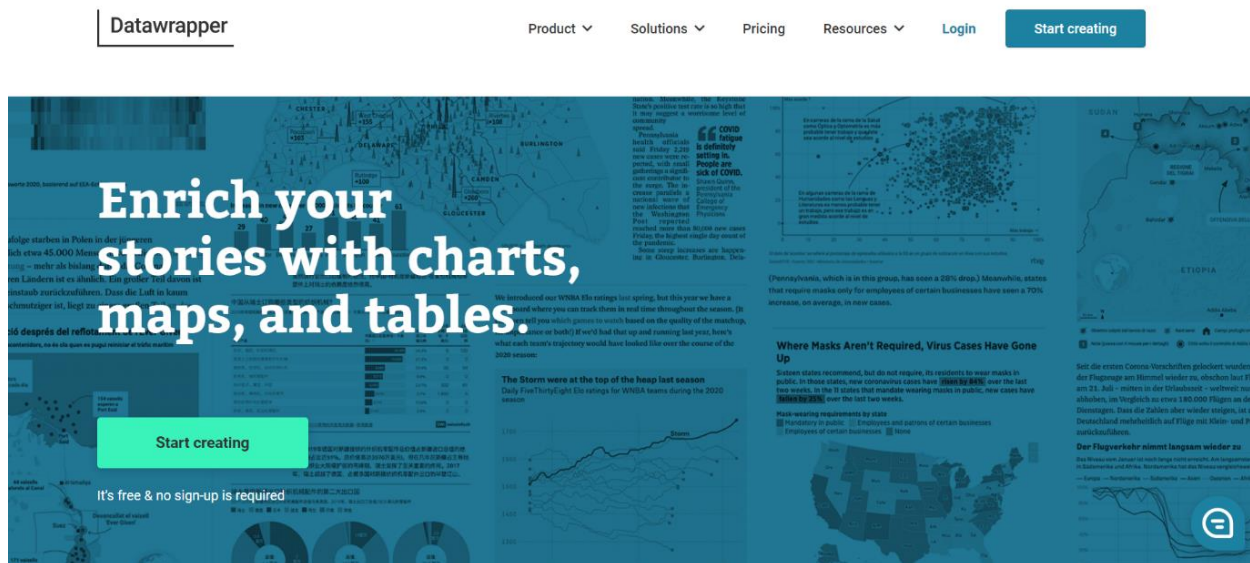


Figure 26: Datawrapper platform²⁷

Datawrapper has the ability to present a beautiful map designing through many settings that it provides as well as the easy interface. Many users create visualizations with this website for web applications, with limited ability to export in PDF and SVG format, and it is used in many agencies, government institutions, and financial institutions.

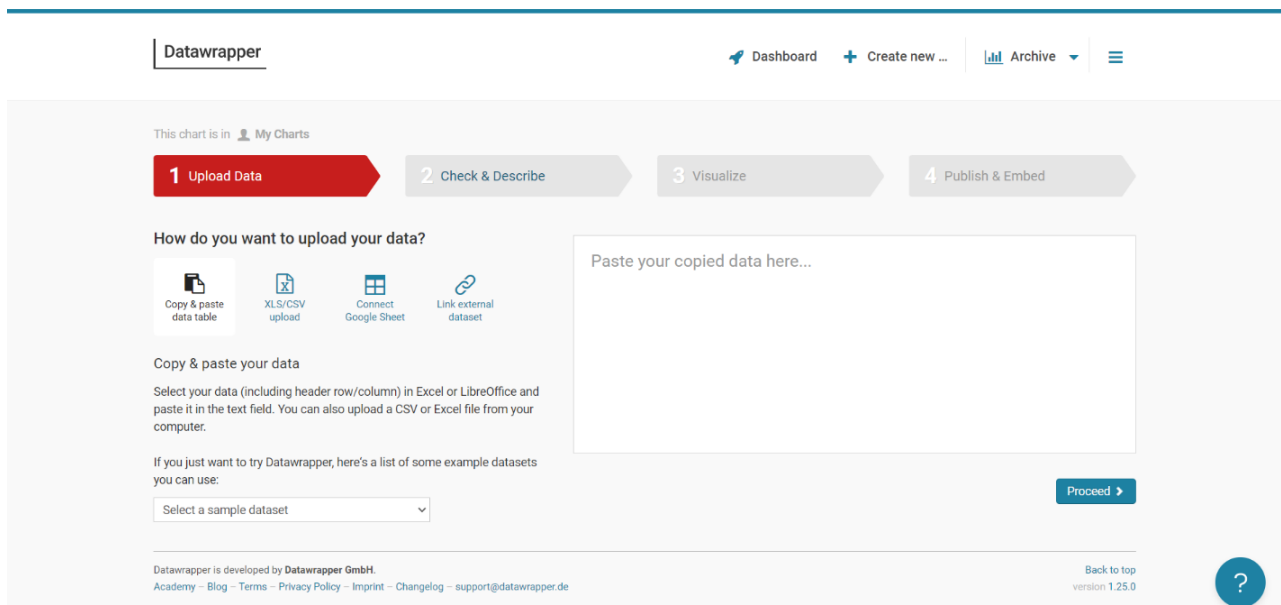


Figure 27: Datawrapper platform, page containing the steps to create map

²⁷ Source: [Datawrapper](https://datawrapper.de/)

Datawrapper offers a clear workflow to create maps and/or charts, which starts in the first step ‘Upload Data’ by choosing the format of your data file (Figure 27). In the second step ‘Check & Describe’, it checks the downloaded data table and chose the Label row. In the third step ‘Visualize’ (Refine and Design) users can choose and modify the data to be displayed on the map. Finally, in the last step ‘Publish & Embed’ the map is published, users can copy the URL or the embed code and download settings for the map are determined (Figure 28).

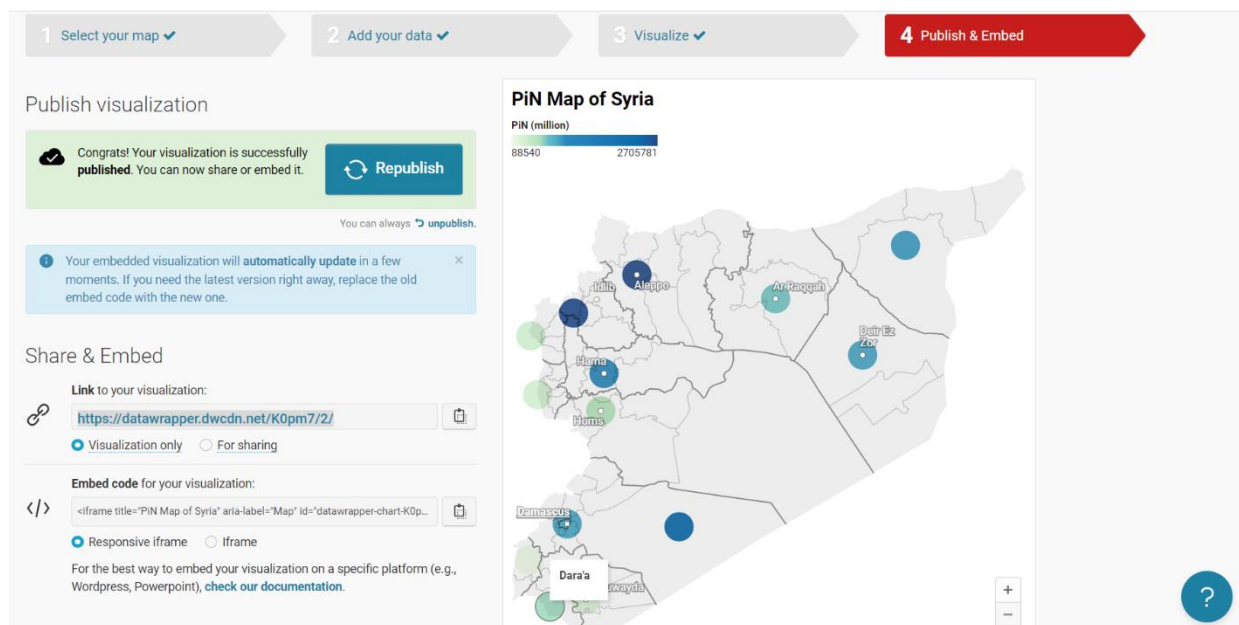


Figure 28: Datawrapper platform, PiN map for example²⁸

4.4 Google My Maps

Users of Google My Maps service (Figure 29) can easily create custom maps of places of interest (such as tourist maps), and have the option to instantly make maps from imported spreadsheets, also embed maps in their website or blog.

Users can collaborate and share all their maps, so their friends can see and edit shared maps, or publish them to the whole world, and users can organize all their maps easily alongside their other documents in Google Drive.

²⁸ Source: [Map of PiN in Syria](#)

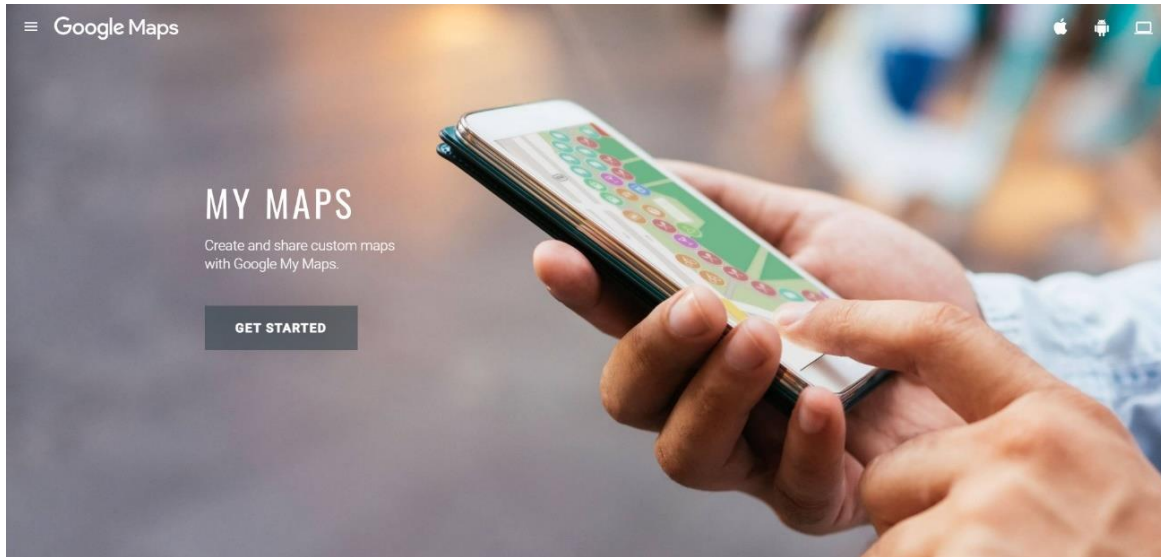


Figure 29: Google My Maps website, main page

Users can create maps by adding points or drawing shapes on the basemap. They can also write a simple explanation and import images and videos to any place. The user can modify the colours and design of the icons according to his desired style. The final result can be published as a simple story map (Figure 30).

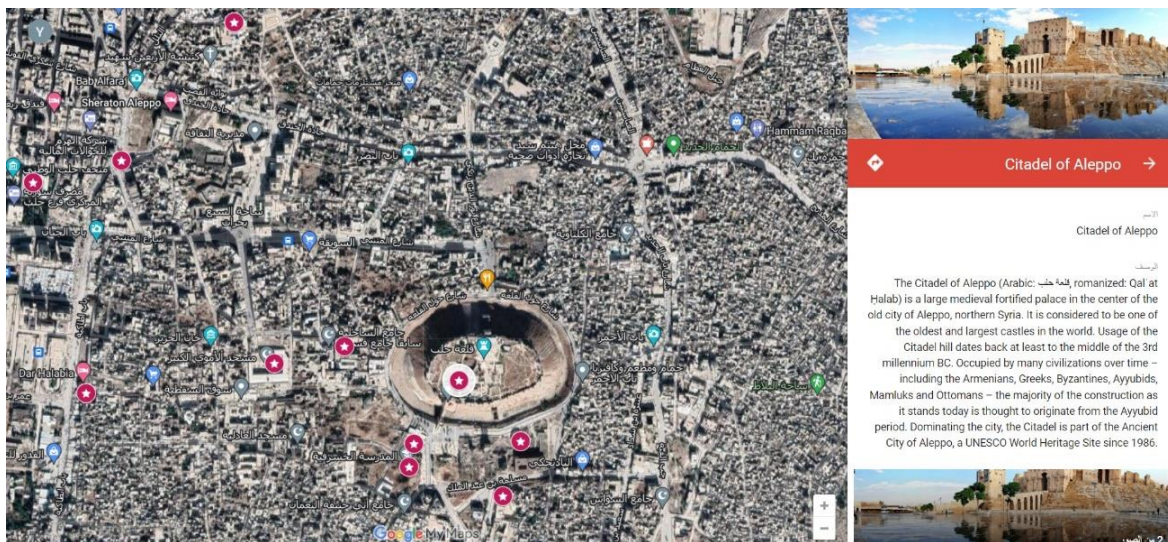


Figure 30: Google My Maps website, Aleppo Touristic map for example²⁹

²⁹ Source: [Old City of Aleppo](#)

4.5 Mapbox

Mapbox is a powerful platform that provides dynamic maps with a variety of features with the abilities to create customizable and interactive maps. After creating an account on Mapbox, users can start benefiting from the platform's products and solutions (Figure 31), for example, they can benefit from fast real-time maps, navigation services for routing, building data, movement data, atlas, statics maps, and the most important option for our case: creating and designing a custom map.

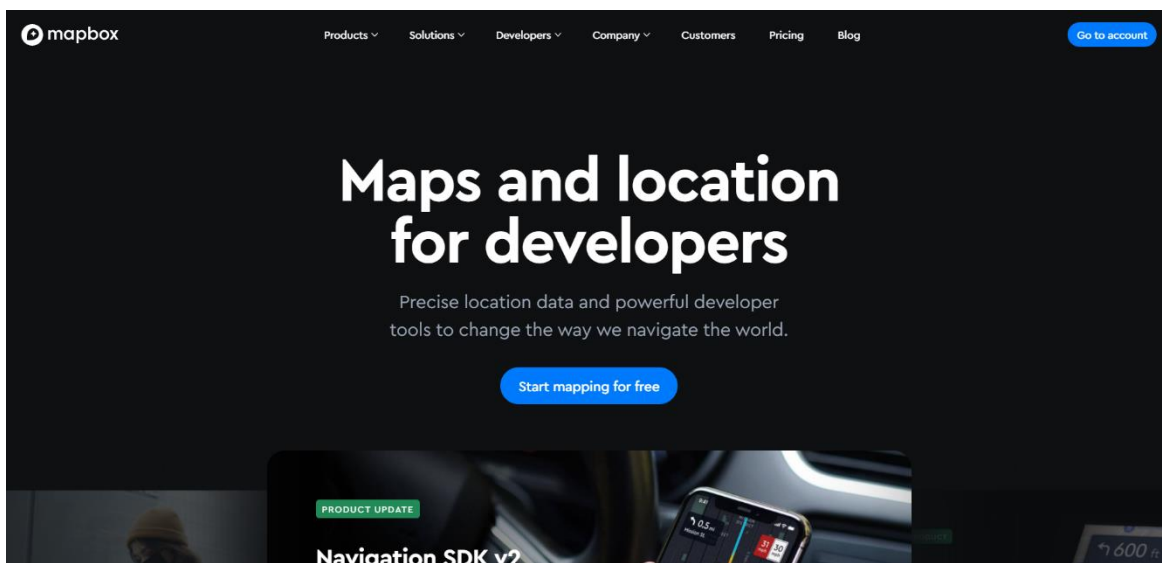


Figure 31: Mapbox platform, main page³⁰

Users can create a custom interactive map, beginning from selecting the background map and also the option of editing it, and after that they can upload their own vector layers in different formats (GeoJSON, zipped shape file, etc) or their datasets. Finally, they can design their own map with popup labels, and share the map with its 'Tileset ID' option (Figure 32).

