

Mapping My Community

Overview

Your mental map is a representation of your own personal geography that you carry around with you and draw on as you make everyday decisions about where to go and how to get there. Everyone's mental map is different. Mental maps reflect the spatial information we use in our daily lives, like where we know and where we don't know, and they are influenced by things like personal experiences, transportation, safety, and accessibility.

Maps are *models* of the world around us. Creating a map requires selecting what information is important, filtering out what is not important, and simplifying how things are represented. Our mental maps do the same thing, whether we realize it or not.

Mental maps also vary based on social differences. For example, people of different races and ethnicities may have different perceptions of the same neighborhood, women have different travel patterns than men at night, and queer communities historically congregated in spaces under the radar that other people might not know about.

In this lesson, you will discover your own mental map of your community by sketching it by hand. Then you will create your mental map using GIS and compare it with other maps to understand how they each represent just one model of reality.

Your Mental Map

First, sketch your own mental map on a piece of paper. Include the locations you visit the most (e.g., your home, school, parks, restaurants, friend/family homes) and routes you take when you go places (e.g., train and bus lines, walking paths, driving routes).

Next, use ArcGIS Online to create a digital version of your mental map. With your group, have everyone pick a color that they will use to symbolize features on their own map (your options are black, blue, green, orange, purple, red, and yellow). On your own, add Map Notes in the form of *point*, *line*, and *polygon features* to represent the locations, routes, and areas you drew in your mental map.

Take a look at your sketched mental map and your digital mental map and consider the following questions:

- How easy was it to translate your sketched mental map to your GIS map? How well do you think the map features capture the subject matter of your map?

- Is there anything that is left out in the GIS map? On the other hand, is there anything that you can more easily see or understand in the GIS map?
- What types of places did you choose to include in your map? Now that you have thought about these places, how do you feel about them?
- If you were to show this map to someone who is unfamiliar with where you live, what impression would they have of the community shown in the map? Would they be correct?
- Open Google Maps, and zoom into the area you mapped. What features are shown on Google Maps that are also on your personal map? What features did you leave out? Why?
- How do you decide what places to go to and how to get there?

Compare Mental Maps

Next, get together with your group and combine each of your map layers together into a single map. Consider the following questions:

- What spaces and places are most important to you? To your community? Why?
- Are there certain areas of the city you tend to visit and others you do not? What do you think influences this? (Think: transportation, activities, familiarity)
- In what ways are your group members' mental maps similar? How are they different?
- Why do you think they are different? Try to find at least three different factors that lead people to have different mental maps.

Storymap

Finally, work with your group members to create a storymap that showcases your mental maps as well as your groups' analysis and conclusions.

Mapping My Community

Implementation Guide

Learning Objectives

In this lesson, students will discover their own mental map of their community by sketching it by hand. They will then use GIS to create a digital mental map. In small groups, students will compare mental maps to consider how they differ and what factors (e.g. access to transportation) may shape what areas they know and do not know. They will then work in small groups to create a storymap that presents their digital mental maps and their analysis and conclusions about why mental maps differ. During this lesson, students will learn GIS skills such as: adding different types of spatial features as map notes (points, routes, and polygons, as well as text), changing symbology, creating and sharing feature layers, integrating map layers from different sources, and creating storymaps.

Standards

- CCSS.ELA-LITERACY.RST.9-10.4 / CCSS.ELA-LITERACY.RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- CCSS.ELA-LITERACY.SL.9-10.5 / CCSS.ELA-LITERACY.SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- CCSS.ELA-LITERACY.WHST.9-10.6 / CCSS.ELA-LITERACY.WHST.11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Lesson Structure

Overview

The lesson starts with a teacher model of the GIS techniques needed for the lesson. The technical skills are detailed in this implementation guide for you to use as a resource.

Getting Started

Provide a brief introduction to mental mapping, including inspirational examples. Working independently, students create a sketch map by hand that represents their personal mental map of their community. Have students take a picture of their map.

Have each student get a computer and log in to their ArcGIS account. Students can then open and preview the lesson materials. Designate a hashtag for students to tag the map layers they create so they can be searched for by other students in the class.

Lesson Introduction and Model

Provide a brief introduction to the GIS portion of the lesson and answer questions. Before students begin working, model the GIS techniques they will draw on during the lesson (see below for details). At this stage, don't introduce storymaps. You will preview those right before the storymap activity.

Work Time

Students will create a digital mental map in GIS. Assign each student a color to use when creating their map notes. As they work on their individual maps, encourage students to collaborate to figure out how to apply the GIS techniques to their projects. Provide support and answer questions as needed.

After completing their individual GIS maps, students will form groups of 2-3 and compare their maps. Make sure that students in each group used different colors for their GIS map. Help students get into groups, and provide discussion questions to guide the group.

Storymap Activity

Before the storymap activity, model the process of creating a storymap. Students will work collaboratively in their small groups to create a storymap. The storymap will present each member's individual map or they will compile all group members' data layers into a single map. Storymap presentations should conclude with the insight they gathered from group discussion.

When they are done, have students share their storymaps with the class. This can involve either a whole class presentation or small group discussion.

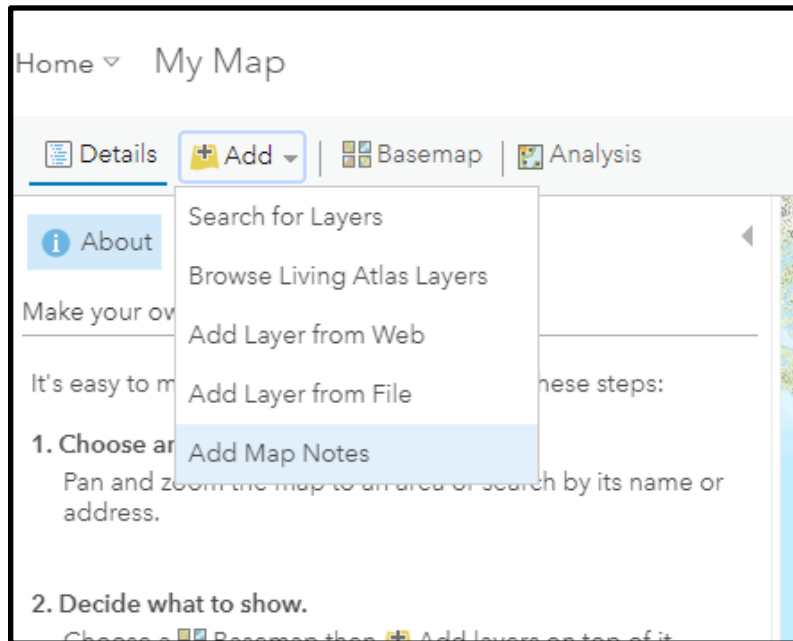
Modeling GIS Skills

At the beginning of the lesson, model the GIS techniques that students will use in the inquiry activities. Step-by-step instructions for the GIS skills that are needed for this lesson are outlined below.

GIS Analysis

Adding Map Notes (Points, Lines, Polygons) and Changing Symbology

In a new blank map, zoom in to the area you drew in your mental map. Create a digital version of your mental map by adding Map Notes for the different features you drew.

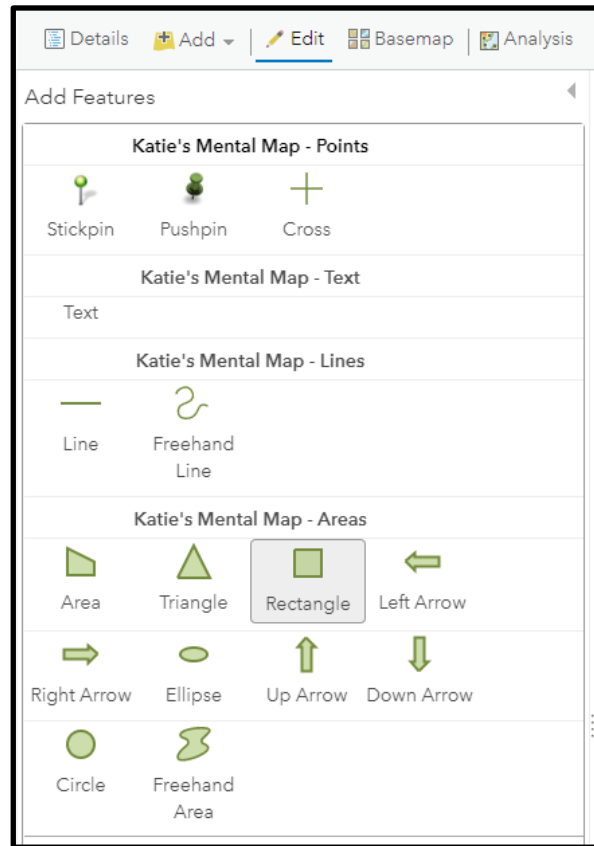


Name the layer. This layer will contain all the different map notes you create, so give it a general name. Use the Map Notes template.

 A screenshot of the 'Add Map Notes' dialog box. The title is 'Add Map Notes' with a close button (X) in the top right corner. There are two input fields: 'Name:' with the text 'Katie's Mental Map' and 'Template:' with a dropdown menu showing 'Map Notes'. Below the fields is a descriptive text: 'Use Map Notes to create basic shapes in a wide variety of applications.' At the bottom, there are two buttons: 'CREATE' (in blue) and 'CANCEL'.

The Add Features window will be displayed. Select the appropriate feature type for what you are adding to the map.

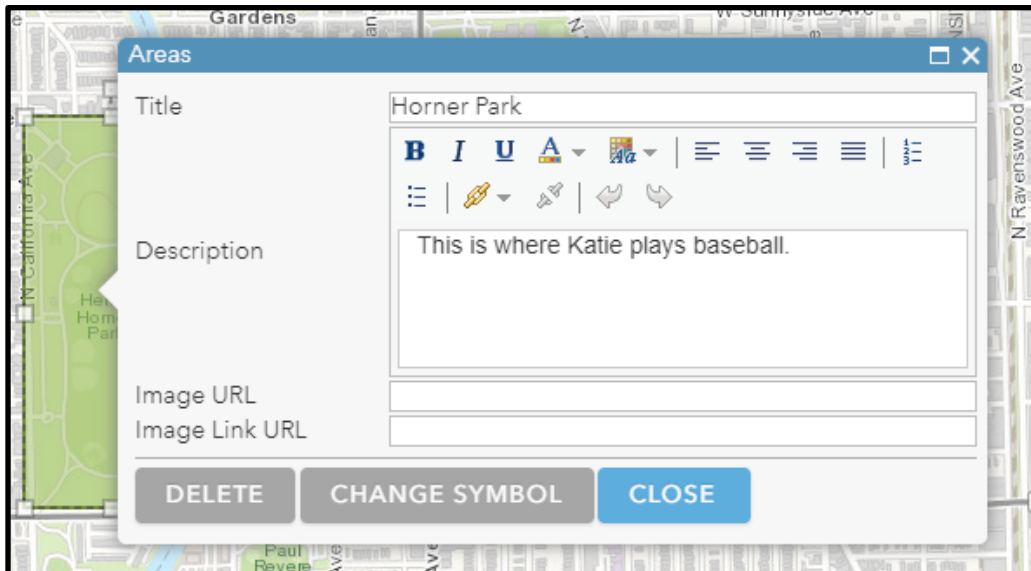
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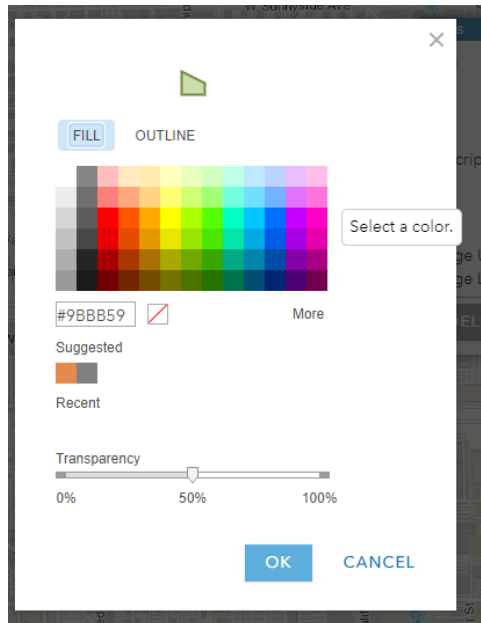
Pay attention to the popup instructions for how to create each type of feature.



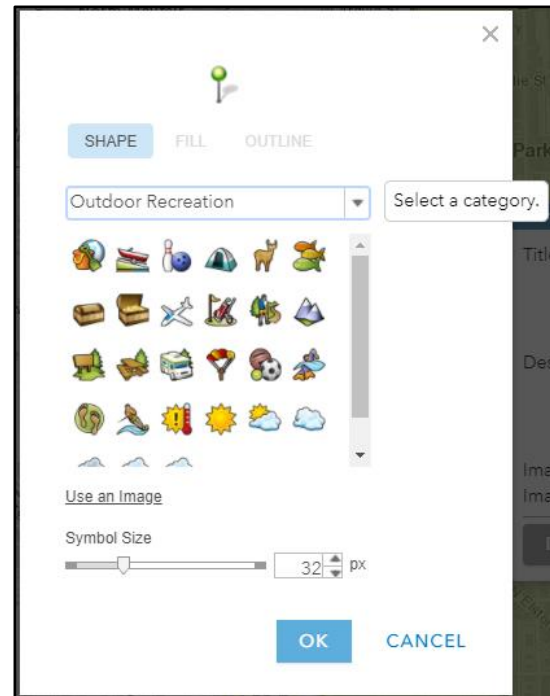
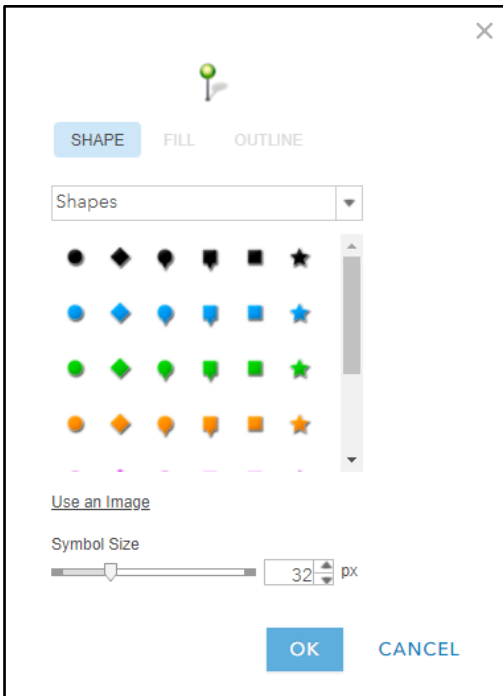
After creating a feature, you will give it a title and an optional description for more detail.



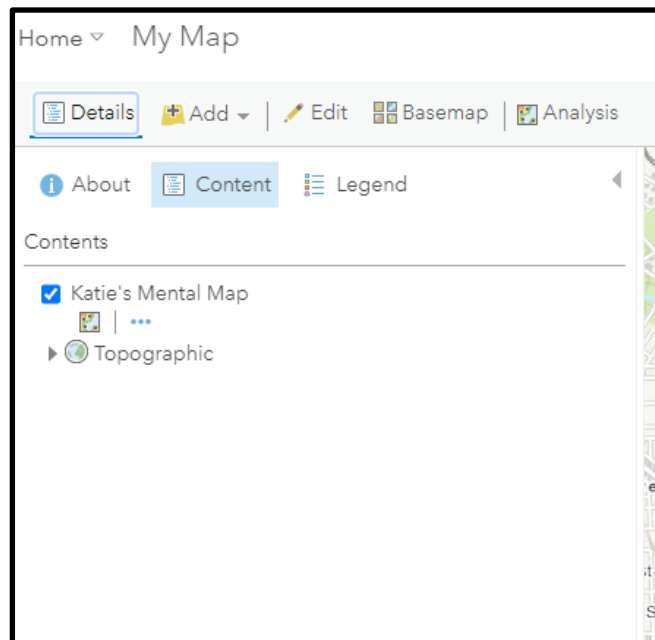
Click Change Symbol and select the color you chose for your map. For line features, you will also be able to change the thickness of the lines.



For point features, we are using the default “Shapes” category so that students can color-code their map features. However, they may also choose to explore other symbol categories to be more creative with their maps.



When you have finished adding your Map Notes, click Details to return to the table of contents view. If you want to return to adding Map Notes, just click Edit and you will see the Add Features window again. You can also edit existing Map Notes by clicking them while in Edit mode.

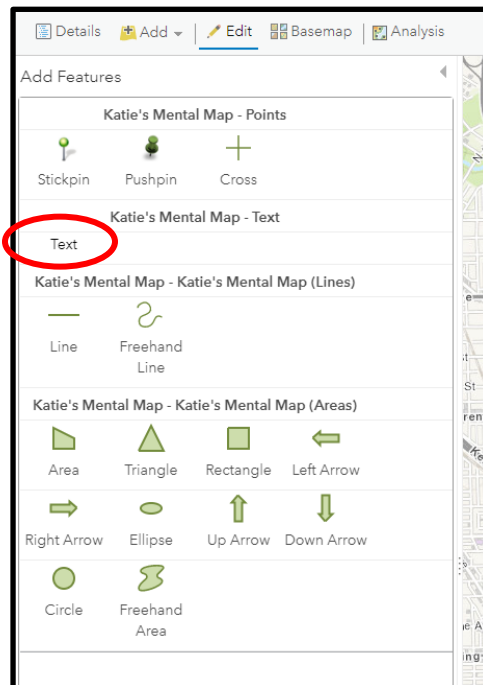


You can view the label and description for map note features by clicking on them.

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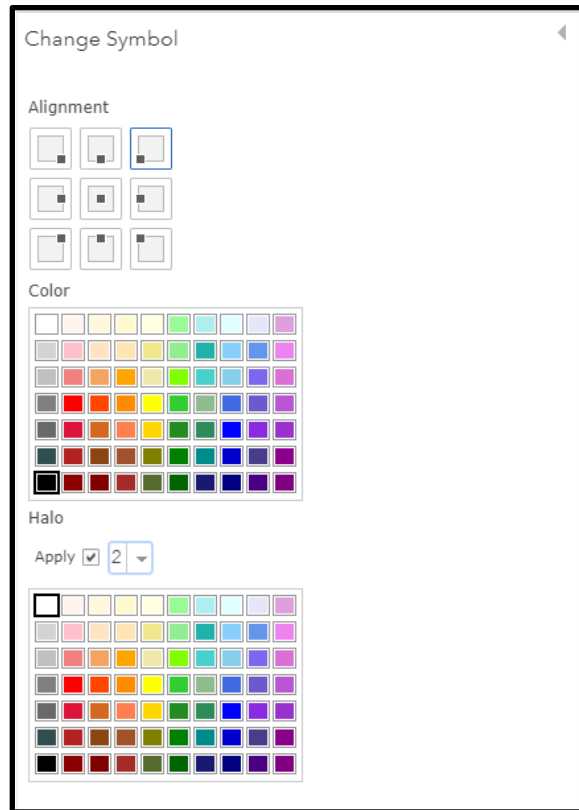


If you want to see labels displayed on the map without clicking, you can add a text map note. This is one of the options in the Add Features window when you are editing.



Adding a halo to your text is a good way to make sure it's visible.

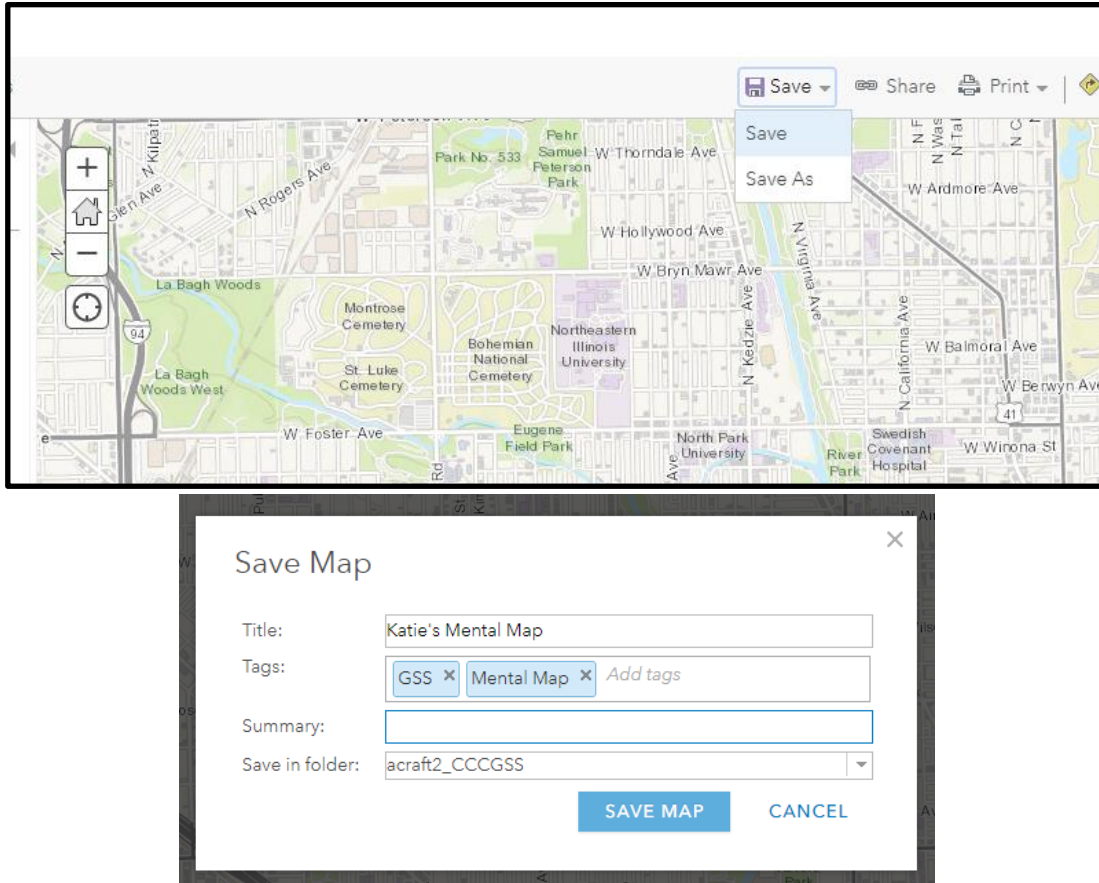
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You can also change the direction of text by clicking the top center box encircling the text when it's selected.



Save your map, tagging it with the class hashtag.

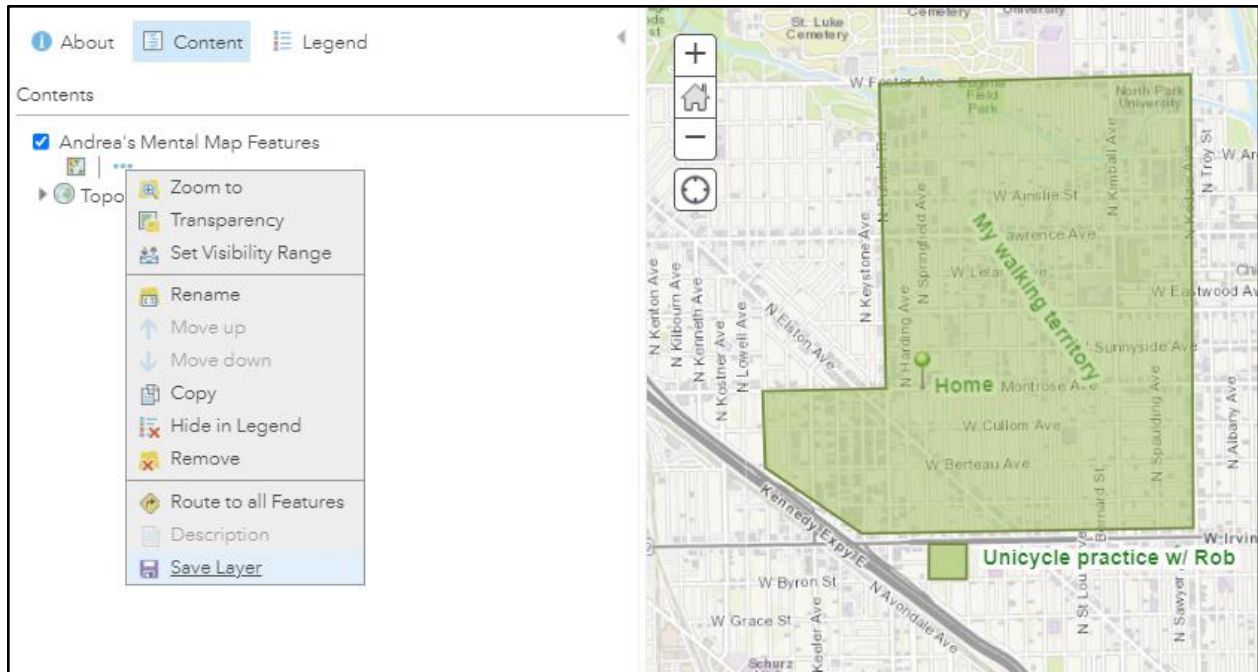


Combining map layers into group map

After you have finished adding your map notes, save your collection of map notes as a Layer. You will need to give it a title and add at least one tag. The teacher should designate a hashtag for the class to use.

*If you do not save your map notes as a layer, they will be stored only within your map.

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The 'Create Item' dialog box is shown with the following details:

- Title: Andrea's Mental Map Features
- Tags: Mental Map, GSS
- Summary: These are the map features I created for my mental map assignme
- Save in folder: acraft2_CCCGSS

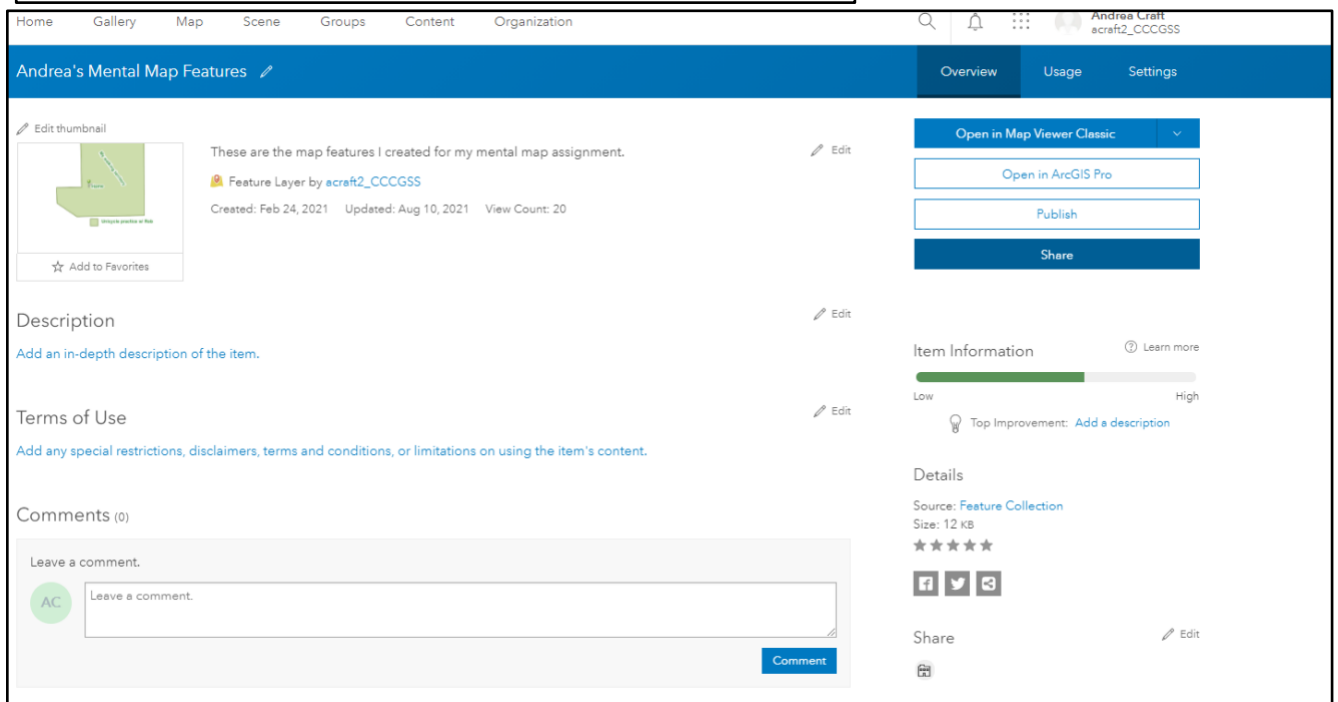
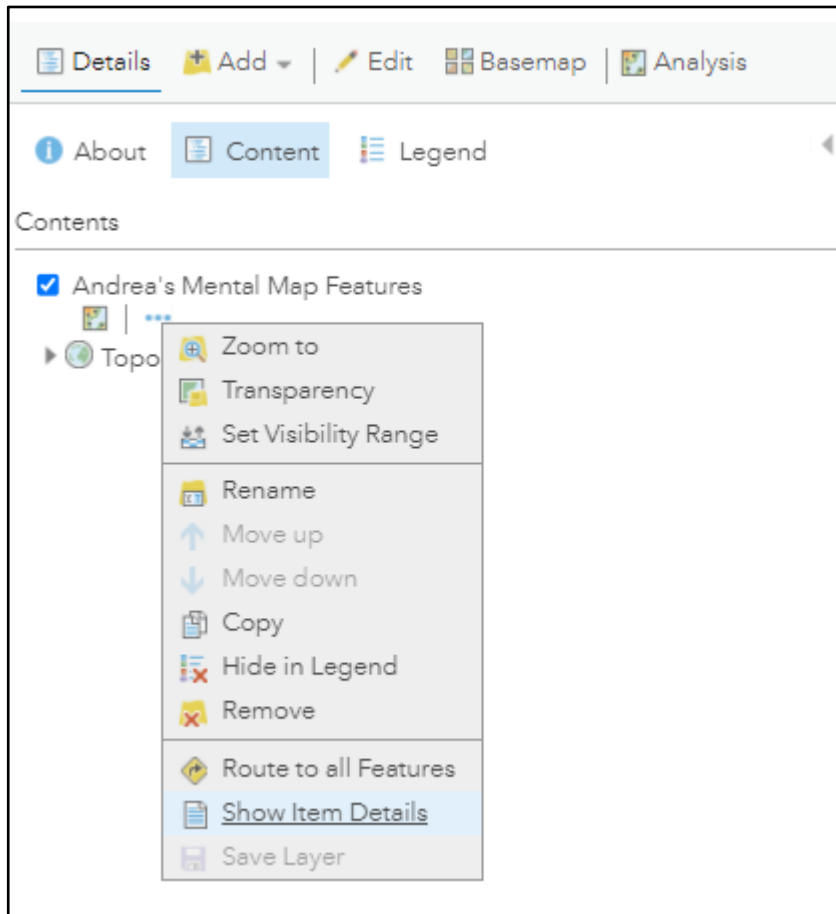
The 'CREATE ITEM' button is highlighted in blue.

You will now have this map layer as a published feature layer in My Content. By default, the sharing level is set to Owner, which means that other people cannot find it.

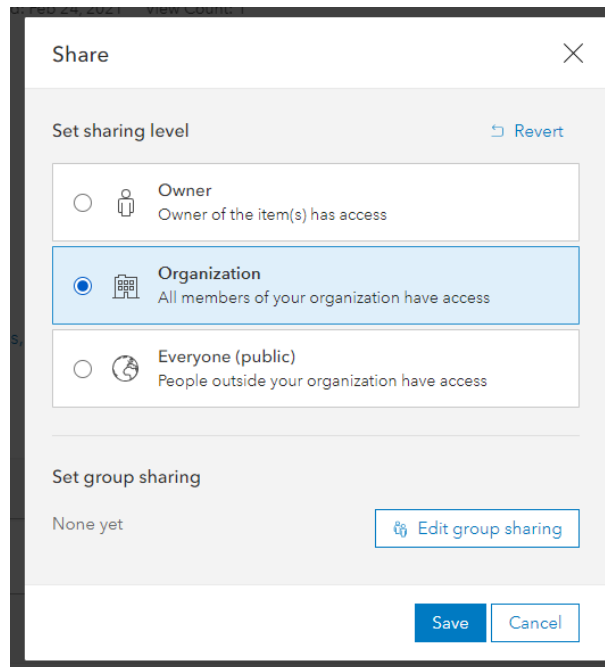
You must also change the sharing level to "Organization" so your classmates can access your layer.

Under the layer options, select Show Item Details. Then on the details page, click Share, and set the sharing level to Organization.

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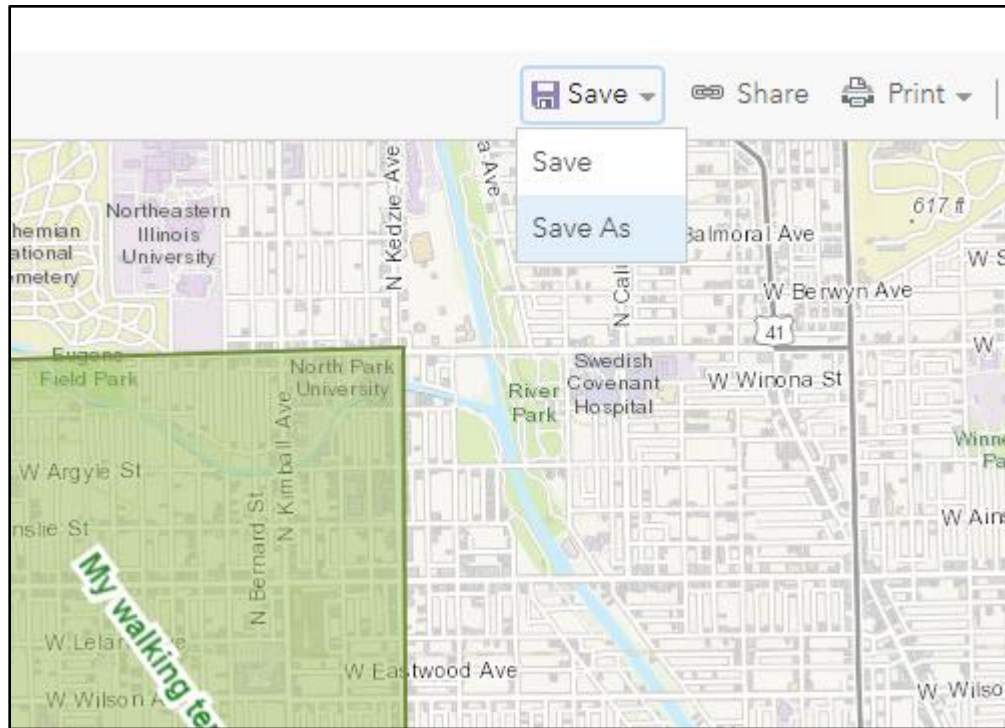
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Choose one group member to be in charge of hosting the group's collaborative map.

They will save a new copy of their map using "Save As" and giving it a new name.

