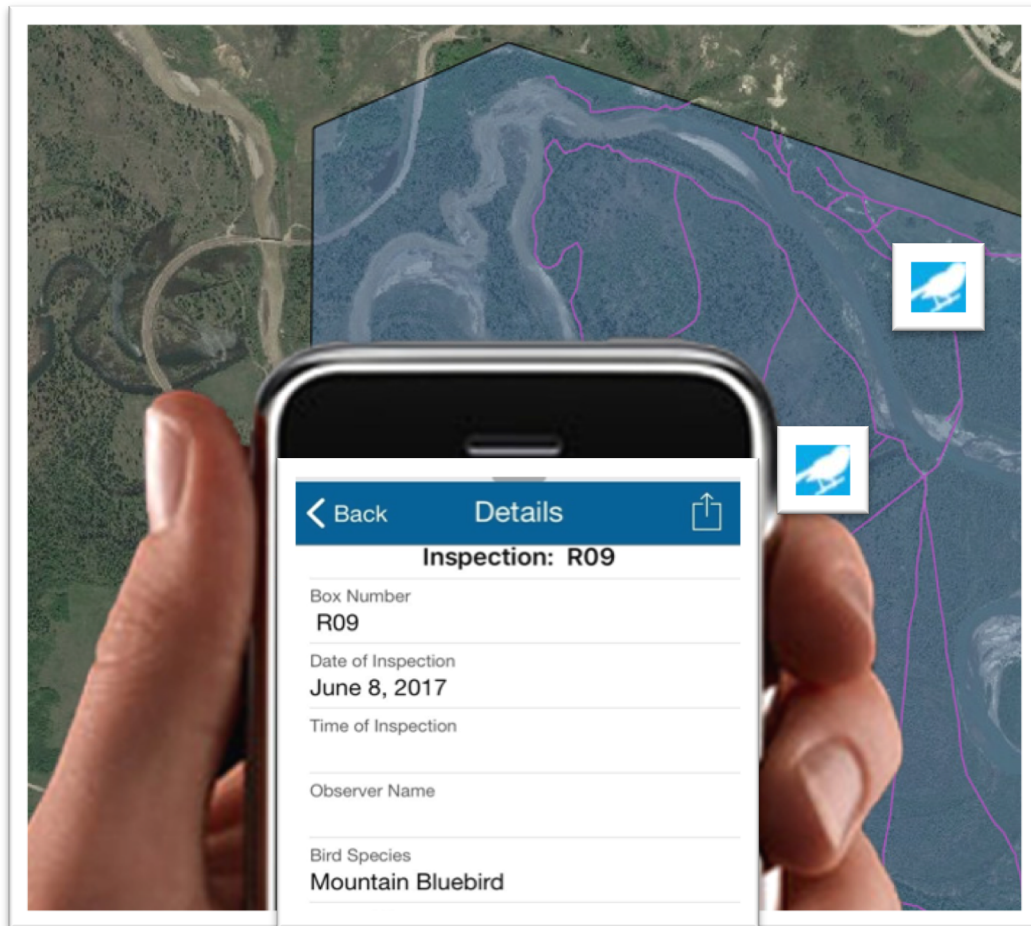


Spatial Data Collection for Citizen Science



Developing Collector Applications with ArcGIS

Manual and Tutorials

Based on ArcMAP version 10.6

August 2018

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Table of Contents

Introduction to Geospatial Citizen Science	4
What is Citizen Science?	4
Geospatial Citizen Science	4
Spatial perspective and asking spatial questions	4
The Importance of a Spatial Perspective	4
Use of Spatial Data	5
Geographic Information Systems	7
What is GIS?	7
Spatial data – What can be mapped?	8
What is Collector?	9
What spatial question do you want to ask?	9
Constructing a Collector App	10
Structure of Customizing a Collector App	11
Tutorials	13
Best practices to start every project	13
BikeSafe Collector App	13
Constructing Your Geodatabase	14
Constructing Your Feature Class	16
Configuring Your Map	21
Sharing your Feature Service on ArcGIS Online	25
Sharing Your Collector Map	29
Cemetery Collector App Tutorial: Historical Demographic Mapping	33
Constructing Your Geodatabase	33
Constructing Your Feature Class	38
Sharing Your Feature Service on ArcGIS Online	45
Sharing Your Collector Map	49

Customer Appeal Collector App Tutorial - Market Survey.....	52
Constructing Your Geodatabase	52
Constructing Your Feature Class.....	55
Sharing Your Feature Service on ArcGIS Online	60
Sharing Your Collector Map.....	63
HabitAPP Collector App Tutorial – Ecological Monitoring.....	65
Constructing Your Geodatabase	65
Constructing Your Feature Class(es)	67
Sharing Your Feature Service on ArcGIS Online	71
Sharing Your Collector Map.....	72
Bird Box Collector App Tutorial – A Visual Guide to Related Tables	75
Constructing Your Geodatabase	75
Constructing Your Feature Class.....	79
Constructing Your Table	84
Constructing Your Relationship Class.....	91
Sharing Your Feature Service on ArcGIS Online	96
Sharing Your Collector Map.....	100
Working Offline with Collector.....	103
Adding Collector Data to ArcMap – Post Collection Analysis	109
Analyses in ArcGIS Online.....	109
Analyses in ArcMap.....	110
References Cited.....	114
Appendix A: Suggested Reading.....	115

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Jessica (Paquette) Goodsell was instrumental in the HabitApp customization.

Introduction to Geospatial Citizen Science

What is Citizen Science?

“Citizen science” is the involvement of volunteers in the collection, analysis, and use of data (Bonney and Dickinson 2012). While the term citizen science is relatively new, the practice dates back hundreds of years (Miller-Rushing *et al.* 2012). There has been a tremendous increase in the number of both citizen science projects and volunteer participants over the past two decades (McKinley *et al.* 2015), not only in the natural and physical sciences but also in the social sciences and humanities (Dobrevá and Azzopardi 2014), where terms such as “crowdsourcing” may be used instead. Development of and access to new technologies is a major driving force behind this increase (Newman *et al.* 2012), and one of the most important is geospatial technology.

Geospatial Citizen Science

Geospatial citizen science is any citizen science project that collects and uses location information. A well-known example is eBird in which bird watchers place their bird observations onto maps, allowing for analysis of species distribution (eBird.org). The inclusion of geospatial data allows for more in-depth analysis and reveals patterns and trends that may otherwise go undetected. Geospatial data can be collected either by having citizen scientists entering data onto an online map once they return home or directly uploaded in the field using a geospatially-enabled application on a Smartphone or other mobile device.

Spatial perspective and asking spatial questions

The Importance of a Spatial Perspective

The use of spatial thinking through the analysis of location is critical to understanding real-world issues. Location information enables the understanding of how features are distributed, identifying the relationship between features, and understanding the trends across time and space. Many of us consider things from a spatial perspective without realizing it: how long it will take us to get to work using different routes, assessing the safety risk of a certain area, determining where to live considering proximity to work or school and cost of housing and location of other amenities. When studying ecological phenomena, such as the nesting habits of bluebirds, the location of their nests and the duration of their occupation is important. However,

to understand what contributes to the success of the nest other spatial relationships have to be accounted for, including the proximity of human activity, competing species, predatory species, food availability and land use. Mapping incidents of disease outbreaks or traffic accidents needs to consider the characteristics of the space around the specific locations to make sense of contributing factors.

Use of Spatial Data

Locations can be mapped. However, the location of a feature may not be helpful unless we can tie in additional information, which does not need to be geographic in nature. One example is Canada Census data. The age of individuals is collected in census surveys, as is the community they live within. Age is not a geographic consideration, though community is. When you map the age of individuals living in various communities across a city, you can discover trends in the demographics of different communities. The same can be said for other non-geographic data such as average income, religious belief, and country of birth.

The following three maps (Figures 1a-1c) show the population of Calgary from the Statistics Canada 2011 census (Statistics Canada 2018). Figure 1a shows Calgary's total population. Figure 1b shows the population of those aged 25 to 29 and Figure 1c shows the population aged 85 and up.

Comparing these three different maps can help us to discover trends, such as where older and younger people live compared to others, and identify areas where specific problems may occur. For example, the areas with the highest concentrations of those aged 85 and up would likely need easiest access to medical emergency access. They may also need access to public transportation and seniors' housing. Areas with the highest concentrations of those aged 25 to 29 will likely soon need access to public schools and health care facilities, as at this age many people begin families. This information can be invaluable for City planning.

In the following tutorials, you will see how technology, particularly Geographic Information Systems (GIS) can be applied to citizen science for a variety of different situations and disciplines.

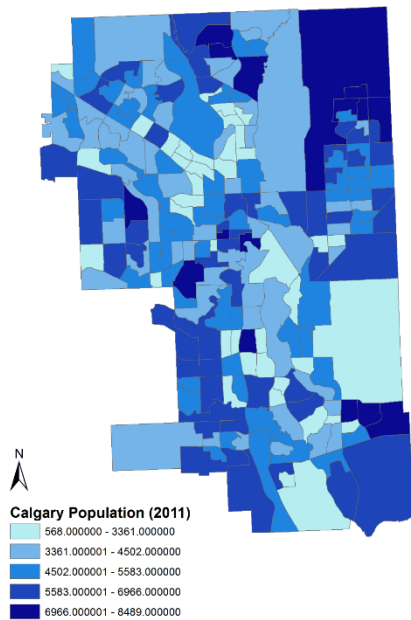


Fig. 1a. Distribution of the population of Calgary, all ages, 2011

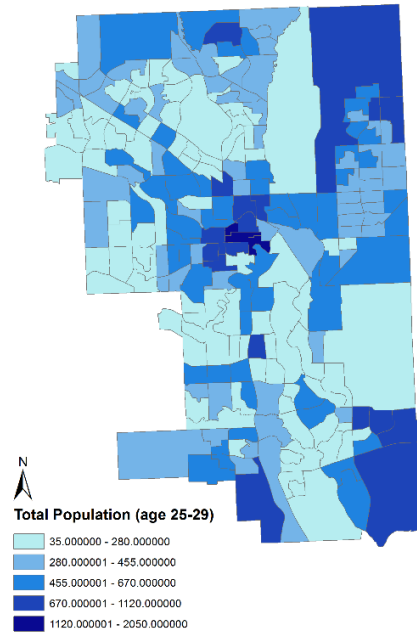


Fig. 1b. Distribution of the population of Calgary, age 25-29, 2011

Fig. 1. Demographic maps of the City of Calgary, by age range, 2011. Darker colours represent more densely populated areas by specific age range: Fig. 1a (all ages), Fig 1b (age 25-29) and Fig. 1c (age 85+). Patterns can be found by comparing maps, such as the central clustering of seniors aged 85+ (Fig. 1c) and the predominance of 25-29 year olds in the outer suburbs. Industrial areas (east central area) can also be inferred from the lack of people living there.

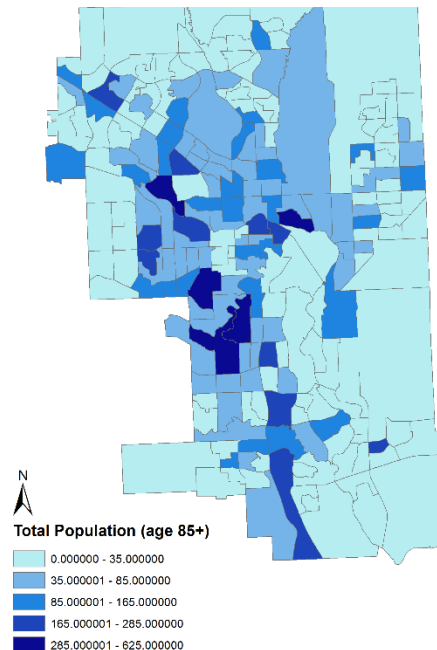


Fig. 1c. Distribution of the population of Calgary, age 85+, 2011

Geographic Information Systems

What is GIS?

The acronym GIS stands for **Geographic Information System**. A GIS is a computer information system that allows you to link information to a geographic location. Using a GIS, information related to a specific location can be captured, stored, visualized, and analyzed. It is an invaluable tool for aiding people in understanding spatial information, especially in identifying and analyzing relationships and patterns in data. GIS programs also allow you to combine or “layer” different pieces of information (Figure 2). Turning those layers on or off helps to visualize, interpret, or analyze the information in unique ways and see patterns that would otherwise not be apparent. For example, if you wanted to buy a house and required access to major roadways and an elementary school, you could add a layer of all roads and layer of all schools to a map of your desired neighbourhoods. By comparing distance from roads and schools, the GIS can help you to decide which houses in which neighbourhoods would best meet your criteria.

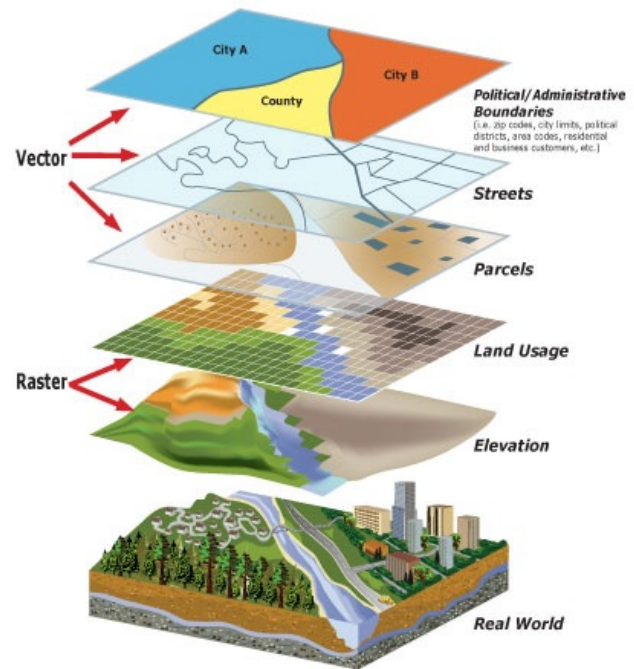


Fig. 2 A GIS enables the analysis of multiple layers of information, all tied to geographic space. Image: National Oceanic and Atmospheric Administration (2018).

Many of us use GIS technology every day without realizing it. Tools such as Google Maps can aid you in finding the location of nearby restaurants, and the navigation system in your car will map a route from your house to a concert venue by referring to the street network and current traffic conditions. GIS is also used by countless businesses, governments, and agencies to effectively locate their services and operate efficiently in an increasingly global landscape. Governments can make decisions based on GIS-supported models of populations and land use. Environmental agencies can use GIS to map effects of forestry in sensitive areas, or to provide risk assessments. GIS is used by municipalities in a multitude of ways, including managing infrastructure and services, as well as disaster relief efforts and event management.

A GIS is comprised of several components: hardware, software, data, and the user. The hardware includes basic things like computers, scanners, and digitizers, but also includes the hardware needed to generate and collect data, such as sensors on planes, UAV's (drones) or satellites, GPS units, mobile devices and cameras. The software required is the GIS program itself. At Mount Royal University, we largely rely on the Esri GIS suite of products, known as ArcGIS. Other software sometimes used includes photo editing programs or basic imagery programs, such as Adobe Photoshop. The data used in GIS work includes location information and attribute information (description about a feature at that location). Finally, a user is necessary for GIS to be useful. The user is responsible for the compilation, processing, analysis, and presentation of GIS generated information. This can include collecting data (in multiple ways, including with a Collector App), analyzing data to extract more information about patterns and trends, and, presenting information. Without any of these four components, GIS will not function. In order to create a Collector App for Citizen Science, you should have some familiarity with GIS. At Mount Royal University, courses in GIS are offered through the Department of Earth and Environmental Sciences, and there is also support from the Library.

Spatial data – What can be mapped?

The **data** you add to a map is where the potential for GIS to be useful takes off. Any sort of data you desire to add to a map can be added within GIS. Data related to human populations, animal populations, industry, land type and land use, climate, geology, air quality, and favourite ice cream flavours are but a handful of examples. Data can be accessed through open online databases, often run by governments, as well as through databases operated by institutions. Data can also be created by the user. Most data comes in the form of **features** that a user can add to the map. Features are symbols that represent real-world phenomena, such as fire hydrants, streets, or city blocks. If the feature represents a single unique entity, such as a family restaurant, it is referred to simply as a **feature**. Features take three different forms: points, lines, and polygons. Point features are used to indicate specific discrete points on a map, such as a building or a tree. Line features are used to represent features that follow a linear or sinuous path, such as a road or a border. Polygon features are used to represent an area, such as a country or a city park. The use of each of these feature forms is highly dependent on the scale of your map; using a polygon for a city park may be appropriate if your map is large-scale while using a point feature may be more appropriate if your map is small-scale. If the feature is one of many of the same kind of feature, such as a park, it is part of a **feature class**. Different features within a feature class are symbolized the same on the map. For example, if a feature class was "Convenience Stores", each individual convenience store (feature) would be represented with the same symbol

Once you have added your data (your features) to your map, you can begin using the tools built into GIS programs, such as the ArcGIS suite of programs. ArcMap allows you to easily combine maps and data to produce analyses and other relevant data.

What is Collector?

Esri's Collector for ArcGIS allows for the creation of custom mobile data collection apps. The benefit of building a data collection app in Collector is that it can be used on a mobile device, the fields or categories for data capture can be specified and controlled by the developer, it is fairly easy to build, with no cost to the user or developer, and the data collected is accessible for presentation and/or analysis through online and desktop GIS. A Collector App can support several feature classes, the most common type of feature being "point" (single location), line, (transect between multiple points) and polygon (area encircled by points). App creators can also customize the legend symbols and names of the fields to ensure a user-friendly experience. Additionally, the app creator can enable users to attach photos to any data points they collect. This can help verify data entry and add other data that cannot be accommodated in the app's pre-defined fields. These attributes make Collector ideally suited to citizen science projects.

Once the feature classes are finalized, they are shared to ArcGIS Online, Esri's cloud-based mapping platform. Here, the app creator can further enhance the look of the app, by creating a map on which to display the feature class. Symbol appearance and pop-up appearance can be further modified, and a basemap can be added to help orient the app user.

One of the benefits of Collector is the ability to collect data even when not connected to a network. For this, the user downloads the app to their mobile device, and then syncs it back to ArcGIS Online (where the collected data is stored), when next connected to a network. To read more about this feature and how it works, see "Working Offline with Collector."

What spatial question do you want to ask?

Geospatial citizen science is useful if you want to know

- where a certain feature is located? (eg. invasive species, public washrooms, potholes),
- what is at a certain location? (eg. heritage features, graves, amenities)
- what is the state of a feature? (eg. bird nest monitoring)
- what are the likely factors influencing a feature? (eg. pollution and incidence of disease)

Constructing a Collector App

The general Collector App is available through the Windows/App Store and can be downloaded for free on any mobile device. Custom apps developed for Collector will be able to be accessed through this app, using an Esri account. The user must have an Esri account to access custom maps. This also allows for the storage of the collected data. Any Mount Royal University student or employee has free access to an account through IT or the Department of Earth and Environmental Science. Trial accounts are also available through Esri's websites.

The customization of the interface is configured with the ArcMap software. Esri has some excellent online resources for preparing your data, creating shared maps and customizing the interface, including building the geodatabase and the feature classes which will appear as the data entry fields (Esri, n.d.).

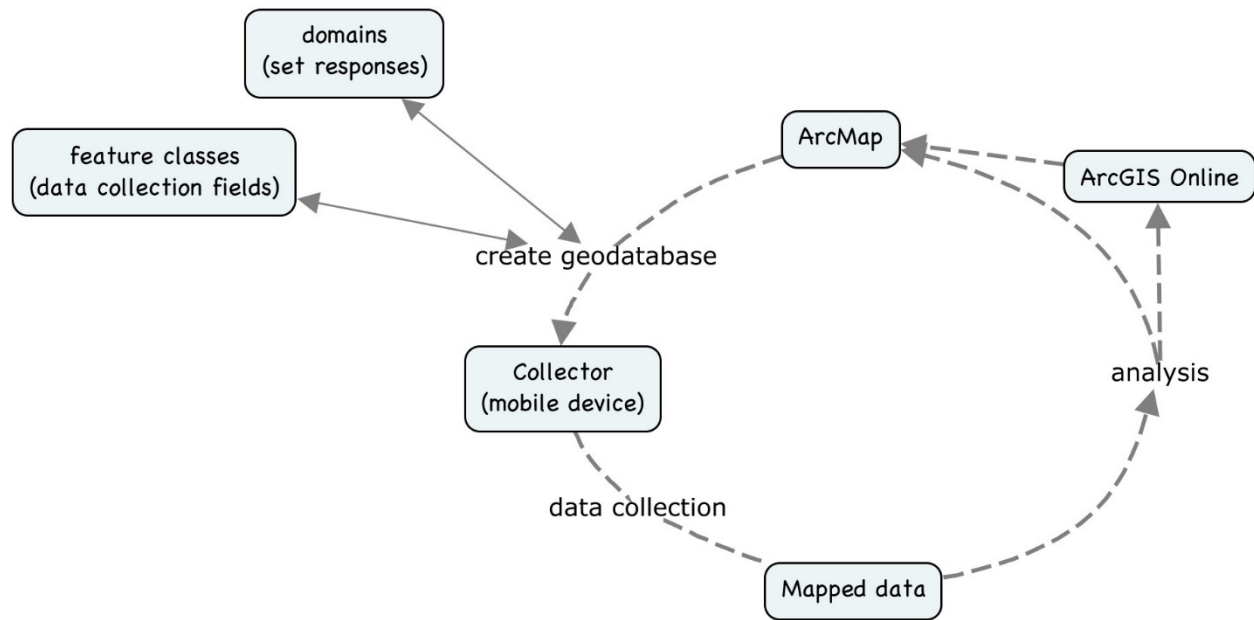


Fig. 3. Customizing a Collector app starts in ArcMap, where the geodatabase is created to hold the structure of the data entry fields (feature classes), the domains (any set responses you want the users to use) and any data that is collected. The user accesses the Collector App on their mobile device and then signs in to an Esri account to access the custom app. Using their mobile device, they collect data which is housed on ArcGIS Online. Any subsequent data processing or analysis can be done through ArcGIS Online or ArcMap.

The tutorials in this manual will walk you through the process of customizing a Collector Application.

Structure of Customizing a Collector App

Developing the structure of the app first requires creating a geodatabase and setting the feature classes (data entry fields – eg. time, species, road conditions) and any specific domains (set responses you want the users to choose from). Examples of domains include:

- time: you may wish them to record it by general time of day so the choices would be morning, afternoon, evening; another choice would be by hours of the day
- species, the choices could be restricted to just invasive species you want mapped;
- road conditions, the domain could specify good, fair, poor, impassable. Another choice would be by capacity, for example, one lane, two lanes, four lanes

Once established, domains can be used for more than one feature class. For example, if you were mapping out areas of downtown exposed to sunlight during the day, you could create a Time domain that specified the range of time you might want for an answer (eg. 6-7am, 7-8am etc..). This domain could be used for a feature class indicating when an area was first illuminated by sunlight and a second class of when the area went back in to shadow. Using domains just ensures the users are answering using consistent terminology, values, or number ranges.

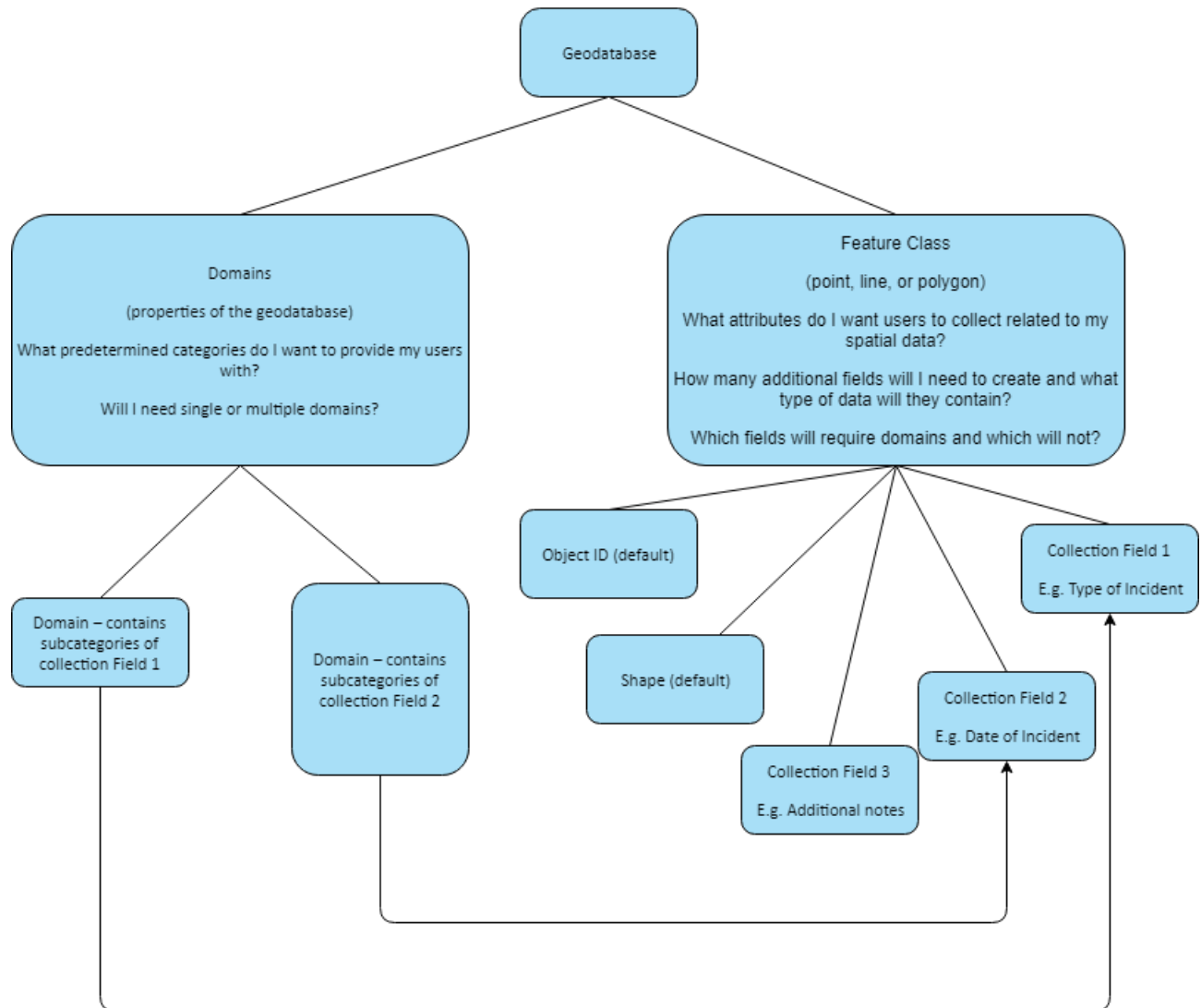
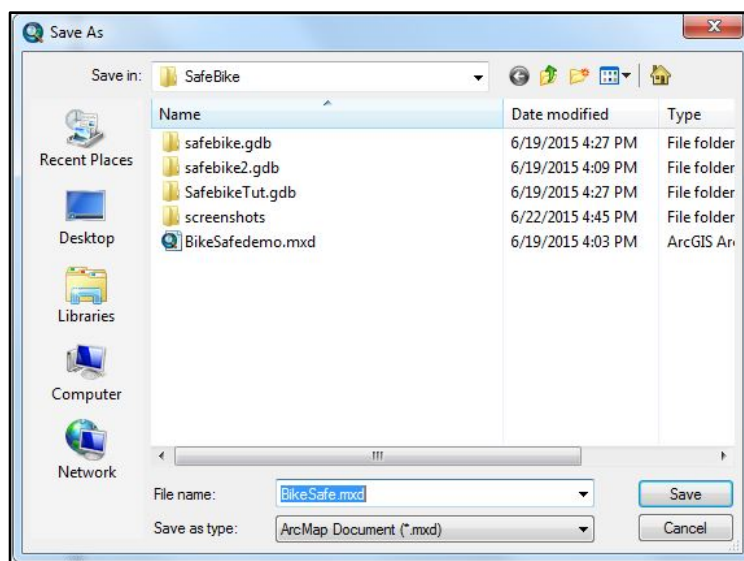


Fig. 4 Geodatabase design. In this example, the classes to be mapped are “Type of Incident” (Collection Field 1), “Date of Incident” (Collection Field 2), and “Additional notes” (Collection Field 3). Two domains (list of set responses) were created – the first was the type of incident, which would define the choices of responses for Collection Field 1, and the second, the choices of date entry for Collection Field 2. No domain is required for Collection Field 3 (Additional Notes) because it is left for the user to describe in their own words.

Tutorials

Best practices to start every project

1. Create a project folder (eg. SafeBike). This folder will house your data, geodatabases, and all of the maps that you create for the project.
2. Open ArcMap and create a new map document (*.mxd). Save this map to your newly created folder with an intuitive name and be sure to “save relative pathnames to data sources” to access your data readily later.



File>Map Document Properties > Store relative pathnames to data sources

Below you will find five different tutorials to create Collector Apps for different purposes. You can try them all or pick the one that is most similar to the type of application you would like to create.

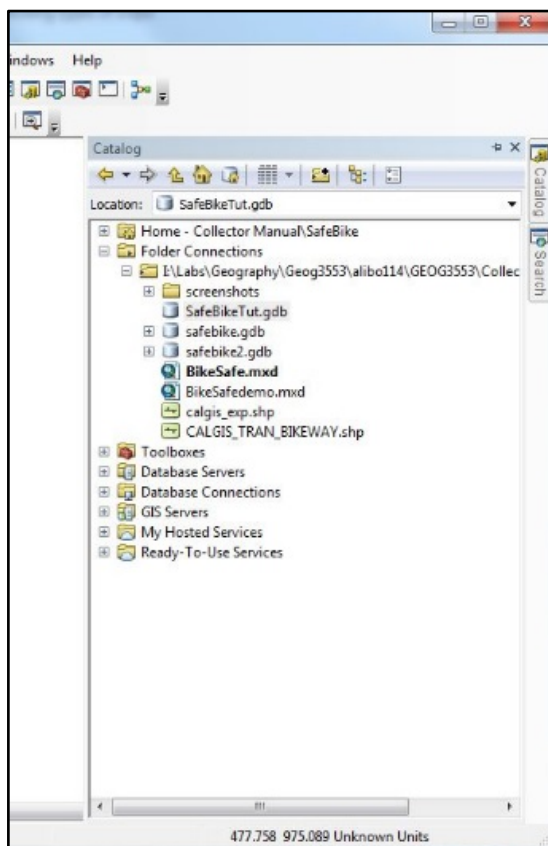
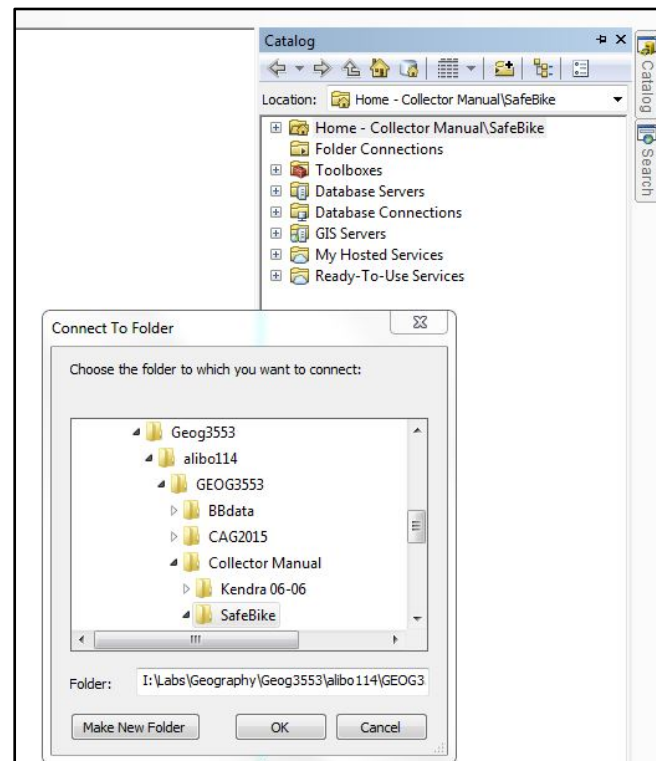
BikeSafe Collector App

The purpose of this app is to provide cyclists in Calgary a way to record areas of high concern on Calgary’s new and growing bike lanes. As we are learning to share the road, conflicts may arise. These may be correlated with areas of high traffic congestion and as such it may be useful for cyclists to plan their routes to avoid certain intersections or city blocks.

Attributes important to these spatial data are the type of incident that occurred, the date and time of occurrence, and a short description of the incident. In the case of collision, a photo attached to the initial data can be a way to record damage. This map is intended to be used by cyclists planning their routes, as well as motorists. With regular reporting, the publication of collision and harassment could be of importance in helping motorists understand some of the serious risks faced by cyclists when riding in high traffic areas with little protection.

Constructing Your Geodatabase

Open ArcCatalog, click Connect To Folder (folder with a + sign) at the top of the Catalog window and navigate to the folder where you saved your map document previously. Connect to this folder to access layers and data you may wish to add to your map document.



As stated earlier, this folder will also be the home for your geodatabase. By expanding the list under Folder Connections, you can begin to construct a geodatabase within your designated Collector folder. Right-click on your connected folder and select New > File Geodatabase. In this menu you will see the option for either Personal or File Geodatabase. File geodatabases are equipped to handle more data than a personal geodatabase and also allow multiple users to access the data. For the purpose of a Collector app, choose the File Geodatabase. A cylinder symbol will now appear within your Collector folder and will require a name that is pertinent to the data you will collect. This naming convention does not allow any spaces or special characters. In this tutorial you will call it SafeBikeTut.gdb.

Database Properties

General Domains

Domain Name	Description
BikingIncidents	Incidents cyclists encounter while using bike lanes

Domain Properties:

Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description
Traffic	Traffic Congestion
Harassment	Harassment by the driver of a motor vehicle
Collision	Collision with a motor vehicle

OK Cancel Apply

Next, configure the properties of the database. Right-click on SafeBikeTut.gdb and select Properties. Navigate to the Domains tab where you will begin creating the pre-determined responses for your collection fields. Domains are simply standardized responses that you can apply in your app. Setting domains helps to keep responses valid and error free. The first one you will create will be BikingIncidents, a domain to allow the cyclist to categorize the incident they experienced. You will create three coded values of text data for Traffic, Harassment, and Collision.

Next, create a Time domain. Due to the fact that cyclists will want to report the approximate time at which the incident occurred, create as many time periods as possible. Create a domain called Time with coded text values. Then divide the hours of the day into as many time periods possible, keeping in mind that cyclists are not as active between the hours of midnight and 6 a.m. Without a specific time data entry field, the app will record the current time displayed on the phone, but if users collect their data points after the incident has occurred, their collection will not reflect the actual time at which the event occurred. Once you have completed your domains, click Apply, and then OK.

Database Properties

General Domains

Domain Name	Description
Biking Incidents	Incidents encountered by cyclists while using Calg
Time	Approximate time of the incident

Domain Properties:

Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

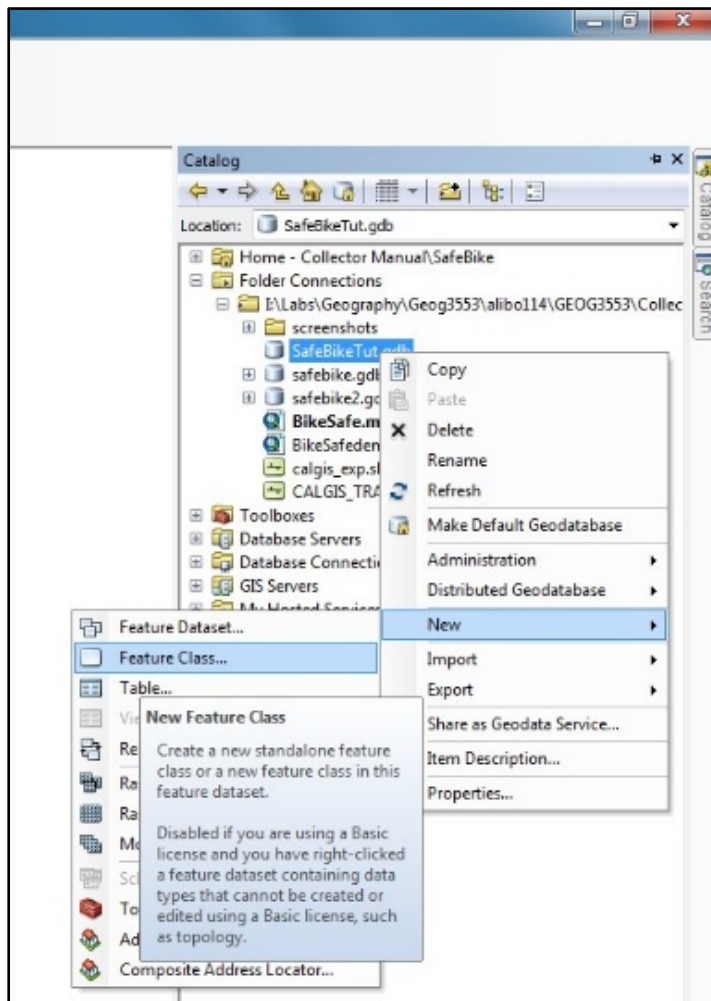
Coded Values:

Code	Description
00:00-6:00	Midnight - 6:00 AM
7:00-9:00	7:00 AM - 9:00 AM
9:00-11:00	9:00 AM - 11:00 AM
11:00-12:00	11:00 AM - Noon
12:00-14:00	Noon - 2:00 PM

OK Cancel Apply

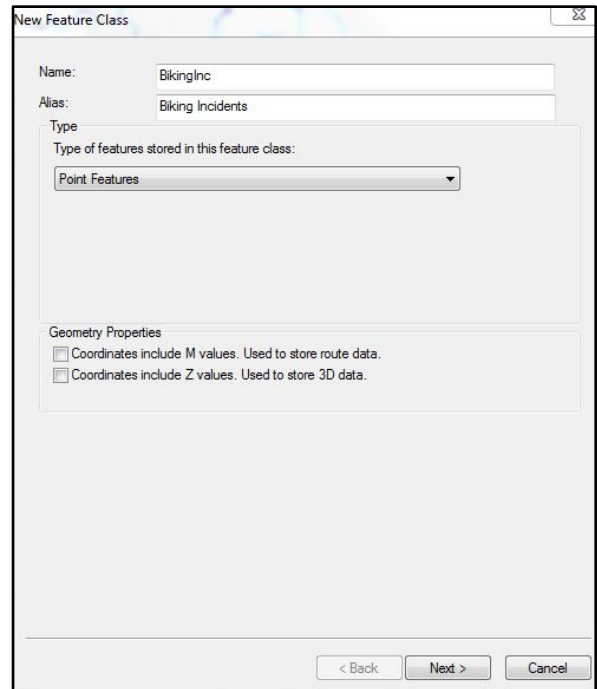
Constructing Your Feature Class

Now that you have configured your geodatabase, you can create the container for your geographic data. This is called a feature class, and it can contain point, line, or polygon data. From there, you can also configure fields that ask additional questions about your spatial data. These will be your collection fields.

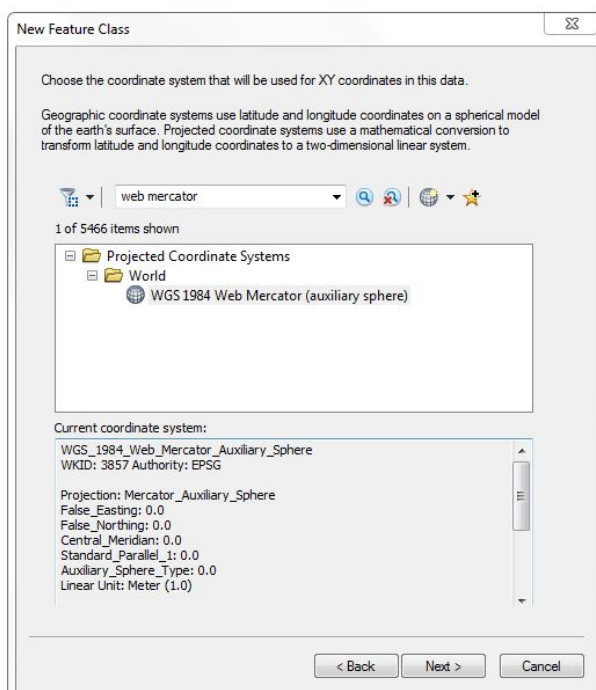


Right-click on your geodatabase and select New > Feature Class.

Give the Feature Class a name that includes no spaces or special characters. The alias may contain spaces. Indicate that it will be point data, but leave geometry properties unselected. Click Next.



The 'New Feature Class' dialog box is shown. The 'Name' field contains 'BikingInc' and the 'Alias' field contains 'Biking Incidents'. The 'Type' dropdown menu is set to 'Point Features'. Under 'Geometry Properties', both checkboxes for 'Coordinates include M values' and 'Coordinates include Z values' are unchecked. The 'Next >' button is highlighted.