³⁰ Source: [mapbox](https://www.mapbox.com/)

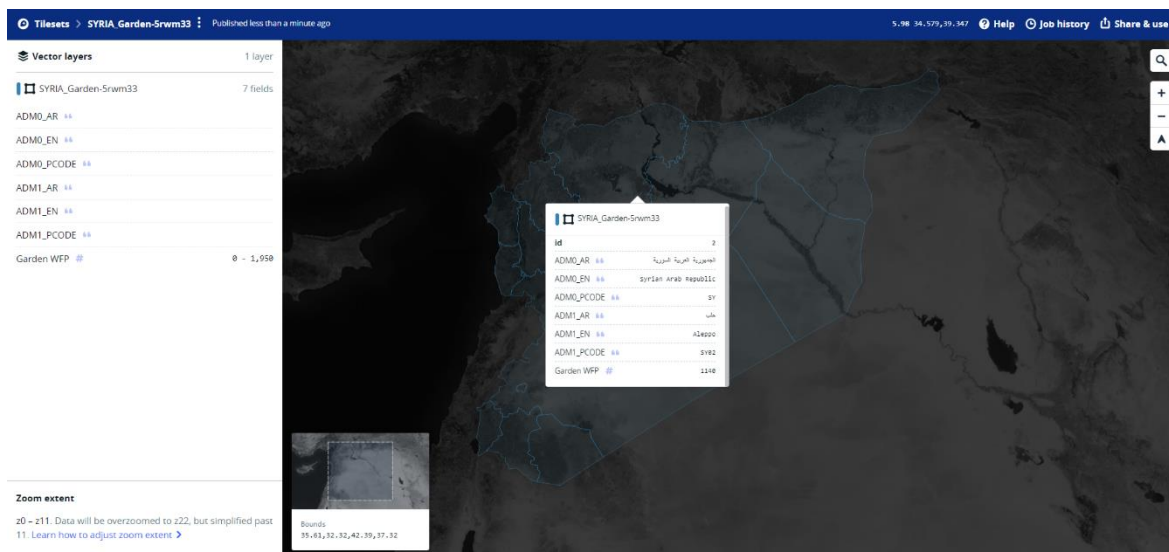


Figure 32: Mapbox platform, Tileset page to explore the map³¹

³¹ Source: [Map of SYRIA Garden](#)

5. Workflow methodology

In the previous chapter it was explained that there are many websites providing web map and dashboard services with different capabilities. After carefully identifying the advantages of each of them, we relied on the services offered by **ArcGIS Online** website to create our maps and build the methodology of this research. ArcGIS Online is one of the largest and most famous mapping sites in the world, which provides most of the services we need in our project for free and provides very great options in creating and modifying the display of map layers, offering distinctive designs of the symbology and effects that help to attract the reader's attention to the most important elements of the map and its understanding. Another very important factor that influenced this decision was that the website also provides numerous applications (configurable, instant apps, and story maps) with special capabilities that are difficult to find on another similar websites.

5.1 Basemap of Syrian Arab Republic

There are several ways to obtain a base map, including digitizing old maps, using aerial images, etc. or downloading ready-made layers of the base map from a reliable source as in our case.

The base map layers have been downloaded from the OCHA website **HDX** (Figure 33), which contains a huge database for the entire Syrian territory. The administrative divisions layer for Syria contains all the Governorates and the subdivisions layer for the sub-districts of Aleppo Governorate (Figure 34).

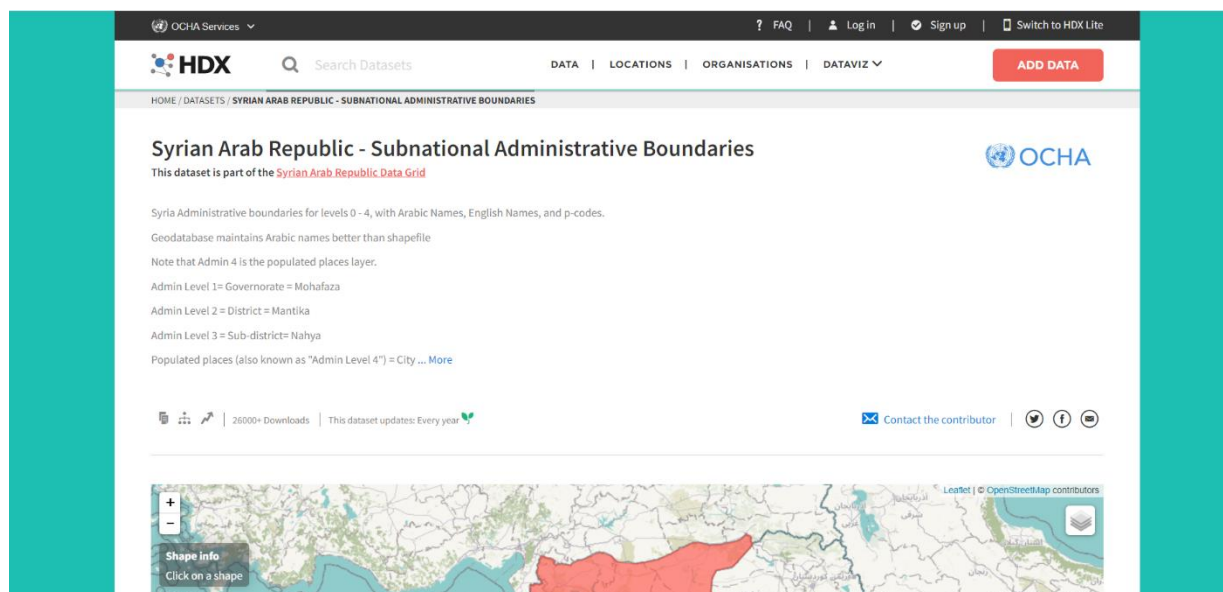


Figure 33: HDX platform, Administrative Boundaries of Syria Page³²

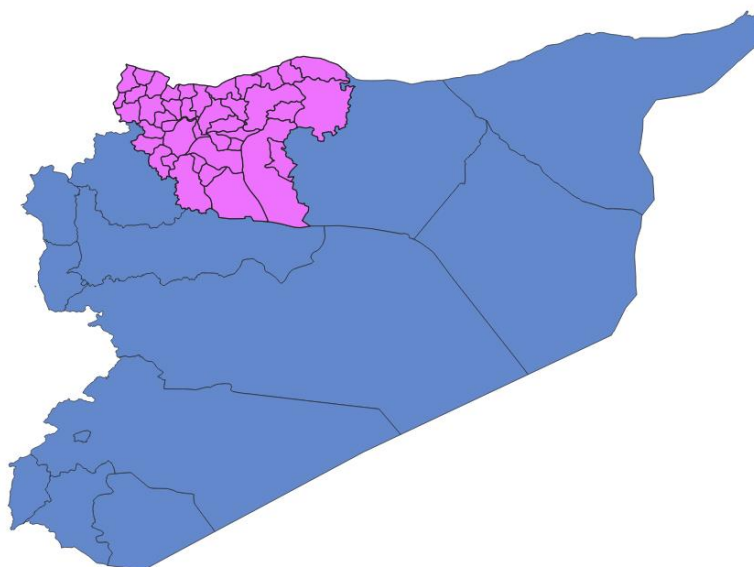


Figure 34: Administrative Boundaries of Syria, and sub-Districts of Aleppo Governorate

³² Source: [Syrian Arab Republic - Subnational Administrative Boundaries \(SYR Administrative Divisions Geodatabase\)](#)

5.2 Data Visualisation

It is not always easy to select the correct method or solution for data visualization. In our case, thematic maps are the appropriate cartographic solution to represent the distribution of an organization's activities.

Thematic maps: are special purpose maps, which represent structural characteristics for some geographical distributions of physical, social or cultural phenomena. Thematic maps draw attention to particular aspects in order to portray the geographic distribution statistical of data. Components of thematic maps are the geographic or base map, the thematic overlay, as well as the general map elements (title, legend, data source, etc.) to understand the represented topic and help the reader to comprehend the content on an appropriate manner. There are different methods of representation used in thematic cartography, in our specific case the following methods were used for the representation of:

- 1- Primary (absolute) data: Symbols. In the template maps developed within this research the symbols will not be placed on the exact location in an area, but they are just referred to the area and don't have exact reference points in the area.
- 2- Relative data: filled area or choropleth maps. This method is the most often used one in the current online thematic cartography. The method is used to represent the average values of a particular quantity in different areas. We cannot represent the exact locations of the objects in the map, and we express the different quantity numbers of the ratio by color density, shading, hatches or areal symbols.

This research will rely on several types of data and appropriate representation methods (choropleth and symbols maps) for each of them (Figure 35).

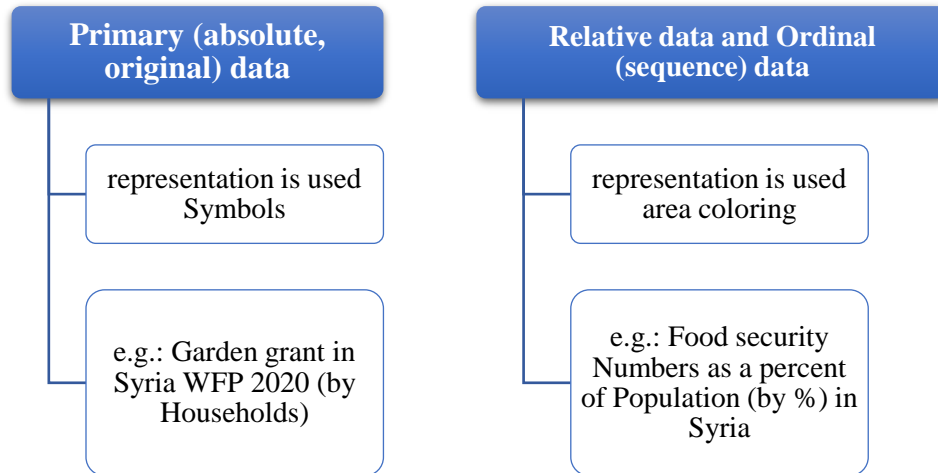


Figure 35: Types of data used in this project

According to the traditional principles of thematic cartography, a map combining symbols and choropleth to represent two variables together can be considered a complex (complex-analytic) thematic map. In the research project, two layers will be used to create each map, the first layer based on colored areas, and the second layer with symbols. In the case of maps made for specialists, the map consists of three layers, but in general, according to the magnification of the map scale, only two layers will be visualized together for the user.

5.3 Preparing the layers

We used QGIS open-source software to prepare layers for uploading them to ArcGIS Online. First, we add the data tables (.xlsx) to the software using ‘Join’ to joining it to the basemap layers (add the attribute data to the geographic borders) (Figure 36).

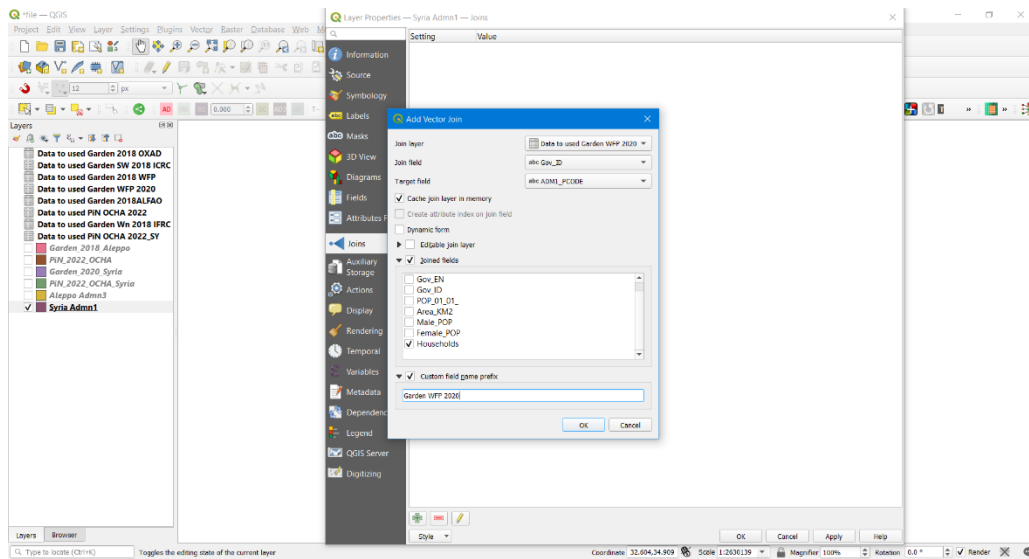


Figure 36: Join table to a vector layer

The base layer to which the data will be added is determined. This is done after selecting the table to be added and the field common to the layer to which attribute data is also added (Figure 37).

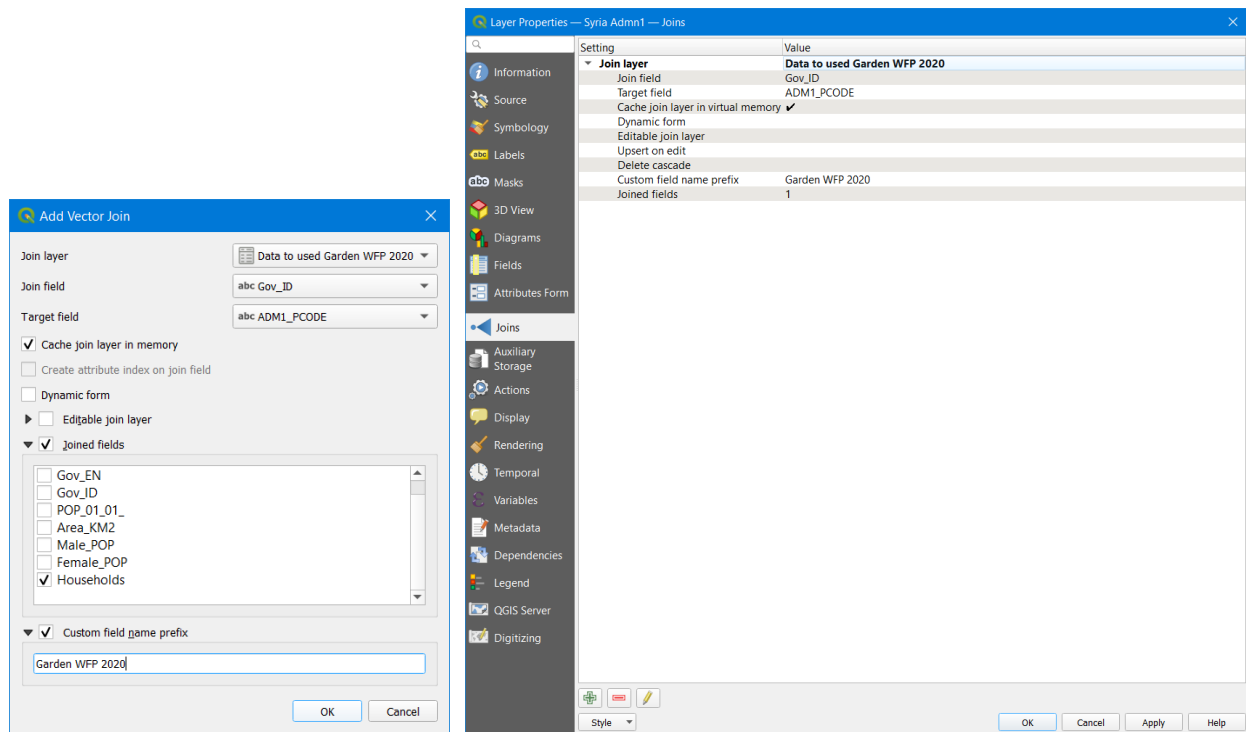


Figure 37: Vector join command and the Layer Properties after adding the table to the layer

It should be noted that adding attribute data to the layer is temporary, and if we wish, as in our cases, to permanently save the layer with the data, it must be exported as a new layer. A coordinate reference system (CRS) should be defined for the new layer: WGS 84 coordinate system was selected because the map workspace in ArcGIS Online site is also defined with the WGS 84 system (Figure 38).

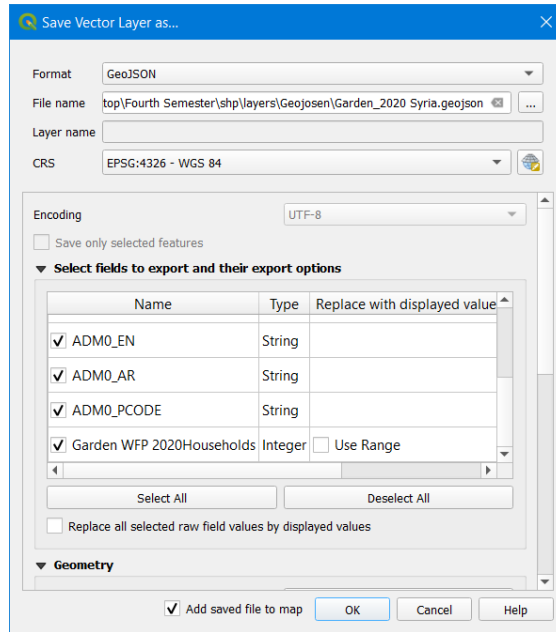


Figure 38: Saving the vector layer after joined the data table

Our base map is with all the necessary data and all layers have been exported. Then we move on to the next stage, which is to upload these layers to the ArcGIS Online servers.

5.4 ArcGIS Online guidelines

ArcGIS Online is defined by Esri as a “cloud-based software to create and share interactive web maps”³³. This GIS-based online platform offers diverse options for the joint visualization of different graphic solutions, including:

Configurable Apps: template to provide a focused map experience for the users; such as Instant apps (the most suitable applications for our data are: Basic, Countdown, Interactive Legend, Sidebar), Instant apps give the possibility to choose an app template according to considerations of purpose, functionality, and aesthetic.

Story maps: latest and versatile place-based storytelling tool. It has a lot of storytelling potential, and it makes use of the most up-to-date design patterns, accessibility standards, and technology.

Story maps can combine texts, images, videos, and maps, as well as offers interactive options for map visualization as: Sidecar to guide the readers through multiple slides (e.g. photos with a caption) visiting one slide at a time. Map Tour leads the users through an orderly set of places, stopping one tour at a time. Swipe allows users to compare two maps, two layers or two images side by side using an interactive slider.