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Save Map

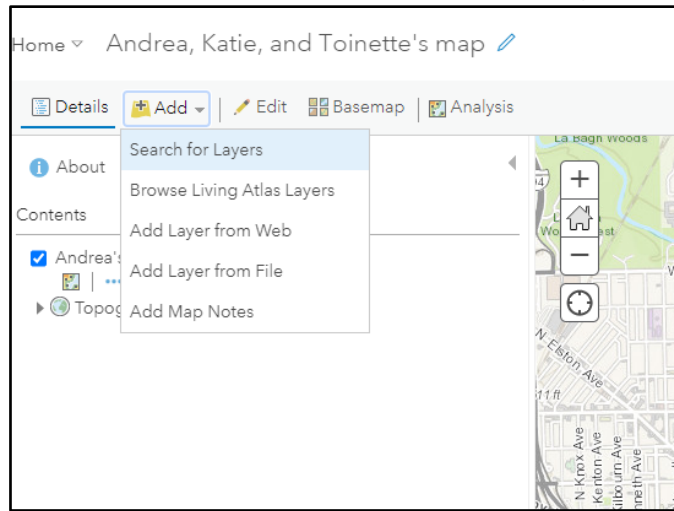
Title:

Tags:

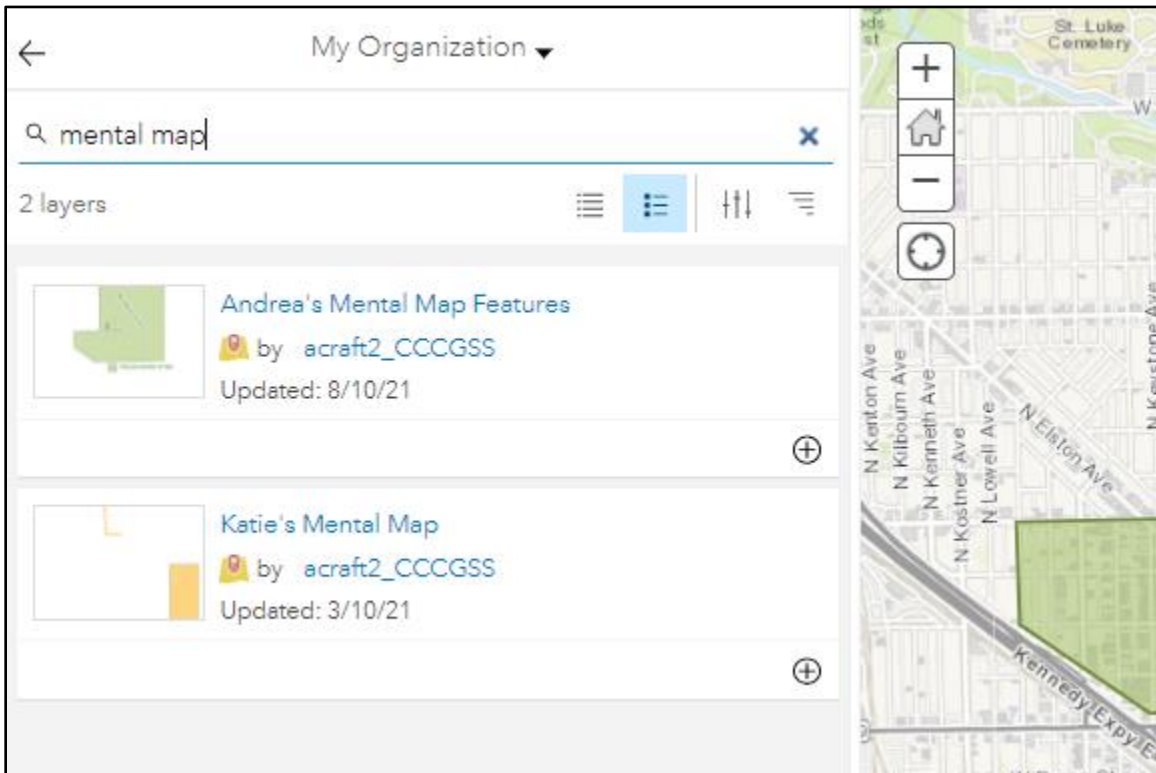
Summary:

Save in folder:

Add the map feature layers created by the other group members.

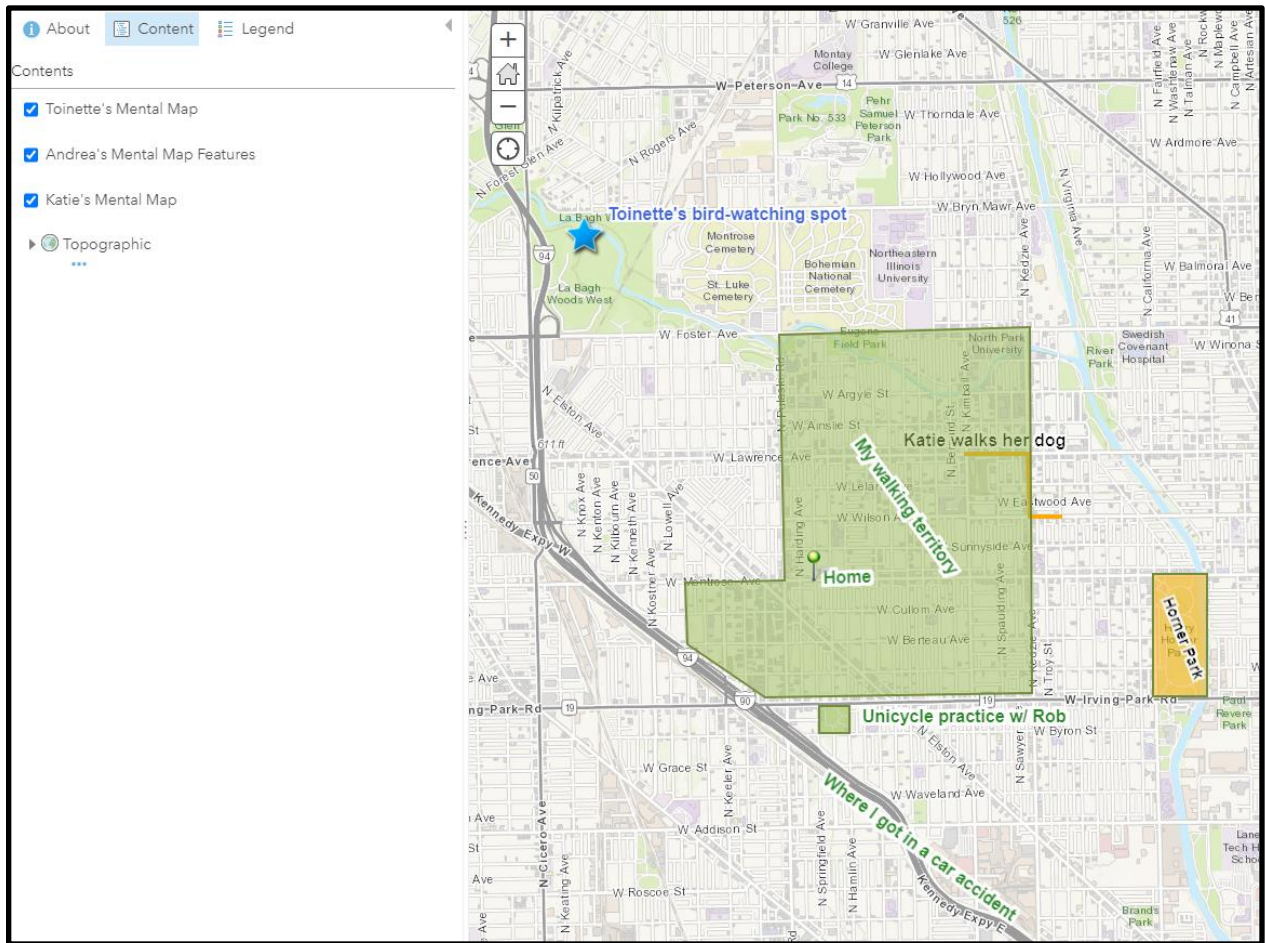


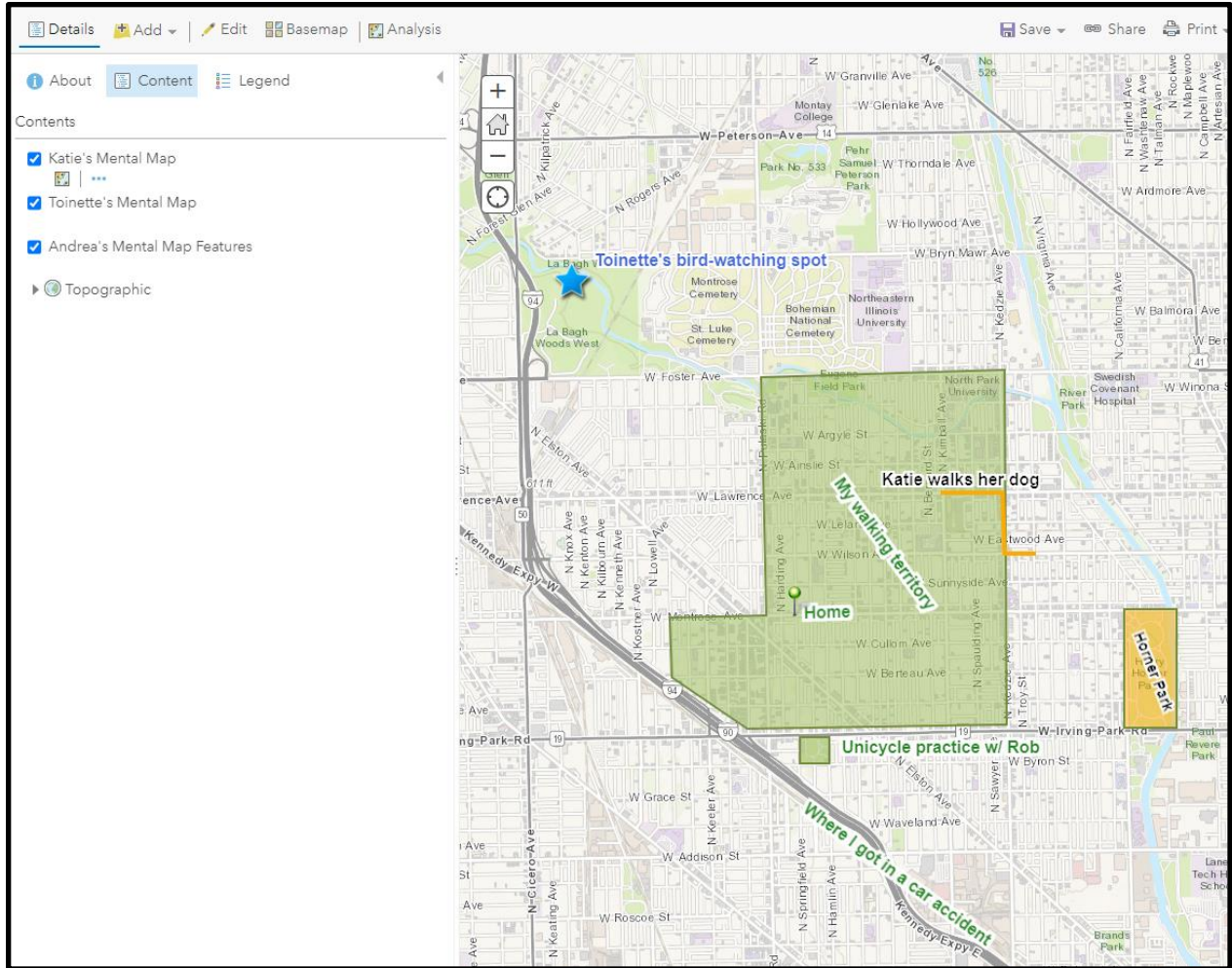
Search for the name of the layer or the class hashtag within My Organization, and add it to the map.



If you have any features that overlap, you can drag them to change the order in the table of contents, to improve visibility.

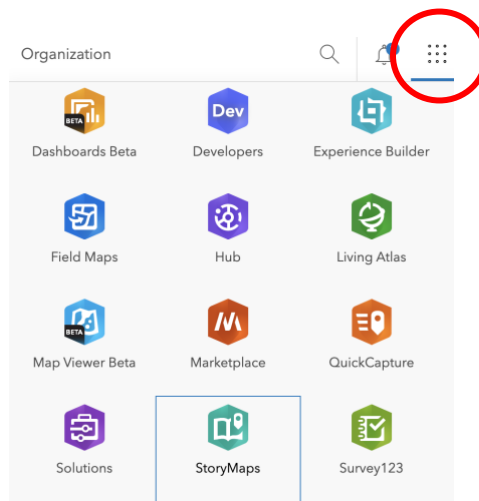
Chicago Geospatial Semester Project



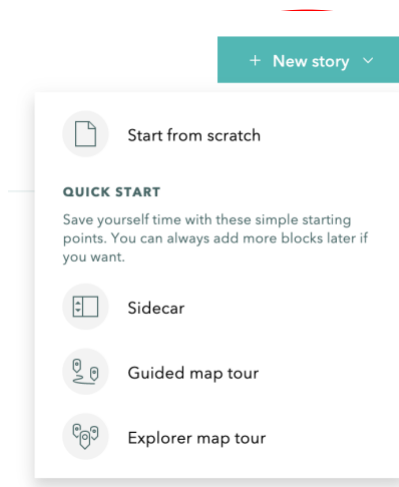


Create a Storymap

In the home menu, click on the app builder icon and select the "StoryMaps" app.



Click “New Story” and select the type of StoryMap you want to create. If you want the most flexibility, try “start from scratch.” If you want a pre-set structure, try the other options.

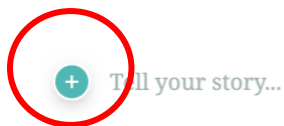


Follow the prompts to add information to your storymap. Click the green plus sign to add other media, such as maps and videos, or more text to your story. When you are ready to share your story, don't forget to click publish!

Title your story

Start with a short introduction or subtitle

Katie James | Draft



Food Access in Chicago

Overview

In this lesson, you will use Survey123 (a mobile data collection app) and GIS to gather and analyze data related to food access in Chicago. You will collect local data related to food access in your community, use GIS to analyze spatial patterns and relationships in your data, and share your analysis and answers to your research question with the class. The goal of this project is to better understand inequities in access to healthy foods that exist across Chicago and develop an action plan to help improve them.

Food Access

Issues of food access occur all around the world. Take a look at the resources below to learn more about food access in Chicago and Memphis.

- The Food Desserts of Memphis: [Memphis Grocery Stores](#)
- The Food Desert (*Chicago Magazine*): <https://www.chicagomag.com/Chicago-Magazine/July-2009/The-Food-Desert/>

With a partner, discuss the following questions:

- Were you surprised by anything in the article and video?
- What was something you already knew about food access and something new you learned from the article and video?

For this lesson, you will collect data about the places people buy food in your community to help you answer the following research questions:

1. Do issues of food access exist in your community?
2. Are there differences in access to healthy foods as income levels vary within and across Chicago?
3. Are there spatial patterns and relationships between food access and the races and ethnicities of people living in those communities?

Survey123

First, you will work as a class to design a survey that will enable you to collect data to answer the research questions. To get started, consider the following questions and share your answers first with a partner and then with the whole class:

- Where do people buy food in your community?
- How would you characterize the different types of stores where people buy food?
- Do the stores sell fresh produce?

- What other data do you need to collect to address the research questions?
- What survey questions do you need to ask to collect that data?

Data Collection

Use the survey your class designed and the Survey123 app to collect this data within a ½ mile of your home.

GIS Analysis

Next, you will use GIS to analyze spatial patterns and relationships in the data you collected to understand and explain differences in food access in Chicago. As you analyze the data, think about how your findings could be used to improve your community and develop an “action plan” to put these improvements into action. As you work on your action plan, consider the following questions:

- How could the results of your GIS analysis be used to improve access to healthy food in Chicago?
- What actions would you recommend based on your analysis?

As you analyze your data, consider the following questions:

- What trends, patterns, or relationships do you see in the data?
- What do you think is causing these patterns?
- How does the data change as you look at different locations in your community?
Across the entire city?

Next, begin researching and adding additional data from ArcGIS Online and The Living Atlas that could help you understand and explain the issue you are investigating, the patterns and relationships you see, and, most importantly, answer the research questions. Examples of relevant data include age, race and ethnicity, crime, landscape, socioeconomic status, census data.

Storymap

Finally, you will create a storymap to showcase your analysis, findings, and action plan. Your storymap should focusing on addressing these questions:

- What issue(s) did you examine? Why are they important?
- What insights has your analysis provided?
- What is your action plan for using your findings?

Share your storymap with your classmates and make a plan to share your work with relevant community members.

Food Access in Chicago Teacher Implementation Guide

Learning Objectives

In this lesson, students will use mobile data collection technologies and geographic information systems (GIS) to gather and analyze data related to food access in Chicago. Spatial patterns and relationships in the data, including the type of food available to purchase and the location and number of stores selling food, will be examined spatially across agreed upon geographies. The overall goal of the project is to promote student collaboration and integrate collected data into ArcGIS online for mapping, display, and analysis purposes. Findings and results will be communicated through the creation of storymap presentations *OR* other assessment strategies determined by the instructor.

Common Core Standards

- CCSS.ELA-LITERACY.RST.9-10.4 / CCSS.ELA-LITERACY.RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.IMP-1.A Identify types of maps, the types of information presented in maps, and different kinds of spatial patterns and relationships portrayed in maps.
- CCSS.ELA-LITERACY.SL.9-10.5 / CCSS.ELA-LITERACY.SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- CCSS.ELA-LITERACY.WHST.9-10.6 / CCSS.ELA-LITERACY.WHST.11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

AP Standards

- IMP-1.A Identify types of maps, the types of information presented in maps, and different kinds of spatial patterns and relationships portrayed in maps.
- IMP-1.B.1 Data may be gathered in the field by organizations or by individuals.
- IMP-1.B.2 Geospatial technologies include geographic information systems (GIS), satellite navigation systems, remote sensing, and online mapping and visualization.
- IMP-1.B.3 Spatial information can come from written accounts in the form of field observations, media reports, travel narratives, policy documents, personal interviews, landscape analysis, and photographic interpretation.
- IMP-5.B.3 Challenges of feeding a global population include lack of food access, as in cases of food insecurity and food deserts; problems with distribution systems; adverse weather; and land use lost to suburbanization.

General Lesson Structure Overview

Students will be introduced to data collection, focusing on examples of data that exist (related to food access issues) in their communities and Chicago. Next, students will use esri's Survey123 to collect and report data on the number, type, and offerings of various food stores. (*Work with students to clearly define quantitative and qualitative variables*). GIS can be used to look for patterns and relationships within the collected data and start the process of finding solutions to food access issues in Chicago.

NOTE: This lesson can be done individually by each student or in student groups of various sizes depending on the individual needs and circumstances of the classroom where this lesson will be conducted.

Lesson Introduction

Begin by asking students to explore the provided resources. Next, students will discuss food access in their community and define what variables to measure/observe/collect and plan collection strategies. *NOTE: teachers should prepare for this lesson by creating the Survey 123 Survey to be used by the class FIRST, it can then be shared with all students or student groups.*

Instructors should provide a brief overview of Survey123 and its workflow, Arcgis Online and the relationship between the software/technology and the lesson's goals.

Modeling Survey123 use and Arcgis Online Techniques

Demonstrate how to access the previously created survey for the lesson via Survey 123.

Review the survey with the class and solicit feedback and suggestions on how to improve the survey before it is used.

Students should also be familiarized with the use of Arcgis Online's mapping tools, particularly the use of a map note to mark a specific location on a map, and a buffer tool to identify areas within a ½ mile of a specific location on a map.

Work Time

Recommendation: demonstrate survey creation ONLY and then collectively use the class-wide data collection survey previously created. This will provide for a more robust analysis of potential food equity / food access issues. Parameters for data collection should be monitored by the teacher and can be scaled up or down depending upon the amount of allocated time and the size of the defined geography students plan to examine.

Students will then collect data and from Survey 123, import into Arcgis Online for GIS analysis. Potential relationships and patterns in the collected data will be analyzed using GIS and compared/coupled with other data from differing sources (Arcgis Online and or esri's Living Atlas).

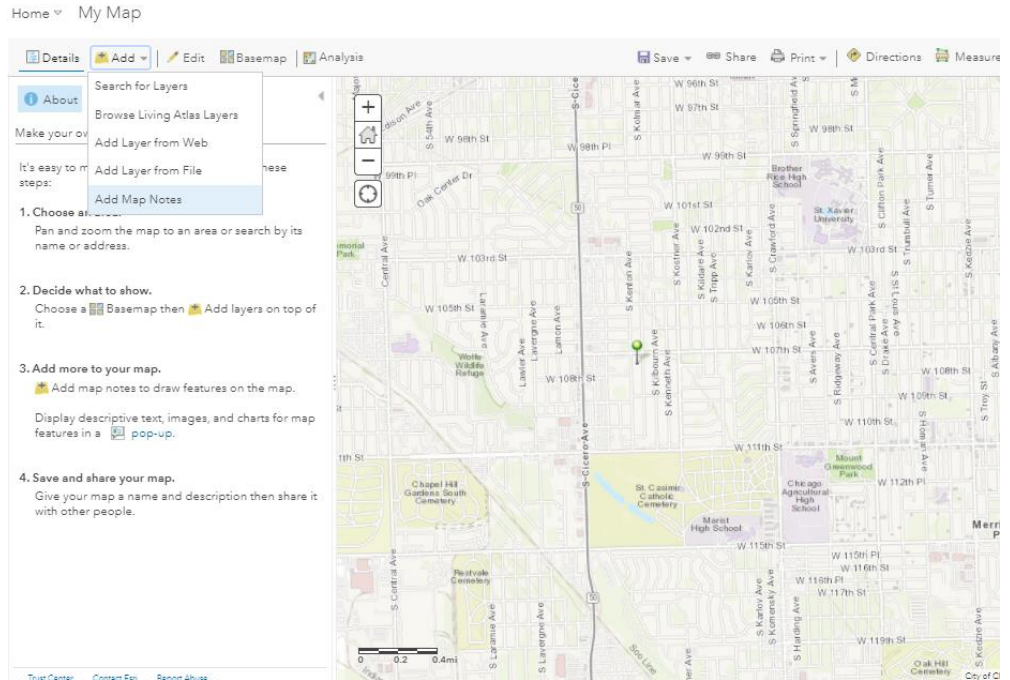
Introductory GIS Skills

If needed, students should be introduced to (or spend time reviewing) the steps needed to ADD a MAP NOTE and run a ½ mile BUFFER around a point using specific tools in the Arcgis.com ecosystem.

Once a map note has been added to a map, a ½ mile BUFFER can be placed around the location identified by clicking on Analysis and the "Use Proximity" option. "Create Buffers" is the tool needed to establish the specific geography related to this investigation.

Storymap Activity

Before the storymap activity, model the process of creating a storymap. Students will work collaboratively in their small groups (or individually) to create a storymap that includes their maps, analysis, and research question answers.



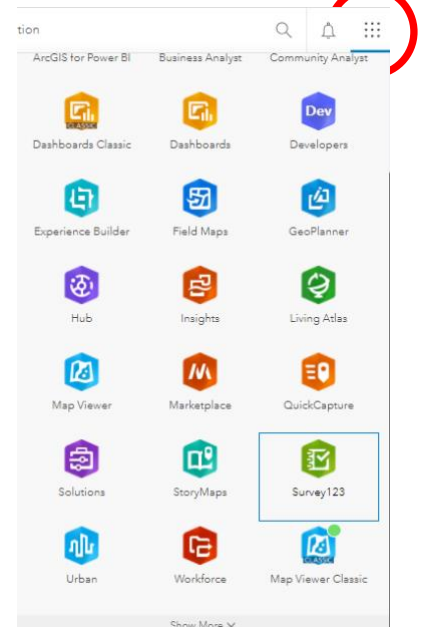
When they are done, have students share/present their storymaps with the class. This can involve either a whole class presentation or small group discussion.

Modeling GIS Skills At the beginning of the lesson, model the data collection techniques (using Survey123) that students will use in this lesson. Step-by-step instructions for the data

collection/survey use, and GIS skills that are needed for this lesson, are outlined with the following:

Instructions for the TEACHER Survey 123 USE: Survey Creation and deployment.

Creating a survey begins with accessing Survey123 within the Arcgis Online ecosystem. The “waffle” icon on the top right of the screen provides access (RED CIRCLE on RIGHT)

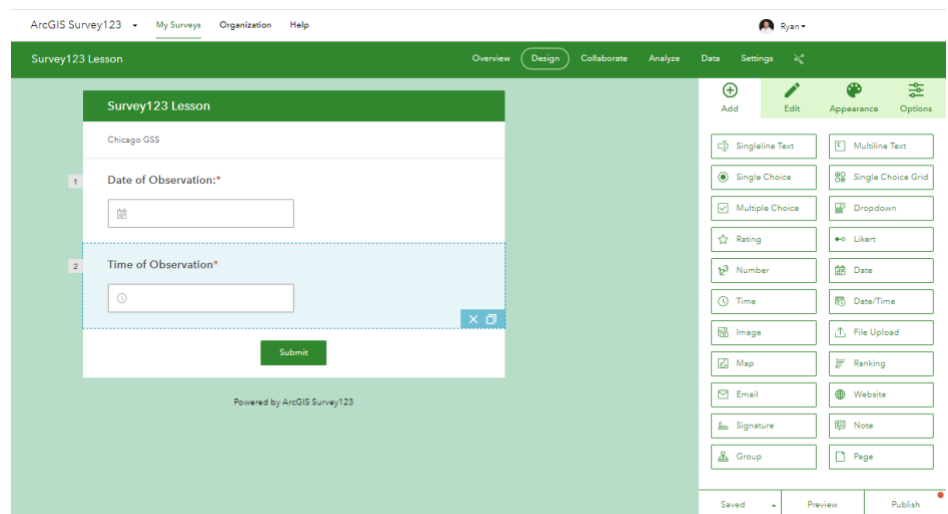


Follow the prompts related to “create a new survey”, the option related to blank surveys provides the most flexibility in choosing how data will be collected.

Modifying Surveys

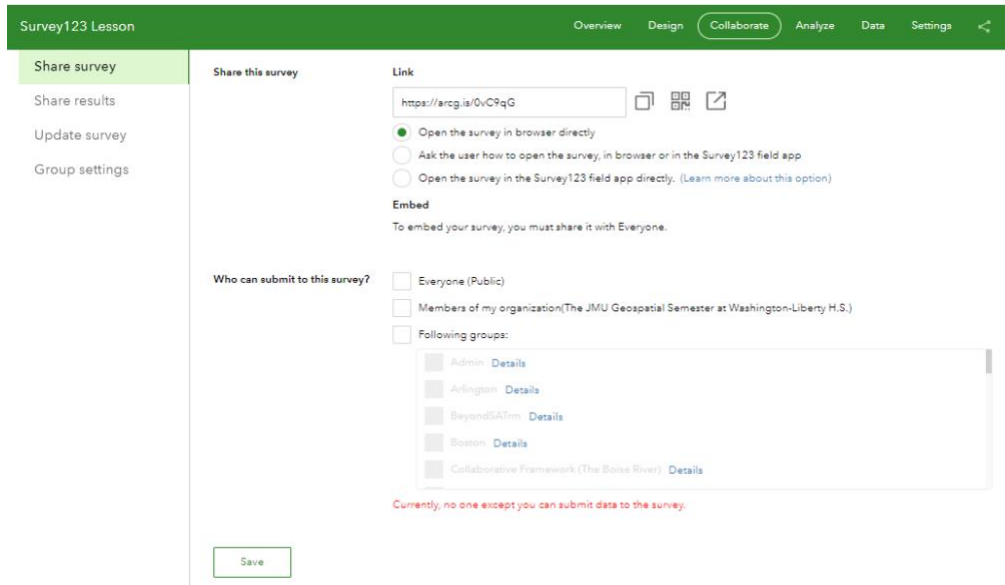
Demonstrate how to insert questions and adjust visible parameters based upon the preference of the survey designer. Modifications can be made following provided prompts. Important: stress to students the need to ask appropriate and related questions that help to potentially answer their proposed research questions.

Examples of the page where modifications to the survey are provided in the image to the right:



IMPORTANT: survey results for this lesson will be dependent upon the location where data is taken. The MAP feature will need to be added to the survey to collect location data. It is in the list of parameters in the image to the right.

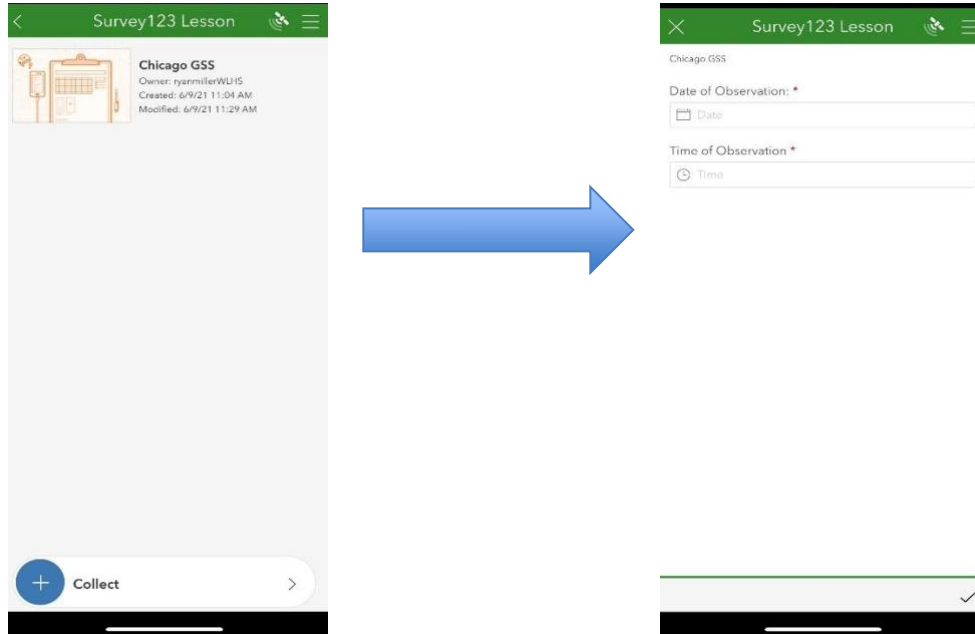
Saving and publication are the last steps in the protocol, if other people will be collecting data for the survey, it is important to grant access, **Collaborate properties** must be adjusted. The survey can then be sent/shared with other collaborators.



Distributing Survey for Data Collection

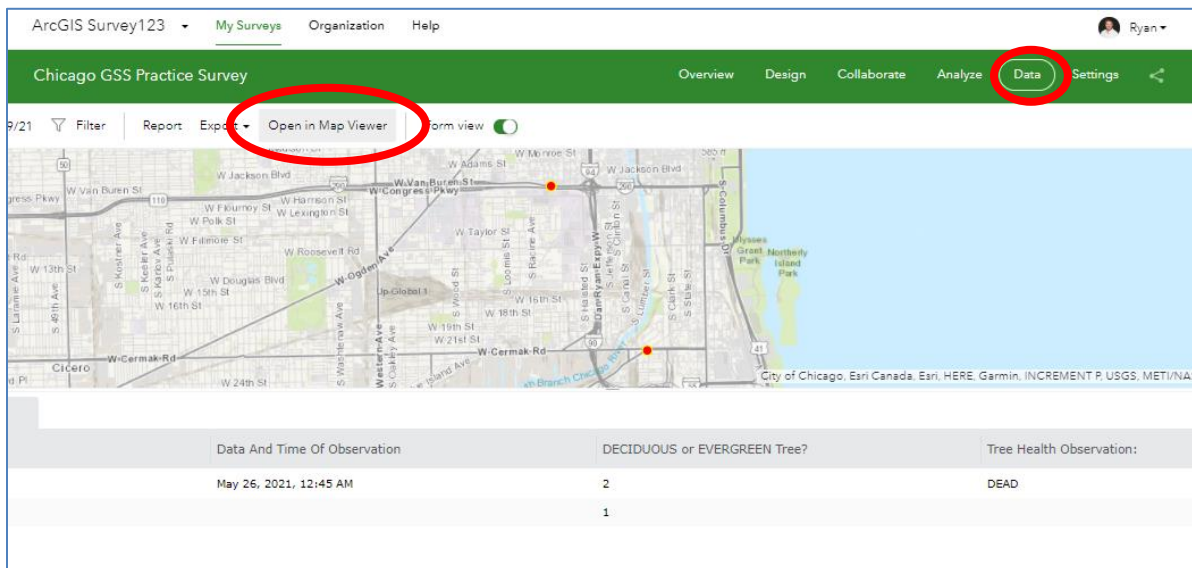
Two options exist for Survey123 users when collecting data. Action can be taken using a URL to access the survey OR a user may download the Survey123 APP onto a mobile device. Both

will require Arcgis Online log-in credentials for use. Searching in the APP for your survey needs to be done first, then the survey can be added to the app for use.



Using GIS to analyze collected data

Students can be directed to log into their Arcgis Online accounts once data collection is complete and return to the Survey123 section. Access the survey, click on Data in the green menu bar and “Open in Map Viewer” to begin using GIS for analysis work.



Opening and displaying the data in the map viewer will allow users to add data relevant to the process of answering the research. Upon the completion of the GIS analysis, Web Maps

must be SAVED and then SHARED (user sets the properties) to proceed to the final lesson objective: creating a Storymap Application that presents the results of each survey's data analysis and answer(s) to the proposed research question.

Suggested GIS Analysis Tools - Data Enrichment, Hot Spot Analysis, Density Analysis, Create Buffers, Predominant Mapping, Tessellations

Suggested Data Analysis Questions for Students - Optional guidance questions that can be provided to students

1. How many food stores are located in your neighborhood? Near your school? (Use the zip code for your home and/or school for this analysis)
2. What are the racial and ethnic profiles of each of these neighborhoods?
3. What is the average household income of each of these neighborhoods?
4. How would you categorize the types of food stores in each of these neighborhoods?

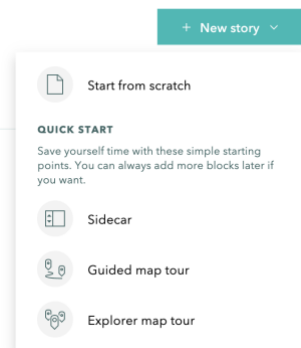
Final Lesson Deliverable: Storymap Application Development OR

Other Suitable Product

Open the map that was created and used in the analysis section above. Hit "SHARE," select "CREATE A WEB APP," and then "BUILD A STORYMAP" to commence work on the final lesson deliverable, the storymap application that displays the collected data, the GIS analysis via created maps, and subsequent discussion of results and research question answers. OR, once logged into Arcgis Online:

Click "New Story" and select the type of StoryMap you want to create. If you want the most flexibility, try "start from scratch." If you want a pre-set structure, try the other options.

Follow the prompts to add information to your storymap. Click the green plus sign to add other media, such as maps and videos, or more text to your story. When you are ready to share your story, don't forget to click publish!



Creating Maps Using Geographic Information Systems (GIS)

Introduction

Geographic Information Systems (GIS), specifically, Esri's arcgis.com ("AGO") online software, will be used to:

- **identify** and **ADD** existing GIS data to make maps
- **change** the look of features on a map, the symbolology
- **create** map notes to display custom data
- **filter** and display specific data based upon an attribute

You will work to develop a research question relative to data related to Chicago city parks and will examine trends in the data spatially across *an area you specifically choose*. This is referred to as **your defined geography**.

GIS Data Types – definitions

Spatial data:

Attribute data:

Think of the parks you've seen and visited around Chicago. List examples relative of respective spatial and attribute data of these parks.

Data Type	Examples
Spatial Data	

Attribute Data	
---------------------------	--

Defining “Your” Geography

GIS analysis requires you to focus upon a specific area.

- *How many parks will you focus on?*
- *Are the locations of the parks in a certain part of Chicago, or are they across the entire city?*
- *What factors will influence your decision to focus upon specific parks?*

DEFINED GEOGRAPHY:

PROJECT Research Question -

What differences about parks across the City of Chicago can you think of? What are some specific characteristics that vary with parks you have visited across the city? More importantly, why do these differences exist and how could GIS help to study this situation to improve your community?

RESEARCH QUESTION (RQ) (*remember focus and purpose*):

Getting Chicago Park GIS Data

Search ArcGIS Online with the tags: **#CHICAGO_GSS** and **Parks** for available data related to parks in Chicago. Choose the layers to work with and add them to your map.

