

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.

- In ArcCatalog create a new file geodatabase (.gdb) in a folder of your choosing. Remember, to create a new file geodatabase right-click on the desired folder where you want the new geodatabase to be located and select the option 'New' >> 'File Geodatabase' from the options provided. Give the new file geodatabase a title that will make sense given the nature of your work and the to-be-published feature service. In this instance we are creating various features in and around the Quad at SFSU, so we should name the new geodatabase "Quadfeatures."

2. Define geodatabase domains

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

- In the Catalog, right-click the **Quadfeatures** geodatabase and select **Properties**. Select the tab labeled 'Domains' and do the following:
 - In the first row of the first table within the **Domains** tab, type `Color` under Domain Name and `Lamp Post Color` under Description.
 - In **Domain Properties** table, the second table within the **Domains** tab, establish the **Field Type** as 'Text.' Doing so will then populate the **Domain Type** as 'Coded Values.'
 - In the **Coded Values** table, the third table within the **Domains** tab, enter the following values, one per row, with identical descriptions:
black, white, red, green, blue, purple, unpainted
 - Click Apply, then OK

- 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** it is a good idea, in most cases, to have both the **Code** and the **Description** be identical. However, in this lab we will be using the Latin name of tree species/genera for the code and the common name of tree species/genera for the description (see table below for further clarification). *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 |
| | | Cupressus spp. | Cypress |
| | | Eucalyptus spp. | Eucalyptus |
| | | Liriodendron spp. | Tulip tree |
| | | Pinus spp. | Pine |
| | | Quercus spp. | Oak |
| | | Rhododendron spp. | Rhododendron |
| | | Salix spp. | Willow |
| | | Sequoia spp. | Redwood |
| | | 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 | | |
| Other | Other (in Comments) | | |
| Unknown | Unknown | | |
| 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 window of ArcMap and create a new feature class (right-click **Quadfeatures** geodatabase, navigate to 'New,' and then select 'Feature Class'). A **New 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. Default the rest of the settings and click 'Next' to go through the steps of the wizard.
- The final step within the wizard is for the establishment of **Fields** for the new feature class. Establish the **Fields** for each new feature class according to the table below. 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.
- One final point, for the **Tree** feature class, allow users to take **pictures** and attach them to the features collected. To do this you will need to enable attachments in Catalog by right-clicking the Tree feature class, navigating to 'Manage' and selecting 'Create Attachments.'

| 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 |
| MaintCover | Maintenance hole cover | Point | comment | Text | |
| | | | id | Text | |
| | | | user_name | Text | |
| | | | label | Text | MaintLabel |
| Path | Path | Polyline | comment | Text | |
| | | | id | Text | |
| | | | user_name | Text | |
| | | | surface | Text | Surface |
| Tree | Tree | Point | comment | Text | |
| | | | id | Text | |
| | | | user_name | Text | |
| | | | species | Text | TreeSpecies |
| | | | circumBH | Float | |
| | | | ht_distance | Float | |
| | | | ht_upangle | Float | |
| | | | ht_downangle | Float | |
| | | | health | Text | TreeHealth |
| photo | Raster | | | | |
| Generic_point | Generic point feature | Point | comment | Text | |
| | | | id | Text | |
| | | | user_name | Text | |
| Generic_line | Generic polyline feature | Polyline | comment | Text | |
| | | | id | Text | |
| | | | user_name | Text | |
| Generic_polygon | Generic polygon feature | Polygon | comment | Text | |
| | | | id | Text | |
| | | | user_name | Text | |

- 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.

| 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 |

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. *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 ArcMap, sign in to ArcGIS Online (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.
 - 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.
 - 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 CEL program is needed for the CEL GPS 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.).