The steps for working on ArcGIS are six steps from creating an account to publishing (Figure 39).

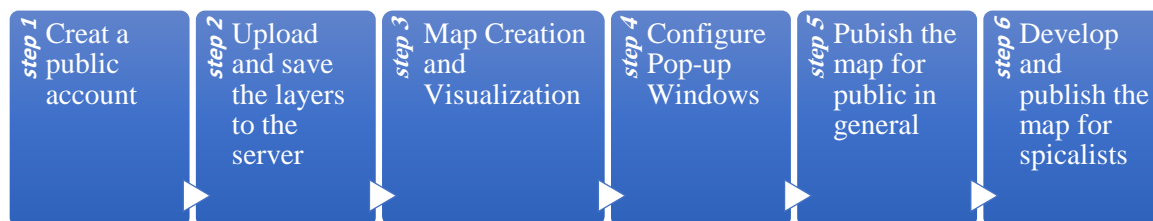


Figure 39: Guidelines for a workflow in ArcGIS Online

5.4.1 Creating a public account

There are several types of accounts that can be used (professional, public, etc), but in this research a free public account was used with all the capabilities it provides (Figure 40).

³³ Source: [ArcGIS Online overview](#)

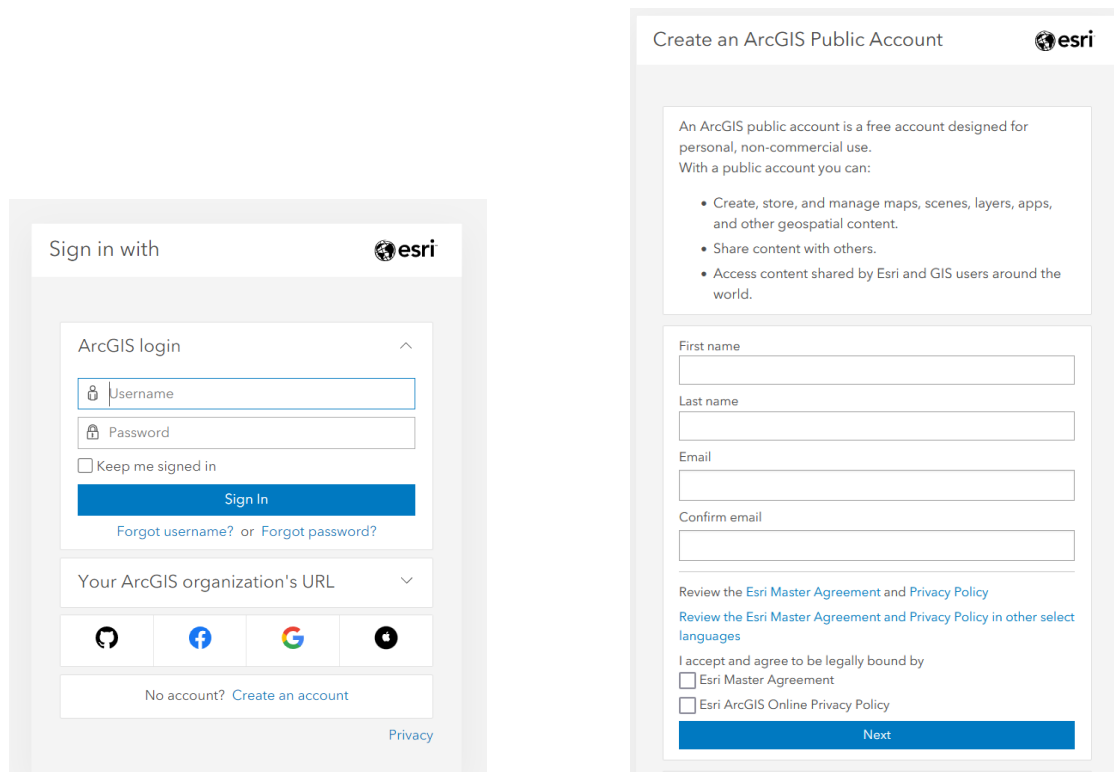


Figure 40: ArcGIS Online login

5.4.2 Uploading the layers to ArcGIS Online

Esri developed a new Map Viewer (Figure 41), which offers similar capabilities to the Map Viewer Classic, but with the addition of new tools, such as adding Effects on the group of layers. From my point of view, this feature in our case gives a more aesthetic character to the map, but does not provide the reader with more clarity and ease in understanding web map elements, therefore I decided to use the previous version, because I am better acquainted the **Map Viewer Classic**.

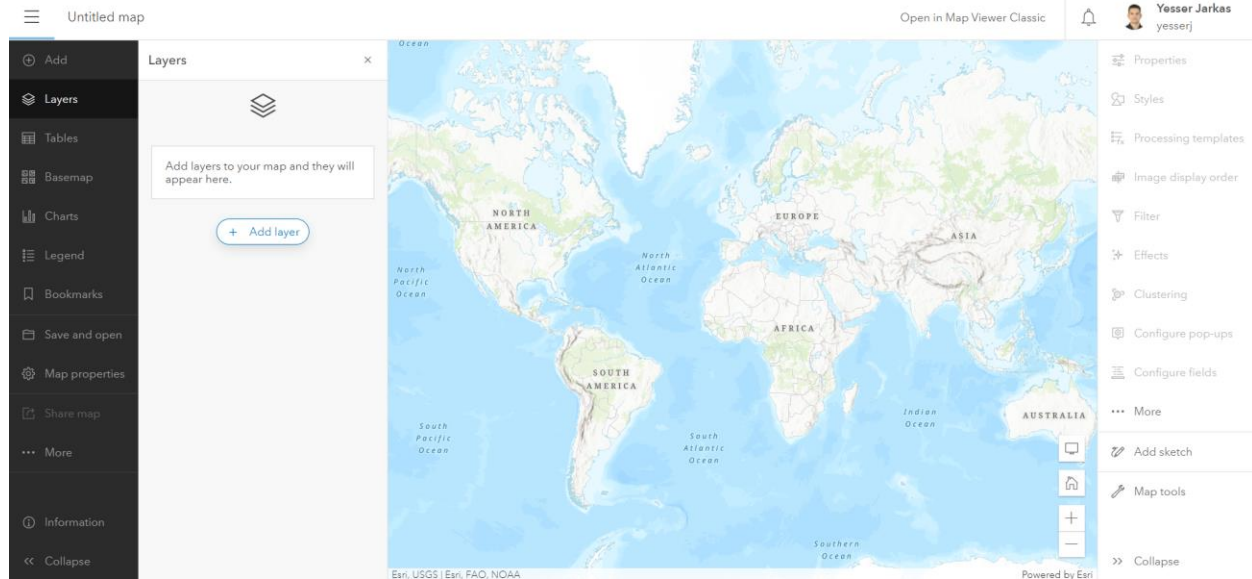


Figure 41: New Map Viewer, ArcGIS Online³⁴

After the user logged in to the ArcGIS Online account, he can use the Map Viewer option to start uploading layers to the server and saving the (Figure 42).

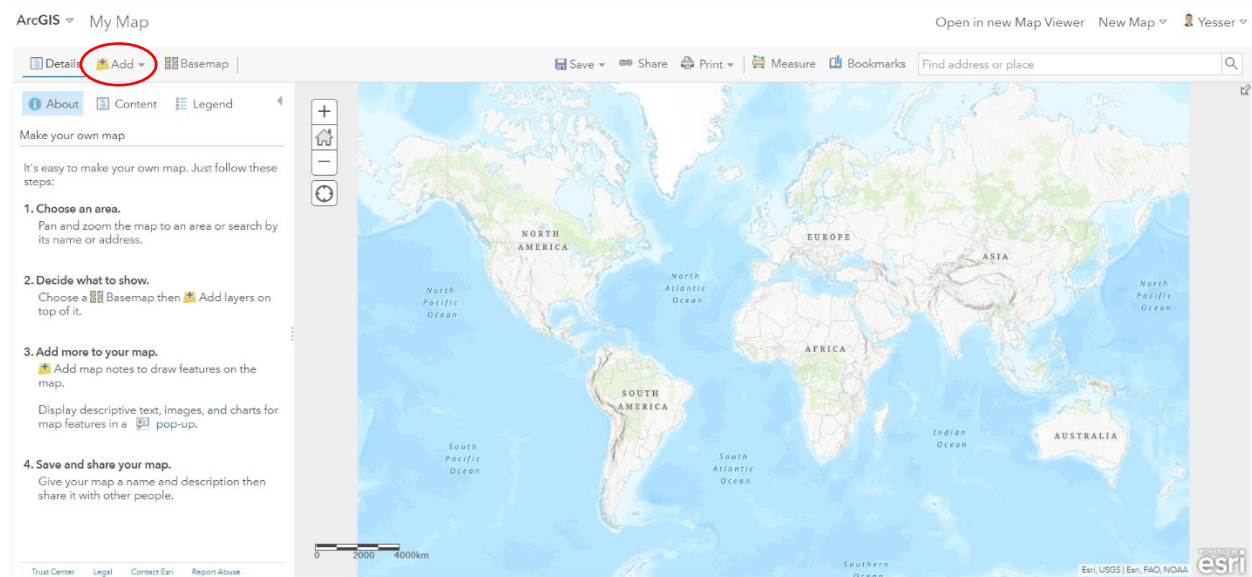


Figure 42: Adding a layer in My Map page, ArcGIS Online³⁵

³⁴ Source: [new Map Viewer](#)

³⁵ Source: [Map Viewer Classic](#)

Users can also add layers from the Living Atlas Layers or from the Web, as well as users can upload the layer files from his own personal computer too (Figure 43).

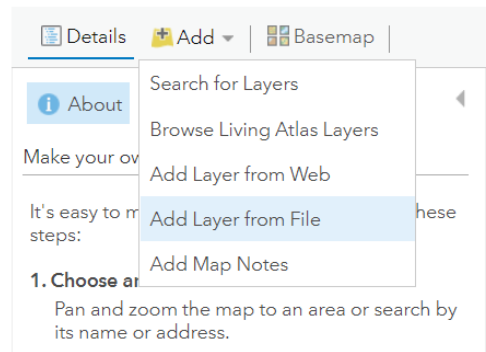


Figure 43: different ways to add layers to the map

Users can upload the layers in multiple different formats, but based on personal experiences the best and most practical format is GeoJSON, which does not need to be compressed using ZIP format or to enter coordinates, as e.g., in the case of CSV format (Figure 44).

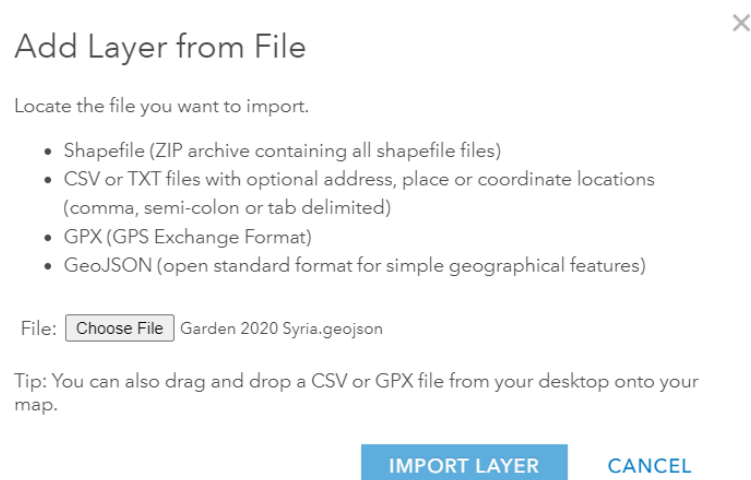


Figure 44: Adding layer from a file

In order to be able to save the layer in the server and use it in several different maps (layers without styles yet), it must be saved and given a name of its own (Figure 45).

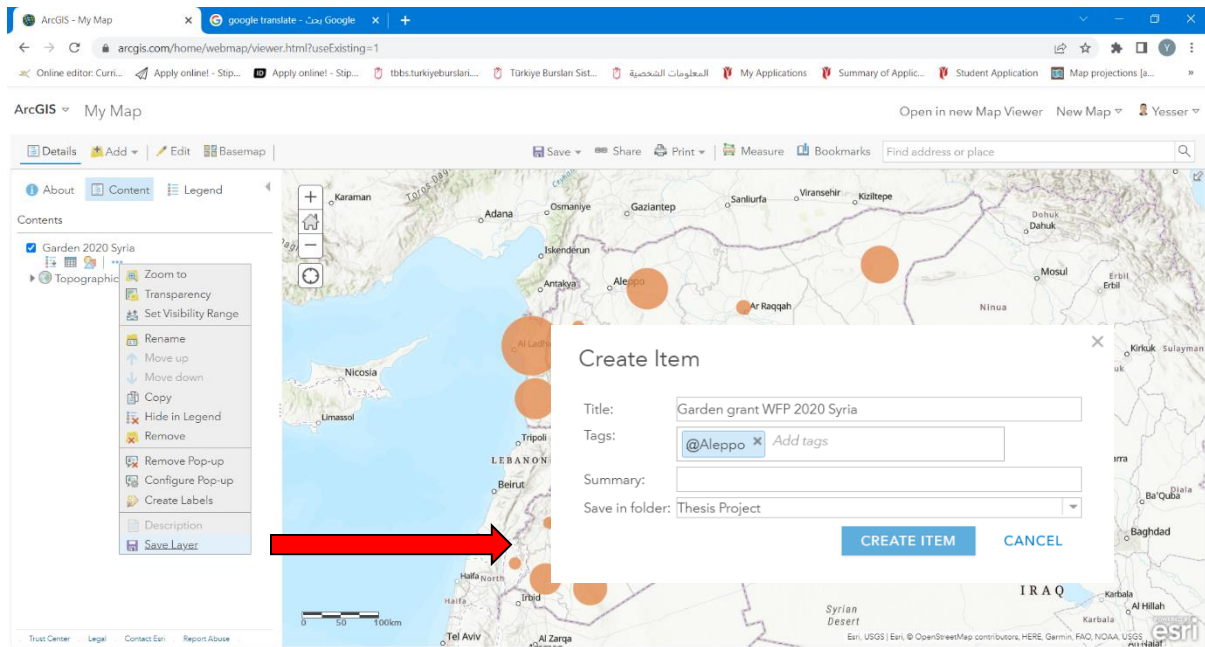


Figure 45: Saving the layer to ArcGIS Online server

Users can check the layers from the Content page after exporting the layers to the server, ensuring that they are ready for the next stage of map making.

5.4.3 Map making and visualization

The first step to create a map is to add the necessary layers to each map. It depends mainly on the goal of the map, as well as the type of users directed to them. We can change the names of the layers, and save the map with a clear name (figure 46).

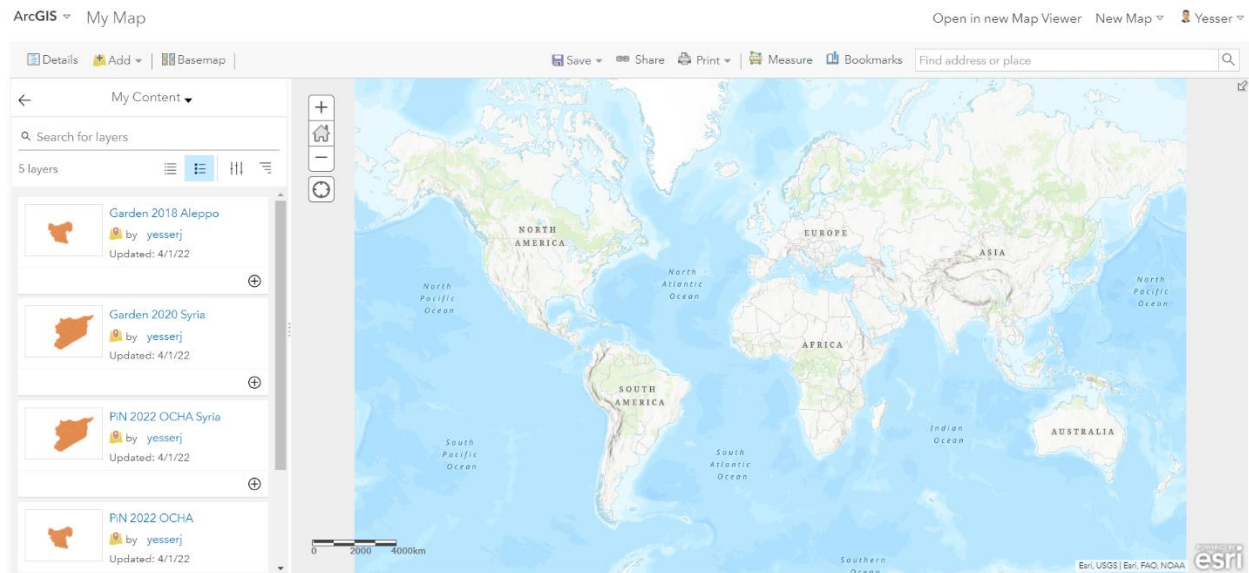


Figure 46: Adding layers from the ArcGIS Online server to the map

User should select the attribute data which is necessary to build the design after adding the layers, and select the appropriate drawing style from several styles available according to the data (Figure 47). Users can select colored area or symbols (with different shapes and with the option to link a picture as a symbol).

