



Client-Side Web GIS

Data Collection Apps

Image from NASA:

https://commons.wikimedia.org/wiki/File:Earth_Western_Hemisphere_transparent_background.png#filelinks



The focus of this module is using web GIS and ESRI technologies to collect data.

Module Topics



1. Volunteered geographic information and location-based services
2. Configuring a hosted feature layer for data collection
3. Instant apps for data collection
4. Survey123 for survey administration
5. ESRI mobile apps for data collection

These are the topics covered in this module.

Volunteered Geographic Information (VGI)

- ❖ Allows users to edit geospatial data using a mobile or web interface
- ❖ Users will edit the data made available by the feature service



The image shows a screenshot of a web form titled "Wanted Sighting Report". Below the title is a section header "1. Enter Information". The form contains several input fields: "Suspect Sighted" (with a dropdown menu), "Description of Sighting" (a text area), "Date Sighted" (with a date picker), "Date Reported" (with a date picker), "Your Name" (a text field), and "Your Phone Number" (a text field). At the bottom of the form is an "Attachment" section with a "Select File" button.

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Volunteered geographic information (VGI) relates to collecting geospatial data and information from volunteers or the general public. Examples include the Waze app for collecting traffic data and OpenStreetMap for digitizing geospatial data.

Web GIS technologies have greatly improved our ability to collect VGI data using webpages, web maps and apps, and mobile apps.

There are Instant Apps available that allow for data to be collected and/or edited.

◀...▶ Location-Based Services (LBS) ▶...▶

- ❖ Use real-time geospatial from a mobile device or smartphone to provide information, entertainment, or security
- ❖ Since smartphones are GPS enabled, your location information can be integrated into the apps

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Location-based services relate to using your location information to locate yourself and your device and collect spatial location information. This is how a phone app knows your location: it has access to your GPS data if enabled.

Location-based services have been well integrated into mobile apps and can enhance and simplify the user experience.

Location-based services can be used in some instant apps.

Set Up Layers for Editing

◀▶ Create a New Hosted Feature Layer ▶◀

- ❖ Navigate to **Content**
- ❖ Select New Item 
- ❖ Select Feature Layer 
- ❖ Options to Create an empty feature layer
 - Define your own layer
 - Select an existing layer
 - Use a template
 - Provide an ArcGIS Server layer URL
- ❖ Name Layer and define geometry



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If you need to create a layer in which to collect data, there are several options.

You could generate the data as a CSV file or shapefile and then upload it to ArcGIS Online as a template for the data collection. You could also publish a feature class from ArcGIS Pro.

Alternatively, you could generate a new layer from scratch as a hosted feature layer. A feature layer can store vector data with associated attribute information. It is a feature class that is available for use in web maps and apps. A hosted feature layer is a feature layer stored on ArcGIS Online.

When you create a hosted feature layer, you are able to edit it, allow others to edit it, and change the symbology. So, they are generally good options for collecting VGI data via the web and mobile apps.

ArcGIS Online provides a wide variety of templates to create hosted feature layers for common task. Alternatively, you can build a layer from scratch.

◀▶ Create a New Hosted Feature Layer ▶◀

- ❖ Add GPS metadata fields/Enable Z-values
- ❖ Provide item title, location, tags, and summary
- ❖ Click Save

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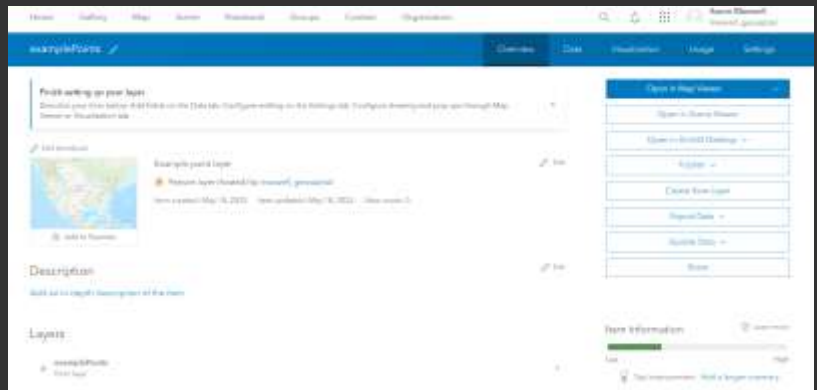
When you define a hosted feature layer, you can choose to collect GPS metadata. This can be useful if data will be collected with field apps and to assess the positional accuracy of collected data. If you enable Z-values, this allows for storing elevation data with each vertex.

