



# EDUCATION GIS CONFERENCE

## Geoprocessing with ArcGIS Pro

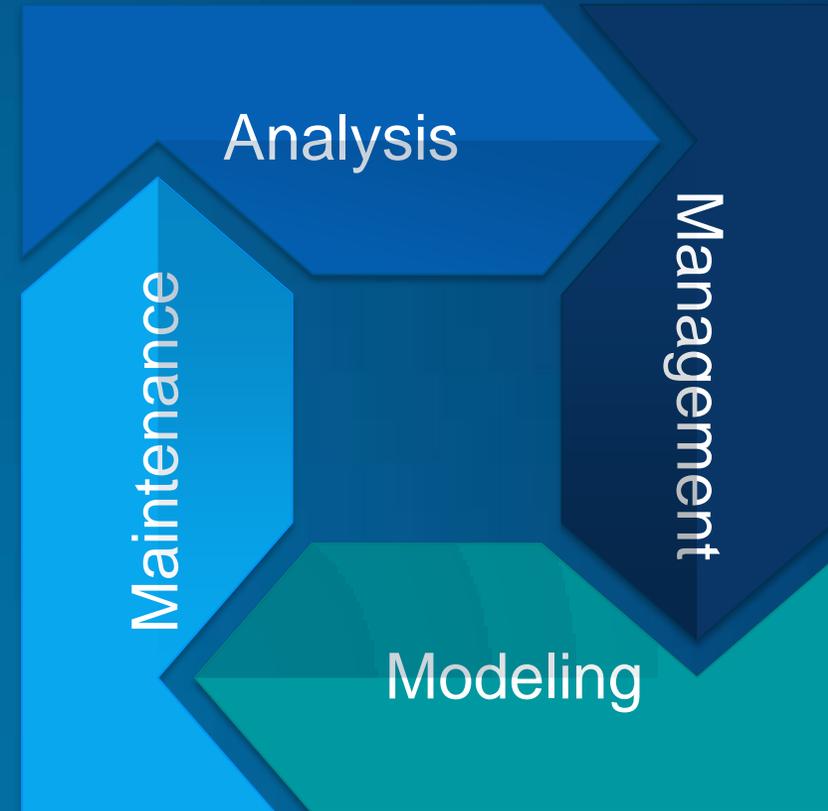
Rudy Prosser GISP CTT+  
Instructor, Esri