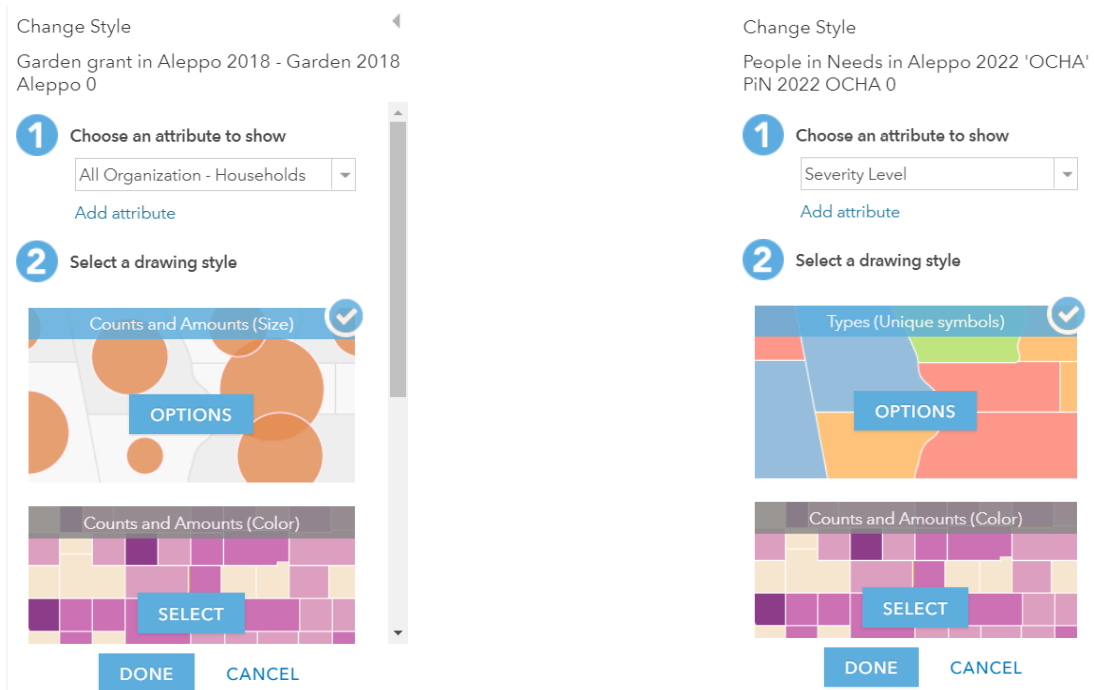


Figure 47: Change style properties in the layers (Livelihoods Activities in Aleppo Map)

A very important step is to choose the classification method in which the data will be grouped into categories. Based on my personal experience, I determined that the best method for the representation of our data is the Natural breaks.

Natural breaks (Jenks): Natural concentration of data along breaks or splits. In this method we concentrate similar values within isolated intervals. In one interval there is maximum homogeneity in the data groups, because the values we have divided into classes whose boundaries are set where there are relatively big differences in the data values.

The benefit of this type of classification is that it is based on the values of the variable. However, the disadvantage is that the intervals are subjective, and not always easy to understand in big datasets.

According to the values we have for grants, the value 0 does not matter to us, because if the number of families benefiting from the organization's activities in this area is 0, this means that there is no activity for this organization there, so we modify the starting value of the field from 0 to 1 manually (Manual breaks) (Figure 48).

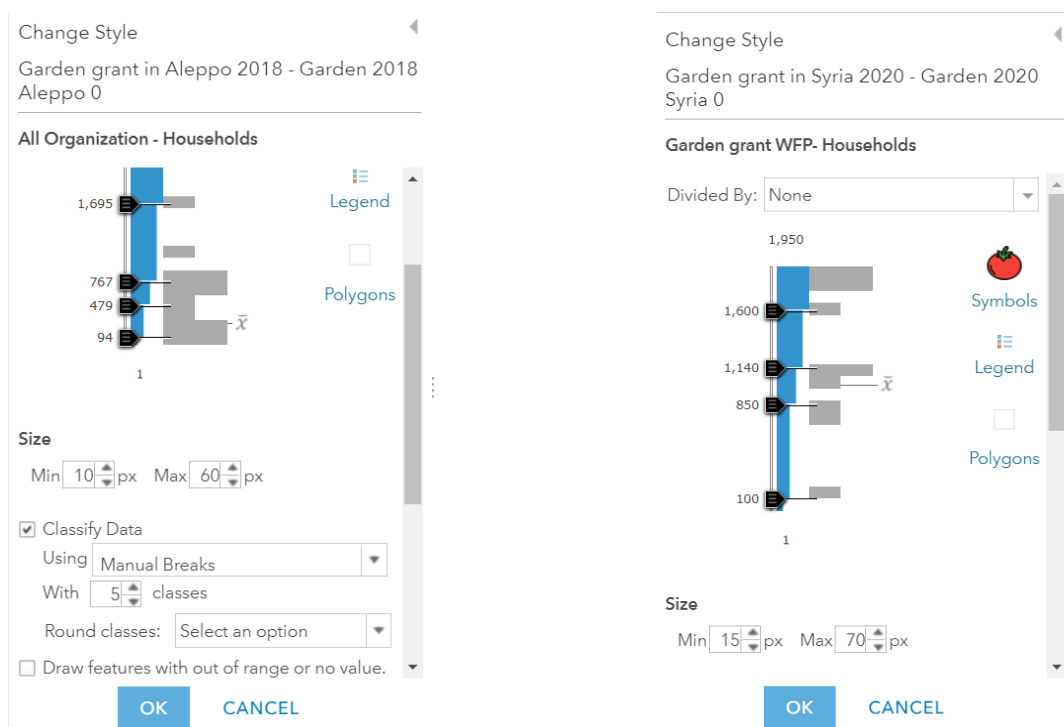


Figure 48: Changing the classification method and the symbols used on the map

We can also set the transference of the area coloring layers in order to show details from the base map (for example: 50%), and change the label of the symbol in the ordinal data, for example: Severity of Needs in Aleppo map (Table 3).

Severity of Needs	Label of the symbol
1	Minimal
2	Stress
3	Severe
4	Extreme
5	Catastrophic

Table 3: Changing the label of the ordinal data symbol in Severity of Needs layer-Aleppo map

In addition, it is also possible to add a layer containing the administrative divisions (districts) of the governorate (i.e., Aleppo governorate), the purpose of which is to show the name of the governorate districts as labels within the borders of each district, in order to help the reader, recognize and distinguish the administrative areas within the governorate.

In the beginning, this layer does not contain metadata about organizations activities, so there is no need to show the layer using fill colors, we only show the borders for each county: we choose the attribute to show location only, drawing style just outline with no fill, and we set the Visible Range. After it we choose to create a label and choose the county name field and adjust the field of view to match the layers that contain metadata (Figures 49 and 50).

Label Features

Aleppo districts name

☒ Label Features

Text: ADM2_EN

Font: Arial

13 B / U

☒ Halo 1

Visible Range:

Counties Cities

OK CANCEL

Figure 49: Creating Label Features

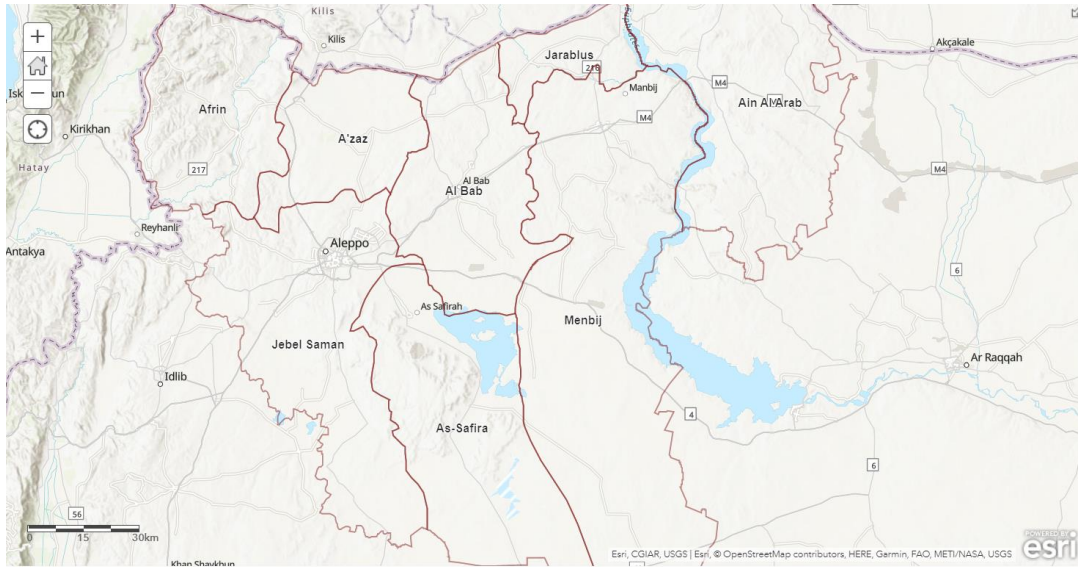


Figure 50: Aleppo districts name layer without fill color

At the end of this stage, the arrangement of the layers is completed, the symbols are set, and the appropriate colors are chosen to show the data appropriately to achieve the goals of the map (Figures 51 and 52).

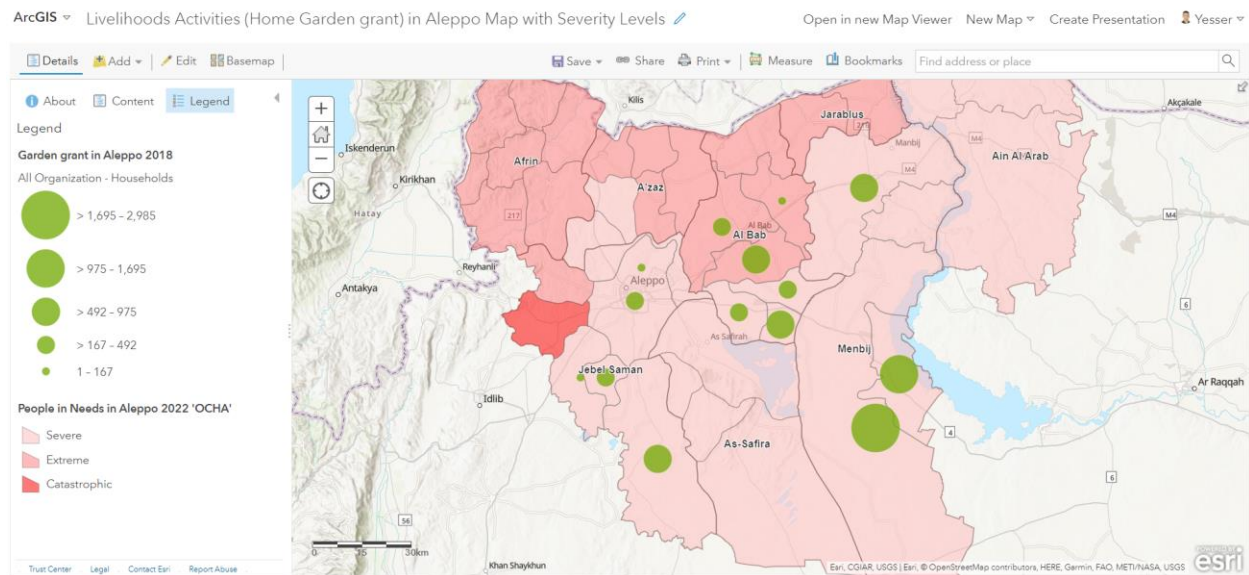


Figure 51: Livelihoods Activities (Home Garden grant) in Aleppo Map with Severity Levels³⁶

³⁶ It is worth mentioning that ArcGIS Online places the symbols in the centroid of the shape, which leads in some cases (concave shape) to the presence of a symbol outside its polygon. ArcGIS Online does not provide the public user many options for editing, for example, the Edit tool in the Map Viewer interface gives the option to move the position of the layer element (polygon), but not the element symbol.

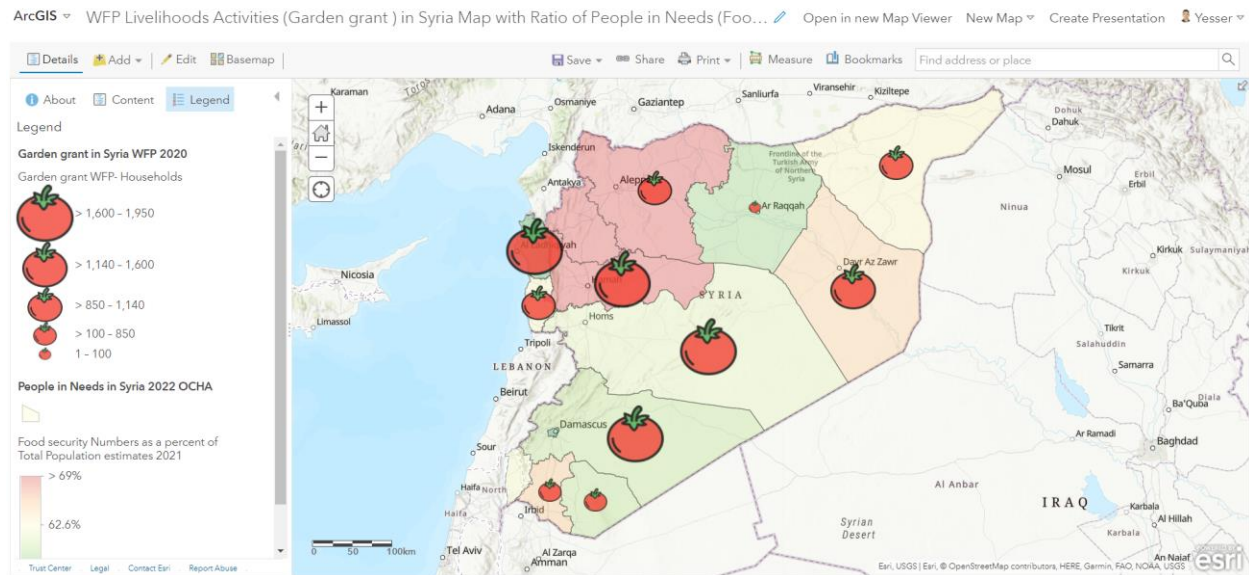


Figure 52: WFP Livelihoods Activities (Garden grant) in Syria Map with Ratio of People in Needs (Food security)³⁷

Layers can be saved again (with styles) if we want to use the layers with their styles in other maps.

5.4.4 Configuring Pop-ups

Users can take advantage of the Pop-up window in order to clarify the attribute information and show the exact statistical values to the user by clicking on the place where the user wish to know more detailed information on the map .Through the Configure Pop-up window of each layer, it is possible to set a title for the Pop-up window, choose and modify the names of the columns to be shown, and set the decimal places to zero, and finally we can also define the most important feature is the creation of statistical charts for specific data (Figure 53).

³⁷ In this map, a color ramp is chosen between two different colors (RdYlGn color ramp), depending on the purpose of the map. The goal of this layer is to show the upper and lower ratios between the population and the number of food insecure people, so we care not only to show the highest values, but also focus on the minimum values is the same, and in the case that we do not want to focus, according to the purpose of the map, on the minimum values, then a ramp can be used with only one-color gradient. It should also be noted that the choice of color ramps is limited in this case in ArcGIS Online. In the Figure 51, the red color scales (Monochromatic Colors) were used in layer of PiN in Aleppo, because the ordinal data values are of a high order of severity and there are no values below the average.

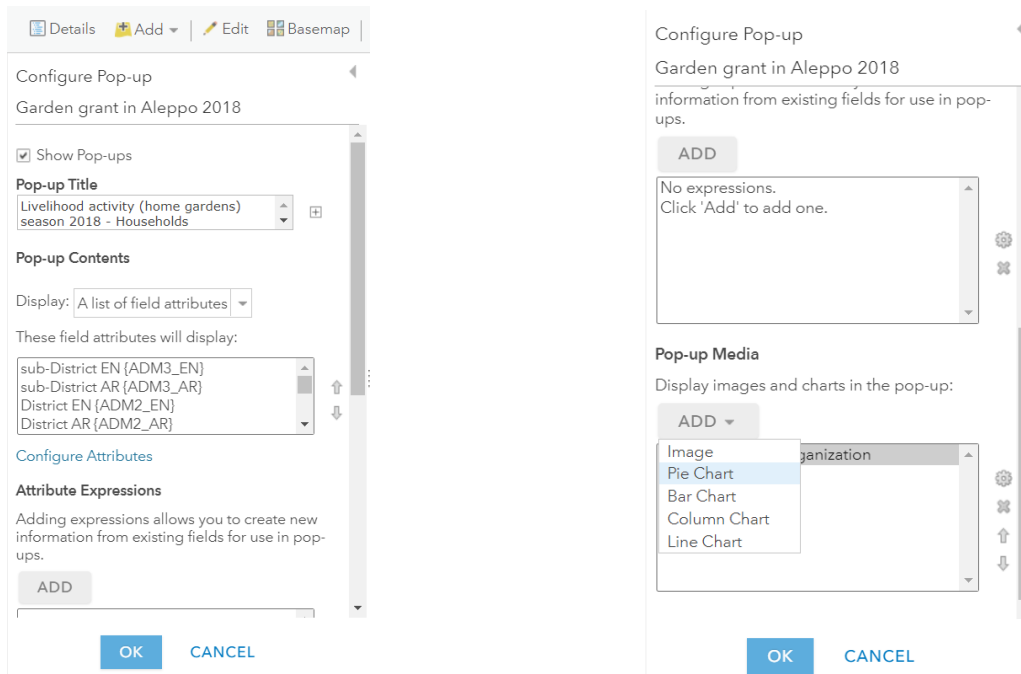


Figure 53: Configuring Pop-up settings

Users can create a statistical chart for specific data and can set the title of the chart, as well as choose the statistical data needed to draw this chart (Figure 54).

