

## Creating Feature Services for GNSS

In this guide, we will go through the basics of creating a feature services in ArcGIS Online (AGOL) for use in collecting field data with a GNSS device (also commonly called GPS, but GNSS includes not only the US GPS but also GLONASS, Galileo and other positioning satellite systems) and Esri's Collector app.

The purpose in this mode of GNSS use is for collecting data to be readily incorporated in a cloud-based GIS, and in this exercise we will publish the feature service in ArcGIS Online. The process will include creating a geodatabase in the desktop, defining menu choices (domains) for the features to be collected, establishing feature classes for the data to be collected and lastly publishing feature classes in AGOL. We will use the SFSU Quad as a field site, and include some features that are found there – lamp posts, maintenance hole covers, paths and trees.

### 1. Create a geodatabase

In order to create a feature service, we will first need to create it in a desktop GIS as a geodatabase. While we could also use a shapefile or other data structures, a geodatabase provides several advantages, such as the ability to create *domains*, used to provide a menu choice for features for which we want the field scientist to select values for – such as a list of tree species – creating an efficient field process.

- Create a new Quadfeatures file geodatabase by starting a new ArcGIS Pro project of that name (in ArcMap, open ArcCatalog and create a new file geodatabase with 'New' >> 'File Geodatabase' named Quadfeatures). The geodatabase should have a title that will make sense given the nature of your work and the to-be-published feature service, thus the name we've chosen makes sense for creating various features in and around the Quad at SFSU.

### 2. Define geodatabase domains

We will establish domains for tree species, tree health, lamp post color, maintenance cover types and path pavement types.

- In a Catalog, right-click the **Quadfeatures** geodatabase go to Domains and create a lamp post color domain, with the following properties:
  - Domain Name: `Color`
  - Description: `Lamp Post Color`
  - Field Type: `Text`
  - Domain Type: `Coded Value Domain`
  - Split Policy: `Default`
  - Merge Policy: `Default`

then add the following codes, with identical descriptions:

`black, white, red, green, blue, purple, unpainted`

(ArcMap will do the above in various tables)

- Follow the exact same procedure as in the previous step in order to create the domains located in the table below. Note that the **Domain Name** does not have spaces, but the **Description** allows for them. Furthermore, with respect to **Coded Values**, you can just make the description the same as the code, but for species we'll use the common name in the description. *For the exercise, only enter the first 8 species (which are all genus only) and the last 3 choices (Other, etc.) which are all in bold below; the other entries are optional.*

Domain name	Description	Coded values (enter one per row)	
Surface	Path surface type	asphalt, concrete, unpaved, gravel	
MaintLabel	Maintenance Hole Cover Label	communication, electric, water, irrigation control, gas, street lighting, other, unlabeled	
TreeSpecies	Tree species	Species	Common
		<b>Cupressus spp.</b>	<b>Cypress</b>
		<b>Eucalyptus spp.</b>	<b>Eucalyptus</b>
		<b>Liriodendron spp.</b>	<b>Tulip tree</b>
		<b>Pinus spp.</b>	<b>Pine</b>
		<b>Quercus spp.</b>	<b>Oak</b>
		<b>Rhododendron spp.</b>	<b>Rhododendron</b>
		<b>Salix spp.</b>	<b>Willow</b>
		<b>Sequoia spp.</b>	<b>Redwood</b>
		Arbutus spp.	Arbutus
		Betula spp.	Birch
		Juniperus spp.	Juniper
		Cedrus spp.	Cedar
		Camelia spp.	Camelia
		Ilex cornuta	Chinese holly
		Pinus radiata	Monterey pine
		Pinus contorta	Shore pine
		Pinus torreyana	Torrey pine
		Quercus suber	Cork oak
		Liriodendron tulipifera	Tulip tree
		Lagunaria patersonia	Primrose tree
Camelia japonica	Camelia		
Salix lasiolepis	Arroyo willow		
Sequoia sempervirens	Coast redwood		
<b>Other</b>	<b>Other (in Comments)</b>		
<b>Unknown</b>	<b>Unknown</b>		
TreeHealth	Tree health	healthy, diseased, broken, needs pruning, wilted	