As with other ArcGIS Online content, you must/can provide a title, tags, and a summary. You can also save the hosted feature layer to a subfolder within your ArcGIS Online content. Again, I highly recommend using folders to organize your Content.

Layer Editing and Settings



- ❖ Find layer in **Content**
- ❖ Open drop page
- ❖ Information
 - Item Name
 - Thumbnail
 - Description
 - Layers
 - Owner
 - Keywords
 - Tags
 - Credits/attribution
 - Layer URL



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Once a hosted feature layer is created, it will have an associated drop page like all other ArcGIS Online content items.

Note that the layer will be assigned a URL. This URL can be used to link to the data in a web map or scene.

◀▶ Add Fields ▶◀



- ❖ Navigate to drop page for layer in **Content**
- ❖ Navigate to **Data** tab
- ❖ Switch to Fields view
- ❖ Click **Add Field**
- ❖ Field Name = actual field name
- ❖ Display Name = alias name (for cleaner display)
- ❖ Types = date, double, integer, or string
- ❖ Can specify default value
- ❖ Can choose to allow or not allow Null values



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Fields can be added to a hosted feature layer under the Data tab on the layer's drop page. In this tab, you will need to switch to field view.

Field names represent the actual name stored in the table while the display name is a cleaner name used for display. This is comparable to an alias name for a field in a file geodatabase feature class.

You can define fields as either a date, double, integer, or string type. When using a string type, you can increase or decrease the allowed number of characters.

For a field, you can also specify a default value and choose whether or not to allow Null or empty entries.

Domains (Coded Values)



- ❖ Navigate to drop page for layer in **Content**
- ❖ Navigate to **Data** tab
- ❖ Switch to Fields view
- ❖ Click on field name
- ❖ Get started for **Domains** or **Edit**



☐ Label (displayed value)	☐ Code (stored value)	
☐ Sandstone	☐ etc. sandstone	AAA
☐ Limestone	☐ etc. limestone	AAA
☐ Dolostone	☐ etc. dolostone	AAA
☐ Shale	☐ etc. shale	AAA
☐ Mudstone	☐ etc. mudstone	AAA
☐ Conglomerate	☐ etc. conglomerate	AAA
+ Add value		

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You can also specify domains to only allow for certain values or a certain range of values to be entered into a field.

A coded values domain creates a list of allowed entries for a specific attribute. This will allow for only a subset of categories or allowed values to be recorded in the field. For example, you could define a coded values domains for a buildings layer that only allows the building to be labeled into a set of pre-defined types (e.g., residential, commercial, industrial, and public). This can allow for much cleaner tables. Each allowed value is assigned a label, which serves as a clean and interpretable display name, and a code, which is the value or string actually stored in the table.

Domains (Range Values)



- ❖ Navigate to drop page for layer in **Content**
- ❖ Navigate to **Data** tab
- ❖ Switch to Fields view
- ❖ Click on field name
- ❖ Get started for **Domains** or Edit

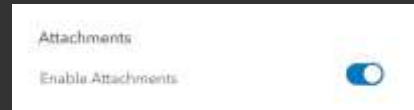
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A range value domain can be specified for a double or integer field by specifying allowed minimum and maximum values. If a range value domain is set up, then the user will not be able to enter numbers outside of this range. This could be useful if only values within a certain range are valid. For example, a field that holds percentages may only allow values between 0 and 100 to be entered.

Attachments



- ❖ Navigate to layer in **Content**
- ❖ Navigate to Overview tab
- ❖ Turn on **Enable Attachments**



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You can also allow attachments to be associated with records or features stored in a layer. For example, this could allow photos to be uploaded along with points collected in the field using a field or mobile app.

Make a Layer Editable



❖ Share with Group, Organization, or Everyone (public)

❖ Approve for public data collection

❖ Editing options

- Add
- Delete
- Update (attributes only vs. attributes + geometry)
- Which features editor can see/edit
- Allow caching
- Allow export



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If you want users to be able to edit a feature layer, you must share it with the intended audience (either your organization or everyone). If it is shared with everyone, it must be configured for public data collection.