The 'New Feature Class' dialog box is shown, focusing on the coordinate system selection. The search bar contains 'web mercator'. The list shows 'Projected Coordinate Systems' expanded, with 'World' expanded, and 'WGS 1984 Web Mercator (auxiliary sphere)' selected. The 'Current coordinate system' section displays the following details:

- WGS_1984_Web_Mercator_Auxiliary_Sphere
- WKID: 3857 Authority: EPSG
- Projection: Mercator_Auxiliary_Sphere
- False_Easting: 0.0
- False_Northing: 0.0
- Central_Meridian: 0.0
- Standard_Parallel_1: 0.0
- Auxiliary_Sphere_Type: 0.0
- Linear Unit: Meter (1.0)

The 'Next >' button is highlighted.

All ArcGIS Online data works on the WGS 1984 Web Mercator (auxiliary sphere) projection (see Appendix A). You can either search for it or navigate through Projected Coordinate Systems to find it. Select it and click Next.

New Feature Class

XY Tolerance

The XY tolerance is the minimum distance between coordinates before they are considered equal. The XY tolerance is used when evaluating relationships between features.

0.001 Meter

Reset To Default [About spatial reference properties](#)

☒ Accept default resolution (recommended)

< Back Next > Cancel

Leave the XY tolerance as .001 metres to avoid merging features. Click Next.

Now you can create each data collection field or category. OBJECTID and SHAPE are default fields for point data. In the third row, create a field called Biking Incident and select Text as the data type. In Field Properties, indicate that it is within the domain BikingIncidents. This is one of the domains you created in your geodatabase. If your domains are not appearing in the dropdown menu, ensure you have selected the same data type (eg. text), as when you created the domain.

New Feature Class

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
Biking Incident	Text

Click any field to see its properties.

Field Properties

Alias	Biking Incident
Allow NULL values	Yes
Default Value	
Domain	BikingIncidents
Length	50

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

New Feature Class

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
Biking Incident	Text
Date	Date

Click any field to see its properties.

Field Properties

Alias	Date	
Allow NULL values	Yes	
Default Value		

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

Your next field will be for users to record the date of the incident. Call this field Date and indicate its data type is Date.

The next field you will create will link your other domain with a collection field. Call your next field Time and designate it as Text data. In the domain dropdown list, select Time. This will give users time periods in which they can report the timing of their incident.

New Feature Class

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
Biking Incidents	Text
Date	Date
Time	Text

Click any field to see its properties.

Field Properties

Alias	Time	
Allow NULL values	Yes	
Default Value		
Domain	Time	
Length	50	

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

The last field you will create will allow the user to give a description of their incident. Call this field Description and designate it as Text data. Change the length to be somewhere between 150 and 200 characters. Users will have ample room to give a description of what occurred.

Note: Fields must be created in the order you wish them to appear to the user as the order cannot be changed later. Fields can be added on to the bottom of the list later. Also, double-check you have changed the aliases of your fields to ensure the field names are intuitive.

Once you have six fields, OBJECTID, SHAPE, Biking Incident, Time, Date, and Description, click Finish.

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
Biking Incidents	Text
Date	Date
Time	Text
Description	Text

Click any field to see its properties.

Field Properties	
Alias	Description
Allow NULL values	Yes
Default Value	
Domain	
Length	150

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

If you receive the following message, click Yes to add underscores into the field names, or go back and remove the spaces from the field names manually.

Invalid Field Names

The following field names are invalid:

Biking Incidents

Do you want to automatically rename these field names to the following?
(Select 'No' to return to the field property page)

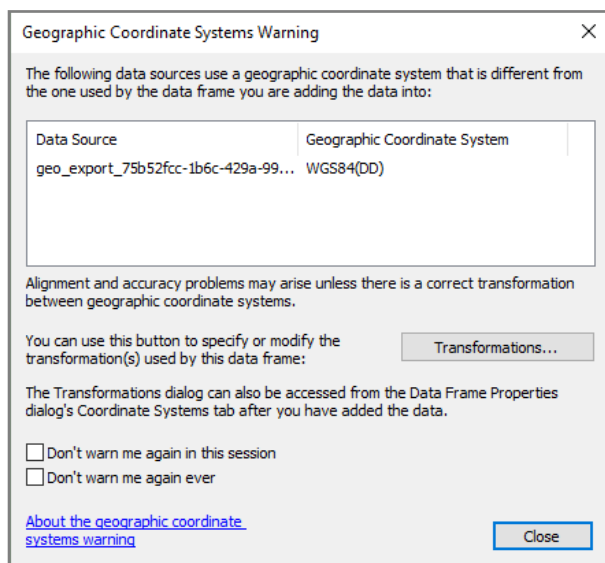
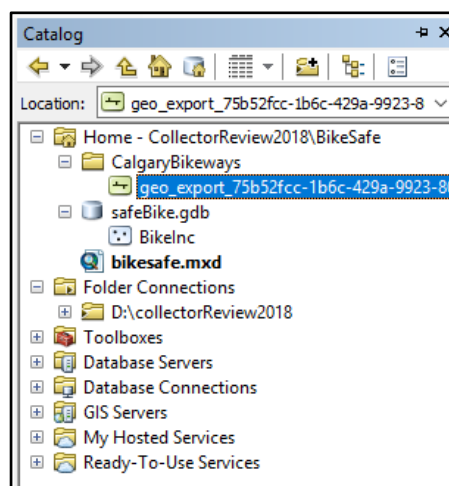
Biking_Incidents

Yes No

Configuring Your Map

Users are intended to use this collection tool for interactions with motorists, so when you configure the map it is important for cyclists to see all the available routes in the city where they interact. That data is available at <https://data.calgary.ca/browse?q=bike%20trails&sortBy=relevance> . Alternately, if the above link does not work, navigate to <https://data.calgary.ca/> (the City of Calgary's open data website), click Browse Data, and search for Calgary Bikeways. Click on the Calgary Bikeways result, and click Export. Export the data as a Shapefile, and save and unzip the file to the same folder you created to house your map document and your geodatabase. By downloading and unzipping this file into your Collector folder, you can have it available to view in ArcMap as a layer over the basemap. This is one way you can optimize the map visually for the user.

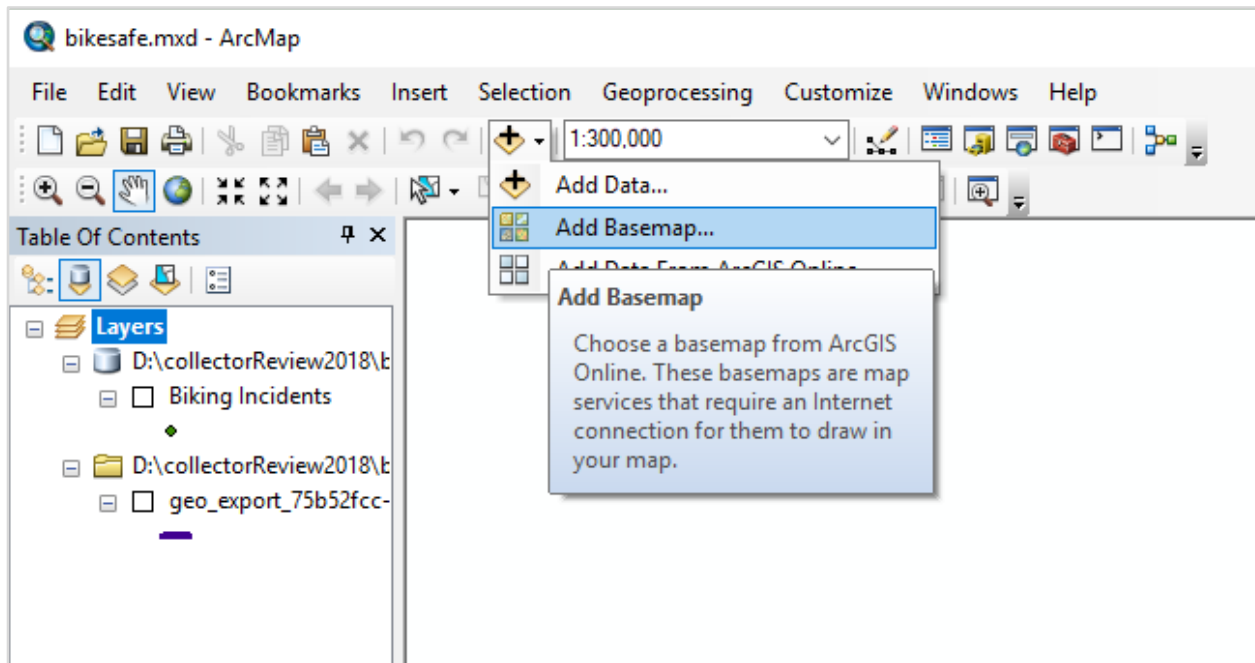
If you have saved the data into the same folder as your geodatabase, navigate through your folder until you find it, then drag it over to your table of contents. If it is somewhere else, connect to that folder first, then bring your data into the Table Of Contents on the left-hand side of your screen. If you do not see the data in your folder list, right-click on the folder and click Refresh.



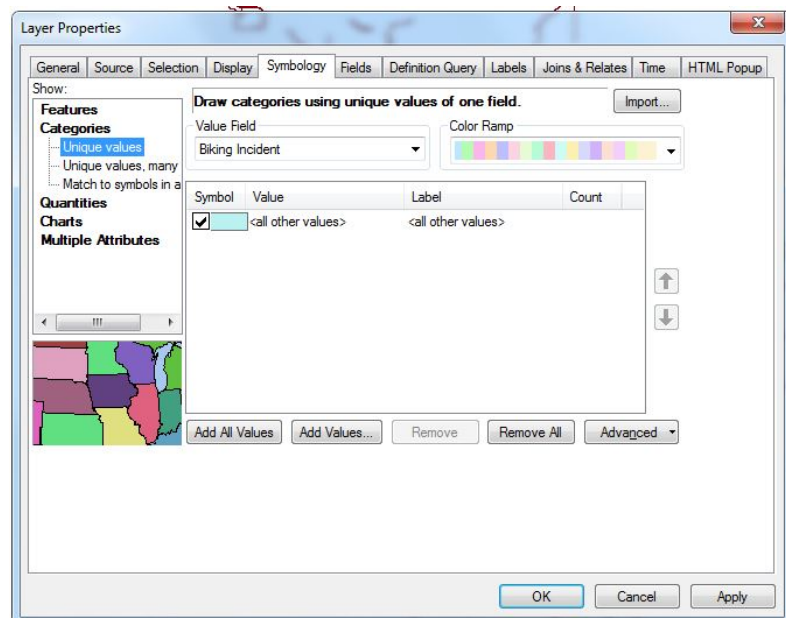
It should now appear as a second layer underneath your Collector layer. If you receive a Geographic Coordinate Systems Warning, leave “Don’t warn me again in this session” and “Don’t warn me again ever” unchecked, and click Close. This warning appears because the Calgary Bikeways data is not in the Web Mercator projection that you set the feature class to. When the Collector app is shared to ArcGIS Online, ArcGIS Online automatically projects all data to Web Mercator if necessary.

Add a basemap to make sure it aligns correctly with the streets (however, remove the basemap before sharing the feature service online as it creates problems with scale). Double-checking that

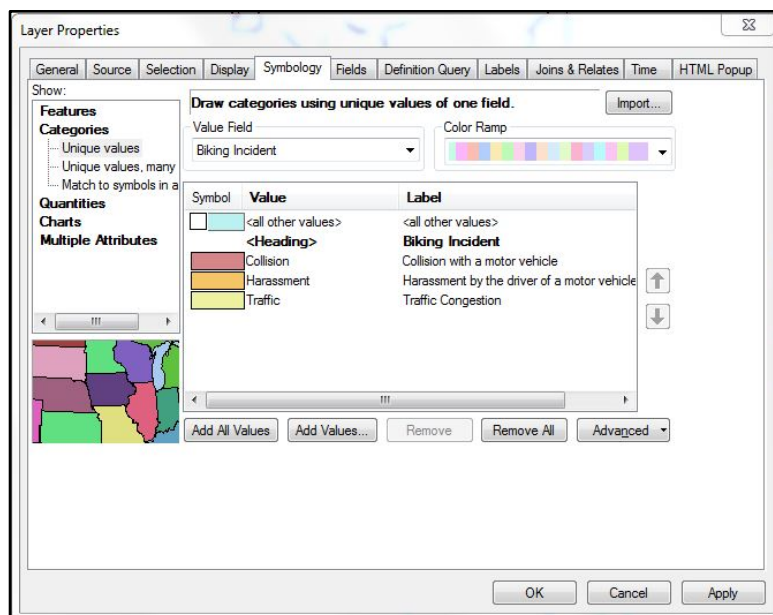
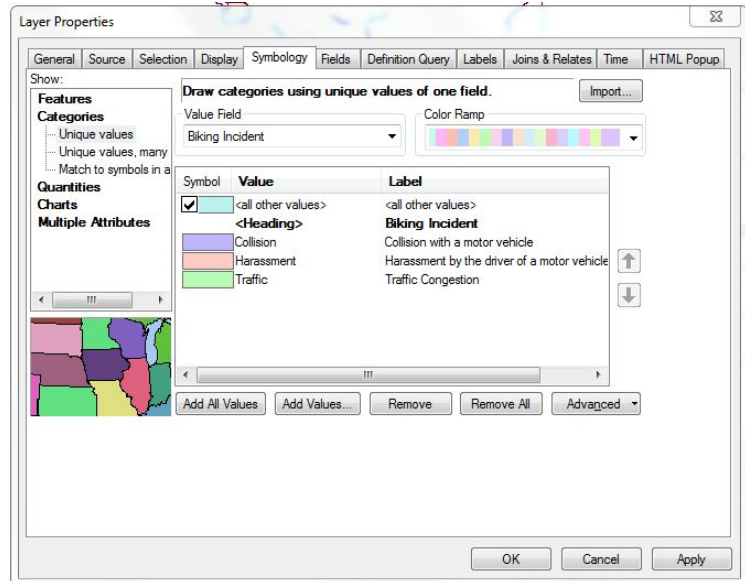
it matches with the basemap ensures the correct coordinate system has been selected for the layers. Select the tool next to the scale bar in your top toolbar with the square and plus sign. Select a basemap that shows the street names so you can make sure it is correct. Remove it once you can see that it lines up correctly by right-clicking on the imagery listed under Layers and select Remove.



The next thing you need to do to configure the map is to edit the map's symbology. Right-click on the Biking Incident layer and select Properties. Navigate to the Symbology tab, making sure that the category selected on the left-hand column is Unique Values, and then select Add All Values.

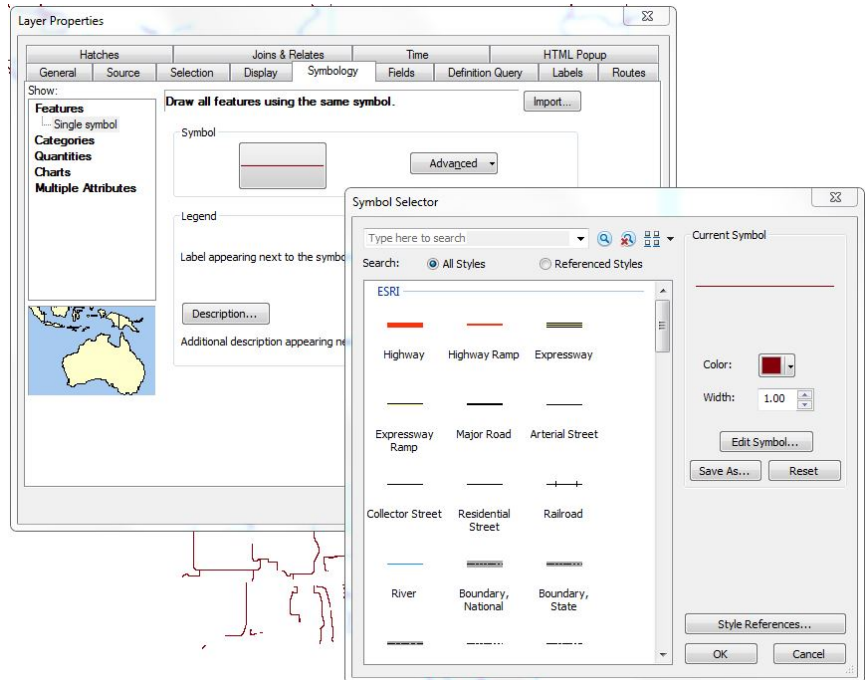


You should see all the responses you created in the feature class with a corresponding colour. If you double-click on the symbol next to each category, you can adjust the colour. Using colours in a gradient is often appropriate for issues of increasing severity.



The colours have been set to yellow, orange, and red. Click Apply and OK to exit the Layer Properties window.

In the Table of Contents, right-click on the trail data layer that you added. Select Properties and navigate to the Symbology tab. Notice on the left-hand column that this layer only has a single symbol, as opposed to the categories in the previous example. Select the default symbol and increase the width within the Symbol Selector window, and change the colour to be one that is different from your categories, then click OK.



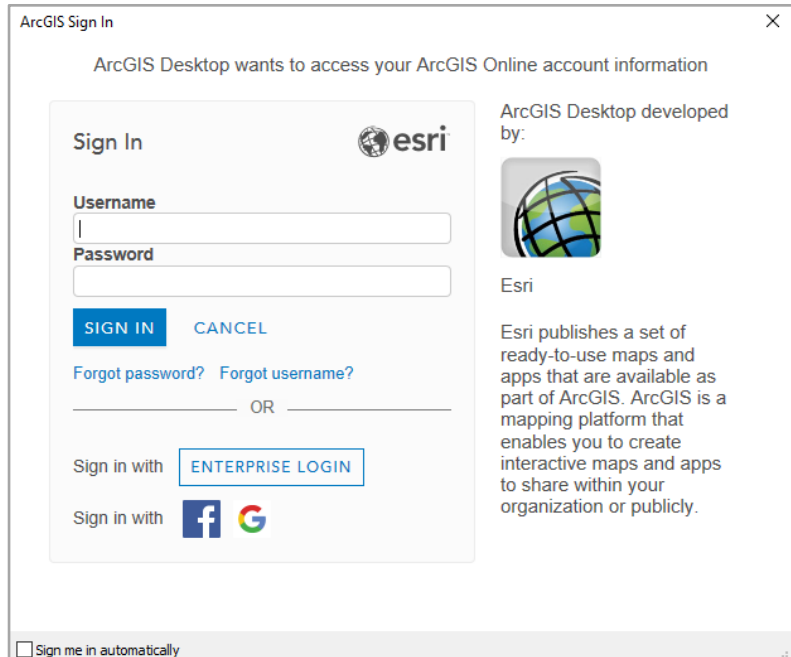
Widening the line symbol will make it more visible to the data collector. The wide purple line has been selected to indicate bike lanes. The layer now looks like this:



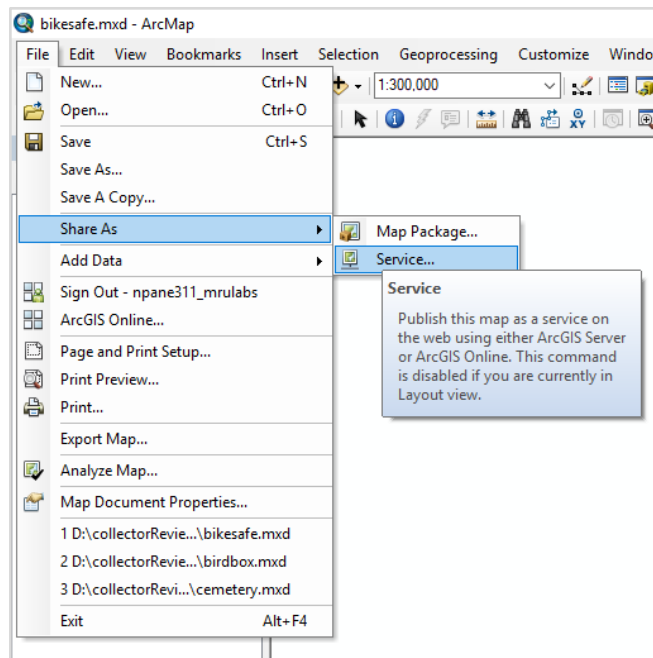
Sharing your Feature Service on ArcGIS Online

You can now begin the last few steps to share your map on ArcGIS Online.

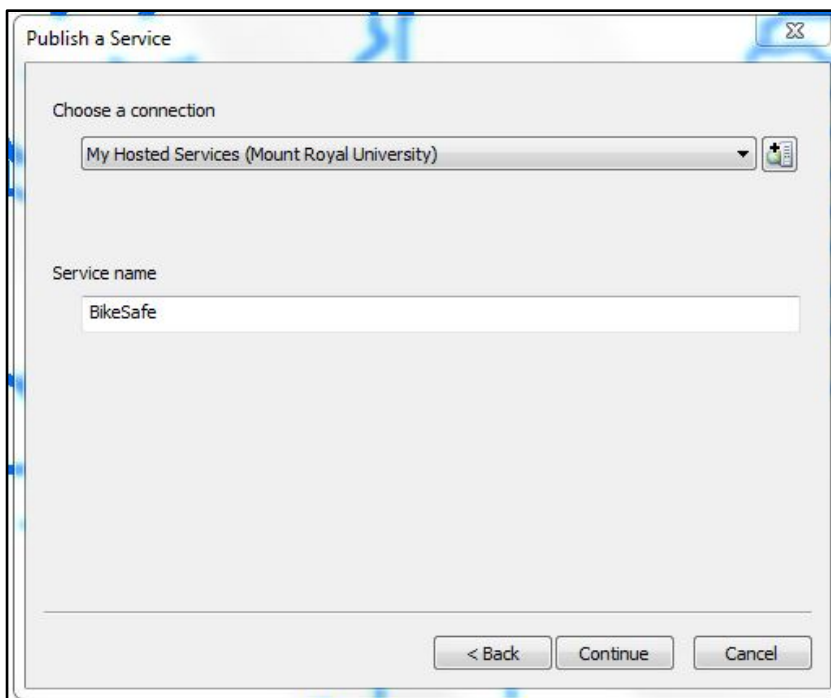
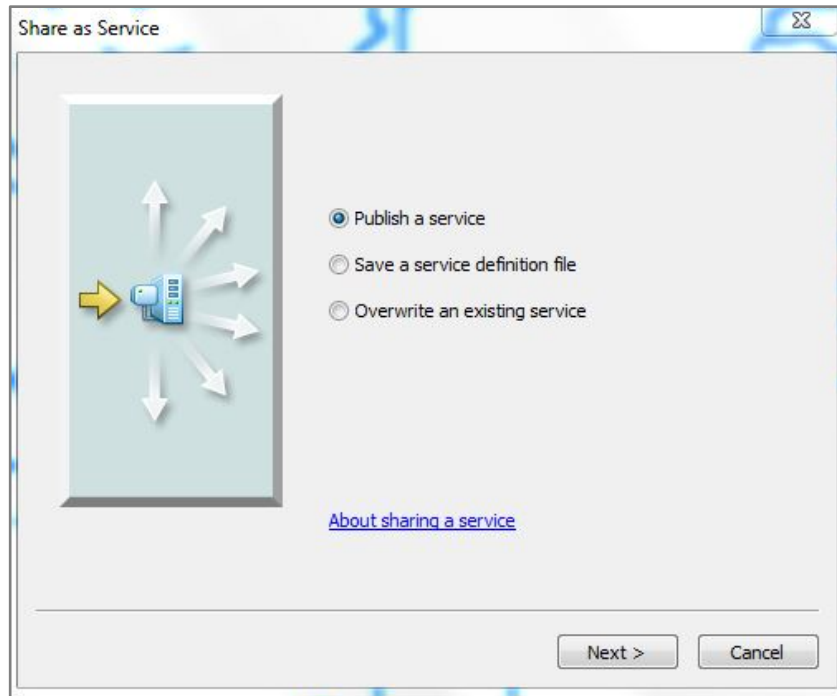
Begin by selecting Sign In from the File menu. This sign-in window will pop up.



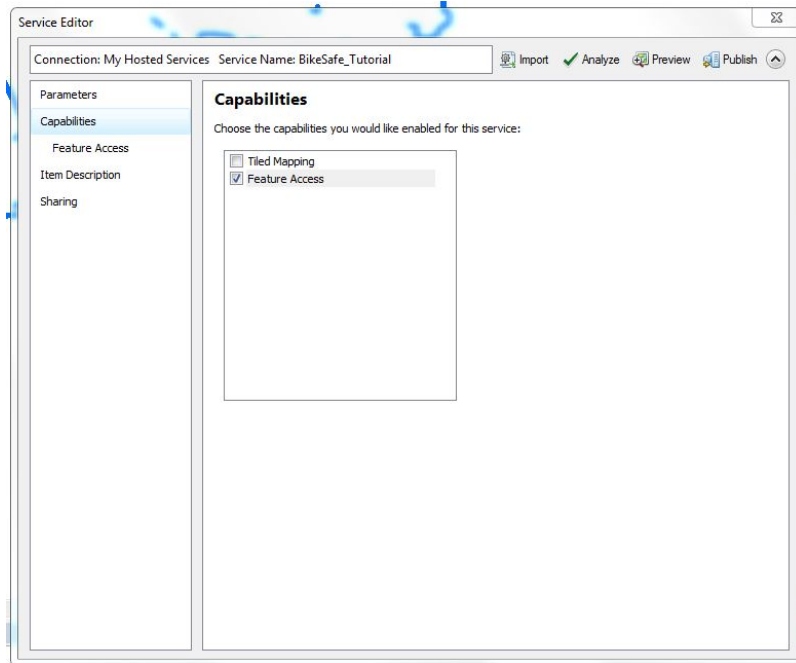
When you are signed in, return to the File menu and select Share As > Service.



Select “Publish a service” and click Next.

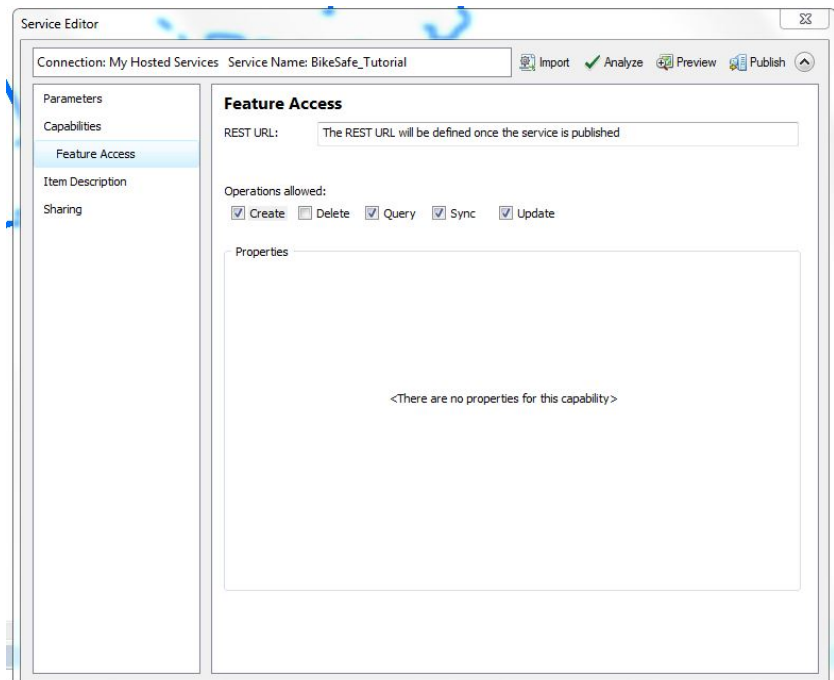


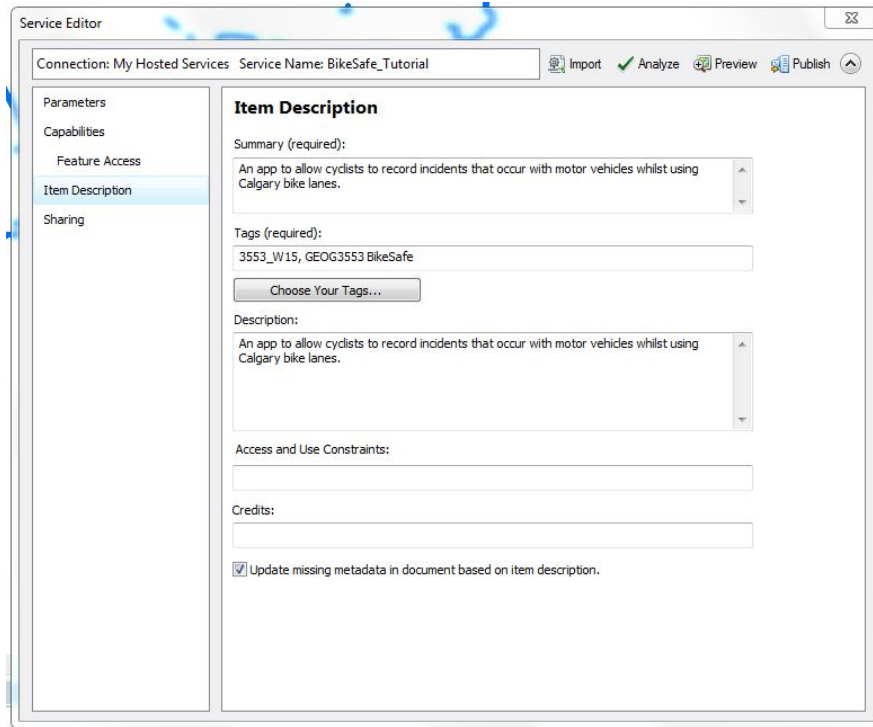
Select My Hosted Services (Mount Royal University) as the connection, and give your map an appropriate name. If you have not signed into ArcGIS Online already, this connection option will not show up. Click Continue.



The Service Editor window will open to allow you to configure options pertaining to your feature service. De-select Tiled Mapping and ensure Feature Access is selected. Click Feature Access on the left-hand side to move on.

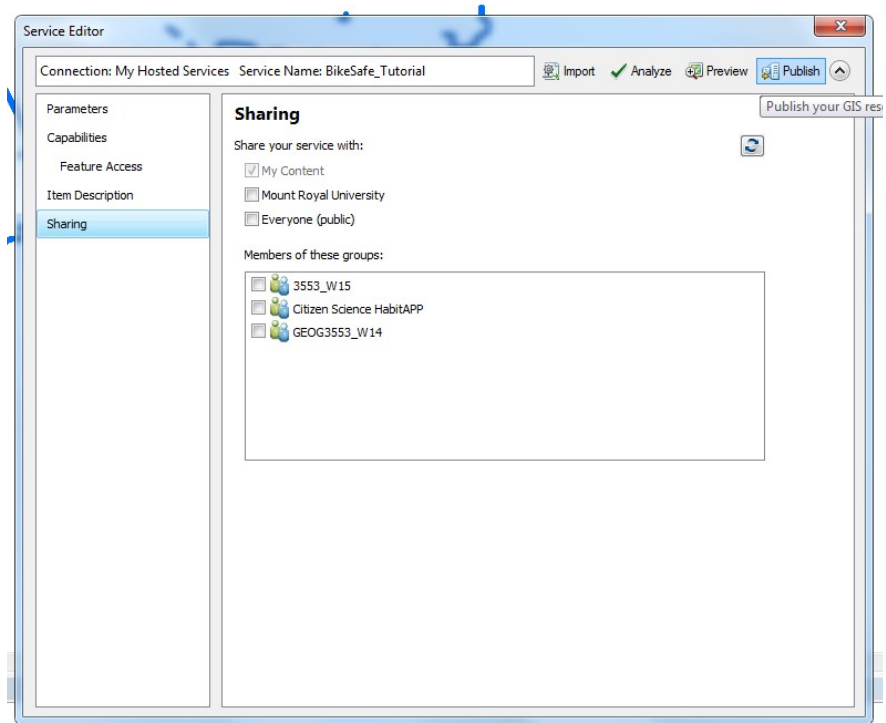
Select all the capabilities you would like users to have when using your Collector. Create, Query, Sync and Update are necessary. However, you may want to disallow deletion as this can cause users to delete points already on the map. Click Item Description to move onto the next step.





Summarize the purpose of your Collector app and provide some tags (separated by commas) that will make it searchable to others involved in your project, class, or institution. Once you are finished, click Sharing on the left hand side.

Lastly, select who will see your feature service. You can have it remain only accessible to you (My Content), or you can make it accessible to your institution, class or project. Once you have added all the people you'd like to have access to your map, click Analyze in the top right-hand corner. If no Errors appear, click Publish.

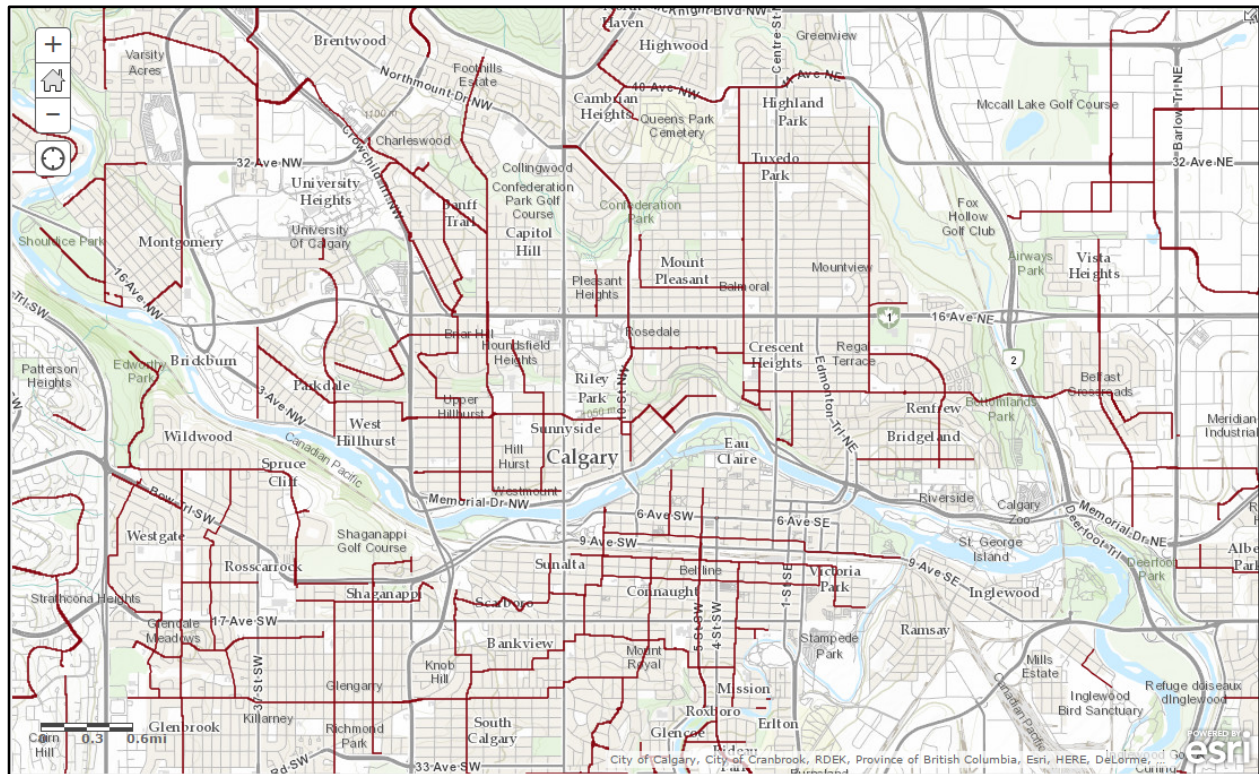


Sharing Your Collector Map

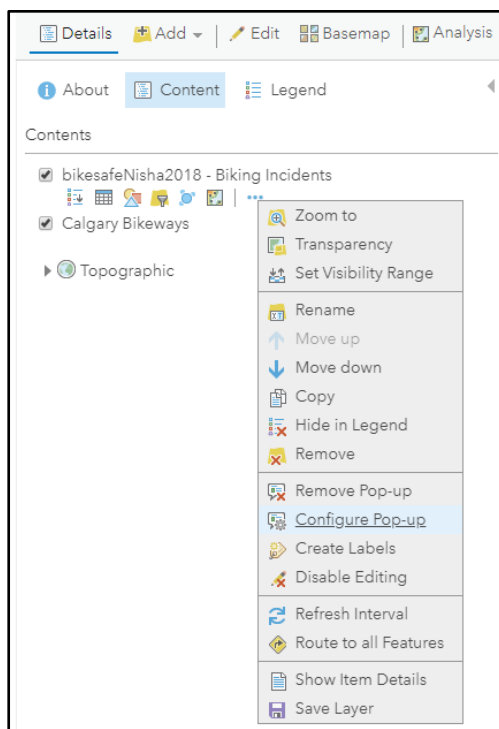
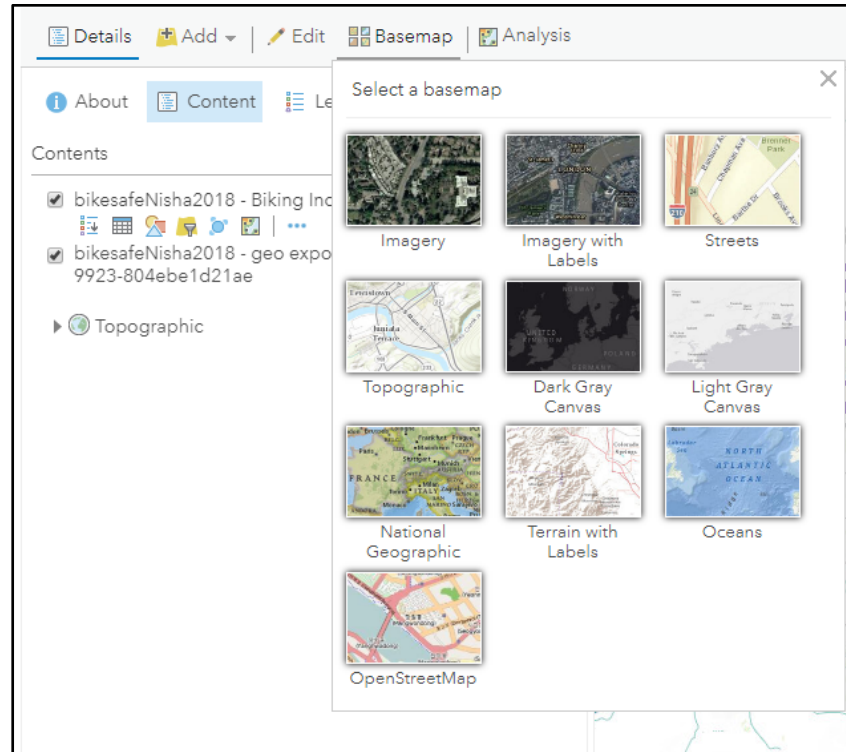
Go to <https://www.arcgis.com/home/> and sign in. Navigate to Content. Locate your feature layer in the listed content. You will now add this to a basemap and share the newly created web map.

Once you have opened your feature service you will see the Description you created earlier. On the right-hand side, click Open in Map Viewer > Add to new map.

Zoom into the Calgary area where you should see streets and the bike path layer on top:



If you would like to change your basemap to include imagery, select Basemap from the top toolbar.



To configure your map to ask for the date of the incident as soon as the user opens the map, select the three blue circles next to the “Biking Incidents” layer and select “Configure Pop-up”.

Highlight the {Date} field under Pop-up Contents and then click Configure Attributes.

Home ▾ My Map

Details Add ▾ Edit Basemap Analysis

Configure Pop-up

bikesafeNisha2018 - Biking Incidents

☒ Show Pop-ups

Pop-up Title

Biking Incidents: {Biking_Incidents} +

Pop-up Contents

Display: A list of field attributes ▾

These field attributes will display:

Biking Incidents {Biking_Incidents}

Date {Date}

Time {Time}

Description {Description}

Configure Attributes

De-select “Show time” for this particular Collector because the “Show time” option will default to the time displayed on the user’s device. Because cyclists may choose to collect their incident after it has occurred, the “Show Time” option is better suited to an immediate collection. Don’t hesitate to play around with attribute options to see how it changes the user interface. Click OK when you have finished.

Configure Attributes

Check the fields you want to display and edit. Select a field to change its alias, order it, and format it.

Display	Edit	Field Name	Field Alias
<input type="checkbox"/>	<input type="checkbox"/>	{OBJECTID}	OBJECTID
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{Biking_Incidents}	Biking Incidents
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{Date}	Date
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{Time}	Time
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{Description}	Description
<input type="checkbox"/>	<input type="checkbox"/>	{GlobalID}	

Format

12/21/1997 ▾

☐ Show time

Hint

OK CANCEL

Share

×

Choose who can view this map.

Your map is currently shared with these people.

☐ Everyone (public)

☒ Mount Royal University

☐ Members of these groups:

☐ 3553_W15

☐ Citizen Science HabitAPP

☐ GEOG3553_W14

Link to this map

☒ Share current map extent

Facebook

Twitter

Embed this map

EMBED IN WEBSITE

MAKE A WEB APPLICATION

Note: To embed your map, you must share it with Everyone.

DONE

Select Save on the top toolbar, and then select Share to choose who will have access to your webmap.