Creating Maps

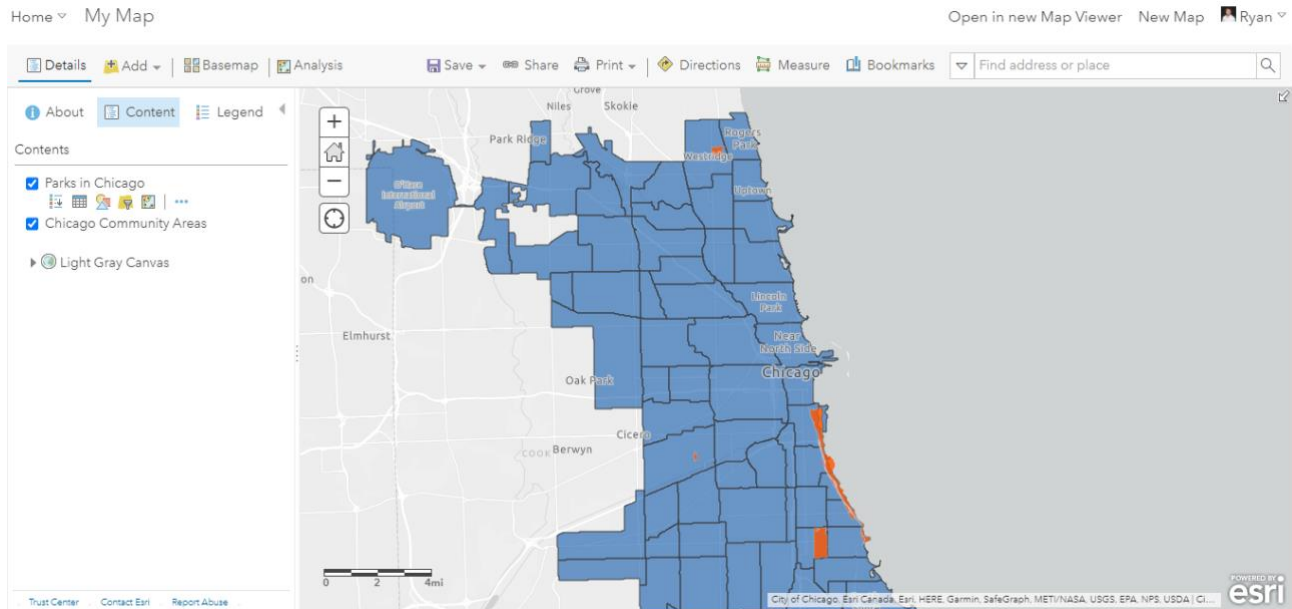
Practice adding, filtering, and displaying data by recreating the map below. Have your

teacher check you off before you proceed. *Hints: the selected parks displayed below have 10 or more basketball courts at the location.*

Assignment

Data Layers for use for this assignment include:

- *CHICAGO PARK FACILITIES (Found using #CHICAGO_GSS and Parks in*



AGO)

- *Parks in Chicago (Found using #CHICAGO_GSS and Parks in AGO)*

Tasks:

1. Find the location where you live in Chicago. Use and ADD a map note to mark this location.
2. Click on Analysis, choose the Use Proximity Toolset and Create Buffers to create a new layer that identifies all locations within .25 miles from your map note (your home)
3. Identify the number of parks with playgrounds that are within the .25 mile buffer.
4. Change the symbology of the parks with playgrounds to properly convey the location of parks with playgrounds on the map.
5. Save all work for continued use in future lessons.

FUTURE PROJECT

Work created during this lesson will be expanded upon in future lessons to produce a comprehensive analysis of Chicago Parks via the creation of an interactive storymap application.

Representing Data Using Geographic Information Systems (GIS)

Overview

This lesson will introduce you to the techniques involved with representing data using Geographic Information Systems (GIS). You will use Esri's arcgis.com ("AGO") online software to:

- **ADD** existing GIS data to make maps
- **change** the appearance of represented data based upon specific attributes
- **display** different attribute values with color, shape, and size
- **analyze** differences in data after using provided analysis tools

GIS Project Research Question –

WITH A PARTNER: Brainstorm answers to the following questions:

Research Question (RQ) Tasks
1. <i>What parks have you recently visited in Chicago? Do you know the names of the parks? What facilities are offered at these parks?</i>
2. <i>What issues or problems can occur in the parks you have visited? Have you observed any of these issues or problems at any of the parks?</i>

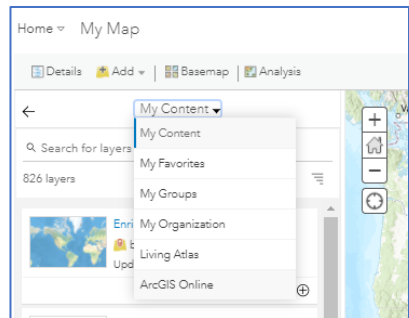
3. What are some improvements that could be done to the issues you listed and or have seen in the parks?

4. Are parks equally available in every part of Chicago?

5. Potential Research Question to investigate with GIS:

Data Available for Lesson

Go to ARCGIS.COM, click on MAP, then ADD from ArcGIS Online, & enter the search tags of **#CHICAGO_GSS & Parks** to find layers related to Parks in Chicago. (Image to the right)

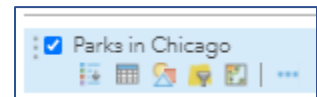


- Polygon layer of all city park boundaries
- Point layer of all park/park facilities in Chicago
- Polygon layer of Chicago Community Areas and the parks within each area

Filtering Data & Creating New Layers from Filtered Data

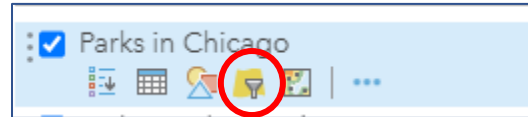
– Guided Practice

The **Parks in Chicago** layer includes several attributes, check the attribute table (*spreadsheet icon under layer*) that includes data about each park. Use this layer and the data to answer the following question:



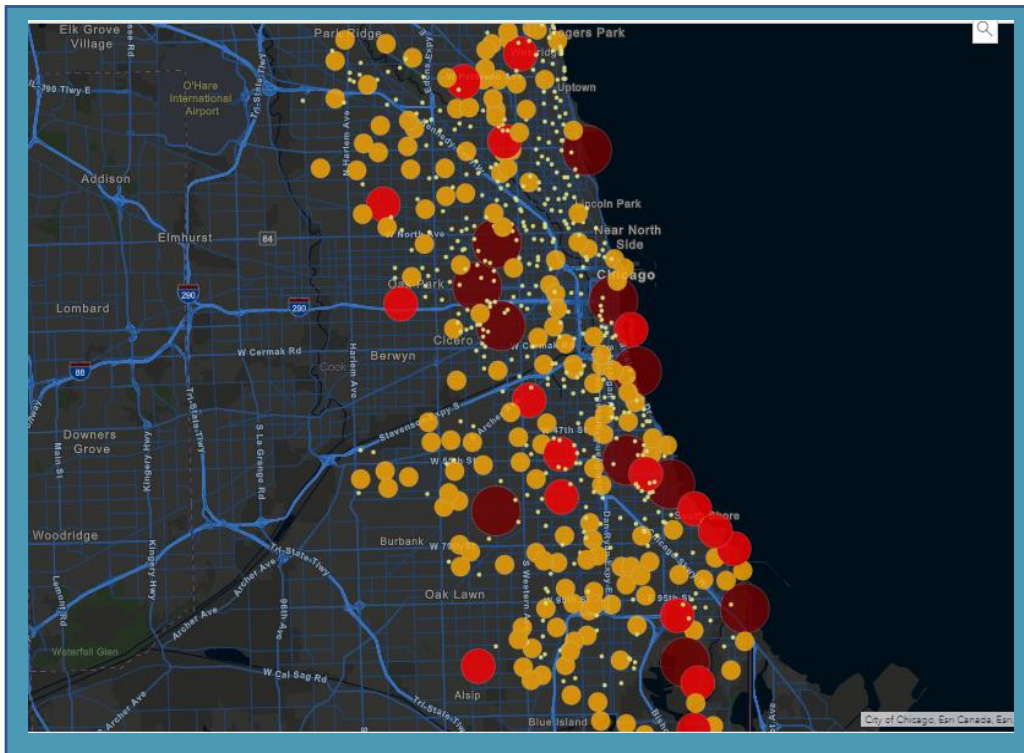
Question: How many Chicago City Public Parks have outdoor swimming pools?
Answer:

HINT with Options: Consider using the FILTER tool red circle in image to the right. Change the filtered point layer's symbology to a POOL symbol.



Using Symbology to Represent Attribute Differences – Guided Practice

Replicate the map below using the ***Parks in Chicago*** layer:



Hints: Use Acres as your changing styles attribute, classify the data with 4 manual breaks of 5, 50, and 150 acres and individually change the color of the 4 points.

Assignment – Access to Chicago Parks with Tennis Courts

Data Layers for potential use for this assignment include:

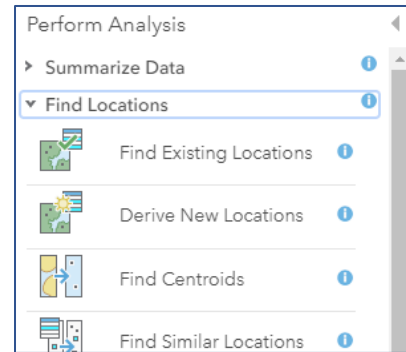
- *Parks in Chicago (Found using #CHICAGO_GSS and Parks in AGO)*

Directions:

1. Add the parks layer from ArcGIS Online to a map.

2. Filter the layer to display parks that have Tennis Courts. How many parks meet this criteria?

3. Create centroids of these filtered parks to generate a new layer. The tool is in the **Perform Analysis Toolkit** and in the **Find Locations** Toolset.
4. Using the **Use Proximity** Toolset and the **Create Drive Time Tool**, create a .25 mile walking distance around each of the 8 parks with Tennis Courts. *Walking Distance Definition:*



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3377942/>

Teacher Directed Assessments: *your instructor will tell you which option to move forward with for this lesson*

Items to Turn-In for Grading: Take your Webmap(s) made in AGO and share them to convert them into esri storymap applications. Select a storymap template that allows you to share your maps and analysis as well as your answers to questions in this lesson.

Include: ADD **Chicago Boundary** using #CHICAGO_GTT in ArcGIS Online. Use the enrichment tool (Analysis Tools) to determine the current population of the entire city within the boundary file. Use the enrichment tool to determine the total population within the walkable areas only.

Q1: What is the 2021 population of the entire City of Chicago?

Q2: What is the 2021 population of the areas in the city that are within 0.25 walkable miles of public parks with tennis courts?

Q3: What percent of the city population lives within 0.25 walkable miles of public parks with tennis courts?

Creating Maps Using Geographic Information Systems (GIS) *Instructional Guide*

Overview

This skill-building lesson is designed to introduce & reinforce to students, the concepts related to creating maps for analysis using Geographic Information Systems (GIS).

Esri's arcgis.com ("AGO") online software will be used to:

- **identify** and **ADD** existing GIS data to make maps
- **change** the look of features on a map, the symbology
- **create** map notes to display custom data
- **filter** and display specific data based upon an attribute

Students will work to develop a research question relative to data related to Chicago city parks, and trends in the data will be examined spatially across *an area selected by the student, this is referred to as **the defined geography***. Factors related to potential relationships will be investigated during this lesson, as well as the accompanying next three lessons.

OPTION: based upon class size and available devices, make this an individual or group assignment.

GIS Data Types – Recommended Group Activity

Spatial data is data related to the location (relative to a situation) of an object in both TIME & SPACE and represented on a map. **Attribute data** is qualitative and or quantitative variables that relate to features on a map, are about a feature in a location but not related to locating that feature. Direct students to think of the parks they've seen and visited around Chicago. Provide an opportunity for students to list examples relative to various parks visited with respective spatial and attribute data

Data Type	Examples
Spatial Data	
Attribute Data	

Defining “Your” Geography

GIS analysis requires the user to define a specific geography (a location) from which they will examine and analyze data. In this lesson the focus will be with Chicago park data. Example questions to consider as students are directed to define your geography include:

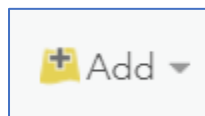
- *How many parks will you focus upon?*
- *Are the locations of the parks in a certain part of Chicago, or are they across the entire city?*
- *What factors will influence your decision to focus upon specific parks?*

Developing a Potential Research Question - Recommended Group Activity

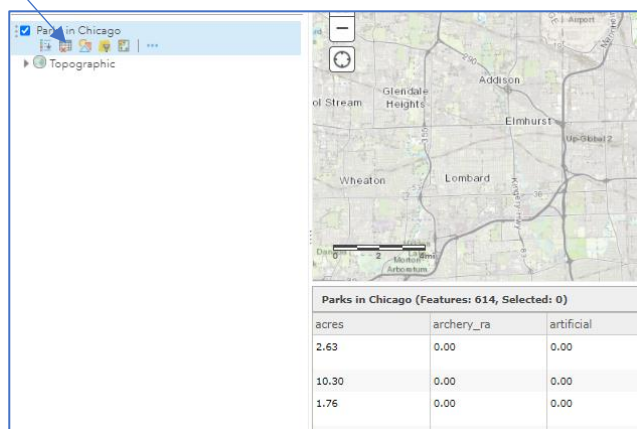
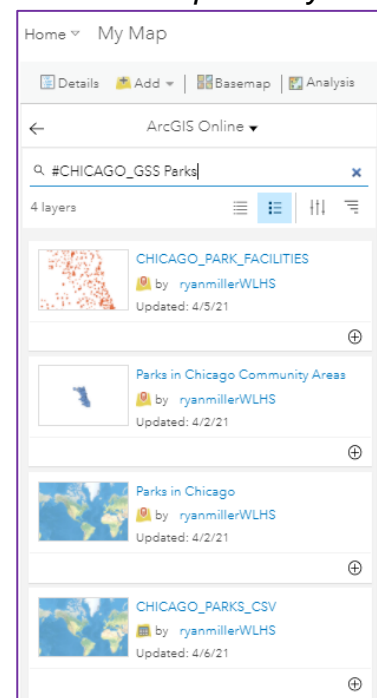
Have students note differences about parks across the City of Chicago. What are some specific characteristics that vary with parks they have visited across the city? More importantly, how could they use GIS to study existing surrounding parks to improve the community? Allow students an opportunity to develop a specific RESEARCH QUESTION (RQ), with focus and purpose, that examines current park conditions or issues in Chicago. Use data and GIS to dive into your question with the hope of finding solutions to potential problems/issues over these next several lessons.

Getting Chicago Park GIS Data

Data already exists in the ArcGIS Online that is related to Chicago City Parks.



Search for the *Parks in Chicago* layer by accessing and searching ArcGIS with the tags: **#CHICAGO_GSS** and **Parks** (example to the right). Park facilities, locations, and park attribute data is available, click on the spreadsheet icon under the layer to access the attribute table and subsequent attribute data. This data may assist with the development of the student’s RQ.



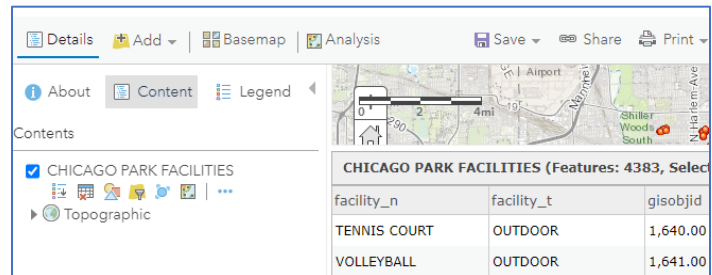
Creating Maps

Adding Data: After reviewing the attribute data associated with the *Parks in Chicago* layer, have students explore the options available to change the **symbology** of the various parks in the city as well as filter out and show specific parks based upon an attribute selected.

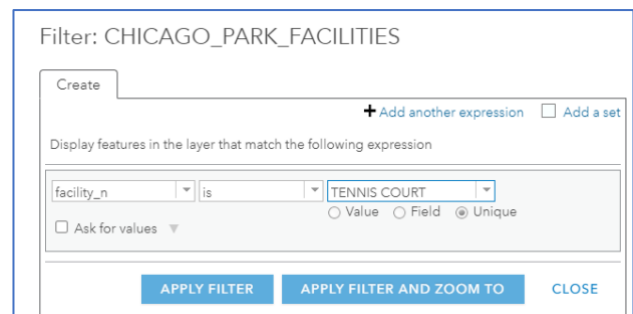


The change style icon, accessible when clicking on an individual layer in contents, allows the user to change the appearance of any layer displayed on the map. Under prompt 1, options are available to show the location of the parks only or to use an attribute for display. Then prompt 2 provides the options for changing the look of the symbols representing each layer.

Adding Map Notes: Map Notes are a way to customize items added to a map by inserting points, drawing lines, or drawing polygons onto a map. They are accessed by clicking the ADD Button and choosing the last selection (Map Notes). Map notes can be named accordingly, and the type of map note (point, line, polygon) can be selected. The symbology of each map note can be modified by following the provided AGO prompts.



Filtering Data: Within a large dataset, students may need to display only certain types of a feature. Using the filter tool will allow for a select amount of data to display. For an example and using the existing Chicago Park Facilities layer from ArcGIS Online, you can see that some parks have tennis courts, some do not.



Example: Setting the filter to look for parks that have tennis courts will only display these selected facilities. 536 out of 4,383 parks in the City of Chicago have tennis courts and are now exclusively displayed on the map.

Assignment

Data Layers for potential use for this assignment include:

- *CHICAGO PARK FACILITIES (Found using #CHICAGO_GSS and Parks in AGO)*
- *Parks in Chicago (Found using #CHICAGO_GSS and Parks in AGO)*

Student Tasks:

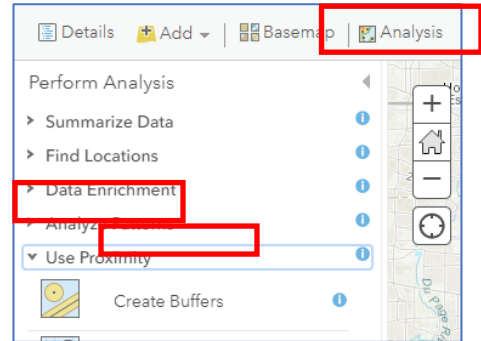
1. Find the location they live in Chicago. Use and ADD a map note to mark this location.
2. Click on Analysis, choose the Use Proximity Toolset and Create Buffers to create a

2. (Cont.) new layer that identifies all locations within .25 miles from your map note representing where each student lives.

3. Students will identify the number of parks with playgrounds that are within the .25 mile buffer.

4. Change the symbology of the parks with playgrounds to properly convey the location of parks with playgrounds on the map.

5. Save all work for continued use in future lessons.



Formative Assessment

Saved relative to the assignment above can be printed and or presented to the entire class.

Summative Assessment

All student work created during this lesson will be expanded upon in future lessons to produce a comprehensive analysis via the production of Storymap Application in AGO.

Representing Data Using Geographic Information Systems (GIS) Instructional Guide

Overview

This skill-building lesson is designed to introduce & reinforce the various methods used to represent data using Geographic Information Systems (GIS). Students will work with Esri's arcgis.com ("AGO") online software to:

- **ADD** existing GIS data to make maps
- **change** the appearance of represented data based upon specific attributes
- **display** different attribute values with color, shape, and size
- **analyze** differences in data after using provided analysis tools

Based upon lesson 1, the *introduction to GIS*, students have established (or at least brainstormed) potential **research questions** that guide a GIS investigation related to parks across the City of Chicago. A **defined geography** should have been established that set parameters on the specific locations that their analysis will cover.

OPTION: based upon class size and available devices, make this an individual or group assignment.

GIS Project Research Question –

WITH A PARTNER: Brainstorm answers to the following questions:

Research Question (RQ) Tasks

1. What parks have you recently visited in Chicago? Do you know the names of the parks? What facilities are offered at these parks?

2. *What issues or problems can occur in the parks you have visited? Have you observed any of these issues or problems at any of the parks?*

3. *What are some improvements that could be done to the issues you listed and or have seen in the parks?*

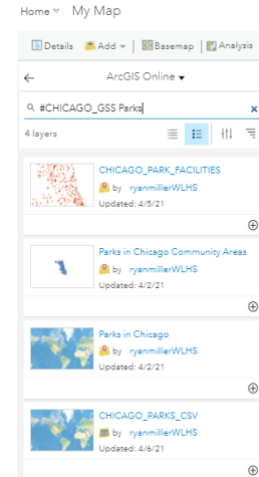
4. *Are parks equally available in every part of Chicago?*

5. ***Potential Research Question to investigate with GIS:***


Data Available for Project

Within the ArcGIS Online database (image to the right) you will find several mappable features focusing upon parks in the City of Chicago, the search tags of **#CHICAGO_GSS & Parks** will identify layers representing:

- *Polygon layer of all city park boundaries*
- *Point layer of all park/park facilities in Chicago*
- *Polygon layer of Chicago Community Areas and the parks within each area*

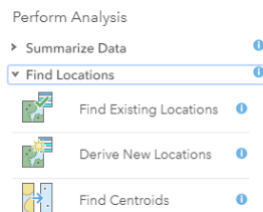


Filtering Data & Creating New Layers from Filtered Data

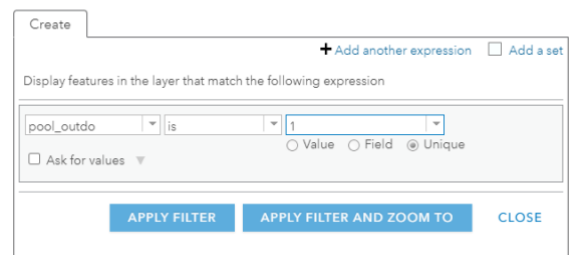
The **Parks in Chicago** layer includes several attributes that detail the type of park and the facilities available at each park in the city. Click on the layer and hit the filter icon  button.

In the example below, the parks with outdoor pools are filtered displaying only parks with this feature. Note: the category **pool_outdo**, is, **1** using **unique** as the attribute type. Clicking on the **Analysis Button**, choose the **Find Locations** Section and select the **Find Centroids** tool.

This will take **ONLY** the filtered parks with pools that are displayed and turn them into an individual layer of parks with pools. 50 parks are then filtered out and represented in this new layer.



Filter: Parks in Chicago



Creating Unique Symbols

The change style icon can now be used to adjust the symbology of the park locations points representing pools. Several options exist to represent pool locations (as seen in the legend in the associated map in this section). *Note: any attributes within the Parks in Chicago Layer can be filtered out and singularly displayed using unique symbology. Explore other features or assign students types of features based upon their preferences for map creation.*

Using Symbology to Represent Attribute Differences

The change style icon, accessible when clicking on an individual layer in contents, allows the user to change the appearance of any layer displayed on the map.

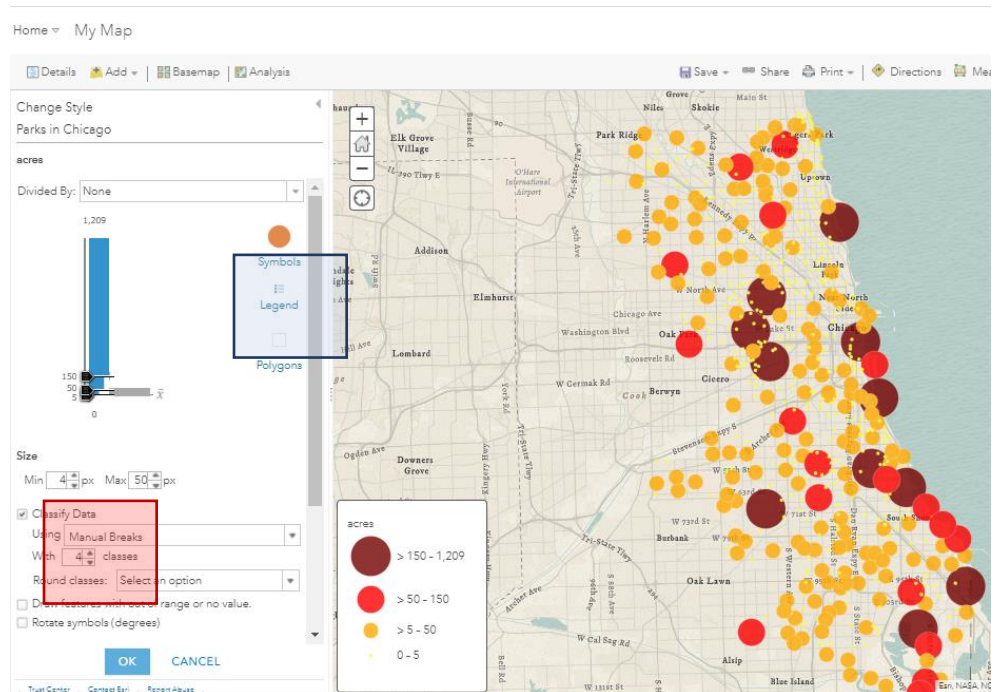
The **Parks in Chicago** layer, in the map above, has been modified with the options available in the layer's **Change Styles**. The attribute **acres** was chosen in prompt 1 and Counts and Amounts was selected. *Note in the image above that Classify Data was selected as well, using manual breaks with 4 classes set.*

Park sizes of 5, 50 and 150 acres were manually entered by clicking on the numbers left of the side scale (*red highlighted area*). The individual symbol colors were changed by clicking on the work Legend (*blue highlighted area*) and then clicking on each individual point and manually changing the color. *Note: most symbology can be changed to meet the needs of the user, the map above is demonstrating park size using color and point size.*

Assignment – Access to Chicago Parks with Tennis Courts

Data Layers for potential use for this assignment include:

- *Parks in Chicago (Found using*



#CHICAGO_GSS and Parks in AGO)

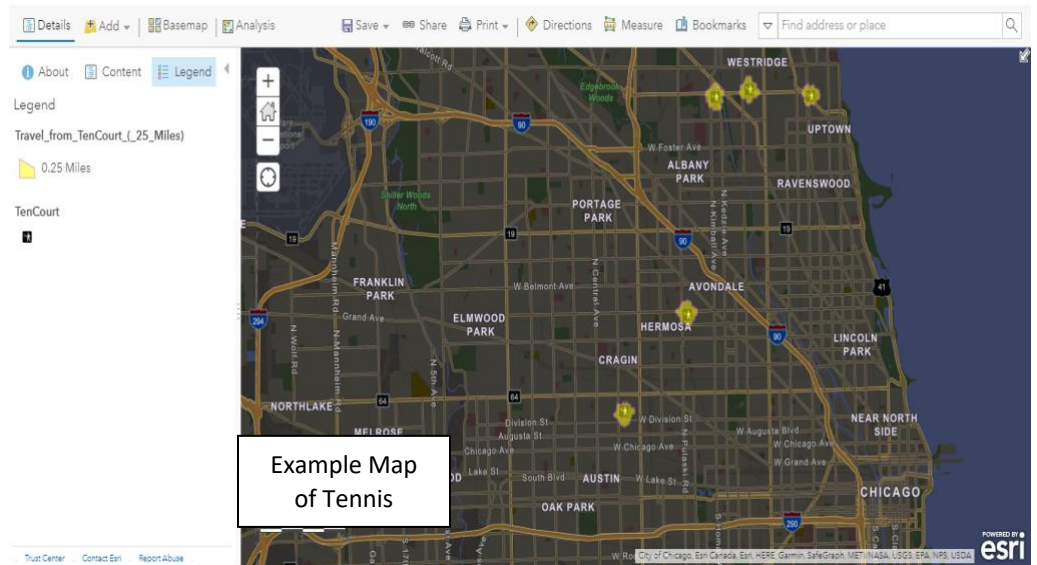
Student Tasks:

1. Add the parks layer from ArcGIS Online to a map.
2. Filter the layer to display parks that have Tennis Courts. (*Teacher note: there are 8 parks*).
3. Create centroids of these 8 parks to generate a new layer.

4. Using the **Use Proximity** Toolset and the **Create Drive Time Tool**, create a .25 mile walking distance around each of the 8 parks with Tennis Courts. *Walking Distance Definition:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3377942/>

5. A new layer that identifies all locations within a .25 mile walk from each park with tennis courts is created.

6. Save all work for continued use in future lessons.



Formative Assessment

Saved work, relative to the assignment above, can be printed and or presented to the entire class by students or student groups.

SUMMATIVE ASSESSMENT:

Teacher Directed Assessments: (from student facing lesson):

Items to Turn-In for Grading: Take your Webmap(s) made in AGO and share them to convert them into esri storymap applications. Select a storymap template that allows you to share your maps and analysis as well as your answers to questions in this lesson.

Include: ADD **Chicago_Boundary** using #CHICAGO_GTT in ArcGIS Online. Use the enrichment tool (Analysis Tools) to determine the current population of the entire city within the boundary file. Use the enrichment tool to determine the total population within the walkable areas only.

Option 2: Have students search for and ADD **Chicago_Boundary** using #CHICAGO_GTT in ArcGIS Online. They can use the data enrichment (Analysis Tools) to determine the current population of the entire City. Have the students

Chicago Geospatial Semester Project

then run the same population enrichment with the .25 mile walk polygon layer.

They can calculate the number of people with walkable access to public park tennis courts that live in Chicago. (*Hint: 0.675% of the population of Chicago lives within walking distance of a park with public tennis courts.*) Data to answer this query can be found by opening the attribute table of the enriched layers that were

created, finding the columns that contain the enriched data, clicking on the column heading and selecting "Statistics." Column totals will be presented.



1	0.00
1	0.00

Analyzing Data Using Geographic Information Systems (GIS) - Instructional Guide

Overview

This skill-building lesson is designed to introduce & reinforce the various methods used to analyze data using Geographic Information Systems (GIS). Students will work with Esri's arcgis.com ("AGO") online software to:

- **classify** data using various classification schemes
- **add** additional reference data to assist in analysis work
- **deploy** specific GIS analysis tools to examine a topic
- **identify & interpret** spatial patterns and relationships in displayed data

During, the *first two lessons in this grouping*, students have established **research questions** that specifically guide a GIS investigation related to parks across the City of Chicago. **Defined geographies** have been established that set parameters on the specific locations that their analyses will cover.

OPTION: based upon class size and available devices, the following can be completed as an individual or group assignment.

DATA ANALYSIS OPTIONS

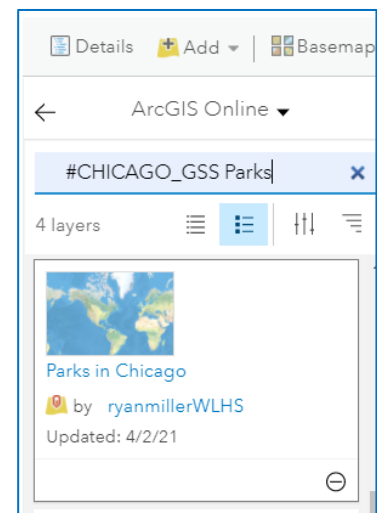
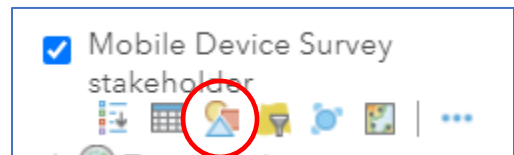
CHANGING STYLES (SYMBOLOLOGY) Option

Data analysis using Arcgis.com ("AGO") can be done using attribute data (*the data "behind" the data visible on the map*) and by changing the physical look of any points, lines, and or polygons displayed on any map.

The *change style icon* (red circle in the image to the right), provides the user all options to change the display of any map features based upon attribute data associated with said features.

Data associated with this lesson is already in the AGO system and has been used in previous lessons. ADD, from ArcGIS Online, the **Parks in Chicago** layer as seen in the image to the right.

Mouse over the layer in the contents section of your webmap, open the attribute table and review the various attribute data associated with each polygon displayed with this feature. Emphasize to students the need to review what data you have available BEFORE starting the analysis process.



Proceed to the change style icon and follow the provided **numeric prompts** starting with #1.

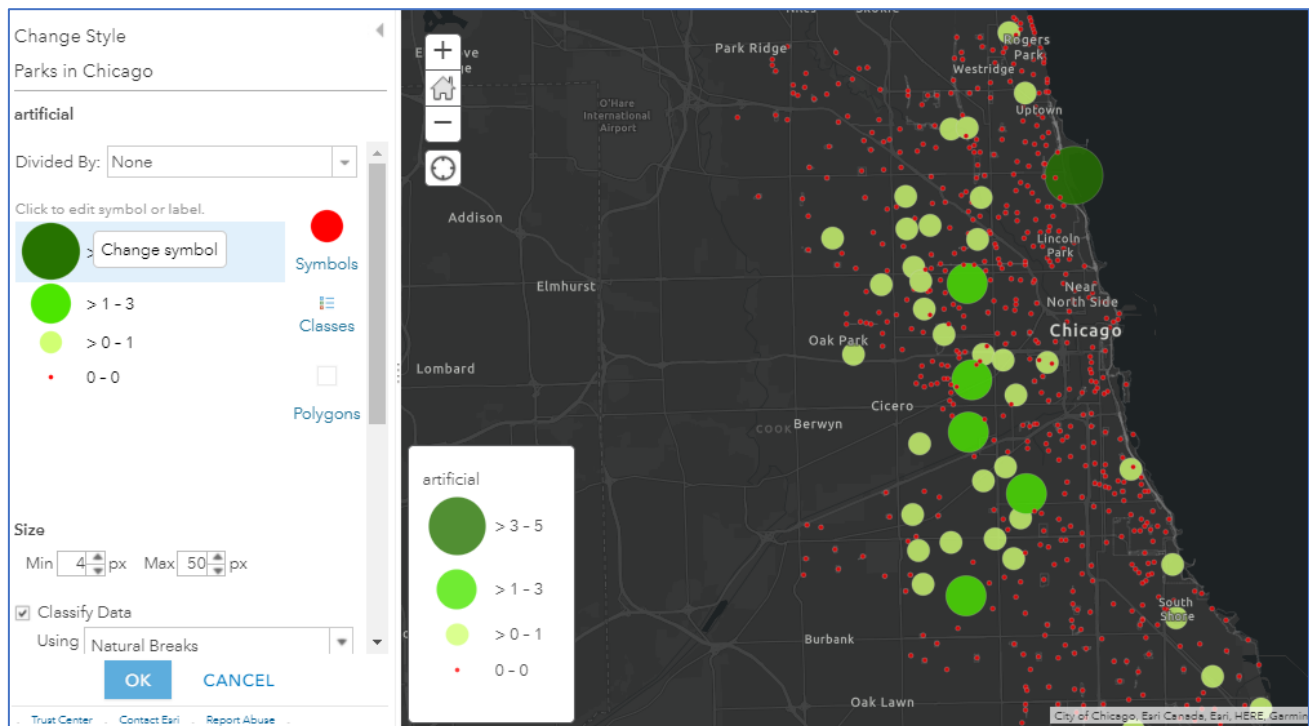
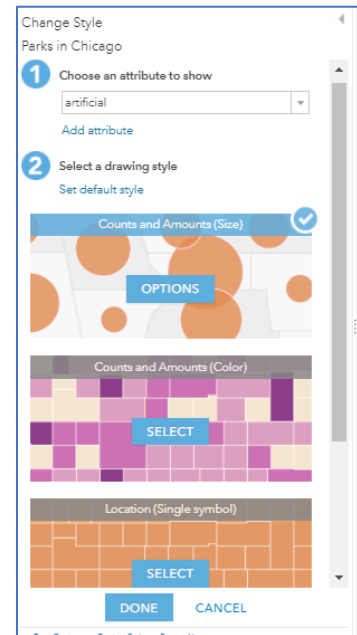
Feel free to use any attribute for instructional purposes, the attribute chosen to display in this lesson will be “**artificial.**” These are parks in Chicago that have artificial turfgrass facilities on premises. 1 = 1 artificial field.

Data analysis using the change style methods involve

1. Determining the attribute to examine (STEP 1)
2. Setting the “drawing style” (STEP 2)
3. Working with the “OPTIONS” after a style has been chosen (STEP 3).

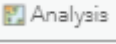
When using the options available to display data, be mindful of spatial considerations related to the type of data you are working with: *Are you using points, lines or polygons?*

Modifying the look of your spatial data will allow for GIS data analysis, an example in the map below. Symbols, representing parks, were changed using SIZE and COLOR of the symbology to represent the number of artificial fields at various parks across Chicago. The colors, size, shape, number of classes, type of data classification, can all be adjusted according to the interests of the GIS user. *In the example below, the larger and darker green points are parks with more artificial athletic fields.*

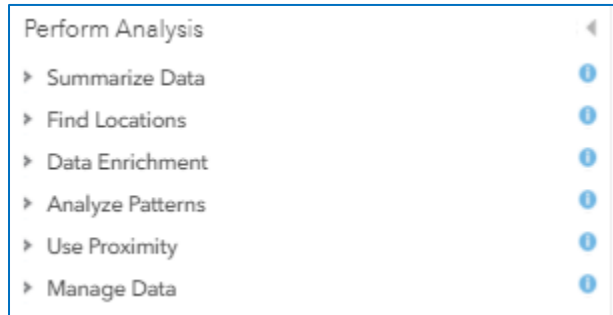


Any attributes associated with your layer can be displayed based upon the parameters set by the user. This is one means of AGO data analysis.