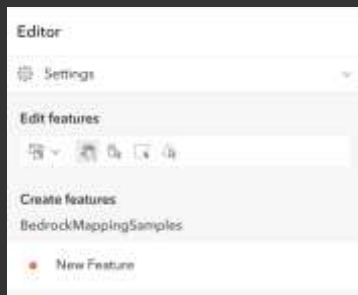
You can also specify what can be edited. For example, the user may only be able to add new features as opposed to delete or update existing features. You can also control whether the user can edit only attributes or both the attributes and the geometry.

If a layer will be used within mobile apps or for field data collection, it can be useful to turn on caching. If there is limited internet access or cell reception, data can be cached to the user's device then uploaded once a connection is reestablished.

↔ Edit in Web Map



❖ Right Pane → Edit

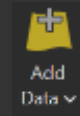


The 'Create features' form for 'Bedrock Mapping Data Collection' includes fields for 'Rock Type*', 'Strike*', 'Dip*', 'Collection Date*' (with a date picker), and 'Notes'. An 'Attachments' section shows 'No attachments'. A '+ Add' button is at the bottom left, and a 'Create' button is at the bottom right.

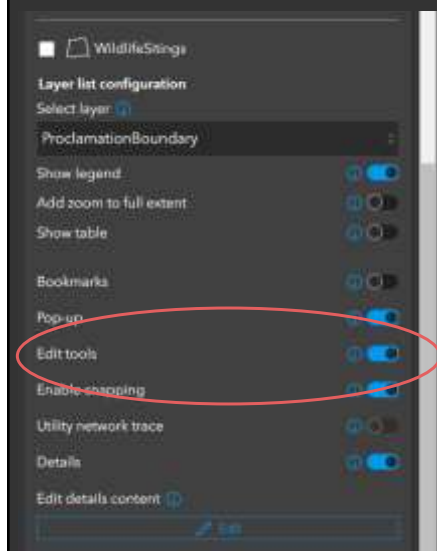
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In the Map viewer, an editing widget is provided in the right pane.

- ❖ Must be logged in
- ❖ Add Data → Portal → My Content → Find layer
- ❖ Edit like a local layer



If you are logged into your ArcGIS Online account in ArcGIS Pro, you can add and edit a hosted feature layer. Editing is implemented the same as a local layer. It is also possible for multiple users to view and edit the layer at the same time.



- ❖ Must turn on **editing tools**
- ❖ **Sidebar app** is a good choice
- ❖ Make sure to turn editing off for layers that you do not want the user to edit

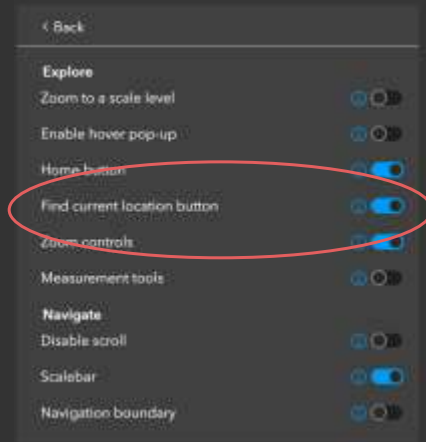
In order to be able to edit data layers in a web map, the edit widget must be able to be added. Not all Instant apps have this option.

If you are wanting to be able to edit into a hosted feature layer from an app, I would recommend the Sidebar app. If you do use this app, you will need to turn on the Edit tools option, which will add the editing widget. You will also need to make sure that the layer has editing enabled and is shared appropriately. For example, if you only want members in your organization to be able to edit the layer, you will need to make sure that it is shared with only your organization. If you want anyone to be able to edit the layer, it should be shared publicly or with everyone.

Activating Location-Based Services

❖ Add Find current location button 

❖ User will need to allow location services to be used



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If you want individuals to be able to use their location-based services when collecting data, you will also need to add the “Find current location button”, which adds geolocation capabilities. User will generally need to agree to the use of location-based services in order for this to function. This option can be especially useful when data will be collected in the field.

Survey123

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We will now explore the Survey123 app, which is used to implement surveys and collect data using forms.