You can make it accessible to your project members, class, or institution. An active link is also provided to make email sharing quick and easy. Click Done. You are now ready to use your Collector on your smartphone or tablet.

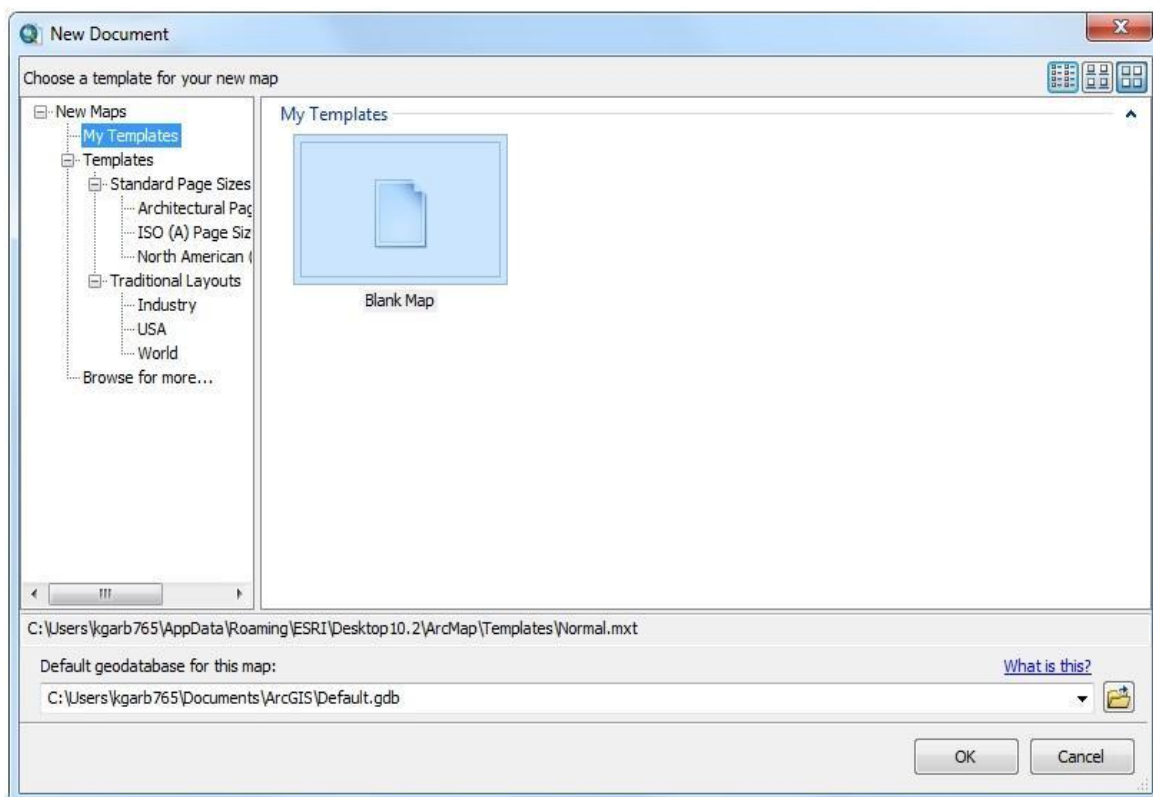
Cemetery Collector App Tutorial: Historical Demographic Mapping

This cemetery Collector map is meant to collect information about cemetery demographics. The Collector map will facilitate collection of information about the deceased's country of birth, country of death, year of birth, year of death, and name, as well as the geographic location of their grave within the cemetery. It could be used by historians, anthropologists, or statisticians to develop models of migration, mortality, and genealogy. Collector will allow you to add a photo or image file to the features you create so that the information entered into the App can be verified.

Constructing Your Geodatabase

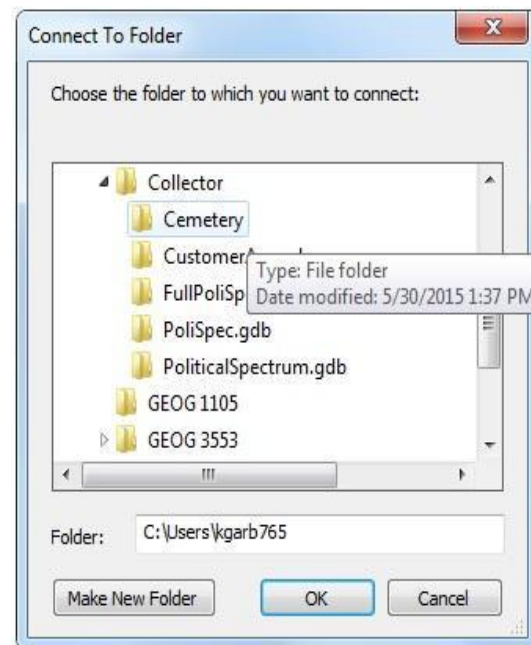
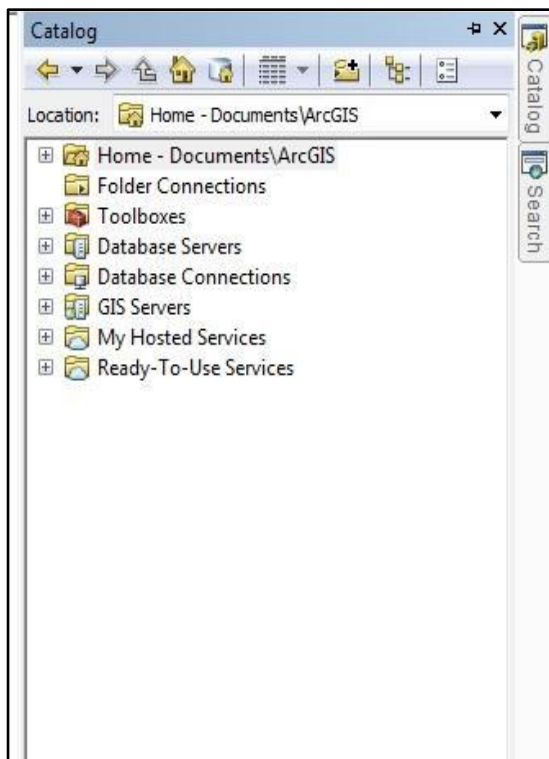
Once you have created or located your folder, open ArcMap.

You will be prompted with a pop-up window asking what you would like to do. The default option is to work on a Blank Map. This selection will work for creating your geodatabase, so leave the default geodatabase pathway as is for now and click OK at the bottom of the window.



On the right side of your ArcMap screen, there are two tabs: Catalog and Search. The Search tab is useful if you are not sure where to find a tool within ArcMap or if you have questions about specific tools within the program. For now, your focus is the Catalog panel. Click on the Catalog tab. It will open up a panel on the right side of your screen.

The bar along the top of the panel provides you with several options. There is an icon that looks like a folder with a + sign. This is the Connect to Folder icon, and it is used to connect ArcMap to your desired folder. Select this icon and find your folder within the menu.

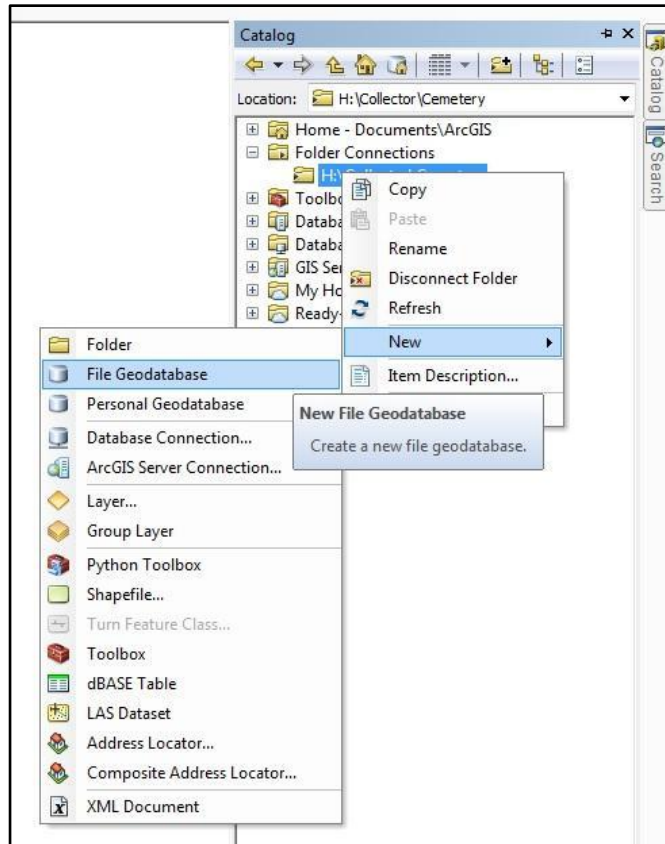


If you are planning to use files that lie outside the particular folder you want your geodatabase to be housed in, select the umbrella folder that contains *all* the information that you require. It is recommended that you create a folder devoted exclusively to your geodatabase so that any subsidiary files or folders that are created in the process are kept in the same place apart from the rest of your data.

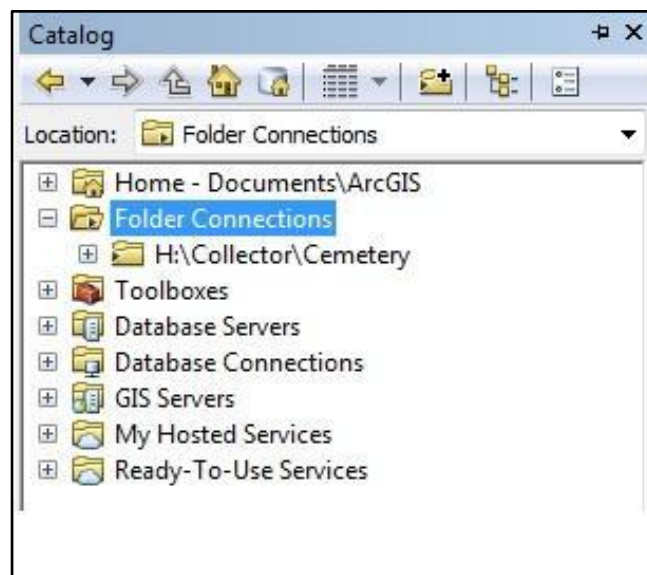
Once you have connected to your folder, re-open the Catalog panel and choose the second option in the list of folders called Folder Connections. Your connected folder should appear in this list. If it is not there, go through the Connect to Folder process again.

After you have successfully added and located your folder, you can begin creating your geodatabase in earnest. Right-click on your desired folder. A menu of options will appear next to your cursor. Select New from the list. From the extended list, there are two options in this list that look likely: the File Geodatabase and the Personal Geodatabase. For the purposes of a Collector map, the File Geodatabase is the best option. Select it from the list.

The menus will close and a new item will appear in your Catalog panel beneath your desired folder. The symbol looks like a grey or blue cylinder, and will be called New File Geodatabase.gdb. You will be prompted upon its creation to give your geodatabase a name. Remember to ensure the name is simple, intuitive, and less than 13 characters.



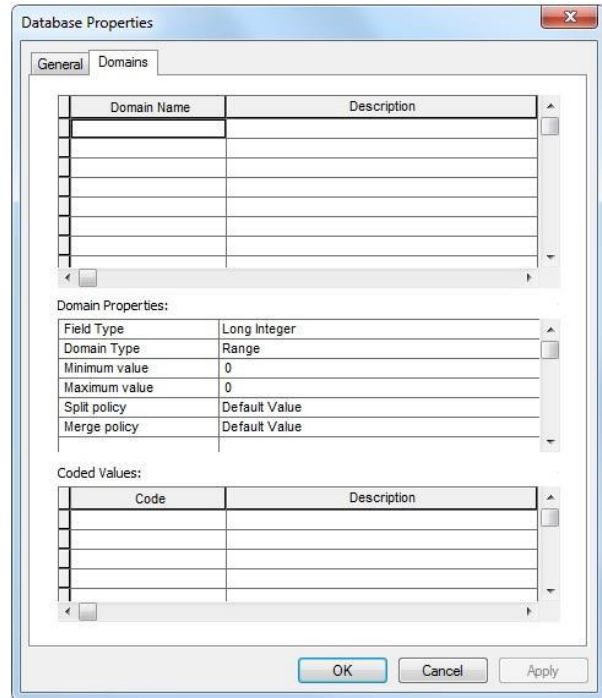
Once you have given your geodatabase a name, right-click on it within your Catalog panel. A drop-down menu will appear. From the options provided, select Properties at the very bottom of the list. A pop-up window will appear to guide you through the creation of the framework of your geodatabase.



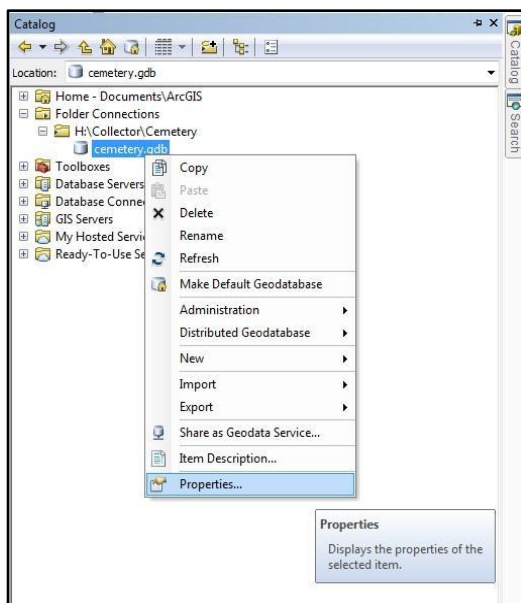
The pop-up window has two tabs within it. The first tab, General, should be entirely left as the default.

The second tab, Domains, contains three subsections. The first subsection has a selectable field of boxes, with the headings Domain Name and Description. The Domain Name is the name of the first kind of information you want to collect. In this Cemetery example, the first Domain Name entered is COB. The Description field for this Domain Name is Country of Birth.

In the Domain Properties subsection, there are six categories. Each Domain that is created needs to have properties. These properties help to frame the data that can be collected for each Domain.



The first category, Field Type, dictates what kind of information can be collected: numeric or text. If you choose the text option, the only possibility is to provide a drop down list for your Collector user to choose from, also known as coded values. The third subsection below Domain Properties allows you to determine those Coded Values. In this window, in the Code column, you enter the code you want your user to be able to choose. The Description next to it can be a repeat of what you choose your Code to be. For the Cemetery Collector app example, the coded values include:



Austria, Belgium, Canada, China, Czech Republic, Denmark, England, Finland, France, Germany, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Korea, Lebanon, Mexico, Netherlands, Norway, Pakistan, Philippines, Poland, Portugal, Romania, Russia, Scotland, Spain, Sweden, Switzerland, Ukraine, United States of America, Vietnam, Wales, Unknown, Other

The Description to go with each of these Codes will match: you unfortunately must type each one out twice. Make sure you click Apply after completing your Codes and Descriptions, because if you navigate away from the window, all your Codes and

Descriptions will disappear and you will have to re-enter them! These same coded values will be used for the second Domain named COD, Country of Death.

The Short Integer field type may also be given coded values like the Text field type. For example, in the Cemetery Collector app, a potential Domain would be “Presence of flowers,” and the coded short integer values could be 0 for no and 1 for yes. The coded values for these short integers would have to be established with the Collector user prior to use.

The third field will contain Dates. The Date field type can be used to record dates in the Mm/dd/yyyy hh:mm:ss AM/PM format. Be sure to recognize the mm/dd/yyyy format for date collection, as this format is not uniform across North America and may confuse some users. The Domain Type for Dates is Range. This allows users to enter a numeric value between a minimum value and a maximum value that you choose. For the Cemetery Collector example, two numeric

Domain Name	Description
COB	Country of Birth
COD	Country of Death
YOB	Year of Birth
YOD	Year of Death

Domain Properties:

Field Type	Short Integer
Domain Type	Range
Minimum value	1800
Maximum value	2015
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description

Domains have been created: Year of Birth (YOB) and Year of Death (YOD). These have each been given a Field Type of short integer, and the Domain Type of Range. The minimum value for each Domain has been set to 1800 and the maximum value has been set to 2015. This Range has been chosen for the specific setting of the map (within Calgary) and so it is highly unlikely that dates found on headstones in local cemeteries will predate 1800.

Unless you are quite ArcGIS savvy, it would be best to leave both Split Policy and Merge Policy fields as the Default Value.

For the Cemetery geodatabase, you want to collect information related to the Country of Birth, Country of Death, Year of Birth, and Year of Death for each headstone.

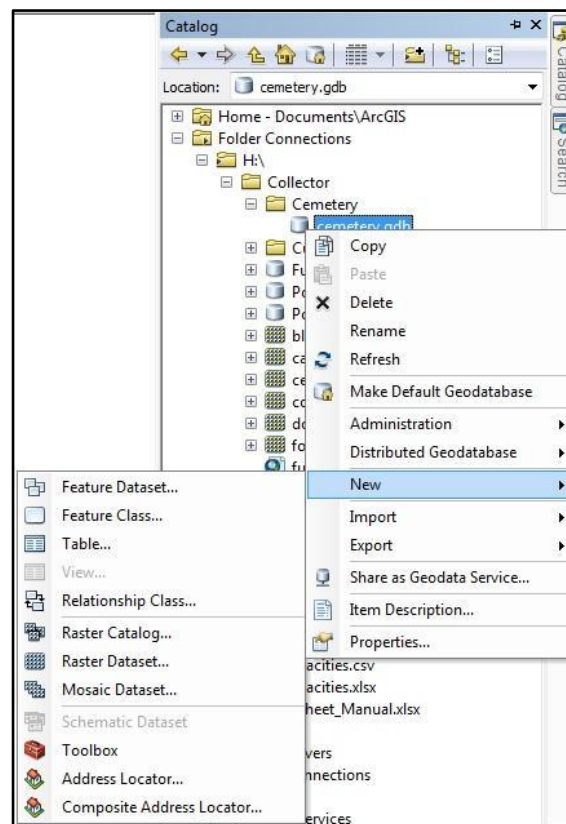
You also want to collect information related to the name of the individual, but you will create the field to do that later in the process. The geodatabase Domains tab now looks like the left image. When you are satisfied with the Domains you have created, click Apply at the bottom of the pop-up, and then click OK. This will close the window.

You have now created the geodatabase framework for your map. This framework will be used to shape your information and allow you to tailor the appearance of your map!

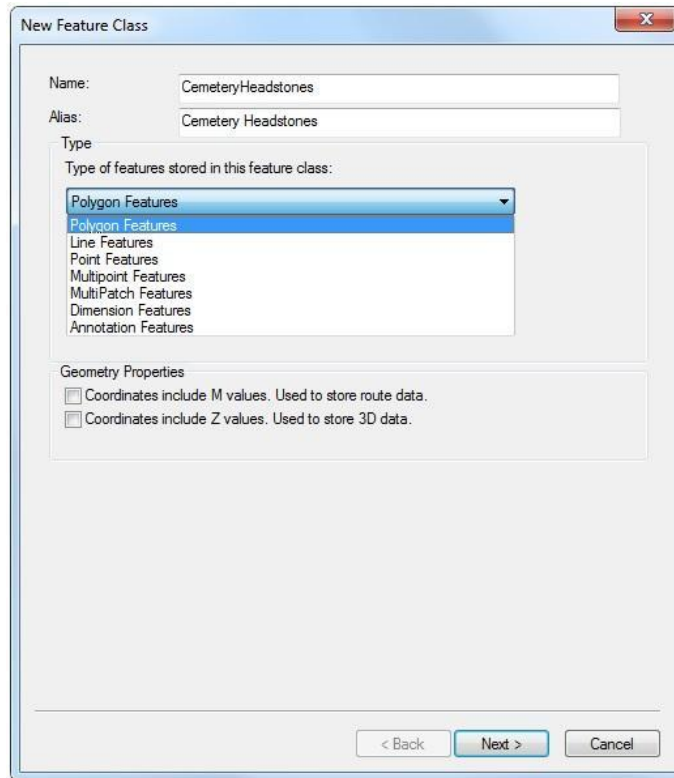
Constructing Your Feature Class

The next step in the process is to create a feature class. In this example, you will use just one feature class for collecting all of your information.

To create a feature class, open your Catalog panel on the right of your ArcMap screen. Find your geodatabase, and right-click on it. From the menu that appears, select New. From the next menu, choose Feature Class. This will open a pop-up window that will allow you to define your Feature Class for your Collector map.



In the first screen, you need to provide your Feature Class with a Name and an Alias. The Name cannot contain spaces or special characters, so keep it simple. The Alias can contain spaces and is what your users will see, so make it clear and intuitive. You also need to choose your feature type – you can choose from seven different options.

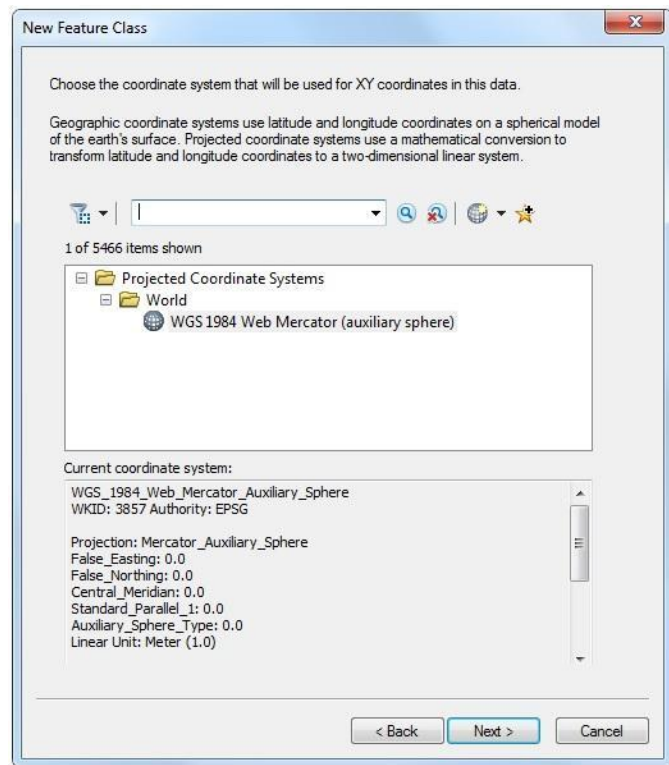


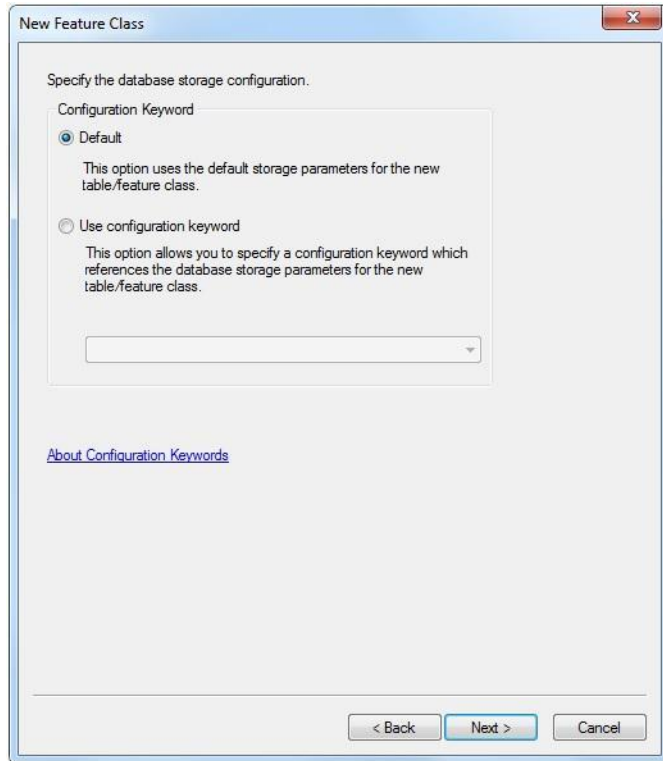
Choose the feature type that best suits your data. For the Cemetery map, you are collecting discrete headstones. You will be using point features, or features that are symbolized by a single point on a map, for each headstone.

In the same window, there are check box options for collecting M data and Z data for your map. You can check off either of these boxes if you care to collect route data or elevation data.

If you are satisfied with your choices on this screen, click Next to proceed to your next step.

Next, you need to choose the coordinate system you will be using to collect your information. The coordinate system is used to place and recall the geographic location of your features. For the purposes of Collector maps, the easiest choice is the WGS 1984 Web Mercator projected coordinate system as this is the default coordinate system used by Collector. This can be found in the Projected Coordinate System folder, and then in the World subfolder. Select your preferred coordinate system, and click Next.





If you have elected to use Z (elevation) data, you will also need to choose a vertical coordinate system for your elevation data. Choose your preferred vertical coordinate system, and click Next.

The next screen asks you to choose your XY tolerance. The default is 0.001 meters, and it is recommended that you leave this as is. If you have chosen to use Z and/or M data, you will also need to choose tolerance values for these measurements. It is also recommended that you accept the defaults for these. If you are happy with your XY, Z, and M tolerances, click Next at the bottom of the window.

The next screen will ask you to specify the database storage configuration. Here you

can set the configuration keyword for the feature class. It is highly recommended that you select the default option on this screen! Unless you have in-depth knowledge of Python, the coding script used in ArcMap, using a keyword will be difficult and may cause more problems than it solves.

The next screen allows you to create fields for your feature class. Fields allow you to use the pre-created Domains to collect information that needs to have coded values to choose from, as well as allowing you to create new Fields for data collection with looser constraints.

For your Cemetery example, utilize the Domains created earlier and supplement with a few other Fields. The first step is to enter a Field Name and select your preferred Data Type. OBJECTID and SHAPE are default fields for this feature type. Click on a blank box in the Field Name column, and enter the name of your desired Field. the first Field is named COB, and the Data Type selected is Text. In the Field Properties box beneath, there are several options. The Alias is what the user will see when looking to collect data, so make sure your Alias makes sense! Allow NULL values lets you choose if users can leave this particular field blank when collecting data. Default value lets you select a default option for the field when it is pulled up in Collector. Domain, if present, allows you to select a pre-created Domain to link to. The Length allows you to choose a character limit on your field. Your COB, Country of Birth, field needs an Alias to inform users of what field they are populating, and it has a pre-made Domain associated with it.

Your screen for the COB Field then looks like this:

New Feature Class

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
COB	Text

Click any field to see its properties.

Field Properties

Alias	Country of Birth
Allow NULL values	Yes
Default Value	
Domain	
Length	

Domain: COB, COD

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

You will populate the next three Field Name boxes with the other Domains: COD, YOB, and YOD. Make sure that if you want to use a pre-made Domain for a Field you set the Data Type to the *same data type* as the Domain you had created. If you do not do this, these fields will not be given the coded values you may have previously assigned.

In creating Field Names and assigning their Data Type, you can create Text fields that do not require domains with coded values and instead rely on user input. For each headstone, you want to collect the surname, first name, and possible maiden name of the individuals buried. These will be created as three different text fields. You also provided the option in the COB and COD Domains to choose 'Other' as an option with intuitive aliases to match. You will create text fields for those as well. The fields must be created in the order you want them to appear to the user. The other premade Domains, COD, YOB, and YOD have been used for the COD, YOB, and YOD Fields, respectively. *Note:* Fields must be created in the order you wish them to appear to the user as the order cannot be changed later. Fields can be added on to the bottom of the list later.

Also, double-check you have changed the aliases of your fields to ensure the field names are intuitive.

Our completed field selection looks like this:

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
COB	Text
Dther	Text
COD	Text
Other_1	Text
YOB	Short Integer
YOD	Short Integer
Surname	Text
FirstName	Text
MaidenName	Text

Click any field to see its properties.

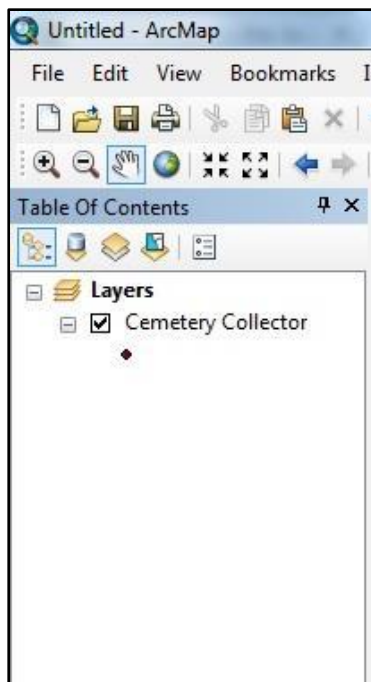
Field Properties

Alias	If other, enter:	
Allow NULL values	Yes	
Default Value		
Domain		
Length	50	

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

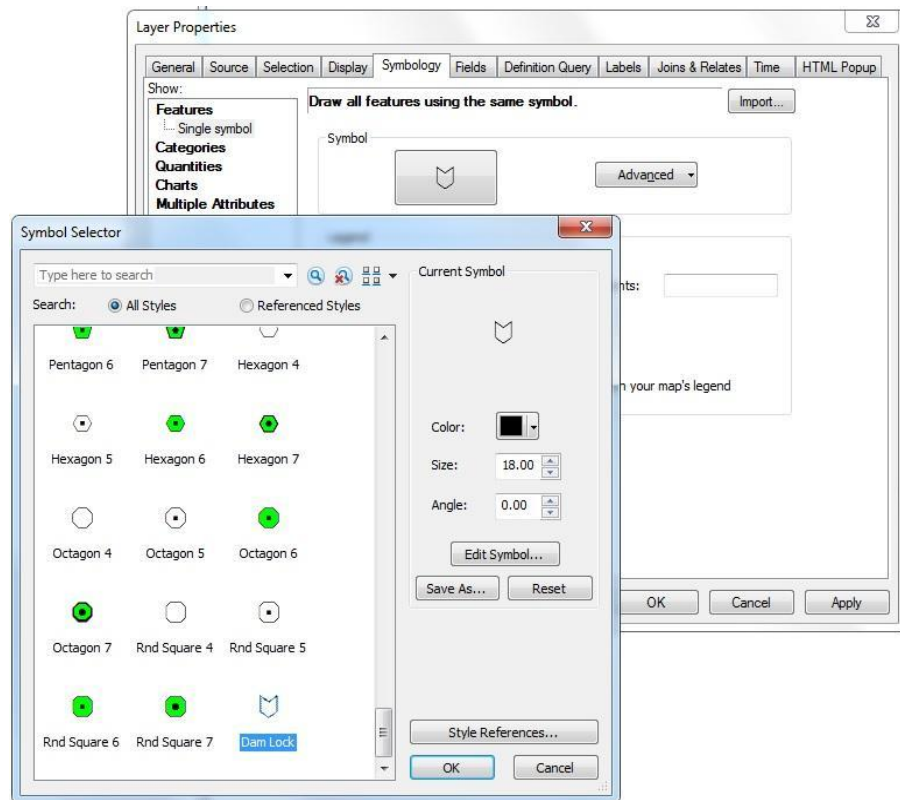


Once you are satisfied with the Fields you have created for your Feature Class, you can click Finish at the bottom of the pop-up window. This will close the pop-up and return you to the main ArcMap screen. The left panel in ArcMap is your Table of Contents panel. It will now have your feature class listed under Layers. Depending on what feature type you chose, the symbol beneath the name of your feature class. For this example, you elected to use a point feature type, and so the symbol appears as a small diamond. If you chose to use a line feature type, a line would appear beneath your name, and if you chose a polygon, a small box would appear beneath your feature class.

Now you can customize the symbology of your feature class. Right-click on the name of your feature class in the Table of Contents panel, and choose Properties from the drop down list. This will open a pop-up window with several tabs at the top. From these tabs, select Symbology.

There are several components to the Symbology tab. On the left, a box contains five options for what you want to show with your Feature Class.

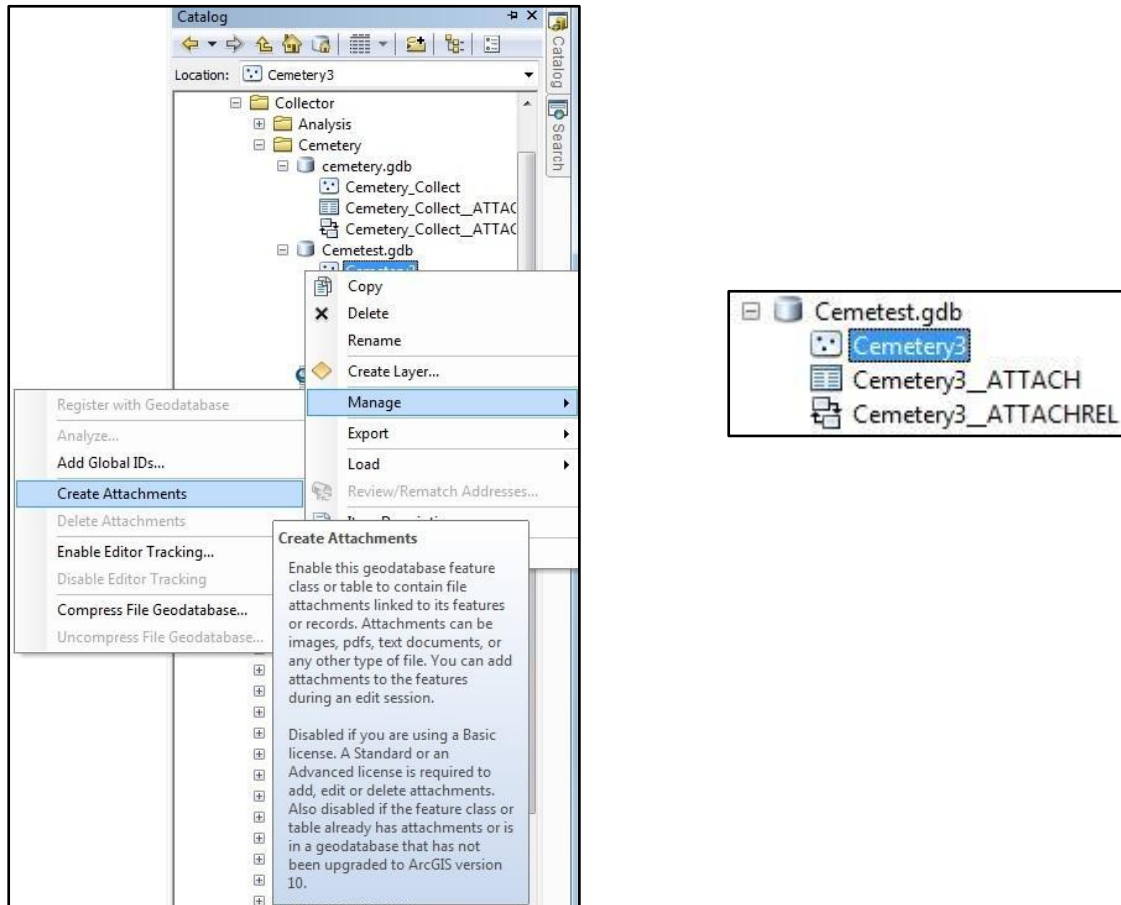
For the Cemetery example, you could symbolize the data using several methods. You could use a single symbol to represent every point collected or you could use the Categories with unique values to symbolize the data by country of birth or country of death. However, to keep things simple in this example, you will be using just the Features > single symbol option. All data collected will be symbolized using the same symbol across the board.



To change the symbol you are using to represent the headstones in the cemetery, click on the symbol box itself. This will open up a pop-up window full of options. Select a symbol that you like from the box, or enter a search term in the bar above the box to see what is available in the database. If you want to edit the symbol, click the Edit Symbol button beneath the colour and size options on the right side of the pop-up. Another pop-up will show you a greater variety of symbols, as well as a variety of options to edit your symbol with. Try to choose colour and size options that will stand out on your map. Once you are happy with your choices, click the OK button.

The symbol in your Table of Content screen should now look like the symbol you have chosen.

If you want your Collector users to be able to attach photographs to the data they collect, you can make that possible in ArcMap. Open the Catalog panel in your ArcMap screen. Locate your geodatabase and its subsidiary feature class(es). Right-click on the Feature Class you want to enable attachments in. From the list that appears, select Manage, and from the menu that appears from there, choose Create Attachments. This will generate two new files in your Catalog panel beneath your feature class. Be sure you do not delete either of these files, because attachments will not successfully be created without both files intact.



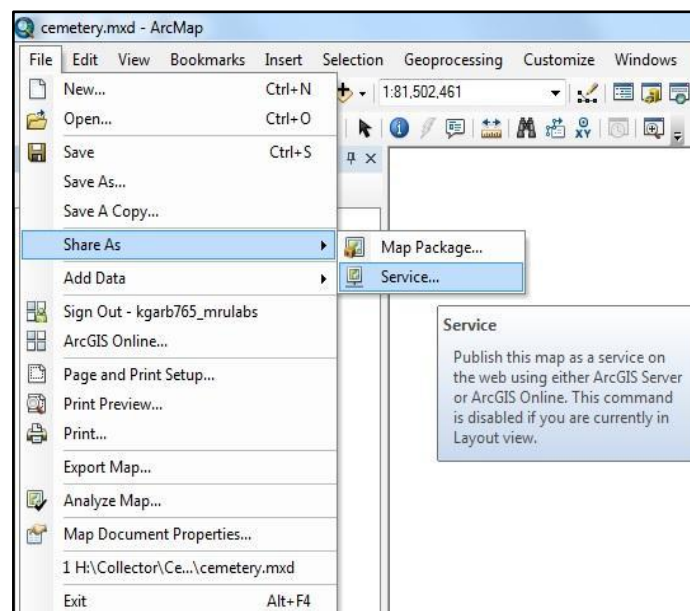
If you have not already done so, your final step is to save your ArcMap file so that you can retrieve it later, if needed. Go into your ArcMap File menu at the top left of your screen, and go down to the bottom of the list to select Map Document Properties. A pop-up window will appear. Leave everything blank, but make sure you check the box for pathnames: Store relative pathnames to data sources. This means all your data will remain intact and related even if you move it from folder to folder. If you do not select this option, it could mean all your map progress will be destroyed if you move a file. Click Apply at the bottom of the window.

In the File Menu, choose Save As. Find the folder that you want to house all your Collector data, and save your map within this file. Your map will save as an .mxd file format, the native file format in ArcMap.

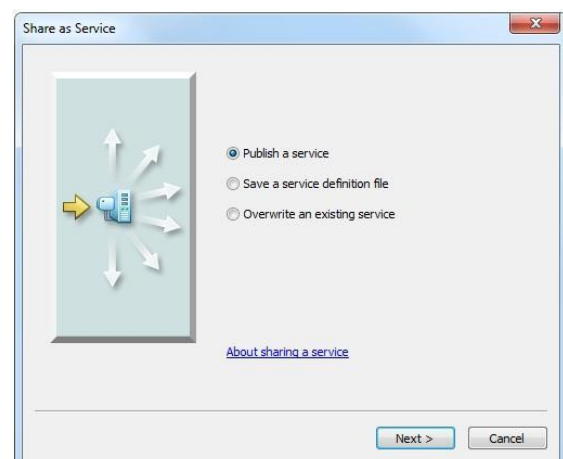
You have now created a Feature Class that you can share with the world!

Sharing Your Feature Service on ArcGIS Online

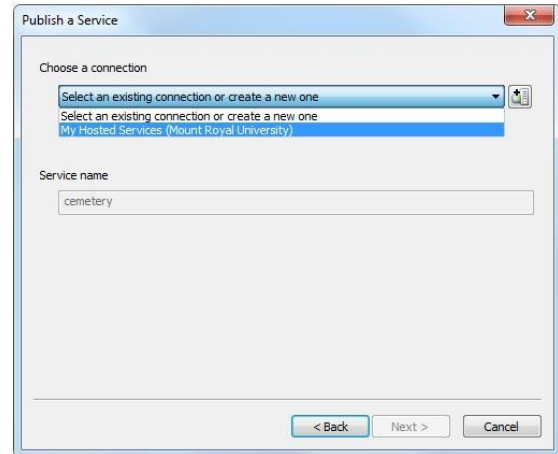
To make your Geodatabase and Feature Class accessible online and to turn them into a functional Collector map, you must share them to the ArcGIS online database. Open your File menu at the top of your ArcMap screen, and choose Sign In. This will open a pop-up menu that prompts you to sign in to ArcGIS Online. Enter your username and your password. The pop-up will disappear, and you can once again go into the File menu. Choose Share As, and select Service. A pop-up will appear that will guide you through the process to share your data.



In the first screen, choose to “Publish a service”.
Click Next.

