

Exercise 1: Geodatabase - Introduction to Geodatabases



Introduction

In this exercise, you will learn how to create a File geodatabase. You will then create new Feature Datasets and Feature Classes and their attributes. Finally, you will practice importing existing data from supplementary geodatabases and set up connections in ArcCatalog to Forest Service SDE geodatabases and to ESRI map services.

Upon completion of this exercise, you will be familiar with:

- Creating a File Geodatabase
- Defining a spatial domain by creating a Feature Dataset
- Creating a feature class
- Connecting to an ArcGIS Server map service
- Connecting to a multi user, SDE database

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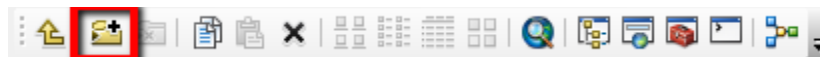
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Part 1: Connect to the Course Data & Create a File Geodatabase

A geodatabase stores spatial and tabular data in related tables. A primary benefit of using geodatabases over older storage formats, such as shapefiles, is having better data quality control. A goal of this exercise is to teach how to make a new geodatabase and how to populate it with a new feature dataset and feature class using ArcCatalog. For your information, a similar process can also be completed through ArcMap.

A. Start ArcCatalog.

1. Start ArcCatalog by clicking on the **Start** button and navigating to **All Programs | ArcGIS | ArcCatalog 10..** The ArcCatalog window opens
2. Create a folder connection to the Data folder and review its contents.
3. Click the **Connect To Folder** button on the Standard toolbar. Alternatively, you can right-click the Folder Connections node and choose Connect Folder.



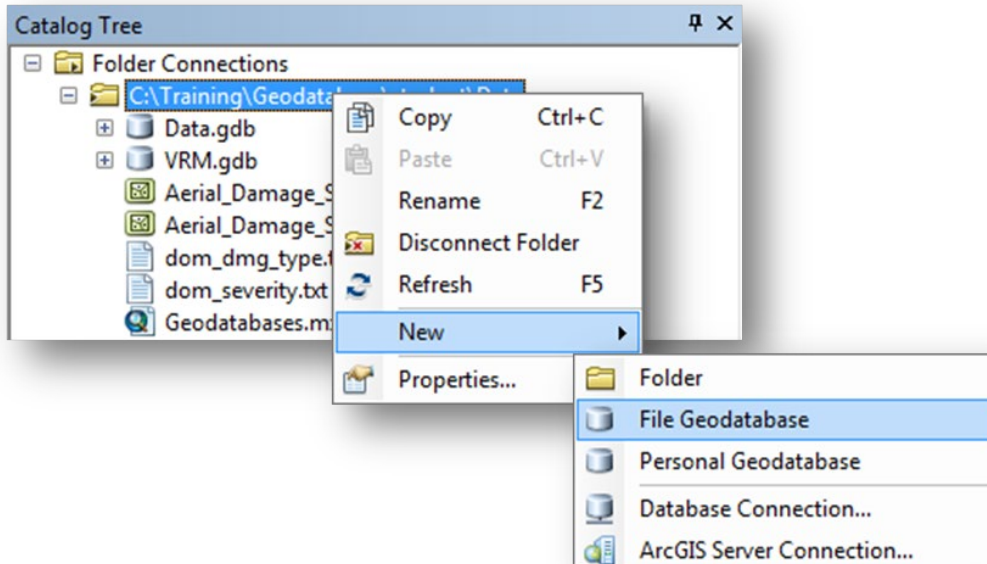
4. Navigate to the location where you stored the course data. It should unzip to a folder called **Geodatabases** and contain a folder called **Data**. Henceforth referred to as the **../Data** folder.
5. Single mouse click to highlight the folder, and click **OK** to establish the folder connection.
6. Expand the **...\Data** folder within the **Catalog Tree** window.

*Within the contents of the **...\Data** folder are two File Geodatabases (.gdb), two ArcGIS Shapefiles (.shp), two text files (.txt) and an ArcMap Map document (.mxd). This exercise walks you through the process of creating a file geodatabase, a feature dataset and how to import features into the dataset.*

QUESTION - How do you know the Geodatabase is a "File" Geodatabase?

B. Create a File Geodatabase.

1. From the Catalog Tree, right-click the **...\Data** folder, then click **New | File Geodatabase**.



2. Rename the new File Geodatabase **Bitterroot.gdb**. Hint: Right-click the new geodatabase and select Rename.

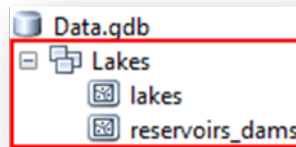
Contents Preview Description	
Name	Type
Bitterroot.gdb	File Geodatabase
Data.gdb	File Geodatabase
VRM.gdb	File Geodatabase
Aerial_Damage_Survey_2015.shp	Shapefile
Aerial_Damage_Survey_2016.shp	Shapefile

FYI: Another option to create a File Geodatabase is the Create File GDB tool in ArcToolbox. (ArcToolbox > Data Management > Workspace)

Now, let's create a Feature Dataset and a Feature Class to populate the Geodatabase created in the previous step. When creating a Feature Dataset, you will also define its spatial reference. This includes the coordinate system used to store each feature class or raster dataset, as well as other coordinate properties such as the coordinate resolution for X,Y coordinates and optional Z (elevation) and M (measure) coordinates.

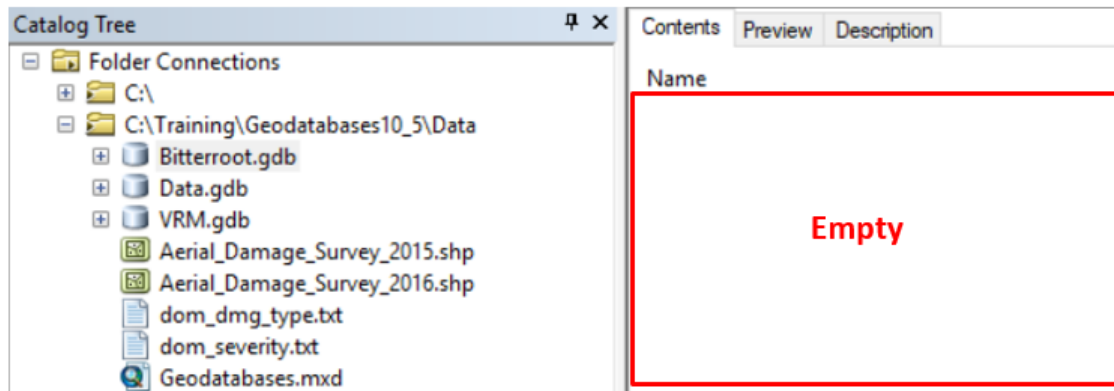
Part 2: Create a Geodatabase Feature Dataset and Feature Class

What is a feature dataset? A feature dataset is a collection of feature classes stored together that share the same spatial reference; in other words, they share a coordinate system, and their features fall within a common geographic area. Feature classes with different geometry types (point, line or polygon) may be stored in the same feature dataset.



A. In ArcCatalog, display the contents of the Bitterroot.gdb File Geodatabase.

1. In the Catalog Tree, highlight the **Bitterroot.gdb**.
2. Select the **Contents** Tab. The File Geodatabase does not contain any feature classes.



B. Create a new Feature Dataset within the Bitterroot.gdb File Geodatabase.

1. In the Catalog Tree, right-click on **Bitterroot.gdb** | **New** | **Feature Dataset**. The *New Feature Dataset* dialog opens.
2. For the Feature Dataset's name, enter **Bitterroot_NF**. The semi-cryptic name represents Bitterroot National Forest.
3. Click **Next**.

Each Forest unit in the Forest Service displays and manages geographic data using a spatial domain specific to their area of the globe. This limits a forest to maintain data within the boundaries of their forest and allows for higher accuracy when editing and/or analyzing the datasets in their Forest.

To assist with this effort, we will define a spatial domain. The spatial domain will reference a UTM NAD 1983 Zone 11N (Universal Transverse Mercator, North American Datum 1983).

What is a spatial domain?