PERFORM ANALYSIS TOOLS Option

ArcGIS Online has a suite of analysis tools available to examine data as well. These tools are accessed through clicking on the “Perform Analysis” icon that is provided under each layer (where it can be done) or by clicking on the icon  that is adjacent to the Basemap Tool.

Six Options of Analysis tools are provided with several tools available under each option. These are displayed to the right.

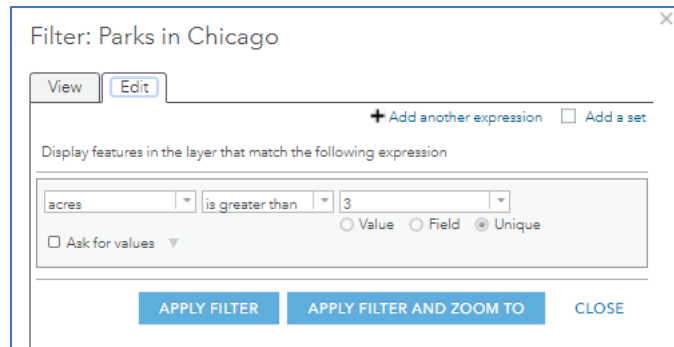


GIS analysis using these individual tools depends upon the needs of the user and the goals of the specific project. This lesson will use analysis tools from the **Use Proximity**

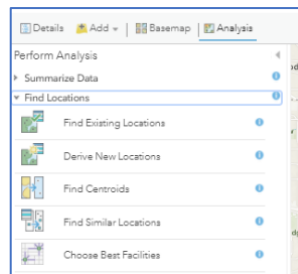
toolset, the **Analyze Patterns** toolset, the **Find Locations** toolset and the **Data Enrichment** toolset. There are many other possible analysis tools to use and explore.

Pose this Question to the Class: *What percentage of the population of Chicago is within a 10-minute walk of a park that is 3 acres or more?* Iterations of other questions can be deployed as well.

Start by using the **Parks in Chicago** layer added to a webmap from ArcGIS Online. **FILTER** the parks by size and chose to filter parks that are greater than 3 acres in size (this will give you 252 parks out of 614 parks).

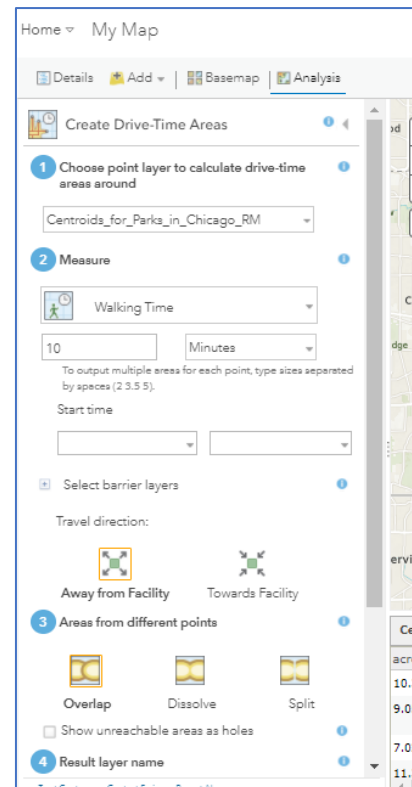


With the data filtered, visit **ANALYSIS TOOLS**, click on the **Find Locations Toolset** and chose the **Find Centroids** Tool. Follow



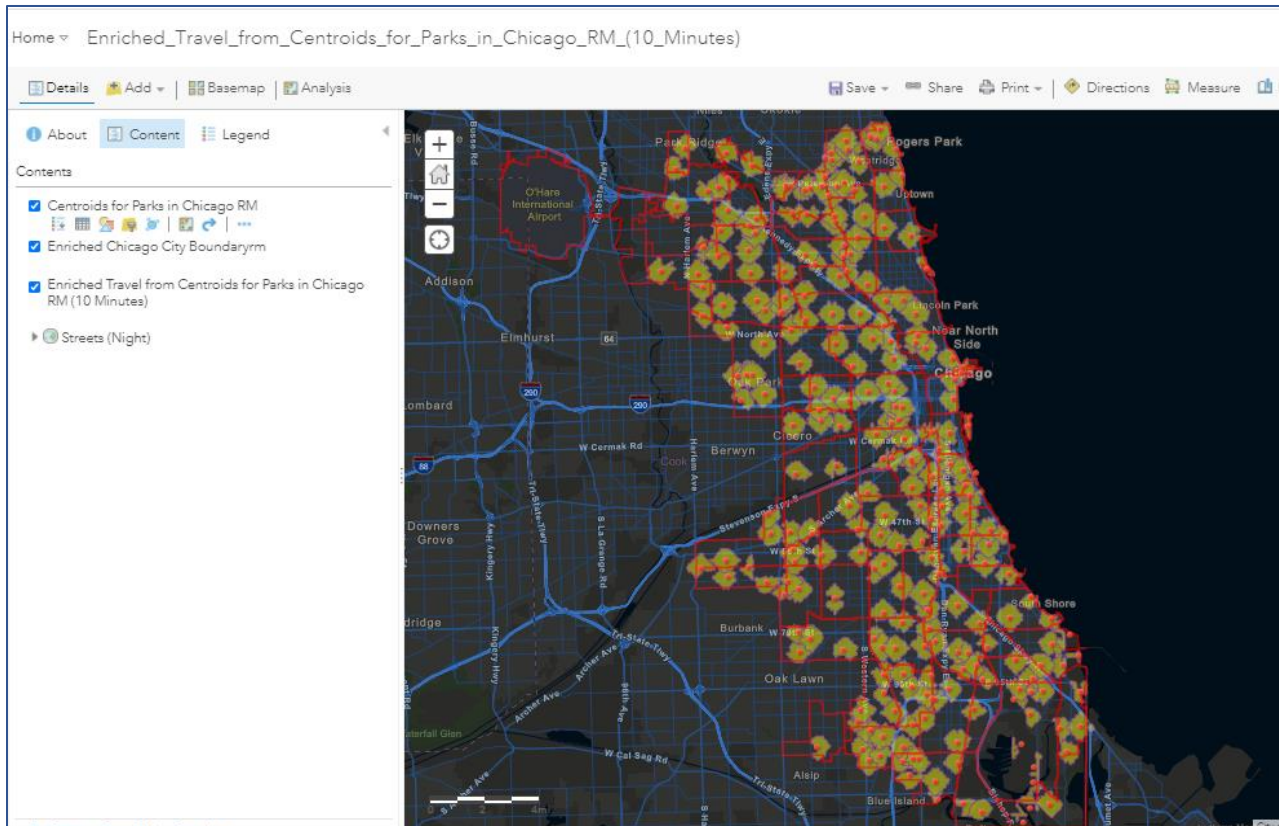
the numeric prompts and make sure to give the feature you are creating a Unique Name (use initials as an example) and make sure to uncheck the “Use Current Map Extent” button. This tool will take all parks that are displayed (and being filtered) and convert them to points from their original polygon look.

Then use the **Create Drive-Time Areas Tool** (from the Use Proximity Toolset) to create a new feature that determines the locations that are within a 10-minute walk of each filtered park point. *You will run this tool on the centroid points created above.*



Once the polygon file representing areas in Chicago within a 10-minute walk of parks that are 3 acres or bigger is generated, click on the **Data Enrichment Tool** to enrich the layer with Population Data (*follow data enrichment prompts for using population data*). The number of people in Chicago that live in this selected area will then be determined with the number provided in the attribute table of the newly generated enriched feature.

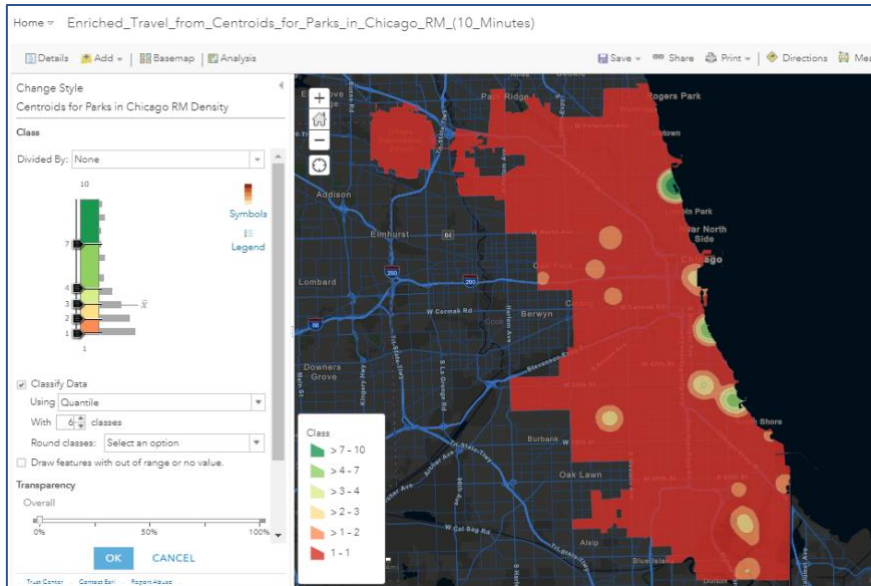
Search ArcGIS Online for a polygon file representing the entire City of Chicago and enrich that polygon with population data too. Examine the attribute table of this generated feature for the population of the entire city.



The results of the enrichments should approximately indicate that within the locations in Chicago that are a 10-minute walk from parks that are 3 acres or bigger, 1,671,474 people reside. Comparing that population total with the enriched total population of the entire City of Chicago at 2,713,105 shows that **61.6% of the population of Chicago lives within a 10-minute walk of parks that are 3 acres in size or bigger.**

An alternative analysis tool for consideration comes from the **Analyze Patterns** toolset. Several of the tools within this toolset are designed to provide analyses of points and attributes of points that are displayed on a map.

Using the **Calculate Density** tool, a density map of the centroid points of the parks, generated in earlier steps in this lesson, will be created. Parameters were adjusted in the initial analysis to include a Count Field and a boundary of where the analysis will be conducted. The size of the parks is used in the example to the right (step 2) and the boundary of the analysis was set to the entire City of Chicago.



In the image above, post the density analysis, you can further adjust the symbology and display of the density output to examine the density of parks (or any data you are looking at). The density map above is showing where the highest density of sizable city parks in green. Other analysis, using similar methodology, is provided in the AGO system.

Assignment – Dog Parks and Income in Chicago

Data Layers for potential use for this assignment include:

- *Parks in Chicago (Found using #CHICAGO_GSS and Parks in AGO)*
- *Chicago Community Areas*

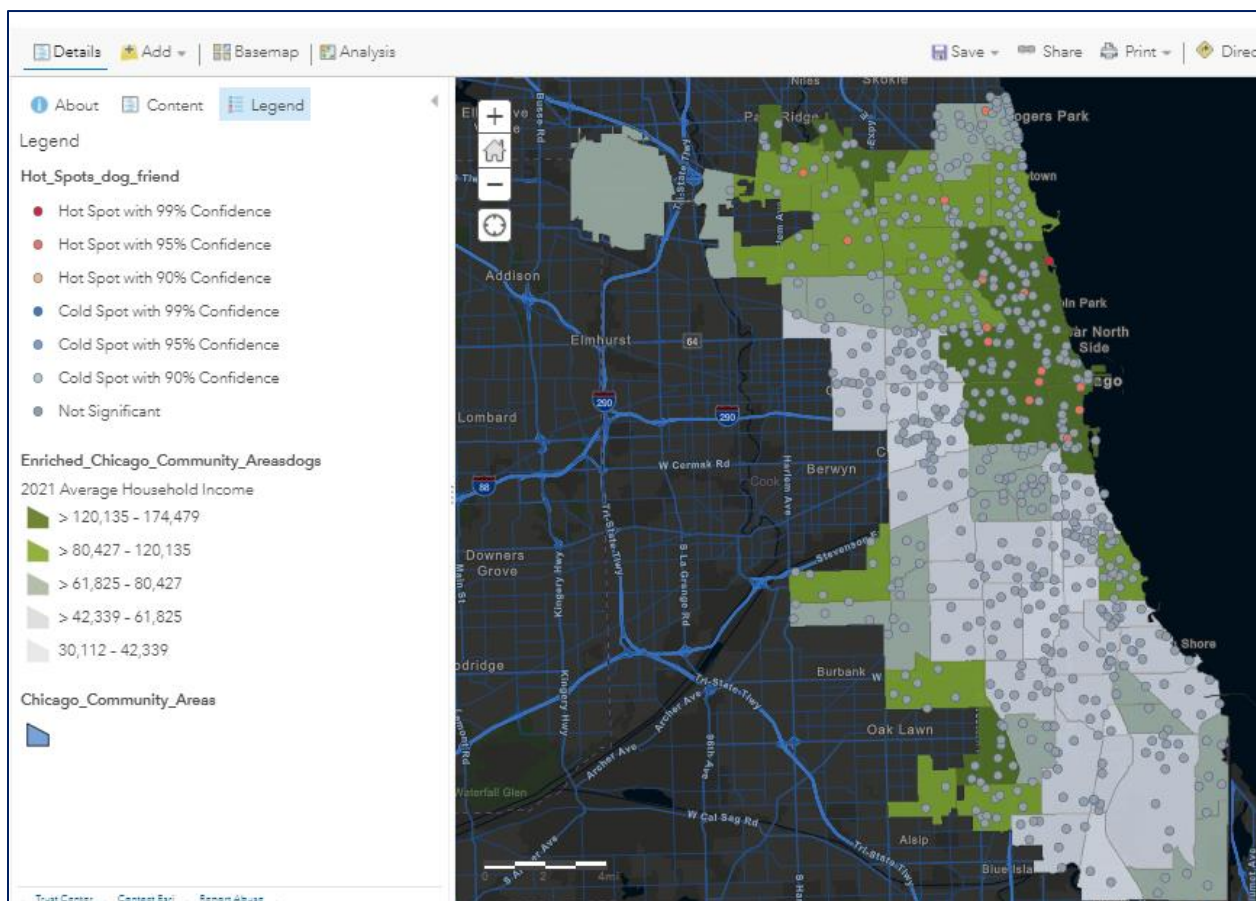
Research Question: Do the income levels of Chicago Community Area residents relate to the location of dog parks in Chicago City Parks?

Student Tasks:

1. Add the parks layer and community areas layer from ArcGIS Online to a map.
2. Create centroids of all parks to generate a new point layer of all parks.
3. From the Analyze Patterns toolset, run the Hot Spot Analysis Tool on the park centroids, specifically to **Find Clusters** of dog friendly parks (step 2)

The Hot Spot Analysis Tool uses statistics to look at the position of all parks in the city, with an emphasis on the parks that are dog friendly. The tool uses statistics to determine if the location of dog friendly parks is simply random or if there is SOME variable that discriminately influenced the location of the dog friendly parks in the city. The tool does NOT identify the variable of influence, it simply indicates if the influence is present. (it is)

4. Enrich the Chicago Community Area polygons with income data (*this can be specified or students can choose*). Analysis tools in the Change Style options can be deployed to create a choropleth map of community areas using color to show income level differences in the various areas.
5. An example analysis of dog friend parks (via hot spots) and community level income is below:



6. Save all work for continued use in future lessons.

Formative Assessment

Saved work, relative to the assignment above, can be printed and or presented to the entire class by students or student groups.

Summative Assessment

Option: All student work created during this lesson will be expanded upon in future lessons to produce a comprehensive analysis via the production of a Storymap Application in AGO.

Analyzing Data Using Geographic Information Systems (GIS)

Overview

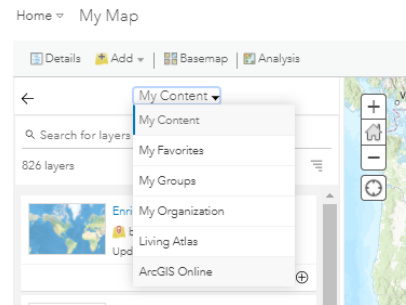
This lesson is designed to introduce you to data analysis using Geographic Information Systems (GIS). You will use ArcGIS Online to:

- **classify** data using various classification schemes
- **add** additional reference data to assist in analysis work
- **deploy** specific GIS analysis tools to examine a topic
- **identify & interpret** spatial patterns and relationships in displayed data

Lesson Data

Within the ArcGIS Online database (image to the right) you will find several data layers related to parks in the City of Chicago. You can use search tags **#CHICAGO_GSS** & or **Parks** to locate the following layers:

- *Polygon layer of all city park boundaries*
- *Polygon layer of Chicago Community Areas*



Guided Practice

Next, you will do a few guided activities to learn the techniques you will need to use in your research project, including changing styles,

Change Style Options

The **Parks in Chicago** layer describes the type of park and the facilities available at each park in the city. Use this layer to answer the following question:

Question: Are parks with artificial fields equally accessible to all residents across the City of Chicago?

Answer:

Directions: 1. ADD the parks layer.

2. Create a centroid feature representing each park

3. Use the artificial attribute to determine the location of parks with this feature

4. Represent the differences in parks with artificial fields by changing the size and color symbology of the parks

Analysis Tools

Research Question (RQ): What percentage of the population of Chicago is within a 10-minute walk of a park that is 3 acres or more? Iterations of other questions can be deployed as well.

Answer:

Suggested analysis tools:

- **FILTER** the parks by size, choose parks that are greater than 3 acres in size
- **Find Locations Toolset** and use **Find Centroids** (for the parks)
- **Use Proximity Toolset** and use **Create Drive-Time Areas Tool** around the parks
- **Data Enrichment Tool** for population data

Dog Parks and Income in Chicago

You will need the following layers for this activity:

- *Parks in Chicago (Search #CHICAGO_GSS and Parks in AGO)*
- *Chicago Community Areas*

Research Question: Does the income level of Chicago Community Area residents relate to the location of dog parks in Chicago City Parks?

Directions:

1. Add the parks layer and community areas layer from ArcGIS Online to a map.
2. Create centroids of all parks to generate a new point layer of all parks.
3. From the Analyze Patterns toolset, run the Hot Spot Analysis Tool on the park centroids, specifically to **Find Clusters** of dog friendly parks (step 2)

Hot Spot Analysis Tool uses statistics to look at the position of all parks in the city, with an emphasis on the parks that are dog friendly. The tool uses statistics to determine if the location of dog friendly parks is simply random or if there is SOME variable that discriminately influenced the location of the dog friendly parks in the city. The tool does NOT identify the variable of influence, it simply indicates if the influence is present. (it is)

4. Enrich the Chicago Community Area polygons with income data. Then analyze data using the Change Style options to create a choropleth map of community areas using color to show income level differences in the various areas.

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5. Save all work for future maps, share maps, and create a storymap to showcase your answers to the RQ.

Exploring Layers & Relationships

Using Geographic Information Systems (GIS)

Overview

You will explore how map layers and accompanying attribute data can be looked at for potential relationships between variables. Geographic Information Systems (GIS) will be used for this exercise. Esri's arcgis.com ("AGO") online software will be used to:

- **examine** attribute data relative to the City of Chicago
- **display** attribute data
- **analyze** potential relationships between variables
- **identify & interpret** spatial patterns and relationships in displayed data

OPENING ACTIVITY – In your class journal, briefly write about the experiences you have had (or not had) with air pollution. Read the article distributed by your teacher.

ADDING DATA & EXAMINING ATTRIBUTE DATA

Log-in to AGO. Visit Map and "Add" (searching for and using ArcGIS Online) the CHICAGO_AIR_QUALITY layer. Search parameters to find this layer are "**#CHICAGO_GSS**" and "**Quality**"

The **Tree_AQI** layer, as seen in the image to the right, should be added to the map.

Mouse over the layer in the contents section of your webmap, open the attribute table (**RED** Circle)

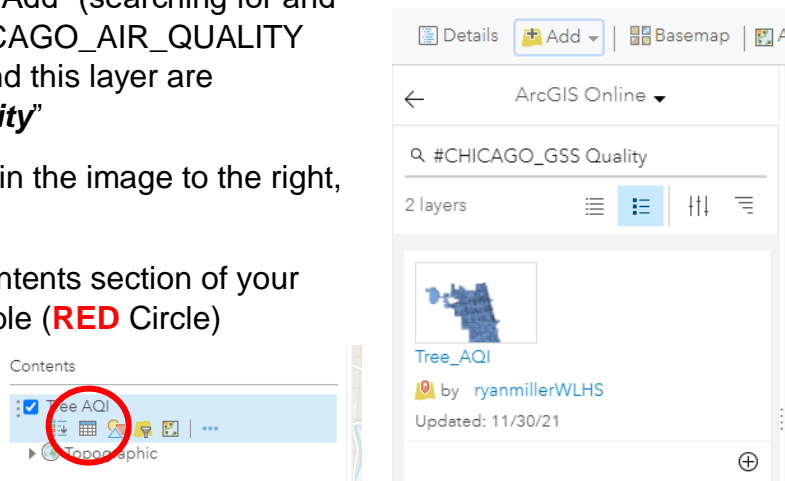
and review the various attribute data associated with each polygon displayed with this feature. Emphasize

to students the need to review what data you have available **BEFORE** starting the analysis process.

Several attribute data, by US Census Block Group (the polygons displayed), are available for analysis with this layer. Notably, **AQI_INDEX** (measured 2020 air quality index data from the *US EPA*) and the **CANOPY_PER**, the measured percentage of tree canopy from the *Chicago Regional Trees Initiative 2020 Tree Census*) can be used for this activity.

Visit <https://www.airnow.gov/aqi/aqi-basics/> for information on the EPA's air quality index (AQI).

Tree Census Data: https://mortonarb.org/app/uploads/2021/05/2020-Chicago-Region-Tree-Census-Report_FIN.pdf

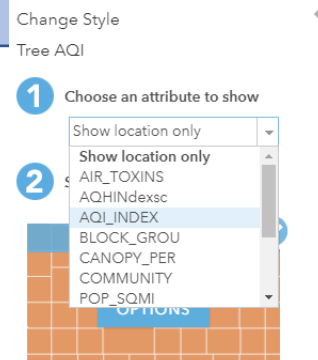


DISPLAYING ATTRIBUTE DATA

As it was done in previous lessons, the CHANGE STYLE icon can be used to display differences in attribute data using COLOR, SHAPE, & SIZE of various icons on the map.

ACTIVITY: use the blank map of the City of Chicago, provided in class, to annotate the location of school, and to try and show the locations in the city where there is more tree canopy (based upon past experiences traveling around the city).

1. Examine differences in data related to AQI_INDEX, CANOPY_PER, and POPULATION (STEP 1)
2. Set the “drawing style” (STEP 2)
3. Work with the “OPTIONS” after a style has been chosen (STEP 3).

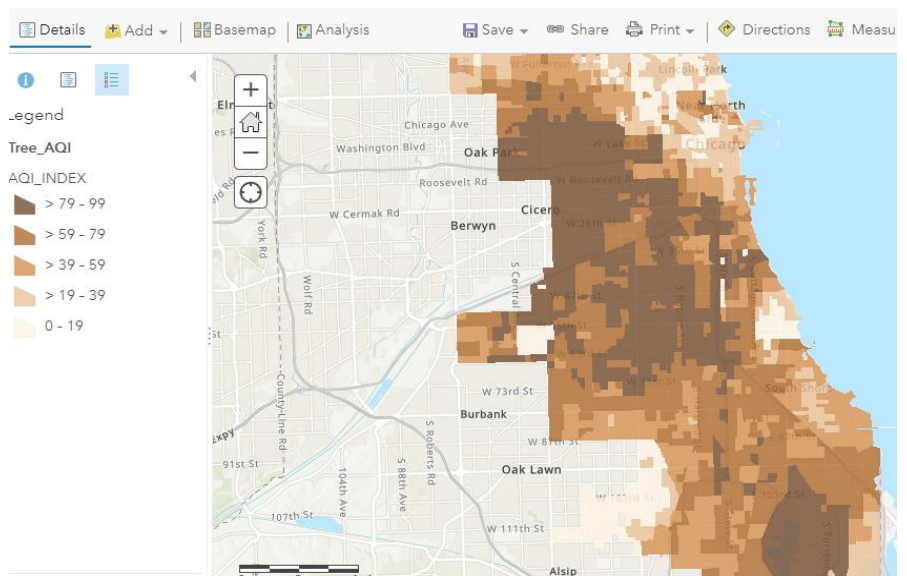


Important: When using the options available to display data, be mindful of spatial considerations related to the type of data you are working with: *Are you using points, lines or polygons?*

Modifying the look of your spatial data will allow for GIS data analysis, an example in the map below. AQI is displayed with color by US Census Block Groups. Optional: change the classification scheme of the data. Investigate and report back the differences in how the data is displayed when natural breaks is compared to equal interval or quantile, etc.

COPYING LAYERS for COMPARISON PURPOSES

ArcGIS Online provides an option to copy any layer. The Tree AQI layer can be copied and the resulting copied layer can then be used to show a different attribute within the same geography. The maps to the right are displaying the original layer and the copied layer. Tree Canopy percentages are displayed on top of the AQI data.



Question: *Are there specific (identified) locations in Chicago where differences in air quality have differences in the amount of tree canopy?*

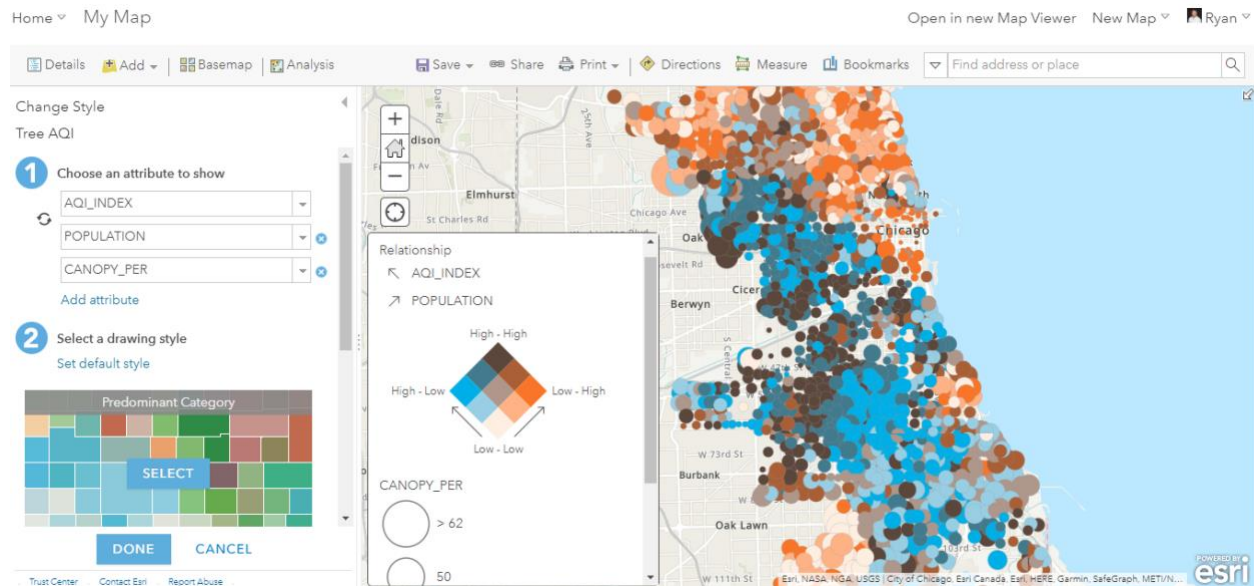
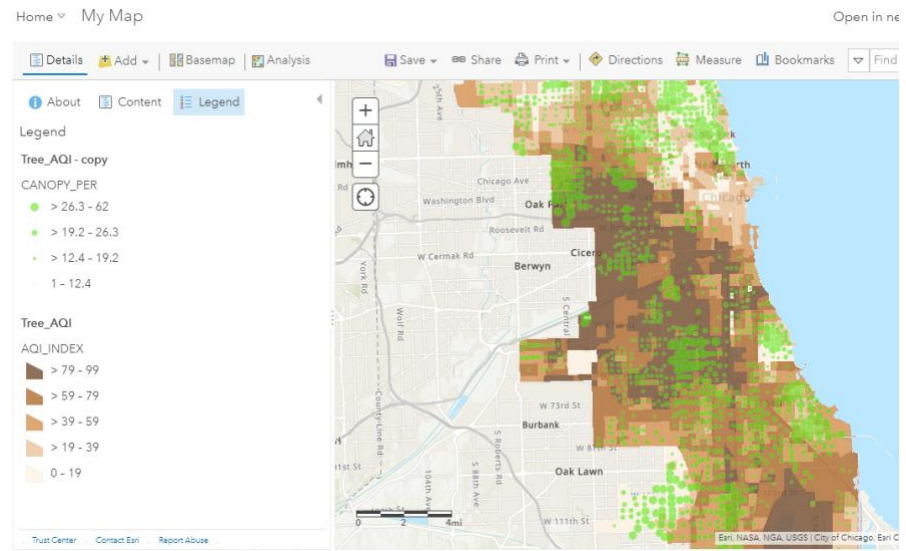
ANALYZING RELATIONSHIPS BETWEEN VARIABLES

The procedure of copying a layer is one way to compare attribute data to look for

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potential relationships between layers and or data. The procedure above can be reversed with the polygons switched to the points, OR multiple variables can be displayed simultaneously OR other attributes can be introduced into the analysis as well.

Multiple variables can be displayed at the same by adding attributes at the



initial stage of Changing Styles (RED oval below).

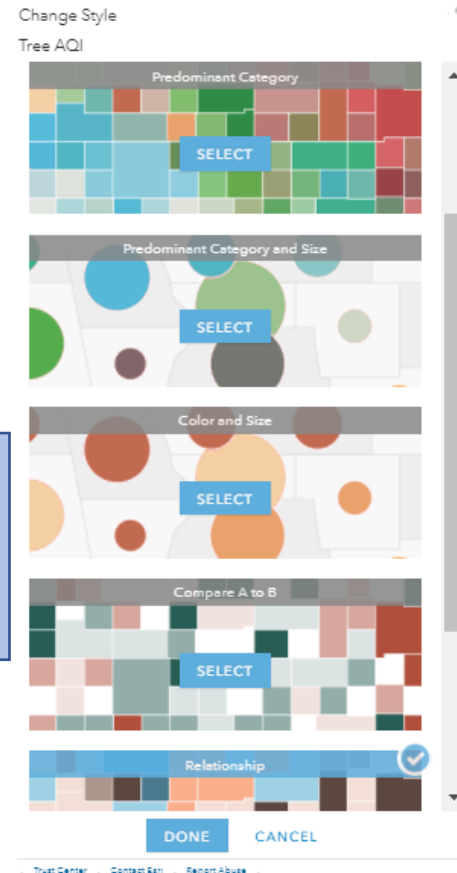
Note: the more attributes that are added the harder it can become to interpret data displayed on the map.

When adding multiple attributes for display, options exist to show relationships between the variables using differing methods. These methods include (*displayed on the right*):

- PREDOMINANT CATEGORY
- PREDOMINANT CATEGORY and SIZE
- COLOR AND SIZE, COMPARE A to B
- RELATIONSHIP

Allow time to explore these different methods and allow students to use them as an inquiry-based procedure in class. Ask students to note differences in the various methods and how the displayed data changes as the methodology changes.

OPTIONAL CLASS ACTIVITY: with your assigned group, determine how the assigned “change style” method works and how this impacts the display of the data. Share findings to the class in a presentation.



Assignment: Identify & interpret spatial patterns & relationships in displayed data– *Trees, Population and Air Quality*

Data Layers for potential use for this assignment include:

- *Tree_AQI (Found using #CHICAGO_GSS and Quality)*
- *Optional: Chicago Community Areas*

Research Question: Does the population and the amount of tree canopy in an area impact the measured levels of air pollution?

Student Tasks:

1. Add the Tree_AQI and community areas layer from ArcGIS Online to a map.
2. Create another copy of Tree_AQI
3. Use various methods of changing the styles and displaying attributes to determine if there is a relationship between the amount of people living in the Chicago U.S. Census Block Groups AND the percentage of Tree Canopy in the block group versus the reported EPA air quality readings for the block groups.
5. An example analysis of dog friend parks (via hot spots) and community level income is below:
6. Save all work for continued use in future lessons.

Deliverable:

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After performing your GIS analyses, use maps and write about your answers to the posed RQ. Create an esri storymap to showcase your maps and findings.

Layers and Relationships Using Geographic Information Systems (GIS) - *Instructional Guide*

Overview

This skill-building lesson is designed to introduce & reinforce the how various map layers and accompanying attribute data can be looked at for potential relationships between variables. Geographic Information Systems (GIS) will be used for this exercise. Students will work with Esri's arcgis.com ("AGO") online software to:

- **examine** attribute data relative to the City of Chicago
- **display** attribute data
- **analyze** potential relationships between variables
- **identify & interpret** spatial patterns and relationships in displayed data

During, the *first three lessons in this grouping*, students have established **research questions** that specifically guide a GIS investigation related to parks across the City of Chicago. **Defined geographies** have been established that set parameters on the specific locations that their analyses will cover.

OPTION: based upon class size and available devices, the following can be completed as an individual or group assignment.

OPENING ACTIVITY (optional): Ask students to journal about experiences they have had (or not had) with air pollution and or introduce an article to read related to air pollution.

ADDING DATA & EXAMINING ATTRIBUTE DATA

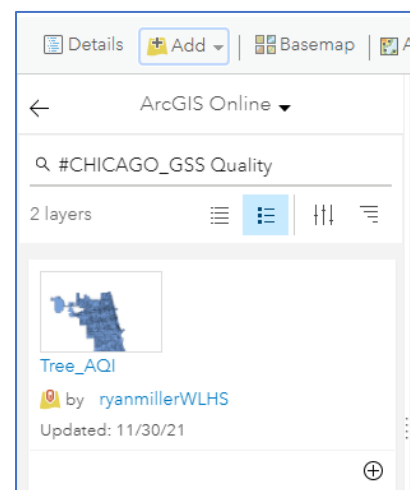
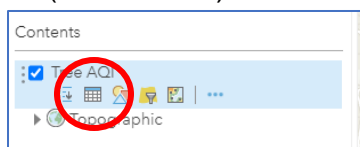
Students will log-in to AGO. Visit Map and "Add" (searching for and using ArcGIS Online) the CHICAGO_AIR_QUALITY layer. Search parameters to find this layer are "**#CHICAGO_GSS**" and "**Quality**"

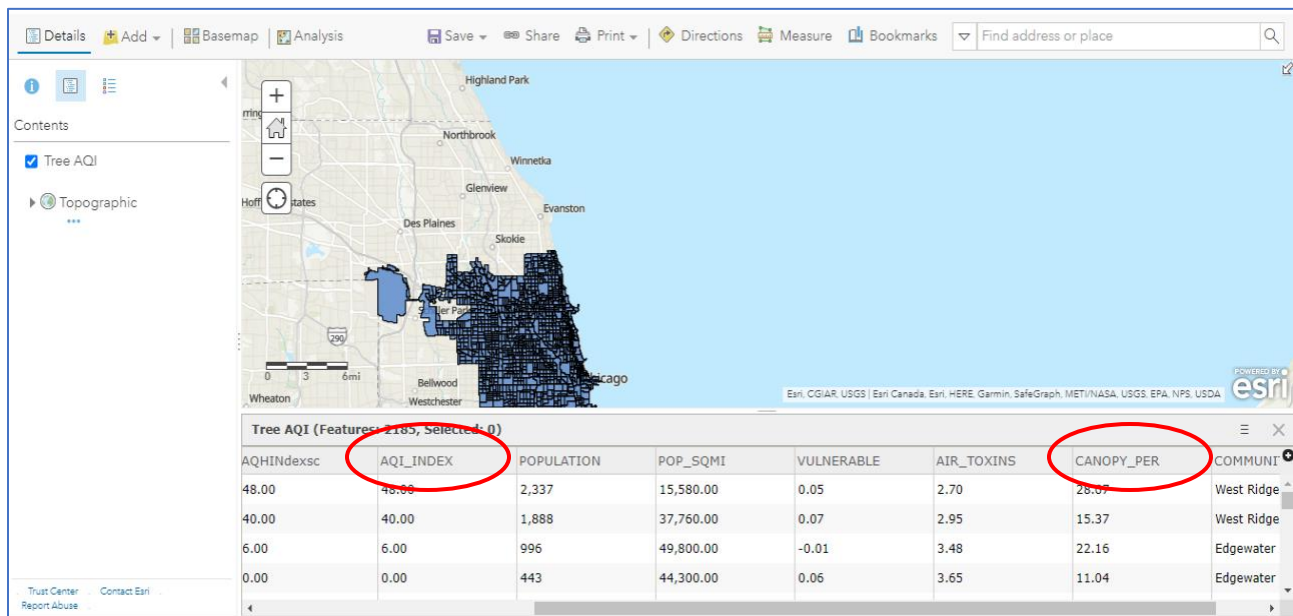
The **Tree_AQI** layer, as seen in the image to the right, should be added to the map.