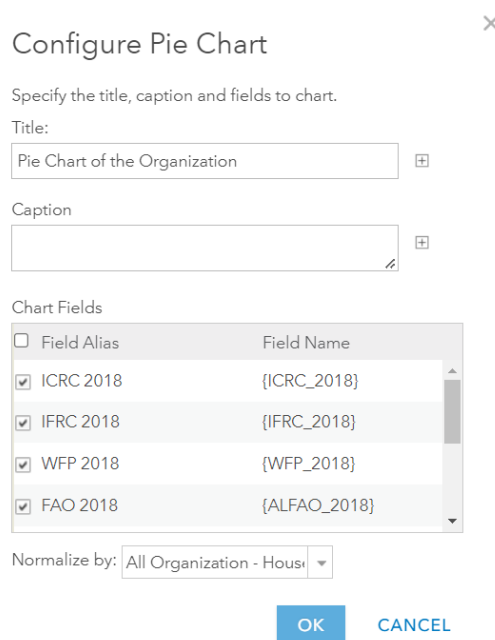


Figure 54: Configuring Chart for the Pop-up window

In the end, we get an interactive map showing specific activities of organizations within a specified geographical boundary, and an interactive pop-up window containing information and a statistical chart for a particular layer (Figure 55).

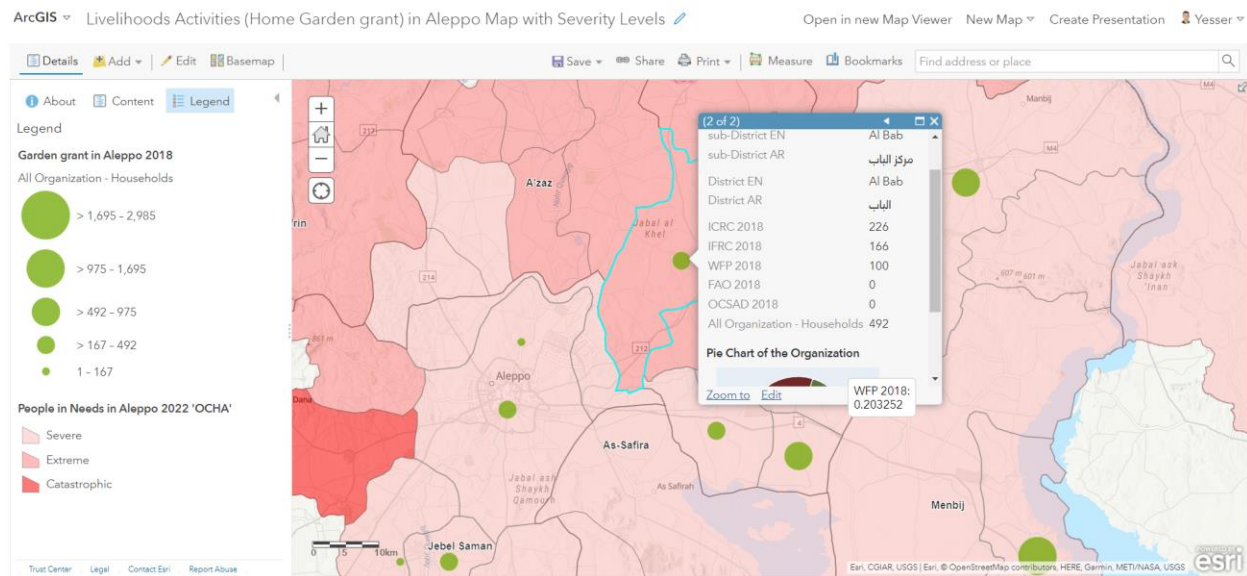


Figure 55: Activating the pop-up when clicking on the map

5.4.5 Publishing a map for the public in general

The Story map application (Figure 56) will be relied on to publish maps of organization's activities to the public in general, who are not specialists. Story maps can give general information about the organization's activities to visitors, including an introduction to the organization's activity and an explanation of the grant (for example, Kitchen Garden grant in Syria 2020 WFP), with a statistical chart on the beneficiary families, as well as Sidecar or Swipe maps showing the locations of the grant distribution in general and the number of beneficiary families and an overview of the humanitarian situation there, while pictures and videos can be also added.

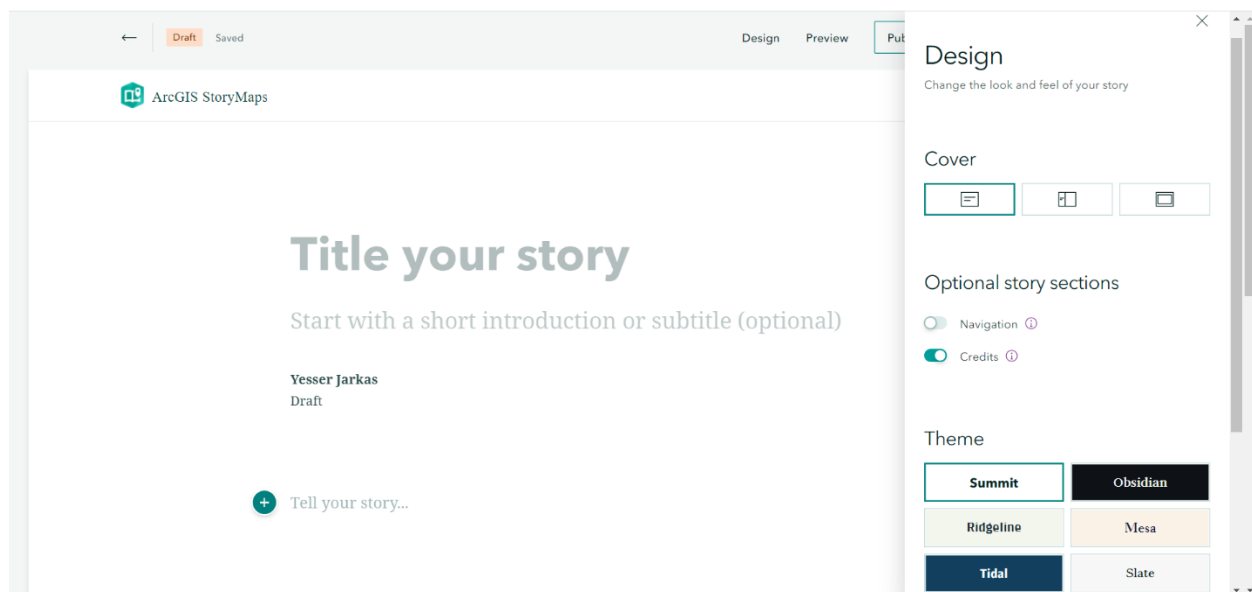


Figure 56: ArcGIS Story Map, Draft Story page³⁸

We start creating the Story Map by writing the title of the Story and a short explanation about it, with the possibility of adding an image as a background for the title (Figure 57) or even modifying the display theme of the Story Map page.

³⁸ Source: [New Story map](#)



Figure 57: Story Map, writing the title and setting a background image

Datawrapper was used to create a column chart after we uploaded our data and chose the characteristics, colors, and the column showing the number of families benefiting from the grant in all Syrian governorates to be added to our story map (Figure 58).



Figure 58: Creating a column to be added to the story map

Thematic maps can be added to a story map by using different media tools for their more interactive and attractive visualization. In this specific case **Swipe** media tool was selected, because Swipe tool let the readers easily compare two web maps (or layers in our case), showing maps or images with an interactive slider and the legend for both layers (Figure 59).

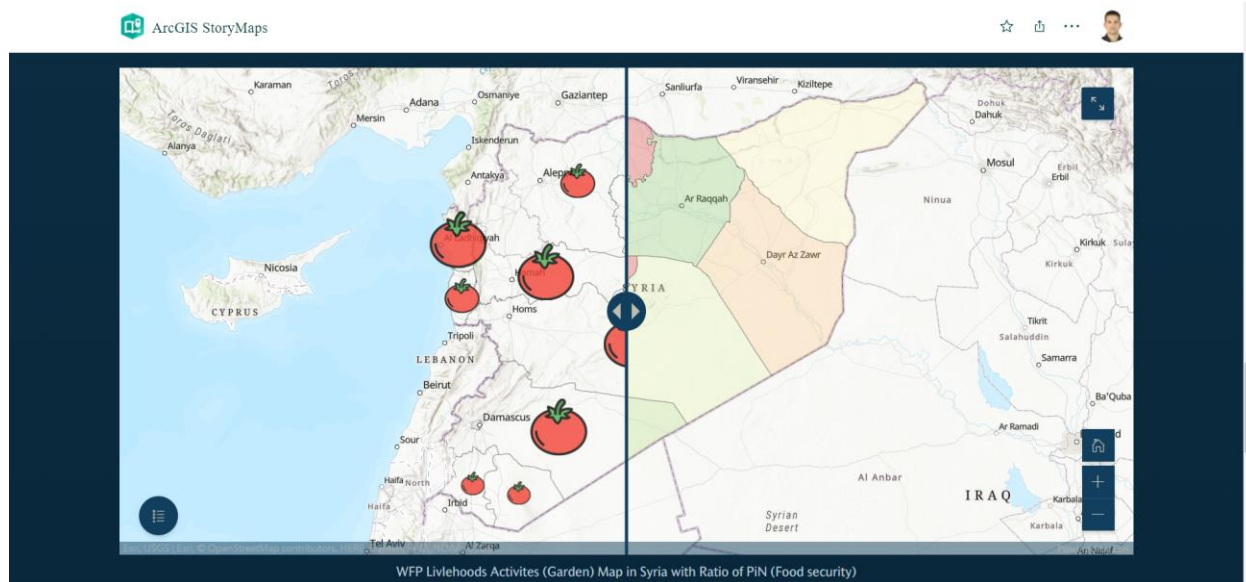


Figure 59: Story Map, Swipe media tool

At the end of the story map, we can add a video or a number of photos to make the story map more attractive to readers. Finally, we should make the map public, and after it we can share it for the public in general.

5.4.6 Developing and publishing the map for specialists

Maps for specialists are distinguished by the abundance and accuracy of the represented data. Therefore, we need to add layers that give more accurate data in terms of location and statistics as well. Creating a map for specialists implies that we need to visualize the layers with appropriate colors and symbols, providing clear and accurate information about the organization's activity in this area.

In general, the database of the organization's activities is designed in a way that does not match the requisites needed to represent them on the maps for specialists (Figures 60 and 61). Generally, it is a database containing the names and some information about the families benefiting from the grant. If we wish to create maps for specialists within the third administrative level or the sub-district, the database may often be suitable, or it needs some analysis such as collecting number of families from different villages located in the same sub-district. At same time, if we aim to develop more detailed spatial analyses for different grants or organizations, we need to prepare and design a special database for all the villages supported by grants. We can re-organize several types of different grants provided by several organizations to only one database if needed. In the specific case of our project, the thematic map for specialized users will be based on data for almost similar grants (Home Garden 2018) belonging to several organizations (ICRC, IFRC, WFP, FAO, ACSAD).

Village EN	Village AR	sub-District EN	sub-District AR	District EN	District AR	Grant type	Materials granted	Implementing of the grant	Funding and supporting of the grant	Date	Households
column 1	column 2	column 3	column 4	column 5	column 6	column 7	column 8	column 9	column 10	column 11	column 12
Name EN	Name AR	Name EN	Name AR	e.g. Al Bab	e.g. الباب	e.g. agricultural Livestock educational	e.g. Winter home gardens Summer. Winter home gardens with irrigation networks. Poultry. Sheep.	Partner local organizations and associations of international support organizations	international support organizations	Date of the grant	Numbers of families

Table 4: Designing the grants database in each village³⁹

Al Bab Organizations (Features: 48, Selected: 1)											
Village EN	Village AR	sub-District EN	sub-District AR	District EN	District AR	Grant type	Materials granted	Implementing of the grant	Funding and supporting of the grant	Date	Households
Fihan	فيهان	A'rma	عريمة	Al Bab	الباب	Agricultural	Summer and winter home gardens	SARC	ICRC	2018	49
western Akola	شركة غربية	Dayr Hafir	دير حافر	Al Bab	الباب	Agricultural	Summer and winter home gardens	SARC	ICRC	2018	3
Rasm Al Hamyer	رسم الحمير	Tadaf	تداف	Al Bab	الباب	Agricultural	Summer and winter home gardens	SARC	ICRC	2018	9
Taanah	طانة	Al Bab	مركز الباب	Al Bab	الباب	Agricultural	Summer and winter home gardens	SARC	ICRC	2018	58
Al Khirba	الخربة	Tadaf	تداف	Al Bab	الباب	Agricultural	Summer and winter home gardens	SARC	ICRC	2018	16
Al-Waraidah	الوريدة	Tadaf	تداف	Al Bab	الباب	Agricultural	Summer and winter home gardens	SARC	ICRC	2018	32
Rasm Elabed	رسم العبد	Eastern Kvaines	كويرين شرقي	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	53
Efesh	عفش	Eastern Kvaines	كويرين شرقي	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	39
Mran	مران	Al Bab	مركز الباب	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	100
Arran	عران	Tadaf	تداف	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	100
Western Kvaines	كويرين غربي	Eastern Kvaines	كويرين شرقي	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	26
Kaskis	كسكيس	Eastern Kvaines	كويرين شرقي	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	36
Sain	الدين	Eastern Kvaines	كويرين شرقي	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	57
Eastern Kvaines	كويرين شرقي	Eastern Kvaines	كويرين شرقي	Al Bab	الباب	Agricultural	Home Garden	Department of Agriculture	WFP	2018	39
Um Elmara	أم المران	Dayr Hafir	دير حافر	Al Bab	الباب	Agricultural	Summer home gardens + irrigation networks	SARC	IFRC	2018	250
Mashrifat Abu Jabbar	مشرفة أبو جابر	Tadaf	تداف	Al Bab	الباب	Agricultural	Summer home gardens + irrigation networks	SARC	IFRC	2018	20
Mran	مران	Al Bab	مركز الباب	Al Bab	الباب	Agricultural	Summer home gardens + irrigation networks	SARC	IFRC	2018	166
Magharet Abu Jabbar	مغارة أبو جابر	Tadaf	تداف	Al Bab	الباب	Agricultural	Summer home gardens + irrigation networks	SARC	IFRC	2018	28

Figure 62: Databases that contain detailed information about villages and grants

³⁹We can add a field with the name ‘Number of times support’ in the case of the village supported by grants several times, but in our case, we did not add this field because we do not know the actual number of times support for these villages in general for all organizations (number of grants).

Data layer will be added containing a higher degree of administrative information, in our case Sub-districts within Aleppo governorate, joined with a data set of organization's activities there. For example, after compiling the Home Garden grant database of Al-Bab villages, the spreadsheet is joined with the points layer for the villages that were previously downloaded⁴⁰ (Figure 63), as we explained in subchapter 5.3. After it, we save the layer to the JSON format (JavaScript Object Notation format) and import it later on ArcGIS Online (Figure 64).