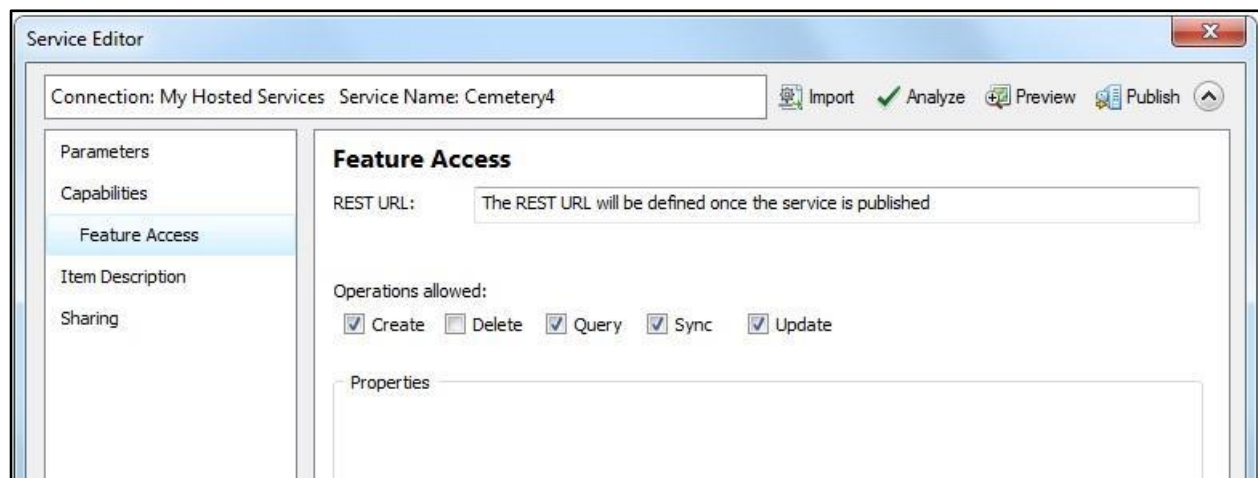


The second window asks you to choose a connection. For the Cemetery Collector example, you will be using an existing connection with Mount Royal University. Once you have selected or created a connection, you can re-name your Service in the Service Name box beneath. Your Service name cannot contain spaces or special characters. Click Next.



A large pop-up window will appear for the next step. This is your Service Editor screen. The Parameters screen is not editable, so leave it as is. In the left panel, choose Capabilities. Check the box next to Feature Access, and uncheck the box next to Tiled Mapping. This will change the next item in the left panel. Choose Feature Access from the left panel. The REST URL bar should be left as the default. For Operations allowed, you can choose what you want your Collector users to be able to do with the data collected.

At the bare minimum, your users must be able to Query the data. You can allow your users to do any other combination of operations, including allowing them to do all of them. For the Cemetery example, you will allow users to Create, Query, Sync, and Update features, but they will not be allowed to Delete features.

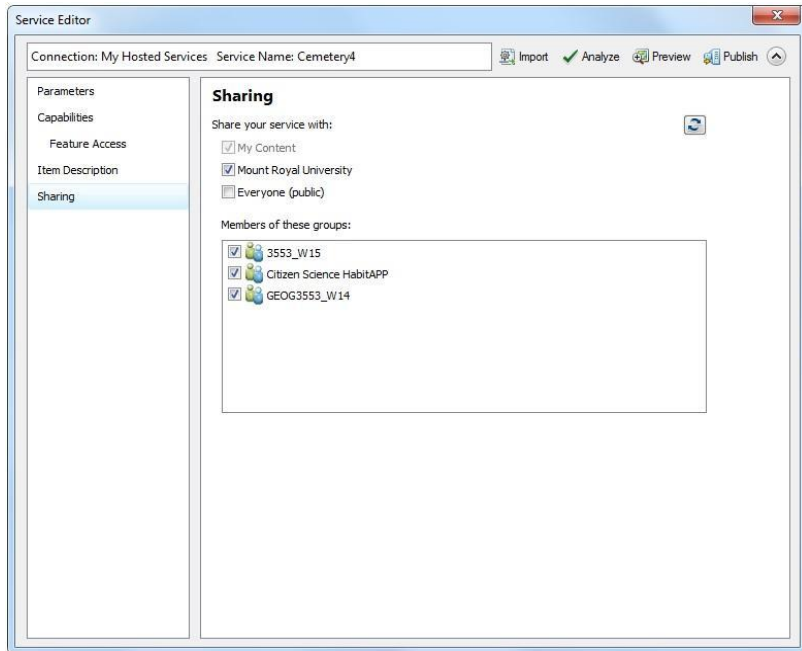


The next tab in the window is Item Description. A summary is required for your Feature Service, as are tags. Separate the tags with commas; otherwise the words which are entered will be one long tag. Alternately, you can click Choose Your Tags to select from tags you have already created. You can also add a description, access and use constraints, and credits if you so choose. It may be helpful to type the summary and description out in a word processor (e.g. Microsoft Word), as there is no spell check in the Service Editor window. Saving the summary and description in a separate file is also useful if you need to republish the service at a later time and do not want to type them out again. the cemetery example, when filled out entirely, looks like this:

The screenshot shows the 'Service Editor' window with the 'Item Description' tab selected. The window title is 'Service Editor'. At the top, it shows 'Connection: My Hosted Services' and 'Service Name: CemeteryCollector'. There are buttons for 'Import', 'Analyze', 'Preview', and 'Publish'. On the left, a sidebar lists 'Parameters', 'Capabilities', 'Feature Access', 'Item Description' (selected), and 'Sharing'. The main area is titled 'Item Description' and contains the following fields:

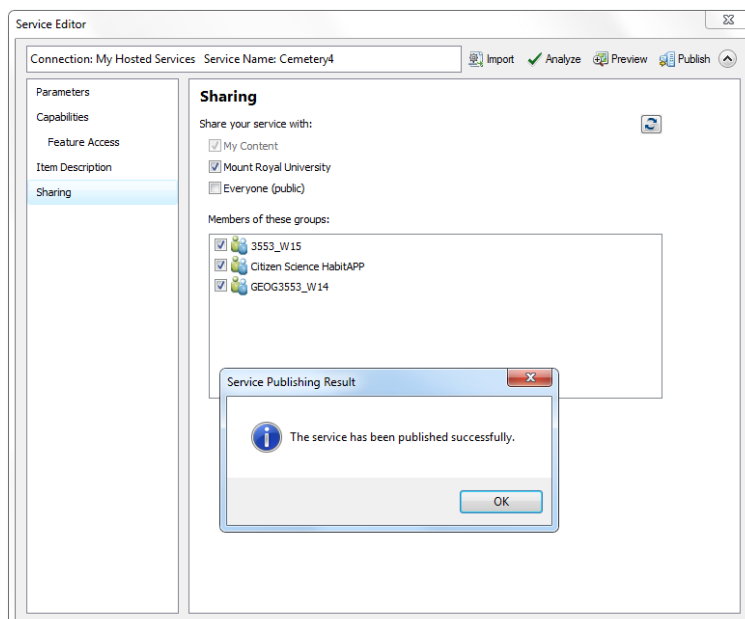
- Summary (required):** A text area containing: 'A Collector app to collect information about the individuals' name, year of birth, year of death, country of birth, and country of death from headstones in a cemetery.'
- Tags (required):** A text area containing: 'Collector GIS ArcMap Cemetery MRU Tutorial'. Below it is a button labeled 'Choose Your Tags...'.
- Description:** A text area containing: 'A Collector app to collect information about the individuals' name, year of birth, year of death, country of birth, and country of death from headstones in a cemetery. The collection of this data is to aid in creating historical data on births, deaths, migration, and families in the Calgary area over the past 215 years. This Collector app was built as part of a tutorial on Collector.'
- Access and Use Constraints:** An empty text area.
- Credits:** A text area containing: 'Mount Royal University, Kendra Garbutt, Alice Liboiron, Lynn Moorman, Dorothy Hill'.
- ☒ Update missing metadata in document based on item description.

The final tab in the Service Editor window is the Sharing tab. In this screen, you can choose which groups can see your service. the cemetery example is going to be shared with members of the Mount Royal University network, but not with the general public. As such, the Everyone box is left unchecked but the MRU networks are checked off.



Once you have filled out the Service Editor screen to your satisfaction, click the Analyze button at the top of the window. This will run through your options and verify that there are no major errors that will impede the publishing of your service. The analyze options will generate a bar at the bottom of your ArcMap screen that will itemize any errors you have in your service. Errors will prohibit you from publishing your service.. You must correct these issues before you can publish your service! Warnings of any severity will not prevent you from publishing your service. Once you have addressed any errors that need addressing, you can choose to Publish at the top of the Service Editor window. This will upload your Service to the ArcGIS Online database.

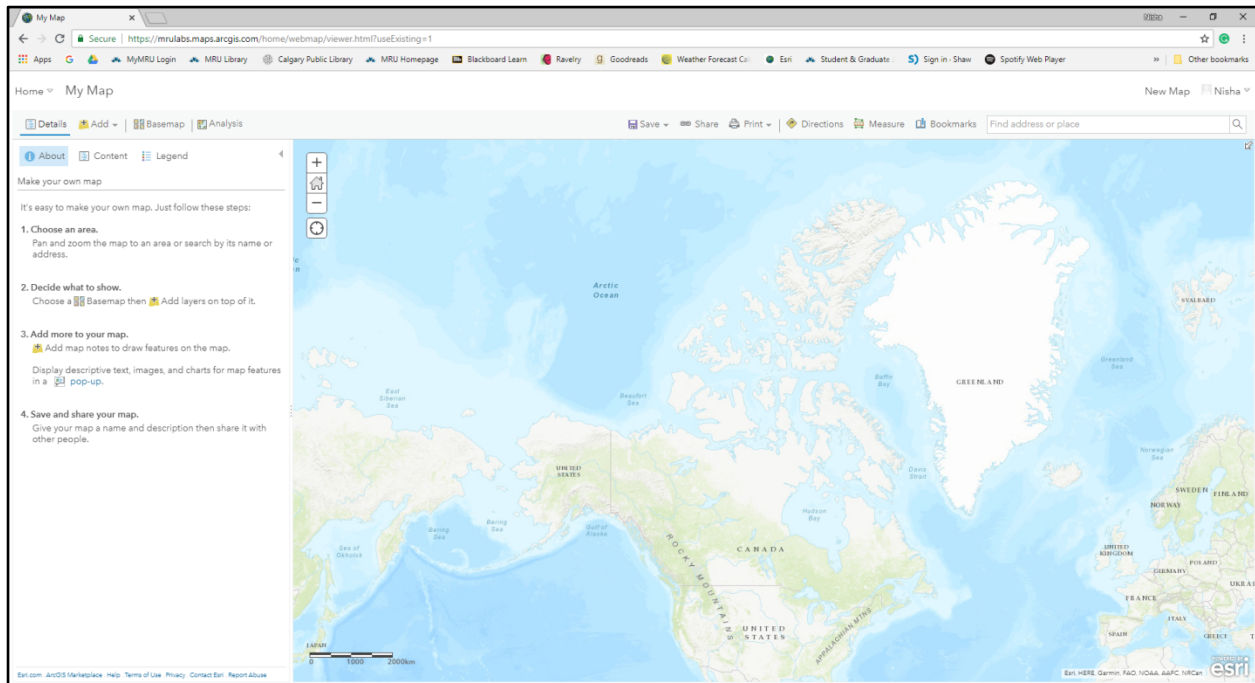
A pop-up window will show you the progress of various upload processes, and will notify you when the process is complete.



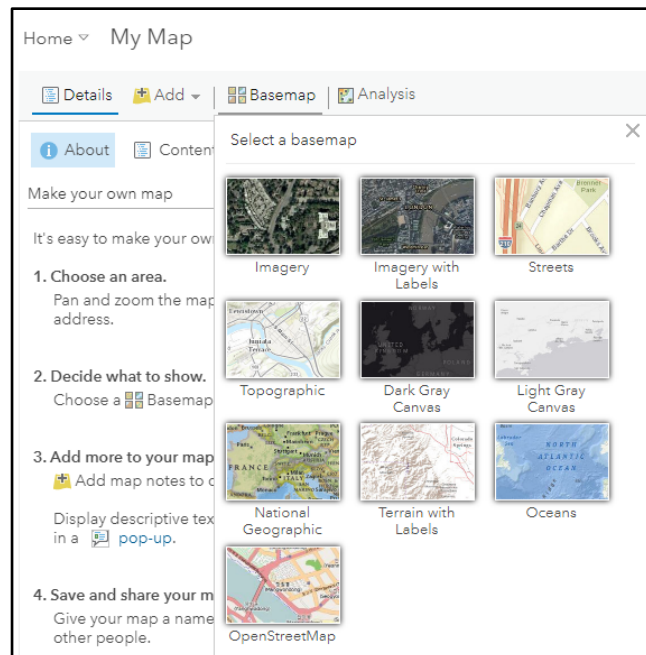
Your next step is to go online and verify that your information did indeed upload properly, and from there you can share it properly as a full-blown Collector map.

Sharing Your Collector Map

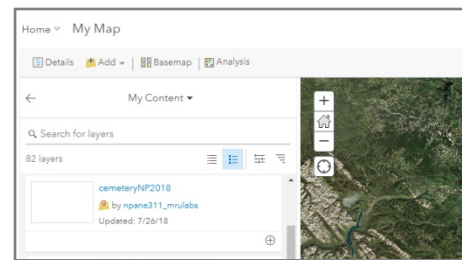
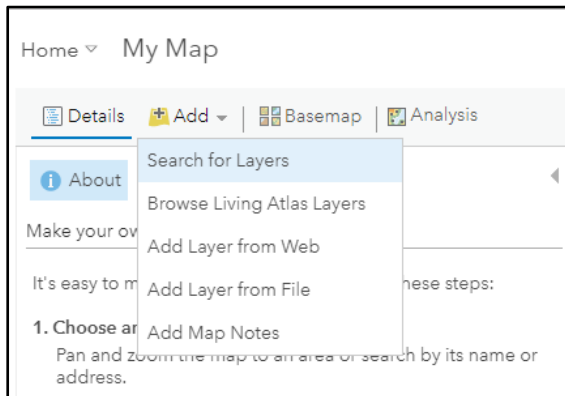
Open your web browser and go to www.arcgis.com. Click the blue Sign In button in the centre of the page. Enter your username and password. You will be directed to a screen with a ribbon of options at the top of the screen. From this ribbon, choose Map. This will take you to a screen with a panel at the left and a map in the centre.



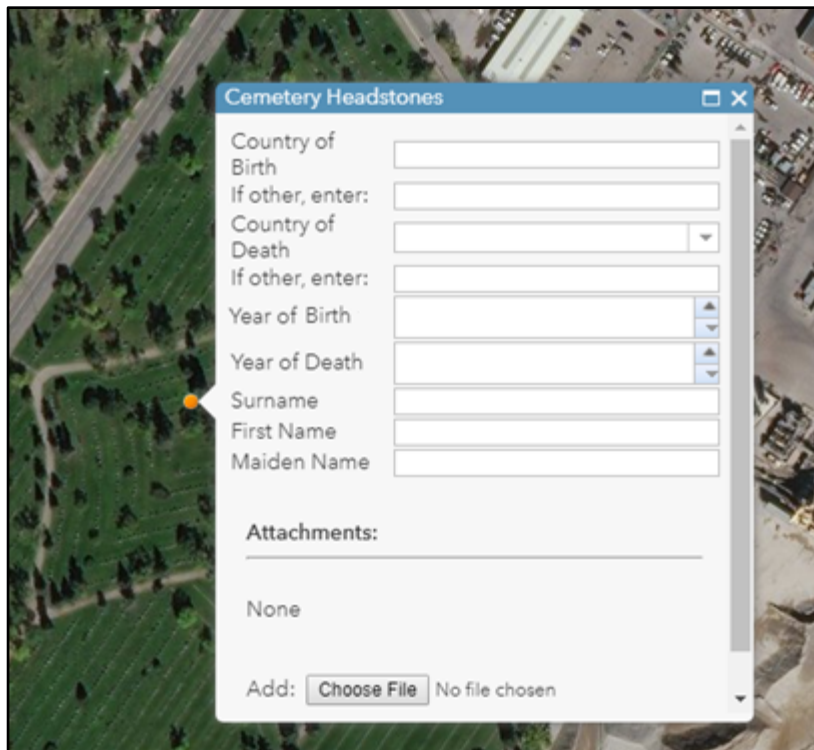
In the ribbon at the top of the screen, there is an option called Basemap. This option will allow you to choose the map that will be used in your Collector. You can select any of the maps in the menu. The choice of basemap depends on the purpose of your map. For example, maps based on the collection of plant data may not be best suited to a basemap primarily based on street information.



Once you have chosen your Basemap, you can add your own data to the map. In the top ribbon, select Add. From the drop-down menu, select Search for Layers. The easiest way to find material is to look in the folder 'My Content.' Once you find your data, click the + sign in the bottom right corner of your desired data to add it to your map. Click the back arrow when you are finished adding layers to close the menu.



Your left panel should now have items listed in the Content tab. You should see the name of your layer, and beneath it the name of your Basemap. Now you can optionally add points for your Collector map in ArcGIS Online. Click the Edit button in the top ribbon. This will populate the left panel with the different symbols you chose in ArcMap. You can add these points to your map now, or you can choose to leave data collection until you have fully completed and published your Collector app.



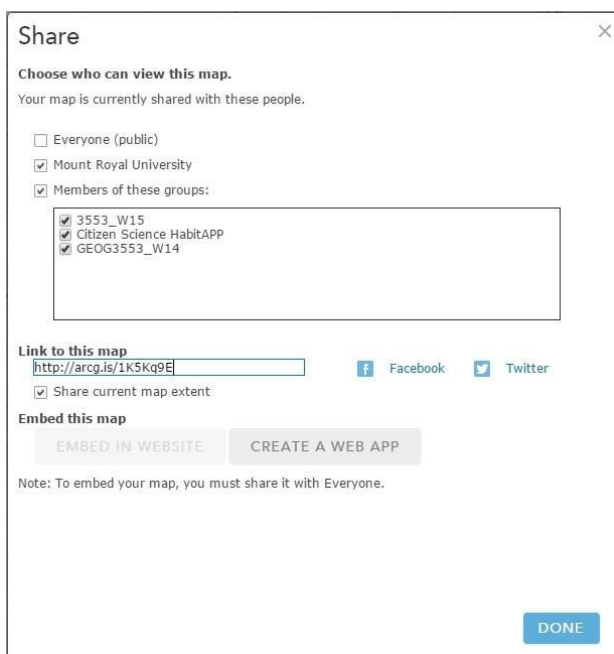
To add points, click on the symbol in the left panel. You can then click anywhere on your map and create a feature.

After you have created the features you desire on the map, if any, you must save your map. In the ribbon at the top of the screen, choose the Save option, and choose the Save As choice. Enter a Title for the map, and provide at least one tag for the map. Press the Enter key on your keyboard after each tag you create. Alternately, you can

select from tags in the drop-down menu that appears as you type. You can optionally add a Summary for your map as well. If you are creating multiple maps, it may be useful to add a description to help you keep this map, including its details and version, distinct from others you may produce. Click Save Map when you are ready.

Once you have saved your map, you can share it with the world! Next to Save in the top ribbon, select Share Map. A pop-up will appear asking you how you want to share your map. There will be options that you can check off to share your map with various groups. You must select at least one of the presented options, or else you will not be sharing your map!

This pop-up also provides you with a permalink to your map. If you desire to share your map with others who are not part of the groups listed in this window, be sure to copy the link. To share a Collector map, you do not need to embed the map or create a web app, so do not select either of these options. Click Done at the bottom of the pop-up when you are satisfied.



The image shows a 'Share' dialog box with a close button (X) in the top right corner. The main heading is 'Share'. Below it, the text 'Choose who can view this map.' is followed by 'Your map is currently shared with these people.' There are three checkboxes: 'Everyone (public)' (unchecked), 'Mount Royal University' (checked), and 'Members of these groups:' (checked). Under the 'Members of these groups:' checkbox, there is a list box containing three items: '3553_W15', 'Citizen Science HabitAPP', and 'GEOG3553_W14', all of which are checked. Below this, the 'Link to this map' section shows a text input field with the URL 'http://arcg.is/1K5Kq9E' and two social media icons: Facebook and Twitter. There is a checkbox for 'Share current map extent' which is checked. The 'Embed this map' section has two buttons: 'EMBED IN WEBSITE' and 'CREATE A WEB APP'. A note at the bottom states: 'Note: To embed your map, you must share it with Everyone.' A blue 'DONE' button is located at the bottom right of the dialog box.

You have now successfully shared a Collector map!

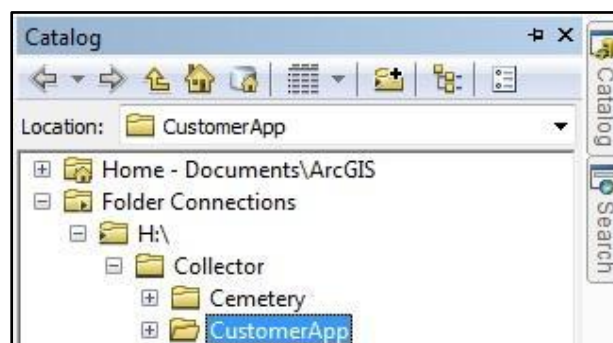
Customer Appeal Collector App Tutorial - Market Survey

In this Collector app example, an economics student has been assigned to develop a small business. They have elected to start a food truck, and are surveying their desired area to discover what their best food options and prices would be in that space. The feature class used in this particular Collector app will be polygon, rather than point, so that the aspiring food truck owner can survey large areas and generalize about the potential customers' desires. By allowing the user to draw polygons, they can draw as large or small an area as they see fit, so the survey may cover an area the size of a city block or an entire neighbourhood.

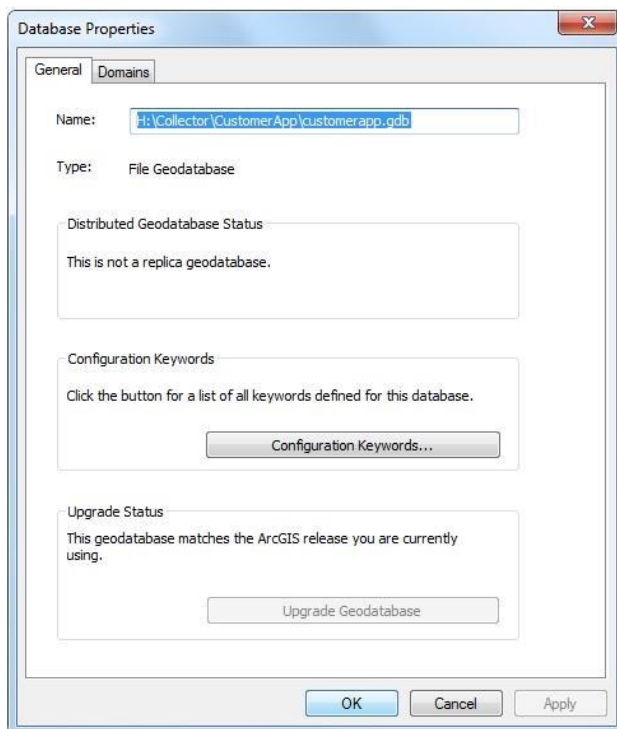
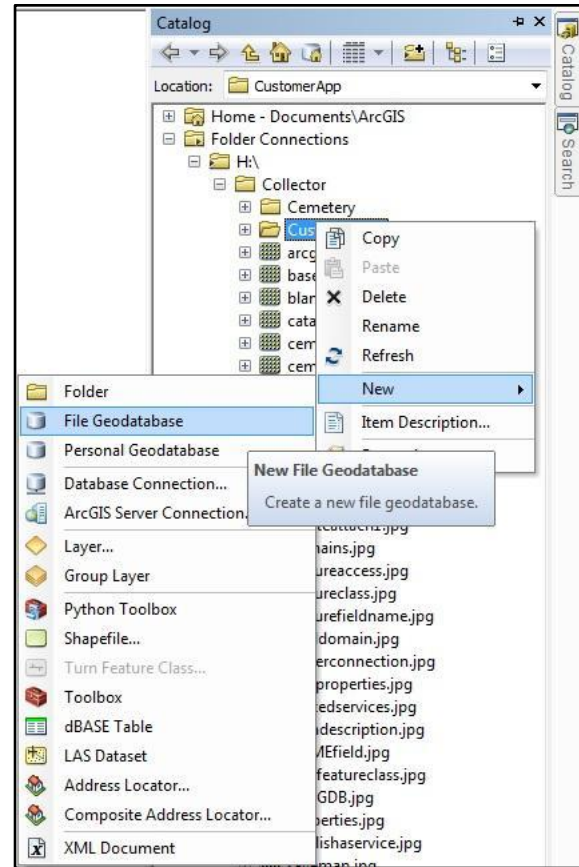
Constructing Your Geodatabase

Begin by opening your Windows Explorer window and creating your necessary folders to house your geodatabase. Be sure to name them appropriately and intuitively, using no special characters and no spaces, and try to keep the name under 13 characters long.

Open up ArcMap. Open the Catalog panel on the right side of the main window. Connect to your desired folder by clicking the Connect to Folder icon (the folder with a plus sign) and selecting your folder from the list. It is recommended that you connect to the overarching umbrella folder that contains all the necessary data for your Collector app. This way, if you have any files that you want to incorporate that fall outside the specific folder for your geodatabase, you do not have to connect to another folder late in the build. In the screenshot above, the folder that is connected to is the H:\ umbrella folder, rather than the particular CustomerApp folder.



Right-click on your desired folder and select New. From the drop down list that appears, select File Geodatabase. A new item will appear in your Catalog window. This is your new File Geodatabase. Provide your Geodatabase with an appropriate name (no special characters, no spaces, under 13 characters).



Once you have named your Geodatabase, right-click on the file and select Properties from the list. This will open a new pop-up window with two tabs at the top, General and Domains. Leave all the General options as their defaults. In the Domains tab, enter your desired Domain Names, their Description, and fill in the Domain Properties for each of your created Domain Names. Remember, the Domain Name is usually an abbreviated word that will allow you to recall what kinds of responses are contained within each respective domain. The Description field is what your Collector app user will see, so make sure it makes sense for the everyday user.

Database Properties

General Domains

Domain Name	Description
Baked	Would you eat baked/bread food truck items
Dessert	Would you eat dessert food truck items
Meat	Would you eat meat food truck items
PriceRange	What would your price range be for food truck opti
Seafood	Would you eat seafood food truck items
useFoodTrucks	Does the customer eat from food trucks
Veggie	Would you eat vegetable food truck items

Domain Properties:

Field Type	Short Integer
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description
0	No
1	Yes

OK Cancel Apply

For the CustomerApp Collector example, the Domains used are useFoodTrucks, Baked, Dessert, Meat, Seafood, Veggie, and PriceRange. For the all the Domains except PriceRange, the Domain Properties are as such:

Field Type	Short Integer
Domain Type	Coded Values
Split Policy	Default Value
Merge Policy	Default Value

The Coded Values for each of these Domains are binary: 0 with a Description of No, and 1, with a Description of Yes. This means that rather having to set the Field Type to Text, you can just use integers. It is a bit quicker and simpler.

For your domain of PriceRange, the field type is set to Text, and the Domain Type is set to Coded Values. This is because integer values do not allow for the use of special characters, such as dollar symbols. For the sake of clarity about prices, we will use a Text field type.

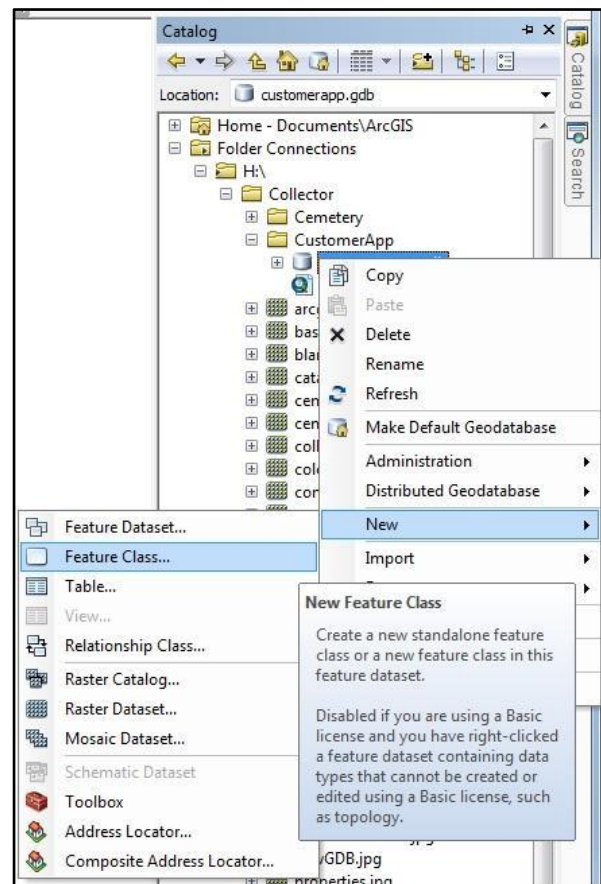
Coded Values:

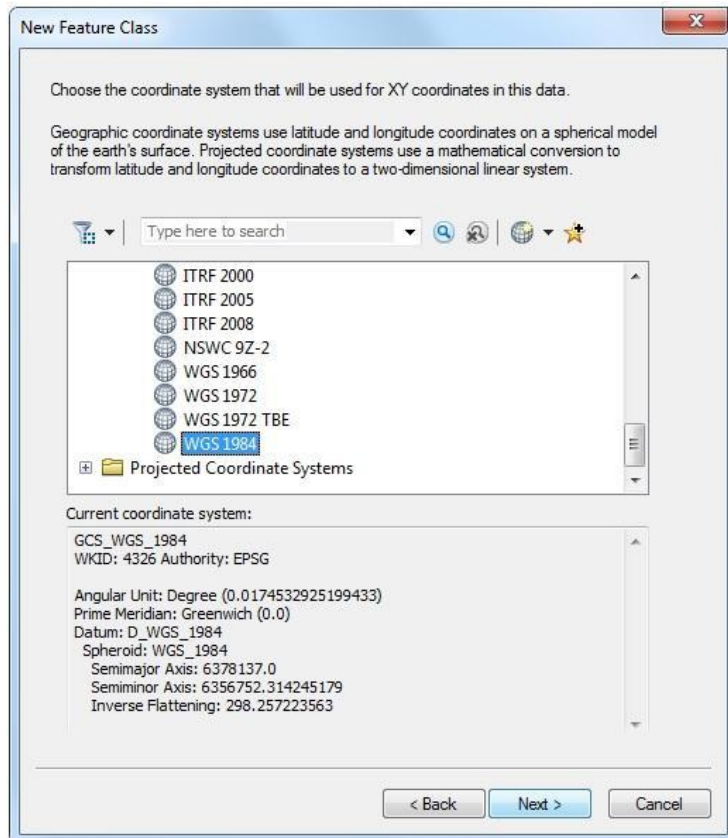
Code	Description
\$0-\$5	\$0-\$5
\$0-\$10	\$0-\$10
\$0-\$15	\$0-\$15
\$0-\$20	\$0-\$20

Once you have set all your desired Domain Names, Descriptions, and the Properties for each of your Domains, click Apply and then OK and close the window.

Constructing Your Feature Class

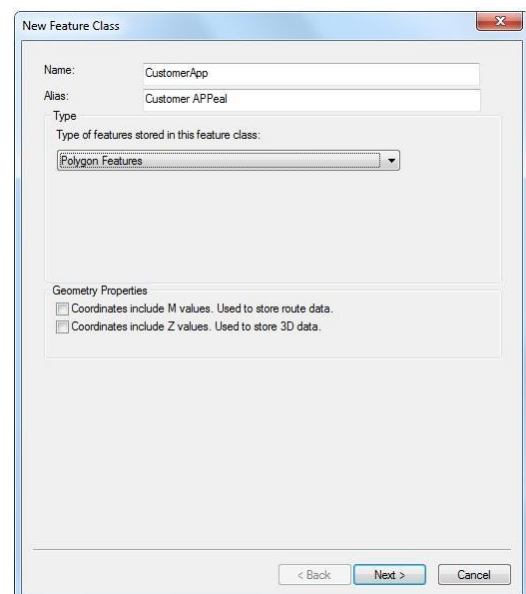
Right-click on your Geodatabase and select New. From the drop down list that appears, select Feature Class.



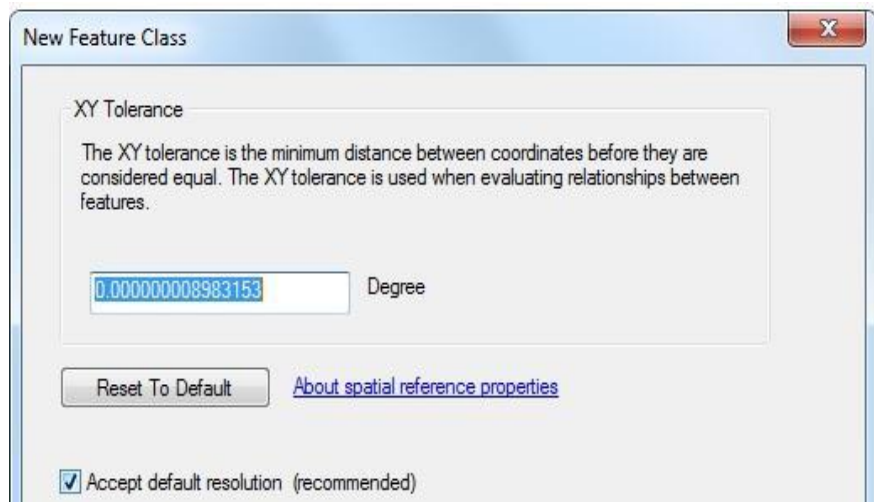


A window will pop-up that allows you to create your Feature Class, or what kinds of shapes you want your Collector to collect. In this window you can Name your Feature Class, as well as provide it an Alias, and you can select the type of features that are stored in your Geodatabase for your Collector app. In the CustomerApp example, you will be collecting polygon features. Leave Geometry Properties unchecked.

After naming your Feature Class and choosing the Type of your feature, click next. The next screen asks you to choose the coordinate system for your Feature Class. For the CustomerApp Collector, you will be using the Geographic Coordinate System of WGS84 (World Geodetic System 1984). As in previous examples, the coordinate system you use will depend on the location and scope of your Collector app. The CustomerApp Collector could be used anywhere around the world where someone wants to survey the feasibility of a food truck, so a global coordinate system was chosen.



The next window allows you to set your XY tolerance. The XY tolerance is used by ArcMap to evaluate relationships between features on a map and will affect future analysis in ArcMap, should you choose to do so. It is highly recommended that you choose the default resolution suggested by ArcMap.



The image shows the 'New Feature Class' dialog box with the 'XY Tolerance' section selected. The text explains that the XY tolerance is the minimum distance between coordinates before they are considered equal. A text box contains the value '0.000000008983153' and a unit dropdown is set to 'Degree'. Below the text box is a 'Reset To Default' button and a link to 'About spatial reference properties'. At the bottom, the checkbox 'Accept default resolution (recommended)' is checked.

XY Tolerance

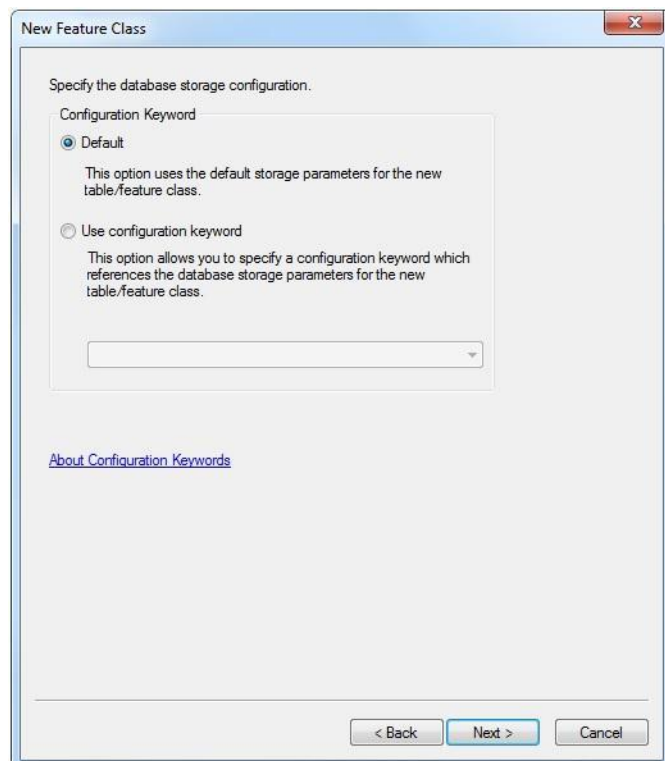
The XY tolerance is the minimum distance between coordinates before they are considered equal. The XY tolerance is used when evaluating relationships between features.

0.000000008983153 Degree

Reset To Default [About spatial reference properties](#)

☒ Accept default resolution (recommended)

The next window allows you to specify the database storage configuration. It is recommended that this screen also be left on its default.



The image shows the 'New Feature Class' dialog box with the 'Specify the database storage configuration' section selected. The 'Configuration Keyword' section has two radio buttons: 'Default' (selected) and 'Use configuration keyword'. The 'Default' option uses default storage parameters, while the 'Use configuration keyword' option allows specifying a keyword that references database storage parameters. A dropdown menu is visible below the radio buttons. At the bottom, there are links to 'About Configuration Keywords' and navigation buttons: '< Back', 'Next >', and 'Cancel'.

Specify the database storage configuration.

Configuration Keyword

☒ Default

This option uses the default storage parameters for the new table/feature class.

☐ Use configuration keyword

This option allows you to specify a configuration keyword which references the database storage parameters for the new table/feature class.

[About Configuration Keywords](#)

< Back Next > Cancel

New Feature Class

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
useFoodTrucks	Short Integer
Baked	Short Integer
Dessert	Short Integer
Meat	Short Integer
Seafood	Short Integer
Veggie	Short Integer
PriceRange	Text

Click any field to see its properties.

Field Properties

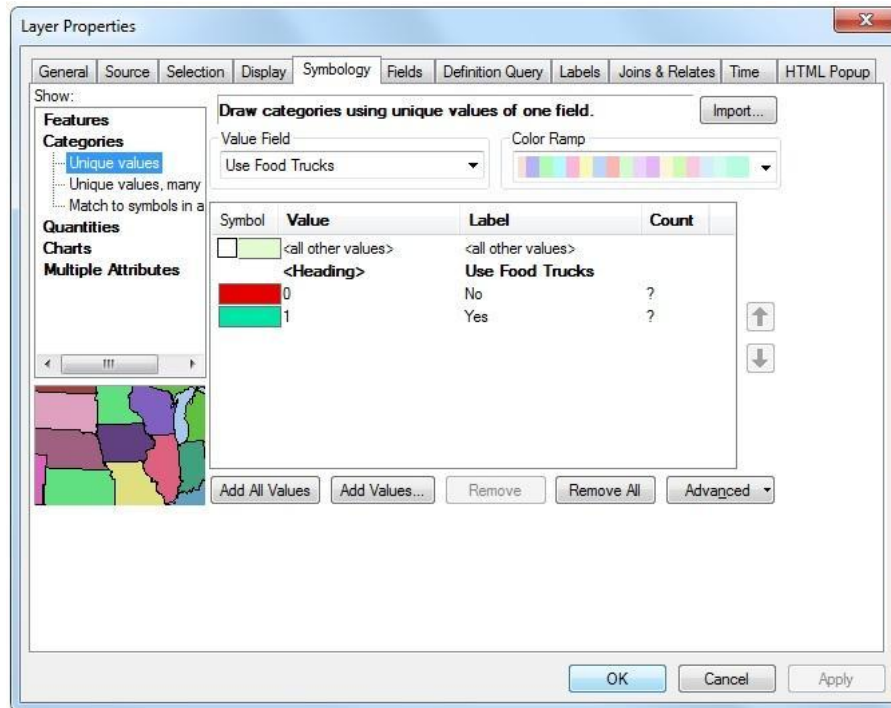
Alias	Price Range	<input type="checkbox"/>
Allow NULL values	Yes	<input type="checkbox"/>
Default Value		<input type="checkbox"/>
Domain	PriceRange	<input type="checkbox"/>
Length	50	<input type="checkbox"/>

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

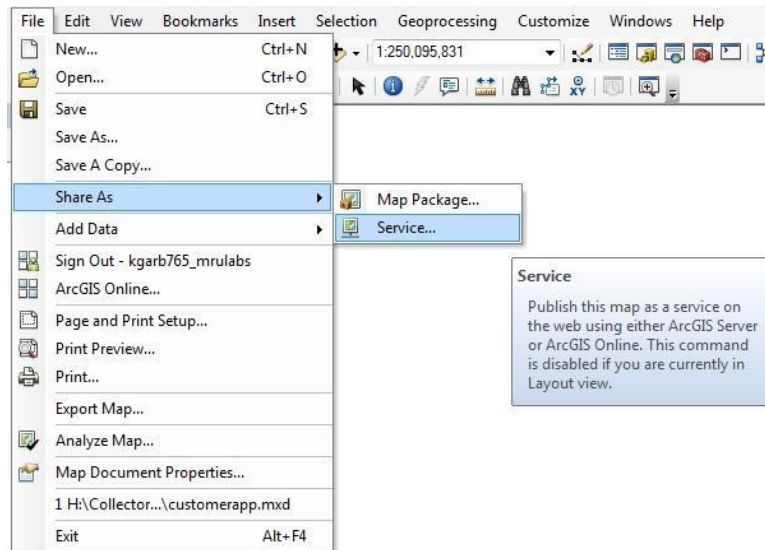
The last window allows you to fill a series of Field Names and their Data Type to populate your Collector app. In the Field Name field, enter the names of all the domains you created previously. Also specify their respective Data Types to follow the data types you designated during domain creation. This way, when each collection field is created, you can choose in the Field Properties box (below the Field Names) to set the Domain to the options you set at the beginning of your geodatabase construction. In the CustomerApp Collector example, all the Domains created at the beginning of the database construction have been set to match in the Field Name box. You can also add fields that you did not create as Domains in this Field Name box. Be sure you set the Data Type to the correct form of data that you want collected.