Mouse over the layer in the contents section of your webmap, open the attribute table (**RED Circle**)

and review the various attribute data associated with each polygon displayed with this feature. Emphasize

to students the need to review what data you have available **BEFORE** starting the analysis process.





Several attribute data, by US Census Block Group (the polygons displayed), are available for analysis with this layer. Notably, **AQI_INDEX** (measured 2020 air quality index data from the *US EPA*) and the **CANOPY_PER**, the measured percentage of tree canopy from the *Chicago Regional Trees Initiative 2020 Tree Census*) will be used in the teaching portion of the lesson.

Visit <https://www.airnow.gov/aqi/aqi-basics/> if explanations of the AQI (Air Quality Index) are needed.

Tree Census Data: https://mortonarb.org/app/uploads/2021/05/2020-Chicago-Region-Tree-Census-Report_FIN.pdf

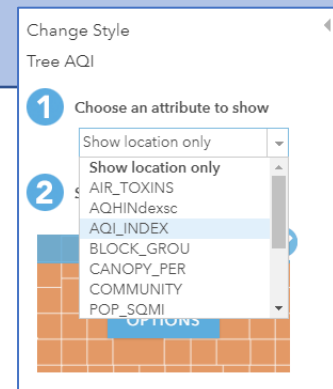
Work with the students to make sure the data and related values are understood before moving into the next section.

DISPLAYING ATTRIBUTE DATA

As it was done in previous lessons, the CHANGE STYLE icon can be used to display differences in attribute data using COLOR, SHAPE, & SIZE of various icons on the map.

Optional: provide students with a blank map of the City of Chicago and ask them to annotate the location of their school, and to try and show the locations in the city where they think more tree canopy is as well as where the highest levels of air pollution exist.

1. Students should be directed to examine differences in data related to AQI_INDEX, CANOPY_PER, and POPULATION (STEP 1)
2. Set the “drawing style” (STEP 2)
3. Work with the “OPTIONS” after a style has been chosen (STEP 3).



Important: When using the options available to display data, be mindful of spatial considerations related to the type of data you are working with: *Are you using points, lines or polygons?*

Modifying the look of your spatial data will allow for GIS data analysis, an example in the map below. AQI, is displayed with color by US Census Block Groups. Optional: direct students to change the classification scheme of the data. Have them investigate and report back the differences in how the data is displayed when natural breaks is compared to equal interval or quantile, etc.

COPYING LAYERS for COMPARISON PURPOSES

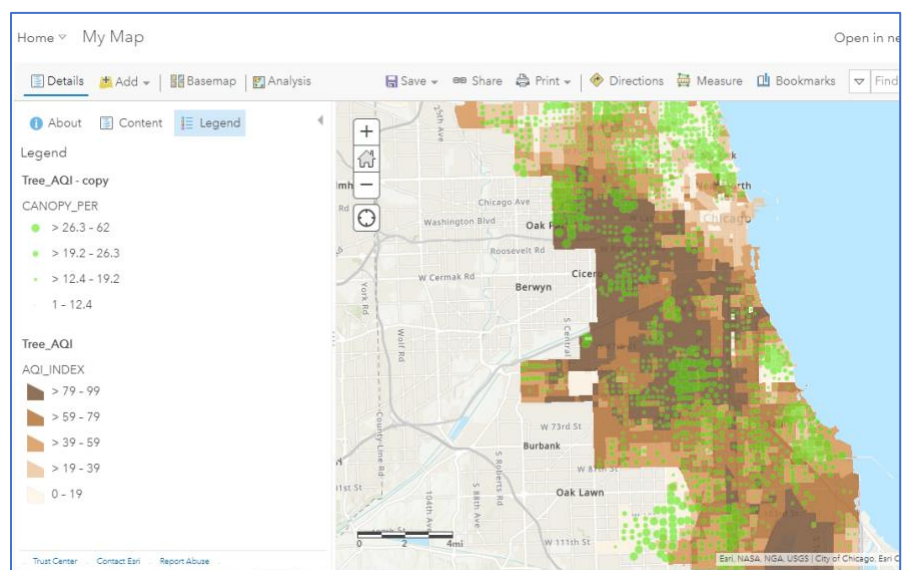
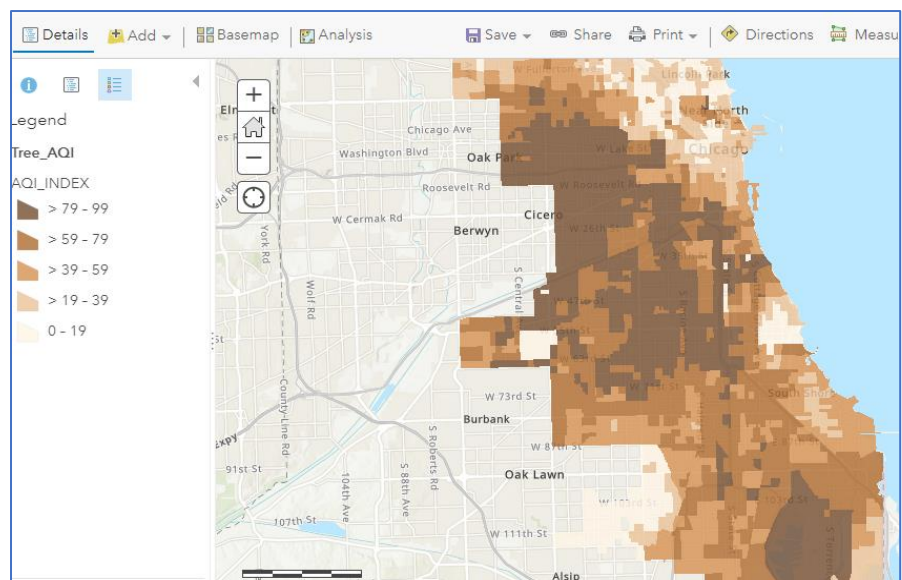
ArcGIS Online provides an option to copy any layer. The Tree AQI layer can be copied and the resulting copied layer can then be used to show a different attribute within the same geography. The maps to the right are displaying the original layer and the copied layer. Tree Canopy percentages are displayed on top of the AQI data.

Pose this Question to the Class: *Are there specific (identified) locations in Chicago where differences in air quality have differences in the amount of tree canopy?*

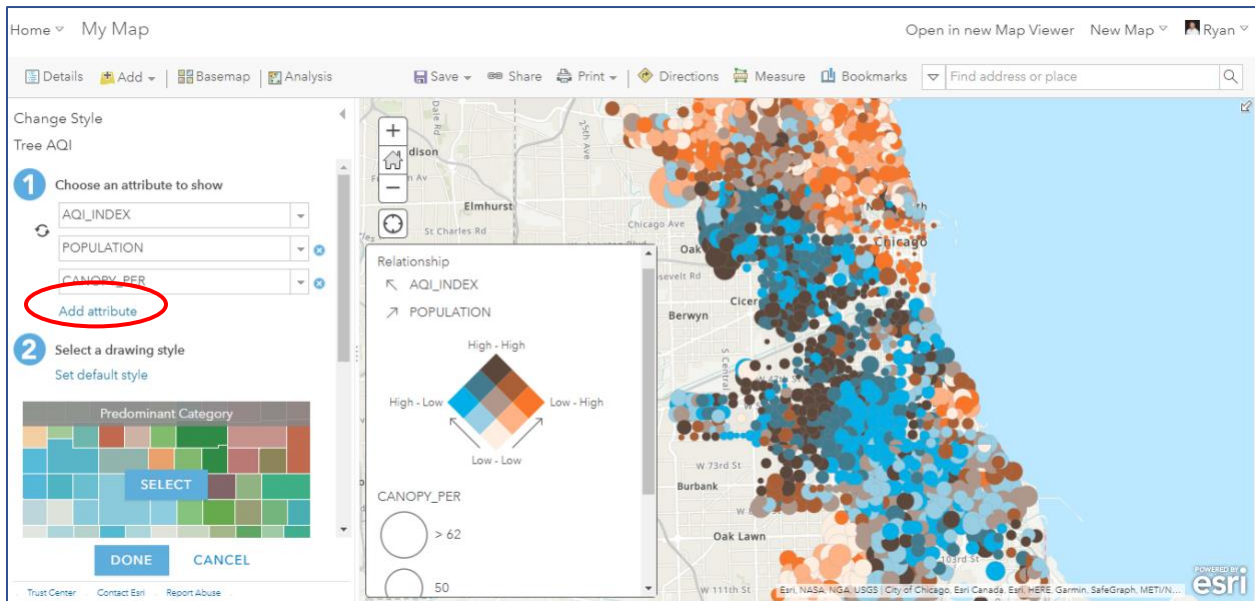
ANALYZING RELATIONSHIPS BETWEEN VARIABLES

The procedure of copying a layer is one way to compare attribute data to

look for potential relationships between layers and or data. The procedure above can be reversed with the polygons switched to the points, OR multiple variables can be displayed simultaneously OR other attributes can be introduced into the analysis as well.



Multiple variables can be displayed at the same by adding attributes at the initial stage of Changing Styles (RED oval below). Note: the more attributes that are added the harder it can become to interpret data displayed on the map.

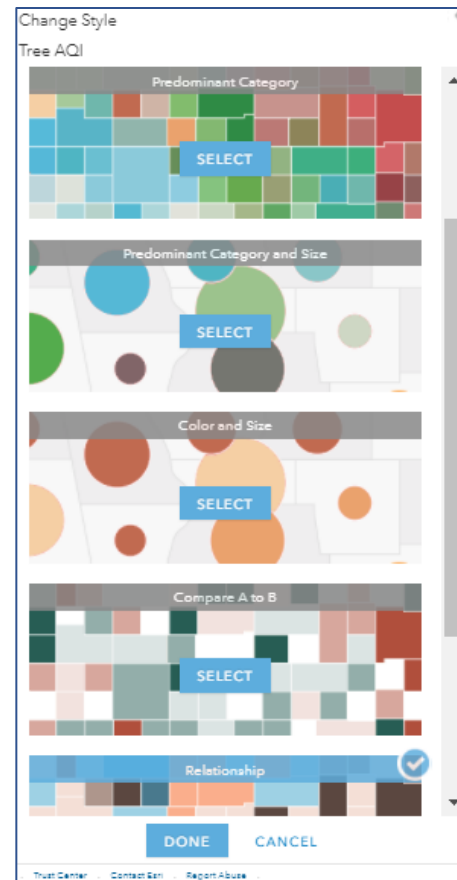


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- PREDOMINANT CATEGORY and SIZE
- COLOR AND SIZE, COMPARE A to B
- RELATIONSHIP

Allow time to explore these different methods and allow students to use them as an inquiry-based procedure in class. Ask students to note differences in the various methods and how the displayed data changes as the methodology changes.

OPTIONAL: divide students into groups and assign each group a method. Have the group determine how the method works and how this impacts the display of the data, ultimately the group's findings can be shared to the class in a presentation.



Assignment: Identify & interpret spatial patterns & relationships in displayed data– *Trees, Population and Air Quality*

Data Layers for potential use for this assignment include:

- *Tree_AQI (Found using #CHICAGO_GSS and Quality)*
- *Optional: Chicago Community Areas*

Research Question: Does the population and the amount of tree canopy in an area impact the measured levels of air pollution?

Student Tasks:

1. Add the Tree_AQI and community areas layer from ArcGIS Online to a map.
2. Create another copy of Tree_AQI
3. Use various methods of changing the styles and displaying attributes to determine if there is a relationship between the amount of people living in the Chicago U.S. Census Block Groups AND the percentage of Tree Canopy in the block group versus the reported EPA air quality readings for the block groups.
5. An example analysis of dog friend parks (via hot spots) and community level income is below:
6. Save all work for continued use in future lessons.

Formative Assessment

Saved work, relative to the assignment above, can be printed and or presented to the entire class by students or student groups.

Summative Assessment

Option: All student work created during this lesson will be expanded upon in future lessons to produce a comprehensive analysis via the production of a Storymap Application in AGO.

Mapping CTE Career Opportunities

Overview

In this lesson you are going to use Geographic Information Systems or GIS to identify the best location to live for the career you want to pursue. To make informed choices about your future, it is important to consider the type of job you are interested in and research the best areas to live to achieve those goals. In this assignment, you will conduct research and analysis to help you weigh all of the factors and options available and to help you make an informed decision.

Career Research

First, create a list of the careers that you are interested in learning more about. If needed, narrow down your list to your top 1 or 2 career options.

Next, use Google and ArcGIS Online to research relevant locations for those careers. For example, if you are interested in healthcare you could search for the locations of hospitals. If you are interested in a technology career (e.g., software engineering) you could search for the locations of technology companies, such as Apple, Google, Microsoft, T-Mobile US, Verizon, PayPal, Comcast, and AT&T.

Based on your research, create a .csv spreadsheet that includes the address or latitude/longitude of the relevant locations you identified. In your research, you may find a data spreadsheet of relevant locations for the career(s) you are interested in. If you do, download it. You can also add your own data as you research.

Finally, add your data to ArcGIS to create your own career map.

GIS Analysis: Heatmap

Next, use GIS to identify the best regions or metropolitan areas for the career you are interested in. Based on your heatmap, what conclusions can you draw about where your career is most prevalent in the U.S.?

Choose the best location for your career to focus on in the rest of your analysis (If you want to, you can compare two of the best locations).

Quality of Life Analysis

To better understand what life is like in the area you selected, you are going to add some additional data layers to the map. First, search for “2020 County Health Rankings” and add the data layer to your map.

Look at the County Health Rankings data for the area you selected and consider the following questions:

- What do you notice about the data for that county and the surrounding counties?
- How does it compare to other places you might live?

Search the living atlas to find at least one other data layer that would help you understand if this is the best location to live for your desired career. You can search for anything you are interested in. If you don't find a data layer you are interested in, you can also find or create your own .csv spreadsheet with the relevant data and upload it.

Examples of factors you might consider include:

- **Educational Opportunities:** Are there colleges or technical education centers with relevant programs near your chosen location?
- **Personal Security/Crime:** Is the location safe?
 - Violence, Burglaries, Accidents, Murders, etc.
- **Work/Life Balance:** Will the location enable you to have a good work/life balance? Work/life balance influences your overall welfare, contributes to your overall productivity in the workplace, and helps you to be healthy and happy.
 - Cost of living (search “location affordability index”), access to your favorite activities (e.g. museums, sports arenas, movie theatres, your favorite store), etc.
- **Cultural Factors:** What is the culture and population of the area?
 - Political affiliation, Demographics, Unemployment Rate, Education Levels, Age, etc.
- **Salary Range:** What is the typical salary range for the career you are interested in near your chosen location?

Look at the data and consider the following questions:

- What do you notice about this data?
- What does the data mean to you?
- How does this data help you understand whether this is the best location?
- Is there anything else you need to know before making your decision?

Explain Your Findings

Next, write a paragraph that summarizes what you found. Please use information from the map and your analysis to explain why the location you selected is the best location for the career you want to pursue.

Create a Storymap

Finally, create a storymap that includes your map(s) and your explanation of the best location for your chosen career.

Share your storymap with your classmates and discuss the following questions:

- What did you learn from each other's storymaps?
- Do you agree that they identified the best location? Why or why not?
- Is there anything they could add to improve their map or explanation?

Optional: Advanced GIS Analysis

Your teacher may choose to incorporate additional advanced GIS analysis options into this lesson. If you complete those options, be sure to include your maps and analysis in your Storymap and use them as additional evidence to explain the best location for your chosen career.

Mapping CTE Career Opportunities Implementation Guide

Learning Objectives

Students will use GIS to analyze the best location to live for their desired career. Through this lesson, students will learn GIS skills including searching the living atlas, adding data layers, heatmaps, and storymaps. They will engage in spatial reasoning and analysis with maps to understand the best location for their desired career. They will also use their maps and analysis to create an explanation of the best location for that career, which they will share with their classmates through a storymap.

Standards

- CCSS.ELA-LITERACY.SL.9-10.2 / CCSS.ELA-LITERACY.RST.11-12.7: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
- CCSS.ELA-LITERACY.RST.9-10.4 / CCSS.ELA-LITERACY.RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- CCSS.ELA-LITERACY.SL.9-10.5 / CCSS.ELA-LITERACY.SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- CCSS.ELA-LITERACY.WHST.9-10.6 / CCSS.ELA-LITERACY.WHST.11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- CCSS.ELA-LITERACY.WHST.9-10.8 / CCSS.ELA-LITERACY.WHST.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

Lesson Structure

Overview

The lesson starts with a teacher model of the GIS techniques needed for the lesson. The technical skills are detailed in this implementation guide for you to use as a resource. The main lesson has several parts: Career and Education Research, GIS Analysis: Heatmap, Quality of Life Analysis, Explain Your Findings, and Create a Storymap.

Advanced GIS Analysis Options: If you have more time and want to challenge your students to build more complex technical skills, you can also incorporate the Advanced GIS Analysis options included at the end of this document. In Advanced Option I, students identify the best area to live in the city/metro area they are focusing on. In Advanced Option II, students compare commute times from local colleges to their chosen location. If you choose to incorporate the advanced options, you can model them for the whole class or provide the instructions directly to individual students who are interested in an additional challenge.

Getting Started

Have each student get a computer and log in to their ArcGIS account. Students can then open and preview the lesson materials.

Lesson Introduction and Model

Provide a brief introduction to the lesson and answer questions. Before students begin working, model the GIS techniques and meaning making they will draw on during the main lesson (see below for details). At this stage, don't introduce storymaps. You will preview those right before the storymap activity.

Work Time

As they work on their project, students should collaborate to figure out how to apply the GIS techniques to their projects and conduct their analyses. Students should talk with a neighbor to discuss the questions that appear throughout the lesson. Provide support and answer questions as needed.

Storymap Activity

Before the storymap activity, model the process of creating a storymap.

Have students share the career and location they chose. Help them form groups of 2-3 to work on their storymaps. If possible, create groups of students who chose the same career or location.

When they are done, have students share their storymaps and discuss the provided questions. This can involve either a whole class presentation or small group discussion.

Modeling GIS Skills

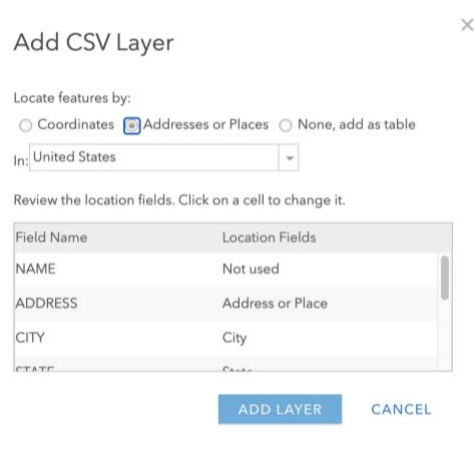
At the beginning of the lesson, model the GIS techniques that students will use in the inquiry activities. Step-by-step instructions for the GIS skills that are needed for this lesson are outlined below. They are organized by the section of the lesson they apply to: GIS Analysis: Heatmap, Quality of Life Analysis, Storymap, and Advanced options.

GIS Analysis: Heatmap & Quality of Life Analysis

Importing Data from CSV

You can import external data into GIS to create a map. First, find a dataset that includes a spatial component (e.g. address, latitude/longitude). A good source for local data is the Chicago Data Portal (<https://data.cityofchicago.org/>), which includes a wide range of data from public safety to health and human services.

Next, save your data as a .csv file. In ArcGIS online, click on “map” to open a new map. Drag and drop your CSV file on the map. In the dialog box that opens, indicate whether your data uses coordinates (latitude/longitude) or addresses/places. Then click “add layer” to create your map.



Add CSV Layer

Locate features by:

Coordinates Addresses or Places None, add as table

In: United States

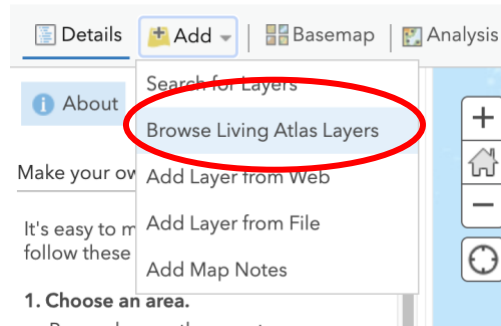
Review the location fields. Click on a cell to change it.

Field Name	Location Fields
NAME	Not used
ADDRESS	Address or Place
CITY	City
STATE	State

ADD LAYER CANCEL

Searching Living Atlas & Adding Layers

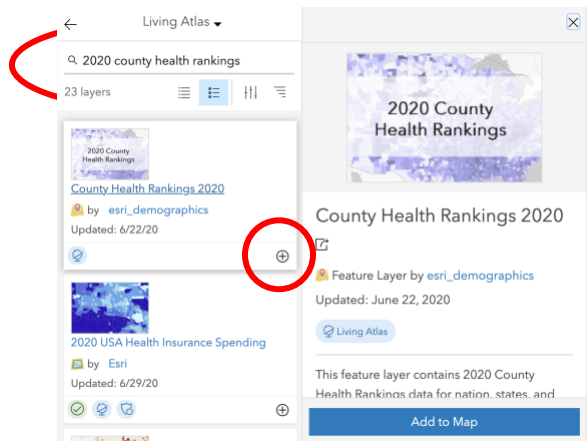
To find data layers, go to the add menu and select “Browse Living Atlas Layers.” You can then search for layers.



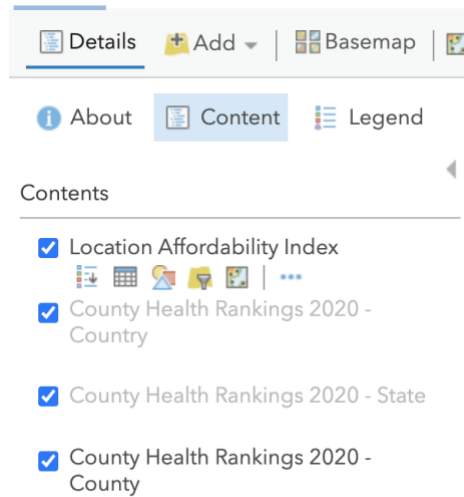
First, enter keywords the plus sign (+) or data layer to your to look at the

layer to learn more about what the data are showing you. Click on the name of the data layer to show the description.

in the search. Then click “add to map” to add the map. You may also want description of the data

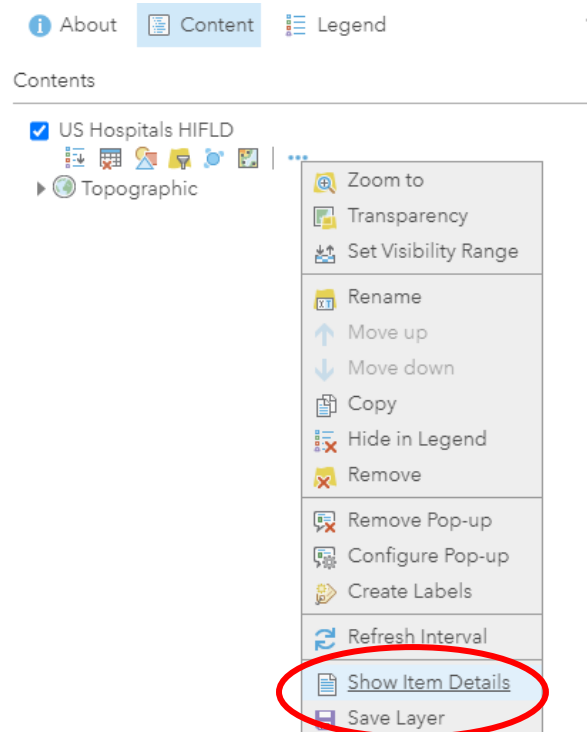


Layers will display on the map in the order they appear in your content list. You can reorder layers by hovering over the layer you want to move and dragging it to a different position in the list.

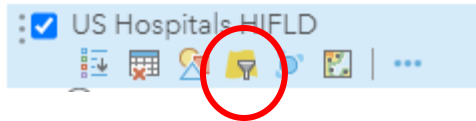


GIS Analysis: Heatmap

Before you start working with your data layer, click “Show Item Details” to read a description of the data source.



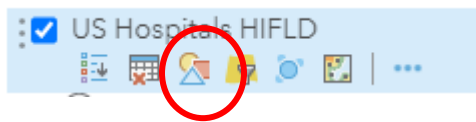
Show the attribute table for your data layer.



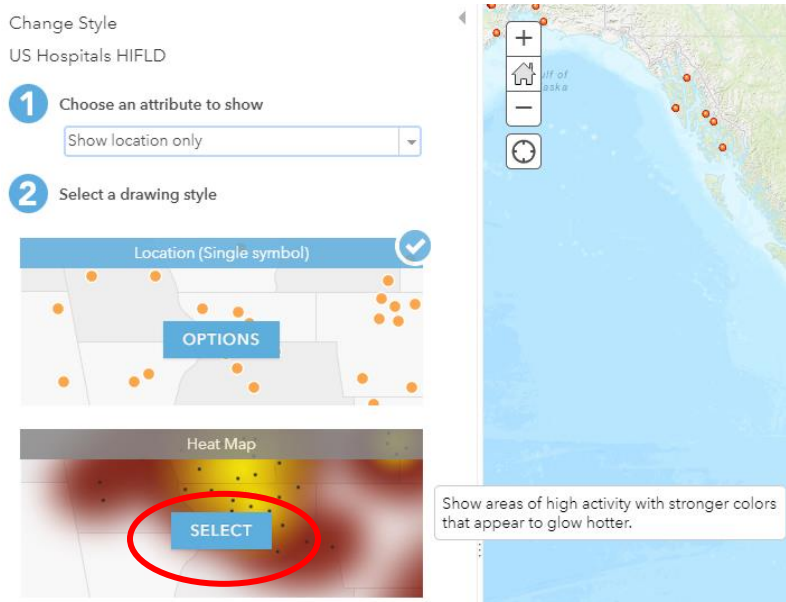
Scroll through to find out what attributes are available for each data point. For example, in the attribute table below, each hospital has one row in the table, and the columns represent different descriptive attributes available for the hospitals.

US Hospitals HIFLD (Features: 7596, Selected: 0)				
ID	NAME	ADDRESS	CITY	STATE
0005793230	CENTRAL VALLEY GENERAL HOSPITAL	1025 NORTH DOUTY STREET	HANFORD	CA
0053391362	LOS ROBLES HOSPITAL & MEDICAL CENTER - EAST CAMPUS	150 VIA MERIDA	WESTLAKE VILAGE	CA
0011190023	EAST LOS ANGELES	4060 WHITTIER	LOS ANGELES	CA

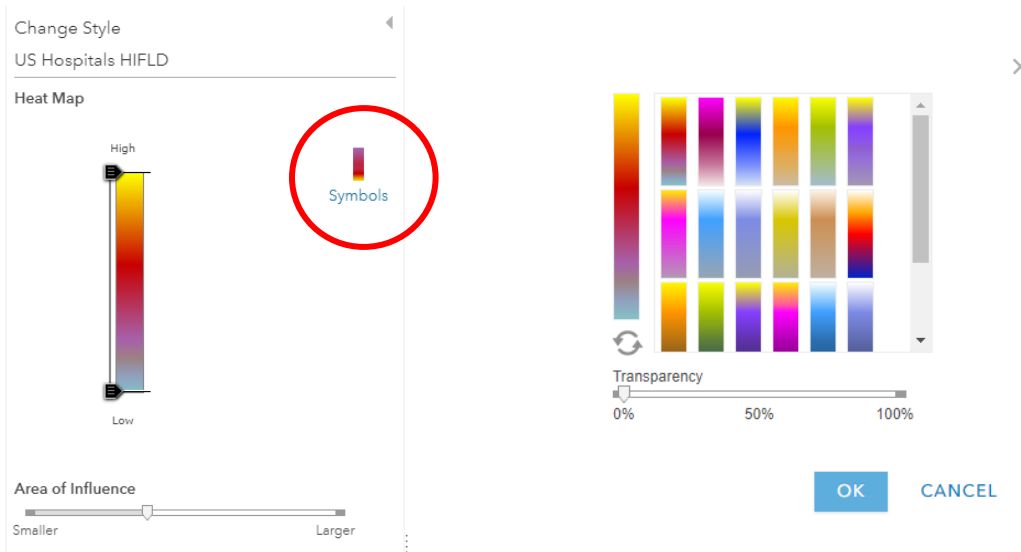
Now that you are familiar with the data layer, change the symbology to display it as a heat map. A heat map allows us to visualize where points are clustered, which will indicate what areas have a higher concentration of the targeted career than others.



In the Change Style pane, select the "Heat Map" drawing style. Since we are just interested in locations, there is no need to choose an attribute.



Click Options to adjust the symbology of the heat map, then click Symbols to see other options for the color ramp. Select a color ramp that best represents the spatial pattern you want to see.

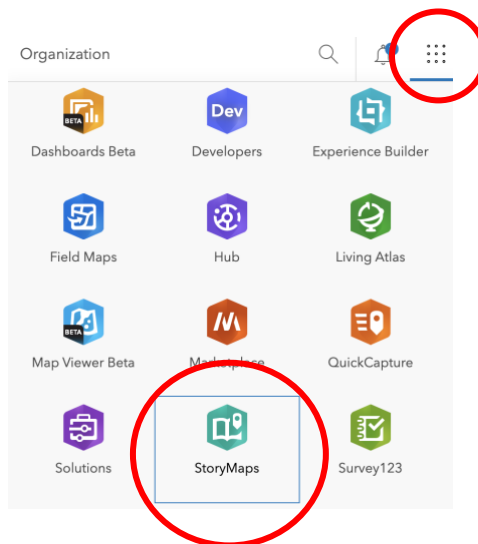


You also have the option to invert the color ramp, if that would be a better choice for visualizing the clustering of hospitals on your heat map.

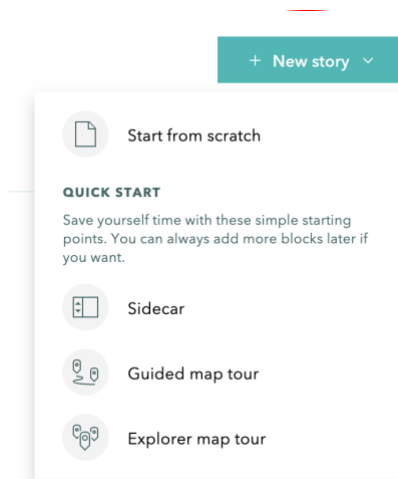
You can also experiment with changing the “Area of Influence” slider to see how that changes what the map communicates. You can come back and adjust this again if needed.

Create a Storymap

In the home menu, click on the app builder icon and select the “StoryMaps” app.



Click “New Story” and select the type of StoryMap you want to create. If you want the most flexibility, try “start from scratch.” If you want a pre-set structure, try the other options.

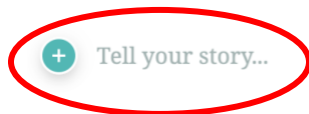


Follow the prompts to add information to your storymap. Click the green plus sign to add other media, such as maps and videos, or more text to your story. When you are ready to share your story, don't forget to click publish!

Title your story

Start with a short introduction or subtitle

Katie James | Draft

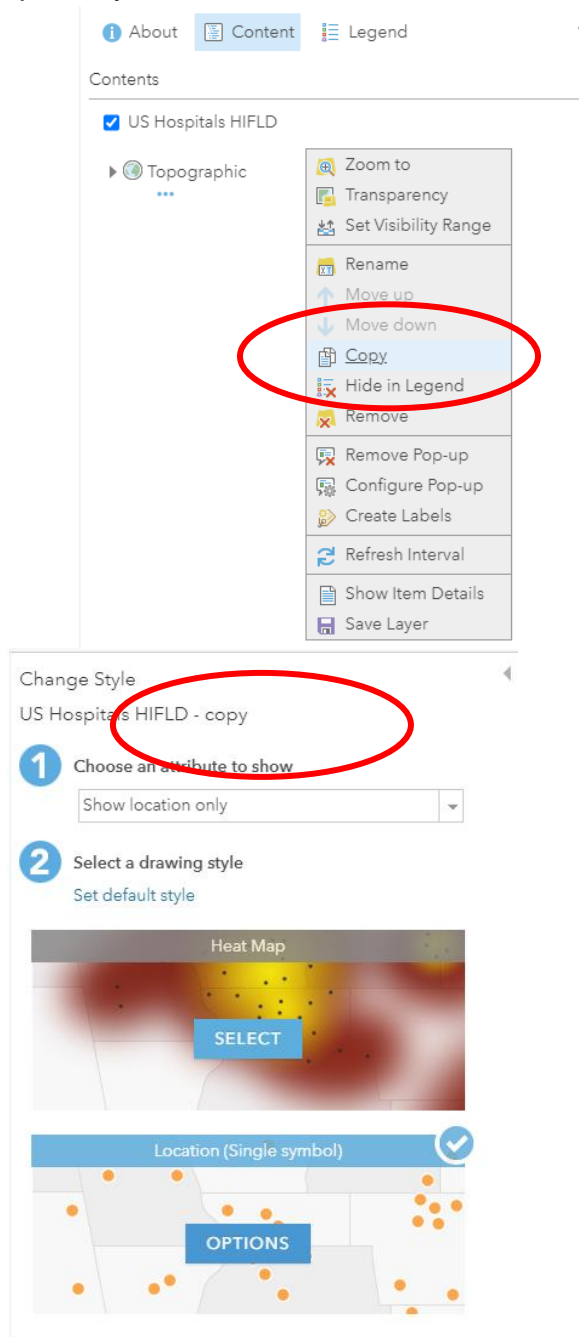


Optional: Advanced GIS Analysis

Advanced Option 1: Identify the best areas to live for your career

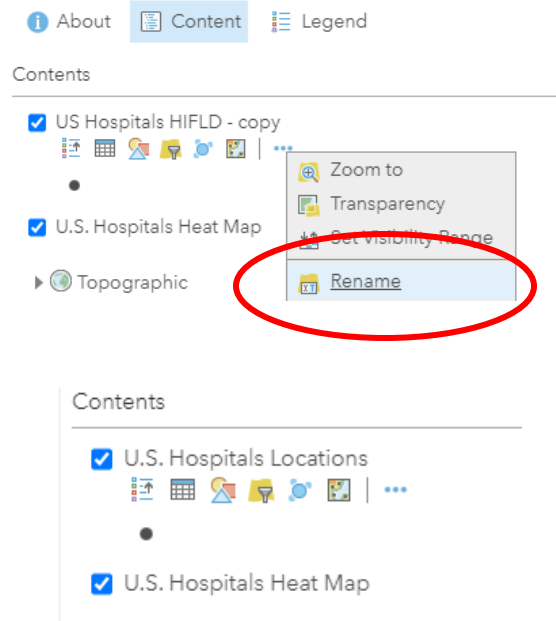
In this advanced GIS analysis option, your students will identify the best area to live for their career in the city/metro area they have chosen to focus on. This example focuses on the Chicago metro-area, since my heat map showed that it is a high-density area for hospital locations.

Create a copy of the data layer you used to make your heatmap and change the style to show locations as a single point symbol.