- ❖ Form-centric data gathering
- ❖ Create forms to collect or edit data
- ❖ Create surveys



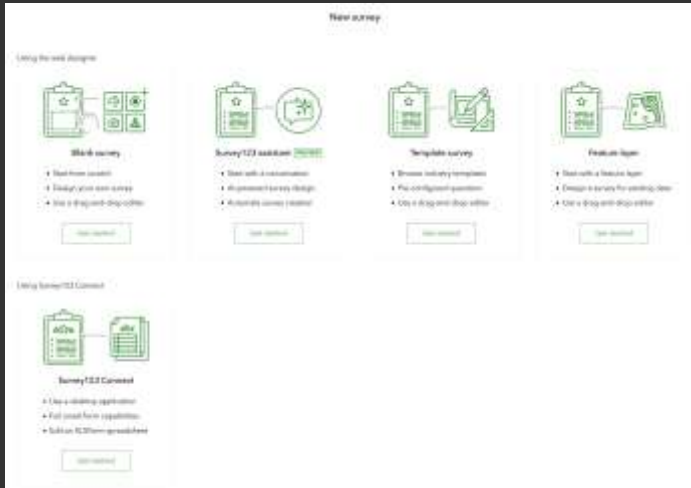
<https://survey123.arcgis.com/>

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Although mobile apps are not the focus of this course, I did want to provide at least a brief overview of ESRI's field-based apps.

ArcGIS Survey123 is used for gathering data using forms. It allows users to create forms or surveys that can then be deployed to users.

Getting Started



❖ Blank Survey

❖ Survey123 Assistant

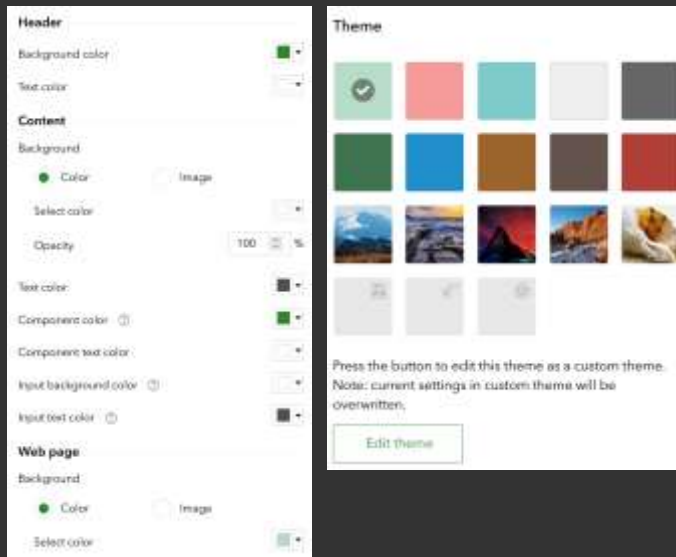
❖ Template Survey

❖ Feature Layer

❖ Survey123 Connect

Forms can be initiated from scratch, using a template, or using a feature layer as a reference.

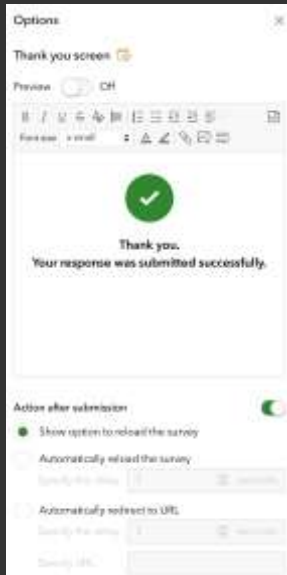
Themes



- ❖ Choose from available
- ❖ Configure/customize
- ❖ Shared amongst organization
- ❖ Import from prior surveys

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ESRI provides themes for your survey. You can also configure and customize the base themes or use themes shared within your organization or import a theme from an existing survey.