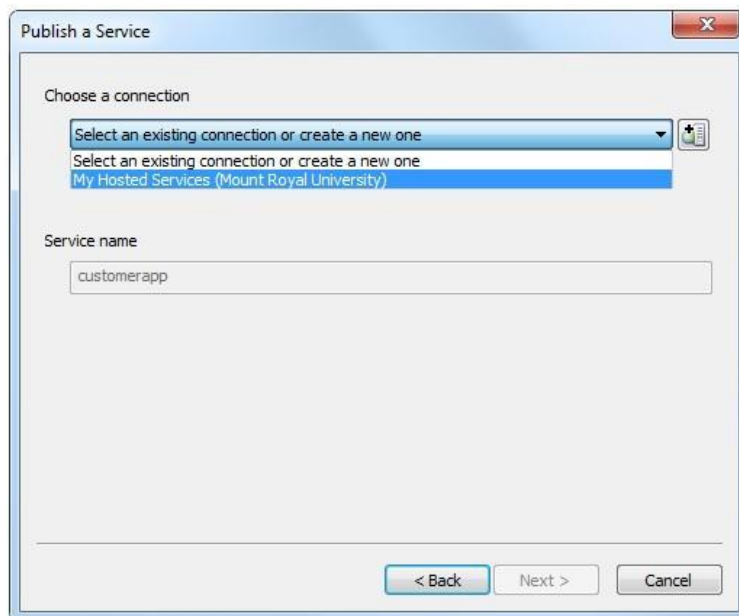
When you are satisfied with your Field Names, Data Types, and the corresponding Field Properties, click the Finish button at the bottom of the pop-up window. Once your feature class is all set up, the Table of Contents panel at the left side of your ArcMap window will be populated by your feature class. To change the symbology of your feature class, right-click on it in the Table of Contents panel. Choose Properties, and go into the Symbology tab at the top of the pop-up window. The left-hand panel in the Symbology tab contains the option to symbolize Categories. Choose Unique Values in the menu. This will alter some of the options in window. There will be a drop-down menu titled Value Field. You can choose in this menu which of your Domains you want to symbolize in your Feature Class. In the CustomerApp Collector example, you will be symbolizing if people use food trucks or not. Once you've selected your desired Field, choose the Add All Values button below the large window. This will add the Coded Values you selected for your Domain to the large central window. You can then symbolize each of the values as you see fit. For this example, the areas where people would not eat from food trucks are symbolized in red, and the areas where people would eat from food trucks are symbolized in teal.

Sharing Your Feature Service on ArcGIS Online

After you have finished designating the symbology of your polygons, you are ready to upload your Collector app framework to ArcGIS Online. Make sure you are signed in to ArcGIS Online through the File menu at the top of your ArcMap window. Once logged in, you must share your data as a Service. Select Share As, and choose Service.

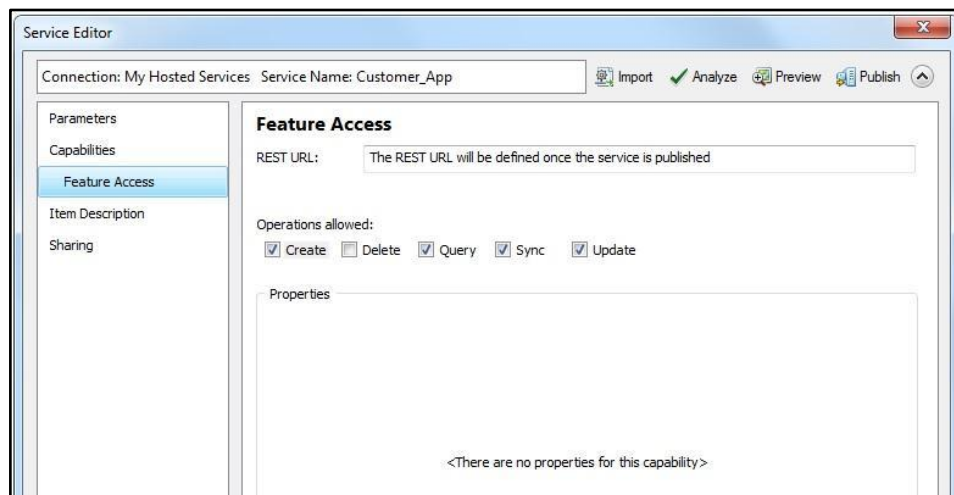


The first pop-up window will ask you what you want to do. Choose Publish a Service, and click next.

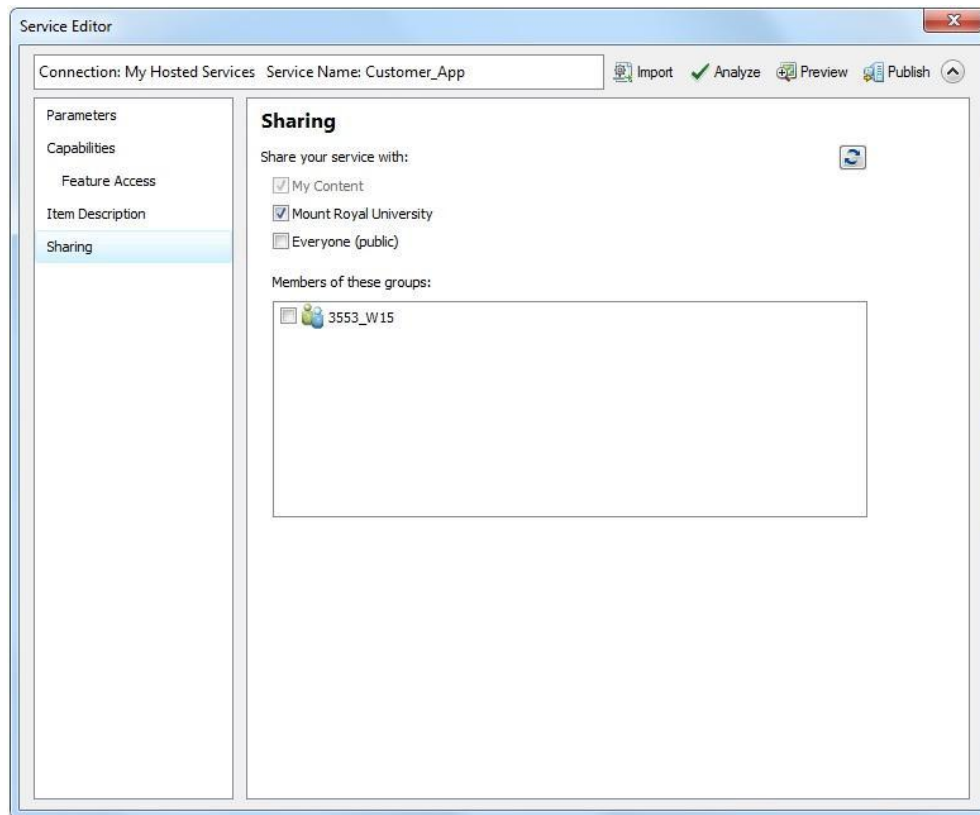


The next screen will allow you to choose a connection. You can create a new one, or you can choose to share through your My Hosted Services. In this example, you will connect through My Hosted Services (Mount Royal University). Finishing this pop-up window will open a new window within ArcMap called Service Editor. The menu on the left side of this window allows you to customize your Service (your Collector app), its functionality, and its accessibility.

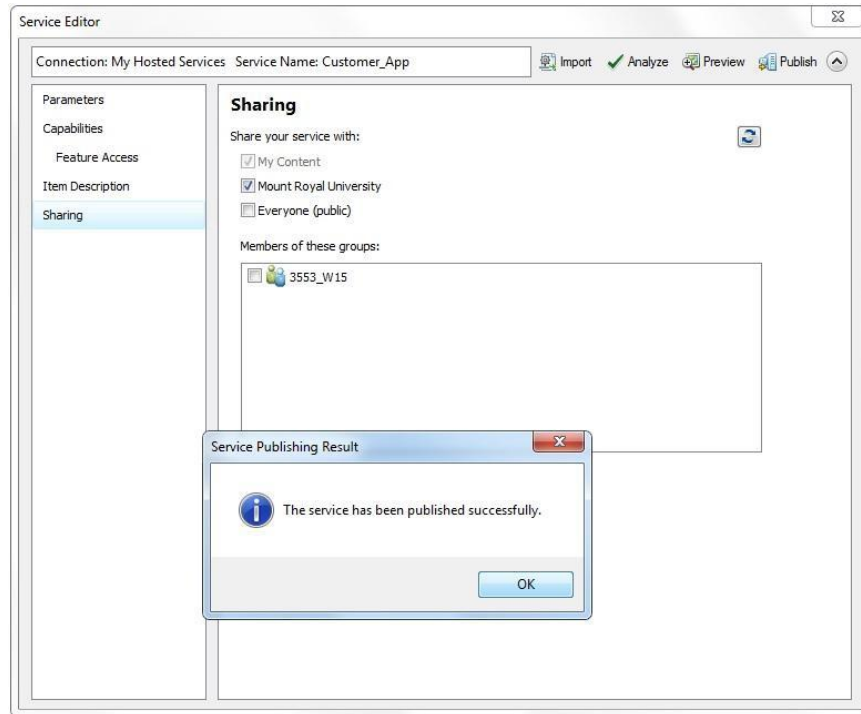
The first option, Parameters, should be left with all its defaults. The second option, Capabilities, asks if you would like Tiled Mapping and/or Feature Access. Check the Feature Access box, and uncheck the Tiled Mapping box. When you do so, the menu on the left of the window will switch and give you the option to customize your Feature Access. In the Feature Access screen, you can select what operations users can use in the Collector app. For the CustomerApp example, users will be allowed to Create, Query, Sync, and Update the app. They will not be allowed to delete data. The Item Description screen allows you to add a summary, tags, a description, access and use constraints, and credits to your service.



The final option in the left side menu is Sharing. This menu allows you to choose whom you share your Service with. the CustomerApp example will only be shared with members of Mount Royal University.

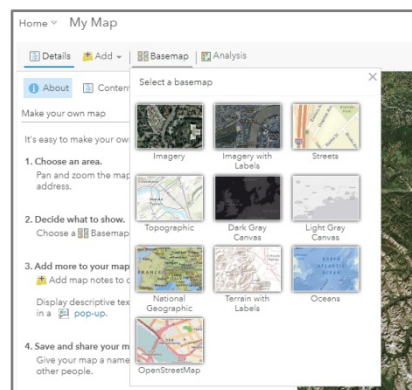


Once you have finished with all the menus on this screen, click the Analyze button at the top of the window. This will identify any potential problems before you choose to share your service, and can help to troubleshoot critical problems if something is incorrect prior to publishing your service. After ArcMap has analyzed your service and you have solved any Errors, you can choose to Publish your Service. Click the Publish button in the top right of the Service Editor window. You will see several loading screens, and when it is finished, a pop-up will let you know.



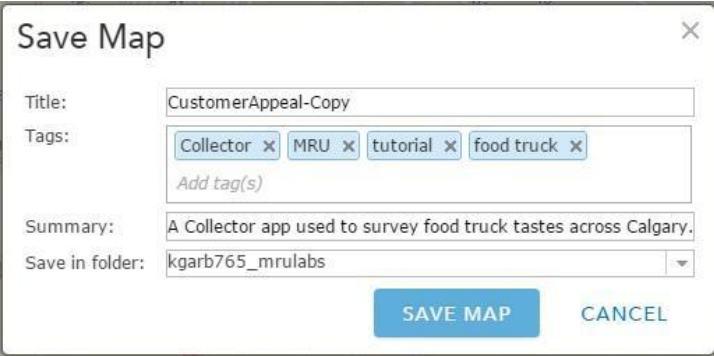
Sharing Your Collector Map

After you have successfully published your Service, you need to Sign In to your account on www.arcgis.com. When you have logged in, you will be directed to a home page for your organization. At the top of your window there is a Map option. Select this option. It will send you to a screen with a left side menu and a large map in the centre of your window. In the ribbon above your map there are four options: Details, Add, Basemap, and Analysis. Your first step is to choose an appropriate basemap for the purpose of your Collector app. Select Basemap. For the CustomerApp example, you will be using the Streets basemap because it provides street detail but is also simple to view.



Once you have chosen your desired basemap, you can add data to your map. Select Add from the ribbon. It will drop down a menu requesting where you would like to add data from. Select Search For Layers. Because it is your own service, you can choose to search within your own content. You can also search within any of the other drop down options if you like. When you find your desired data, click the “+” sign in the bottom right-hand corner of the data you want to add. This will add the data to your basemap. When you have finished adding data to your map, click the Back arrow at the top left of the search screen to return to the Content panel. You can now edit your map with relevant data from your service!

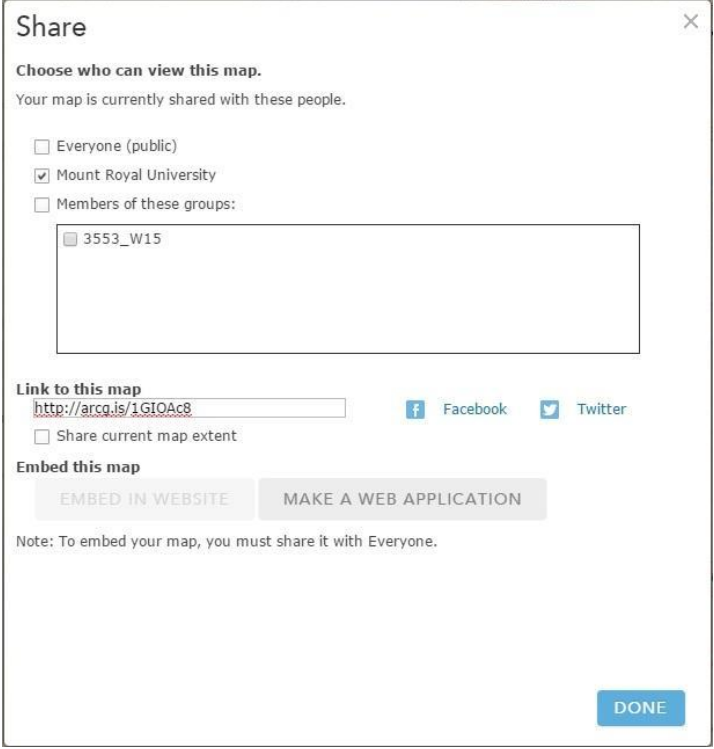
The next step is to share your fully fledged Collector app with the world. From the top ribbon, select Save As. You are asked to give your map a title, tags, a summary, and which folder to save in. Enter all your desired information, and click Save Map at the bottom of the pop-up.



The 'Save Map' dialog box contains the following fields and controls:

- Title:** A text input field containing 'CustomerAppeal-Copy'.
- Tags:** A list of tags including 'Collector', 'MRU', 'tutorial', and 'food truck', each with a close button (X). Below the list is a text input field labeled 'Add tag(s)'.
- Summary:** A text input field containing 'A Collector app used to survey food truck tastes across Calgary.'
- Save in folder:** A dropdown menu showing 'kgarb765_mrulabs'.
- Buttons:** 'SAVE MAP' and 'CANCEL' at the bottom right.

Your last step is to share your full Collector app. Choose Share from the top ribbon. This will bring up a pop-up screen asking for the details of whom you want to share your Collector with. You will also be provided with a permanent url link to your ma. Fill out the screen with your relevant detail, and click the Done button at the bottom of the window.



The 'Share' dialog box contains the following sections and controls:

- Choose who can view this map.**
Your map is currently shared with these people.
 - ☐ Everyone (public)
 - ☒ Mount Royal University
 - ☐ Members of these groups:
 - ☐ 3553_W15
- Link to this map**
A text input field containing the URL 'http://arcgis/1G10Ac8'. To the right are buttons for 'Facebook' and 'Twitter'.
- ☐ Share current map extent
- Embed this map**
Two buttons: 'EMBED IN WEBSITE' and 'MAKE A WEB APPLICATION'.
- Note:** To embed your map, you must share it with Everyone.
- Button:** 'DONE' at the bottom right.

You have now successfully published and shared a Collector app!

For the CustomerApp example, in the Sharing screen you unchecked the box that asks if you want to share your current map extent. This means you would potentially be able to use this app anywhere you chose, as opposed to being limited to a map extent decided by the creator of the app. This has implications when you have downloaded the Collector app on your mobile device.

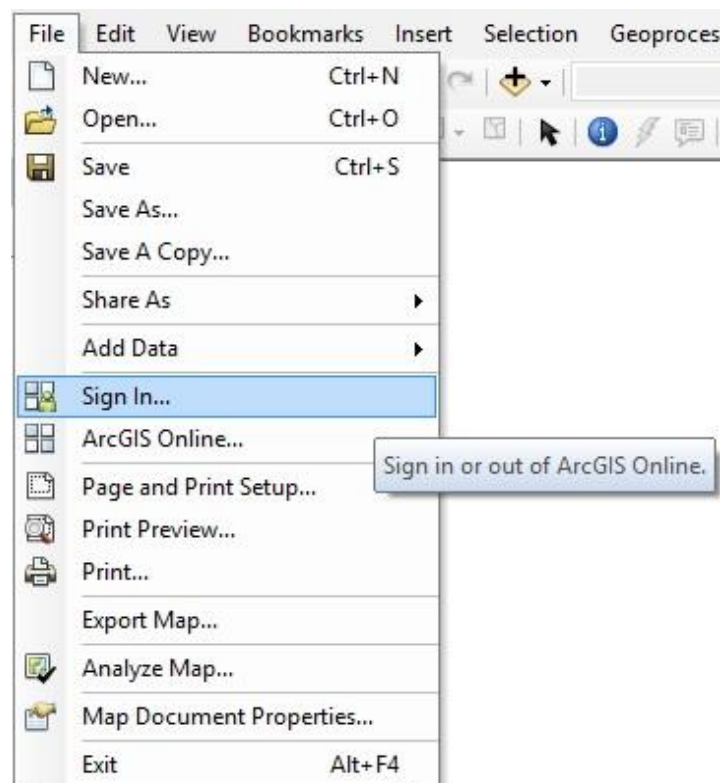
HabitAPP Collector App Tutorial – Ecological Monitoring

The HabitAPP Collector consists of two separate Collector maps: one map for monitoring ecological disturbances, and another for tracking plant communities and non-native invasive species. It was originally developed to monitor the ecological health of public natural area parks within Calgary, but could also be adapted for other ecological monitoring. This tutorial will focus on how to construct the Disturbances Collector map. This Collector differs from some of the other tutorials in that it has multiple feature classes, which allows the user to map three different features on one map. It also allows the user to easily differentiate between the different data being collected, as each of the feature classes are visually symbolized differently.

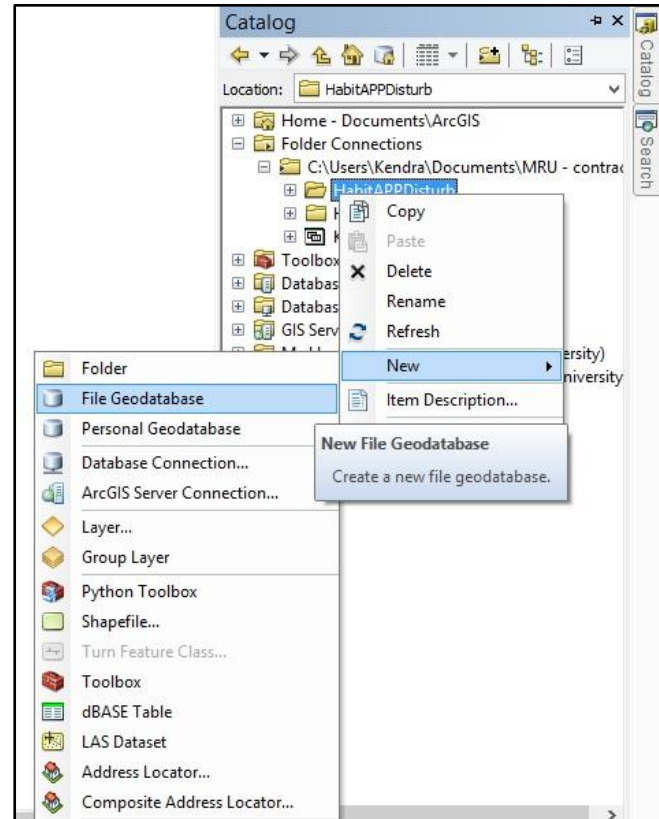
The Disturbance map will have **three feature classes**: natural disturbances, human origin disturbances, and compaction. Natural disturbances include things like floods, fires, and wind, water, or insect damage. Human origin disturbances include things like illegal campsites, fire pits, and litter. Compaction is a measure of how compacted the soil is in a particular spot, which can indicate a high level of use and prevent future plant growth.

Constructing Your Geodatabase

First, sign in to your ArcGIS Online account.



On the right side of your ArcMap screen, open the Catalog panel. Connect to your desired folder by selecting the Connect to Folder icon at the top of the panel and finding your folder. Right-click on that folder and choose New. From the menu that pops up select File Geodatabase. Provide your geodatabase with a name that is memorable and intuitive. Remember to keep the name of all your files under 13 characters long and free of special characters and spaces.



General Domains

Domain Name	Description
Compaction	Compaction (mm of pencil depth)
HumanDisturb	Human Origin Disturbances
NatDisturb	Natural Disturbances

Domain Properties:

Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:

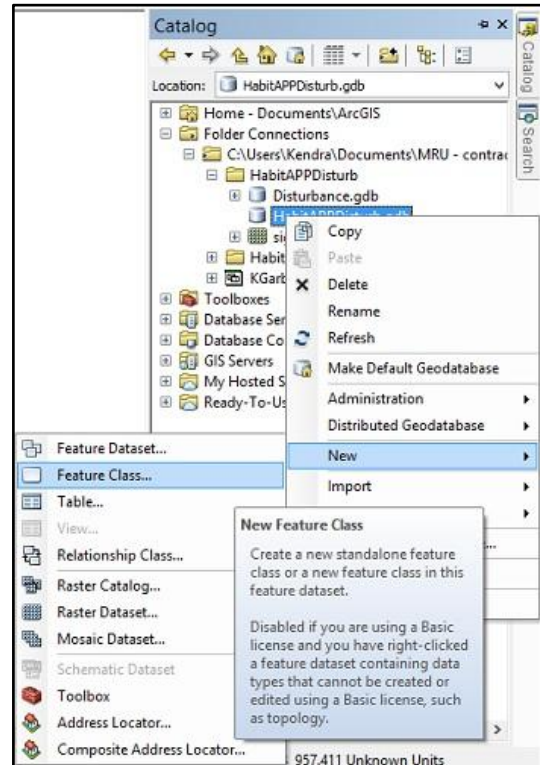
Code	Description
0-20	0 - 20 mm
20-40	20 - 40 mm
40-60	40 - 60 mm
60-80	60 - 80 mm
80-100	80 - 100 mm

OK Cancel Apply

After naming your geodatabase, right-click on it and select Properties from the bottom of the menu. Leave the General tab with all its default settings. Open the Domains tab. This particular Collector map will have three different feature classes, so you will have to create three different Domains: Compaction, HumanDisturb, and NatDisturb.

The Domain name of Compaction was given the field type of Text because it allows the use of a dash (-) which integer Field Types do not allow. The dash is essential to show that the coded value is a range of values, not singular values.

Domains were also created for your other two feature classes, Natural Disturbances and Human Origin Disturbances. They were given also Text Field Types and provided with Coded Values to allow Collector users to select from drop down lists of options.



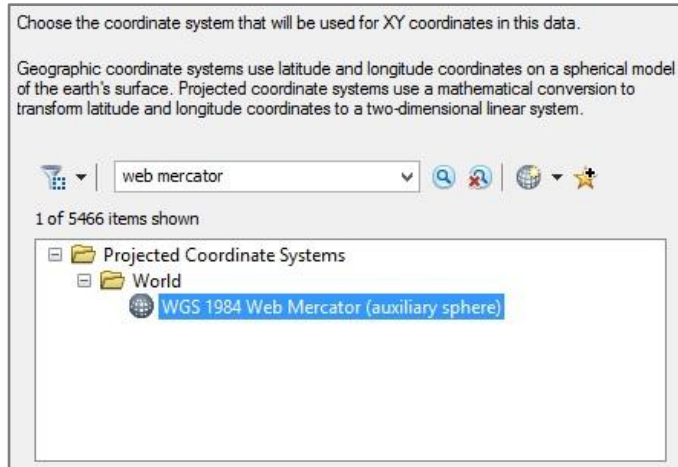
Constructing Your Feature Class(es)

Next, right-click on your geodatabase in the Catalog panel again and select New. From the menu that appears, select Feature Class.

You will be led through a series of options. Your Feature Class needs a Name and an Alias. The Name should be intuitive with no spaces or special characters, and the Alias should be explanatory so that users can tell what they are using and does allow spaces. Next, select your desired feature type. For this example, you are using Point features.

Leave the Geometry Properties blank, as they will not be used.

 A screenshot of the 'New Feature Class' dialog box. The 'Name' field contains 'Compaction' and the 'Alias' field contains 'Compaction Depth (mm)'. Under the 'Type' section, 'Type of features stored in this feature class:', a list box shows options: 'Point Features' (selected), 'Polygon Features', 'Line Features', 'Multipoint Features', 'MultiPatch Features', 'Dimension Features', and 'Annotation Features'. At the bottom, under 'Geometry Properties', there are two unchecked checkboxes: 'Coordinates include M values. Used to store route data.' and 'Coordinates include Z values. Used to store 3D data.'



Hit Next, and in the following screen, select your desired coordinate system. For the HabitAPP Disturbance example, you will be using the projected coordinate system of WGS 1984 Web Mercator.

Proceed to the next screen. The XY Tolerance screen can be left entirely as the default setting. Continue to the next screen. The database storage configuration screen can also be left as the default. Proceed to the next screen.

In the following screen, you will be asked to create and describe your fields. If you enter the Name and Data Type of your previously created Domains, the option to select the coded values you also previously created will appear in the Field Properties box beneath your Field Names. For the HabitAPP example, the field name of Compaction was entered. To use the prepared coded values, find the Domain category in the Field Properties box. Select the blank box to the right of Domain, and a drop down menu will appear. Select your desired Domain from the list.

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
Compaction	Text
Date	Text

Click any field to see its properties.

Field Properties

Alias	Date Collected (dd/mm/yyyy)	
Allow NULL values	Yes	
Default Value		
Domain		
Length	50	

Import...

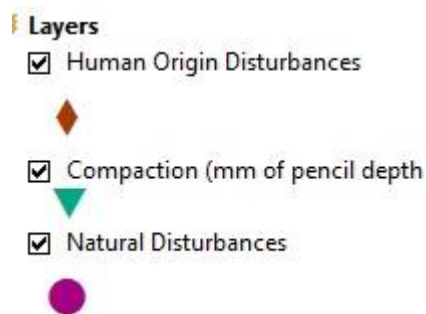
To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

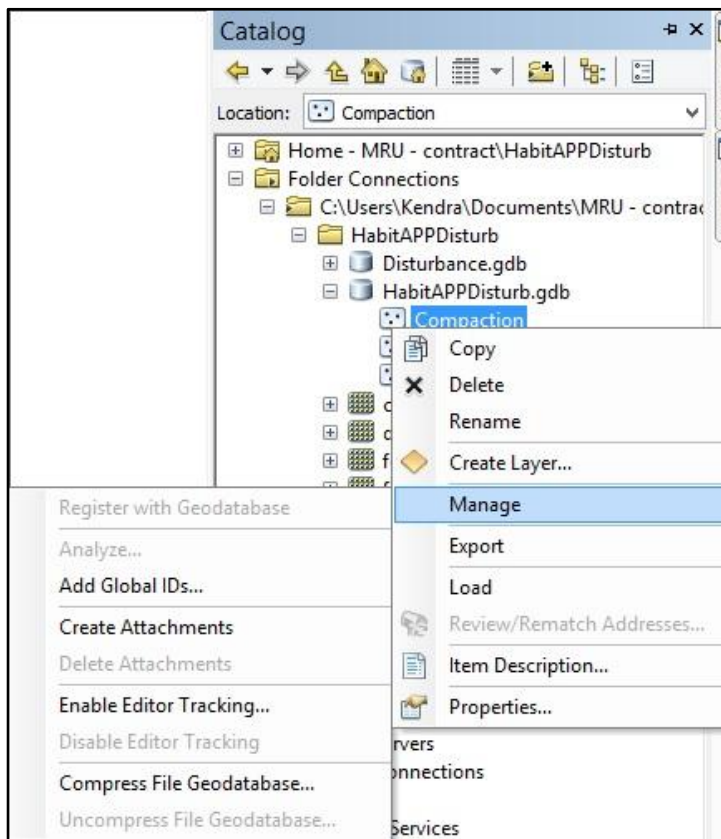
This Collector map is also a temporally sensitive map – many disturbances, such as a fallen tree branch or a camp site, are not in place for extended periods of time. Therefore, this Collector will also add a field to each feature class to collect the date of the observed disturbance. For the Compaction example, the field name of Date was created and given the data type of Text. In the Field Properties box, the Domain option was left empty. This means users can enter their own text. This is the only additional information to be collected for Compaction, so this feature class is complete. Click Finish at the bottom of the window.

ArcMap will generate a Layer for your created Feature Class which will appear in the Table of Contents on the left side of the ArcMap screen.

To create another Feature Class for your Collector map, simply follow the outlined steps and create as many as you like! It is often best to keep your Collector as simple and straightforward as possible. For the HabitAPP Disturbance example, three different Feature Classes were created. the other two feature classes (Human Origin Disturbances and Natural Disturbances) also had Domains created for them. The Domains included fields for all the varieties of disturbance considered relevant. In the Field Name screen in the Feature Class creation, the Domains created for each Class were filled in for the main Field. They were also given two other Fields – a Description Field, with a Text Data Type to allow users to enter their own observations, and a Date Field, allowing users to add the date they observed the disturbance.

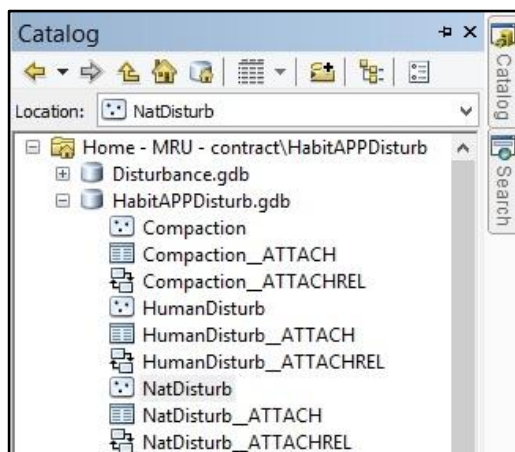


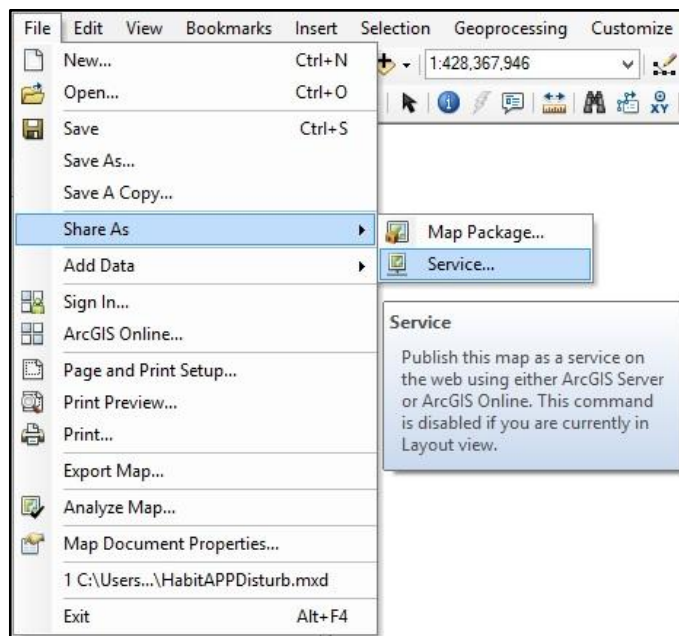
After creating all your desired feature classes, symbolize them however you like. Right-click or double-click your feature class in the Table of Contents panel on the left side of your ArcMap window. Open the Symbology tab at the top of the pop-up window and change to your desired symbols.



A beneficial feature of the Collector app is the option to add attachments to data collection. This feature allows users to take and add photographs to the data they collect. Open up the Catalog menu on the right side of your ArcMap screen. Right-click on the feature class to which you want to have attachments added. In the drop down menu that appears, select Manage. From that menu, select Create Attachments. ArcMap will create two additional files in your Catalog panel named similarly to your feature class. You do not need to do anything to activate your attachments.

Once you have selected your symbols and added attachments, you can share your geodatabase.

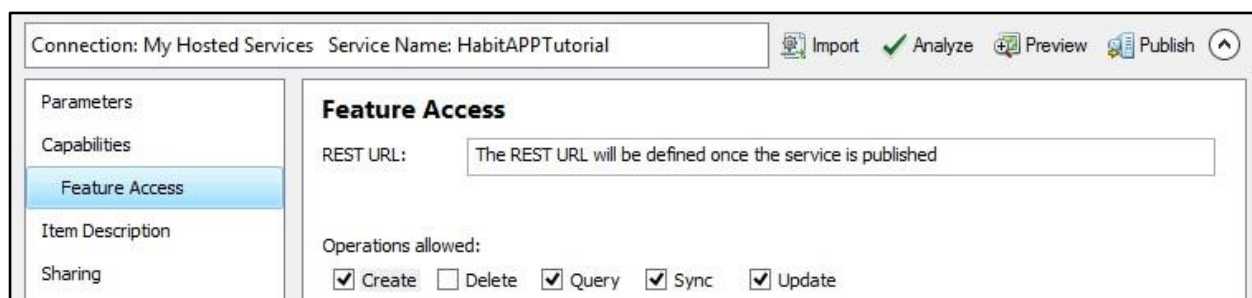




Sharing Your Feature Service on ArcGIS Online

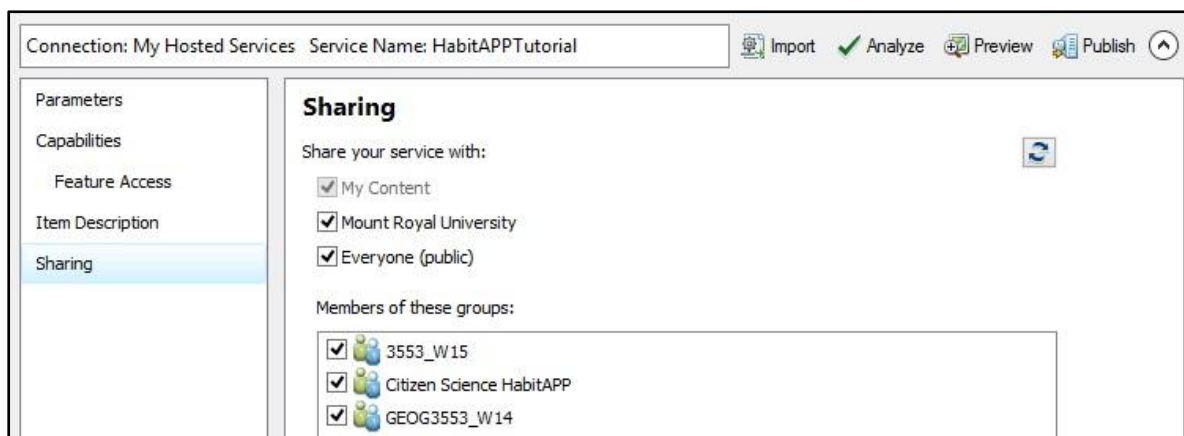
Make sure you are logged in to ArcGIS Online. Once logged in, under the File menu there is an option to Share As. Click this option, and then choose Service. A pop-up window will walk you through the steps to share your geodatabase. In the first pop-up, select Publish a Service. In the second screen, ArcMap asks you what connection you want to use to share your geodatabase. Select My Hosted Services, and then below, provide your service with a name.

In the Service Editor, leave all the options in the Parameters screen as default. In the Capabilities screen, check the box for Feature Access and uncheck the box for Tiled Mapping. In the Feature Access screen, you can choose what you want your users to be able to do. For the Disturbances Collector, users will be able to Create, Query, Sync, and Update data, but they will not be able to delete data.



This is important temporally, like the Date field for your features. You will need to ensure that relevant data stays on your map and irrelevant data does not. For instance, if you want your map to have data for locations throughout the month of June, data points for other months may not be needed. If you need data removed from your map, you as the map owner are the only person who can do that.

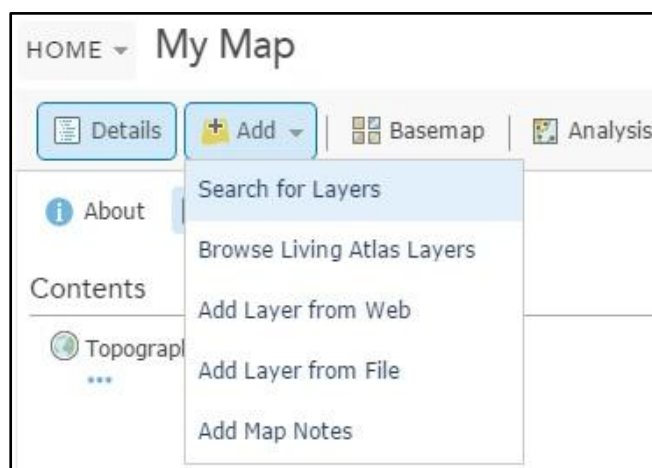
Enter your Item Description in the next screen and continue to the Sharing screen. the Disturbances Collector map will be shared with members of Mount Royal University and groups within that organization as well as with the general public.



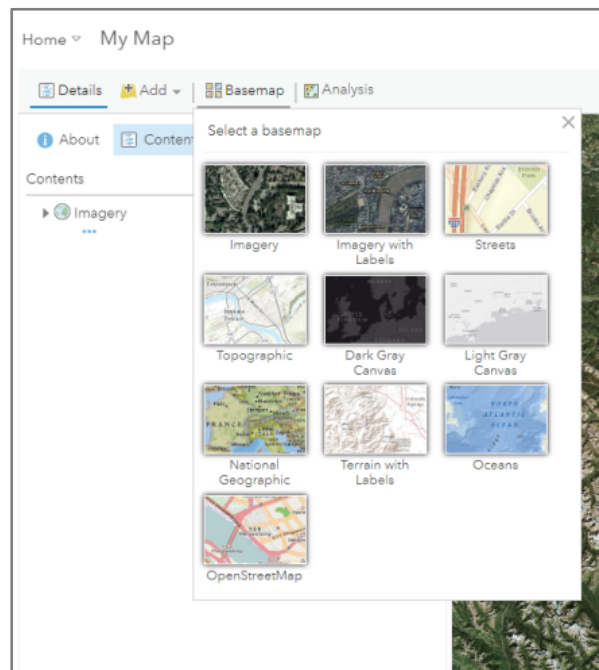
Once you have set up your Sharing the way you would like, click Analyze in the top right of the Service Editor window. If no Errors are found, select Publish at the top of your Service Editor window.

Sharing Your Collector Map

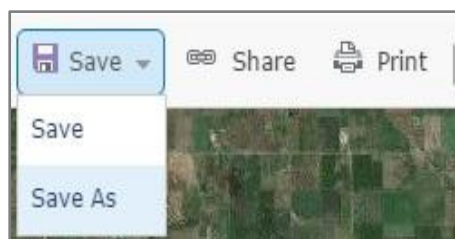
After Sharing your Service, you can create the final product for your Collector map in ArcGIS Online. Go to <http://www.arcgis.com> and sign in. It will take you to a default screen. Select map from the ribbon at the top of the screen. From the ribbon of options at the top of the map viewer, choose Add. Choose Search for Layers, and find your Service from the list. Click the “+” sign in the bottom right corner of the data you wish to add. When you are finished adding data, click the back arrow at the top of the search screen to return to the Content panel. The left panel in your browser will change to show the different features in your Service.



In the top ribbon, you can also choose what Basemap you want your Collector map to display with. Be sure to choose the basemap that will display your data in the most appropriate way.



Once you have chosen your Basemap, you can share your fully functional Service as a Collector map. First, save your map by selecting Save As from the top ribbon. Be sure you save your Collector as something both appropriately named and intuitive so users can find it easily.



