Fix data when it appears in the wrong place

Use the Define Projection tool to replace missing coordinate system information.

Duration	Difficulty
10mins	Beginner

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A colleague sent you some spatial data for a flood mapping project you are working on in England. Unfortunately, when you add the data to a map, it appears in the wrong part of the world. When data appears in the wrong location, it usually means that the coordinate system is not defined, or it is defined incorrectly. When this occurs, you must do some research to find the name of the correct coordinate system. In this lesson, you'll learn how to use the **Define Projection** tool to align data to the correct geographic location.

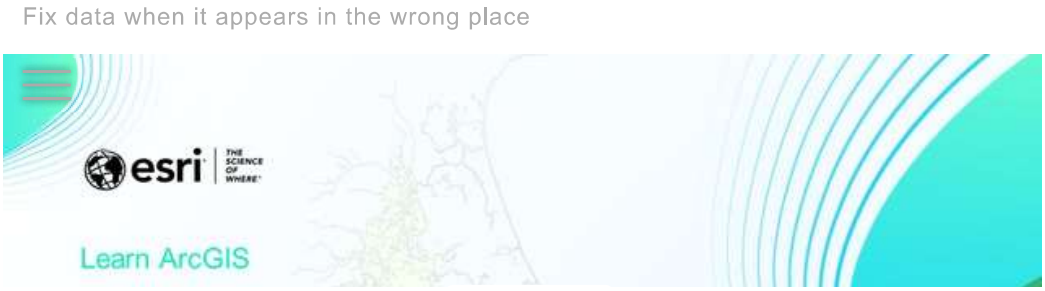
This lesson was last tested on June 3, 2022, with ArcGIS Pro 3.0. If you're using a different version of ArcGIS Pro, you may encounter different functionality and results.

Requirements

- ArcGIS Pro Basic

Video

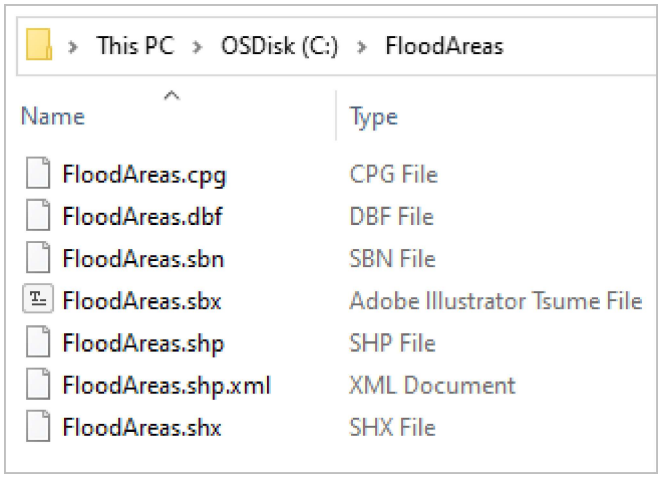
This lesson is also available as a video.



Review the data

First, you'll download and view the data that your colleague sent to you.

1. Download the FloodAreas.zip file and unzip it to a location on your computer, for example, your drive C.
2. Open the unzipped **FloodAreas** folder.

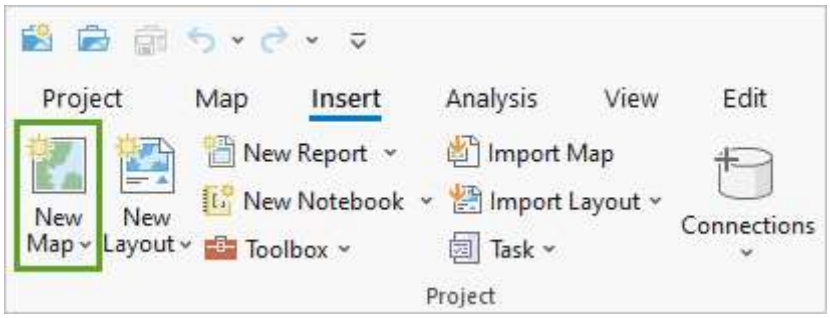


It contains seven files. Together, these files make a shapefile, a spatial data format. There is no file named FloodAreas.prj, which would normally contain the coordinate system information.