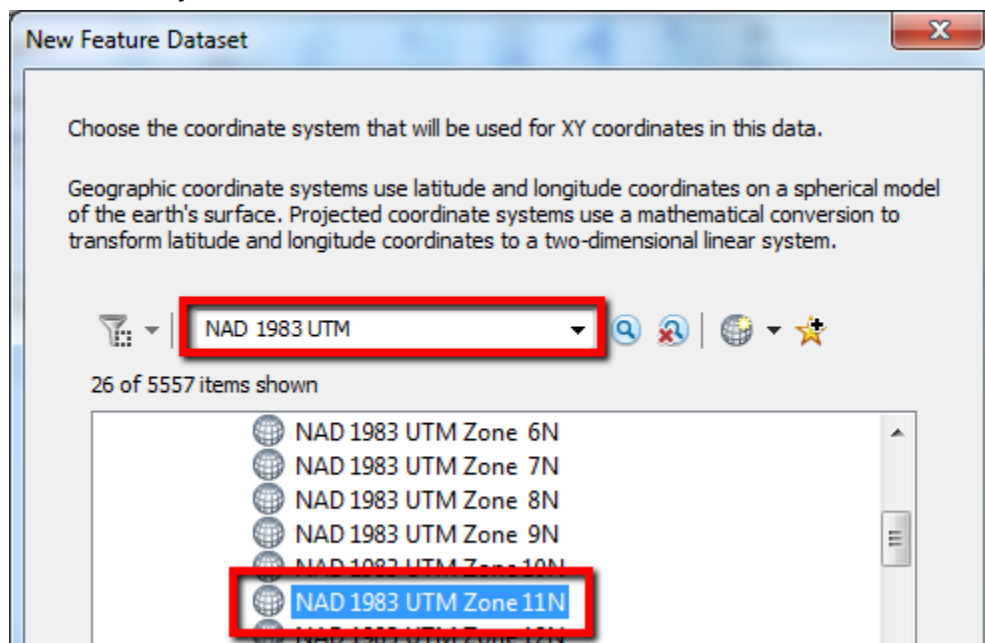
Stored within a spatial domain are the geographic extent (i.e., horizontal and vertical range) and the coordinate system used to establish the spatial environment for the related feature classes. For example, GIS datasets used within your agency might have a spatial domain of your district's or forest's boundaries and use a spatial reference of UTM.

The creation of a spatial domain is essentially a two-step process:

- 1) You create a Feature Dataset, and
- 2) You specify the Feature Dataset's coordinate system.

Any feature class you create within the Feature Dataset will use the spatial domain defined.

4. For the Feature Dataset's horizontal (XY) coordinate system, expand **Projected Coordinate Systems | UTM | NAD 1983**. Or type 'NAD 1983 UTM' into the Search Dialog and press enter to filter the results.
5. Highlight **NAD 1983 UTM Zone 11N**. Notice the message above the bottom window that states 26 out of 5557 items were found in the search.

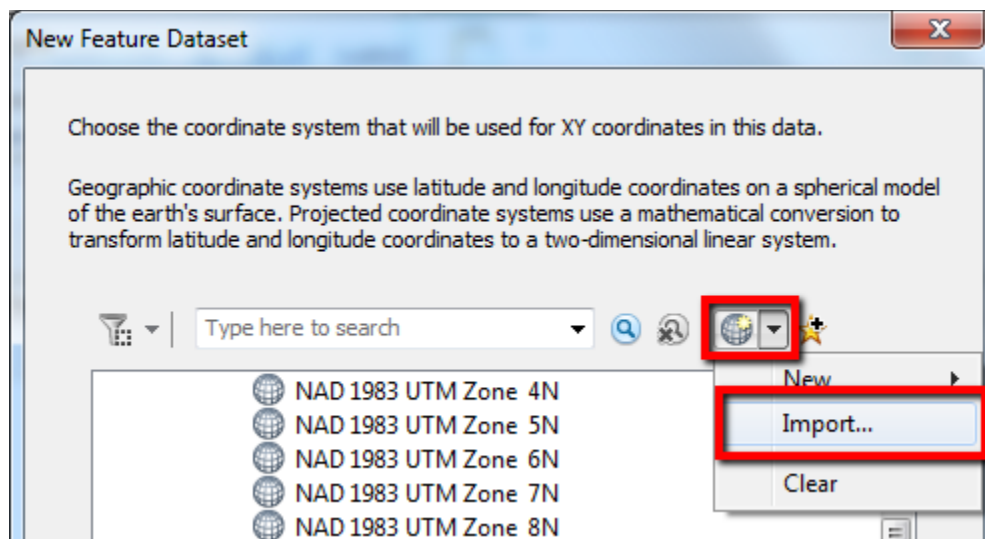


6. Clear the search by clicking the **Clear Search** button.

At this point, we could click Next and move forward, but let's look at another method for defining the X,Y Coordinate. By importing an existing dataset we can import the spatial reference properties from that dataset (coordinate system, domains and tolerances).

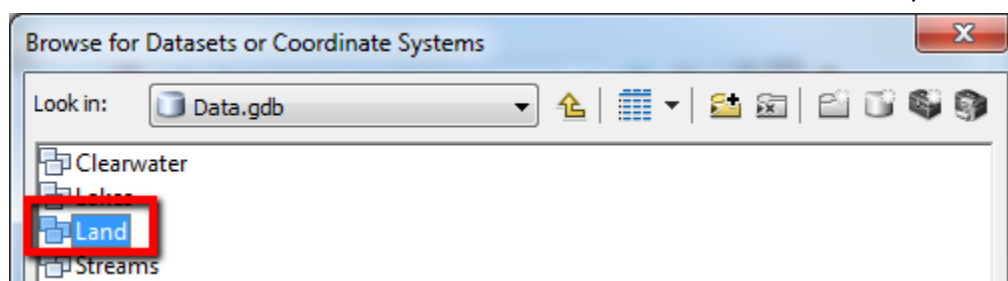
7. Click the dropdown arrow adjacent to the **Add Coordinate System** button.

8. Select **Import**.

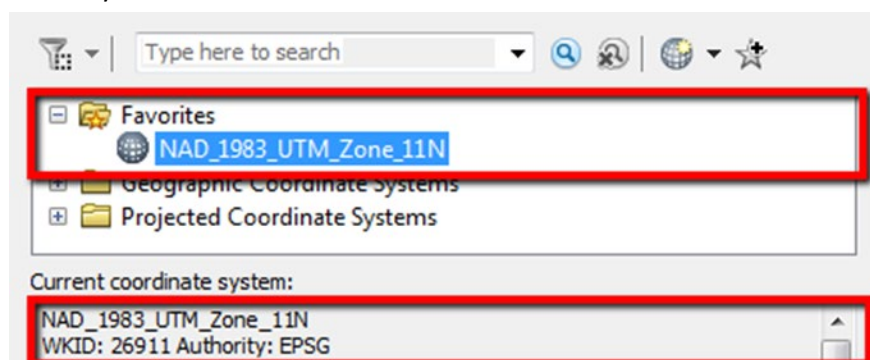


9. Navigate to .../Data/Data.gdb.

10. From the Browse for Datasets or Coordinate Systems window, highlight **Land**, then click **Add**. The Land dataset references a NAD 1983 UTM Zone 11N coordinate system.

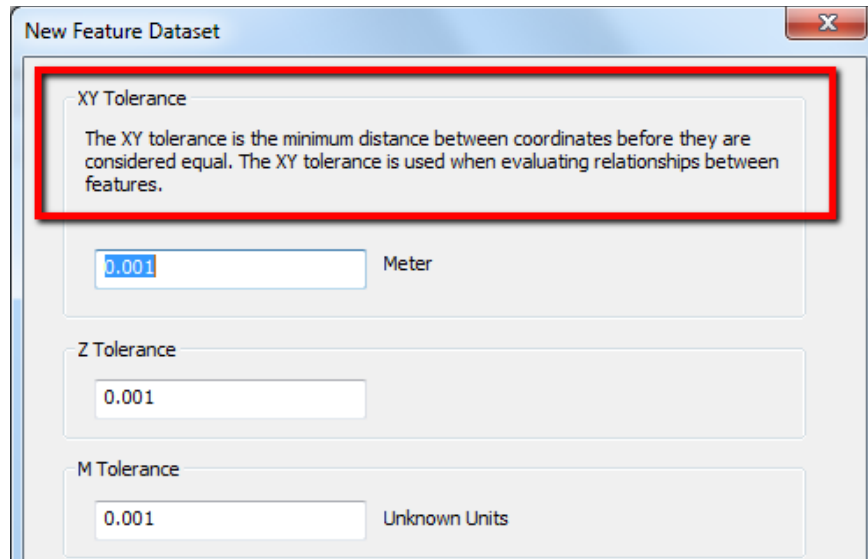


11. Click **Next**. The Coordinate System is listed under Favorites and is identified as the Current Coordinate System for the new feature dataset.



In the next window, you can specify a different spatial reference for vertical (Z) coordinates. For example, if you have elevation data recorded in feet, you would want to select a coordinate system with

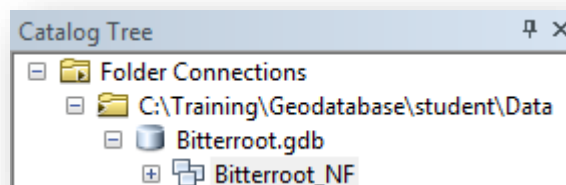
*Map Units of feet (e.g., State Plane). In this exercise, the ADS polygons have no vertical information. **We will skip defining a vertical coordinate system.***



What is the XY Tolerance? The unit for the XY Tolerance is based on the coordinate system you selected for the Feature Dataset. Because we choose NAD 1983 UTM Zone 11N, the unit for XY Tolerance is meters. Based on the default XY Tolerance value, two coordinates need to be within 1/1000 (i.e. a millimeter) of a meter before they are treated as the same coordinate.