- ❖ Include **thank you screen**
- ❖ Configure thank you screen
- ❖ Actions after completion:
 - show option to reload survey
 - Automatically reload survey
 - Automatically redirect to URL

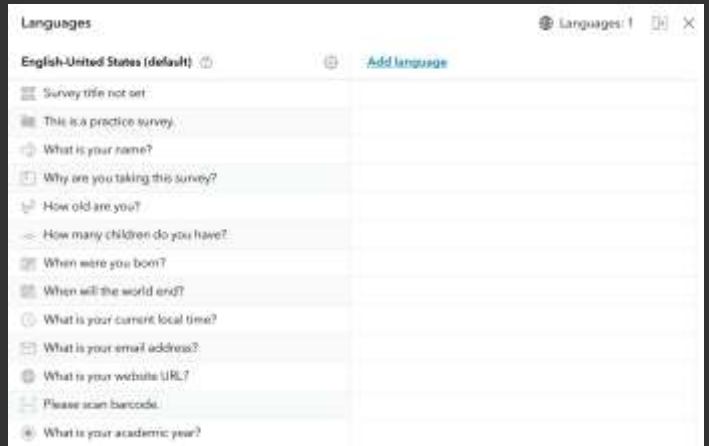
You can configure the final screen that is displayed once a user submits a response. You can also control what happens once the survey is submitted.

Languages



❖ Default language

❖ Add additional



It is possible to configure multiple languages/translations for the survey.

Types of Content

- ❖ Survey Header
- ❖ Survey Description
- ❖ Survey Footer
- ❖ CAPTCHA

Survey element	
 Survey header	☒
 Survey description	☒
 Survey footer	☒
 CAPTCHA	☐

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We will now explore the different types of content that can be included in a survey.

First, you can configure headers, footers, and a survey description. You can also implement a CAPTCHA to reduce the risk of bots accessing your survey.

Response Types (Type Entry)

- ❖ Single line of text
- ❖ Multiple lines of text
- ❖ A number
- ❖ A number entered using a slider
- ❖ Date
- ❖ Time
- ❖ Date and Time
- ❖ Email
- ❖ Website address
- ❖ Scan barcode or QR code

The image displays a variety of form widgets for data entry. On the left, there are five examples of text entry: a single-line text box for 'What is your name?', a multi-line text box for 'Why are you taking this survey?', a single-line text box for 'How old are you?', a slider widget for 'How many children do you have?', and a date/time picker for 'When will the world end?'. On the right, there is a grid of widget icons labeled 'Text, number, date, and time', including Singleline text, Multiline text, Number, Slider, Date, Time, Date and time, Email, Website, and Barcode. Below this grid are two more examples: a date picker for 'When were you born?' and a time picker for 'What is your current local time?'.

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A variety of question types or content can be configured including the ones listed on this page.

Type entry indicates that the user will provide a text, numeric, date, time, or date/time response by typing or interacting with a widget.

Response Types (Selection)



❖ Single Select

❖ Multiple Select

❖ Single Select Grid

❖ Dropdown

❖ Likert Scale

❖ Rating

❖ Ranking

What is your academic year?

☐ Freshman

☐ Sophomore

☐ Junior

☐ Senior

Choice

☒ Single select

☒ Multiple select

☒ Single select grid

☒ Dropdown

☒ Likert scale

☒ Rating

☒ Ranking

How satisfied are you with this survey?

☆☆☆☆☆

What is your major?

☐ Earth and Environmental Science

☐ Sustainability Studies

☐ Other

Answer these questions about your educational experience.

	Yes	No	Unknown
Do you plan to study abroad?	☐	☐	☐
Do you plan to attend graduate school?	☐	☐	☐
Do you plan to attend a professional program?	☐	☐	☐

Rank the following movies.

☐ Gladiator

☐ Gladiator

☐ Gladiator

☐ Gladiator

This survey is a good use of my time.

Strongly disagree — Disagree — Neutral — Agree — Strongly agree

Where do you live?

-Please select-

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Selection-style responses allow for selecting from a list of available options. Examples including selecting one or more options from a list, grid, or dropdown; the Likert scale; ratings (five star system); and ranking different options.

Response Types (Location)



❖ Map

❖ Address

❖ Location from list

Provide your address.

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Location

☒ Map ☒ Address

☒ Location list

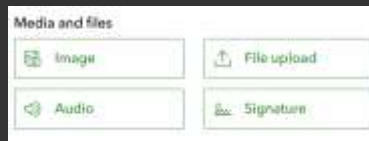


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Users can also enter location data by interacting with a map, entering or searching for an address, or selecting a location from a list. Note that it is not required to include any spatial- or location-related data collection in Survey123-based surveys.