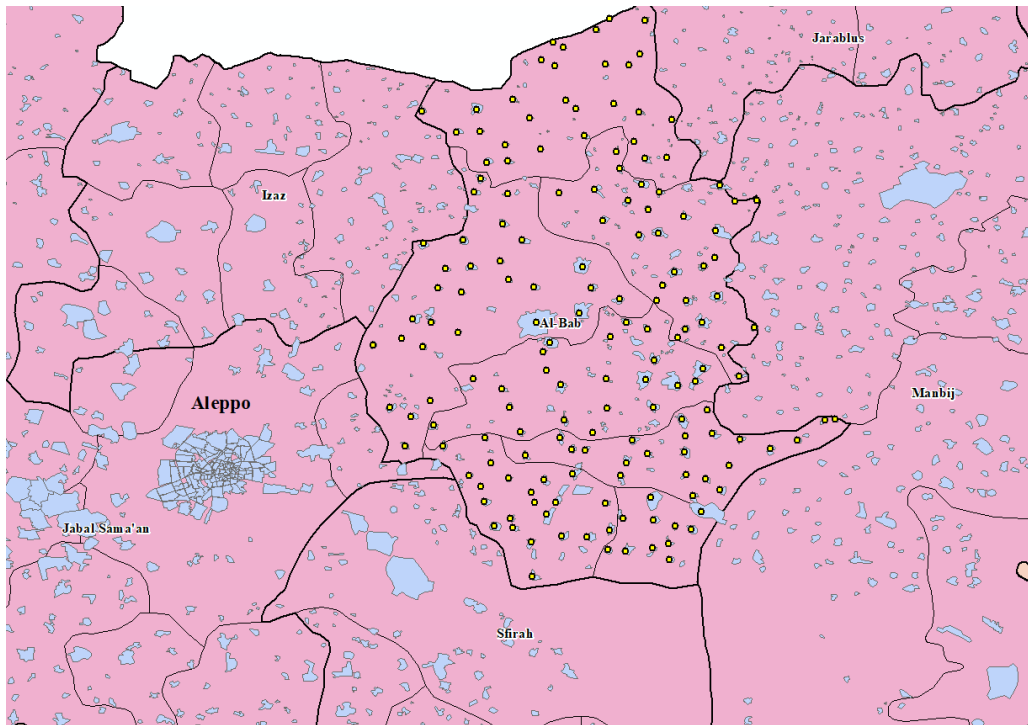


Figure 63: Downloaded villages layer (SYR_PopulatedPlaces) from the HDX website⁴¹

⁴⁰ Special case, Sometimes organizations support villages that are not in the database, that is mean, their location is unknown in the downloaded villages layer, so it must either be digitized from a previous detailed map, drawn by knowing its proximity location to one of the organization's volunteers working there, or by searching for it on the Internet, and the most accurate method is for a team from the organization to monitor the coordinates of the village while they are there during the distribution of the grant by GPS smart phone, after obtaining the coordinates, they can be easily added to the map and given a code in the database. [More information in the chapter 8]

⁴¹ Source: [Syrian Arab Republic - Subnational Administrative Boundaries \(SYR_PopulatedPlaces\)](#)

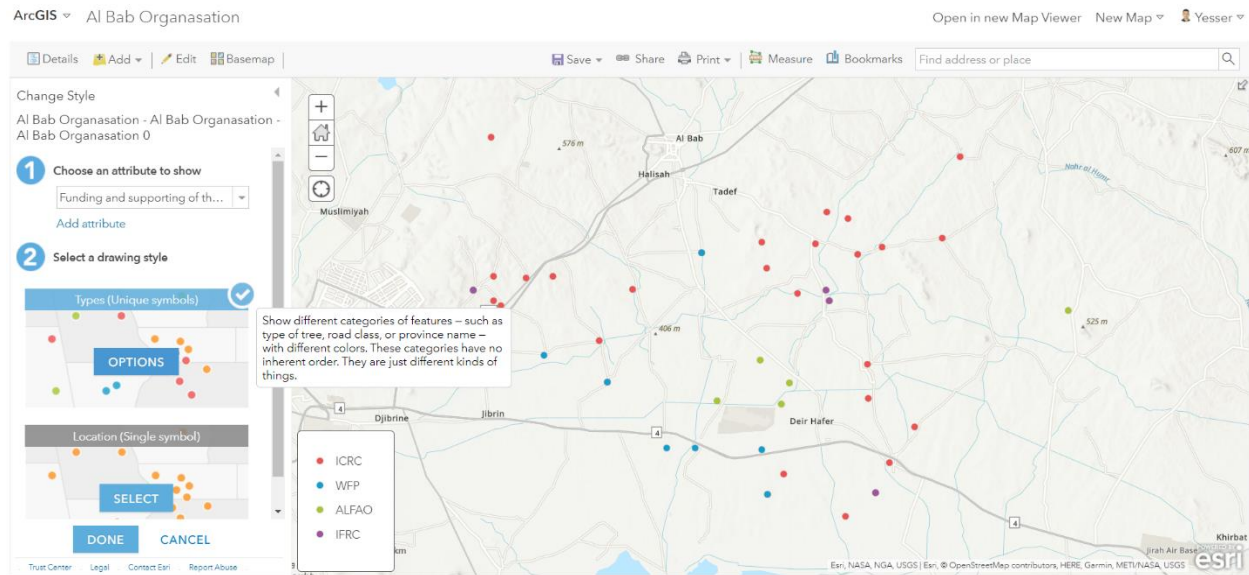


Figure 64: Adding a layer and Style proportion

In our case, we have one layer for several organizations that support similar projects, and we want to represent with a symbol the organization supporting the project grant in each village. When the user clicks on the symbol, the rest of the detailed information appears. We follow the next steps: we choose the organization supporting the project in the Display according to the field option, after it we choose the Unique symbols and modify symbols to pictorial symbols according to each organization's logo (Figure 65). If needed, we can modify the locations of the symbols using the Edit tool. Symbols were just moved a bit to show that all organizations symbols together, and keep giving the exact location of the villages. We set the Visible Range in the range of the cities almost 1:160,000 to 1:200,000, after that we create a Label Feature according to the field (Village EN) and manage the Font, Alignment, and Visible Range.

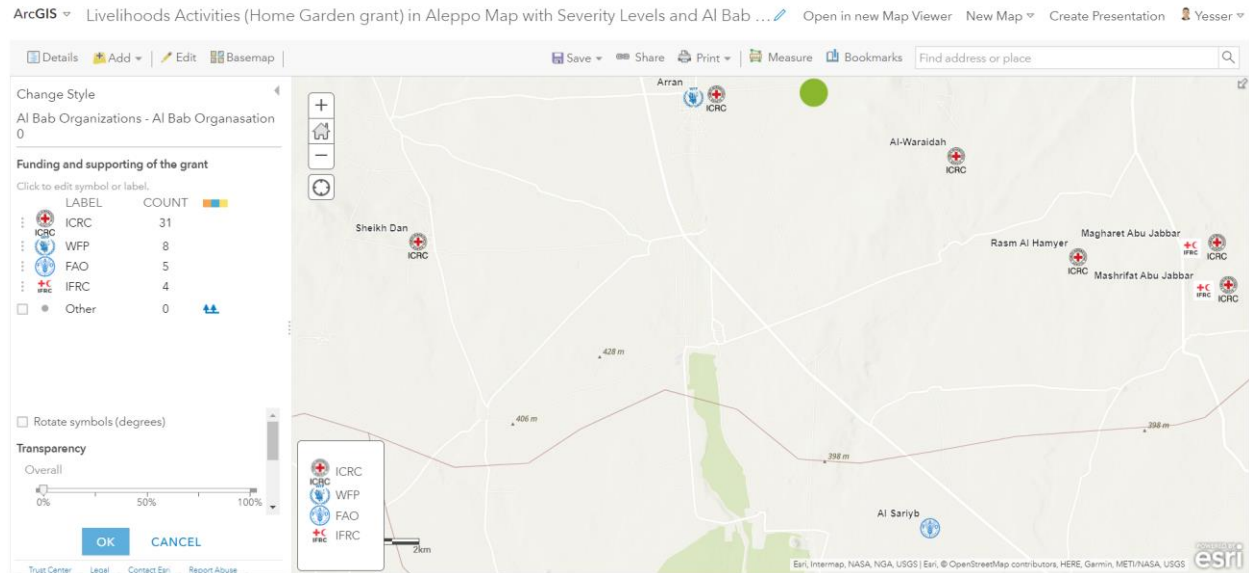


Figure 65: Choosing pictorial symbols for each organization

In the end, the "Livelihoods Activities (Home Garden grant) in Aleppo Map with Severity Levels and Al Bab villages "map for specialists will consist of three layers:

- First layer: People in Needs in Aleppo 2022 'OCHA'. It will be deactivated after the user zoomed within the scale of the third layer (Figure 66).
- Second layer: Garden grant in Aleppo 2018
- Third layer: Al Bab organizations

Thus, this map will provide the reader with accurate information and statistics on the number and location of the beneficiaries of the grant provided by the organization (Figure 67).

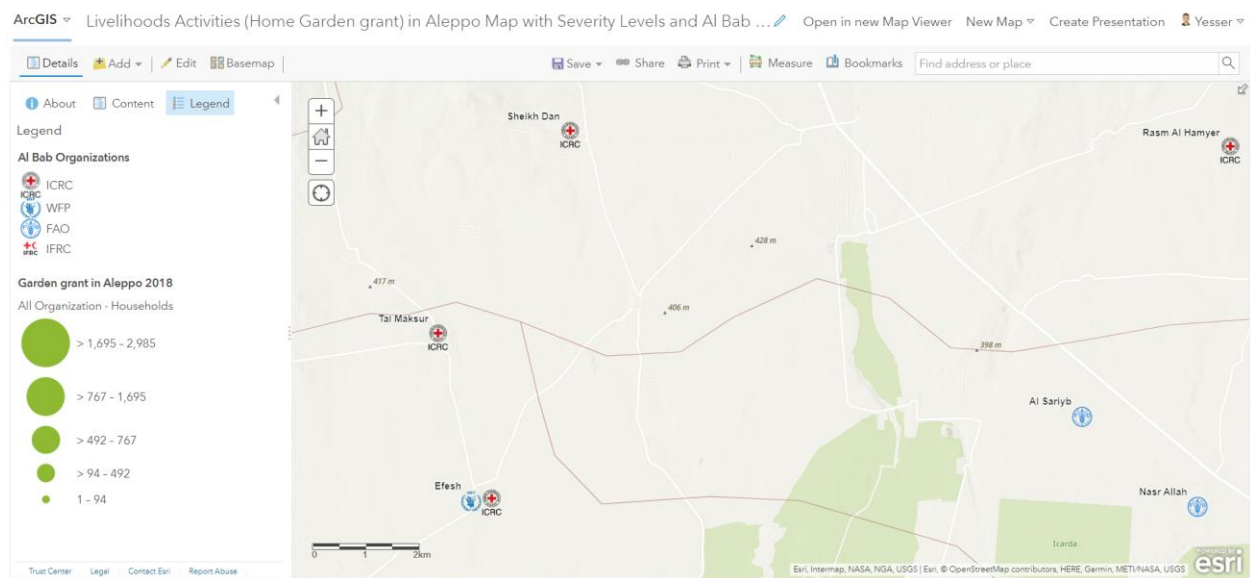
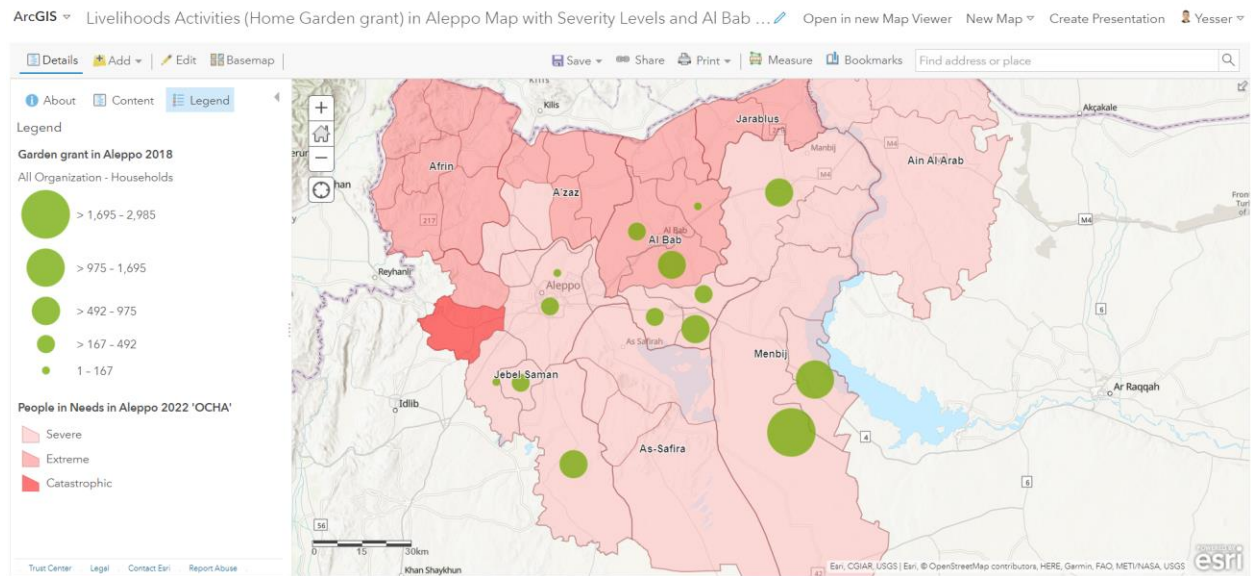


Figure 66: The detailed points layer is hidden and appear when user zoom in to a specific scale

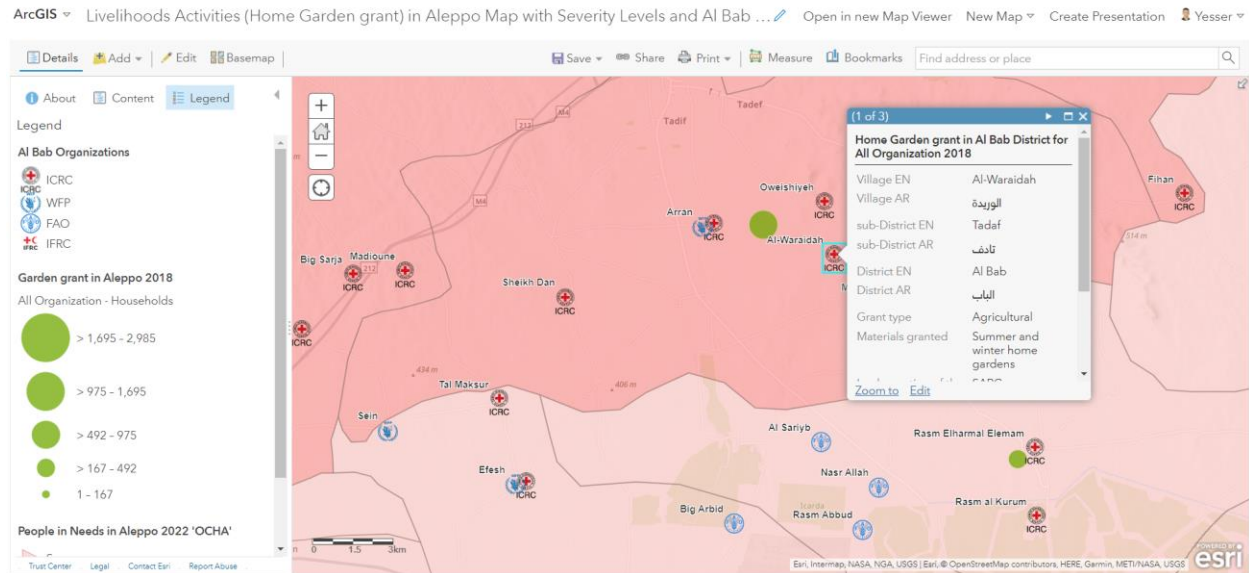


Figure 67: Pop-up window showing detailed information when user click on the symbols in the map

In addition, organization name, grant name, and date layers can be also added. Each layer contains a separate database for each organization and according to a specific grant, that is, if the user wishes to know the villages supported by an organization with a specific grant in a particular year, the user turns on the appropriate layer to obtain this information. GeoJSON files⁴² for all layers of grants and organizations is uploaded to the ArcGIS Online server as I mentioned earlier in the sub-chapter 5.4.2 (set symbols using the “Natural breaks” classification, Visible range, Pop-up window, and Labels), so that we can obtain the set of layers in the appropriated form (Figure 68).

⁴² Don't use ZIP archive containing all shapefiles (group of layers), because the applications deal with separate layers and will not recognize the layer group.

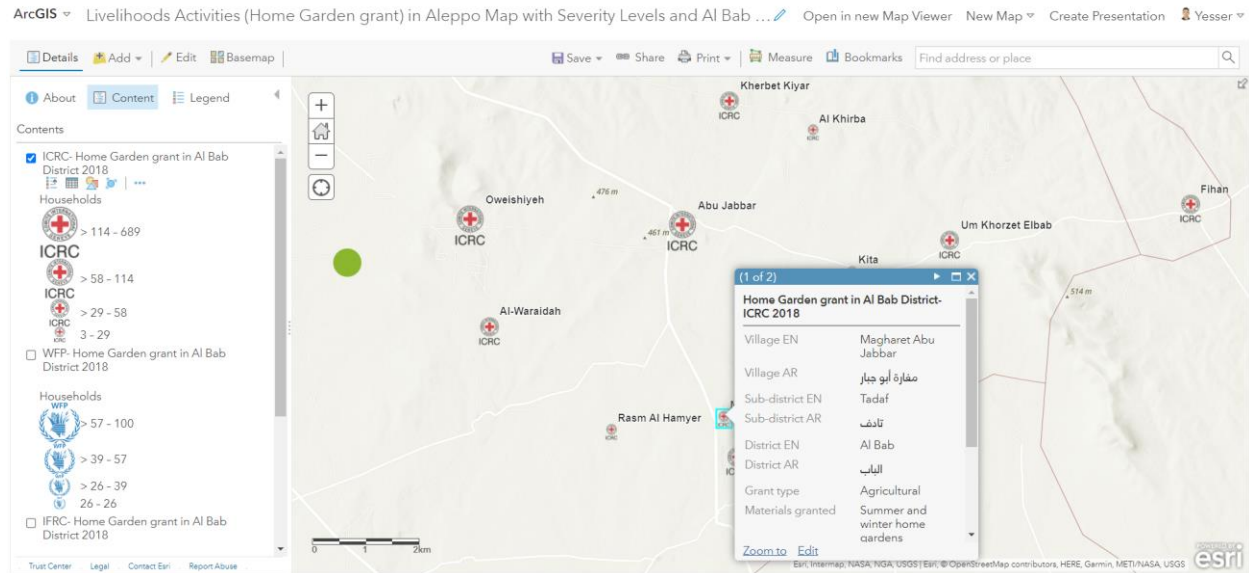


Figure 68: Organization and grants group of layers

Maps can be published for specialists, including Story Map, and other applications can be used within the ArcGIS Online to give greater and more attractive, interactive solutions for users to zoom in the map and access data easily and accurately.