# What is geoprocessing?

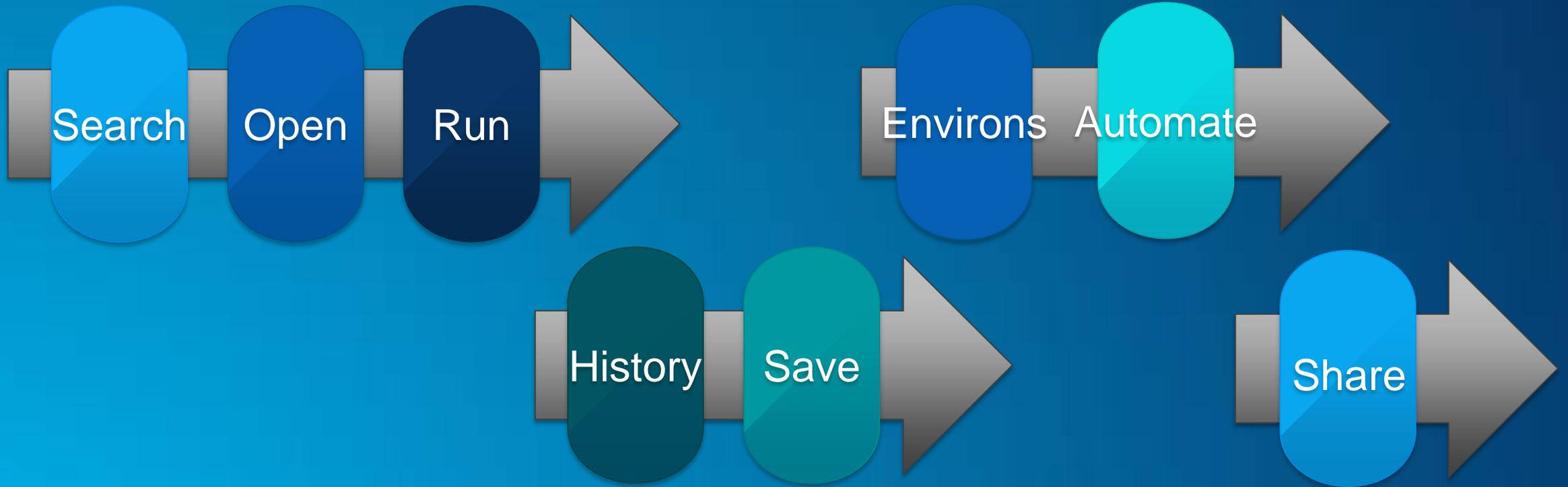
## *Geoprocessing is...*

- *a framework and set of tools for processing geographic and related data*
- *a GIS operation used to manipulate GIS data*
- *getting work done*