Types of Content (Media Files)

- ❖ Image
- ❖ Audio
- ❖ File Upload
- ❖ Signature

A screenshot of a form with four sections, each with a media upload field. The first section is 'Provide a headshot.' with a 'Drop image here or select image' button and a file icon. The second section is 'How is your name pronounced?' with a 'Drop audio here or select audio' button and a speaker icon. The third section is 'Upload your resume,' with a 'Drop file here or select file (pdf, doc, docx, xls, xlsx, pptx, ppt, etc)' button. The fourth section is 'Sign to confirm your responses are factual.' with a signature line and a file icon.

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Users can upload data including images, audio, and files (PDFs, videos, etc.). They can also submit a signature.

Question Configuration



The screenshot shows a 'Single select' question configuration panel. It includes sections for 'Label' (with a text input), 'Hint' (with a text input), 'Options' (a list of items with checkboxes and radio buttons), 'Appearance' (with radio buttons for 'Vertical', 'Horizontal', and 'Horizontal (disabled)'), 'Validation' (with a checkbox for 'This is a required question'), and 'Behavior' (with checkboxes for 'Marked' and 'Not marked').

- ❖ Options vary by type
- ❖ **Label** = state question
- ❖ **Hint** = provide additional information about question
- ❖ **Validation** = is question required

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Individual questions can be configured, though options vary by type. The label states the question while hints can be included to aide the user in understanding what is being asked. Questions can also be flagged as required or not required.

Conditional Behavior



❖ Do not show question based on response from a prior question

Are you an undergraduate?

Yes

What is your academic year?

☐ Freshman

☐ Sophomore

☐ Junior

☐ Senior

Behavior

☒ Visible

☐ Do not store the answer

[Set rule](#)

< Set visibility rule: What is your academic year?

Visibility rule

Are you an undergraduate?

is value

Yes

[Add expression](#)

[Add group](#)

When the visibility rule is not met:

☒ Do not submit the answer

☐ Submit the answer

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Whether a question pertains to a specific respondent or the options that should be provided may depend on how a prior question is answered.

For example, a question could ask a student to provide their academic year (freshman, sophomore, junior, or senior). However, this would only apply to undergraduate students. So, a prior question could be provided to ask the student whether they are a graduate or undergraduate student. If their response to this prior question is “undergraduate” then the academic year question could be displayed. If the answer is “graduate” then the question could not be displayed. Alternatively, a different question could be asked, such as whether the student is pursuing an MA, MS, or PhD.

Survey123 supports this conditional behavior.

Display and Structure



- ❖ **Note** = display text
- ❖ **Group** = Group questions or create subsections
- ❖ **Pages** = Break survey into multiple pages

This information is for internal use only.

Display and structure

Note

Page

Group

General information

What is your name?

Why are you taking this survey?

How old are you?

When were you born?

UNIDENTIFIED

Academic Information

Are you an undergraduate?

Please select:

What is your academic year?

☐ Freshman

☐ Sophomore

☐ Junior

☐ Senior

What is your major?

☐ Civil and Environmental Engineering

☐ Sustainability Studies

☐ Other

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Survey123 allows for further structuring the survey. For example, notes can be added to guide the user, questions can be partitioned into groups based on a theme, and/or the survey can be broken into multiple pages.

Modify Schema



Modify schema

All survey data is stored in a feature layer associated with your survey. Use the settings below to control the field names of your feature layer as well as the names used for choices in your survey. Once published, changes to name and field length are not allowed for existing operations.

Label ID	Name ID	Field type	Field length
Place your barcode	place_your_barcode	one field type/length	255
When is your academic year?	what_is_your_academic_year	one field type/length	255
Undergrad	Undergrad		
Graduate	Graduate		
Junior	Junior		
Senior	Senior		
Graduate Student	Graduate Student		
When is your major?	what_is_your_major	one field type/length	1000
Biology and Environmental Science	Biology and Environmental Science		
Sustainability Studies	Sustainability Studies		
Other	what_is_your_major_other	one field type/length	255
Answer these questions about your educational experience	exp1_1a	one field type/length	
Classroom			
Yes	Yes		
No	No		
Unclear	Unclear		
Continued			
Has your plan to finish undergrad?	field_1a_has_your_plan_to_finish	one field type/length	255
Do you plan to attend graduate school?	field_1a_do_you_plan_to_attend	one field type/length	255
Do you plan to attend a professional program?	field_1a_do_you_plan_to_attend	one field type/length	255
Where do you live?	where_do_you_live	one field type/length	255
Thrive	Thrive		

❖ Stored in feature layer

❖ Can edit:

- field name
- Field type
- Field length

The schema of the survey can be modified including the field names, field types, and field lengths. The collected data or responses are stored in a feature layer.