What is the M Tolerance? The letter M represents linear measurements along routed features (e.g., M could be the road distance between two cities). For more information on M values, perform an Index-help search on “linear referencing.”

12. Accept the defaults for Z Coordinates and click **Next**.
13. We will accept the default tolerance values. Without any changes, click **Finish**. The *Bitterroot.gdb* contains the new *Bitterroot_NF* feature dataset.



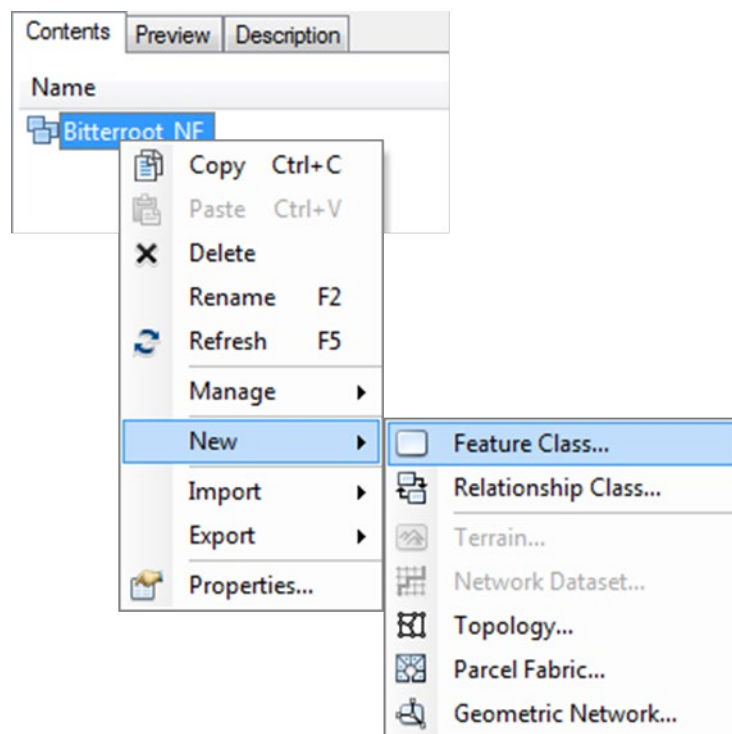
C. Create a new Feature Class inside the Bitterroot_NF Feature Dataset.

Now we will populate the Bitterroot_NF feature dataset with a feature class. Geodatabase feature classes can store geographic features represented as points, lines, polygons and annotations, and their attributes. Feature classes that are outside a feature dataset are called standalone feature classes.

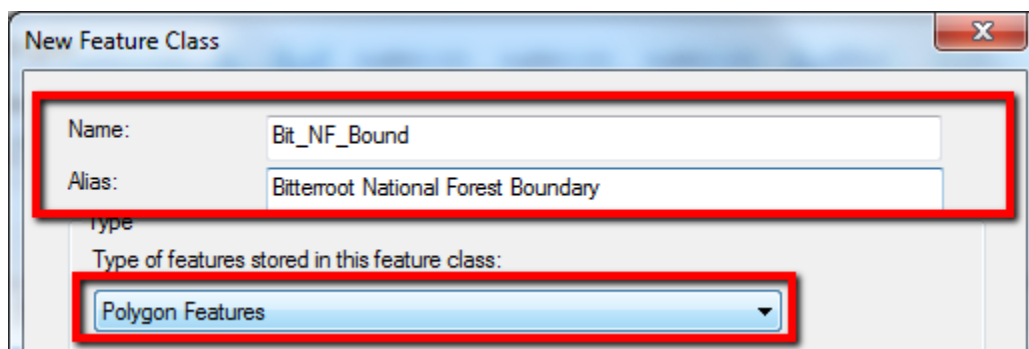
The remainder of this step will demonstrate creating a feature class and defining its properties.

Note: Only the person who creates a feature dataset can add feature classes to it.

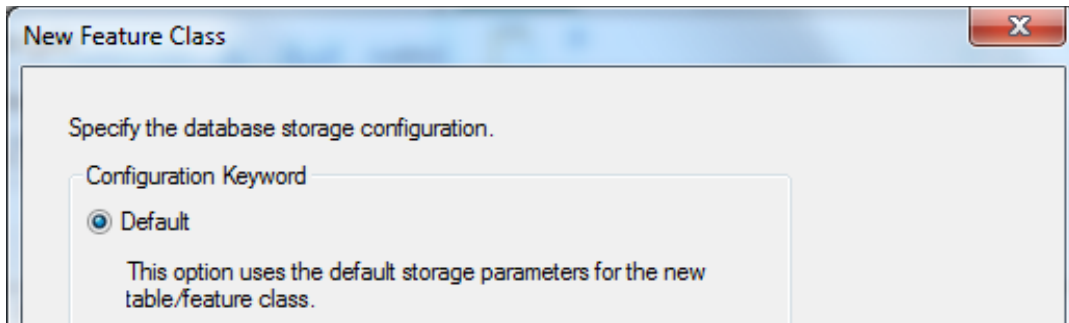
1. Right-click on the **Bitterroot_NF Feature Dataset | New | Feature Class**. The New Feature Class dialog appears. This new feature class will store a polygon outlining the boundary of Bitterroot National Forest.



2. For the feature class's name, enter: **Bit_NF_Bound**
3. For Alias, enter: Bitterroot National Forest Boundary. (The alias is the layer's name as it appears in ArcMap's TOC.)



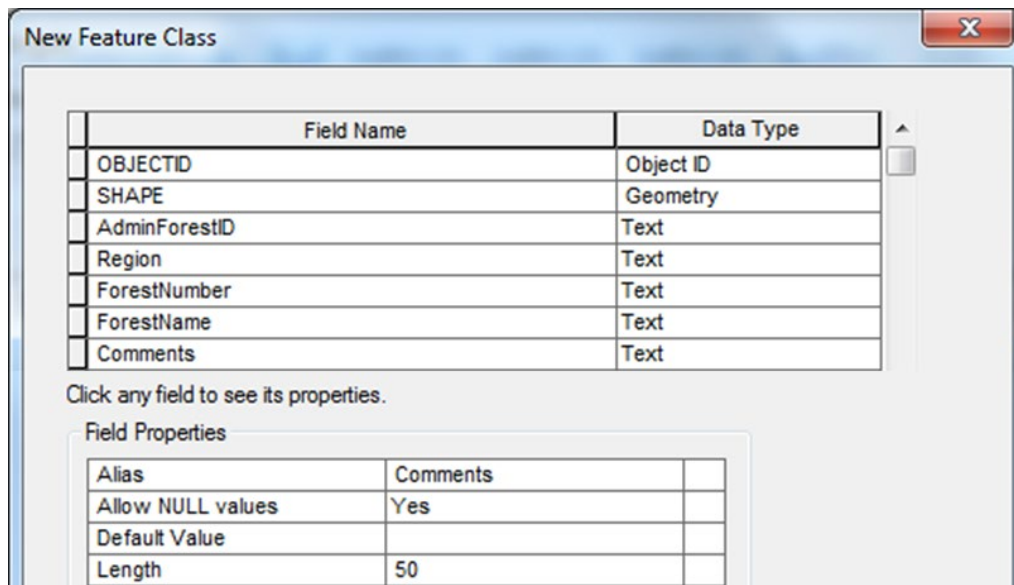
4. Ensure **Polygon Features** is selected for Type and since the dataset will not include Z or M values, we will leave Geometry Properties unchecked.
5. Click **Next**.
6. In the next window, accept the default storage parameters; click **Next**. (Note: Unless you are very familiar with these parameters, it is best to accept the default configuration settings).



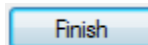
In the final dialog window, you can enter (or import) the attributes to be stored with the new feature class. By default, the feature class will have at least two system-generated attributes: OBJECTID and SHAPE.



7. Near the lower right corner of the window, click the **Import...** button.
8. Browse to ...\\Data\\Data.gdb\\Land\\AdministrativeForest.
9. Highlight **AdministrativeForest**, then click **Add**. The field names and attribute properties from the AdministrativeForest feature class are imported and added to the display.
10. Click the first empty box under Field Name, type **Comments**. Click the **<tab>** key on your computer's keyboard.
11. Select **Text** for Data Type.
12. Enter **50** for Length.