# What is geoprocessing in ArcGIS Pro?

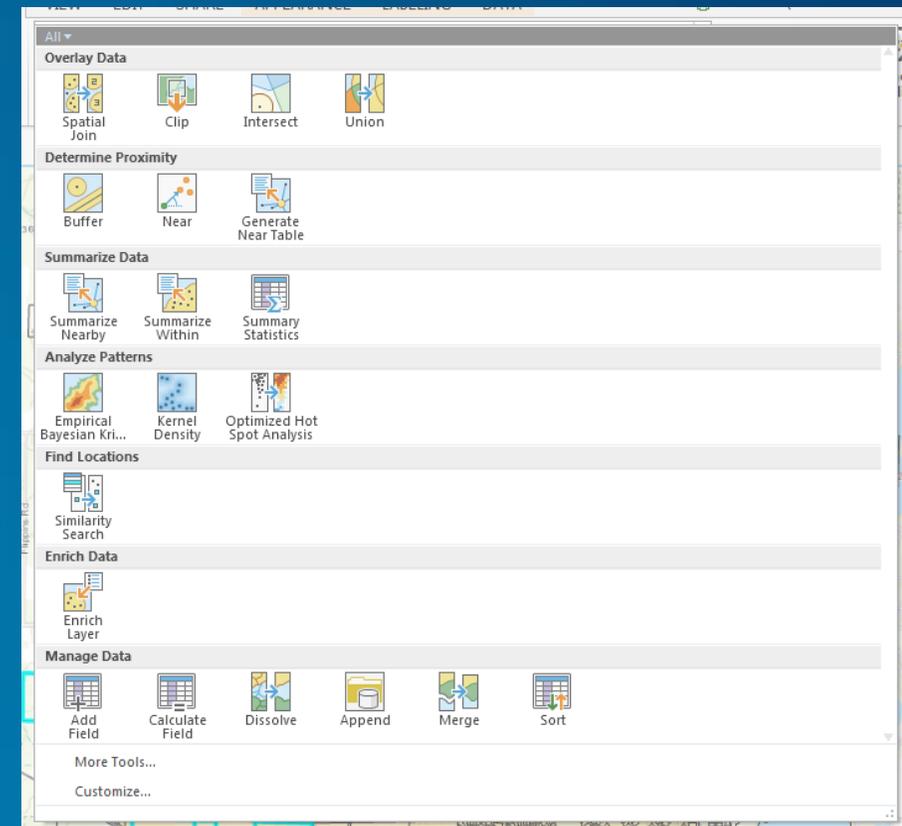
## A workflow



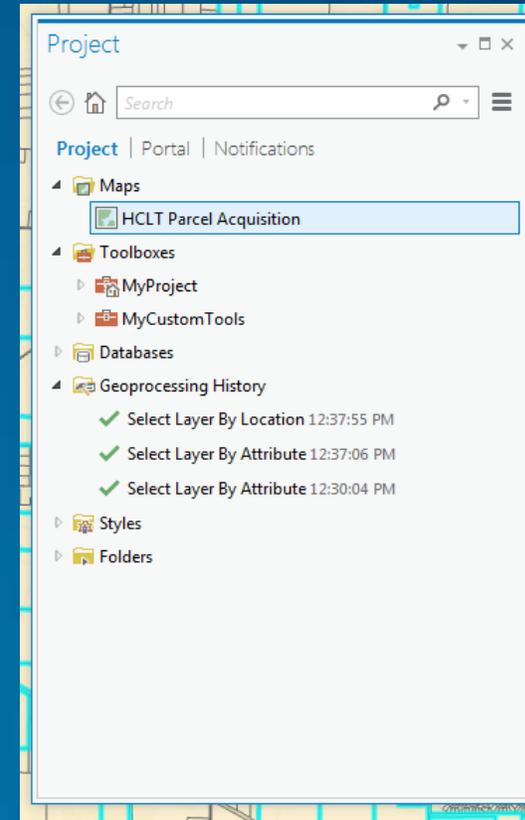
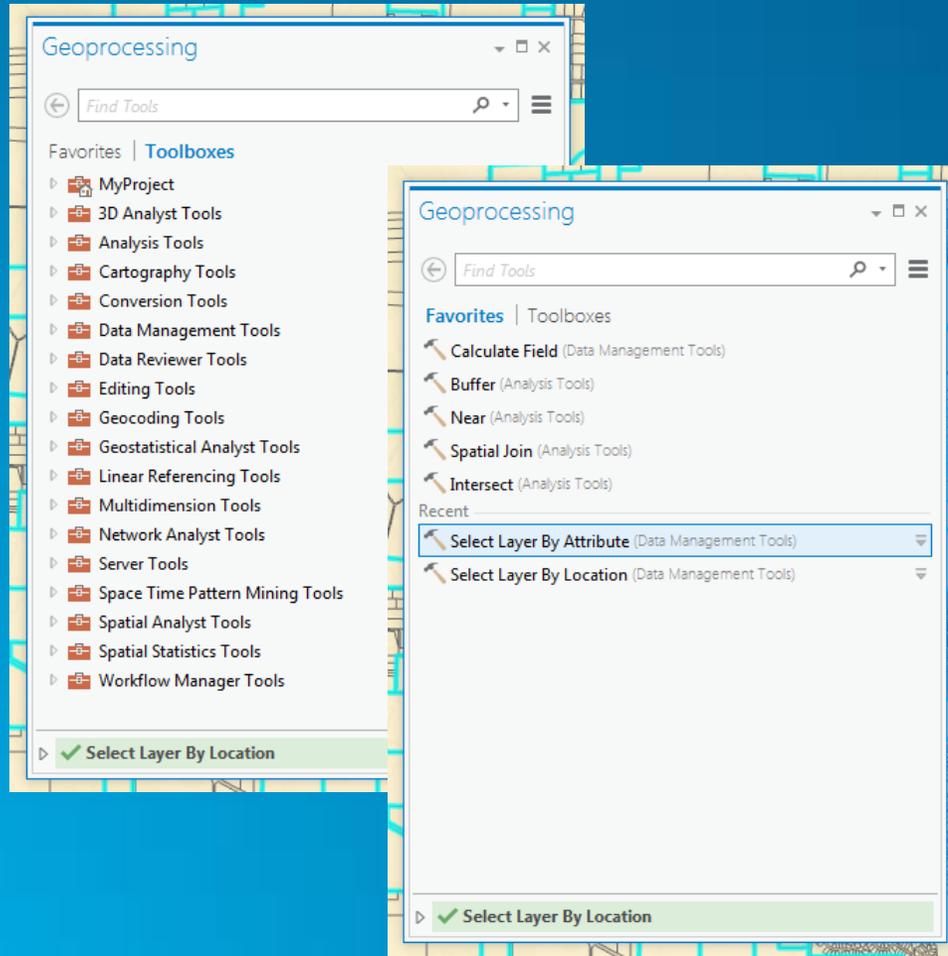
# Analysis ribbon



## Tool gallery



# Geoprocessing pane & Project pane



**Demo**

# Exercise

# Data migration project



**Hamilton County Land Trust,  
Hamilton County, Indiana**

- **Use an ArcGIS Pro project to organize your tasks**
- **Use geoprocessing tools**
- **Use the Python window**
- **Build a model in ModelBuilder**

# Session Evaluation

- **In the Esri Events mobile app sign in with your Esri account credentials**
- **Go to Esri Education GIS Conference**
- **Select More > Speakers > Rudy Prosser > Geoprocessing with ArcGIS Pro**
- **Open the Computer Lab Survey**



Understanding our world.