- ❖ Must **Publish** first
- ❖ Must set up **Collaboration**



Before a survey can be administered, it must be published and collaborations must be set up. Note that the survey will be saved as an item to your ArcGIS Online content.

In Survey123, collaborations refer to the sharing and permission settings that control how different people interact with a survey. Through the Collaborate options, a survey owner can decide who is allowed to submit responses, who can view and analyze collected data, and who can help manage or update the survey. These permissions can be assigned to individuals, groups, an organization, or the public, depending on the intended use. In practice, collaborations make it possible for multiple people to participate in a survey workflow while still controlling access to sensitive forms, records, and results.

Web app version

In every release of Survey123, we introduce new features, bug fixes and improvements to the look and feel for the web app. You can decide whether or not to apply them to this survey by choosing one of the following options.

Tip: Choose **Always use the latest version** if you want to use the latest web app for this survey. If it's important to guarantee that the look and feel (including potential bugs) of your survey is exactly the same across releases, choose **Use the version the survey was published with**.

Note: If you choose **Always use the latest version** and the survey's published version is earlier than the latest version, the loading time of the web app may increase slightly due to the dynamic upgrading. To reduce the impact, you can upgrade the survey to the latest version permanently by republishing it in the [Design page](#).

☒ Use the version the survey was published with (3.24)

☐ Always use the latest version (3.24)

Survey version in the field app

You can require users to update this survey if a newer version is available. Users will not be able to access the survey until it has been updated.

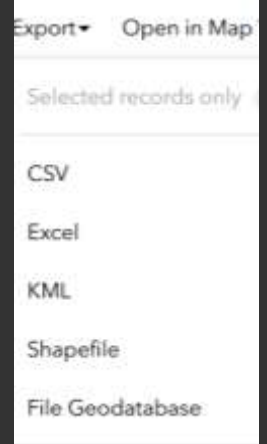
☐ Require update to the latest version of this survey

Save

There are additional settings available, such as whether or not to use the latest version of Survey123 or the version used to create the app when users interact with it.

❖ Export to:

- CSV
- Excel
- KML
- Shapefile
- File Geodatabase



Survey results can be exported to a variety of formats including comma-separated values (CSV), an Excel spreadsheet, Keyhole Markup Language (KML), a shapefile, or a file geodatabase.

Mobile Apps

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This last set of slides provide a brief introduction to mobile apps in the ESRI environment since they are commonly used to collect data.

◀◻▶ ArcGIS Field Maps



- ❖ Build for field mapping and data collection
- ❖ Can use maps and/or forms
- ❖ Maps are configured and deployed using the **Field Maps Designer** app
 - Configure app
 - Define share settings
 - Design, configure, and edit forms
 - Set of geofences to define mapping area and warn users when they are leaving the mapping area
 - Enable offline mode



<https://www.esri.com/en-us/arcgis/products/arcgis-field-maps/overview>

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ArcGIS Field Maps is a tool for field-based mapping, mobile GIS, and data collection. It is possible to develop field maps to collected data using forms and/or maps.

The web-based Field Maps Designer app is used to configure field maps. Users can define share settings, design and configuration of forms, and allow for offline use of field maps when internet and/or cellular access is limited.

You can also define geofences to alter users when they are leaving the mapping area extent.

The Field Maps Designer can be accessed through ArcGIS Online.