After you have saved your map, you can share it with the ArcGIS community. From the top ribbon, select Share. Check off the options that are appropriate in the sharing pop-up window. For the Disturbances Collector, you want to share the map with everyone so that many members of the public can engage in this citizen science project. Select Done at the bottom of the window when you are happy with your sharing options.

The image shows a 'Share' dialog box with a close button (X) in the top right corner. The main heading is 'Share'. Below it, the text reads 'Choose who can view this map.' and 'Your map is currently shared with these people.' There are three checked checkboxes: 'Everyone (public)', 'Mount Royal University', and 'Members of these groups:'. Under the 'Members of these groups:' checkbox, there is a list box containing three items, all of which are checked: '3553_W15', 'Citizen Science HabitAPP', and 'GEOG3553_W14'. Below this list, there is a section titled 'Link to this map' with a text input field containing the URL 'http://arcg.is/1V4FXwP'. To the right of the input field are two social media icons: Facebook and Twitter. Below the input field is a checked checkbox labeled 'Share current map extent'. At the bottom left, there is a section titled 'Embed this map' with two buttons: 'EMBED IN WEBSITE' and 'CREATE A WEB APP'. At the bottom right, there is a blue button labeled 'DONE'.

Share

Choose who can view this map.

Your map is currently shared with these people.

☒ Everyone (public)

☒ Mount Royal University

☒ Members of these groups:

- ☒ 3553_W15
- ☒ Citizen Science HabitAPP
- ☒ GEOG3553_W14

Link to this map

☒ Share current map extent

Embed this map

EMBED IN WEBSITE

CREATE A WEB APP

DONE

Your finished Collector should now appear in your Collector app on your mobile device. Open the map and double check that all your desired feature classes are represented, and that the menu options function the way you want them to.

Bird Box Collector App Tutorial – A Visual Guide to Related Tables

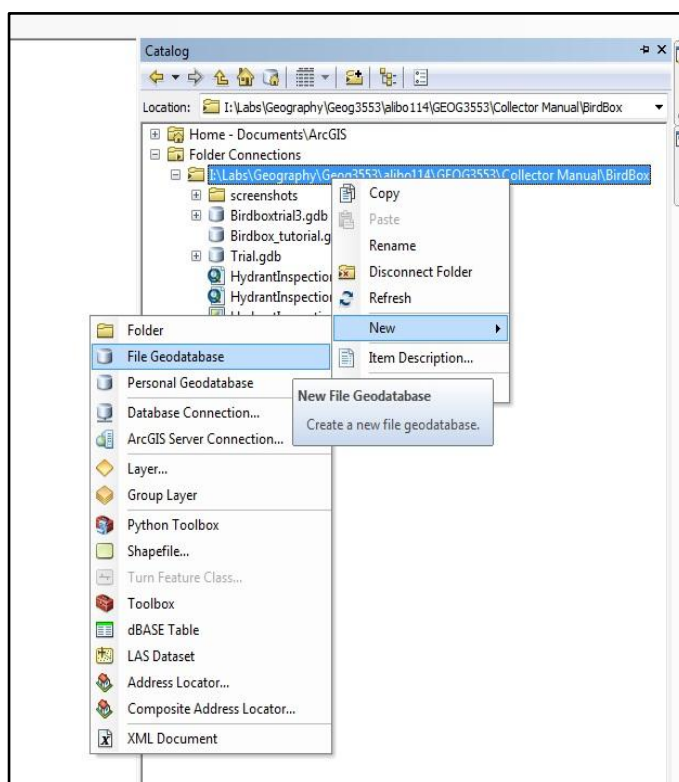
The Bird Box Collector App is a customization based on the needs of “bluebird trail” monitors, citizen scientists who spend many hours each spring and summer monitoring bird nest boxes erected along fence lines in rural North America. Bluebird trail monitoring is a long-term citizen science project, with chapters forming in the late 1970’s and early 1980’s and continuing to this day (Janetatos, 1996). Consequently, this citizen science project began before the internet, GIS, and Smartphones were available, so the App needed to be retrofitted to the existing program. The geodatabase structure of this APP can be applied to any situation in which you want to collect data as sequential entries at a single, fixed location on a map but at different times.

Here the sequential entries are referred to as “inspection tables” because the user will be inspecting the bird boxes, but it is possible to create entries that collect many kinds of data that change over time with relation to a fixed geographical point. This is adaptable for many purposes wherein the point, line or polygon feature needs only be collected once but data associated with that feature can be added many times. The database constructed in this tutorial contains only one relationship class, but it should be noted that it is possible to nest tables three deep. Follow the same general procedure as laid out in previous tutorials. First, construct the geodatabase by defining domains and then feature classes. Secondly, publish it to ArcGIS online and add a basemap. Lastly, share it to allow other users to collect data. The Domains in this tutorial are based on a sample spreadsheet of nest box records collected by citizen scientists at Ellis Bird Farm Inc. in Lacombe, Alberta

(www.ellisbirdfarm.ca).

Constructing Your Geodatabase

Begin by opening a new map document in ArcMap and connecting to the folder where you would like to construct your geodatabase. It is always good practice to prepare a folder for this purpose prior to opening ArcMap. Save this map document in your newly created folder. Click Connect To Folder.



Right-click on the folder you have connected to and create a New > File Geodatabase. You can name it after your intended app. This example is called “Birdbox_tutorial.gdb”.

Database Properties

General Domains

Domain Name	Description
SPECIES	Species of bird inhabiting box

Domain Properties:

Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

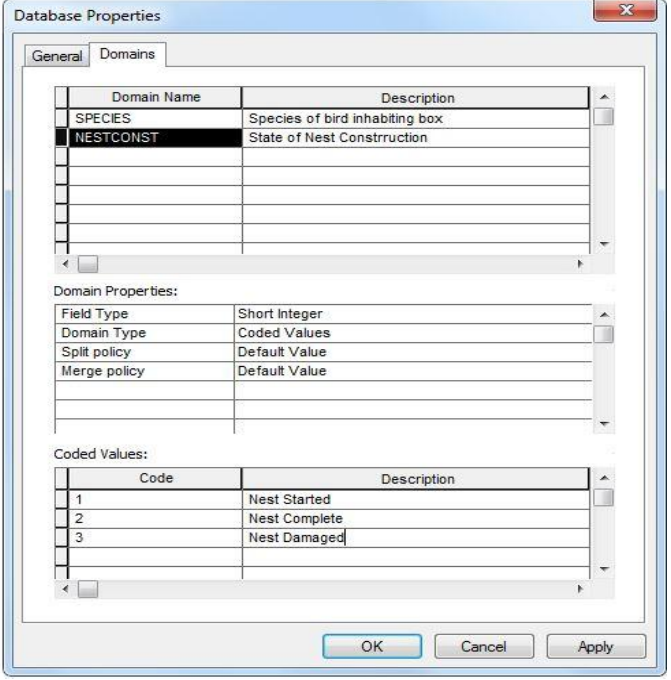
Coded Values:

Code	Description
House Wren	HOWR
House Finch	HOFI
Tree Swallow	TRES
Other	UNKN

OK Cancel Apply

Now begins the construction of your geodatabase. Right-click the geodatabase you have just created and select Properties and then navigate to Domains. In order to create your domains smoothly, it is a good idea to begin by planning out how many of your collection fields will require predetermined responses or ranges. Those fields will require domains. For example, to allow users to select the species of bird inhabiting the box, you need to provide them with a list of bird species that may be expected to use the nest box. This means that you will need to create coded values that are text data. Note that the “Description” field is the one that will be visible to the user, so type them as you would like them to be seen here. These four letter acronyms are IBP (Institute for Bird Populations) standardized species codes (Pyle and DeSante, 2003).

The next domain you will create will allow the user to record what stage of construction the nest is at during their inspection. You will provide three options and use a simple short integer to refer to each stage of construction.



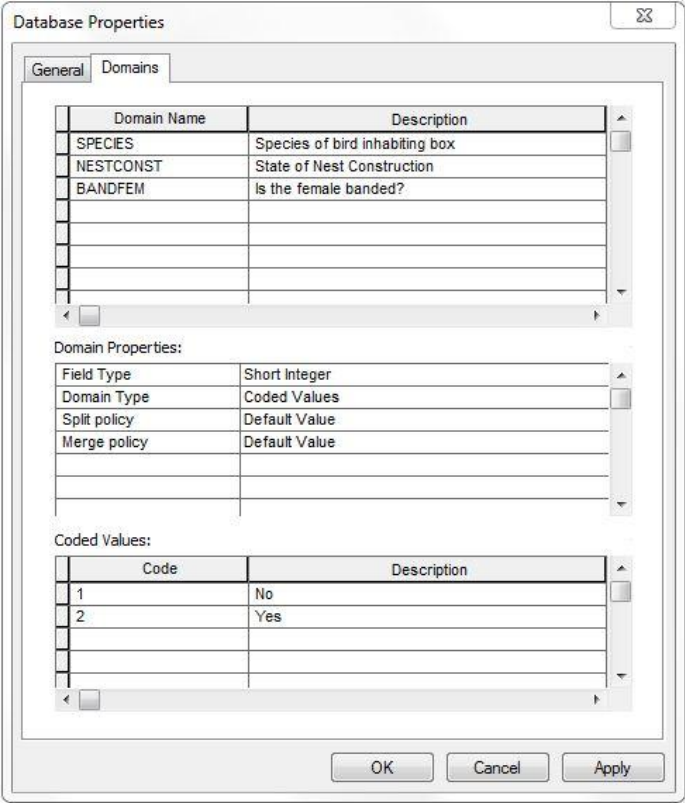
Domain Name	Description
SPECIES	Species of bird inhabiting box
NESTCONST	State of Nest Construction

Domain Properties:

Field Type	Short Integer
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description
1	Nest Started
2	Nest Complete
3	Nest Damaged



Domain Name	Description
SPECIES	Species of bird inhabiting box
NESTCONST	State of Nest Construction
BANDFEM	Is the female banded?

Domain Properties:

Field Type	Short Integer
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description
1	No
2	Yes

Our third and fourth collection fields will be to determine whether the Female and Male bird occupants of the nest have been banded. Allow the responses to be Coded values, with 1 Indicating No band and 2 indicating a band. You can create a BANDMAL domain on your own. Later on, provide a field to record the band number of both the male and female.

If the number of fields in this tutorial seems exhaustive, keep in mind the intentions of your user. Birders are observers so they will appreciate as many collection fields as possible. However, it is important to keep the responses simple and easy to use.

The fifth and sixth collection fields will be to record how many young and/or eggs are present in the nest. This field type will also be short integer, but can be set to be a range instead of coded values. In preparation for geodatabase construction, you must also consider the specifics of the data being collected. Cavity nesting birds usually have a clutch size under 10 eggs (All About Birds, 2018). Feel free to create your own field for NUMEGGS and provide a range identical to the one provided for NUMYOUNG. It is also important to set the minimum to 0, in case no clutch has been laid or the young have not hatched yet.

Domain Name	Description
SPECIES	Species of bird inhabiting box
NESTCONST	State of Nest Construction
BANDFEM	Is the female banded?
BANDMAL	Is the Male banded?
NUMYOUNG	How many young are in the nest?

Domain Properties:	
Field Type	Short Integer
Domain Type	Range
Minimum value	0
Maximum value	13
Split policy	Default Value
Merge policy	Default Value

Coded Values:	
Code	Description

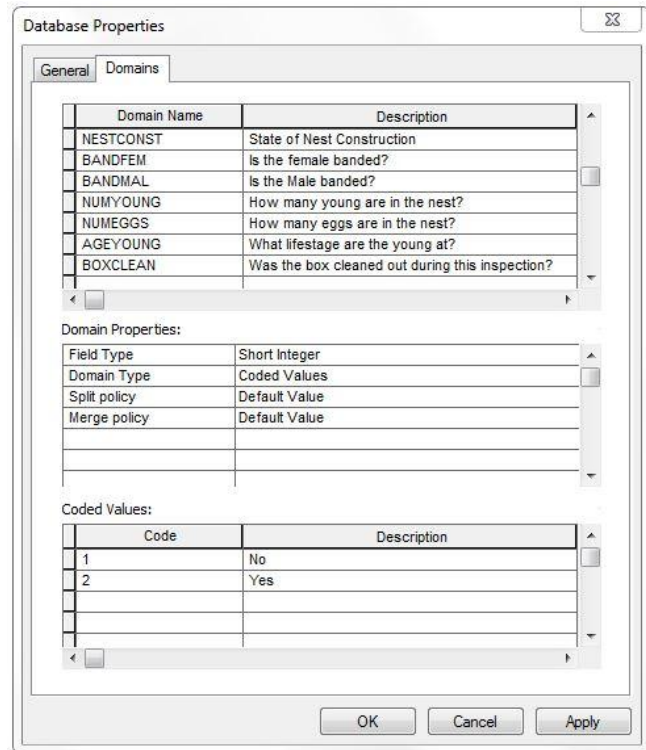
Domain Name	Description
SPECIES	Species of bird inhabiting box
NESTCONST	State of Nest Construction
BANDFEM	Is the female banded?
BANDMAL	Is the Male banded?
NUMYOUNG	How many young are in the nest?
NUMEGGS	How many eggs are in the nest?
AGEYOUNG	What lifestage are the young at?

Domain Properties:	
Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:	
Code	Description
1	Naked
2	Downy Nestling
3	Feathered Nestling
4	Fledgling

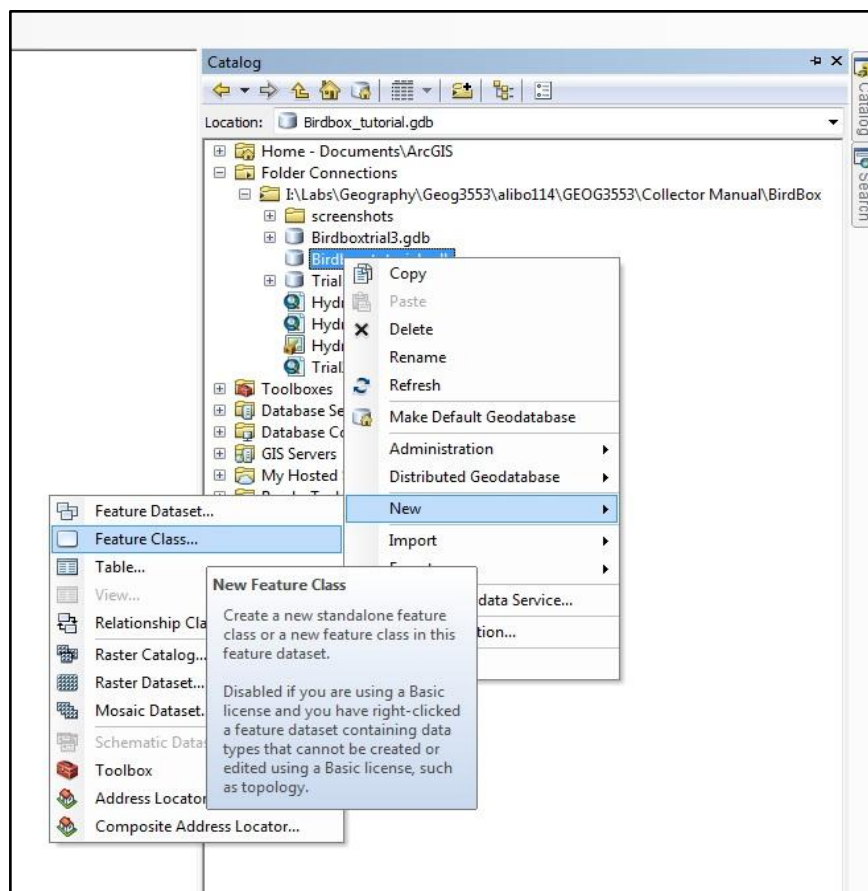
The seventh collection field will be a visual description of the age of the young. Again, in planning the collection fields it may be a good idea to address literature on the subject to determine what are the most appropriate terms. These will be coded values of text data type that correspond to life stages of baby birds.

Our last collection field will allow the user to record whether or not they have cleaned out the bird box. This will likely only occur at the end of the breeding season. This will allow someone in the next breeding season to look back and determine the age of a bird box full of nesting material. Click Apply when you have completed your last domain.

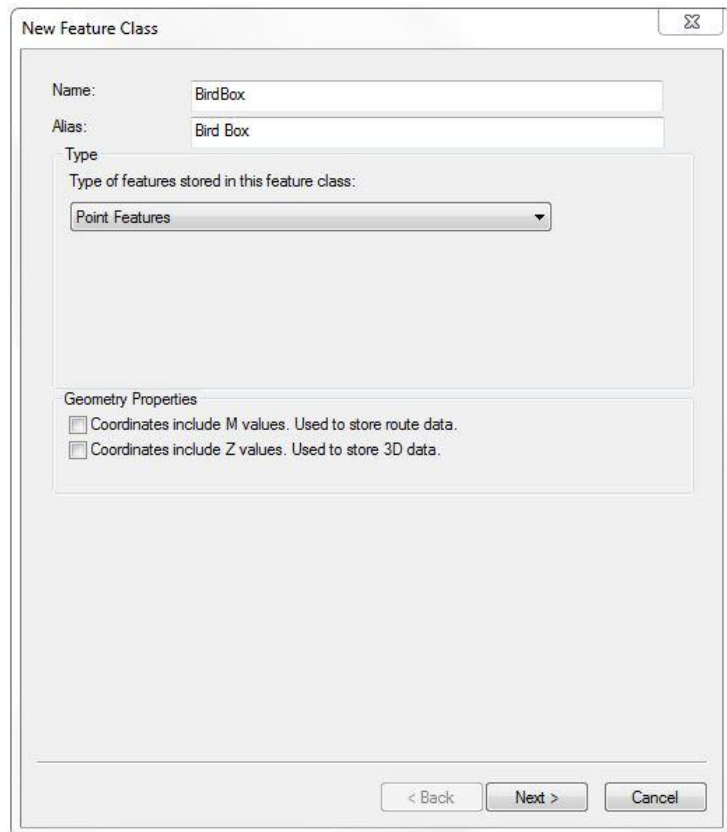


Constructing Your Feature Class

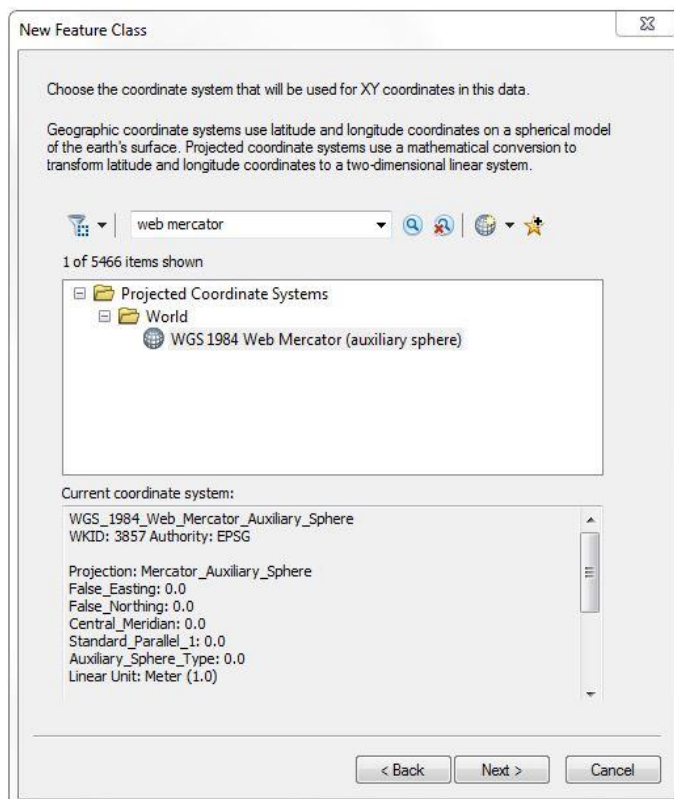
Now that you have created all the predetermined responses and ranges that will be necessary, you can create the feature class that will contain the spatial data. Right-click on your geodatabase and navigate to New > Feature Class.



A feature class can contain point, line, or polygon features. Because the only spatial data will be static bluebird boxes, you will define the features as point data. You are not collecting routes or elevation, so you do not need to select any geometry properties. Click Next when you have given your feature class a name and alias. Note the name cannot have any spaces or special characters. Once you are satisfied with the Name and Alias and the type of features stored in the feature class, click Next.



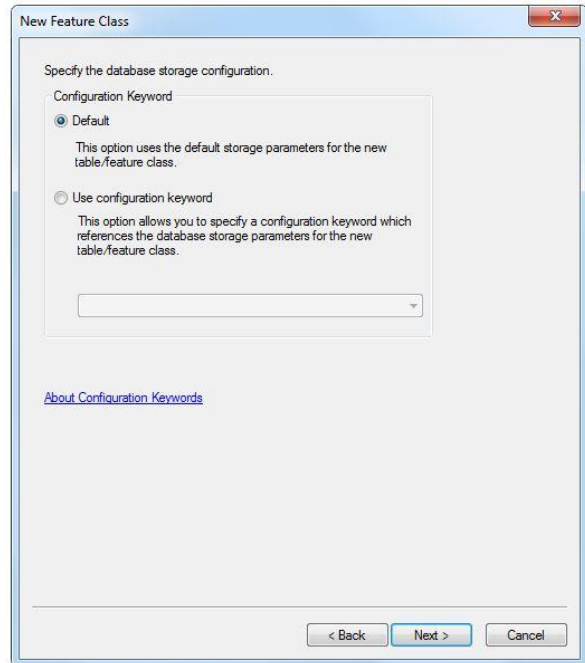
The 'New Feature Class' dialog box is shown. It has a title bar with a close button. The 'Name' field contains 'BirdBox' and the 'Alias' field contains 'Bird Box'. The 'Type' section has a dropdown menu set to 'Point Features'. The 'Geometry Properties' section has two unchecked checkboxes: 'Coordinates include M values. Used to store route data.' and 'Coordinates include Z values. Used to store 3D data.'. At the bottom are three buttons: '< Back', 'Next >', and 'Cancel'.



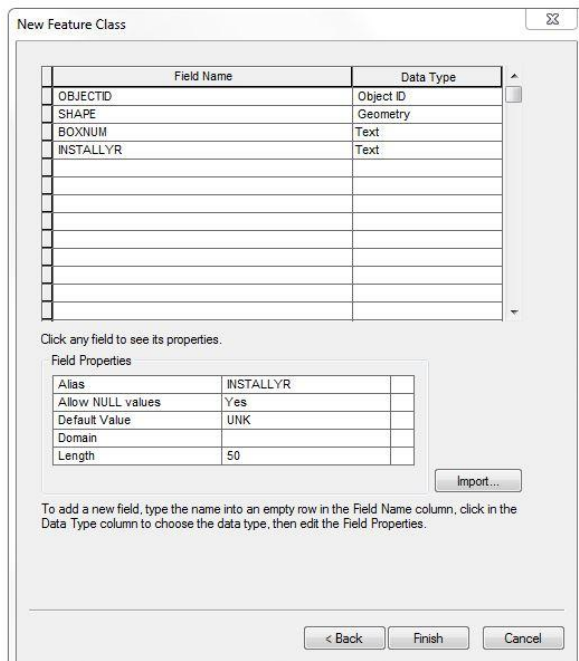
The 'New Feature Class' dialog box is shown, displaying the coordinate system selection screen. It has a title bar with a close button. The text 'Choose the coordinate system that will be used for XY coordinates in this data.' is at the top. Below it is a paragraph explaining geographic and projected coordinate systems. A search bar shows 'web mercator' and a list of 1 of 5466 items is shown. The list contains 'Projected Coordinate Systems' and 'World', with 'WGS 1984 Web Mercator (auxiliary sphere)' selected. The 'Current coordinate system:' section shows the details for 'WGS_1984_Web_Mercator_Auxiliary_Sphere' with WKID: 3857 and Authority: EPSG. The projection details are: Projection: Mercator_Auxiliary_Sphere, False_Easting: 0.0, False_Northing: 0.0, Central_Meridian: 0.0, Standard_Parallel_1: 0.0, Auxiliary_Sphere_Type: 0.0, and Linear Unit: Meter (1.0). At the bottom are three buttons: '< Back', 'Next >', and 'Cancel'.

All ArcGIS online application and data work on the WGS 1984 Web Mercator coordinate system. You can search for it in the search bar or navigate through the many coordinate systems to find it. Click next when you have located it.

Leave the XY Tolerance as the default and click Next. Do not create a configuration keyword for database storage. You can leave this as default and click Next.

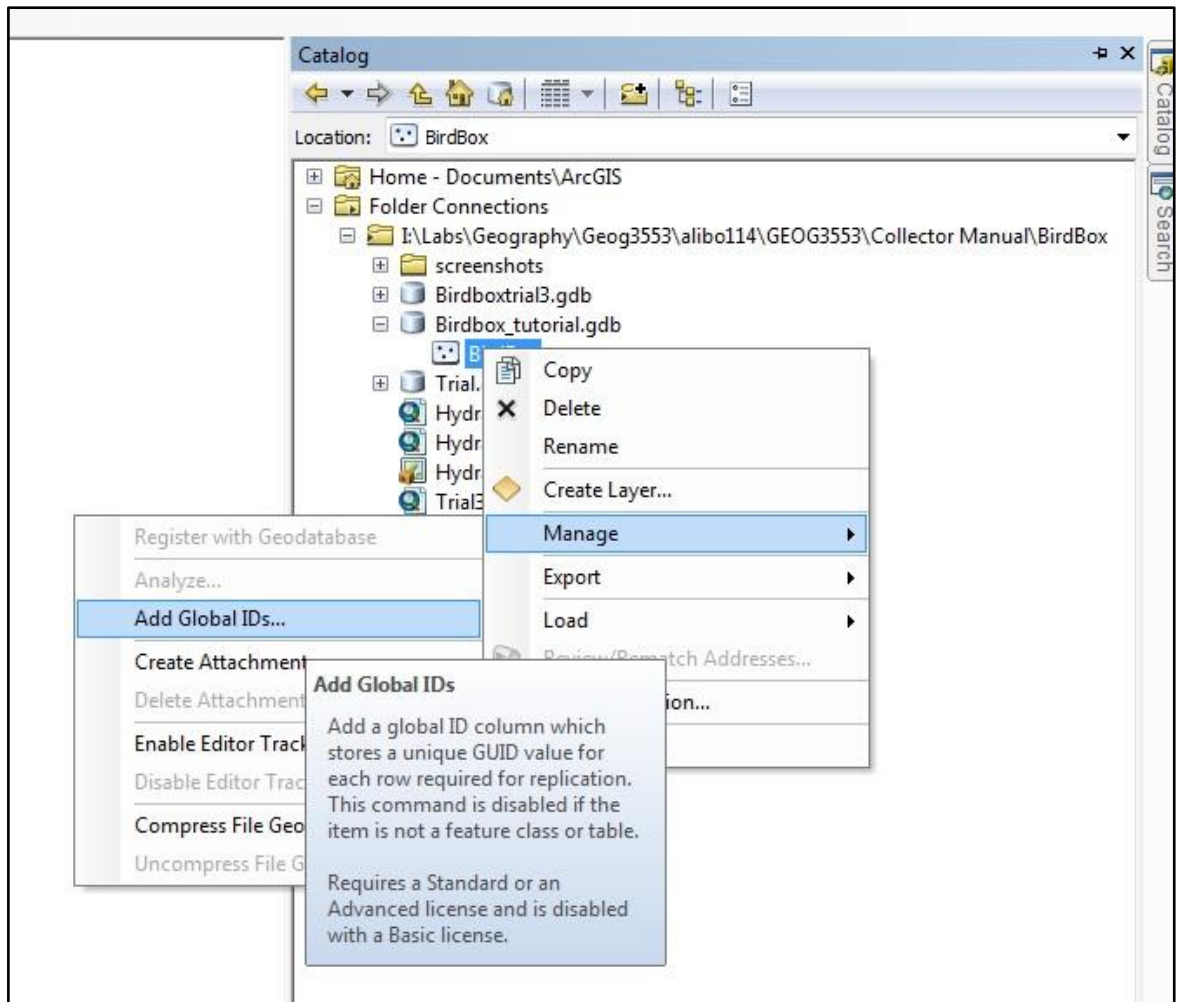


Next, you will create the fields that will be collected alongside the geographic location of the bird box. These are fields that will only be collected once, and do not require domains in this case. OBJECTID and SHAPE are default fields which do not need to be changed. For you to identify each box on the map you will use the box number that has been assigned by the volunteer nest box monitors. These are often written inside the box and are usually a mix of numbers and letters. Note that different bluebird trails in the same area may use the same box numbers. To avoid mixing up the box numbers, the monitors' initials or trail name can be added to ensure each box is uniquely identified. Call this field "BOXNUM" and allow up to 50 text characters.

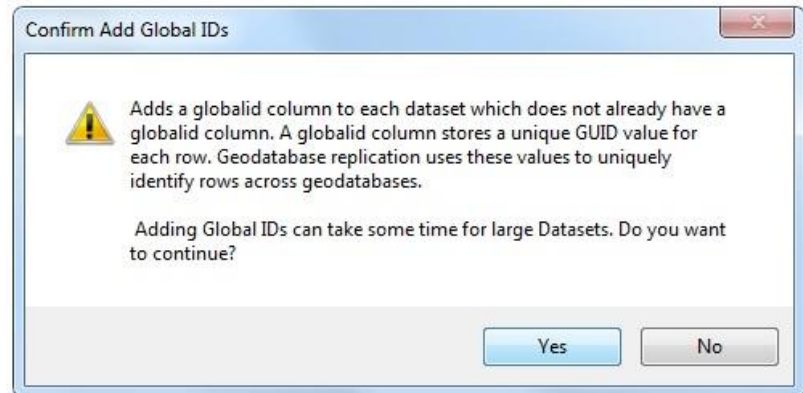


Next provide a field to record the year that each box was installed. Historical records should show the year of install, but if they do not you can pick a default year of install. Check historical records to see if you can determine when nearby boxes were placed to set a default year that is consistent with other boxes in the area or set the default to Unknown.

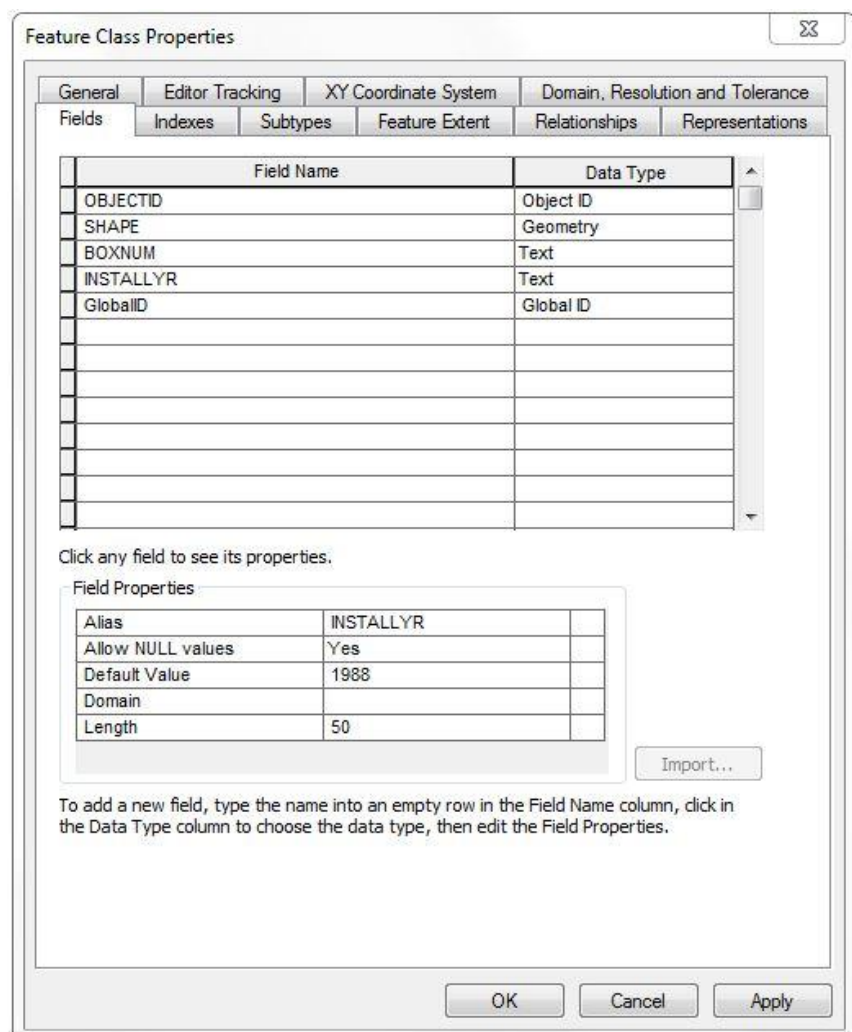
Following the creation of all your collection fields, add another one by a different method in which the software will assign each bird box its own unique numbered identifier. In the catalog, select your feature class and right-click. Navigate to Manage > Add Global ID's to assign a global ID field to each new collected feature.



You may receive this message. If you do, click Yes.

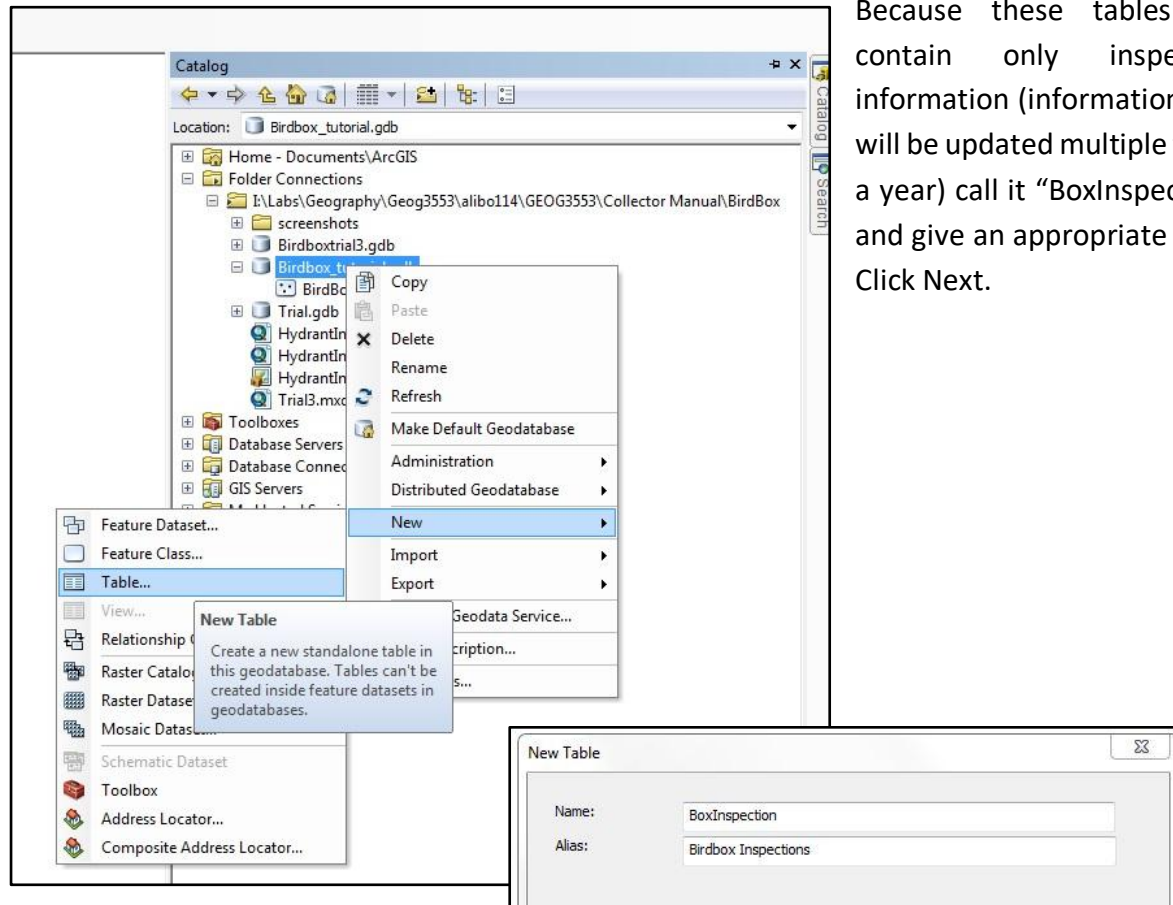


If you right-click on the BirdBox layer and select Properties > Fields for the BirdBox layer, your list of fields will now look like this:



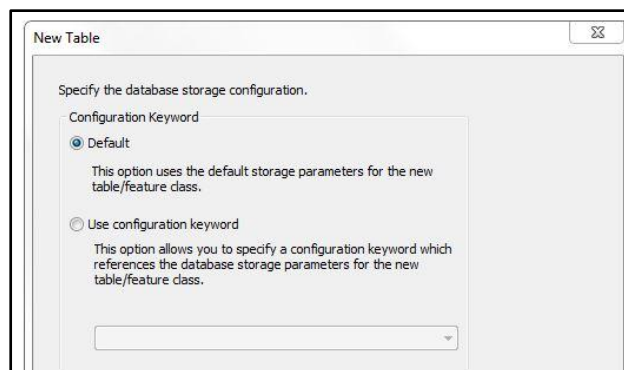
Constructing Your Table

Now you will create the second half of the relationship between bird boxes and inspections. To do so, create a table and fill it with all the additional inspection fields for which you previously created domains. Right-click on your geodatabase and select New > Table.



Because these tables will contain only inspection information (information that will be updated multiple times a year) call it “BoxInspection” and give an appropriate Alias. Click Next.

Again, maintain default options for database configuration. Click Next.



As with the fields within the feature class, OBJECTID is a default field. However, in this table, SHAPE is not. This makes sense because the table you are creating has no inherent geometric feature. It is a way to link conditions (or fields) that are changing over time to a fixed geographic point. Create a field called “Date of Inspection” with the data type “Date”.

Table Properties

General Editor Tracking Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Text

Click any field to see its properties.

Field Properties

Alias	DATE	
Allow NULL values	Yes	
Default Value		

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

OK Cancel Apply

Table Properties

General Editor Tracking Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Text

Click any field to see its properties.

Field Properties

Alias	SPECIES	
Allow NULL values	Yes	
Default Value		
Domain	SPECIES	
Length	AGEYOUNG	
	SPECIES	

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

OK Cancel Apply

Now begin utilizing the domains you created at the beginning of the tutorial. Create a field called Species with the data type Text and within the field properties, indicate that it is within the domain SPECIES. This will call up all of the predetermined species so that the user can choose which one is appropriate in their inspection. If by chance the correct domain does not show up in the Domain options, double check that you have indicated the correct data type.

Table Properties

General Editor Tracking Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Text

Click any field to see its properties.

Field Properties

Alias	NESTCONS
Allow NULL values	Yes
Default Value	
Domain	NEST CONST

Import...

To add a new field, type the name in the Name column, click in the Data Type column to choose the Data Type, and click in the Properties column.

OK Cancel Apply

Our next inspection field will indicate the state of nest construction. You have already created a domain for this, so create the field name as you would like it to be seen by the user, e.g., "Nest Construction", and indicate it is within the domain of NESTCONST. Remember, the data type is short integer because you assigned each level of completion as 1, 2, and 3.

Our next inspection field Female Banded? also has a designated domain already, so it can be created in a similar manner to the previous one. Phrase your field as you would like to be seen by the user and select the appropriate domain. This is again short integer. The Male Banded? field is created in an identical fashion. This gives the user the option of 1 – No band and 2 – banded.

Table Properties

General Editor Tracking Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer

Click any field to see its properties.

Field Properties

Alias	BANDFEM
Allow NULL values	Yes
Default Value	
Domain	BANDFEM

Import...

To add a new field, type the name in the Name column, click in the Data Type column to choose the Data Type, and click in the Properties column.

OK Cancel Apply

Table Properties

General Editor Tracking Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer
Male Banded?	Short Integer
Number of eggs	Short Integer

Click any field to see its properties.

Field Properties

Alias	Number of eggs
Allow NULL values	Yes
Default Value	
Domain	NUMEGGS

Import...

To add a new field, type the name in the Name column, click in the Data Type column to choose the data type.

NUMEGGS

NUMYOUNG

OK Cancel Apply

Now create the field to indicate the number of eggs found in the nest. Fill the next field with "Number of eggs," choose short integer as your data type, and indicate it is within the domain NUMEGGS. Recall that you created this field as having a range from 0 to 13.

Now do the same for the field that will record the number of young. Name it Number of Young, identify the data type as short integer, and indicate it is within the domain of NUMYOUNG. This was also created as a range from 0 to 13.

Table Properties

General Editor Tracking Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer
Male Banded?	Short Integer
Number of eggs	Short Integer
Number of Young	Short Integer

Click any field to see its properties.

Field Properties

Alias	Number of Young
Allow NULL values	Yes
Default Value	
Domain	NUMEGGS

Import...

To add a new field, type the name in the Name column, click in the Data Type column to choose the data type.

NUMEGGS

NUMYOUNG

OK Cancel Apply

New Table

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer
Male Banded?	Short Integer
Number of eggs	Short Integer
Number of Young	Short Integer
Age of young	Text

Click any field to see its properties.