# Geoprocessing with ArcGIS Pro

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**Exercise 1: ArcGIS Pro geoprocessing workflows**  
Estimated time: (60 minutes)

## Exercise 1: ArcGIS Pro geoprocessing workflows

Estimated time: (60 minutes)

The Hamilton County Land Trust (HCLT) is starting to move some project work currently being done using ArcGIS for Desktop to ArcGIS Pro. One pilot project is migrating existing data in a variety of formats to a single geodatabase that will be used to support map and analysis services on ArcGIS for Server. The data migration pilot project has two goals: first, to provide HCLT GIS analysts with experience using ArcGIS Pro; and second, to develop expertise with geoprocessing using ArcGIS Pro.

The workflow is to collect and reorganize spatial data currently in a variety of formats in a single staging geodatabase. Once it is collected, the data will be moved to the production geodatabase supporting ArcGIS for Server services. While being moved to the production geodatabase the data will be projected from HCLT's standard spatial reference to Web Mercator. To develop expertise with ArcGIS Pro, HCLT's GIS Coordinator is requiring all the work be done using geoprocessing tools only.

In this exercise, you will:

- Use an ArcGIS Pro project to organize your tasks
- Use geoprocessing tools to convert and import data
- Use the Python window to convert and import data
- Build a model in ModelBuilder to move the data to the production geodatabase.

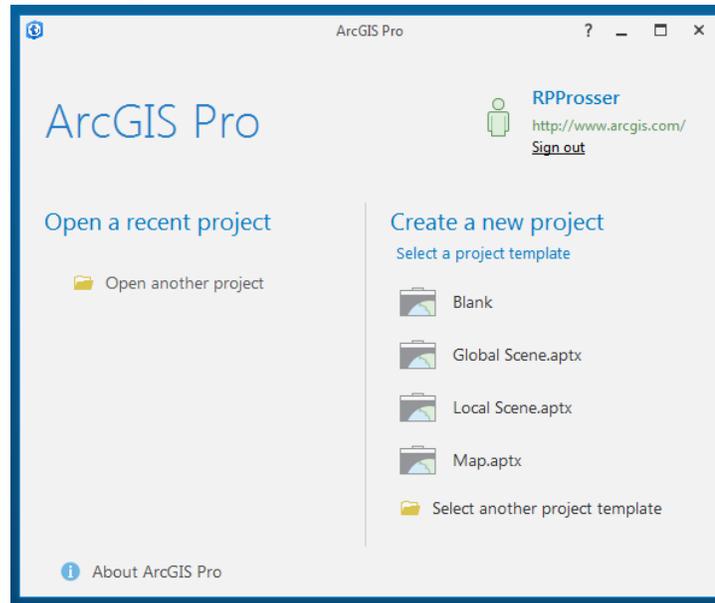
### Exercise Setup:

1. All exercise materials are kept in the C:\Student\GPPRO folder. Unzipping the GPPRO\_EdUC2015 zip file installs the data to C:\Student in the GPPRO folder.
2. Data used in the exercise is in the Data folder
3. You will create the WebMigration project folder used by ArcGIS Pro.

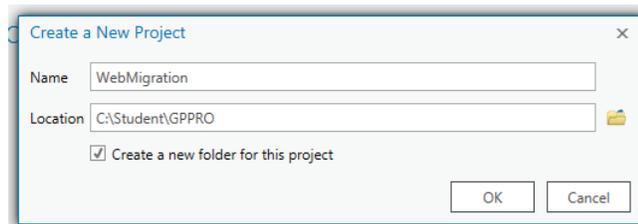
### Step 1: Setup a new ArcGIS Pro project

ArcGIS Pro organizes everything – maps, data, tools – into a project. Your first task is to setup your working project.