Configuring Forms



Bedrock Mapping Data Collection

Rock Type

* Required

Strike

* Required

Dip

* Required

Collection Date

* Required

Notes

- ❖ Conducted in **Field Maps Designer**
- ❖ Builds on **Survey123**
- ❖ Can start from **popup** configuration
- ❖ **Forms** are saved and associated with the map

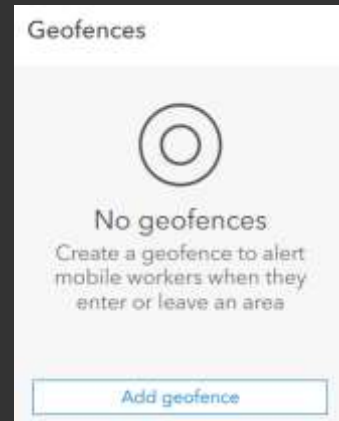


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ArcGIS Field Maps makes use of form-based data collection. The Field Maps Designer app allows you to build these forms using a layer's configured popup or from scratch. This technology builds on Survey123.

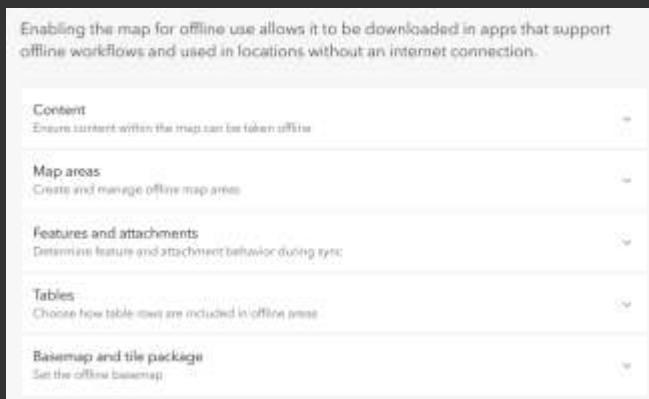
Geofence

- ❖ Send an alert or message to field mapper if they leave an area
- ❖ Safety and operational efficiency

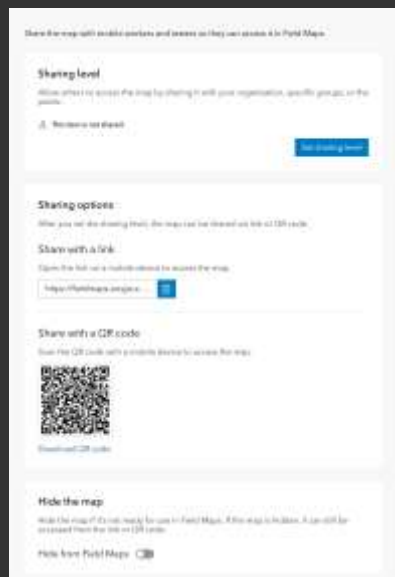


Geofencing can aid users when collecting data in the field.

- ❖ Allow for caching data to local device
- ❖ Useful with unreliable internet connections



Offline data collection can be enabled to allow for local caching of data to the user's device. This is of particular value when internet or cellular signal is limited. The collected data can be synced with the server once a connection is reestablished.



❖ Allow for multiple field mappers to access map



The field app can be shared within you organization or with everyone.

The user will need to have the Field Maps app installed on their mobile device. If the app is shared within your organization only, the user will need to be log into an account associated with the organization and have rights to edit data.

❖ Navigation and routing tools



ArcGIS Navigator is ESRI's mobile navigation app for field crews. It provides turn-by-turn routing using ESRI navigation maps or an organization's custom maps, including custom roads, travel modes, and searchable assets. It can be used online or offline and is useful for helping workers efficiently reach job sites, inspections, or field assets.

❖ Simplified data collection app



ArcGIS QuickCapture is a rapid field data collection app designed for simple, one-tap data capture. Field workers can quickly record observations, locations, photos, and other attributes using large configurable buttons, making it especially useful for fast-moving workflows such as damage assessment, asset inventory, or roadside observations.

- ❖ Workforce management
- ❖ Coordination of field work
- ❖ Assign work to field crews
- ❖ Provide work updates and status
- ❖ Track field worker locations information



<https://www.esri.com/en-us/arcgis/products/arcgis-workforce/overview>

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ArcGIS Workforce is a field workforce coordination app used to assign, manage, and complete work in the field. Dispatchers can create and assign tasks from the web app, while mobile workers use the mobile app to view assignments, update their status, add notes, and coordinate work based on location.



This is the end of this lecture module.

Please return to the West Virginia View
Webpage for additional content.



Thanks! Hope you found this useful.