Sidebar Instant application was used to publish Livelihoods activities map in Aleppo (Figure 69). This application gives us the option to display the map with the legend of each layer, as well as control the selection of the displayed layers, control the scale of the map width, and the feature of the pop-up window when clicking on the element you want to know accurate details about (Figure 72).

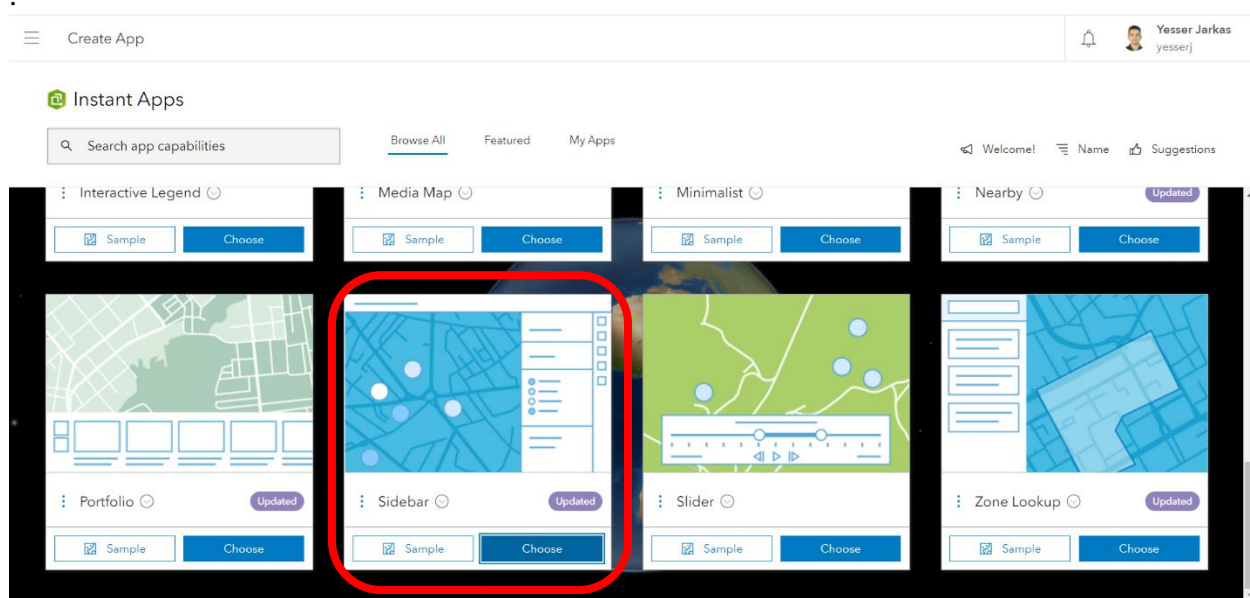


Figure 69: Sidebar app in the Instant apps⁴³

The most essential settings to consider when publishing this app can be explained in five steps (Figure 70):

- first step: we should select the map that we already made
- second step: write some information or introduction for app users about the map, the featured data or how to use the app
- third step: set the sidebar settings to inform app viewers about the map and data featured in the app
- fourth step: configure the exploring and analysis tools that help to understand the key message of our map
- fifth step: customize the layout color and manage widget positions of the app.

⁴³ Source: [Instant Apps](#)

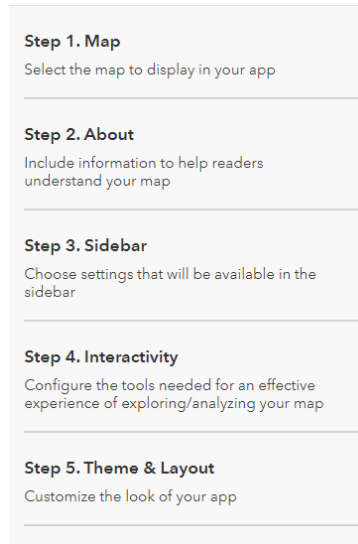


Figure 70: The five steps to publish the Sidebar app

Changes are automatically saved to the draft. After completing the application design, the map can be published and posterior updates are also saved automatically. We can share the app by copying the link, in a social media, or copying the embedded code considering different sharing levels (Owner or Public) (Figure 71).

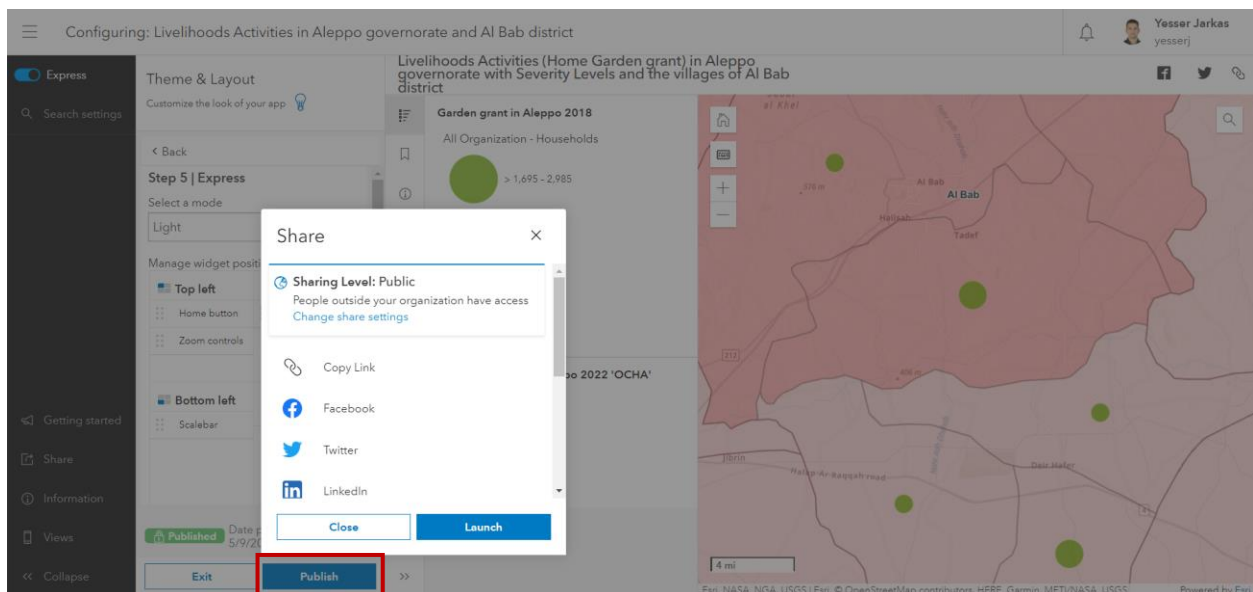


Figure 71: Publishing the Sidebar app in different ways

Livelihoods Activities (Home Garden grant) in Aleppo governorate with Severity Levels and the villages of Al Bab district

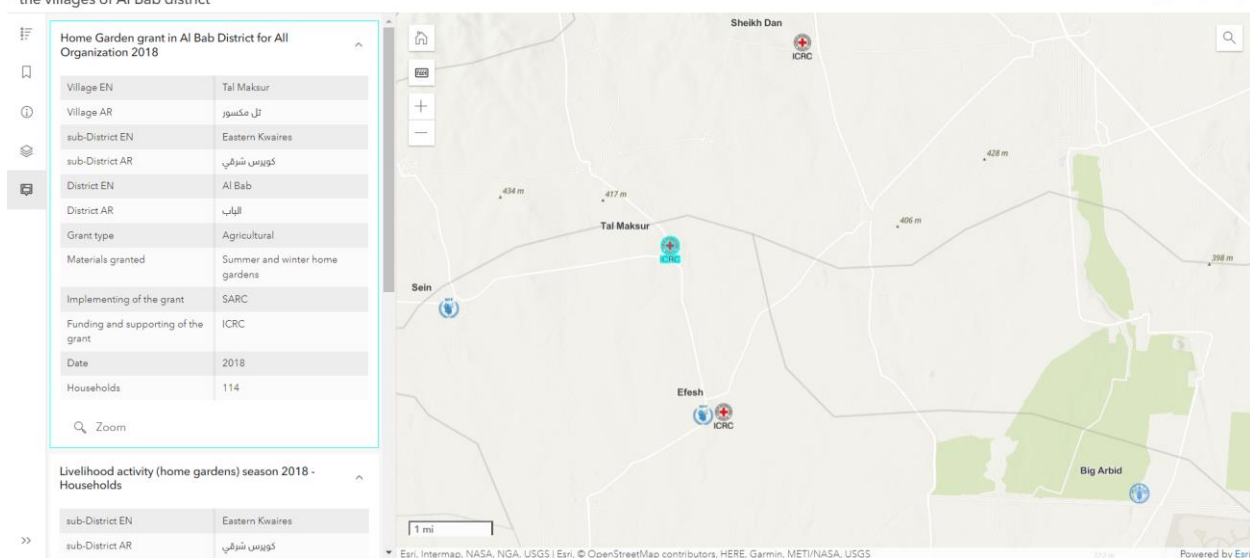


Figure 72: Viewing Livelihoods Activities in Aleppo, Sidebar app as a visitor

5.5 Humanitarian Data Maps for International Organizations

This method can also be used to produce maps not only for the activities of organizations, but also help international organizations to assess the situation of a particular district or to make a decision to direct the activities of the organization to support a more needy area by showing humanitarian data and statistics on an interactive map of that area (Figure 73).

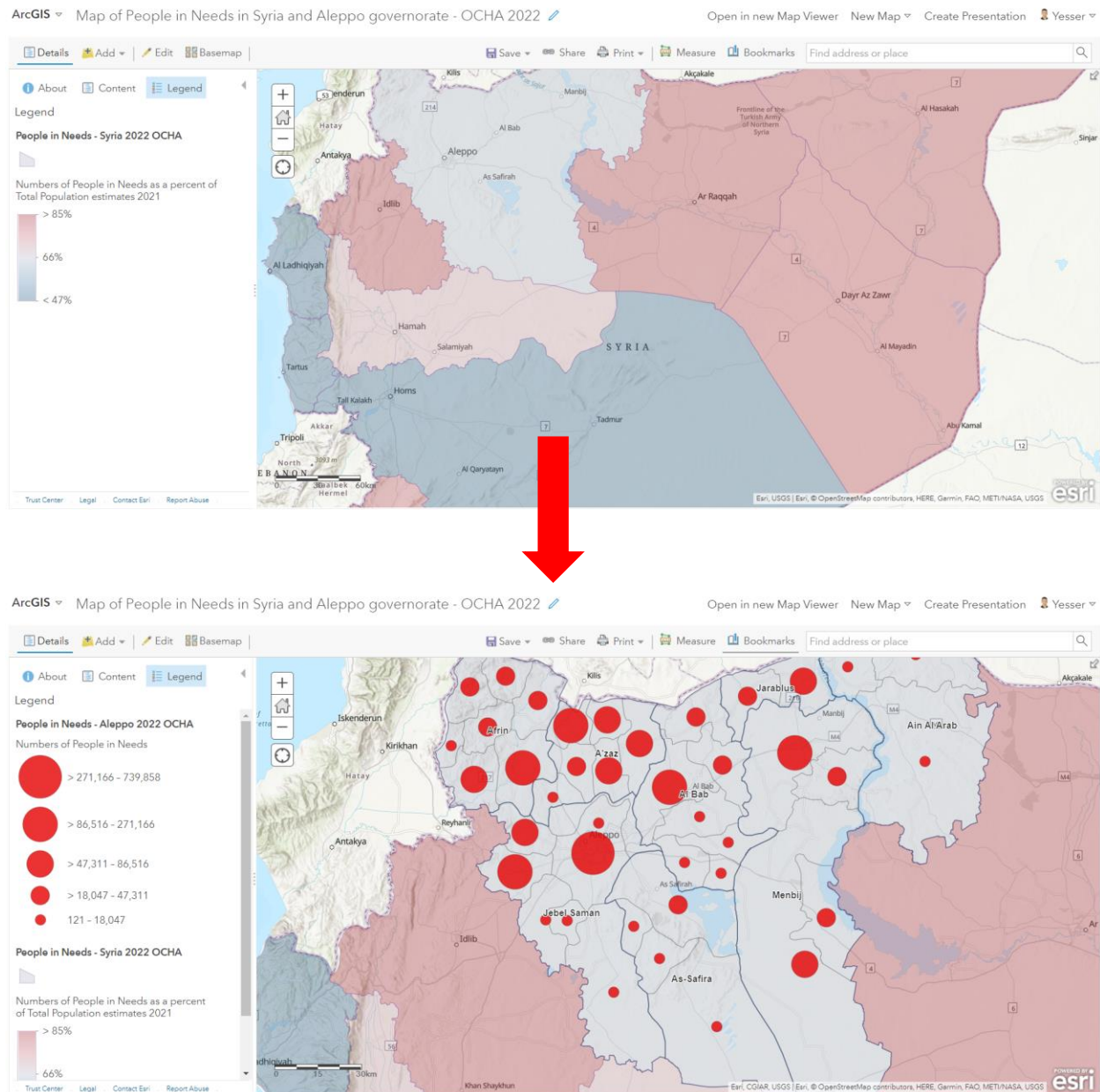


Figure 73: Map of People in Needs in Syria and Aleppo governorate - OCHA 2022, Aleppo layer appear when user zoom in to a specific scale

In this case, it is very useful to publish this map by configuring an Instant map called **Basic**. It is easy to publish and gives the reader wide access to map information and can take a screenshot to any part of the map. We just need to add the map, and set the layout choosing the interactive tools and managing widget positions (Figure 74).

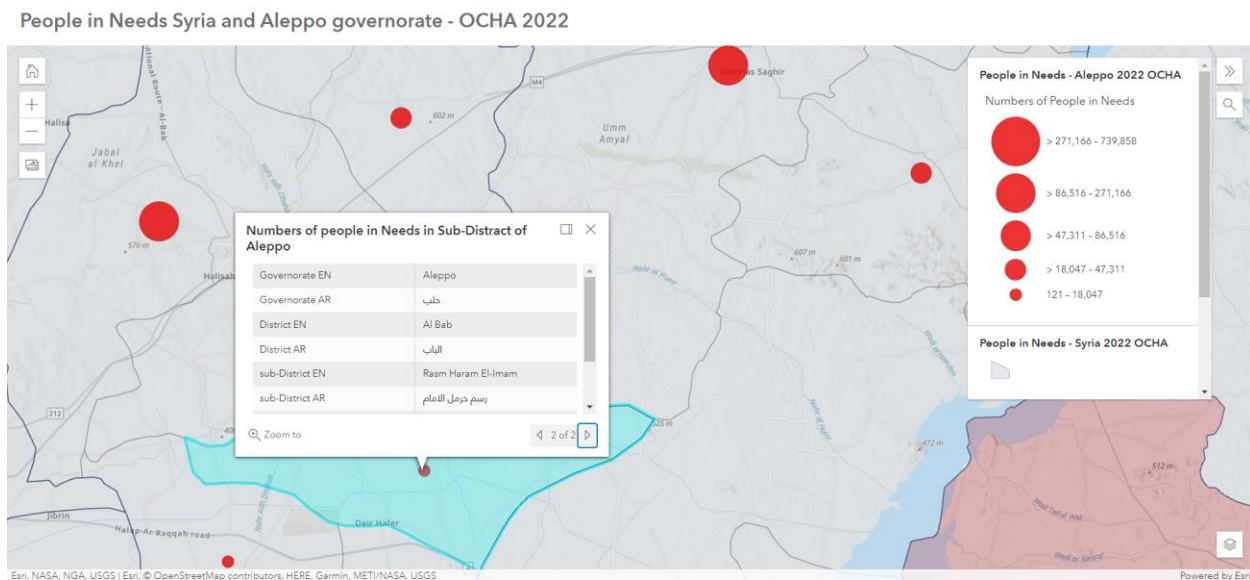


Figure 74: View People in Needs in Aleppo sub-Districts using the Basic app as a visitor

- ❖ StoryMap Classic (e.g., Story map series) can be used to display humanitarian data maps, but according to the decision taken by Esri, this type of applications is no longer under development and is not recommended for future projects, so it is better to use stable applications that remain under development in the future.