Field Properties

Alias	Age of young
Allow NULL values	Yes
Default Value	
Domain	AGEYOUNG
Length	

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

Next is the field to record the visual age of the young. You created a domain using text data for this field, so call it Age of Young as text data and indicate it is within the domain AGEYOUNG.

The next inspection field will indicate whether the user has cleaned out the box at the end of the inspection. You also created a domain for this, so call it "Box cleaned?," set the Data Type to Short Integer, and indicate it is within the domain BOXCLEAN.

New Table

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer
Male Banded?	Short Integer
Number of eggs	Short Integer
Number of Young	Short Integer
Age of young	Text
Box cleaned?	Short Integer

Click any field to see its properties.

Field Properties

Alias	Box cleaned?
Allow NULL values	Yes
Default Value	
Domain	BOXCLEAN

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

Nest box monitors need ample space to record their observations so create a field to allow them the freedom to do this. Call this field "Other Notes" allow null values and give them ample text characters to record their observations. 200 should be sufficient.

New Table

Field Name	Data Type
OBJECTID	Object ID
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer
Male Banded?	Short Integer
Number of eggs	Short Integer
Number of Young	Short Integer
Age of young	Text
Box cleaned?	Short Integer
Other notes	Text

Click any field to see its properties.

Field Properties

Alias	Other notes	
Allow NULL values	Yes	
Default Value		
Domain		
Length	200	

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

New Table

Field Name	Data Type
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer
Male Banded?	Short Integer
Number of eggs	Short Integer
Number of Young	Short Integer
Age of young	Text
Box cleaned?	Short Integer
Other notes	Text
Female band number	Long Integer
Male band number	Long Integer

Click any field to see its properties.

Field Properties

Alias	Male band number	
Allow NULL values	Yes	
Default Value		

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

< Back Finish Cancel

Just as you have created this ambiguous text field, you can also create two ambiguous integer fields to allow for the recording of band numbers. Create two fields, one called "Female band number" and "Male band number". Designate these fields as long integer and allow null values.

Lastly and most importantly, create the field that will serve as the link between the boxes and the inspections. In the feature class you assigned Global ID's. Now in the Table you will mirror these Global ID's, but by a different method. Your last field should be called "Box_ID" and it must be data type Guid. Look over all your fields one more time as they cannot be changed once the table and feature class are linked, then click Apply and OK or Finish, if working from the New Table window. You may have a popup about invalid field names; if this happens, click Yes allow ArcMap to add underscores in the field names, or go back and remove any spaces in the field names manually.

Field Name	Data Type
Date of inspection	Date
Species	Text
Nest Construction	Short Integer
Female Banded?	Short Integer
Male Banded?	Short Integer
Number of eggs	Short Integer
Number of Young	Short Integer
Age of young	Text
Box cleaned?	Short Integer
Other notes	Text
Female band number	Long Integer
Male band number	Long Integer
Box_ID	Guid

Click any field to see its properties.

Field Properties

Alias: Box_ID

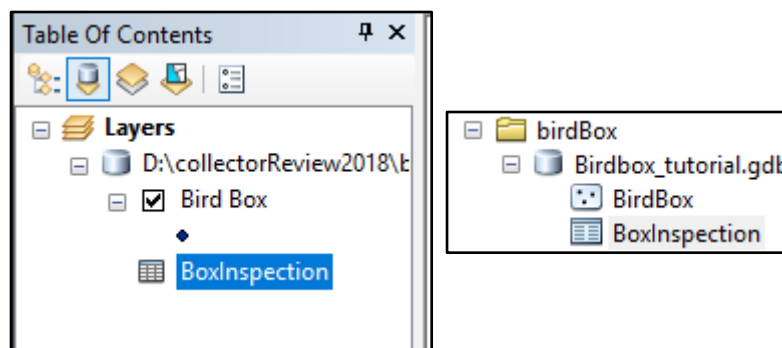
Short Integer
Long Integer
Float
Double
Text
Date
Blob
Guid
Raster

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

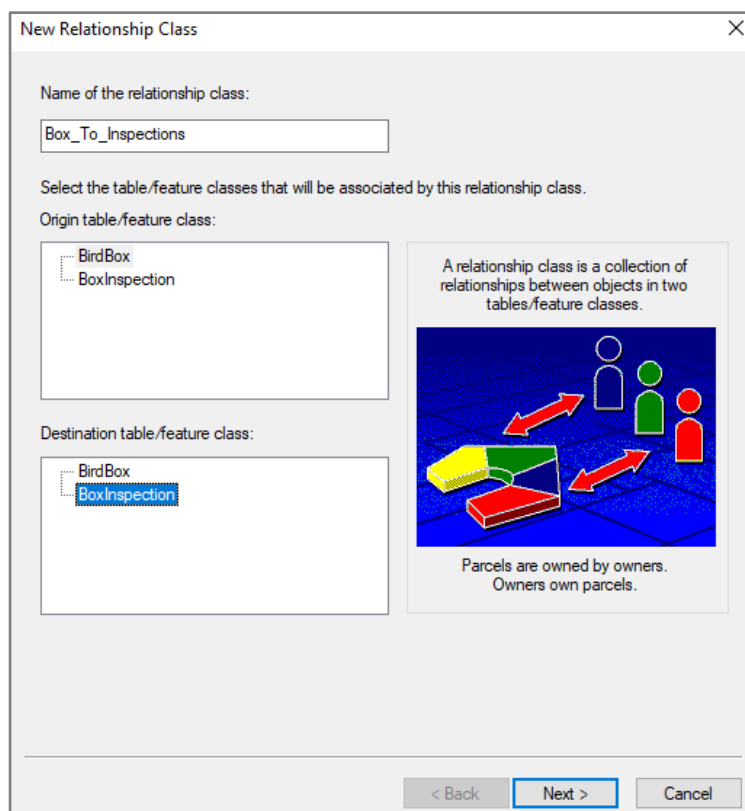
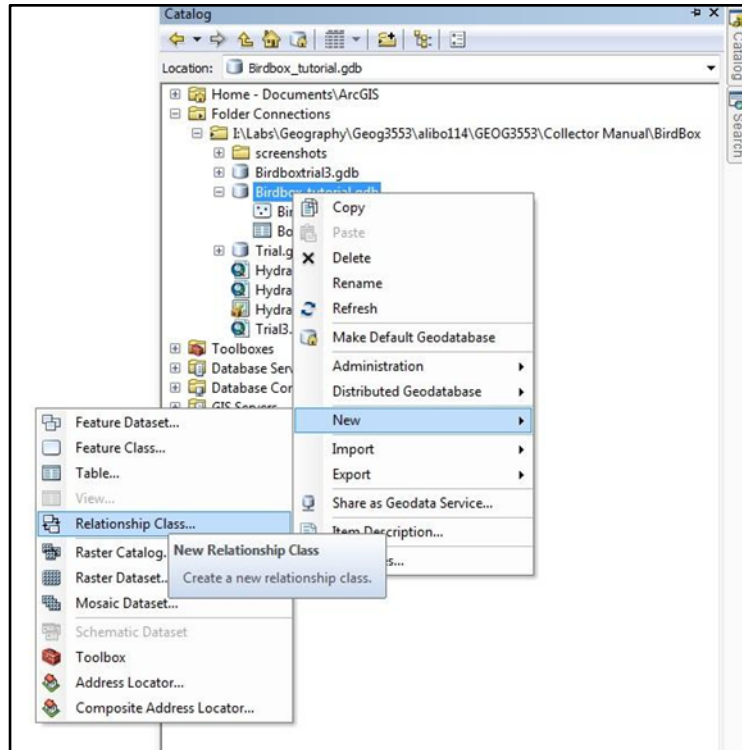
< Back Finish Cancel

You should now see both your BirdBox feature class and your BoxInspection table listed in your Table of Contents on the left-hand side of the window and under your geodatabase in the Catalog panel.



Constructing Your Relationship Class

To link the feature class and table, create a relationship class. Select your geodatabase, right-click and navigate to New > Relationship Class.



Call this Relationship Box_To_Inspection. The origin table/feature class is the feature class or bird boxes. Select "BirdBox" so it appears highlighted in grey or blue. Then select the Destination table/feature class which is the BoxInspection until it appears highlighted in grey or blue. Click Next.

Select a Simple (peer to peer) relationship and click Next.

New Relationship Class

Select the type of relationship that this relationship class will store.

☒ Simple (peer to peer) relationship

Simple or peer-to-peer relationships are relationships that exist between two or more objects in the database that can exist independent of each other. In this kind of relationship, when the object(s) in the origin table/feature class are deleted, the related object(s) in the destination table/feature class are not deleted by default.

☐ Composite relationship

Composite relationships are relationships where the lifetime of the object(s) in the destination table/feature class are controlled by the lifetime of their related object in the origin table/feature class. When the object in the origin table/feature class is deleted, the related object(s) in the destination table/feature class are also deleted.

< Back Next > Cancel

New Relationship Class

Specify a label for the relationship as it is traversed from the origin table/feature class to the destination table/feature class.

BoxInspection

Specify a label for the relationship as it is traversed from the destination table/feature class to the origin table/feature class.

BirdBox

Which direction will messages be propagated between the objects related by this relationship class?

☐ Forward (origin to destination)

☐ Backward (destination to origin)

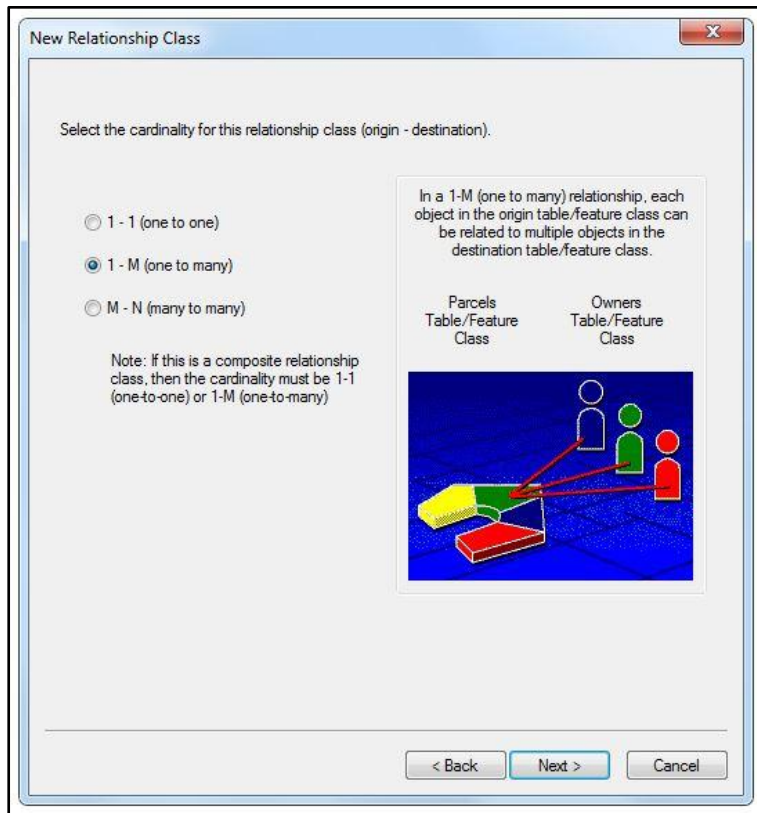
☐ Both

☒ None (no messages propagated)

< Back Next > Cancel

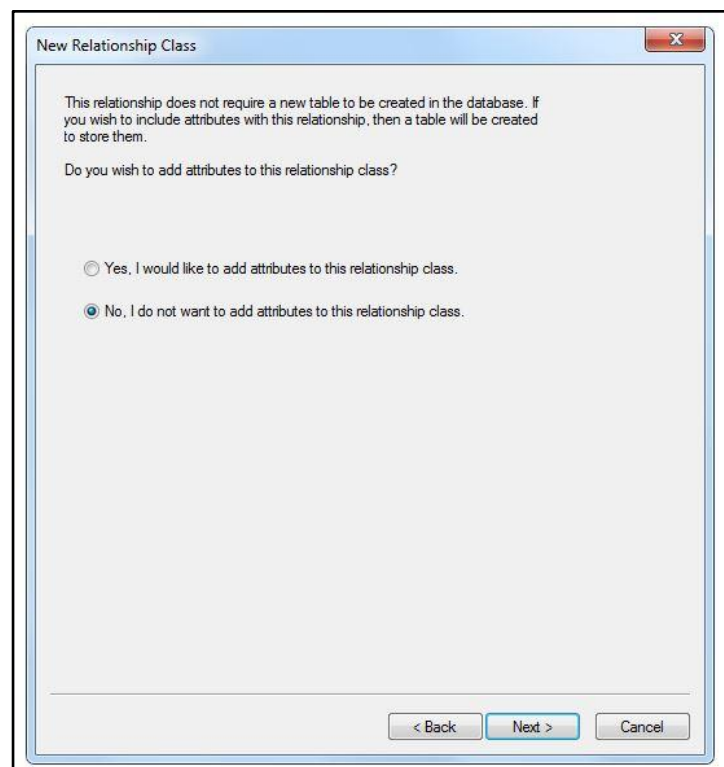
You can name the first field after the destination table, or the BoxInspection. The second field can be named for the origin feature class, or the BirdBox.

The message propagation option can be left to None. Click Next.



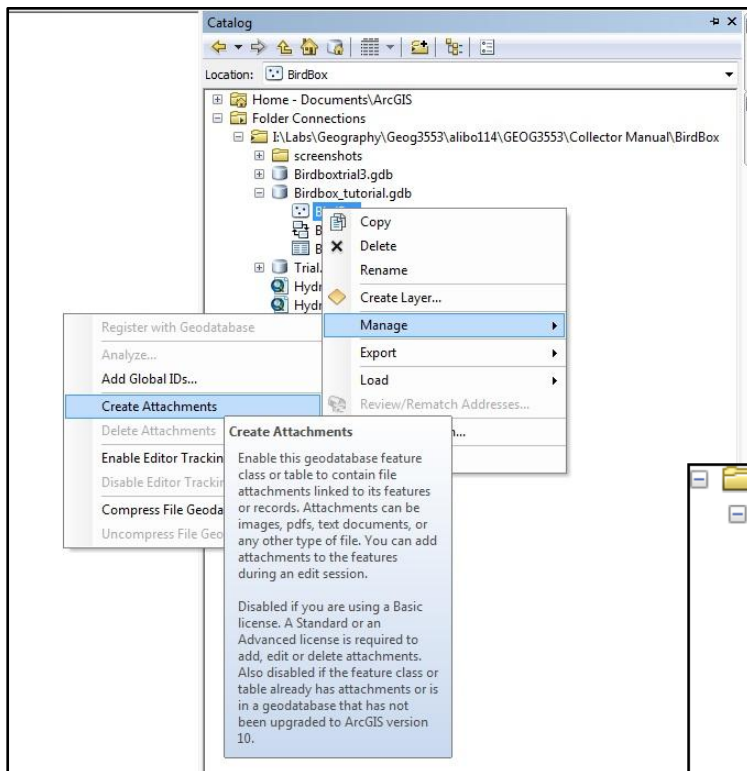
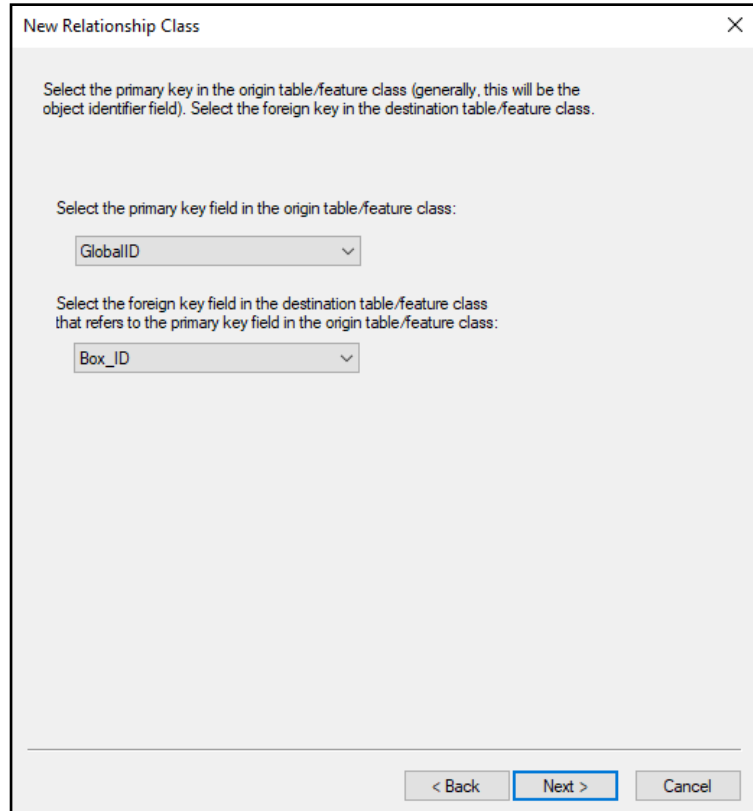
Now indicate the cardinality of the relationship between the bird boxes and the inspection tables. Because one Bird boxes will have many inspection reports associated with it, designate this as a “One to Many” relationship. Click Next.

Indicate that you do not want to add attributes to this relationship class. Click Next.

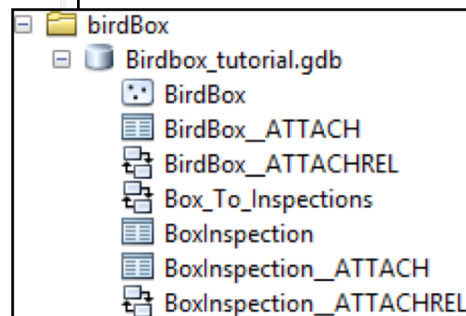


Lastly, select the key created in the feature class to link the bird boxes to the inspection reports. This will be the Global ID's you assigned.

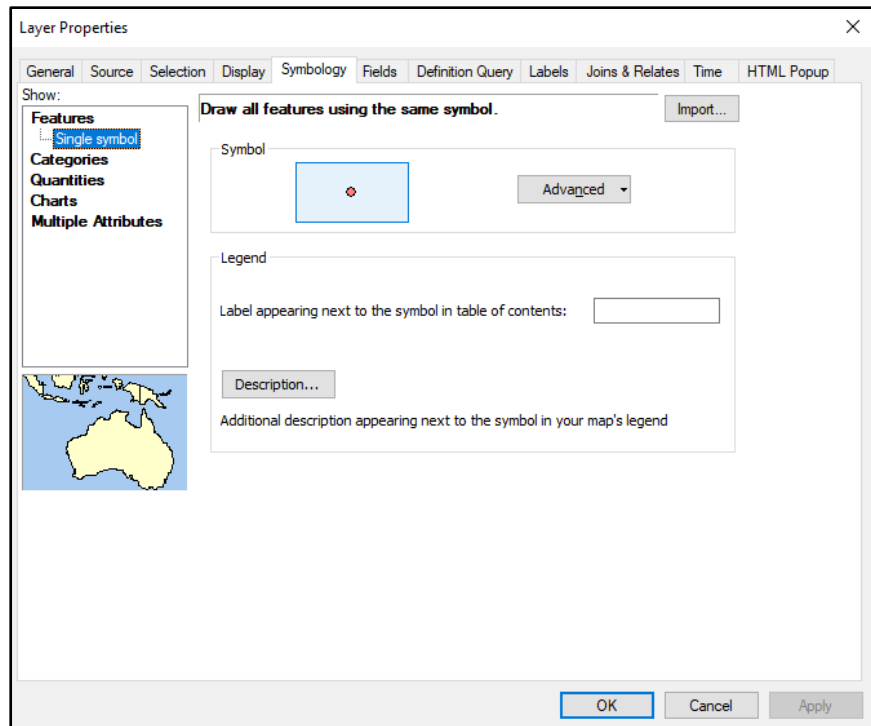
Select the key field in the destination table you created. This is the Box_ID field that you designated with data type Guid. Click Next. The last window is a summary of the relationship class. Make sure everything is correct or click Back to change any of the settings. When everything is to your satisfaction, click Finish.



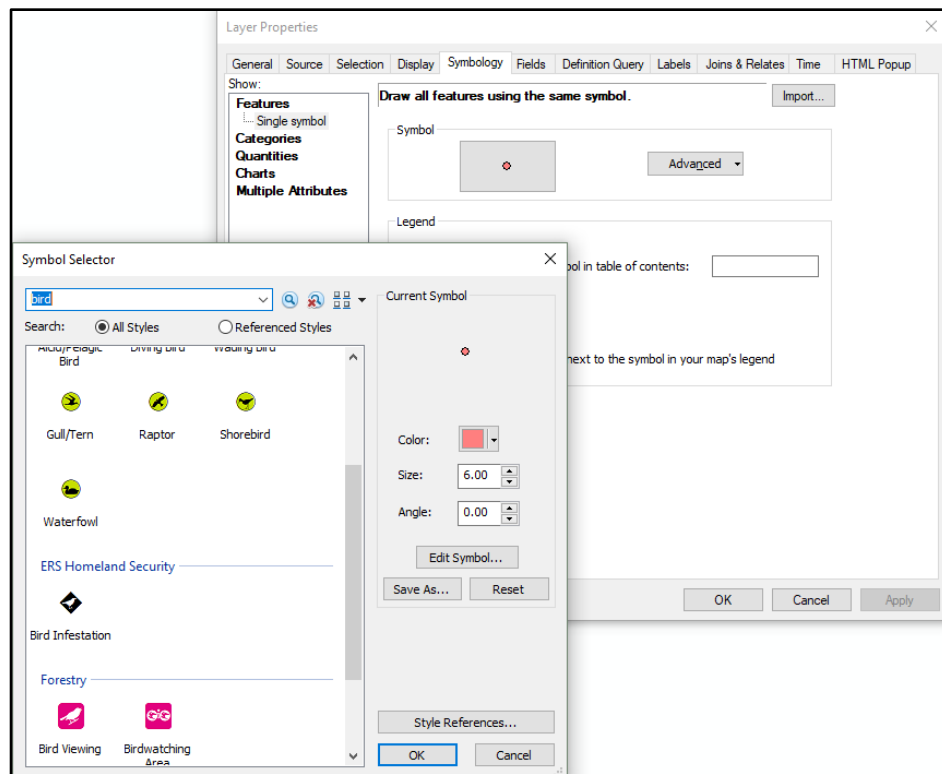
Next you will enable users to attach photos to both the bird boxes and their inspection reports. This is very simple. First, select your feature class. Right-click to navigate to Manage > Create Attachments. Now do the very same for your table, BoxInspection.



Now that you have constructed the geodatabase with all of its fields, you can prepare your Collector to be shared. First coordinate how you would like the map to appear. In the Table of Contents on the left-hand side of the screen, you will see your feature class and table. Right-click on the feature class and navigate to Properties > Symbology.



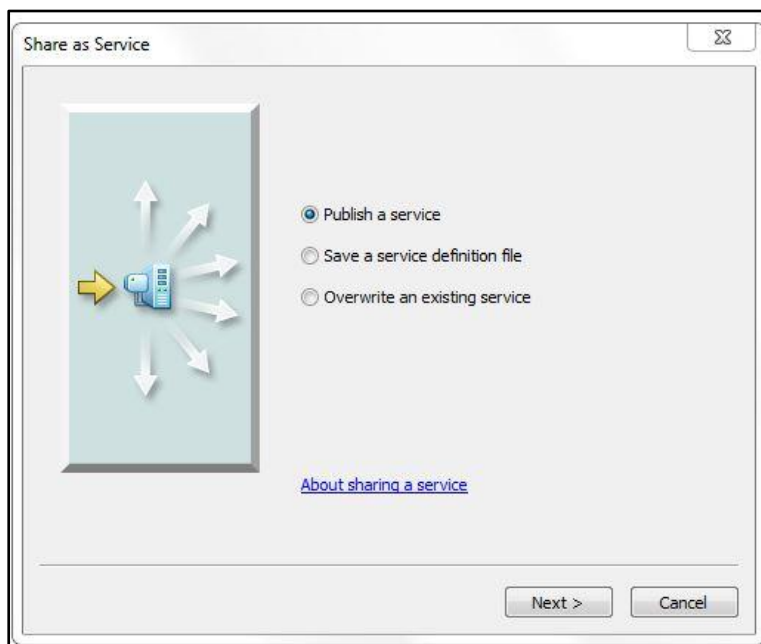
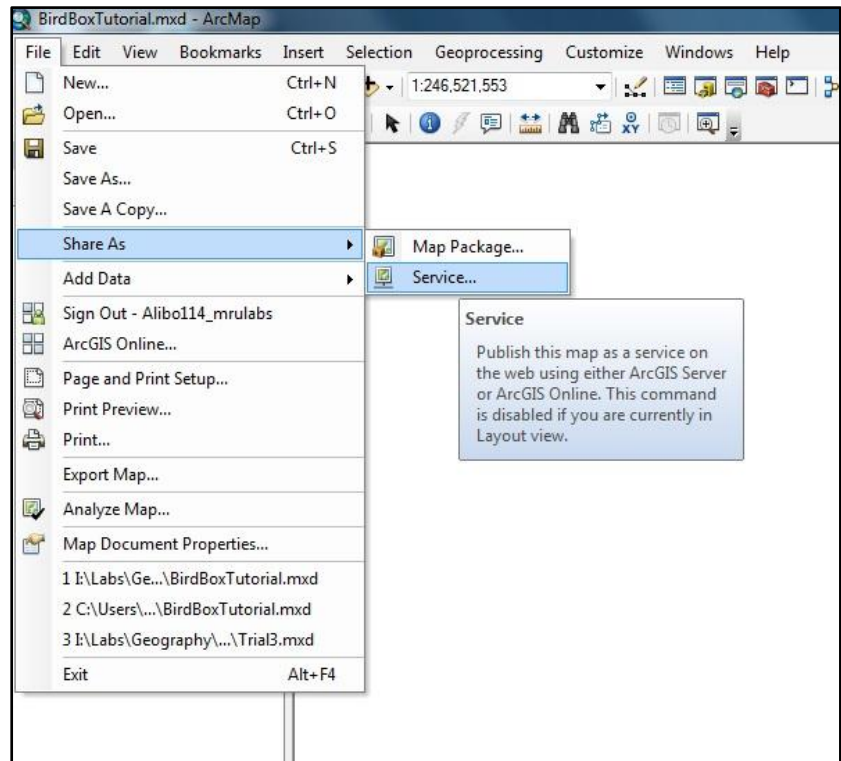
Select the symbol to change it to something more appropriate. You can search by terms to find symbols and change the colour and size as well.



Sharing Your Feature Service on ArcGIS Online

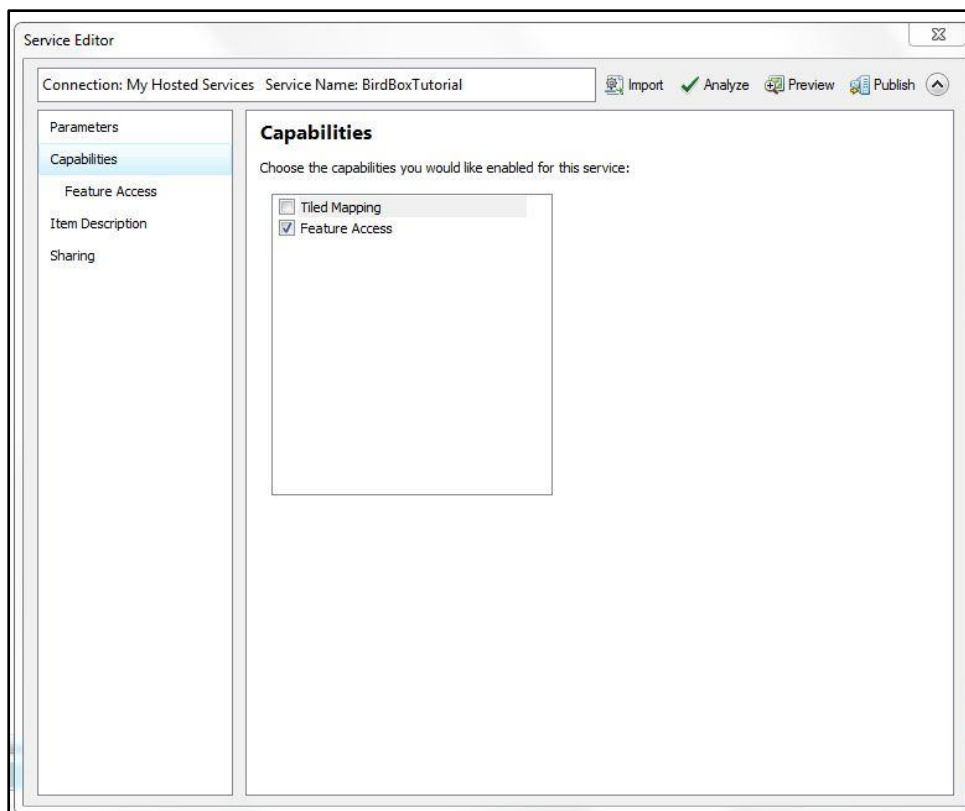
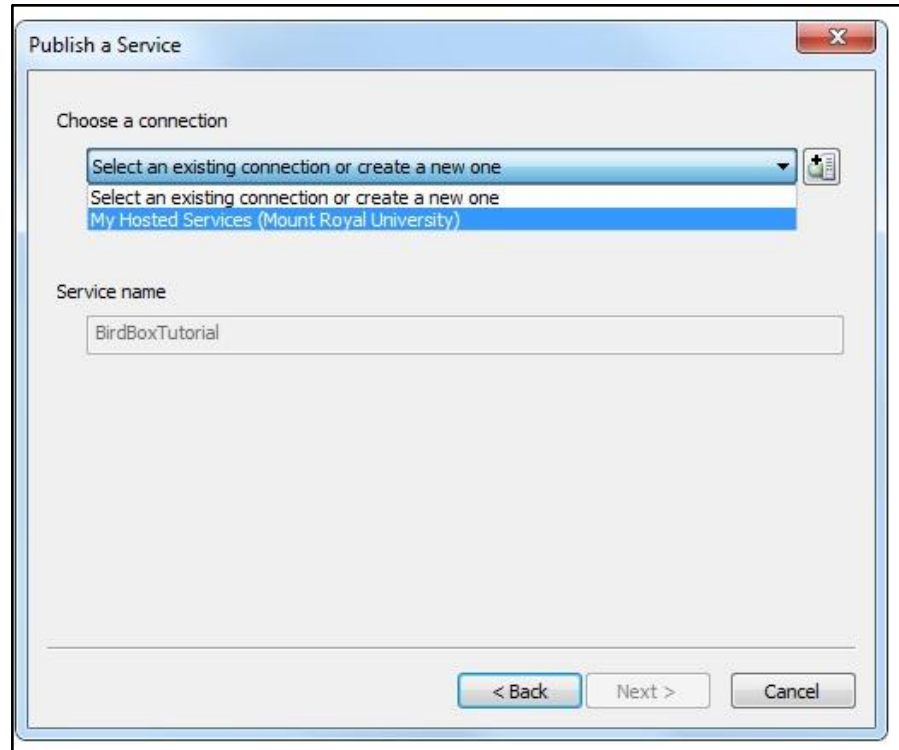
Now share your feature service to ArcGIS Online so that other users can access it. Select File and Share As > Service....

In order to have this work correctly you must sign into your ArcGIS online account before attempting to share it, which can be done in the File menu or by selecting the symbol on the toolbar that looks like this:



Next select “Publish a service.” If you were uploading a new version of a previously created Collector, you would “Overwrite existing service”. This however causes you to lose all the data that has already been collected. Click Next.

Select the Mount Royal University hosted service from the drop down menu. If you are not signed into ArcGIS online, this service will not appear. Give your service a name, and Click Next.



Under Capabilities, de-select Tiled Mapping and select Feature Access. Then click ahead on the left panel to Feature Access.

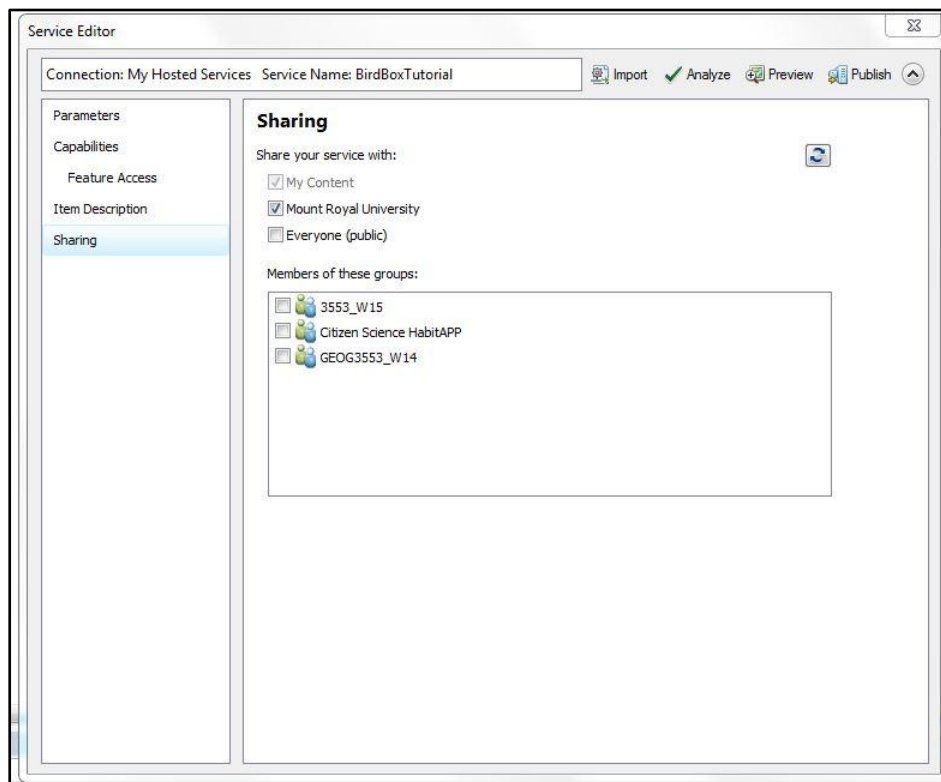
The screenshot shows the 'Service Editor' window with the 'Feature Access' tab selected. The left sidebar contains a list of tabs: Parameters, Capabilities, Feature Access (highlighted), Item Description, and Sharing. The main area is titled 'Feature Access' and contains a 'REST URL' field with the text 'The REST URL will be defined once the service is published'. Below this is a section for 'Operations allowed' with checkboxes for Create, Delete, Query, Sync, and Update. The 'Delete' checkbox is checked. At the bottom, there is a 'Properties' section with the text '<There are no properties for this capability>'. The top of the window shows the connection 'My Hosted Services' and service name 'BirdBoxTutorial', along with buttons for Import, Analyze, Preview, and Publish.

Here you will select what operations you will allow your users access to. You may choose to de-select Delete as for some purposes, you do not want users to be able to delete data points. All other should be enabled. Click on Item Description once you have finished.

Here you can write a summary of what your app can be used for and apply tags so that it is easy for others at your institution or in your class to locate your application.

The screenshot shows the 'Service Editor' window with the 'Item Description' tab selected. The left sidebar contains a list of tabs: Parameters, Capabilities, Feature Access, Item Description (highlighted), and Sharing. The main area is titled 'Item Description' and contains several fields: 'Summary (required):' with the text 'An App for surveying bird boxes', 'Tags (required):' with the text '3553, BirdBox, GEOG3553' and a 'Choose Your Tags...' button, 'Description:' with a large text area, 'Access and Use Constraints:' with a text field, 'Credits:' with a text field, and a checkbox for 'Update missing metadata in document based on item description.' which is checked. The top of the window shows the connection 'My Hosted Services' and service name 'BirdBoxTutorial', along with buttons for Import, Analyze, Preview, and Publish.

Lastly, you can select who you would like to make your feature service available to. If you have not finalized it and would only like people to test it, keeping it within your institution may be a good option. If you would like to open it to all ArcGIS online user, select Everyone. When you have finished, click Analyze in the top right-hand corner. If no Errors appear, you can publish your app by clicking Publish in the top right-hand corner.



Sharing Your Collector Map

Once you have opened a browser and signed into your account at www.arcgisonline.com, locate your feature layer in Content. The BirdBoxTutorial Feature Layer has been highlighted, and it will always be accompanied by a Service Definition. Click on your feature layer to look at its details.

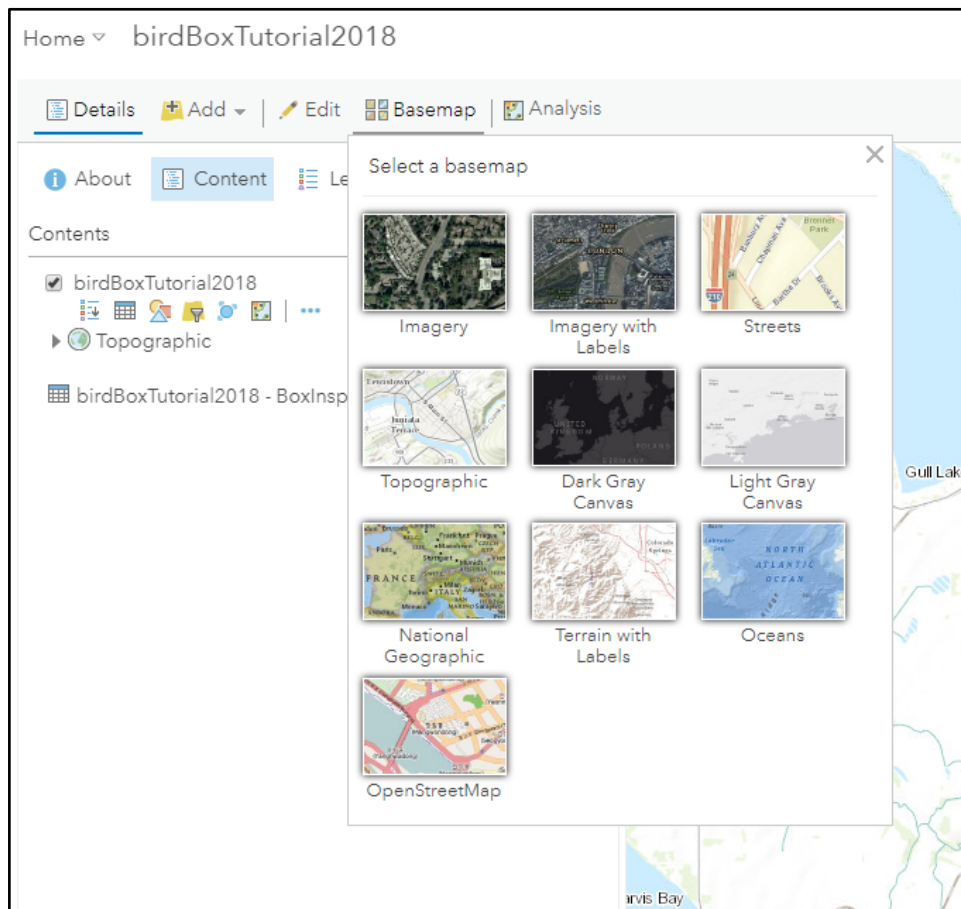
The screenshot shows the ArcGIS Online Content page. The left sidebar contains a 'Folders' section with 'All My Content' and 'npane311_mrulabs' (selected). Below it is an 'Item Type' section with options like Maps, Layers, Scenes, Apps, Tools, and Files. The main area displays a list of items under the search 'npane311_mrulabs'. The 'birdBoxTutorial2018' Feature Layer (hosted) is selected, highlighted in blue. Other items include 'birdBoxTutorial2018' Service Definition, 'Cemetery Map 2018' Web Map, 'cemeteryNP2018' Feature Layer (hosted), 'cemeteryNP2018' Service Definition, 'Harvested Cutblocks in the Ghost Watershed (as of June 4, 2016)-Copy' Web Map, 'Bow_River_WS_Calgary' Feature Layer (hosted), 'Bow_River_WS_Calgary' Shapefile, 'An App for Recreation Management' Web Mapping Application, and 'DPC Redds Fish Habitat Assessment 1' Web Map.

Title	Type	Modified
birdBoxTutorial2018	Feature Layer (hosted)	Jul 27, 2018
birdBoxTutorial2018	Service Definition	Jul 27, 2018
Cemetery Map 2018	Web Map	Jul 27, 2018
cemeteryNP2018	Feature Layer (hosted)	Jul 26, 2018
cemeteryNP2018	Service Definition	Jul 26, 2018
Harvested Cutblocks in the Ghost Watershed (as of June 4, 2016)-Copy	Web Map	Jan 31, 2017
Bow_River_WS_Calgary	Feature Layer (hosted)	Jan 31, 2017
Bow_River_WS_Calgary	Shapefile	Jan 31, 2017
An App for Recreation Management	Web Mapping Application	Dec 8, 2016
DPC Redds Fish Habitat Assessment 1	Web Map	Oct 17, 2016

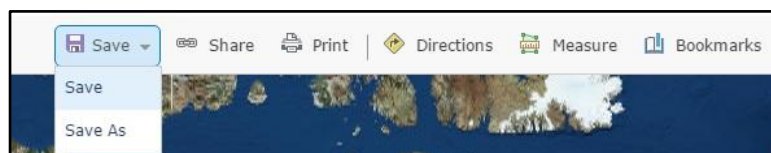
Currently, this is only a singular layer that has not been associated with a web map. Click Open in Map Viewer > Add to new map.