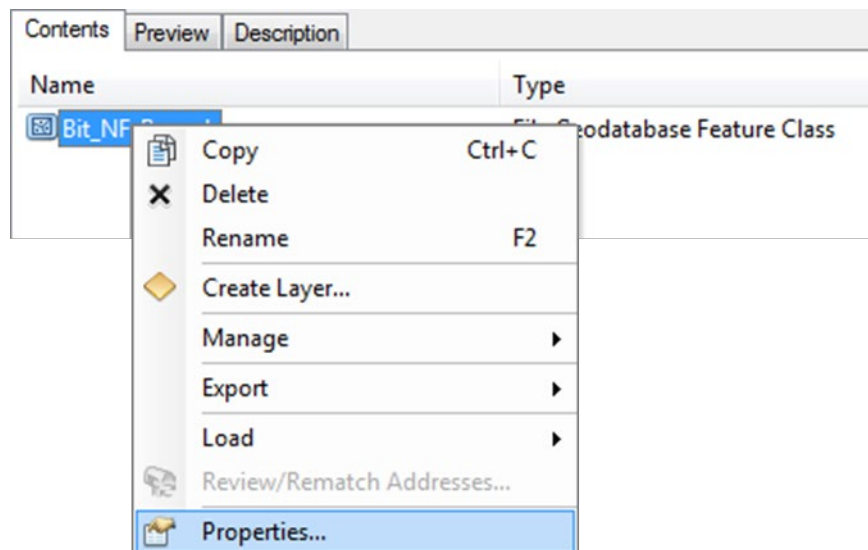


13. Click **Finish** to create the new feature class. *The new feature class is created.*

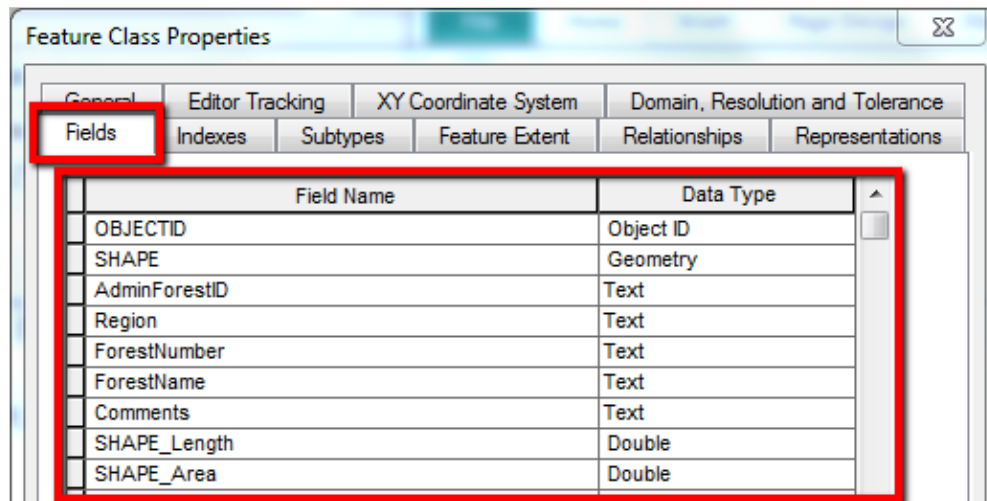


D. View the layer's properties to verify the new attribute fields were created.

1. From the Contents tab, right-click the **Bit_NF_Bound | Properties**. *The Properties dialog appears.*



2. Select the **Fields** tab. Your feature class should have all of the fields shown in the image above. Click **OK** to close the Properties dialog.



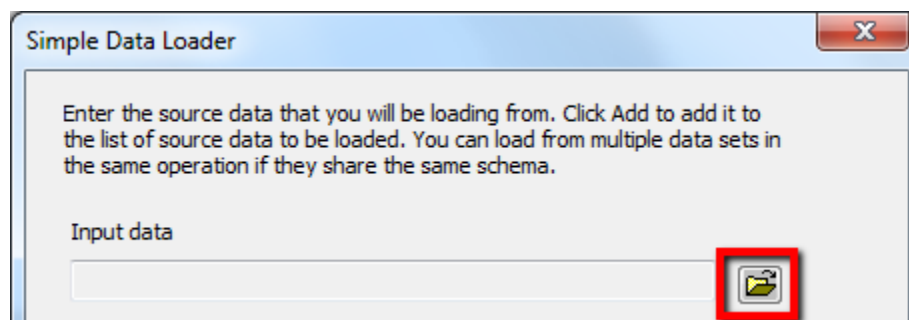
NOTE: When new feature classes are created within a geodatabase, fields are automatically added and maintained that store shape length for polyline feature classes and shape length and area for polygon feature classes. In personal and file geodatabases, these fields are called **Shape_Length** and **Shape_Area**.

Part 3: Load Data into an existing Feature Class

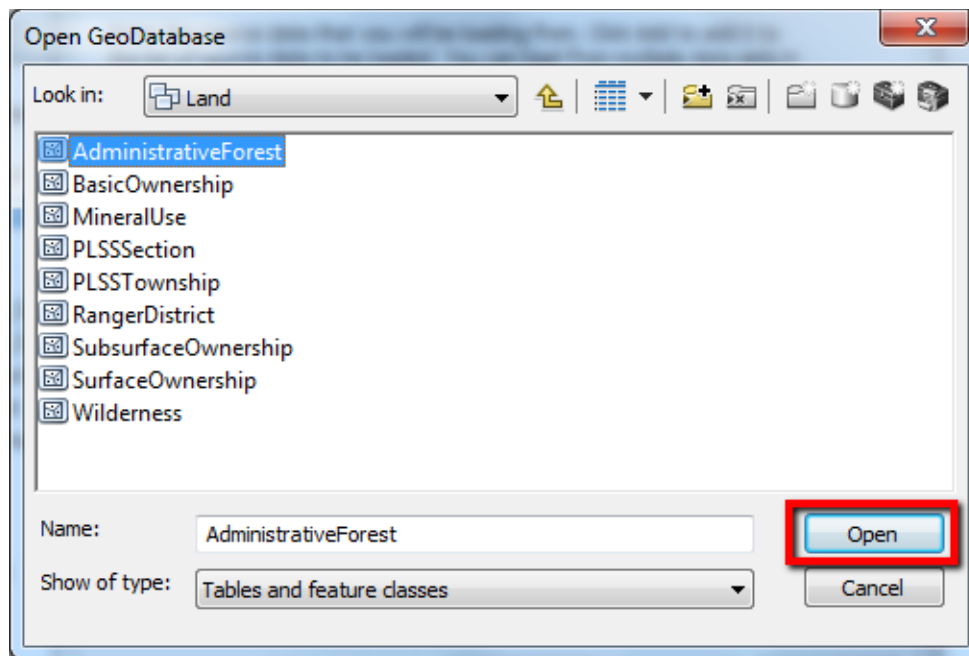
Instead of creating new features in a feature class, we often want to use existing data. For this step, we will populate the Geodatabase feature class created earlier by importing and copying GIS data from our local forest GIS library (Data.gdb).

A. Load data into the Bit_NF_Bound feature class.

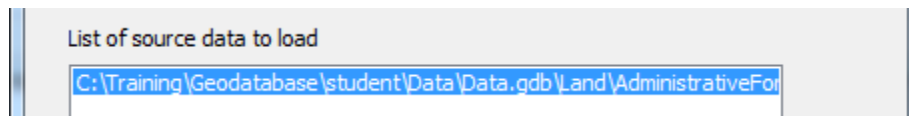
1. From the Catalog Tree, expand: ... \Data\Bitterroot.gdb\Bitterroot_NF.
2. Right-click the **Bit_NF_Bound** feature class, select **Load | Load Data**. The *Simple Data Loader* appears.
3. Read the opening screen from the Simple Data Loader, and then click **Next**.
4. For Input data, select the **Browse** button and browse to the ... \Data\Data.gdb\Land feature dataset.



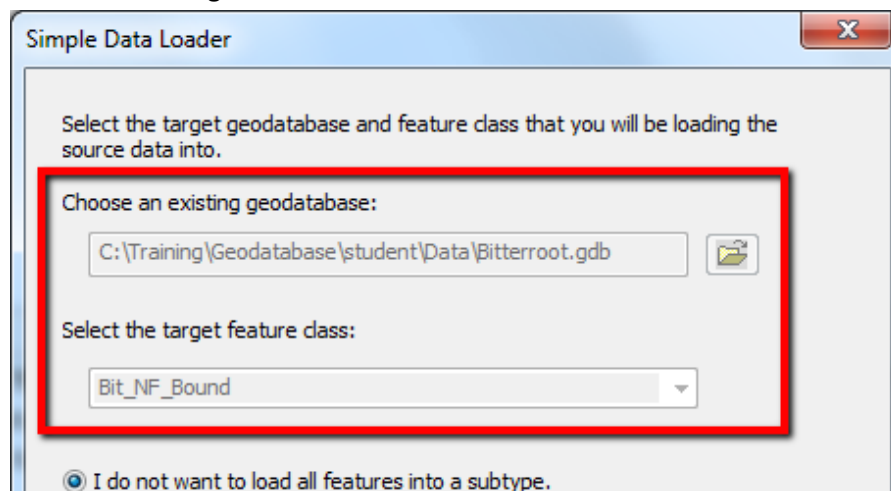
- Highlight the **AdministrativeForest** feature class, and click **Open**. The Simple Data Loader displays the path to the AdministrativeForest layer under Input data.