3. Open ArcGIS Pro. If prompted, sign in to your ArcGIS account.

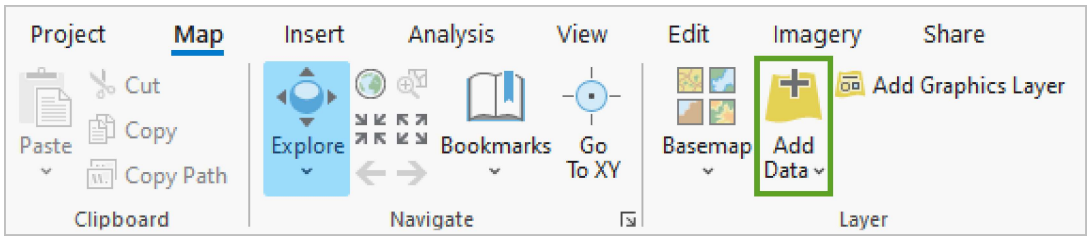
> **Note:**
>
> If you don't have ArcGIS Pro or an ArcGIS account, you can sign up for an ArcGIS free trial.

4. On the ArcGIS Pro start screen, under **New Project**, click **Start without a template**.
5. On the ribbon, on the **Insert** tab, in the **Project** group, click **New Map**.



A map of the world appears.

6. On the ribbon, on the **Map** tab, in the **Layer** group, click **Add Data**.



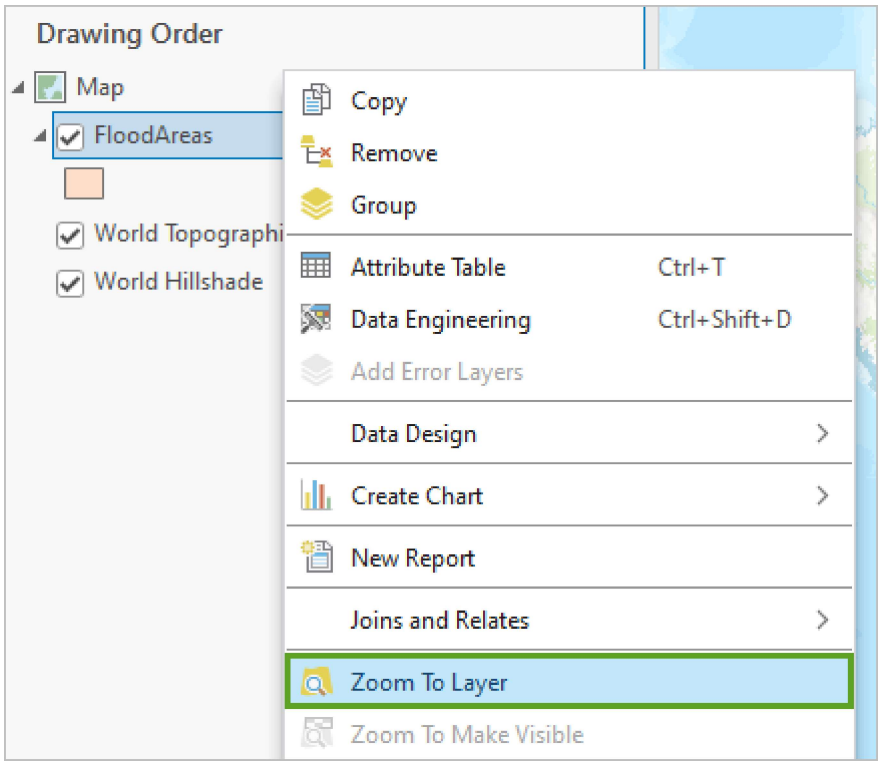
7. In the **Add Data** window, browse to the **FloodAreas** folder.

Only one of the seven files you saw earlier is visible inside the **FloodAreas** folder. Shapefiles are stored as multiple files but act as one layer in GIS.