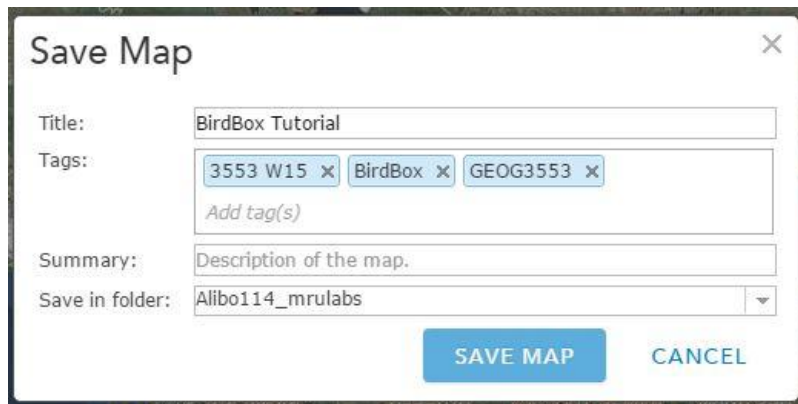
The screenshot shows the details page for the 'birdBoxTutorial2018' item. The page has tabs for Overview, Data, Visualization, Usage, and Settings. The Overview tab is active. It shows a description: 'An app for surveying bird boxes.' and 'Feature Layer (hosted) by npane311_mrulabs'. It also displays creation and update dates (Jul 27, 2018) and a view count of 0. On the right, there is a dropdown menu 'Open in Map Viewer' with options 'Add to new map' and 'Add to new map with full editing control'. Below this are buttons for 'Publish' and 'Create View Layer'.

It will now appear on a map with all its contents visible on the left-hand side. You should see both the feature class and the table that you created. Select an appropriate basemap for your Collector. Consider what features might be important for the user to see. In the case of a bird surveying app, it may be helpful to see street names and numbers, as well as aerial imagery. Select Imagery with Labels.



Then navigate to the toolbar at the top-right of the screen to Save. This will save your layer to an online map document creating a Web Map. You can additionally Save As to give it a new name. Add the tags you specified before and provide a summary of your map. Then click Save Map.





Save Map [X]

Title: BirdBox Tutorial


Tags: 3553 W15 x BirdBox x GEOG3553 x
Add tag(s)

Summary: Description of the map.

Save in folder: Alibo114_mrulabs ▼

SAVE MAP CANCEL

Navigating back to the tool bar, locate Share, found right next to the save option. Here you can again select who can see and use your Collector application. There is also a handy hyperlink that you can copy and paste to give others access to your map. Then click Done. Your Collector app is now ready to use on your tablet, Android, or iPhone.



Share [X]

Choose who can view this map.

Your map is currently shared with these people.

☐ Everyone (public)

☒ Mount Royal University

☒ Members of these groups:

- ☐ 3553_W15
- ☐ Citizen Science HabitAPP
- ☐ GEOG3553_W14

Link to this map

<http://arcg.is/1Nsflmd>  Facebook  Twitter

☒ Share current map extent

Embed this map

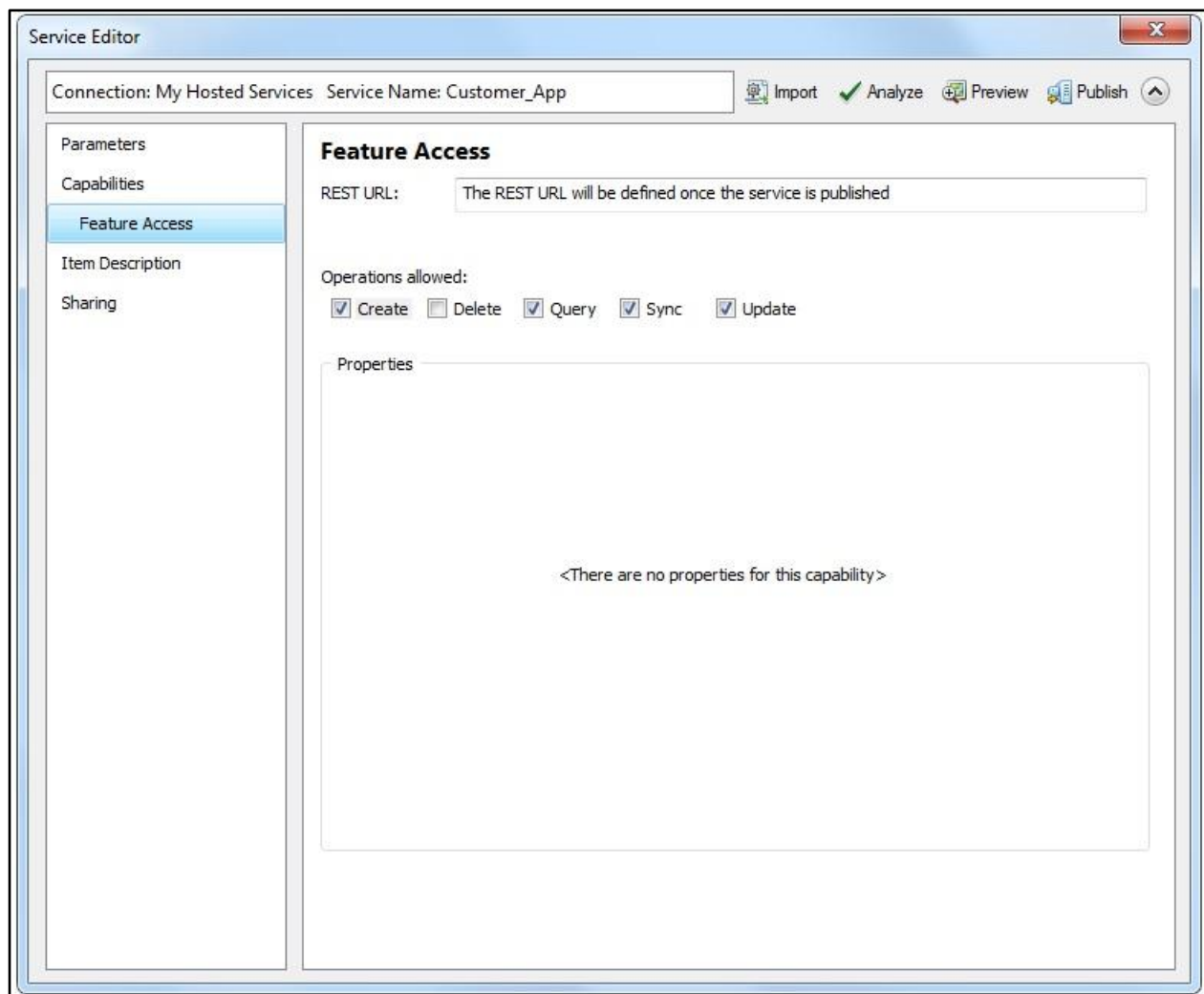
EMBED IN WEBSITE CREATE A WEB APP

Note: To embed your map, you must share it with Everyone.

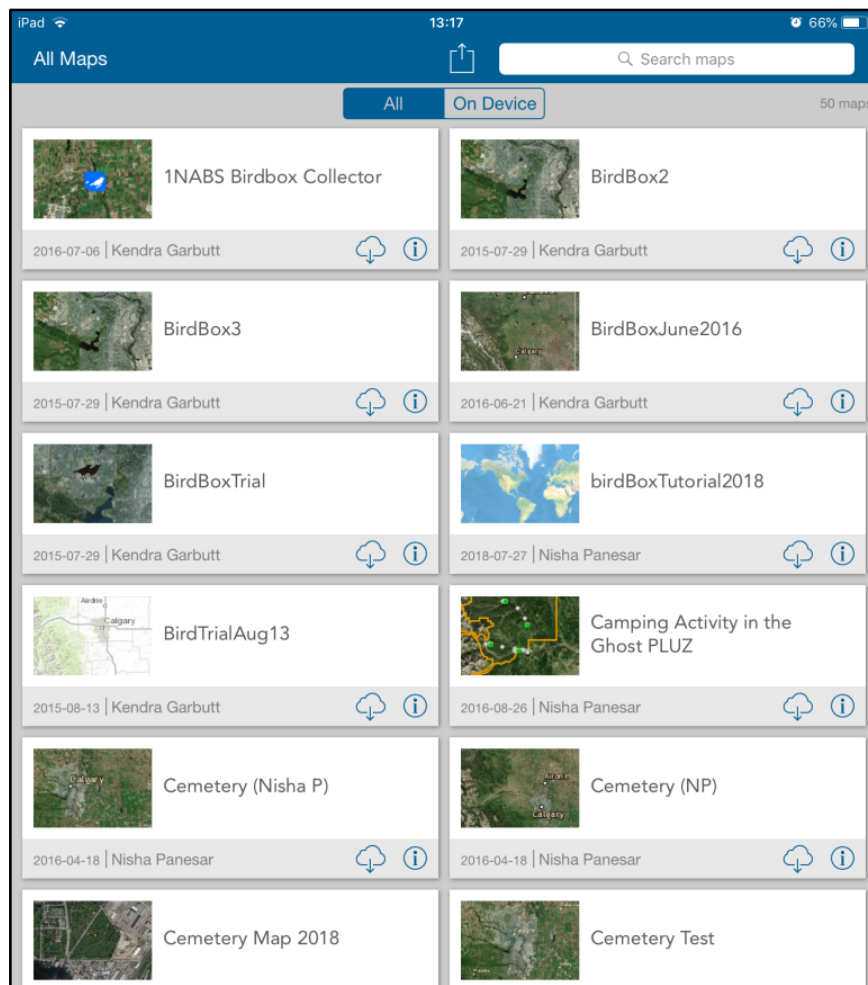
DONE

Working Offline with Collector

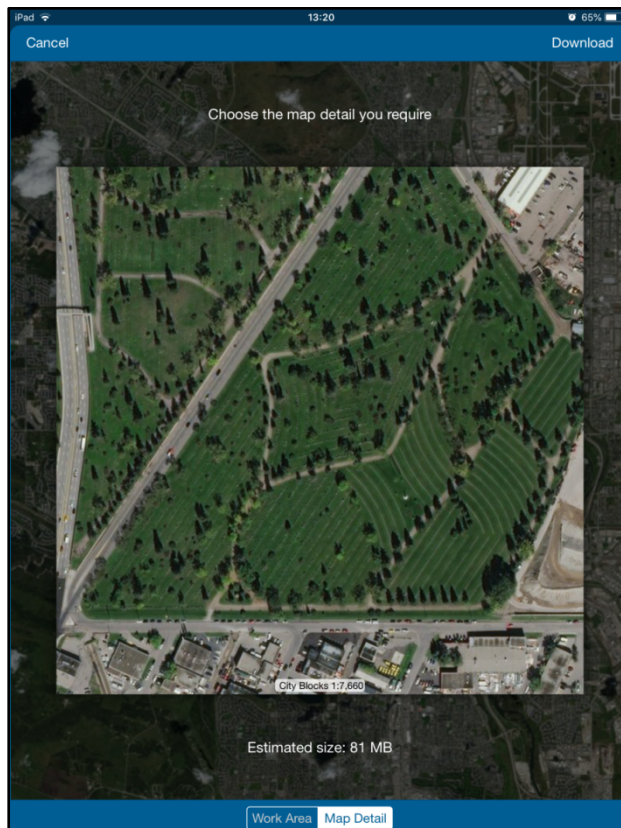
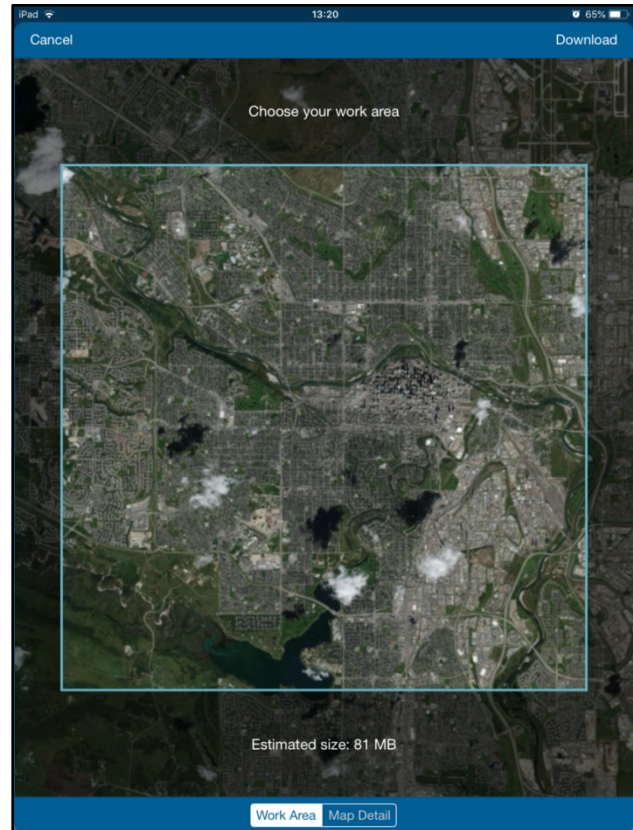
One of the major benefits of using the Collector app is that you have the ability to work whether you are connected to the internet or not. The app itself will store your data until you are near a Wi-Fi signal. However, to be able to use your Collector map offline, you need to download the map to your mobile device. A Collector map will only be downloadable if the creator has allowed it to be synced. This is an option that is enabled in the Sharing stage in ArcMap. All Collector maps that are created in ArcMap 10.2.2 and above are automatically offline-enabled by the program, so making sure you check off the Sync option in the Feature Access screen is the only crucial step that you as a creator need to ensure you are taking.



On your mobile device, your Collector home screen will be populated by maps you have access to. You can select and edit any of these maps simply by tapping on the map image. To work offline, however, these maps need to be downloaded. If you have given your Collector map the ability to be synced, the option to download will appear in the bottom right corner of your particular map menu. Tapping the cloud in the bottom right of the map you wish to download will download the map to your device. You need to plan ahead if you want to work offline – the download function will only work if you are still within Wi-Fi range, as it downloads directly from ArcGIS Online. Make sure you do this before you leave an area with Wi-Fi!

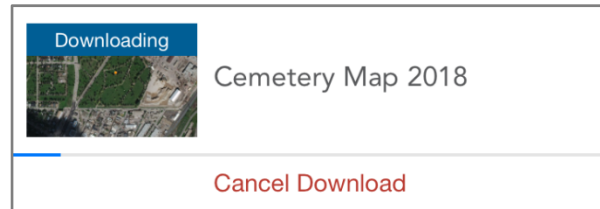


When you choose to download your map, you will be sent to a screen that asks you to select your Work Area. The Work Area consists of the amount of the map you want to be able to edit offline. The size of your Work Area can be changed by zooming in or out on your map. Keep in mind that the larger your Work Area is, the larger a file your mobile device will have to store. If you need to use a large Work Area, it is advisable that you have ample storage available on your device.

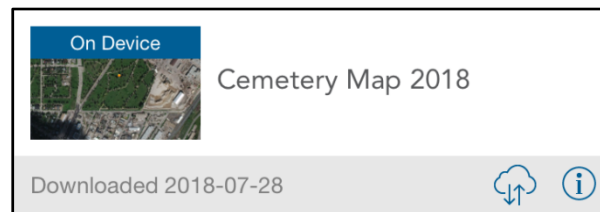


Once you have chosen your Work Area, Collector asks you to select your Map Detail. This allows you to control the resolution of, or how much detail you need within, your Work Area and in turn affects the file size. If your map is meant for collecting large amounts of information in smaller detail, it would be best to choose a higher resolution map. If you are collecting more general data across your map, a lower resolution may suit your needs. Make sure you are selecting a high enough resolution for your map, because you cannot change it once you have downloaded it.

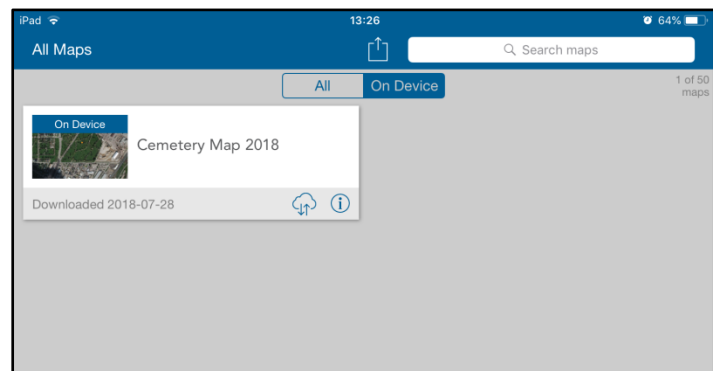
After deciding what Map Detail you need, you can hit Download in the top right corner of your Collector screen. This will begin the download of your selected Work Area. You will be sent back to your main Collector screen and the particular map you have elected to download will show you a progress bar for its download.



When the download is finished, the app will look like this:



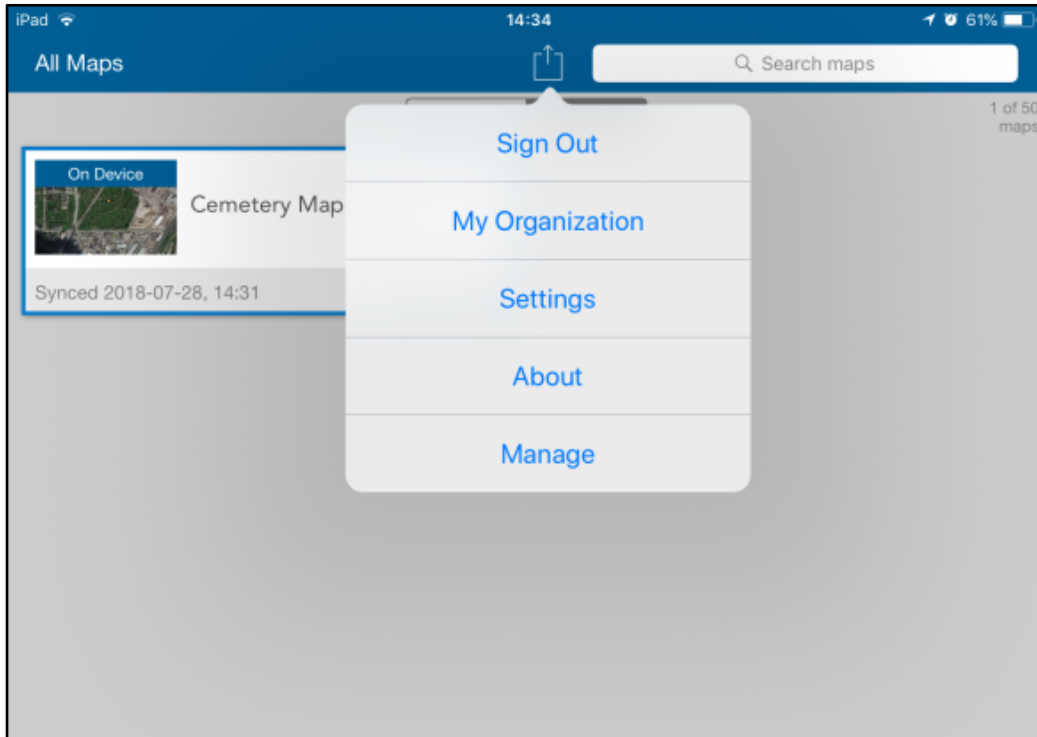
When the download has finished, go to the top of your Collector home screen. There is an option to select All Collector maps or On Device Collector maps. Select On Device.



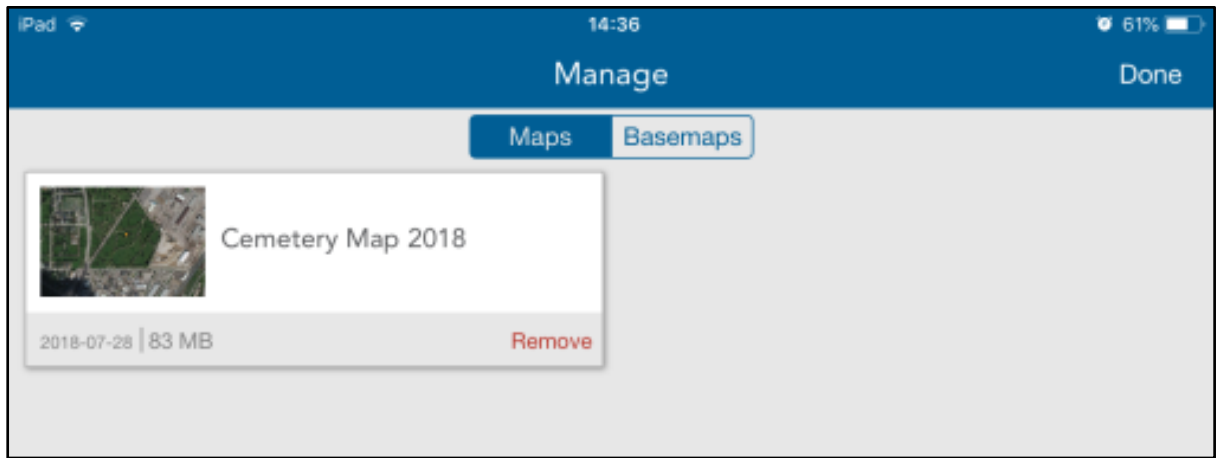
You can now add data to your map offline. Keep in mind that being offline not only means you cannot add data directly to your ArcGIS account but your mobile device's location accuracy may be compromised. Mobile devices use a combination of GPS, mobile networks, and Wi-Fi to triangulate their location. With no Wi-Fi access, the accuracy of the location may suffer.

When you are ready to add the data you have collected offline back to the Collector app, make sure your device has its Wi-Fi or data turned on. Go to your main Collector home screen and locate your particular map. Instead of having a Download option in the bottom right corner, it will now have a cloud with two arrows present. This is your Sync function. A progress bar will appear in the grey portion of your map item. Once it has finished syncing, the date of the last sync will be displayed in the grey bar at the bottom of the map result. When you tap on the map to open it, your edits made offline should appear on the online map.

Sometimes Collector does not like to allow you to work on the online version of the Collector map if you have downloaded it to work offline. After you have synced your changes, at the top of the Collector main menu, select to view maps On Device rather than All. Use the menu button on your device to choose Manage.



From the Manage screen, tap Remove under the map you want to delete from your device. This forces Collector to allow you to access the online versions of maps.

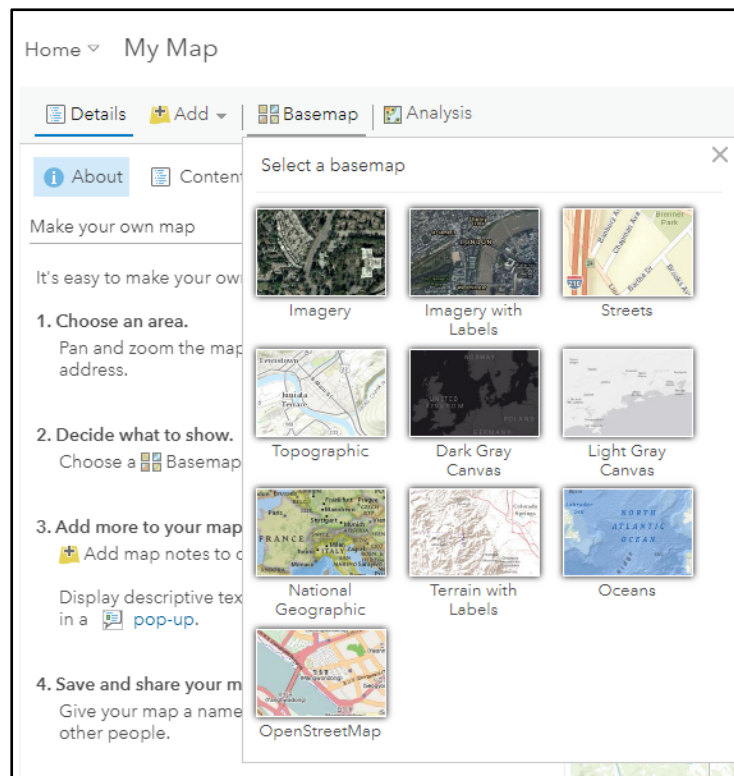


Adding Collector Data to ArcMap – Post Collection Analysis

Collector is a great way to gather data, but it has no analytical capabilities. You have the option to run analyses two different ways once you have collected data: ArcGIS Online or ArcMap.

Analyses in ArcGIS Online

To begin, open up your web browser and go to www.arcgis.com and sign in to your account. Your default homepage will appear. In the ribbon at the top, select Map. You can set your desired Basemap on this screen; you can use the same basemap as the Collector app did, or change the basemap if you want to see a different perspective.

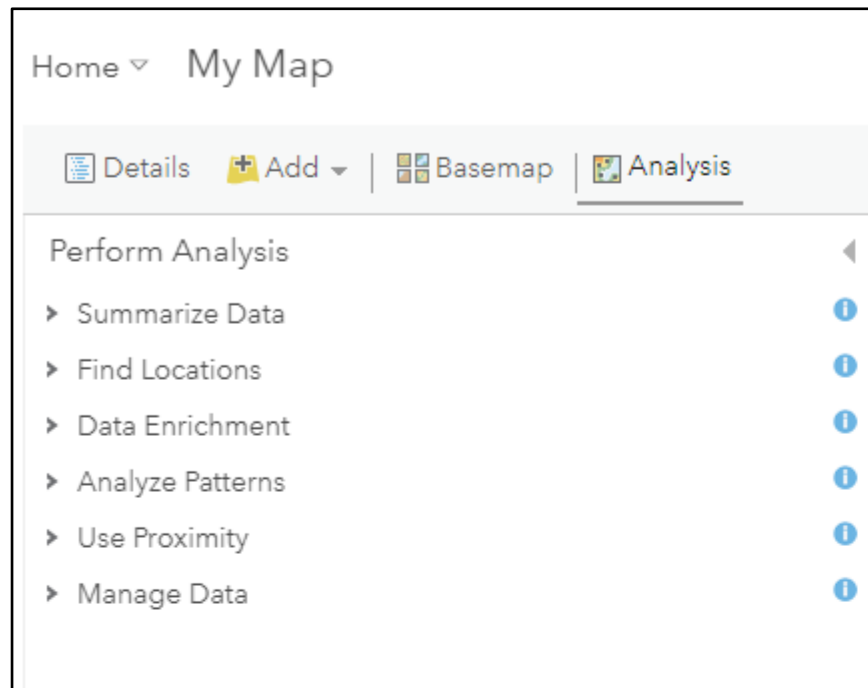


On the same screen, you can add data to your map. Select Add from the ribbon and choose Search for Layers. You can choose to search however you like to find your data (by name, by folder, or by organization) and add that data to your map. When you are finished adding layers to your map, click the back arrow at the top of the search screen. This returns you to the Details panel. You will now have a new feature in the top ribbon, Edit. Choosing this Edit option will change your left panel to a menu of the symbols that can be added to your Collector map. You can elect to add more data to your map in this menu. If you are finished adding data, you can move onto your analysis.

Select Details from the top ribbon of your ArcGIS window. This will change the left panel to a relatively blank box. There are three options within this Details panel: About, Content, and Legend. About provides you details about your Collector app, Legend provides a screen outlining the meanings of your symbols, and the Content option shows you the layers currently added to your map. In this tab you can check layers on and off.

In the top ribbon, click on the Perform Analysis. This will allow you to perform some basic analyses on your layer in ArcGIS Online. Selecting this option will change your left panel menu to all the Analysis tools available to you.

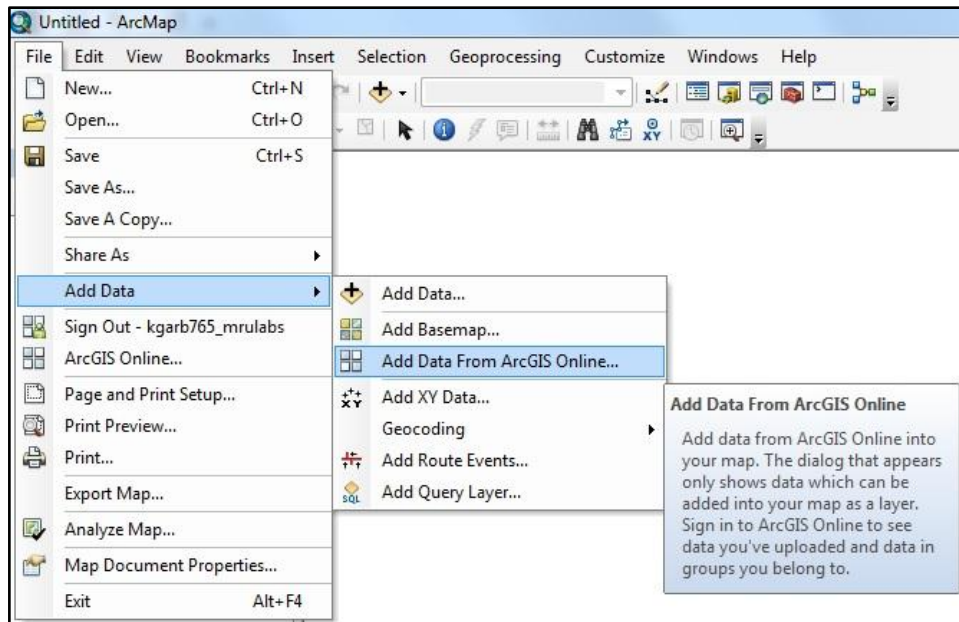
Clicking through this menu highlights the analytical capabilities of ArcGIS Online. ArcGIS Online allows you to run basic analyses regarding your data, its location, and patterns within your data. The use of these analytical tools is dependent on the focus of your study, and thus not all tools will be relevant to each and every Collector map.



Analyses in ArcMap

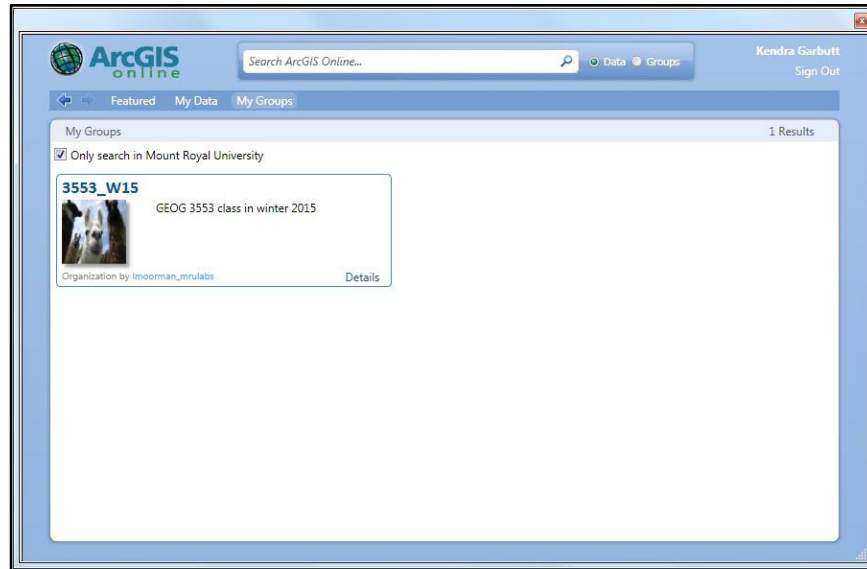
You can also run analyses of your data on your desktop in ArcMap. Begin by opening ArcMap and beginning with a blank map. In the File menu, Sign In to ArcGIS Online. Once you have signed in, you can access all your data from your ArcGIS Online account. You will be prompted to log in in a pop up window, which will close after you have successfully logged in. Go back into your File menu, and select Add Data. Another menu will appear beside Add Data, from which you can

select where you pull your data from. Select Add Data From ArcGIS Online. This will close the File menu and open a pop up window from ArcGIS Online.

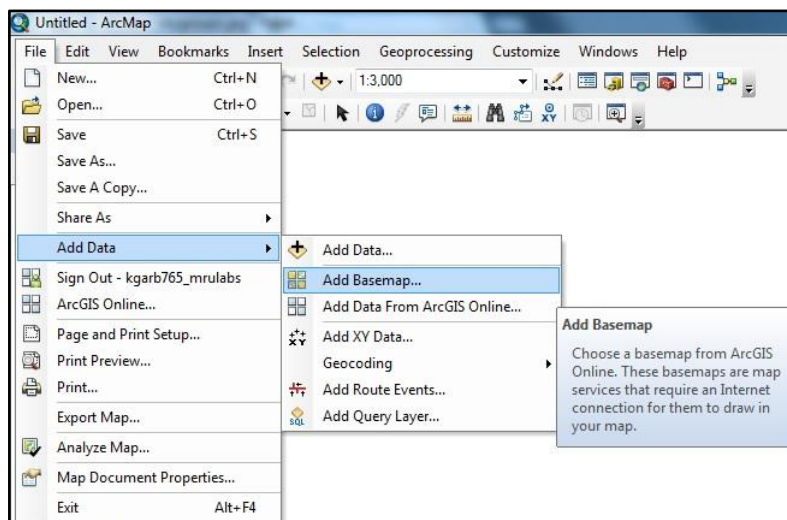


The ArcGIS Online window will initially appear blank. There are three options in a ribbon near the top of the window to find data: Featured, My Data, and My Groups. The two tabs that you need to be concerned about are My Data and My Groups. If you select My Data, the window will be populated with data that you have created. If you select My Groups, the menu will populate with all the groups you are a member of or have access to.





Find your desired data, and select Add from the two options in the bottom corner of your layer's listing. The pop up window will close, and the left panel menu will now have your imported layers. Importing your data will not also import a Basemap, so any symbols you have will appear on a blank screen. You can add a Basemap to allow for easier visualization of your data if you choose. Go into your File menu and select Add Data. Choose Add Basemap. Choose your Basemap from the pop up window, and select Add. Be warned that adding a Basemap can sometimes be a very time consuming process, for whatever reason. It is advisable to leave the program alone and allow it to do whatever it needs to do to add the Basemap – try not to click on other applications or other functions within ArcMap. Adding a Basemap will affect the loading speed of your data when you scroll or zoom, as well as adding time to any analyses you perform, so if you do not require your Basemap for the purpose of visualization, it is recommended that you do not add it to ArcMap.



In ArcMap, you have a very large variety of analytical tools at your disposal. You can run any analysis you would normally run on geospatial data on your Collector app data. For an overview of what is possible in ArcMap, please visit <http://www.arcgis.com> or speak to one of Mount Royal University's geography instructors.

Be sure that after you have run your desired analyses you save your map. If you do not save your map, the results your analyses have generated will still exist but will not necessarily be compiled in a meaningful way.

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- Dobrev, M. and D. Azzopardi (2014) Citizen science in the humanities: a promise of creativity. In: *Papadopoulos, G. (ed.) Proceedings of the 9th International Conference KICSS, Limassol, Cyprus, 6–8 Nov 2014*, pp. 446–451
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- Sabins, F. F. (1997). *Remote Sensing: Principles and Interpretation*. New York: W.H. Freeman and Company.
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Appendix A: Suggested Reading

Compiled by Brian Jackson

Earth and Environmental Sciences and Data Librarian, Mount Royal University

At Mount Royal University, we have access to extensive GIS tools and expertise. Available on every computer across campus is the ArcGIS suite of programs, including ArcMap, ArcScene, and ArcGlobe. ArcScene allows you to view map data that includes z coordinates (elevation values), and ArcGlobe allows you to view large amounts of 3D data in a globe format. The ArcGIS suite of programs contains an extensive Help menu in case you have questions (which you will) or encounter any issues (which you might). The ArcGIS Online Help catalogue is also tremendously helpful to learn the function and uses for ArcMap tools, as well as helping troubleshoot any problems you may run into using the program. It can be found at <http://resources.arcgis.com/en/help/main/10.2/>. If you are interested in enrolling in GIS specific courses, there are three offered at Mount Royal University: GEOG 1105 Introduction to Mapping, GIS and Remote Sensing, GEOG 2553 Geographic Information Systems, and GEOG 3553 Spatial Analysis and GIS. All three courses are excellent preparation to use GIS in your research and studies. Finally, there are a multitude of GIS and Remote Sensing resources available through Mount Royal University's library. The readings included in this list range from introductory texts to advanced discussions of methods and topics.

You will need an ArcGIS Online account to complete these exercises and use Collector. Check with your institution to set up this account. At Mount Royal University, check with IT and/or the Department of Earth and Environmental Sciences.

- Albrecht, J. (2007). Key concepts and techniques in GIS. Los Angeles, Calif: SAGE Publications.
Call Number: G 70.212 A43 2007
Ebook:<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=10326966>
- Arctur, D., 1951, & Zeiler, M. (2004). Designing geodatabases: Case studies in GIS data modeling. Redlands, Calif: ESRI Press. Call Number: G 70.2 A74 2004
- Connolly, T. M., & Begg, C. E. (2010). Database systems: A practical approach to design, implementation, and management (5th ed.). Boston, Mass; Toronto: Addison-Wesley.
Call Number: QA 76.9 D26 C66 2010
- Dodge, M., Kitchin, R., & Perkins, C. R. (2011). The map reader: Theories of mapping practice and cartographic representation. Hoboken, NJ; Chichester, West Sussex: Wiley-Blackwell.
doi:10.1002/9780470979587
Call Number: GA 101.5 D63 2011
- Fu, P. (2015). Getting to know web GIS. Redlands, California: Esri Press.
Ebook:
<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=11050742>
- Goodchild, M. F. & Janelle, D. G. (2004). Spatially integrated social science. New York: Oxford University Press, Incorporated.
Ebook:
<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=10085303>
- Haining, R. P. Spatial data analysis: Theory and practice. Cambridge, UK; New York: Cambridge University Press.
Ebook:
<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=10062302>
- Hernandez, M.J. (2013). Database design for mere mortals: A hands-on guide to relational database design (3rd ed.). Upper Saddle River, NJ: Addison-Wesley.
Call Number: QA 76.9 D26 H47 2013
- Iliffe, J. & Lott, R.. (2008). Datums and map projections for remote sensing, GIS, and surveying (2nd ed.). Scotland, UK; Boca Raton, FL: Whittles Pub.
Ebook:
<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=10904594>

Kennedy, M. (2013). Introducing geographic information systems with ArcGIS: A workbook approach to learning GIS (3rd ed.). San Francisco: Jossey-Bass.

Ebook:

<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=10674842>

Law, M. & Collins, A. (2013). Getting to know ArcGIS for desktop (3rd ed.). Redlands, California: ESRI Press.

Call Number: G 70.212 L39 2013

Liu, J. & Mason, P.J. (2009). Essential image processing and GIS for remote sensing. Chichester, U.K; Hoboken, N.J: Wiley-Blackwell.

Ebook:

<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=10310613>

Mamoulis, N. (2012). Spatial data management. San Rafael, Calif.: Morgan & Claypool.

Call Number: G 70.217 G46 M36 2012

Nyerges, T.L., Couclelis, H., & McMaster, R.B. (2011). The Sage handbook of GIS and society (1st ed.). Thousand Oaks, CA: Sage.

Call Number: G 70.212 N94 2011

Peterson, G.N. (2015). GIS cartography: A guide to effective map design (2nd ed.). Boca Raton, FL: CRC Press.

Call Number: GA 105.3 P48 2015

Prost, G.L. (2014). Remote sensing for geoscientists: Image analysis and integration (3rd ed.). Boca Raton: CRC Press.

Call Number: QE 33.2 R4 P76 2014

Srivastava, P. K. (2014). Remote sensing applications in environmental research. Cham: Springer.

Ebook:

<http://library.mtroyal.ca:2048/login?url=http://site.ebrary.com/lib/mtroyal/detail.action?docID=10866647>

Tomlin, C.D. (2013). GIS and cartographic modeling. Redlands, Calif: Esri Press.

Call Number: G 70.2 T66 2013

Tyner, J.A. (2015). The world of maps: Map reading and interpretation for the 21st century. New York; London: The Guilford Press.

Call Number: G 70.12 S54 2014

Wade, T., 1973, & Sommer, S. (2006). A to Z GIS: An illustrated dictionary of geographic information systems (2nd ed.). Redlands, Calif: ESRI Press.

Call Number: G 70.212 A86 2006

Wise, S. (2014). GIS fundamentals (2nd ed.). Boca Raton: CRC Press.
Call Number: G 70.212 W57 2013

Yeung, A.K.W. & Hall, G.B. (2007) Spatial database systems: Design, implementation and project management. Dordrecht: Springer. doi:10.1007/1-4020-5392-4
Ebook: <http://library.mtroyal.ca:2048/login?url=http://link.springer.com/book/10.1007%2F1-4020-5392-4>

Zekavat, S. A. & Buehrer, M. (2012; 2011). Handbook of position location: Theory, practice and advances. Hoboken, N.J: John Wiley. doi:10.1002/9781118104750
Call Number: TK 5105.65 Z45 2012

MRU Library website: <http://www.mtroyal.ca/Library/index.htm>