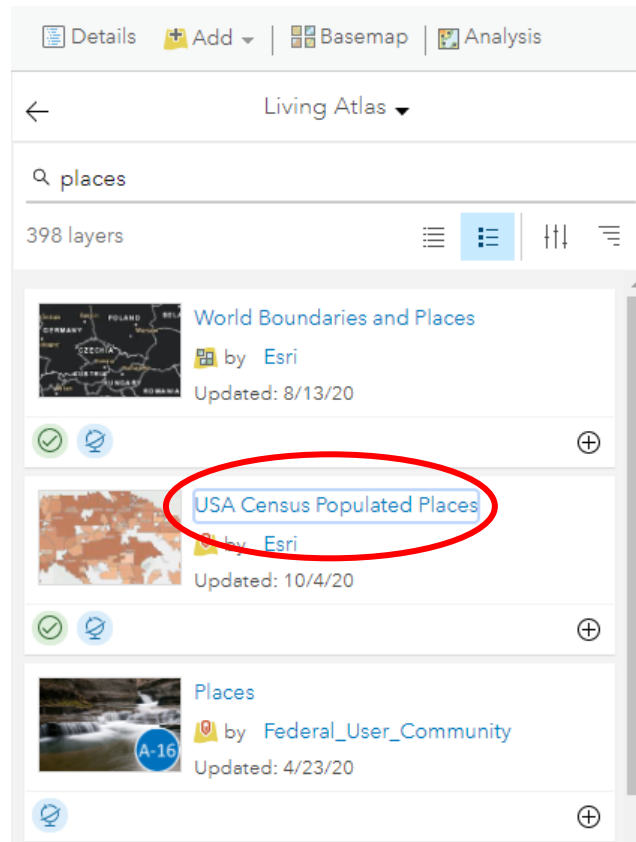


You may also want to rename the layers so you can tell them apart in the table of contents.

Chicago Geospatial Semester Project

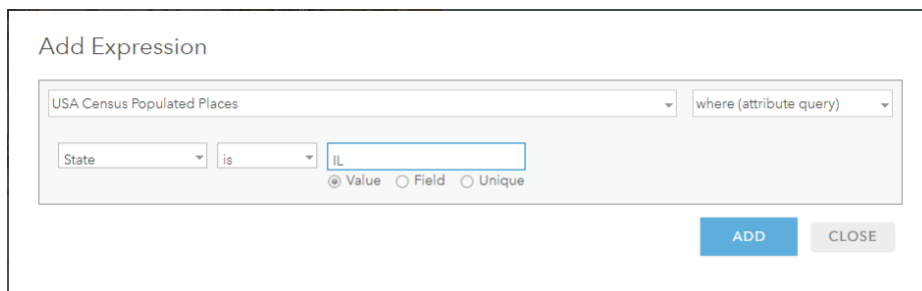
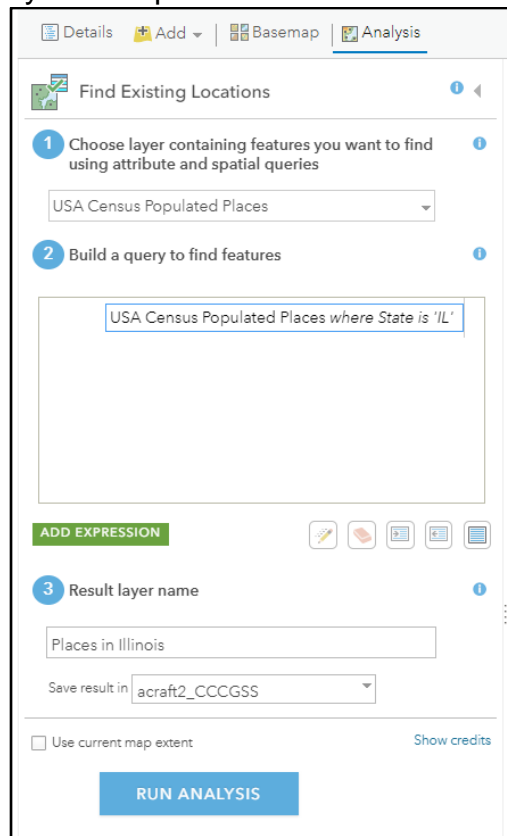


Find a layer representing a local geography, such as municipalities, in the area you have selected. The Living Atlas layer “USA Census Populated Places” includes all cities, towns, and incorporated places designated by the U.S. Census Bureau



Filter the Places layer to just the region you are interested in. (The Places layer has over 29,000 features. Reducing the size is recommended to help the analysis run faster, and will prevent us from “comparing apples to oranges” when grouping results in the map.)

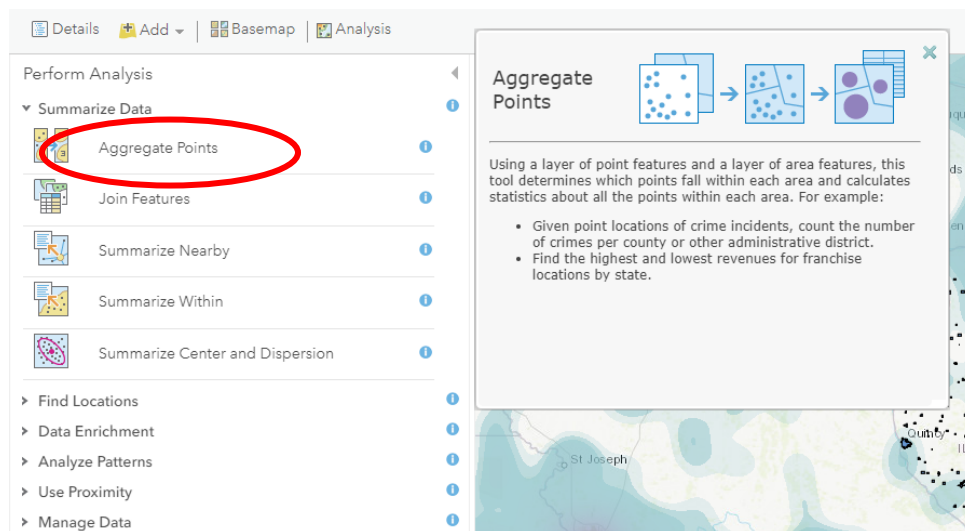
To do this, select “Find Existing Locations”, under “Find Locations” in the Analysis tab. Since the attribute table for the Places layer has a field called STATE, I can build an attribute query to select only the hospitals where STATE = IL.



Run the analysis to get a layer of just the 1,307 Places in Illinois.

Note: In all steps, do not check “Use current map extent”.

In the Analysis tab, select the “Aggregate Points” tool under “Summarize Data”.






Fill in the parameters shown below, then Run Analysis. It’s also a good idea to click the Information icon next to each option so you understand what they mean. (For example, if your dataset has different types of features, such as hospitals *and* nursing homes, you can make those separate groups using Option 4.)

In this example, I added a statistic for summarizing the total number of hospital staff in each place, to provide some information about potential employment demand.

Chicago Geospatial Semester Project

Details Add Basemap Analysis

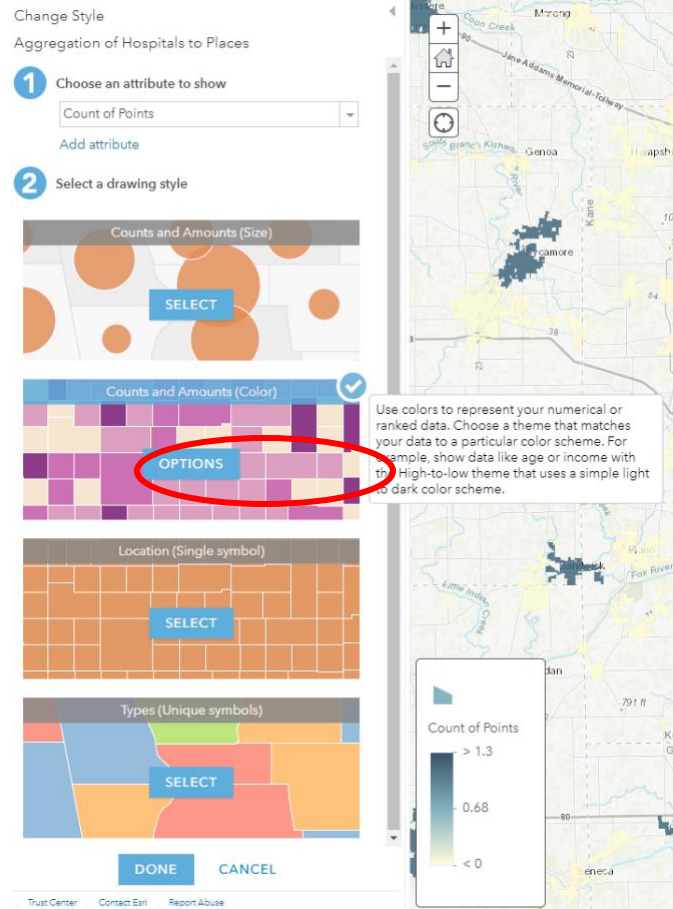
Aggregate Points

- 1 Choose layer containing points to aggregate into areas**
U.S. Hospitals Locations
- 2 Choose layer containing aggregation areas**
  
Polygon Square Hexagon
Choose the polygon layer
Places_in_Illinois
 Keep areas with no points
- 3 Add statistics (optional)**
TTL_STAFF Sum
Field Statistic
- 4 Choose field to group by (optional)**
Field
 Add minority, majority
 Add percentages
- 5 Result layer name**
Aggregation of Hospitals Locations to Places_in_Illino
Save result in acraft2_CCCGSS

Use current map extent [Show credits](#)

RUN ANALYSIS

When the analysis is finished, change the style of the new layer to create a choropleth map by selecting “Counts and Amounts”.



Go into the options, classify your data, and select an appropriate color ramp.

Experiment with classification method and number of classes to create a map that is the most useful for you.

For example, I started by selecting “Natural Breaks” classification method. Then I opened my attribute table and sorted the Count of Points in descending order, and found that Chicago is an outlier with 42 hospitals, and the places with the next highest number of hospitals had only 4. I decided to manually adjust the break point (by clicking and dragging the sliders) so that Chicago is in a class by itself, and the next class is places with 2-4 hospitals.

Chicago Geospatial Semester Project

Aggregation of Hospitals to Places (Features: 1367, Selected: 0)				
Count of Points	Sum ttl_staff	STATEFP10	PLACEFP10	PL
42	-41,958	17	14000	00
4	-3,996	17	59000	02
4	-3,996	17	65000	02
4	-3,996	17	72000	02
3	-2,997	17	01114	02
2	-1,998	17	54885	02
2	-1,998	17	24582	02
2	-1,998	17	35307	02
2	-1,998	17	48242	02
2	-1,998	17	50244	02

Change Style
Aggregation of Hospitals to Places

Count of Points

Divided By: None

42

5

0

Count of Points

Classify Data

Using Manual Breaks

With 4 classes

Round classes: Select an option

Draw features with out of range or no value.

Symbol: ■

Transparency

Overall

0% 50% 100%

Per feature

Set from Attribute Values

Visible Range

World Room

OK CANCEL

The “Count of Points” in the legend refers to the number of hospitals that are located within the boundary of each place.

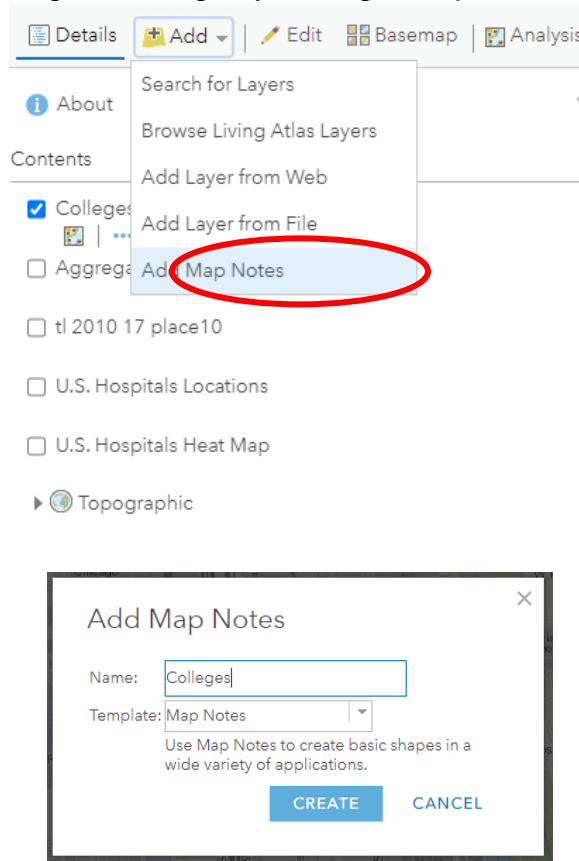
The places with the highest number of hospitals might be good choices for where to live and/or go to school for a career in healthcare.

Option II: Compare commute times

After Option I, students could also research what educational opportunities are located in or nearby the municipalities with the highest number of hospitals. After identifying ~3 colleges that are located in their area of interest and offer degree programs in their career choice, they can calculate the commute times between those colleges and places to live, and compare them with their choices from Option I.

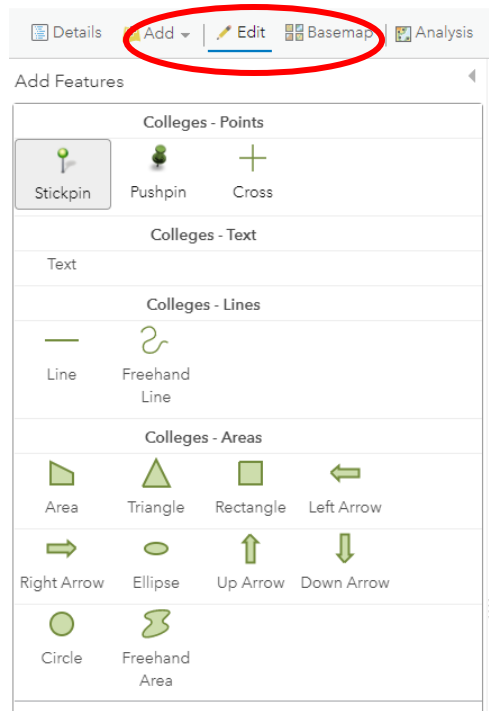
For this example, I am using the University of Illinois at Chicago.

Create a point representing the college by adding a map note.

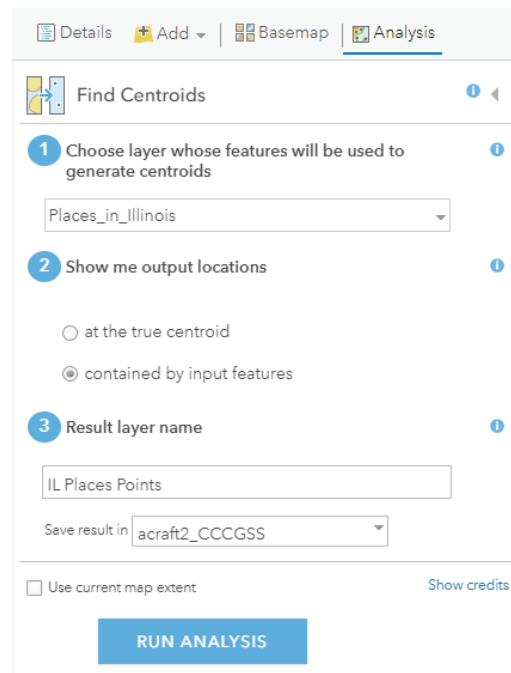


After creating this point, you can continue to add more points using the Edit tab:

Chicago Geospatial Semester Project

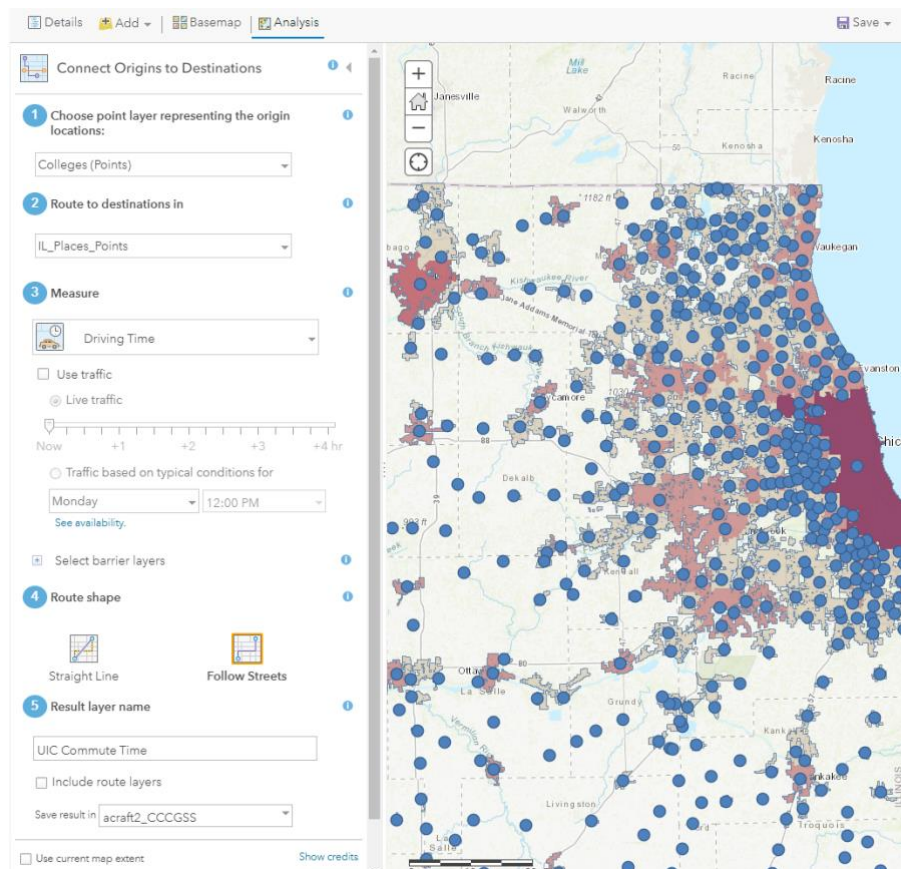
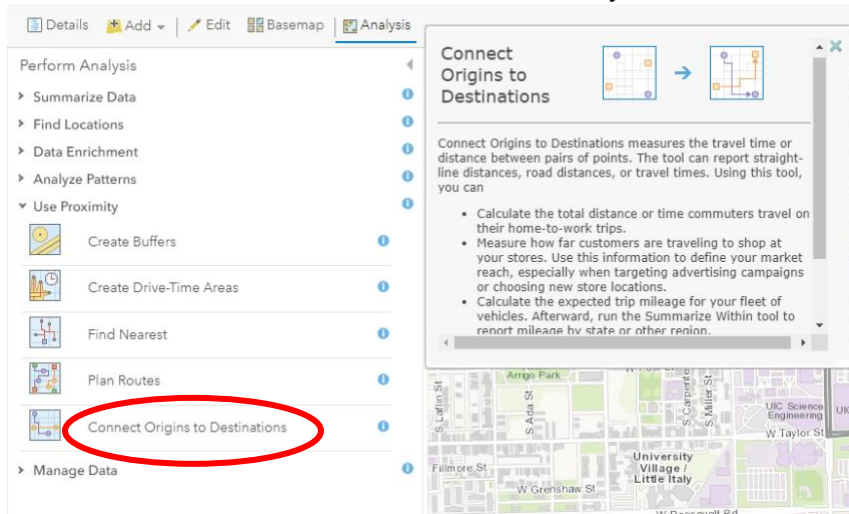


We are going to use the tool “Connect Origins to Destinations” to calculate the commute time. However, this tool only works when connecting point features with point features. The Places layer is polygon, so we need to convert it to points by using the Find Centroids tool, which is under “Find Locations” in the Analysis tab.



Now you can proceed with calculating the travel times.

In the Analysis tab, under “Use Proximity”, select “Connect Origins to Destinations” and fill in the parameters as shown below, then Run Analysis.



Chicago Geospatial Semester Project

In the attribute table of the resulting layer, you will find a field showing driving time between UIC and all Places in Illinois.

UIC Commute Time (Features: 1367, Selected: 0)			
Route Name	Driving Distance (Miles)	Driving Distance (Miles)	Driving Time (Minutes)
Route 1362 - UIC - 1362	3.69	5.95	13.86
Route 915 - UIC - 915	6.47	10.42	21.10
Route 841 - UIC - 841	8.99	14.48	22.31
Route 809 - UIC - 809	10.10	16.26	22.40
Route 850 - UIC - 850	9.58	15.42	23.03
Route 797 - UIC - 797	12.82	20.64	25.16
Route 815 - UIC - 815	8.05	12.95	25.31
Route 866 - UIC - 866	11.27	18.14	25.22

Scroll to the right to see the place names. Identify the locations with the shortest commute to your chosen college.

Safe Routes to School

Overview

In this lesson you will use Geographic Information Systems (GIS) to develop a WebApp for your school's website. Your WebApp will help new students find the safest ways to get to and from school, based on your research and experiences as upperclassmen. You will use GIS to analyze data, such as traffic and crime, provide your own information about safest spots nearby, identify the best routes, and develop a webapp to communicate your findings to other students.

My School

First, think about the area around your school and discuss the questions below with a partner.

- How do most students get to and from your school?
- What issues have you encountered or heard about that cause problems in getting to and from school?
- Are there places around your school where you feel the safest?
- What would make getting to and from school more safe for you and other students?

Based on your conversation, identify the top 2-3 transportation stops (e.g., bus or El stop) or starting points (e.g. home) students use to travel to and from your school (by taking the bus, el, or walking, etc). You should also list 2-3 of the issues and safe spots you talked about and would like to investigate further.

Transportation Stops/ Starting Points	Common Issues	Safest Spots

GIS Analysis: Safe Routes to School

Next, you will add data to a map to help you understand and identify the safest routes to and from your school.

Log into your ArcGIS.com account and open a new map. Locate your school on the map and add a map note for it.

Chicago Geospatial Semester Project

Pick one of the main transit locations (e.g., bus stop, El stop, home) that people travel to and from to get to school to focus on. Add that transportation stop to your map using map notes. Add other map notes as needed to represent issues and safest spots nearby that stop.

After you've created your first map note, you can edit it, or add additional features, by clicking "Edit". Your map notes can be points, lines, or areas.

Choose at least two different data layers to explore that are relevant to the safety issues you identified. To find the suggested data layers listed below, search for layers with the tag #ChicagoGSS, and limit your search to "My Organization." You may find other layers from ArcGIS Online or Living Atlas that you think are relevant. You can also add data to your map based on your own experiences. Some layers that might be useful are:

- Public transit (CTA rail and bus lines)
- Traffic
- Car Accidents
- Crime (e.g., robberies)
- Toxic industrial sites
- Favorite community places (e.g., Libraries, Places to eat, Parks)
- Layers or data points related to the issues and safe spots you identified

Take a look at your map(s) and consider the following questions with a partner:

- Are there any areas that are especially safe around your school?
- Are there particular areas that students should avoid?

Finally, add the data layer "CPS -Safe Passage Routes SY1718". This shows the routes that have community members monitoring them before and after school.

- How does your map compare with the routes CPS has identified as a "safe passage?"
- Does your map overlap with the existing safe passages?
- Are there ways you can connect existing safe passage routes and your safe route?

With a partner, discuss the question below based on your findings.

Based on your analysis, what is the safest possible route to school from the main transportation stop?

Create your safe route to school in your map. Use map notes to draw the route, and use your symbology options to make it stand out.

Presentation and Discussion

Share your map with your classmates. Be sure to use your map to explain why that is the safest route.

Chicago Geospatial Semester Project

Optional: Advanced Web Design

Your teacher may choose to incorporate additional advanced options into this lesson.

Safe Routes to School Implementation Guide

Learning Objectives

Students will use Geographic Information Systems (GIS) to explore relevant data and determine the safest route to and from their school. They will then use GIS to create a WebApp that can be added to the school website to share their findings with other students. Through this lesson, students will learn GIS skills including searching the Living Atlas and ArcGIS Online for layers, adding data layers, creating map notes, creating WebApps, sharing and embedding WebApps.

Standards

- CCSS.ELA-LITERACY.SL.9-10.2 / CCSS.ELA-LITERACY.RST.11-12.7: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
- CCSS.ELA-LITERACY.SL.9-10.5 / CCSS.ELA-LITERACY.SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- CCSS.ELA-LITERACY.WHST.9-10.6 / CCSS.ELA-LITERACY.WHST.11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- CCSS.ELA-LITERACY.WHST.9-10.8 / CCSS.ELA-LITERACY.WHST.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

Lesson Structure

Overview

The lesson starts with a student discussion about the area around their school, focusing on the main transportation stops students use to get to and from school, common

issues students experience traveling to and from school, and possible solutions to common issues. They will add the school and their choice of transportation stop (e.g. bus stop, El stop) to a map as map notes. They will then add relevant data layers (e.g. crime, traffic, etc) that interest them to the map. Next, they will analyze the data layers to identify the safest route to school, which they will add to their map as a mapnote. Finally, they will create a WebApp to communicate their map and analysis, which can be added to the school website.

Lesson Introduction and Model

Have students discuss the “my school” section in pairs then share their insights with the whole class.

Next, have each student get a computer and log in to their ArcGIS account. Provide a brief introduction to the GIS portion of the lesson and answer questions. Next, model the GIS techniques that they will be using during the lesson. The techniques are detailed in lesson order below. At this stage, don’t introduce WebApps. You will preview those right before the WebApp activity.

Work Time

Students will add layers and data points to their maps to analyze the safest routes to and from school. They can explore any layers in the Living Atlas or ArcGIS Online library that they find interesting and relevant (examples are provided in the lesson). They can also add data based on their own experiences.

As they work on their maps, encourage students to collaborate to figure out how to apply the GIS techniques to their projects. Provide support and answer questions as needed.

Presentation and Discussion

Have students share their maps and analysis with the class. This can be done through whole group presentations or small group discussions.

Advanced Options: WebApps

To take the lesson a step further, you can have students create WebApps with their maps and analysis. These webapps can be added to the school website to share their safe routes with other students.

There are three advanced options, which vary in level of difficulty.

Advanced Option 1:

Advanced Option 2:


Advanced Option 3:

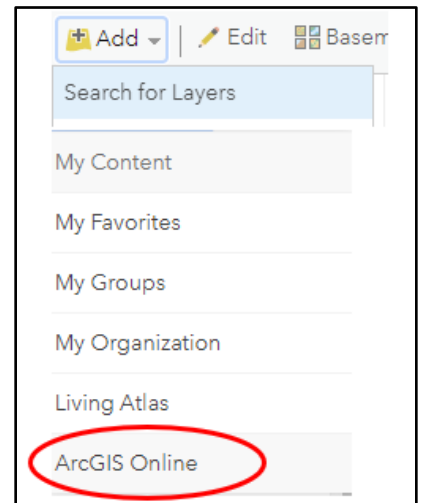
Modeling GIS Skills

At the beginning of the lesson, model the GIS techniques that students will use in the inquiry activities. Step-by-step instructions for the GIS skills that are needed for this lesson are outlined below.

Searching & Adding Layers

To search for layers, go to "Add" and "Search for Layers" and select either the Living Atlas or ArcGIS Online from the menu. Each data library has different data layers available so if you don't find what you're looking for in one, you may want to search the other. (Note: The default is "My Content" which will only search maps you have saved in your account.) You can search within My Organization to find layers that have been created by other GSS instructors, students, and mentors.

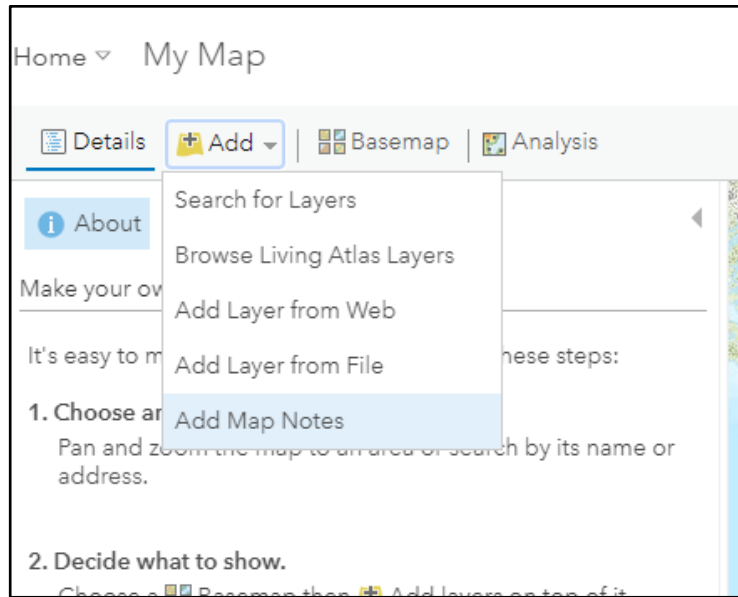
Select a data layer to add to the map by either clicking the plus sign (+) or "add to map." If you would like to see what information is given for the layer, hover the cursor over the layer name, click on More Options  and go down to "Show Item Details".



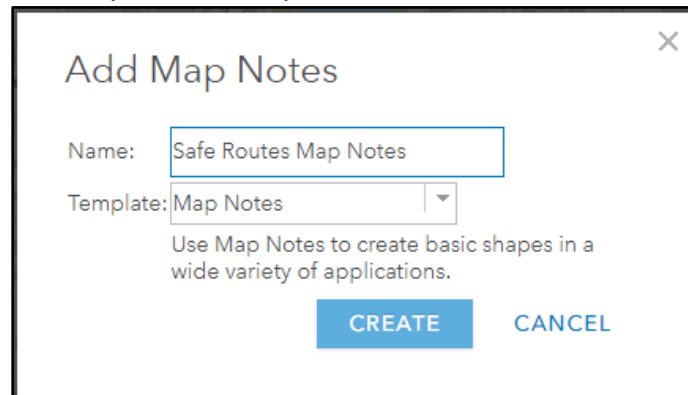
Adding Map Notes and Changing Symbology

Use map notes to add points, lines, or areas representing: school, traffic stops, issues encountered when traveling to school, safe places, and when creating the final safe route to school.

Start by going to the "add" menu and selecting "add map notes."

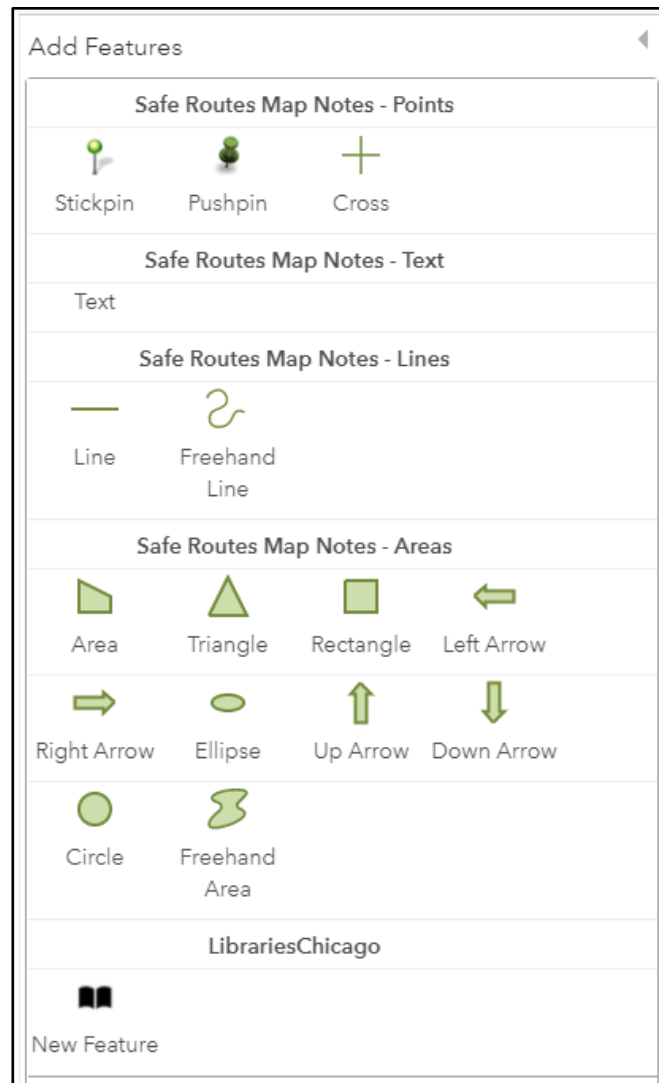


Name the layer. This layer will contain all the different map notes you create, so give it a general name. Use the Map Notes template.



The Add Features window will be displayed. Select the appropriate feature type for what you are adding to the map.

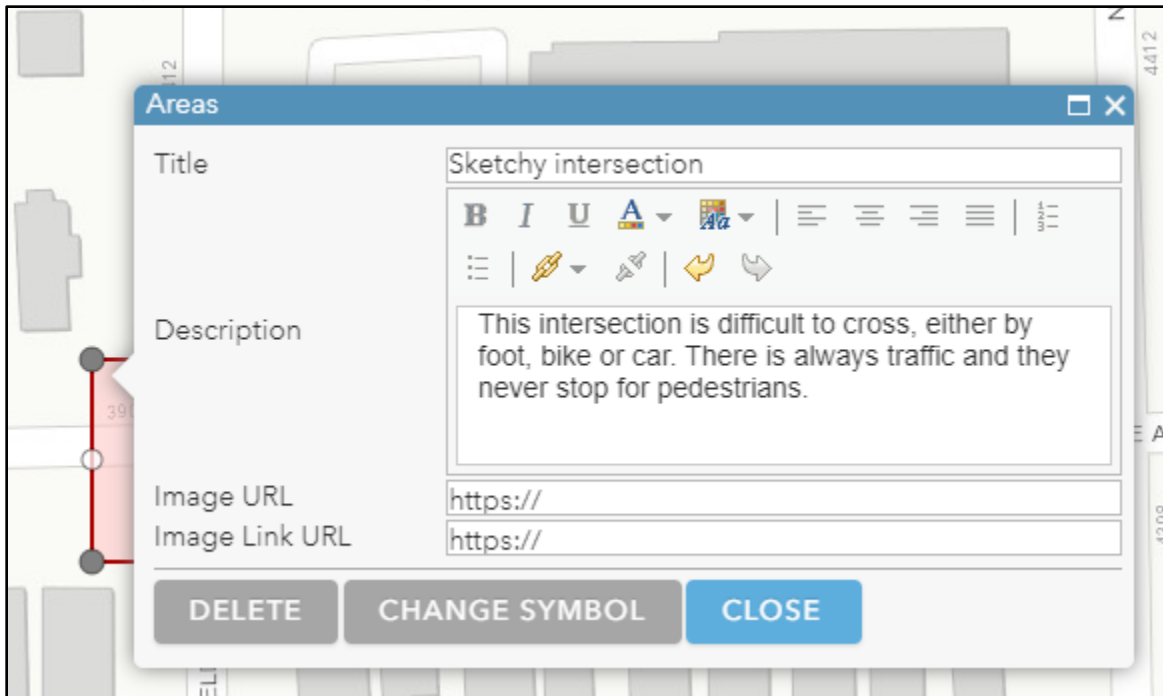
Chicago Geospatial Semester Project



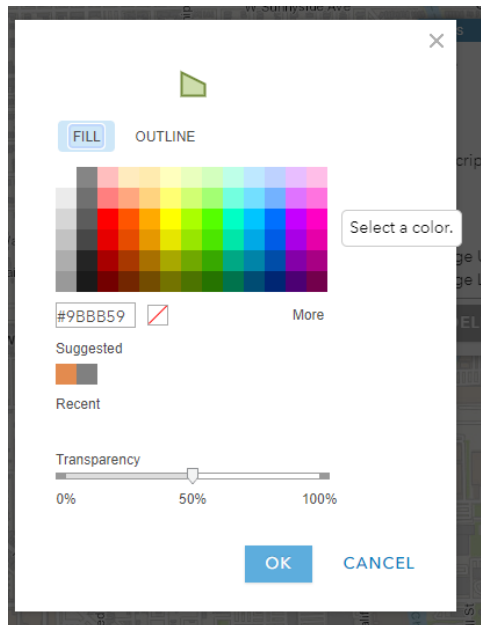
Pay attention to the popup instructions for how to create each type of feature.



After creating a feature, you will give it a title and an optional description for more detail.



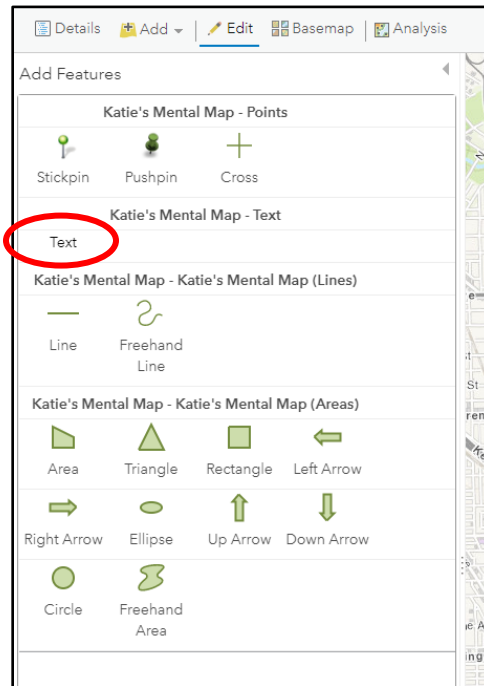
Click Change Symbol to select a color and symbol. For line features, you will also be able to change the thickness of the lines.