3. Define the feature classes, and set up their fields and symbology

- Now that domains have been established, we need to create feature classes for each: Lamppost, MaintCover, Tree, Path, etc. Navigate to the **Quadfeatures** geodatabase in the Catalog and create a new feature class (right-click **Quadfeatures** geodatabase, navigate to 'New,' and then select 'Feature Class'). A **Create Feature Class wizard** will open, and for each new feature class that will be created you will need to specify the **Name, Alias, Type, and Spatial Reference (WGS 84 Web Mercator auxiliary sphere, WGS 1984 Geoid for vertical)**. *Note: do **not** create 3D feature classes—do **not** check this setting to include Z values in Geometry properties – for some reason this does not work with Collector.* We will be creating seven feature classes for this exercise, use the table below for specifics regarding **Name, Alias and Type** for each feature class. Also create the fields and their properties (other than domain, which we'll do next) from the table provided.
- There are other fields to create and domains to link to some fields. In Pro, for both needs, right-click the corresponding feature class in Catalog and go to Design>Fields to bring up the Fields view.
  - For domains, click that cell and a pull-down will let you choose the corresponding domain. Do this for all fields with domains. *Remember to save each field.*

Field Name	Alias	Data Type	<input checked="" type="checkbox"/> Allow NULL	Domain	Default	Length
OBJECTID		Object ID	<input type="checkbox"/>			
Shape		Geometry	<input checked="" type="checkbox"/>			
Shape_Length		Double	<input checked="" type="checkbox"/>			
id	id	Text	<input checked="" type="checkbox"/>			255
user_name	user_name	Text	<input checked="" type="checkbox"/>			255
surface	surface	Text	<input checked="" type="checkbox"/>	<input type="text" value=""/>		255
comment	comment	Text	<input checked="" type="checkbox"/>			
Click here to add a new field.				<Add New Coded Value Domain> Color MaintLabel Surface TreeHealth TreeSpecies		

- For all *point* feature classes, add the following fields (In Catalog view, go to Feature Class Properties, and select the Fields tab). The aliases are highly recommended. Save.

Field name	Field Alias	Field type
ESRIGNSS_RECEIVER	RECEIVER	Text
ESRIGNSS_H_RMS	H_RMS	Double
ESRIGNSS_V_RMS	V_RMS	Double
ESRIGNSS_LATITUDE	LATITUDE	Double
ESRIGNSS_LONGITUDE	LONGITUDE	Double
ESRIGNSS_ALTITUDE	ALTITUDE	Double
ESRIGNSS_FIXDATETIME	FIXDATETIME	Date

Name	Alias	Type	Fields (other than the default)		
Lamppost	Lamp post	Point	Field name	Data type	Domain
			id	Text	
			user_name	Text	
			color	Text	Color
			comment	Text	
MaintCover	Maintenance hole cover	Point	id	Text	
			user_name	Text	
			label	Text	MaintLabel
			comment	Text	
Path	Path	Line	id	Text	
			user_name	Text	
			surface	Text	Surface
			comment	Text	
Tree	Tree	Point	id	Text	
			user_name	Text	
			species	Text	TreeSpecies
			circumBH	Float	
			ht_distance	Float	
			ht_upangle	Float	
			ht_downangle	Float	
			health	Text	TreeHealth
			comment	Text	
			photo	Raster	
Generic_point	Generic point feature	Point	id	Text	
			user_name	Text	
			comment	Text	
Generic_line	Generic polyline feature	Polyline	id	Text	
			user_name	Text	
			comment	Text	
Generic_polygon	Generic polygon feature	Polygon	id	Text	
			user_name	Text	
			comment	Text	

- Enable attachments in the tree feature class by running the geoprocessing tool **Enable Attachments** in the Data Management toolbox.

(ArcMap: In order to define the **Domain** for a new field, select the blank cell adjacent to **Domain** in the **Field Properties** table and a drop-down menu with all of the domains you created in the previous step will appear. Select the corresponding domain for each respective feature class. Click Finish. To enable attachments in Trees, in Catalog right-click the Tree feature class, navigate to 'Manage' and selecting 'Create Attachments.')

4. Publish the data

In this step, we'll publish the data (i.e. the feature class we have created) so we can access it in ArcGIS Online and then lastly in Collector. Let's try just following the instructions for "Publish the contents of a file geodatabase" at <https://doc.arcgis.com/en/arcgis-online/manage-data/publish-features.htm> or Google this. First close out of the ArcGIS Pro project after everything is saved, then zip the geodatabase and upload it your Contents on ArcGIS Online.