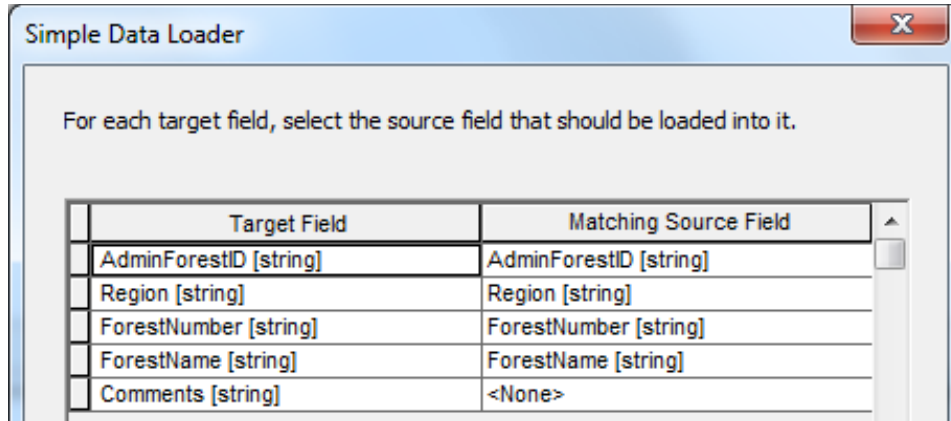
- Click the **Add** button. The layer is added to the **List of Source Data to load** window.



- Click **Next**.
- Because we started this wizard by right clicking the Geodatabase Feature Class for which we intended to load the data to, this page of the wizard is already populated with the correct geodatabase and target feature class. Click **Next**.



9. The next page of the loader allows you to specify the where the source attributes belong among the target attribute fields.



Simple Data Loader

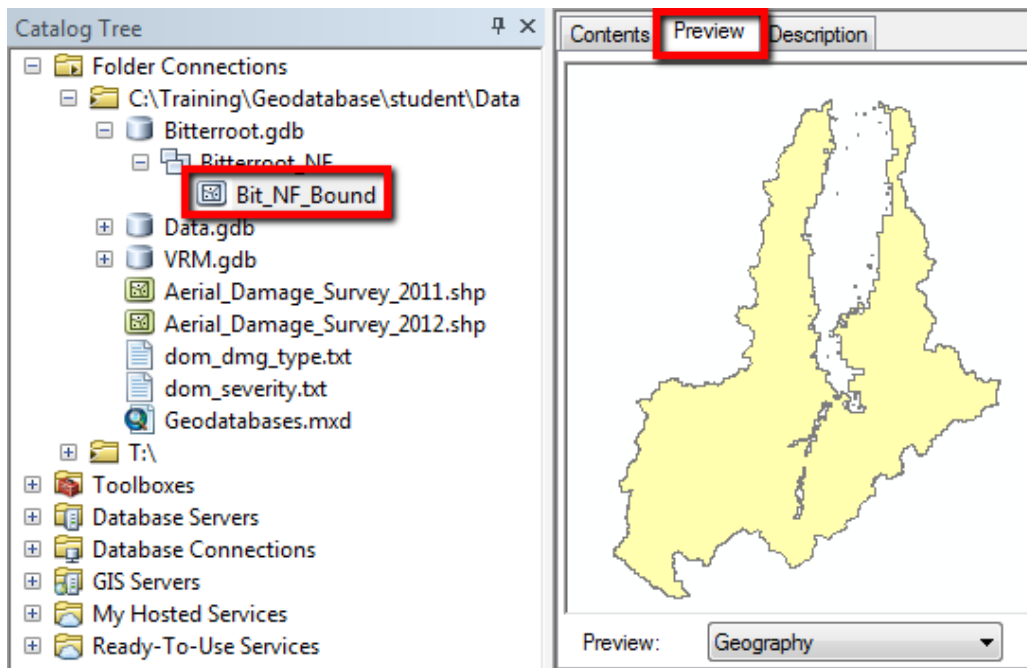
For each target field, select the source field that should be loaded into it.

Target Field	Matching Source Field
AdminForestID [string]	AdminForestID [string]
Region [string]	Region [string]
ForestNumber [string]	ForestNumber [string]
ForestName [string]	ForestName [string]
Comments [string]	<None>

10. Match the **Source Field** to the correct **Target Field** using the dropdowns.
 - i. Because **Comments** was created as a new field it will not have a Matching Source Field. Select **<None>** when you don't want data from a field in the source data to be loaded into the target data.
11. Click **Next**.
12. Ensure the radio button for **Load all of the source data** is enabled and click **Next**.
13. Review the Summary, and then click **Finish**.

B. Confirm the data was loaded into the Bit_NF_Bound feature class.

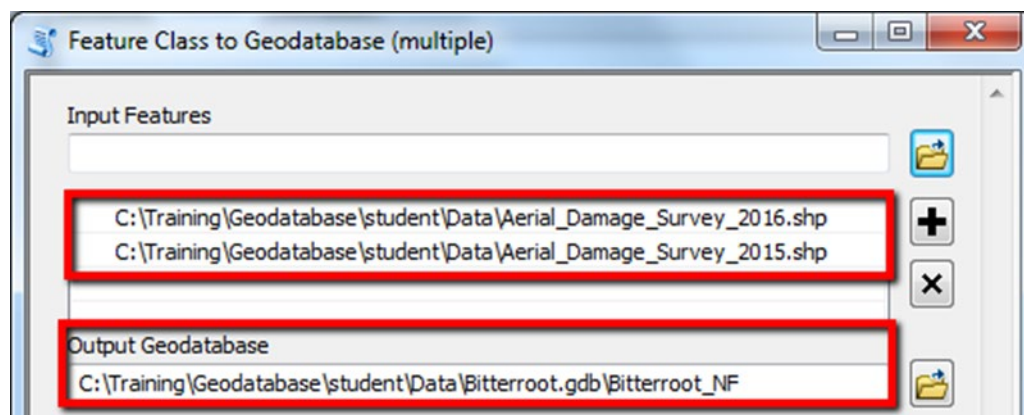
1. From the Catalog Tree, expand: ... \Data\Bitterroot.gdb\Bitterroot_NF.
2. Highlight **Bit_NF_Bound** in the Catalog Tree, and then preview the dataset by selecting the **Preview** Tab. *The boundary of Bitterroot National Forest should display in ArcCatalog's Preview panel.*



Part 4: Import Data into a Feature Dataset

A. Import existing data into the Bitterroot feature dataset.

1. From the Catalog Tree, expand: ... \Data\Bitterroot.gdb.
2. Right click Bitterroot_NF and select Import | Feature Class (multiple)...
 - i. The Feature Class to Geodatabase dialog appears.



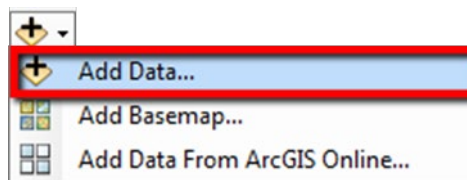
3. The parameters for the import dialog should be as shown below: HINT: Click the **Browse** button, navigate to and add both shapefiles.
4. Click **OK**. Verify the features were imported into the Feature Dataset.

Part 5: ****OPTIONAL**** - Connect to a Web Map Service (WMS) in ArcMap

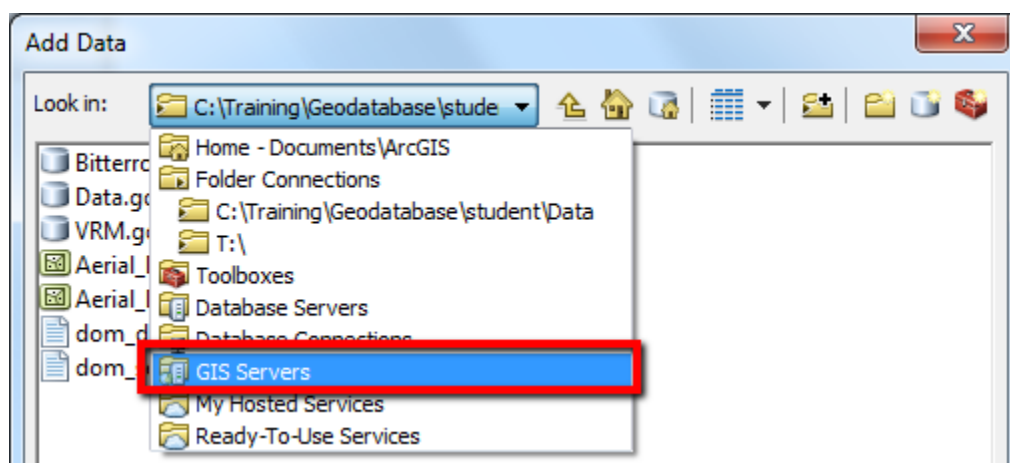
A Web Map Service (WMS) is a standard method to deliver georeferenced maps and GIS data over the Internet. They are generated by a map server using data from a GIS database. You