When you have finished adding your Map Notes, click Details to return to the table of contents view. If you want to return to adding Map Notes, just click Edit and you will see

the Add Features window again. You can also edit existing Map Notes by clicking them while in Edit mode.

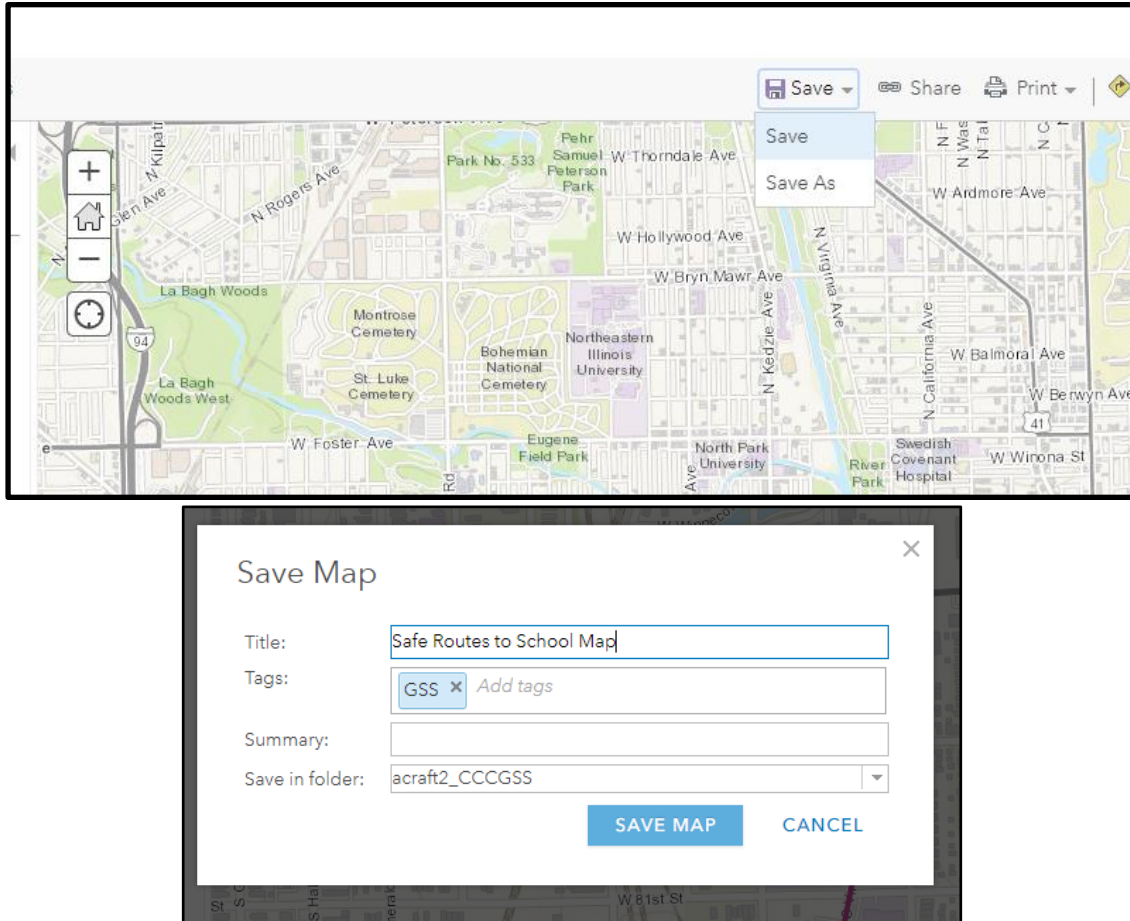
Tip: If you want to see labels displayed on the map without clicking, you can add a text map note. This is one of the options in the Add Features window when you are editing.



Adding a halo to your text is a good way to make sure it's visible.



Save your map, tagging it with the class hashtag.
NOTE: ArcGIS Online does not save automatically!



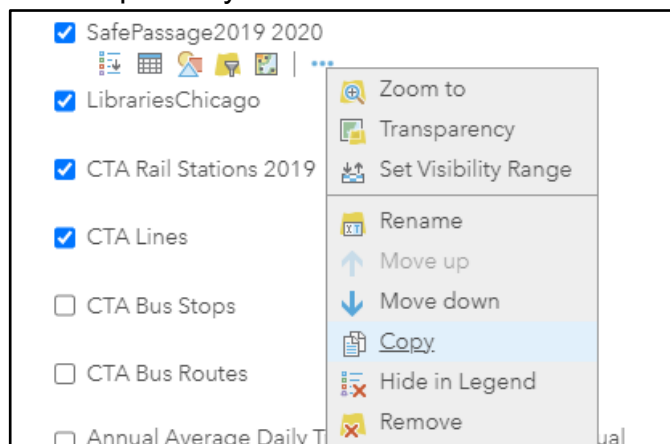
Add data layers from ArcGIS Online

These are some potential data layers we have identified that can be used for this lesson. They are tagged “ChicagoGSS”. They are shared within our organization, and you can add tags for your class.

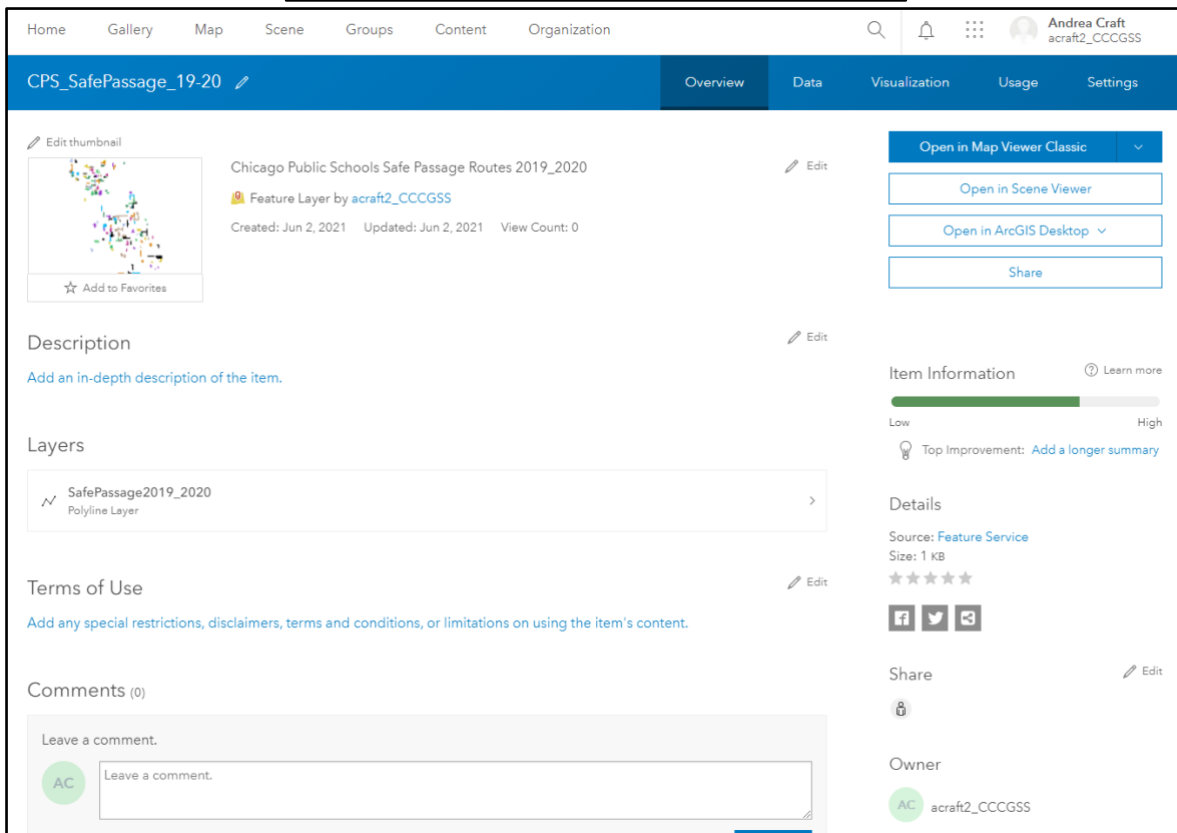
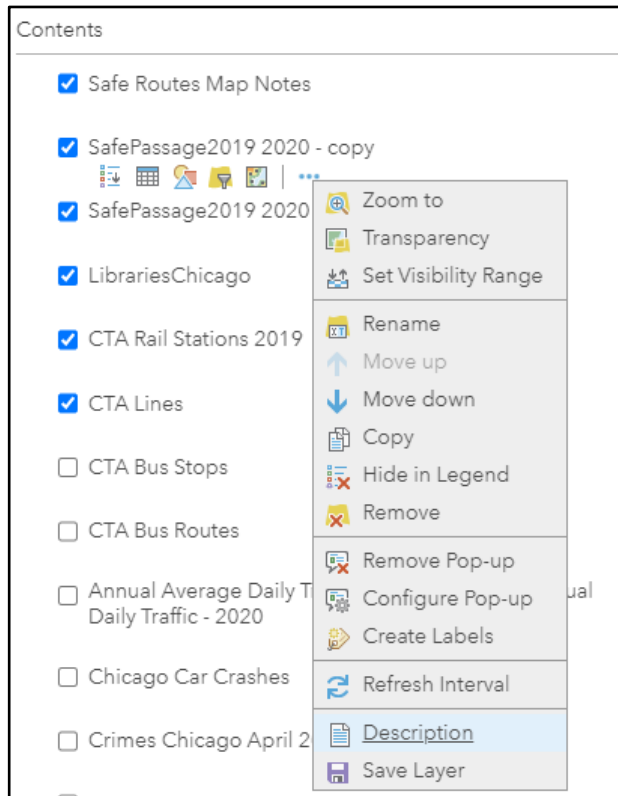
- Public transit
 - CTA rail and station:
 - CTA_Lines*
 - CTA Rail Stations 2019*
 - CTA bus lines and stops
 - CTA Bus Lines*
 - CTA Bus Stops*
- Crime
 - Reported crime points:

- Crimes Chicago April 2020 to 21*
 - Crime index areas
 - USA Property Crime*
- Traffic
 - Car crashes
 - Chicago Car Crashes*
 - Average daily traffic
 - Annual Average Daily Traffic - 2020 - Average Annual Daily Traffic - 2020 - GSS copy*
- Biking
 - Bike routes
 - Chicago Bike Routes 2021*
- Pollution
 - Industrial sites releasing toxic waste
 - Chicago TRI Facilities*
- Police interactions
 - Stop & frisk incidents
 - CPD_ISR_2018_19*
- Safe places, teen hangout places
 - Libraries
 - ChicPubLibraries*
 - Places to eat/get coffee/fun activities near your school?

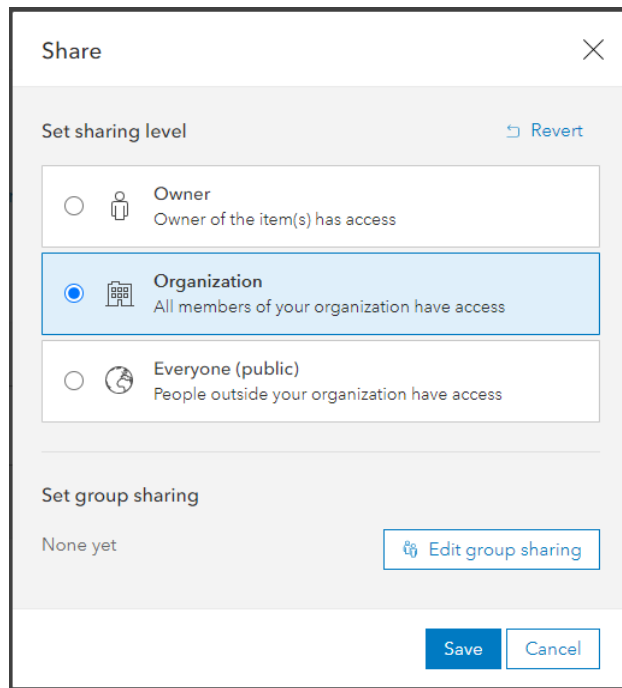
If you find a data layer in ArcGIS Online or Living Atlas, you can save a copy, tag it for your class, and add a description if you'd like.



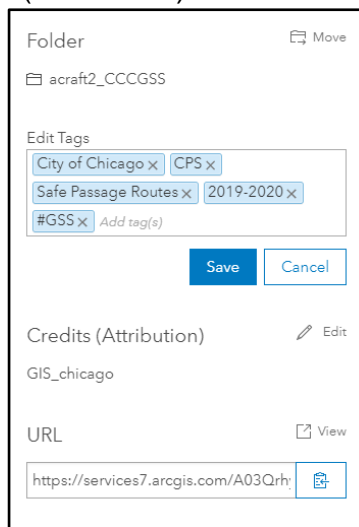
Once you have made a copy, go to Description to change the title, add a description and tag, etc.



Change the sharing level to “Organization”. This is necessary for your students to be able to search for it.



Once you have saved a new copy, you are the owner of this layer. Make sure you list the original source under Credit (Attribution)



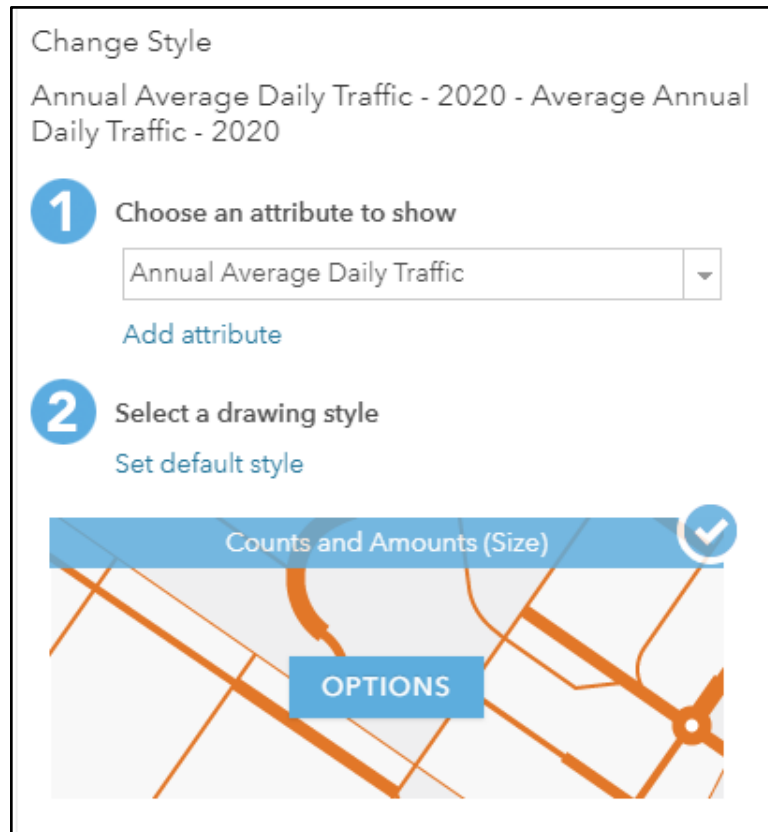
GIS Analysis - How to make use of the data

Some data layers, such as rail lines and stops, can be symbolized by simple shape and color choices. With others, such as traffic and car crashes, we can learn more about patterns in the data by using some additional symbology options.

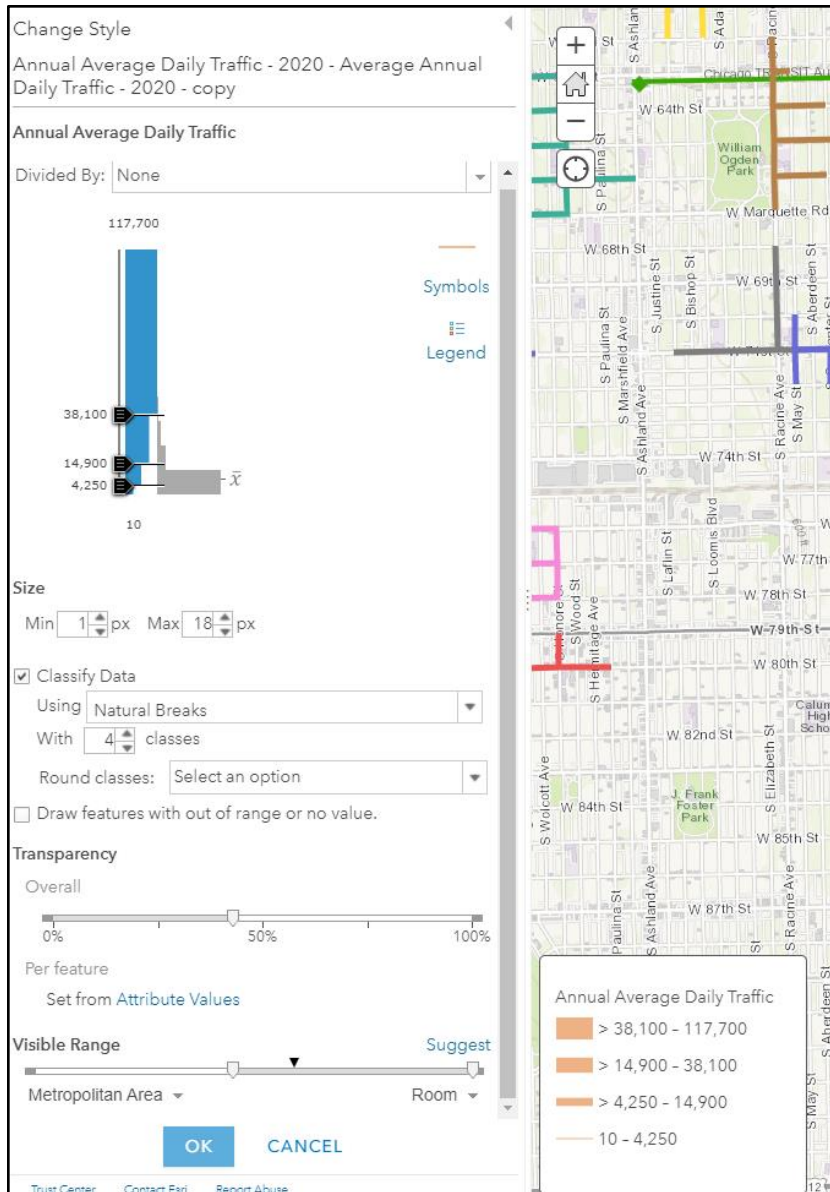
How to symbolize street traffic levels:

Search ArcGIS Online and add: Annual Average Daily Traffic - 2020 - Average Annual Daily Traffic - 2020 - GSS copy

- Change style to show Counts and Amounts (Size) of Annual Average Daily Traffic



- Classify data using Natural Breaks



How to show high density point layers as clusters:

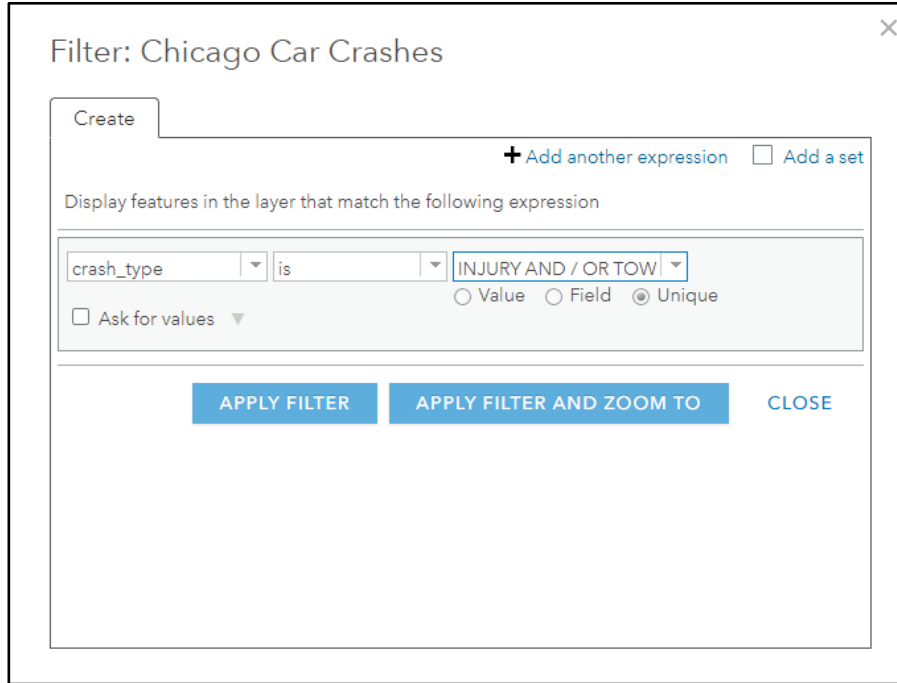
When you have very large datasets with lots of points, you may want to simplify it by grouping the points into clusters.

Search ArcGIS Online and add "Chicago Car Crashes"

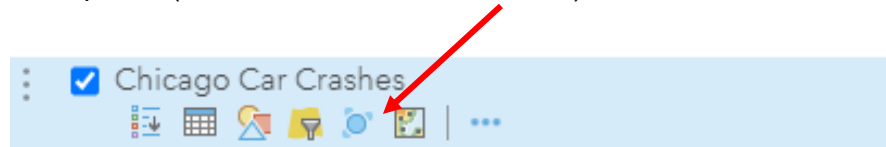
- Create a filter to identify the types of crashes that are most important in assessing a safe commute to school.

- Crash type (injury or not)
- Time of day
- Day of week

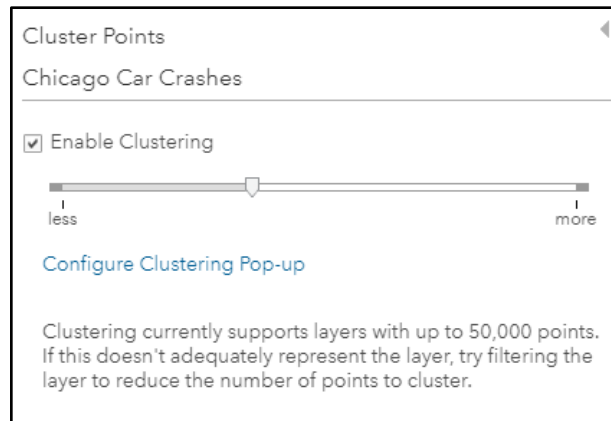
Example:



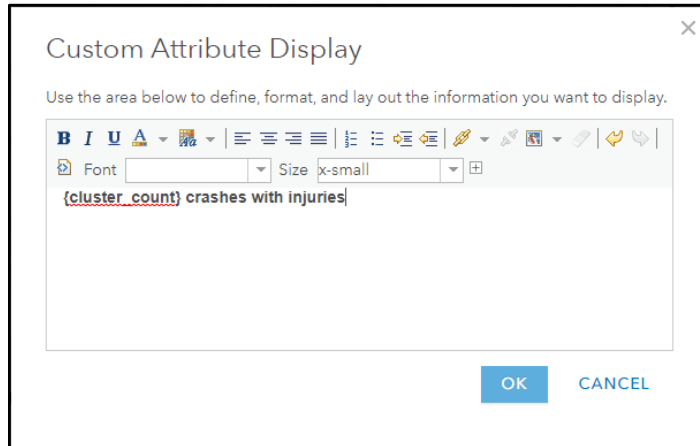
- Then cluster points (it's the 5th icon, the blue circle):



- Use the slider to set level of clustering:



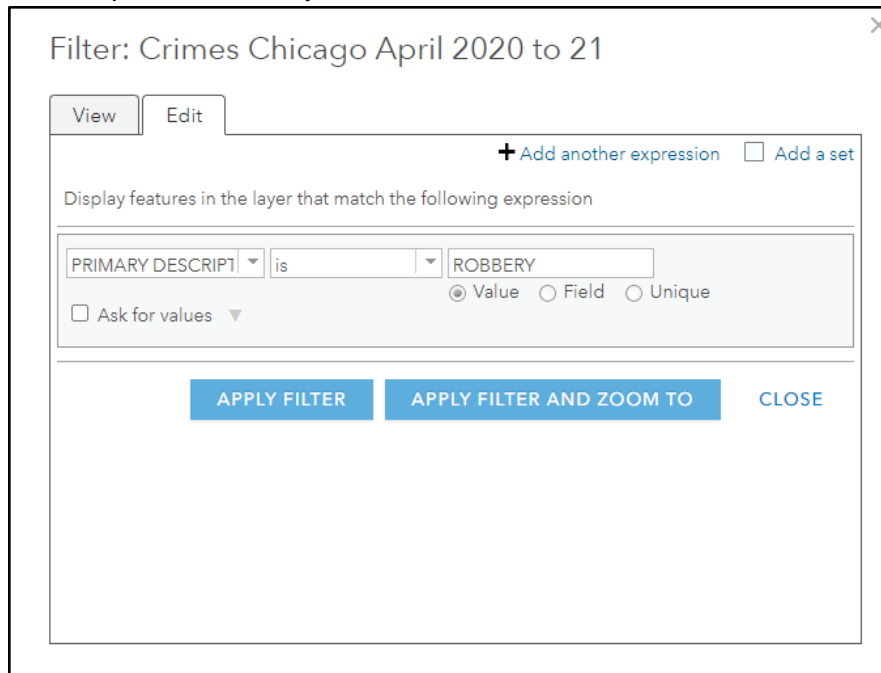
- Configure popups to say how many crashes occurred at each cluster:



How to filter crimes layer to show relevant reported crimes:

Search ArcGIS Online and add “Crimes Chicago April 2020 to 21”

- Filter for Description = Robbery




- Enable clustering and configure popups

Chicago Geospatial Semester Project

Cluster Points
Crimes Chicago April 2020 to 21

Enable Clustering

 less more

[Configure Clustering Pop-up](#)

Configure Clustering Pop-up
Crimes Chicago April 2020 to 21

Show Pop-ups ⓘ

Pop-up Title

Pop-up Contents
















Display:

CONFIGURE

[Configure Attributes](#)

Custom Attribute Display

Use the area below to define, format, and lay out the information you want to display.

B I U   |     |     |    |  

Font Size

{cluster_count} reported robberies near this location

OK **CANCEL**

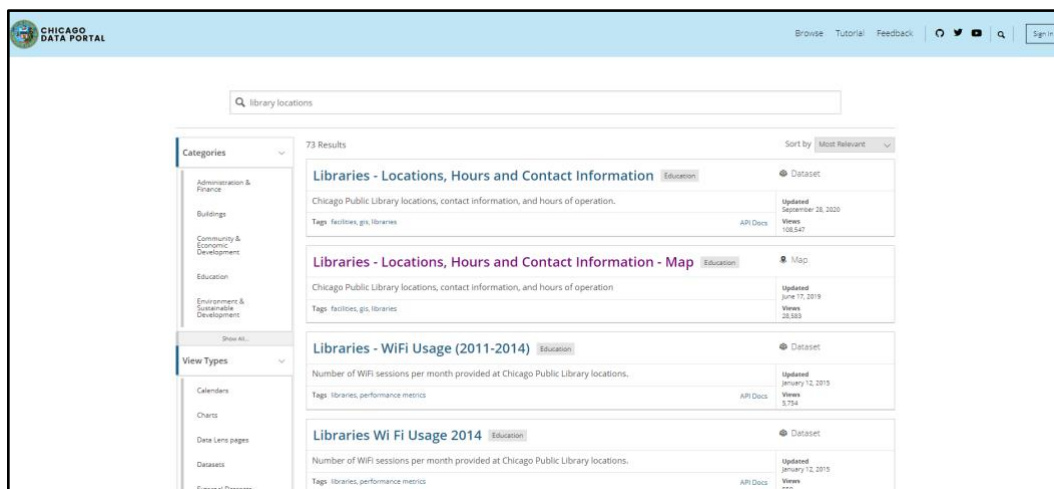
About the Living Atlas crime index layer:

Layer “USA Property Crime”

- This shows property crime index at different scales, down to the block group level
- No data table, but popups are pre-configured

How to find and use external datasets from the Chicago Data Portal:

- Go to <https://data.cityofchicago.org/>
- Search:



- Data does not need to be categorized as “Map” in order to be mapped. If it is a “Dataset”, preview the data table to make sure it has columns with geographic information, such as latitude and longitude or addresses

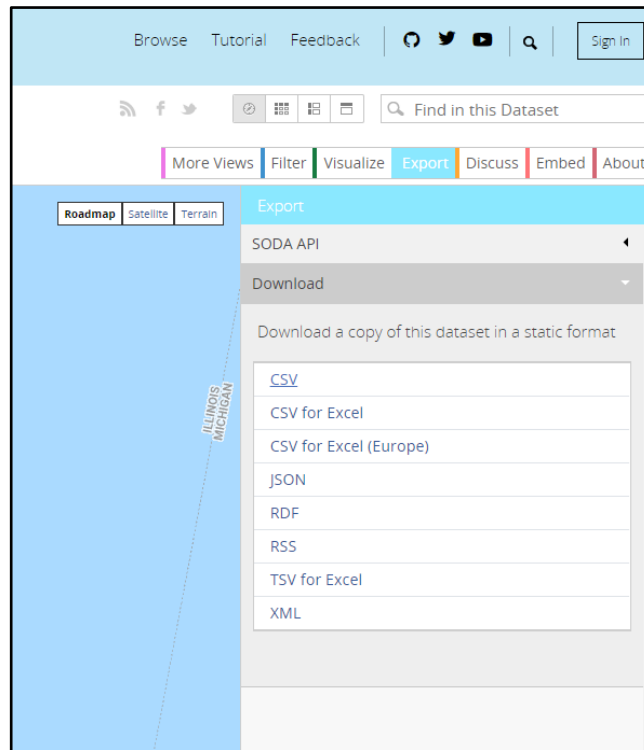
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Table Preview [View Data](#) [Create Visualization](#)

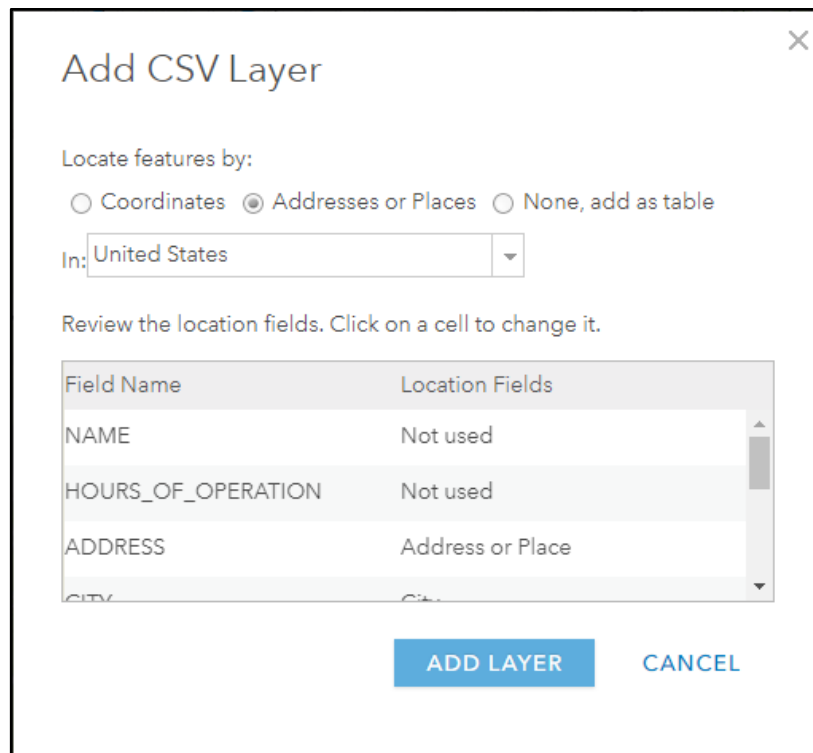
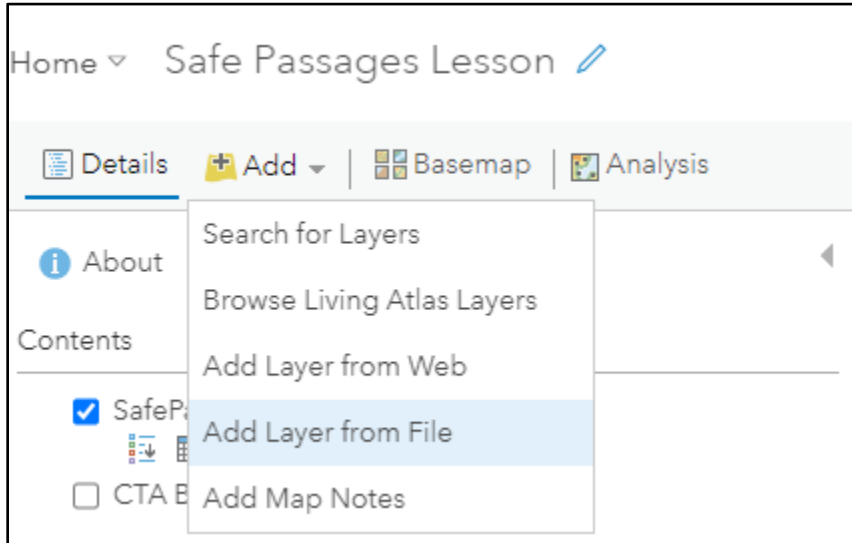
NAME	HOURS OF...	ADDRESS	CITY	STATE	ZIP	PHONE	WEBSITE	LOCATION
Albany Park	Sun., Closed; M...	3401 W. Foster...	Chicago	IL	60625	(773) 539-5450	https://www.ch...	(41.975456°, -8...
Altgeld	Sun., Closed; M...	13281 S. Corlis...	Chicago	IL	60827	(312) 747-3270	https://www.ch...	(41.654730218...
Archer Heights	Sun., Closed; M...	5055 S. Archer ...	Chicago	IL	60632	(312) 747-9241	https://www.ch...	(41.801213659...
Austin	Sun., Closed; M...	5615 W. Race A...	Chicago	IL	60644	(312) 746-5038	https://www.ch...	(41.889272153...
Austin-Irving	Sun., Closed; M...	6100 W. Irving ...	Chicago	IL	60634	(312) 744-6222	https://www.ch...	(41.953173900...
Avalon	Sun., Closed; M...	8148 S. Stony I...	Chicago	IL	60617	(312) 747-5234	https://www.ch...	(41.746717221...
Back of the Yar...	Sun., Closed; M...	2111 W. 47th St.	Chicago	IL	60609	(312) 747-9595	https://www.ch...	(41.808384423...
Beverly	Sun., Closed; M...	1962 W. 95th St.	Chicago	IL	60643	(312) 747-9673	https://www.ch...	(41.721180505...
Bezazian	Sun., Closed; M...	1226 W. Ainslie...	Chicago	IL	60640	(312) 744-0019	https://www.ch...	(41.971681948...
Blackstone	Sun., Closed; M...	4904 S. Lake P...	Chicago	IL	60615	(312) 747-0511	https://www.ch...	(41.805840309...
Brainerd	Sun., Closed; M...	1350 W. 89th St.	Chicago	IL	60620	(312) 747-6291	https://www.ch...	(41.732316757...
Brighton Park	Sun., Closed; M...	4314 S. Archer ...	Chicago	IL	60632	(312) 747-0666	https://www.ch...	(41.815138789...
Bucktown-Wick...	Sun., Closed; M...	1701 N. Milwa...	Chicago	IL	60647	(312) 744-6022	https://www.ch...	(41.912722395...