## Add an item from my computer ? X

Choose File Quadfeatures.gdb.zip

Contents

File Geodatabase ▼

Publish this file as a hosted layer. (Adds a hosted layer item with the same name.)

Title:

Quadfeatures\_gdb

Tags:

GPS X
GNSS X
trees X
SFSU X

Add tags

#### 4. Publish the data (ArcMap method)

In this step, we'll publish the data (i.e. the feature class we have created) so we can access it in ArcGIS Online and then lastly in Collector. *Note: while it's possible to publish all of your feature classes as one feature service, it's best to do these individually: for each feature class, include it alone in ArcMap before publishing it.*

- Still in ArcGIS, sign in to ArcGIS Online (in ArcMap, File/Sign In), if you are not already signed in, then:
  - File/Share As: Service
  - With the default "Publish a service" selected, click **Next**
  - In Publish a Service, choose "My Hosted Services (SF State ArcGIS Online)", then in Service name, type a name (such as "LampPosts" but that's probably been used, so put your initials at the end of the name, with no spaces) and click **Continue**.
  - In the **Service Editor** window, click **Capabilities** then check **Feature Access** and uncheck **Tiled Mapping**.
  - In **Feature Access**, allow all operations: Create, Delete, Query, Sync, and Update.
  - In **Item Description**, enter the required summary of "For SFSU quad feature data collection", and the tags separated by commas: *GPS, GNSS, trees, SFSU* in Tags. You can also use the **Choose Your Tags...** button to find already created tags from your projects.
  - In **Sharing**, select SF State ArcGIS Online and at least one group. For the CEL GPS class, select 'CEL Program.'
  - Click **Analyze** to make sure there are no errors. Warnings are ok.
  - Click **Preview**. The preview should be blank given that there is not data associated with this feature service, yet.
  - Finally, click **Publish** to publish the service. This will go through several steps, and will hopefully end with "The service has been published successfully."

## 5. Configure the editing settings in ArcGIS Online

In this step, we'll make sure that attachments can be stored with features, ensure that ownership of editing contributions is being tracked, and that data are configured for export to other formats and for offline use.

- Log in to ArcGIS Online (sfsu.maps.arcgis.com).
  - Go to "My Content" and click on your newly created feature layer
  - In the "Overview" tab, click on the "Enable Attachments" option for each of the layer(s). This will allow you to store photo attachments with features if you are using a phone or tablet with a camera.
  - Next click the "Settings" tab, and scroll down to the "Feature Layer Settings" section.
  - Check the boxes next to "Enable editing", "Keep track of created and updated features", "Keep track of who created and last updated features," and "Enable Sync". The third setting will allow you to easily identify who made what contributions. The last will allow you to contribute data offline in areas where there is limited wifi or mobile data access and then sync changes back to the main dataset once you are back in range. Save.
  - Scroll way down to the "Export Data" section, and check the box to "Allow others to export to different formats." This will allow users to download the data so that it can be used in non-ArcGIS Online applications. Save.
  - Make sure to save these settings by clicking on the "Save" buttons.
  - Back in Overview, click Share to share the feature service with the necessary folks, including SF State ArcGIS Online and at least one group – the Field Methods group is needed for our class, for instance, or there may be a group for your class or research group.
  - Configure popups in the Visualization tab, for instance to set latitude and longitude to 8 decimal places, and turn off editing for data sent by the receiver (latitude, longitude, etc.).

Quadfeatures\_gdb Overview Data Visualization

Layer: Generic\_point

Pop-up Contents

Display: A list of field attributes

These field attributes will display:

- H\_RMS [ESRIGNSS\_H\_RMS]
- V\_RMS [ESRIGNSS\_V\_RMS]
- LATITUDE [ESRIGNSS\_LATITUDE]
- LONGITUDE [ESRIGNSS\_LONGITUDE]

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 checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{ESRIGNSS_LATITUDE}	LATITUDE
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{ESRIGNSS_LONGITUDE}	LONGITUDE
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{ESRIGNSS_ALTITUDE}	ALTITUDE
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	{ESRIGNSS_FIXDATETIME}	FIXDATETIME

Format: 8 decimal places

Use 1000 Separator

Hint:

Attribute Expressions

Adding expressions allows you to create