8. Click **FloodAreas.shp** and click **OK**.

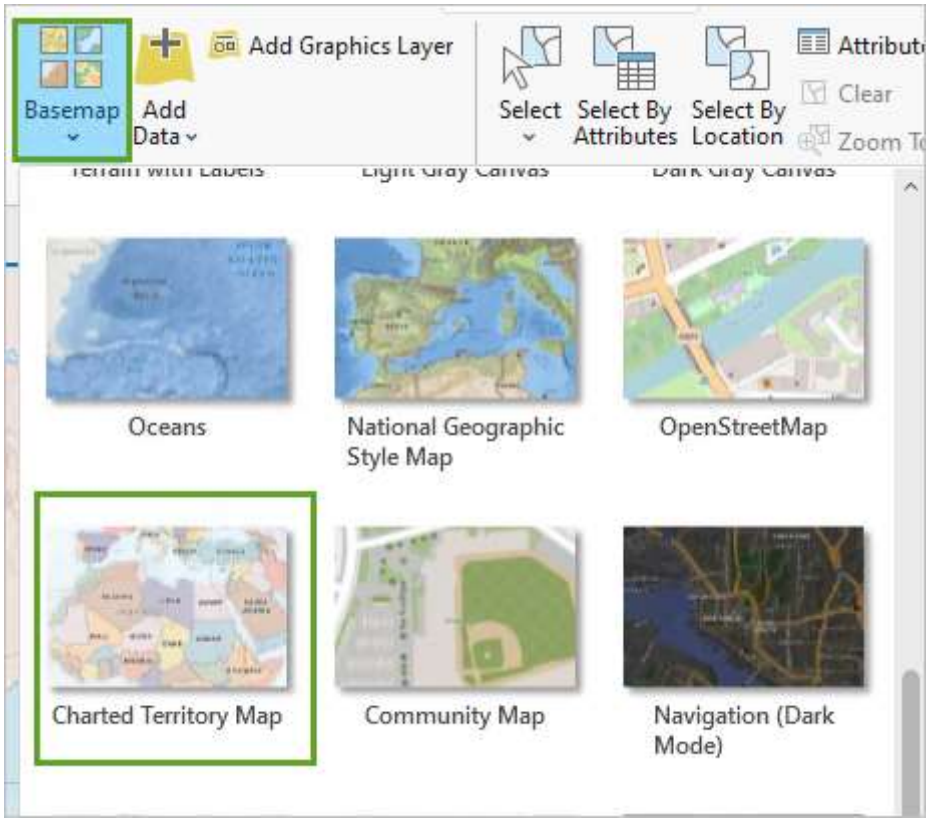
   A new layer appears in the **Contents** pane. It is difficult to see on the map because it is very small.

9. In the **Contents** pane, right-click **FloodAreas** and choose **Zoom To Layer**.



   The map does not zoom to England, as you expected. Instead, the map data appears in the middle of the ocean.

10. Zoom out until you can see the west coast of Africa.
11. On the ribbon, on the **Map** tab, in the **Layer** group, click **Basemap** and choose **Charted Territory Map**.



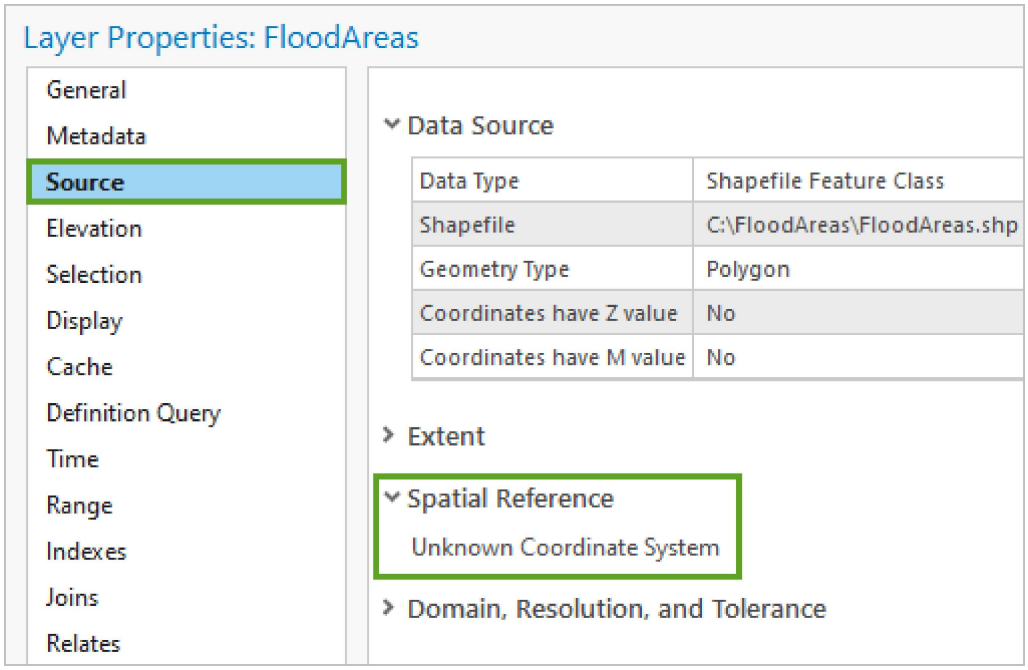
Note:

If **Charted Territory Map** is not present in the **Basemap** gallery, you can skip this step and continue using the existing basemap.

The flood data is positioned near the place where the prime meridian and the equator meet: 0 degrees latitude and 0 degrees longitude, a place that is sometimes referred to as Null Island. When data draws at Null Island, it usually means that the layer is missing the metadata that defines its coordinate system.

In this case, the data doesn't draw at Null Island, but it is nearby, so it is likely the same problem. You'll check to see if this layer has a coordinate system defined.

12. In the **Contents** pane, right-click **FloodAreas** and choose **Properties**.
13. In the **Layer Properties** window, click **Source**. Expand the **Spatial Reference** section.



This layer has an unknown coordinate system.

14. Click **Cancel**.

Find the correct coordinate system

The FloodAreas layer has coordinates that define the latitude and longitude of every vertex, but it doesn't know which coordinate system they belong to. You'll do some research to try to find the correct coordinate system for this layer.

> **Note:**
> Latitude and longitude values are not enough to define location. You also need to know which coordinate system the coordinates are in. To learn why, read the Geographic vs Projected Coordinate Systems ArcGIS Blog article.

You asked your colleague where they found the data. They told you that it's a subset of a larger dataset from the Environment Agency. You'll visit the link they provided and search for coordinate system information.

1. Go to the Environment Agency: Flood Map for Planning (Rivers and Sea) - Flood Zone 2 item page. Search for the words coordinate system, spatial reference, and projection.

   No coordinate system is mentioned on this page. You'll have to search further.

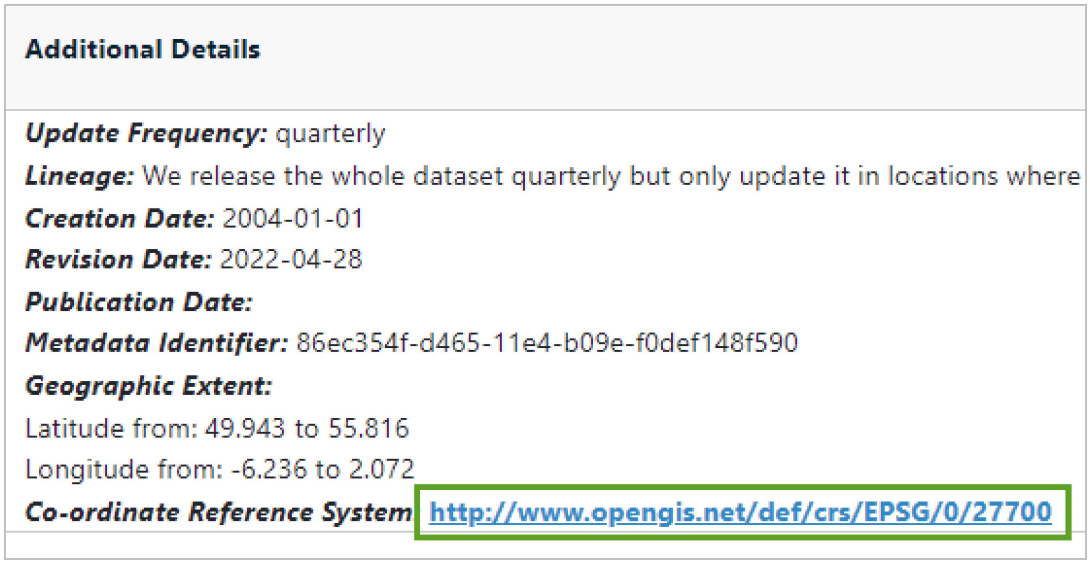
2. Click the **Defra Data Services Platform** link and search for the same words.