A. Add a Forest Service WMS to your ArcMap document.

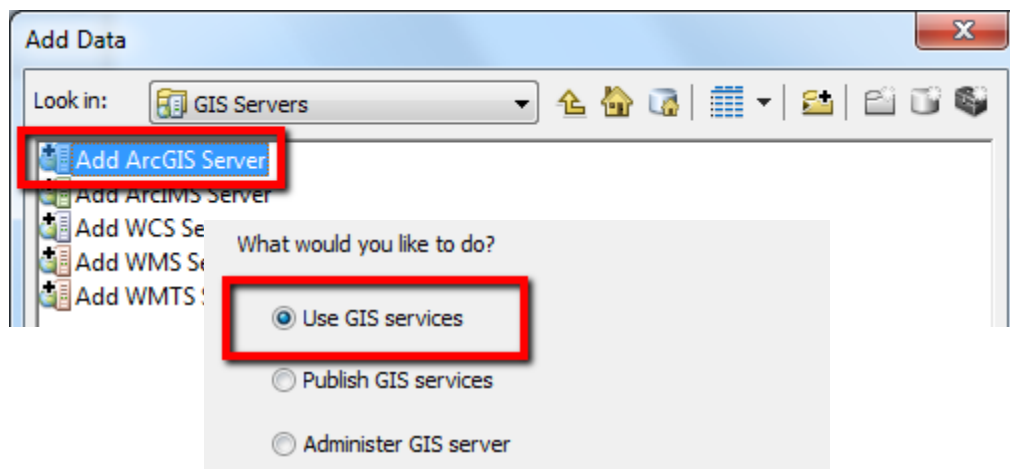
1. Open **ArcMap**.
2. From ArcMap's Standard toolbar, click the **Add Data** dropdown.
3. Select **Add Data...**



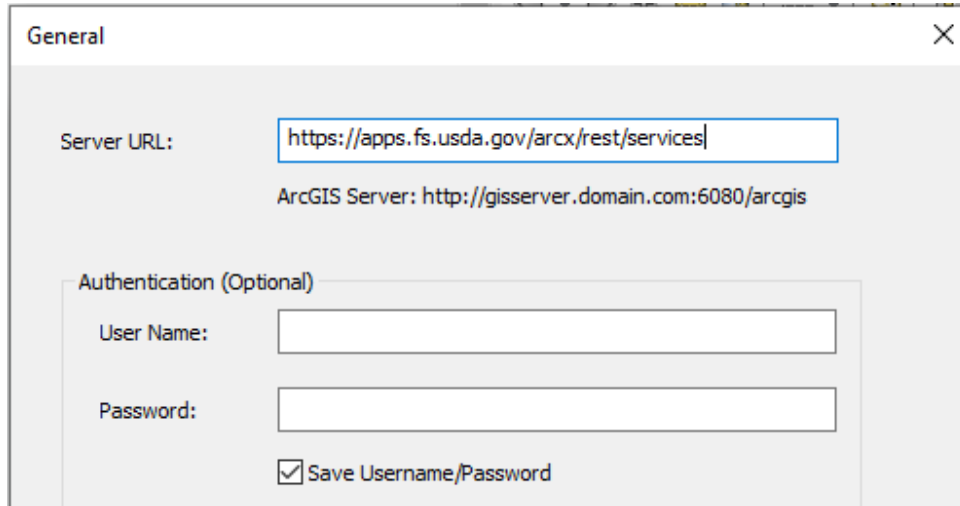
4. From the Add Data dialog, click the **Look In:** dropdown and select **GIS Servers**.



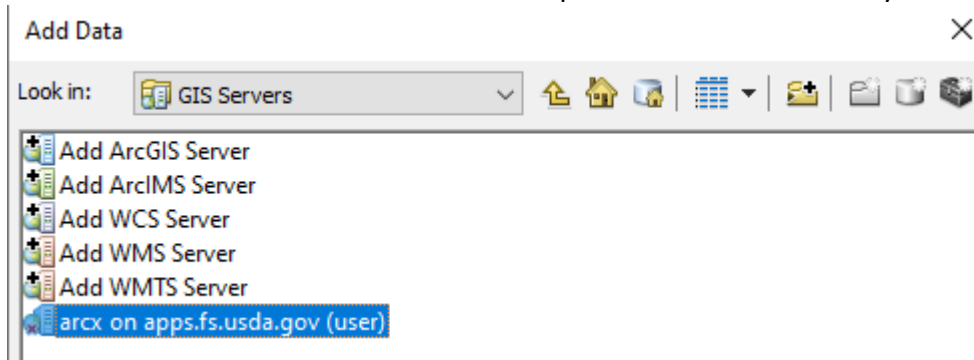
5. Double-click on **Add ArcGIS Server**.



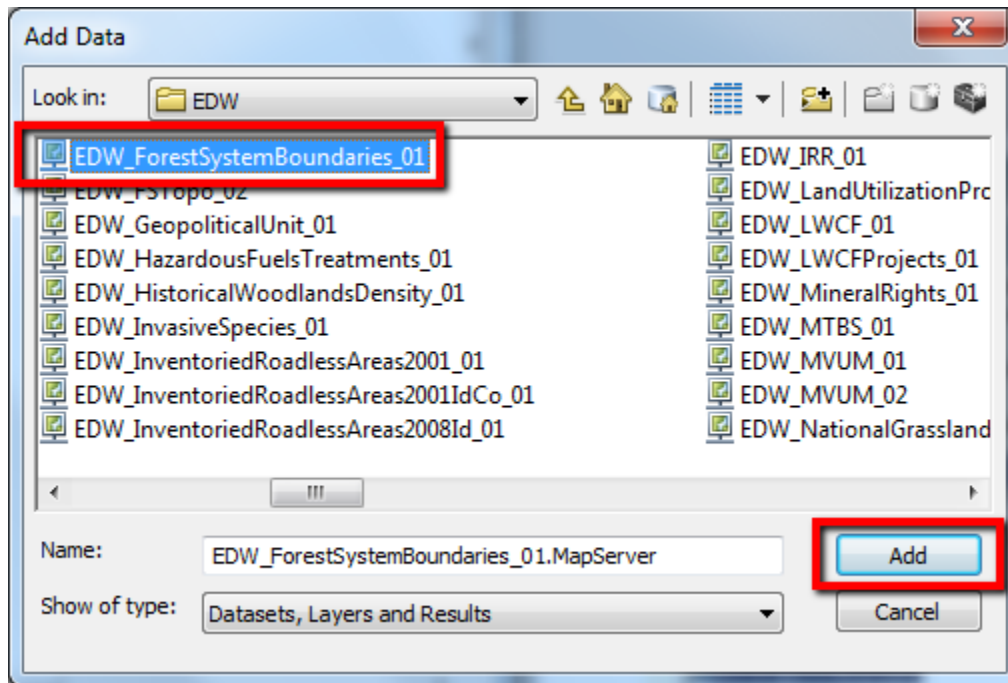
6. Select **Use GIS Services** and click **Next**.
7. Copy <https://apps.fs.usda.gov/arcx/rest/services> into the “Server URL:” box.
Be sure to overwrite the “http:” in the box! Leave the remainder as default settings.



8. Click **Finish**. Your new ArcGIS Server connection is added.
9. Double click **ArcX on apps.fs.usda.gov (user)**.
10. Double click **EDW** to view the available map services in this directory.



11. Click into the EDW folder.
12. Highlight **EDW_ForestSystemBoundaries_01**, then click **Add**. *The layer is added to your map's data view.*

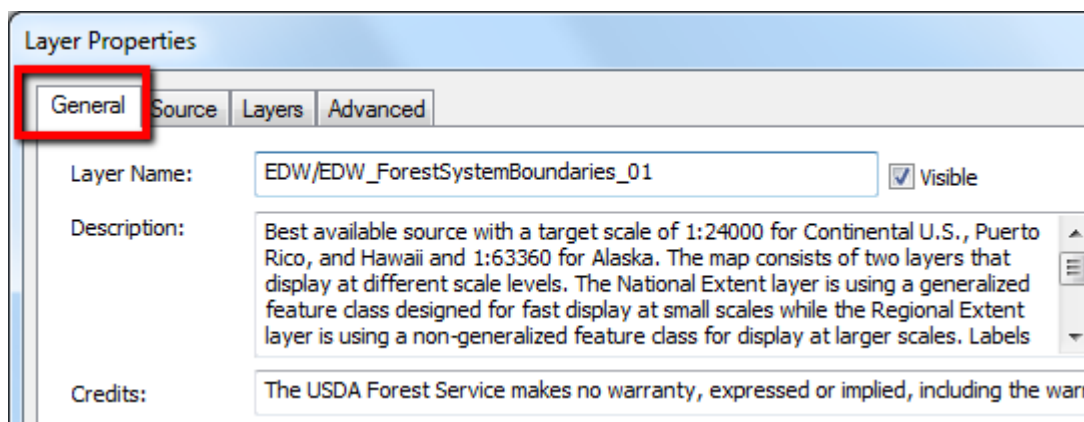


B. View the properties of the Forest Service WMS (EDW_ForestSystemBoundaries_01) service.

1. From ArcMap's Table of Contents, double click **EDW/EDW_ForestSystemBoundaries_01**. You can also open a layer's properties by right-clicking the layer from the Table of Contents, then selecting *Properties*.