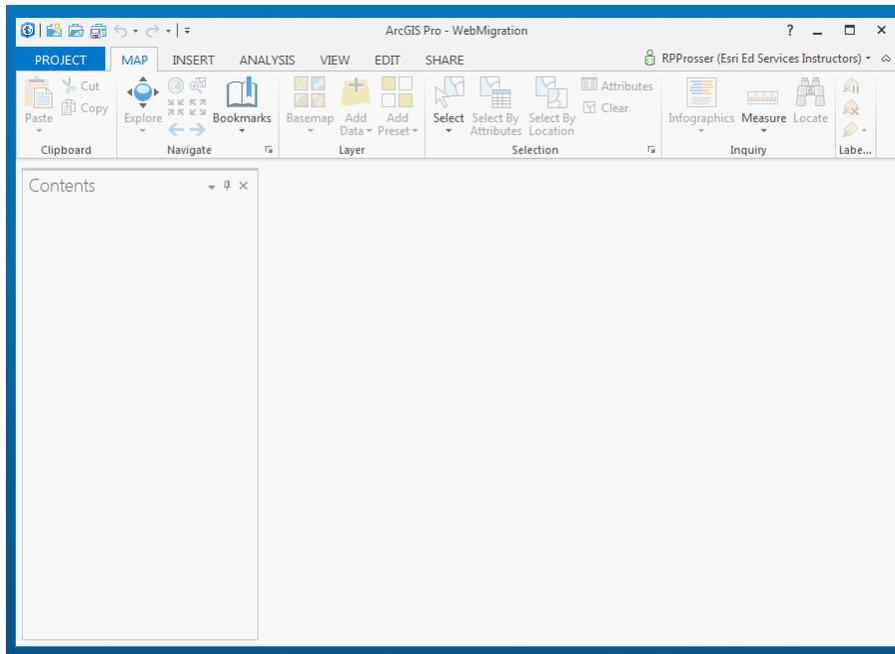
- a. Start ArcGIS Pro by double-clicking the ArcGIS Pro icon on your desktop, pinned to the Windows task bar, or by navigating to Start > All Programs > ArcGIS > ArcGIS Pro and clicking on ArcGIS Pro.
- b. In the ArcGIS Pro project window, under Create a new project, select Blank.



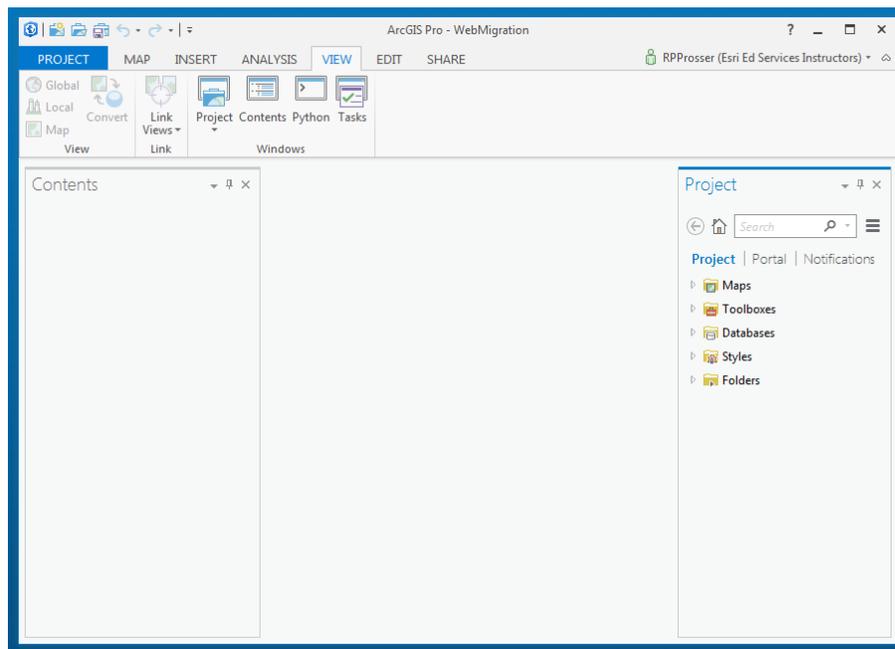
- c. In the Create a New Project window, change the project name to WebMigration and the project location to C:\Student\GPPRO