This page does not have the information that you need either.

3. Near the bottom of the page, click **Additional Details**.

   The last line of the **Additional Details** section says **Co-ordinate Reference System: http://www.opengis.net/def/crs/EPSG/0/27700**. EPSG stands for European Petroleum Survey Group. This group publishes a database of coordinate system information. If you can find a 4- or 5-digit EPSG number associated with your data, that is most likely an identifier code for the coordinate system. The 27700 at the end of the URL is probably the coordinate system of the Flood Areas data.

4. Click **http://www.opengis.net/def/crs/EPSG/0/27700**.



An XML file appears. It contains a variety of 4- or 5-digit codes, but only 27700 is mentioned twice:

- gml:id="epsg-crs-27700
- <gml:identifier codeSpace="EPSG">27700</gml:identifier>

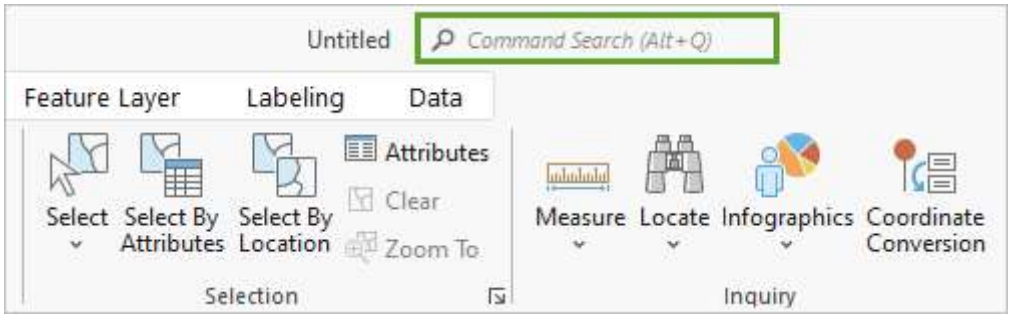
The name British National Grid is also mentioned twice. This is the national coordinate system for Great Britain. Most likely 27700 is the EPSG code for this coordinate system.

5. Close the web browser.

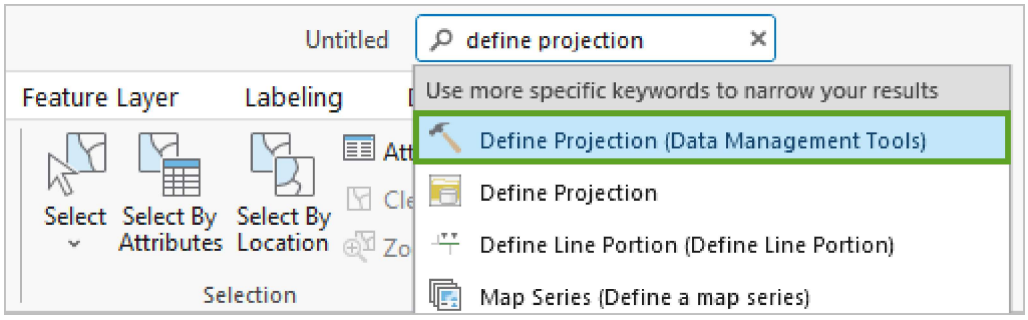
Update the layer

You have probably found the correct coordinate system for the data. Next, you'll define the layer's coordinate system as British National Grid to see if it draws in the correct location. You'll use the **Define Projection** geoprocessing tool.