As with other layers, you use the Layer Properties dialog box to view and change the properties of ArcGIS map service layers.

2. Under the **General** tab, read the layer's **Description**.



3. Select the **Source** tab.

The Source tab displays information such as the map extent, data (service) type, server name or



URL, and the coordinate system of the service. You can also identify any operations allowed and service restrictions.

QUESTION: What is the layer's data type? _____

QUESTION: What is the layer's coordinate system? _____

4. Select the **Layers** tab.

The Layers tab displays the list of sublayers in the map service. It also provides information about their scale ranges of the sublayers and which sublayers have labels that can be toggled on and off.

5. Click **OK** to close the layer's Properties dialog.

Part 6: ****OPTIONAL**** - Setting up FS Enterprise (SDE) Geodatabase Connections in ArcCatalog (Citrix)

Users must set up Database Connections in ArcCatalog, which will be used to access ArcSDE from either ArcCatalog or ArcMap. All SDE feature classes in the Data Center GIS libraries should have public read access (unless restricted), so any user will be able to read everything there. These instructions will connect you to SDE using your personal Oracle profile.

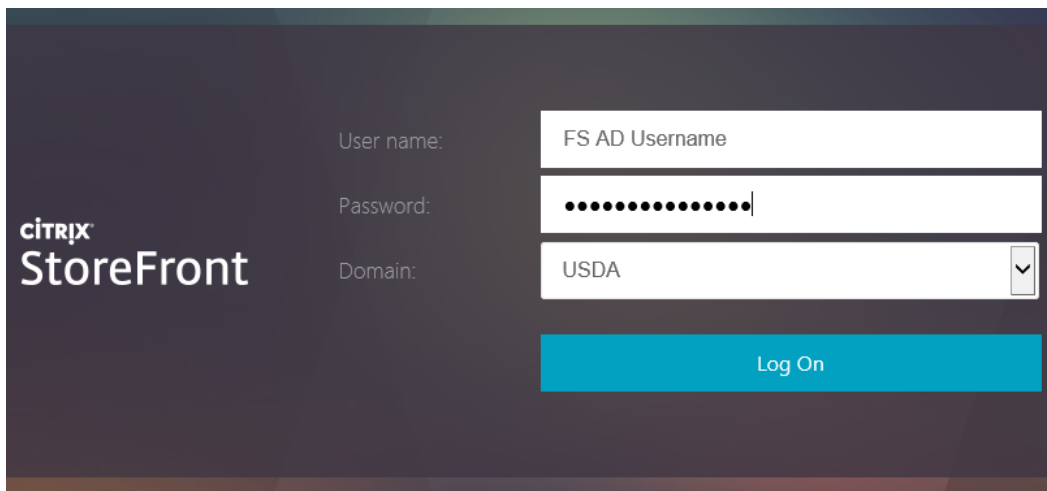
FYI: You must be in Citrix when working with SDE data!

Never connect to and SDE geodatabase while using a local version of ArcCatalog.

A. Open ArcCatalog from the Citrix environment.

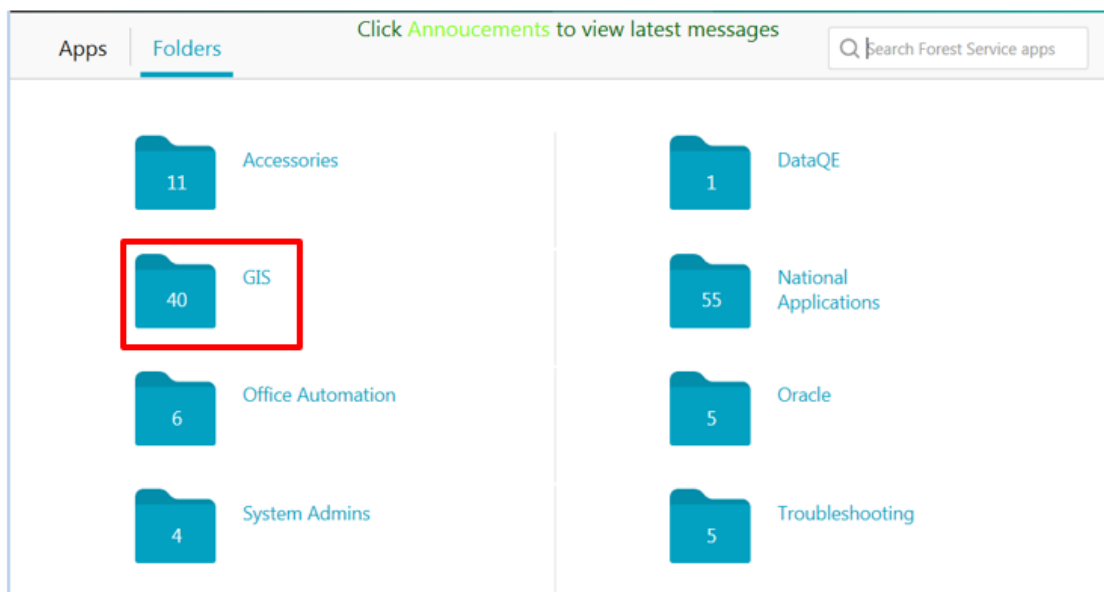
1. In an Internet browser, click [here](https://apps.fs.fed.us/Citrix/auth/login.aspx) or enter the following link to launch Citrix:
<https://apps.fs.fed.us/Citrix/auth/login.aspx>.
2. Enter your **Active Directory (AD) username and password** in the log in boxes provided. Your AD username and password are the ones you use to access your FS computer.



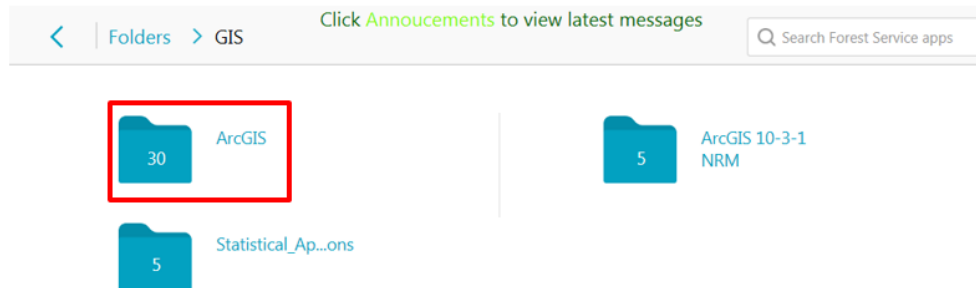


The image shows the Citrix StoreFront login interface. On the left, the Citrix StoreFront logo is displayed. On the right, there are three input fields: 'User name:' with the text 'FS AD Username', 'Password:' with masked characters, and 'Domain:' with a dropdown menu showing 'USDA'. Below these fields is a large blue 'Log On' button.

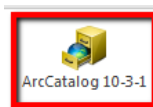
3. Select **Log On**. You will then see the Citrix desktop that includes the applications available to you. This will differ from user to user.
4. Single click the **GIS** folder to open the GIS applications page. Note: If you don't see a GIS Folder, click the Folder button at the top of the interface.



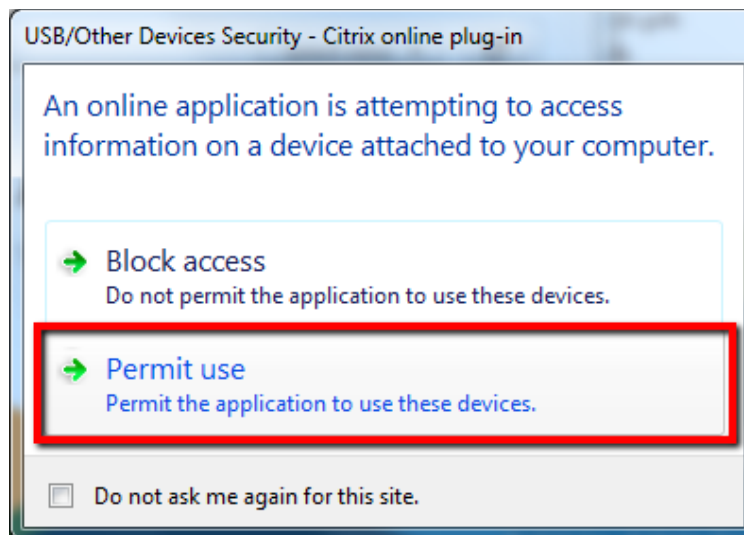
5. Single click to enter the **ArcGIS** folder.