< Previous Next > Showing Rows 1 to 13 out of 81

- Look for “Export” button. Export dataset in .csv or .shp format



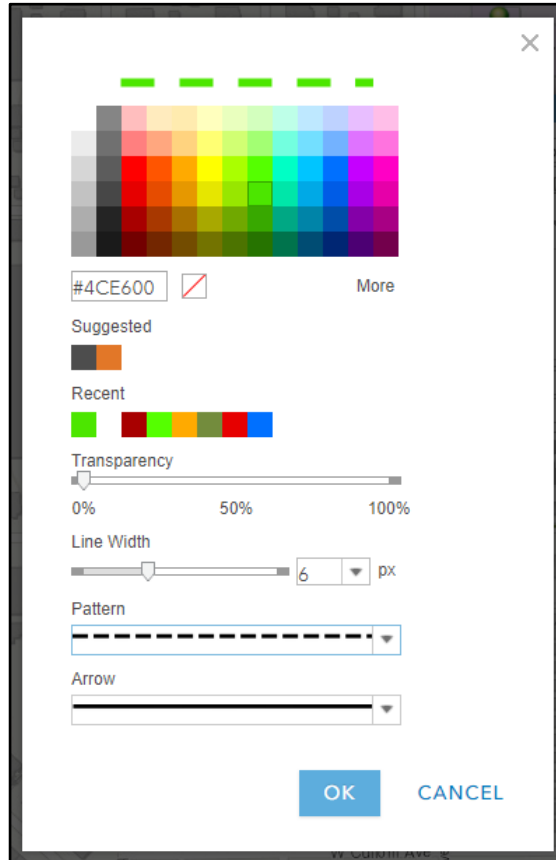
- There are two ways to add a layer to your map.
 - The easiest is to drag and drop the file right into your map.
 - If your file is larger, or there are multiple address fields (address, city, state, etc), select “Add layer from file”



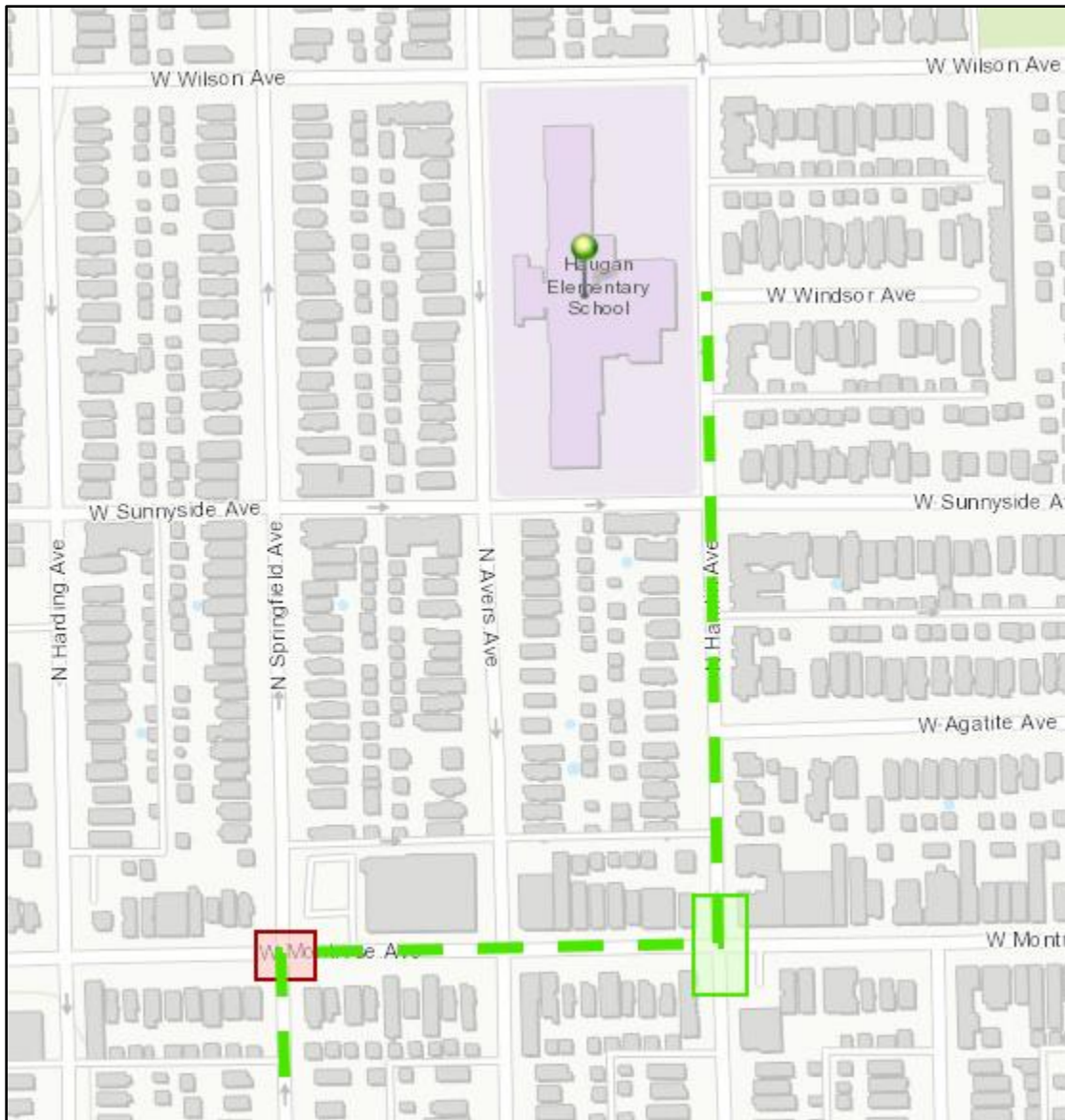
Create your safe route to school

After students have completed their analysis, each group should consider all the information they have gathered and mapped, and determine what route they could take that makes the best use of “safe spots” and avoids or improves problem spots. Add that route to the map using map notes, as a line feature.

Example symbology:



Example map:



Community Change Agents

Overview

In this lesson you will use mobile data collection technologies and geographic information systems (GIS) to collect and analyze data about your community. You will develop a research question related to something about your community that interests you. You will then work with your classmates to collect local data related to your research question, use GIS to analyze spatial patterns and relationships in your data, and share your analysis and answers to your research question with the class.

Data in Your Community

Imagine walking to school. *As you walk, what are things you could count, observe, measure, estimate, or rate during the journey? More importantly, which of these examples is the most interesting to you?*

Complete the chart with 3 examples of data you can collect in your community. Identify which of the community data examples you are the most interested in.

Community Data	What could you do to collect data? (count, observe, measure, estimate, rate)

Defining “Your” Geography

Individuals and societies use many methods to organize people and the land they inhabit. Borders and community areas of various sizes have been established across most of the planet. Examples include countries, states, counties, census tracts, zip codes, community areas, neighborhoods, etc.

As a first step in your project, you need to define a specific “geography” or the area from which you will collect data. Questions to consider as you define your area include:

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- *What is an appropriately sized geography that will provide a meaningful amount of collected data?*
- *What features define the borders of your geography?*
- *Will you be able to equally access most parts of your geography?*
- *What existing geographies could you use for this project? (Why do extra work!?)*

Developing a Research Question

Your goal in collecting local data is to investigate a question you have about your community. This question should be considered your research question (RQ). Collecting local data will allow you to use GIS analysis to help you answer your RQ with evidence.

The ultimate goal of this project is to foster change, improvement, or growth in your community. Think about the community data examples you listed above and consider the following questions alone and then with a partner:

- *Is there a community issue you would like to investigate and solve?*
- *Are there ways you would like to improve your community?*
- *Does your community have assets or highlights that you would like to learn more about?*
- *What local data could you collect related to this community issue, asset, or improvement? Is it related to the community data you listed above?*

Based on your discussion, develop a specific research question that you would like to address. The research question should draw on the community data and issue, asset, or improvement that you would like to investigate. Make sure the community data you choose to collect will help you answer your research question. Write your research question in the space below.

Collecting Local Data with Survey123

Next, use Survey123 to design a tool to collect the data you need for your project. Your teacher will show you how Survey 123 works. Then you will create the survey and collect your data!

GIS Data Analysis

Once you've collected your data, it's time to use GIS to look for spatial patterns and relationships in the data. First, you will move your data from Survey123 into ArcGIS online (Your teacher will walk through this process). Once you have your map, think about the ways you want your data to be classified and symbolized in GIS.

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Take a look at your map and consider the following questions:

- *Do you notice any patterns in the data across your defined geography?*
- *How does the data change as you look at various locations?*
- *What trends/patterns/differences do you see in the data?*
- *What's causing these differences or patterns and how are they related to issues within your community?*

Next, use Arcgis Online, ESRI's Living Atlas, or [The Chicago Data Portal](#) to find additional data that could be helpful in explaining your findings, the patterns you see in the data, and answering your RQ. Examples of relevant data include: age, gender, race/ethnicity, socioeconomic status, crime, landscape/geography, and census data. Add any layers that you think are useful to your map and revisit the questions above.

Save and share all map(s) and layers.

Creating a Storymap

Next you will create a storymap to showcase your maps, analysis, and findings. All maps and layers created need to be shared and then uploaded into a chosen storymap template. Your storymap should focusing on addressing these:

- *What issue(s) does your research question examine?*
- *What answers has your GIS analysis provided?*
- *How can your analysis and findings be used by people in your community?*

Sharing Your Findings

Finally, you will present your storymap to your classmates. If possible, you can also share your storymap with members of your community.

Community Change Agents

Implementation Guide

Learning Objectives

Students will use mobile data collection technologies and geographic information systems (GIS) to gather and analyze data relative to their surroundings/communities. *Examples of data include: student observations of cell phone use by operators of vehicles, the location of trees within parks, broken sidewalk sections, gas station locations, etc.* Patterns and trends in the data will be examined spatially across student-selected geographies and factors related to identified relationships will be investigated. The overall goal of the project is to promote student collaboration and integrate collected data into ArcGIS online for mapping, display, and analysis purposes. Findings and results will be communicated through the creation of storymap presentations.

Standards

- CCSS.ELA-LITERACY.SL.9-10.2 / CCSS.ELA-LITERACY.RST.11-12.7: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
- CCSS.ELA-LITERACY.RST.9-10.4 / CCSS.ELA-LITERACY.RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- CCSS.ELA-LITERACY.SL.9-10.5 / CCSS.ELA-LITERACY.SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- CCSS.ELA-LITERACY.WHST.9-10.6 / CCSS.ELA-LITERACY.WHST.11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- CCSS.ELA-LITERACY.WHST.9-10.8 / CCSS.ELA-LITERACY.WHST.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

- CCSS.MATH.CONTENT.HSS.MD.A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

Lesson Structure

Overview

Students will be introduced to data collection by generating examples ideas of data that exists in their community. Next, students will select a topic related to a community issue and develop a specific research question. They will then use GIS to collect relevant local data and analyze patterns and relationships within the collected data. Analysis, findings, and answer(s) to research questions will be presented via student-made storymap presentations.

NOTE: This lesson can be done individually or in groups. Structure the lesson in the way that will work best for the individual needs and circumstances of your classroom.

Lesson Introduction

Students will develop examples of community data that could be collected, mapped, and analyzed. They will then develop a research question related to an issue or asset in the community or a community improvement project that interests the students.

Provide a brief introduction to Survey123, ArcGIS Online and the relationship between the software/technology and the lesson's goals. Answer questions.

Modeling Survey123 and Arcgis Online Techniques

Demonstrate how to create and modify a survey in Survey123. Provide time for students to familiarize themselves with survey design and creation as well as practice collecting (and retrieving) data for GIS analysis. Various GIS analysis tools will be explored post Survey123 practice time.

Work Time

Students will create individual surveys uniquely fit to collect the community data they have identified and selected. Parameters for data collection will be established by the teacher and can be scaled up or down depending upon the amount of allocated time and the size of the assumed locations students plan to visit.

Students will take their collected data and import it into Arcgis Online. Relationships and patterns in the collected data will be analyzed using GIS and compared/coupled with other data from differing sources (Arcgis Online and or esri's Living Atlas). Answers to proposed research questions will be provided.

Storymap Activity

Before the storymap activity, model the process of creating a storymap. Students will work collaboratively in their small groups (or individually) to create a storymap that includes their maps, analysis, and research question answers.

When they are done, have students share/present their storymaps with the class. This can involve either a whole class presentation or small group discussion.

Modeling GIS Skills

At the beginning of the lesson, model the data collection techniques (using Survey123) that students will use in the aforementioned inquiry lesson. Step-by-step instructions for the data collection/survey use, and GIS skills that are needed for this lesson, are outlined below.

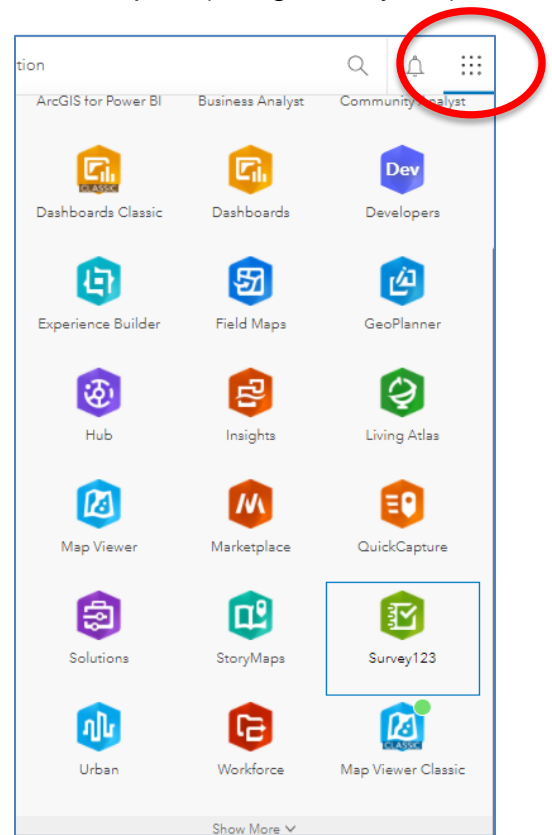
Survey 123 Skills: Survey Creation

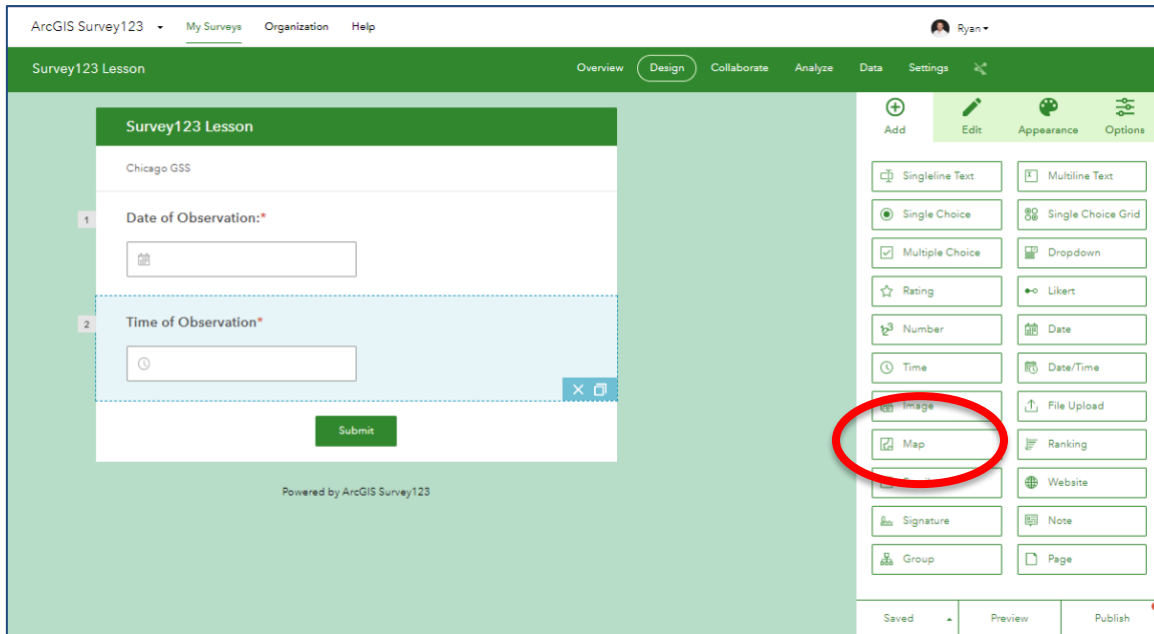
Creating a survey begins with accessing Survey123 within the Arcgis Online ecosystem. The “waffle” icon on the top right of the screen provides access.

Follow the prompts related to create a new survey, the option related to blank surveys provides the most flexibility in choosing how data will be collected.

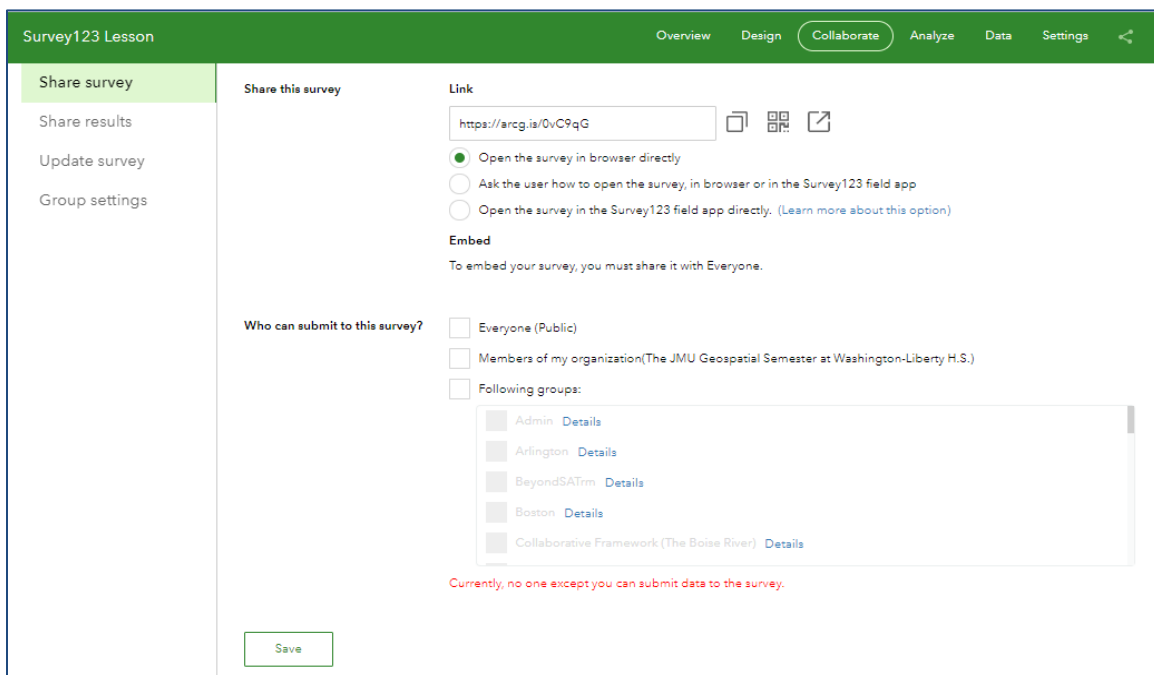
Modifying Surveys

Demonstrate how to insert questions and adjust visible parameters based upon the preference of the survey designer. Modifications can be made following provided prompts. Important: stress to students the need to ask appropriate and related questions that help to potentially answer their proposed research questions. Examples of the page where modifications to the survey are provided, follow below:





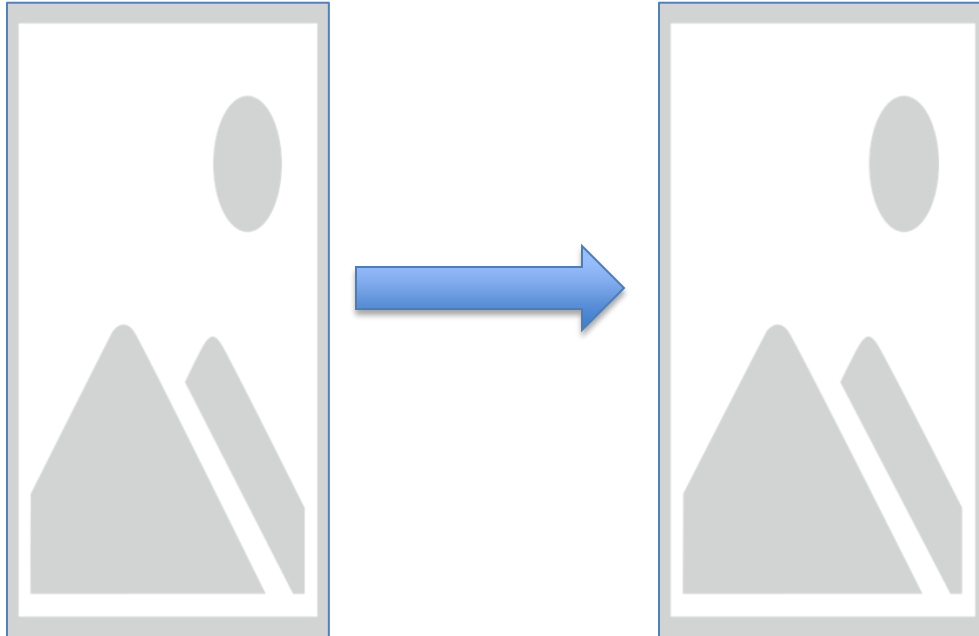
IMPORTANT: survey results for this lesson will be dependent upon the location where data is taken. The MAP feature will need to be added to the survey to collect location data. It is in the list of parameters in the image above.



Saving and publication are the last steps in the protocol, if other people will be collecting data for the survey, it is important to grant access, **Collaborate properties** must be adjusted. The survey can then be sent/shared with other collaborators.

Collecting Survey Data

Two options exist for Survey123 users when collecting data. Action can be taken using a URL to access the survey OR a user may download the Survey123 APP onto a mobile device. Both will require Arcgis Online log-in credentials for use. Searching in the APP for your survey needs to be done first, then the survey can be added to the app for use.



Using GIS to analyze collected data

Students can be directed to log into their Arcgis Online accounts once data collection is complete and return to the Survey123 section. Access the survey, click on Data in the green menu bar and “Open in Map Viewer” to begin using GIS for analysis work.

Data And Time Of Observation	DECIDUOUS or EVERGREEN Tree?	Tree Health Observation:
May 26, 2021, 12:45 AM	2	DEAD
	1	

Opening and displaying the data in the map viewer will allow users to add data relevant to the process of answering the research. Upon the completion of the GIS analysis, Web Maps must be SAVED and then SHARED (user sets the properties) to proceed to

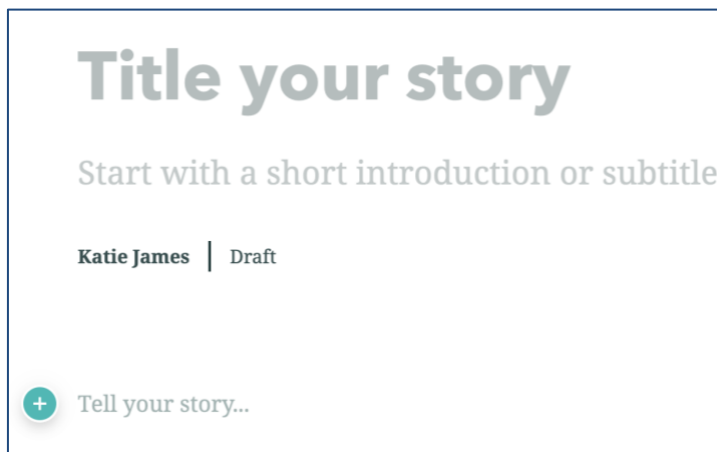
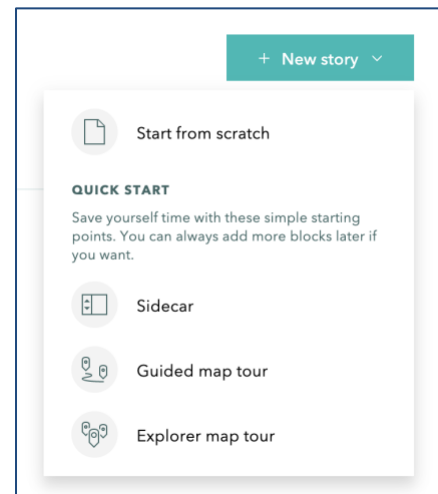
the final lesson objective: creating a Storymap Application that presents the results of each survey's data analysis and answer(s) to the proposed research question.

Creating a Storymap

Open the map that was created and used in the analysis section above. Hit "SHARE," select "CREATE A WEB APP," and then "BUILD A STORYMAP" to commence work on the final lesson deliverable, the storymap application that displays the collected data, the GIS analysis via created maps, and subsequent discussion of results and research question answers. OR, once logged into Arcgis Online:

Click "New Story" and select the type of StoryMap you want to create. If you want the most flexibility, try "start from scratch." If you want a pre-set structure, try the other options.

Follow the prompts to add information to your storymap. Click the green plus sign to add other media, such as maps and videos, or more text to your story. When you are ready to share your story, don't forget to click publish!



Social Action Project

Overview

In this lesson you will use Geographic Information Systems (GIS) to explore and develop an action plan to address a social justice issue in your community. GIS can be used to identify locations (e.g., existing parks and libraries) and spatial patterns, such as a gap in access to healthcare in particular areas of Chicago. You will use GIS to investigate spatial patterns related to any social justice issue you choose. You will then use this information to analyze the root causes of the issue and develop an action project to address it.

My Community

First, think about the community you live in and discuss the questions below with a partner. Be sure to identify 2-3 of the best things about your community and 2-3 things you might like to change and add them to the chart below.

- How would you describe your community?
- What makes you happy about where you live?
- What are some of the best things in your community?
- Are there things about your community that you would like to change?

Community Strengths	Opportunities for Change

GIS Analysis: Community Demographics

Next, create a map that includes the layer “Popular Demographics in the United States.” Locate your home on the map and add a mapnote. Choose at least two different attributes (e.g., average household income) to explore. You can choose any attributes that interest you.

Take a look at the maps for the attributes you chose and consider the following questions with a partner:

- Do you notice any patterns across the City of Chicago?
- As you compare the different data layers to each other, what have you discovered?
- What other information might you want to add to your map to get even more insight about patterns across Chicago?

Social Action Project

The goal of the social action project is to identify a social issue that you care about, more deeply understand this issue and its impact on your community and Chicago, and develop an action plan to address the issue. This project will prepare you to identify, plan, and carry out solutions to issues within your school, community, and city.

Some possible topics are below but you can choose any issue that interests you. Work with your teacher to form a small group based on social issues that interest you.

- **Healthcare Access:** Are there areas of the city that are lacking in access to hospitals or pharmacies? Are there differences in the number of COVID-19 cases or vaccinations across the city?
 - *Possible Data Source:* Browse the Health and Human Services data catalog on [The Chicago Data Portal](#).
- **Healthy Food Access:** Does your community have access to healthy food options? Are grocery stores or farmer's markets equitably distributed across the city?
 - *Possible Data Source:* Search the ArcGIS Online Library for layers such as "Farmers Markets" "Grocery Stores" or "Fast Food"
- **Crime and Safety:** What types of crime are happening in your community or near your school and how often?
 - *Possible Data Source:* Search the Public Safety category of [The Chicago Data Portal](#) for data layers related to crime location and frequency.
- **Community Resources:** Are there parks, playgrounds, libraries, and other resources available in your community? Are there resources that are not currently available that might benefit your community?
 - *Possible Data Source:* Search the ArcGIS Online Library for layers such as "CPD Parks" or "CPD Park Facilities".

GIS Analysis: Spatial Patterns of Social Justice

Find data layers that are relevant to your social justice issue and add them to your map. Next, find relevant attributes in the "Popular Demographics in the United States" layer or add additional data layers that you are interested in exploring and might help you better understand the issue you are investigating. Some examples include:

- Education
- Unemployment
- Household Income
- Diversity, Race/Ethnicity

With your group, explore the data layers and consider the following questions:

- Do you notice any patterns across your community? The city?
- As you compare the different data layers to each other what have you discovered?

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- Do all or some of the factors appear to be related? If so, how?
- Are there particular areas you would want to target in your action plan? How would you address the issue in those areas?

Social Action Plan

Next, work with your group to develop an action plan to help address your issue. Your action plan should do the following:

- Focus on solutions that will address the root causes of a social issue
- Engage community members in the action steps and implementation
- Educate and motivate others to get involved and take action

Examples of action plans and the social issues they address include:

Social Issue	Example Action
Healthcare Access	Develop an action plan to connect community members with the closest available hospitals, clinics, or pharmacies.
Healthy Food Access	Create a proposal for stores or farmers markets targeting areas that currently lack access to healthy foods.
Crime and Safety	Develop a crime prevention plan that focuses on areas with high incidences of crime or locations near schools and leverages community resources
Community Resources	Create a proposal for a new playground or other park facility in areas that lack such resources

Create a Storymap

Finally, work with your group to create a storymap that includes your map(s) and your action plan. Present your storymap to your classmates and make a plan to share your work with relevant community members.

Social Action Project Implementation Guide

Learning Objectives

Students will use Geographic Information Systems (GIS) to explore and develop an action plan to address a social justice issue in their communities. GIS can be used to identify locations (e.g., existing parks and libraries) and spatial patterns, such as a gap in access to healthcare in particular areas of Chicago. Students will use GIS to investigate spatial patterns related to any social justice issue they choose. They will then analyze the root causes of the issue and develop an action plan to address it. Through this lesson, students will learn GIS skills including searching the living atlas and ArcGIS Online for layers, adding data layers, filtering data layers, and creating map notes.

Standards

- CCSS.ELA-LITERACY.SL.9-10.2 / CCSS.ELA-LITERACY.RST.11-12.7: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
- CCSS.ELA-LITERACY.RST.9-10.4 / CCSS.ELA-LITERACY.RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- CCSS.ELA-LITERACY.SL.9-10.5 / CCSS.ELA-LITERACY.SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- CCSS.ELA-LITERACY.WHST.9-10.6 / CCSS.ELA-LITERACY.WHST.11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- CCSS.ELA-LITERACY.WHST.9-10.8 / CCSS.ELA-LITERACY.WHST.11-12.8: Gather relevant information from multiple authoritative print and digital

sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

Lesson Structure

Overview

The lesson starts with a discussion about students' communities, focusing on strengths and opportunities for change. Students will then explore demographic data that interests them and analyze spatial patterns across the city. Next, they will select a social justice issue to explore and create and analyze a map that includes relevant data. Finally, they will use this analysis to inform the development of a social action plan and create a storymap that includes their maps, analysis, and action plan.

Lesson Introduction and Model

After the "my community" discussion, have each student get a computer and log in to their ArcGIS account.

Provide a brief introduction to the GIS portion of the lesson and answer questions. Next, model the GIS techniques that they will be using during the lesson. The techniques are detailed in lesson order below. At this stage, don't introduce storymaps. You will preview those right before the storymap activity.

Work Time

Students will add layers to their maps to analyze spatial patterns and relationships among data layers related to social justice in Chicago.

As they work on their individual maps, encourage students to collaborate to figure out how to apply the GIS techniques to their projects. Provide support and answer questions as needed.

After completing their individual maps, students will form groups of 2-3 based on the social justice issue they want to investigate. Help students get into groups, and provide discussion questions to guide the group.

Storymap Activity

Before the storymap activity, model the process of creating a storymap. Students will work collaboratively in their small groups to create a storymap that includes their maps, analysis, and action plans.

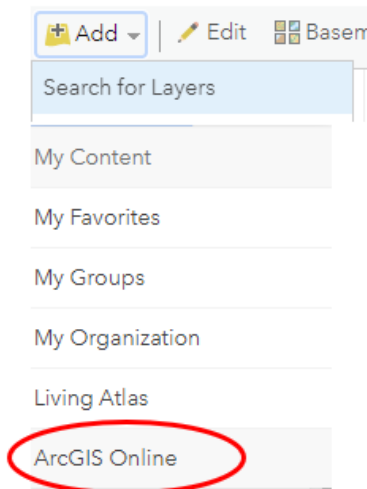
When they are done, have students share their storymaps with the class. This can involve either a whole class presentation or small group discussion.

Modeling GIS Skills

At the beginning of the lesson, model the GIS techniques that students will use in the inquiry activities. Step-by-step instructions for the GIS skills that are needed for this lesson are outlined below.

GIS Skills: Searching & Adding Layers

To find data layers, go to the “Add” menu. You will either search the Living Atlas or ArcGIS Online. Each data library has different data layers available so if you don’t find what you’re looking for in one, you may want to search the other.



To search for layers, go to “Add” and “Search for Layers” and select either the Living Atlas or ArcGIS Online from the menu. (Note: The default is “My Content” which will only search maps you have saved in your account)

During the *GIS Analysis: Demographics* activity, you will search for “Popular Demographics in the United States” in the Living Atlas. Next, add the data layer to the map by either clicking the plus sign (+) or “add to map.” If you would like to see what information is given for the layer, hover the cursor over the layer name, click on More Options **...** and go down to “Show Item Details”.

Adding Data from the Chicago Data Portal

Go to the [Chicago Data Portal](#). Choose the appropriate data category

BROWSE THE DATA CATALOG BY THE FOLLOWING CATEGORIES



For this example, a data layer that depicts the most recent year of crime in Chicago will be used.

Choose Public Safety and search for Crimes – One year to present. Scroll down.

The screenshot shows the dataset page for 'Crimes - One year prior to present' under the 'Public Safety' category. The page includes a description: 'This dataset reflects reported incidents of crime (with the exception of murders where data exists for each victim) that have occurred in the City of Chicago over the past year, minus the most recent seven days of data. Data is More'. It also shows 'Updated March 2, 2021' and 'Views 93,594'. Tags include 'police, crime' and there is an 'API Docs' link.

Click on Export and download the file as a CSV file.

The screenshot shows the 'Export' dropdown menu from the dataset page. The 'CSV' option is circled in red. Other options include 'CSV for Excel', 'Additional Formats', 'CSV for Excel (Europe)', 'TSV for Excel', 'RDF', 'XML', and 'RSS'.

Once downloaded, log into ArcGIS Online. You have two options to import your data.

- 1) Open a map and drag and drop your data file onto the map
- 2) Go to “Content” and select “Add Item” and “From your Computer.” Then click “Choose File” and navigate where the CSV file is located.

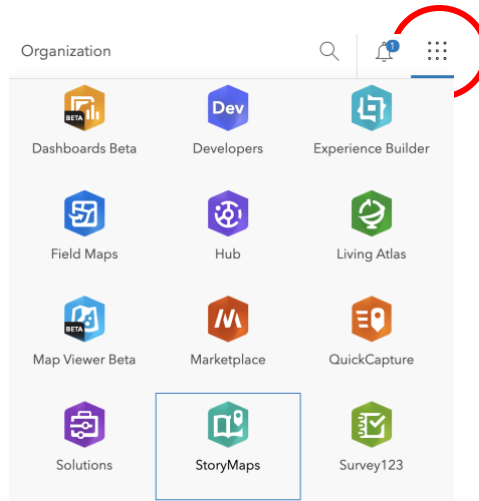
The screenshot shows the 'Add Item' menu in ArcGIS Online. The 'From your computer' option is selected, which allows users to 'Publish a layer from a file; upload a document or image.' The 'Add Item' and 'Create' buttons are visible at the top of the menu.

You will then need to fill in the title and tags and choose the spatial information that GIS should use to create the map. Choose the option that matches the information that is in your data (e.g. Coordinates, Address)

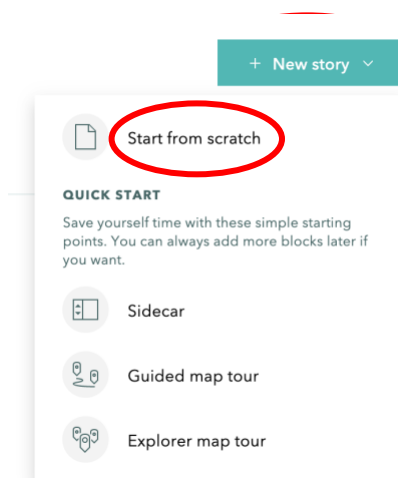
Create a Storymap

In the home menu, click on the app builder icon and select the “StoryMaps” app.

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Click “New Story” and select the type of StoryMap you want to create. If you want the most flexibility, try “start from scratch.” If you want a pre-set structure, try the other options.



Follow the prompts to add information to your storymap. Click the green plus sign to add other media, such as maps and videos, or more text to your story. When you are ready to share your story, don't forget to click publish!

Title your story

Start with a short introduction or subtitle

Katie James | Draft



Tell your story...