1. Return to **ArcGIS Pro**. Above the ribbon, click **Command Search**.

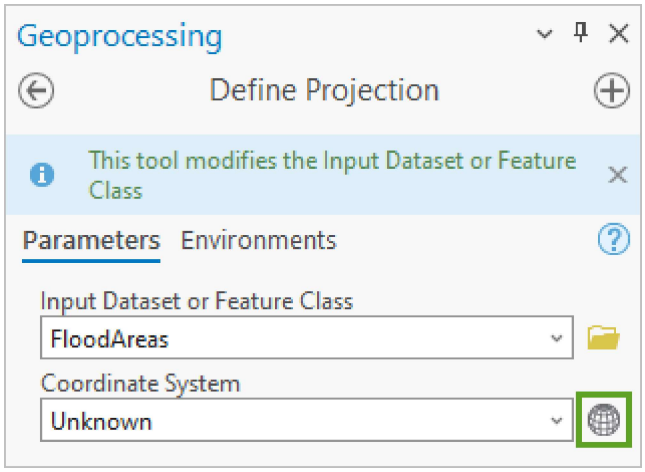


2. Type define projection. In the search results, click **Define Projection (Data Management Tools)**.



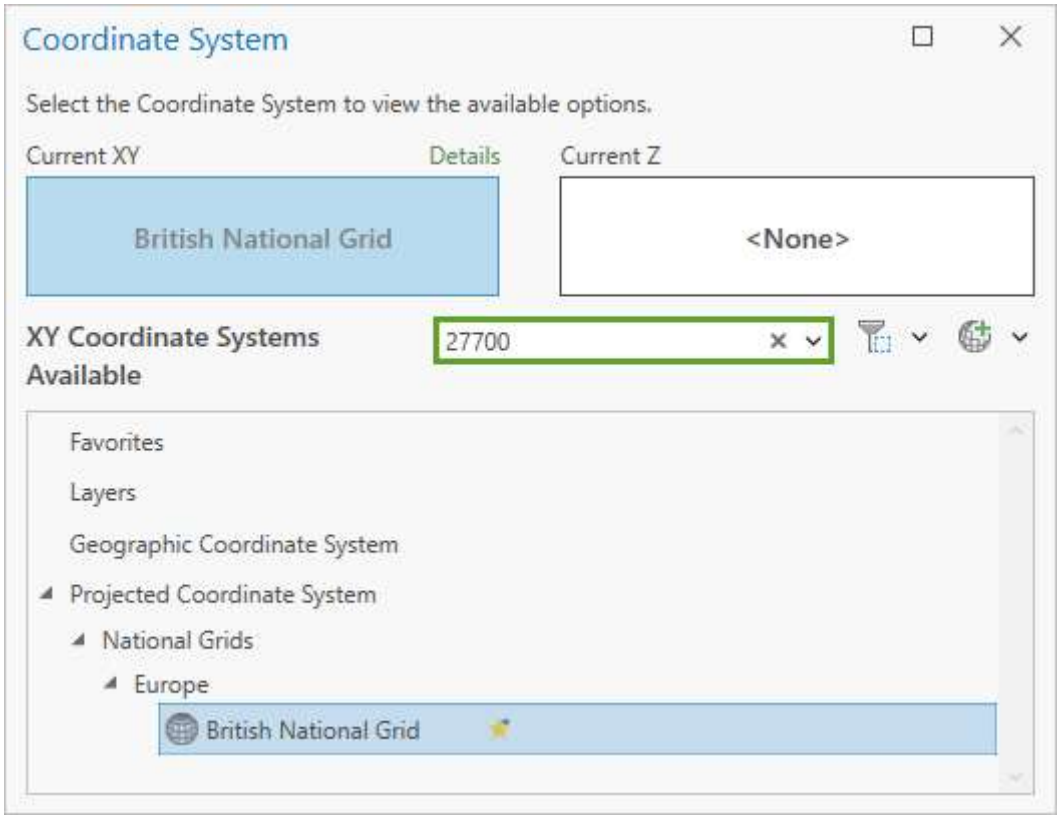
The **Geoprocessing** pane appears.

3. For **Input Dataset or Feature Class**, choose **FloodAreas**.
4. For **Coordinate System**, click the **Select coordinate system** button.