6. ArcGIS Experience Builder for Developer accounts

ArcGIS Experience Builder lets you to instantly transform your data into appealing web apps (Figure 75), without writing a single line of code. In the future it can be used to develop other solutions for professionals, for example: creating web applications in an easy way to display interactive maps for professionals with many interactive tools.

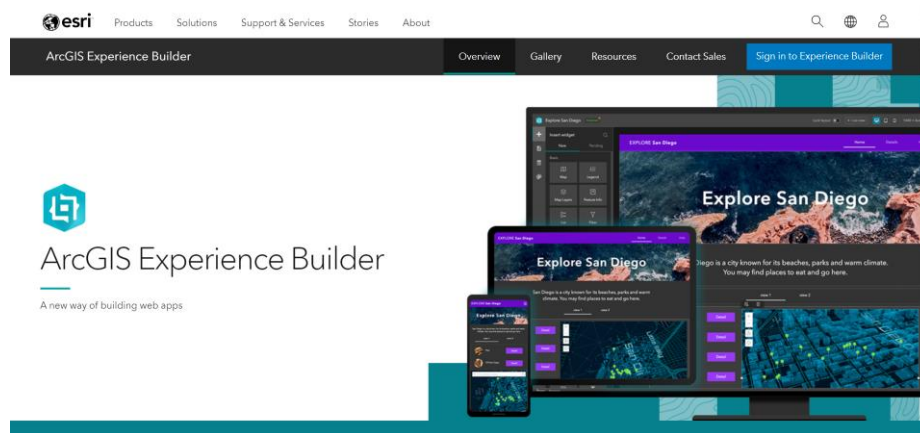


Figure 75: ArcGIS Experience Builder, main page⁴⁴

Users can choose the type of applications, e.g. mapcentric or nonmapcentric apps. They can interact with both types (2D and 3D) of content in one app, and they can design and customize their own templates and widgets (Figure 76). ArcGIS Experience Builder is fully integrated and works conveniently on Personal computer or mobile devices.

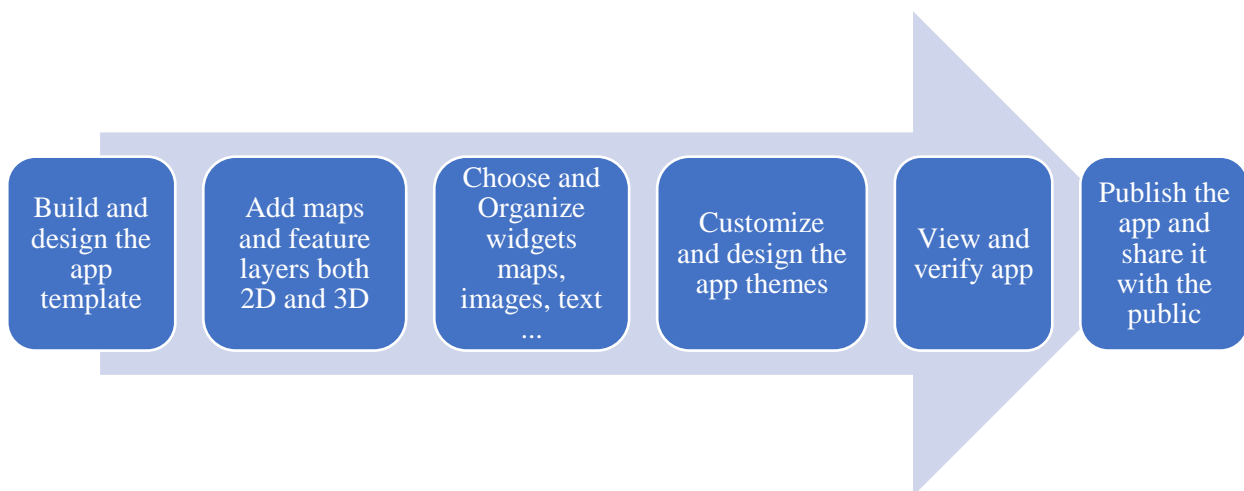


Figure 76: Steps to create an application using ArcGIS Experience Builder

⁴⁴ Source: [ArcGIS Experience Builder](#)

7. ArcGIS Dashboards for International Organizations

ArcGIS Dashboards are visual displays that show data in an easy-to-read style that can be grasped quickly (Figure 77). Dashboards in ArcGIS Dashboards are meant to display several visualizations that operate together on a single screen to present location-based statistics. Dashboards are part of the ArcGIS geoinformation model, just about as web maps and web layers.

ArcGIS Dashboards can be used by any company that uses the ArcGIS platform to help make decisions, visualize trends, and monitor status in real time, as well as slice data to come up with answers they need and update their communities.

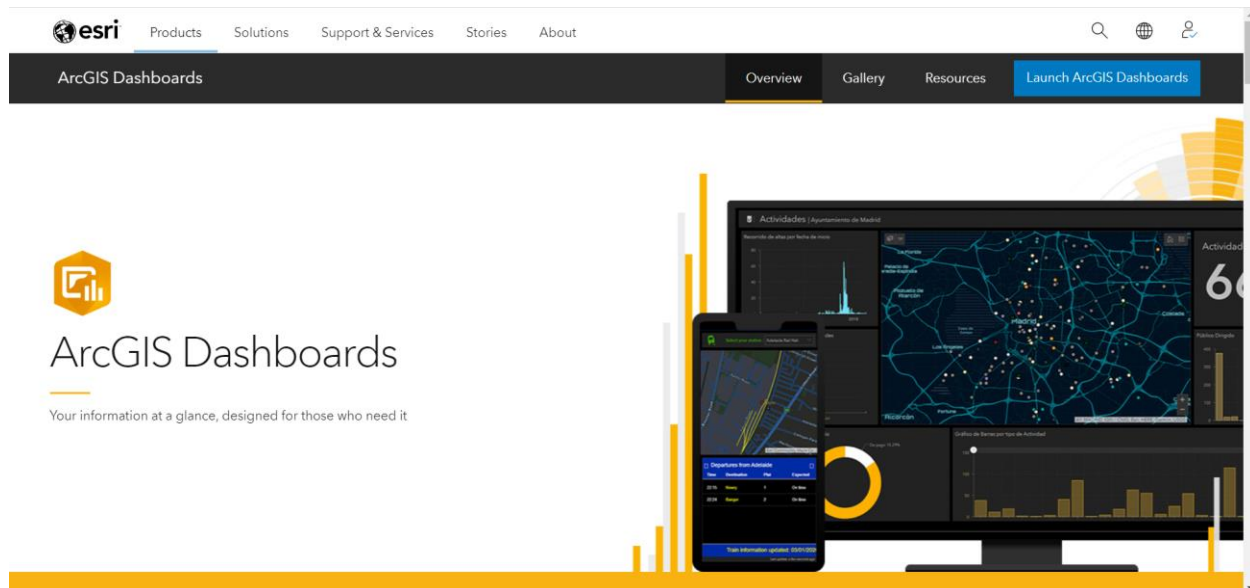


Figure 77: ArcGIS Dashboards, main page⁴⁵

In our case, international organization can use dashboards to access all the data you need to be knowledgeable, make decisions in one area, and monitor the status of an emergency humanitarian response team or campaign in real time.

⁴⁵ Source: [ArcGIS Dashboards](#)

8. ArcGIS Survey123 to help volunteers of the organization

ArcGIS Survey123 (Figure 78). gives you the ability to create, share and analyze surveys forms. Users can create smart forms (models) with skip logic, defaults, and multilingual support with ArcGIS Survey123. Even when the users are not connected to the Internet, they can collect data in a smarter way through web or mobile devices, and users can analyze results quickly and securely upload data for future study to make better decisions, and view summary analysis right in the app, with a deeper analysis of Survey data in ArcGIS. Survey123 integrated with ArcGIS Online, therefore the teamwork can monitor the activity data in real-time.

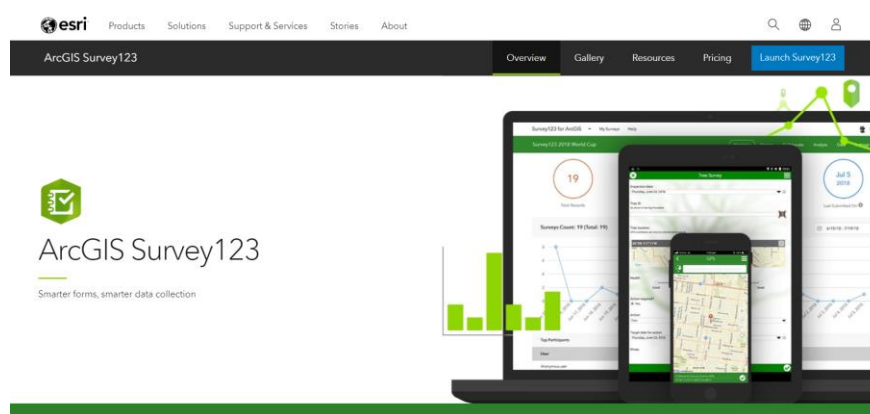


Figure 78: ArcGIS Survey123, main page⁴⁶

In our case in this research, Survey123 can be used to help volunteers of the international organizations during the distribution of grants Within a specific area. The team work in the organization can design the form at the organization office, and later the volunteers can use the Survey123 web app and mobile app to record survey answers (e.g., save the village location and enter the necessary data from the name of the village, the number of families, the name of the grant, etc.) on the laptop or mobile devices, the data is exported (e.g., spreadsheet) and uploaded it immediately to the cloud. Later, upon completion of the distribution of a grant in a specific village, they can use this data in the interactive maps for specialists on ArcGIS Online (Figure 79).

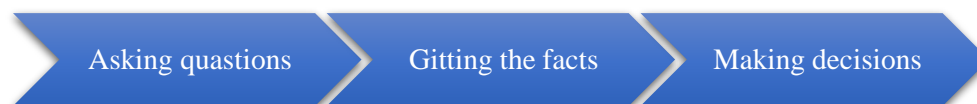


Figure 79: Mobile data collection stages

⁴⁶ Source: [ArcGIS Survey123](#)

9. Important points on methodology

- 1- This research was developed using an ArcGIS Online public account, but using a professional account supports many features and additions that help make our work not only faster and easier, but also other solutions can be also applied (e.g., ArcGIS Experience Builder).
- 2- The Map Viewer workspace in the ArcGIS Online website works with the WGS 1984 Web Mercator coordinate system, so the layer coordinate system preferably must be WGS 1984 Web Mercator as well in order to import the layers in the correct location.
- 3- Databases must be designed appropriately considering the nature (specific characteristics) of the data and the purpose of each layer.
- 4- Natural Breaks classification method is suggested to be used, that suits the spread of our data type, ensuring that in one interval there is a maximum homogeneity. Future developers cannot forget to exclude the zero number for families in our specific theme.
- 5- It is always preferable, after uploading layers to the map, to save the layers in ArcGIS Online server after setting the styles, so that the layers can be imported to other maps with their own saved styles.
- 6- Transparency can be set for layers that use area coloring type of thematic maps (choropleth maps) in order to maintain the visible details from the base map (roads, hydrology, etc).
- 7- When we have a map consisting of several layers with different degrees of detail or resolution, we must pay attention to setting the appropriate scales to visualize each layer at the proper zoom degree.

- 8- Configuring the pop-up windows, we can change the original fieldnames used in the table, to make our pop-up better readable. We can also set the decimal places to zero because in our specific example it does not matter to put decimal for the number of beneficiary families.
- 9- Maps for the public in general are characterized by their simplicity avoiding any more complex solution for data representation, visualizing mainly general data that gives a general idea to the reader. Images, texts and other graphic solutions can complete better the explanation given about the selected theme in the story map.
- 10- It should be noted that the governorate of Aleppo and the Al-Bab district were chosen in the practical application of the methodology for the maps for specialists, because the researcher only got the data for those areas, and not for any other consideration. Therefore, this methodology can be applied in any region or governorate in Syria or countries in a similar situation.

10. Suggestions for the future development

Finally, some future ideas based on research methodology through several directions were developed as follows:

International organizations can develop a common database for the activities of all organizations, for example: in addition to the previous database that collects grants from several organizations, each village from a specific grant can be linked with a list or spreadsheet of personal and economic data of the beneficiary families.

Starting from the previous database, collaboration strategy can be developed between organizations to link and share interactive maps that are continuously updated by these organizations., which strengthens cooperation between organizations, unifies efforts and directs activities towards the area's most in need.

Relying on ArcGIS Online with its wide and varied capabilities opens the prospects for using this methodology with the development of the applications and interactive tools of the platform, as well as the use of professional accounts by international organizations. Professional accounts enable it to facilitate the work on the stages of the methodology through the wide capabilities provided by ArcGIS Online as table editing, data analyses and statistical charts, that make work on the methodology more flexible.

ArcGIS Experience Builder capabilities can be used to create an internal inter-organizational web application designed in a way that displays all activity data, statistics of humanitarian data and all types of charts, as well as publishing previous interactive maps with the option to share these maps and data representations together to acquire the information smoothly.

Interactive programming interfaces can be developed using programming languages such as Python for all non-specialized organization workers to help data input and update database layers, as well as creating interactive maps.

Finally, a website can be created using HTML5 and CSS languages to display interactive maps of all organizations in an easy-to-follow manner according to the grants provided, the different organizations and dates, supporting the appropriateness of the web pages to the screens of personal computers and smart mobile devices.

11. Summary

Since 2011, Syria has suffered a major humanitarian crisis, exacerbated by the years of war, and many international organizations are currently working in Syria to help the Syrian society to rise again in various walks of life.

The research has organized the use of web map services to display the data of grants and activities of organizations in Syria, and to customize them according to users (public or specialists).

In the beginning, data on most organizations and their activities were collected, then studying the state-of-art on the use of web maps by different organizations. On the other hand, the available solutions offered through the various web map services platforms were analysed for choosing the best solution that suits the purpose of the research (ArcGIS Online).

The methodology has been developed to give guidance for the workflow to create web maps about the work of the organizations, as well as special applications for the public (Story Map) and specialists (Sidebar app), and it is possible to use this methodology to show the humanitarian data (Basic app) that help organizations to take decisions to support certain areas most in need. Concluding the methodology, a more advanced solution was proposed for the specialists (mostly not available for public accounts or with very limited capabilities) and some notes were given that help and clarify some important points during the workflow.

In the end, this research can be developed in the future according to several levels, from database development and the level of cooperation between organizations to advanced uses of ArcGIS applications (ArcGIS Experience Builder, ArcGIS Dashboards, ArcGIS Survey123, etc).

The resulting maps (apps) models as an application of the methodology:

- 1- For public: WFP Livelihoods Activities (Garden grant) in Syria with Ratio of People in Needs (Food security), Published as a Story map.

Link: [WFP Livelihoods Activates in SYRIA-Kitchen Garden grant 2020](#)

- 2- For specialists: Livelihoods Activities (Home Garden grant) in Aleppo governorate with Severity Levels and the villages of Al Bab district, Published as a Sidebar app.

Link: [Livelihoods Activities in Aleppo governorate and Al Bab district](#)

- 3- For displaying Humanitarian data: People in Needs in Syria and Aleppo governorate – OCHA 2022, Published as a Basic app.

Link: [People in Needs Syria and Aleppo governorate - OCHA 2022](#)

12. Annex

Tables:

The tables for the practical application of the methodology can be accessed through a link to the 'Thesis Project Excel file' folder uploaded on the drive server:

https://drive.google.com/drive/folders/1kW_SQNHNniZqYZ-Ksqf-bsYuY2YjJ4B_?usp=sharing

That contains spreadsheets for the activities of international organizations and humanitarian data in Excel format, according to the following order:

[Al Bab Organizations 2018_Village](#)

[All Organizations Home Garden grant 2018 sub-District](#)

[FAO Home garden grant 2018 Village](#)

[Home garden grant 2018 sub-District](#)

[ICRC Home garden grant 2018 Village](#)

[IFRC Home garden grant 2018 Village](#)

[PiN 2022 Syria District and Aleppo sub-District](#)

[WFP Home garden grant 2018 Village](#)

[WFP Kitchen garden grant 2020 Syria District](#)

Maps:

The resulting map models when applying the methodology developed in this research according to the available and obtained data are:

[WFP Livelihoods Activities \(Garden grant\) in Syria Map with Ratio of People in Needs \(Food security\)](#)

[Livelihoods Activities \(Home Garden grant\) in Aleppo Map with Severity Levels and Al Bab district](#)

[Map of People in Needs in Syria and Aleppo - OCHA 2022](#)

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DECLARATION

I, undersigned *Yesser Jarkas* (NEPTUN CODE: *AFPLDU*), declare that the present master's thesis is my original intellectual product in full and that I have not submitted any part or the whole of this work to any other institution. Permissions related to the use of copyrighted sources in this work are attached.

I AGREE to the publication of the accepted master's thesis in pdf form on the website of the Department of Cartography and Geoinformatics.

Budapest, 15, 05, 2022

A handwritten signature in blue ink, consisting of a stylized 'Y' followed by a horizontal line and a small flourish.

(signature of the student)