6. Single click **ArcCatalog 10.7** to open the application.



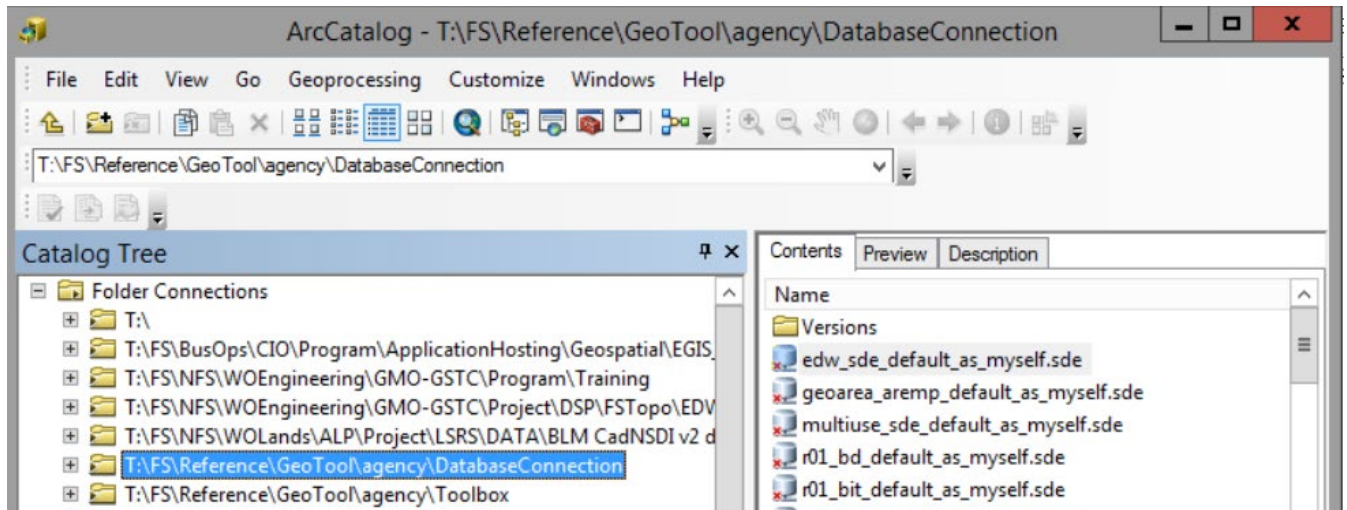
7. If you get the following message, select the option to **Permit Use**. *ArcCatalog opens.*



B. Create a connection to the EDW using a pre-existing ArcSDE connection file.

The recommended method for connecting to the EDW is to use pre-existing connection files on the T:/ drive at: T:\FS\Reference\GeoTool\agency\DatabaseConnection\Versions\V10_5

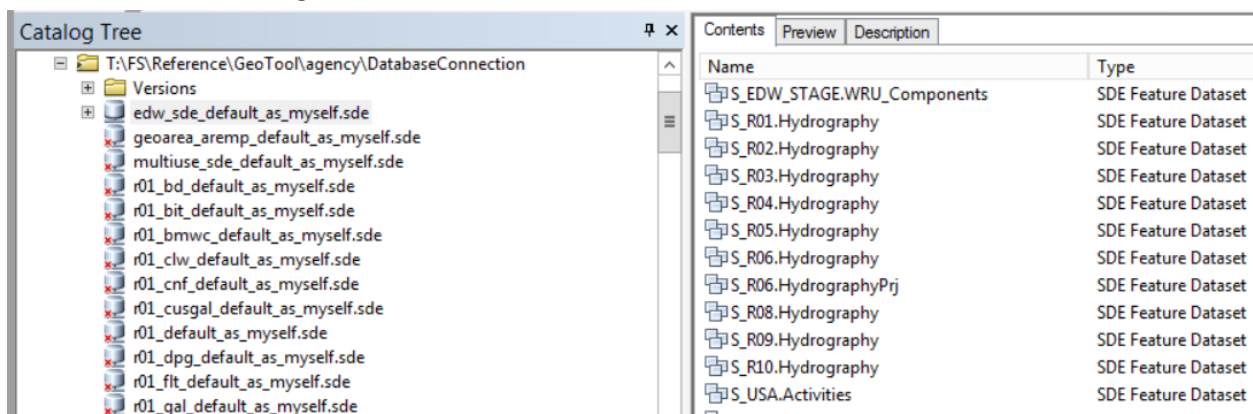
1. From ArcCatalog's Catalog Tree, browse to the Database Connection folder:
T:\FS\Reference\GeoTool\agency\DatabaseConnection
2. From the Contents pane, double click **edw_sde_default_as_myself.sde**. This connects ArcCatalog to the SDE geodatabase allowing you to view its contents.



When you are connected to a database, a plus sign adjacent to a geodatabase symbol will replace the disconnected geodatabase symbol in the Catalog Tree.

Additionally, the contents of the geodatabase are available under the Contents pane or by expanding the plus sign in the Catalog Tree. These layers are now available for your use in Maps, Queries and Analyses.

3. Browse through the list of datasets that are available.



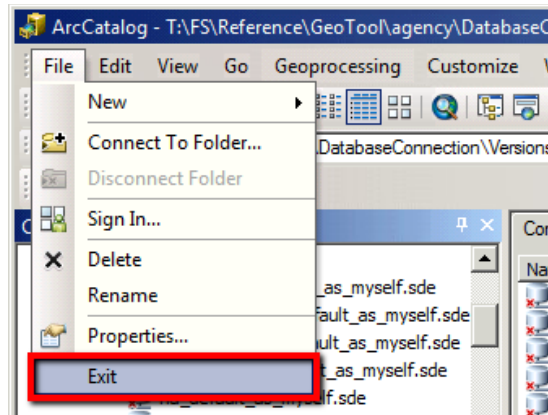
4. When you are finished, disconnect from the database by right-clicking **edw_sde_default_as_myself.sde** in the Catalog Tree, then select **Disconnect**. *Disconnecting connections prevents datasets from becoming locked after logging out of Citrix or out of ArcCatalog.*

IMPORTANT! *When you have finished disconnecting from any active SDE connections, it is very important to exit from Citrix applications properly so that your changes are saved and processes are not left running.*

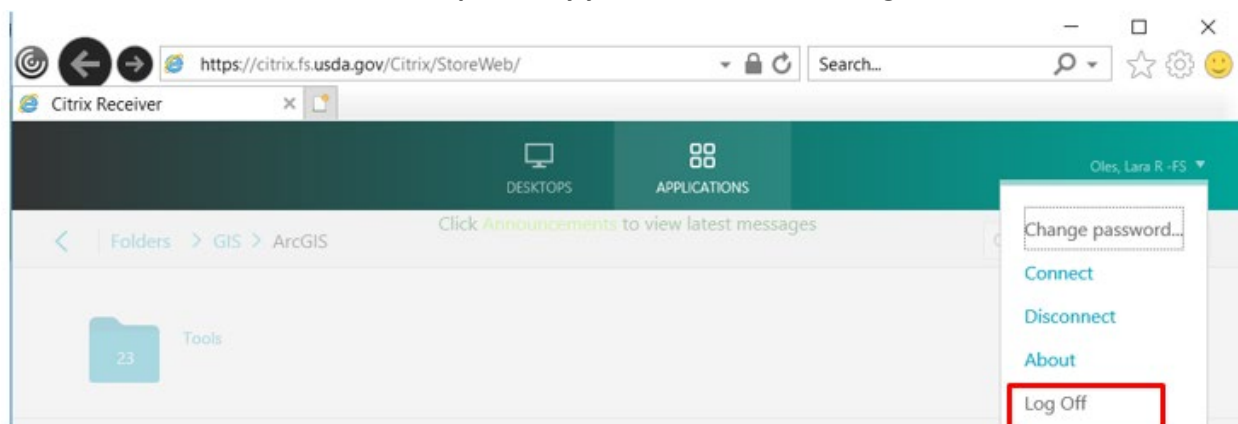
DO NOT close applications by pushing the "X" to close the window.

C. Exit ArcCatalog and log out of Citrix.

1. Always use the File menu to Exit an application. From ArcCatalog's Main Menu, Select **File | Exit**.



2. **DO NOT** just close the browser window to exit from Citrix as this could result in a hung connection. Select the dropdown by your name and select **Log Off**, then close the window.



You have completed Exercise 1