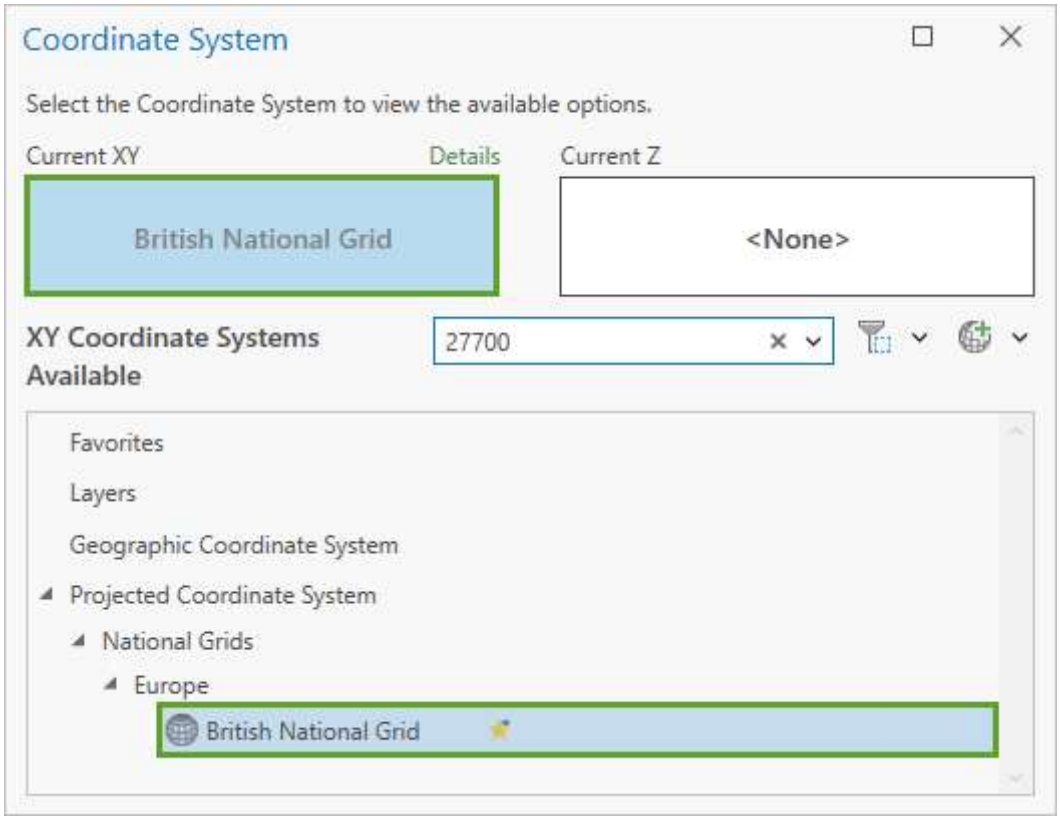
The **Coordinate System** window appears.

5. In the **Search** bar, type 27700 and press Enter.



The **XY Coordinate Systems Available** list filters. The only item that meets the search criteria is **British National Grid**.

6. Click **British National Grid** to ensure that the **Current XY** button updates to this coordinate system.



7. Click **OK**.

   The **Define Projection** tool will not create a new layer. Instead, it modifies the metadata of the exiting layer. The **FloodAreas** layer has no coordinate system defined yet, so no information will be overwritten or lost.

   Caution:

   If you are using the **Define Projection** tool on a layer that you believe has the wrong coordinate system information, be sure to write down the name of the original coordinate system before running the tool. The only way to undo the tool is to run it again and redefine the original coordinate system.

8. Click **Run**.

   The map redraws and the data disappears from the ocean.

9. In the **Contents** pane, right-click **FloodAreas** and click **Zoom To Layer**.

   The data draws in its expected location, on either side of the Humber estuary on the east coast of England. It aligns with the landscape on the basemap. British National Grid is the correct coordinate system for this layer.

   Note:

> To learn more about when to use the **Define Projection** tool, read the Define Projection or Project? ArcGIS Blog article.

10. Close ArcGIS Pro.

    There is no need to save the map. The changes you made in this lesson were applied to the data, rather than the map. When you add the **FloodAreas** layer to any new map, it will draw in the correct location.

In this lesson, you determined that a layer was drawing in the wrong location because it had no coordinate system defined. You researched to find the missing coordinate system name and used the **Define Projection** tool to update the layer. You successfully repaired the data to make it draw in the correct location.

You can find more lessons in the Learn ArcGIS Lesson Gallery.

Acknowledgements

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