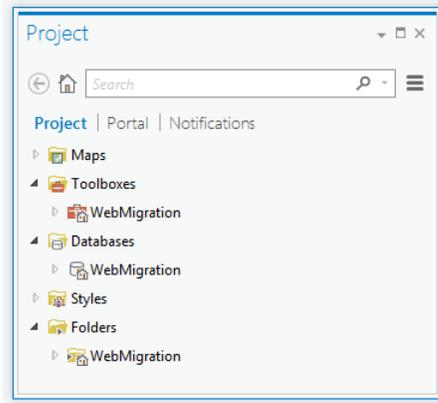
ArcGIS Pro opens with a new empty project.



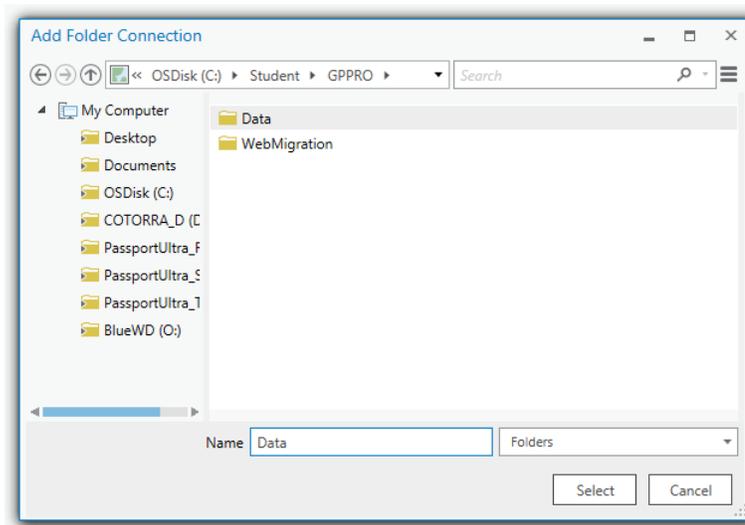
- d. Open the Project pane by clicking on the VIEW tab and selecting Project from the Windows group. The Project pane is added to ArcGIS Pro.



- e. The Project pane provides you with connections to maps, toolboxes, databases, style sheets, and folders used in the project.
- f. In the Project pane, expand Toolboxes, Databases and Folders. A project provides you with a default toolbox and file geodatabase having the same name as the project, and a connection to the project's folder. The data to be migrated will be staged to the new scratch file geodatabase, and then copied to a final production geodatabase WebMigration.



- g. Add a folder connection to the source data by either right-clicking on Folders and selecting Add Folder Connection or by selecting the INSERT tab and clicking on Add Folder in the Project group.
- h. In the Add Folder Connection dialog, navigate to C:\Student\GPPRO and select the Data folder.



A new folder connection should appear in the Project pane under Folders.

- i. Save your project by either clicking the Save button on the Quick Access Toolbar or by clicking the P tab and selecting Save in left-hand column. Click the back arrow, , to return to your project.

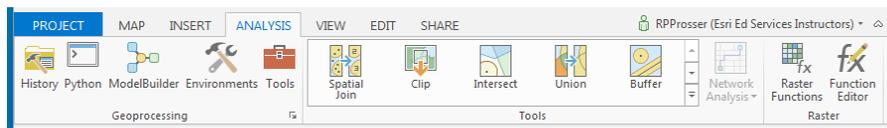
Now that your project is all setup you are ready for the next step, migrating the data using ArcGIS Pro's geoprocessing capabilities.

## Step 2: Geoprocessing and the Analysis ribbon

The Analysis ribbon is your control panel for performing analyses and geoprocessing. You can access all the toolboxes, set the geoprocessing environment, build a model, or review any geoprocessing history in your project.

- a. Click on the ANALYSIS tab.

The ANALYSIS tab is divided into three parts. On the left is Geoprocessing giving you access to different geoprocessing methods, environment settings, and processing history. In the middle is the Tools section containing many of the more commonly used geoprocessing tools. On the right are more specialized tools for working with network and raster data.

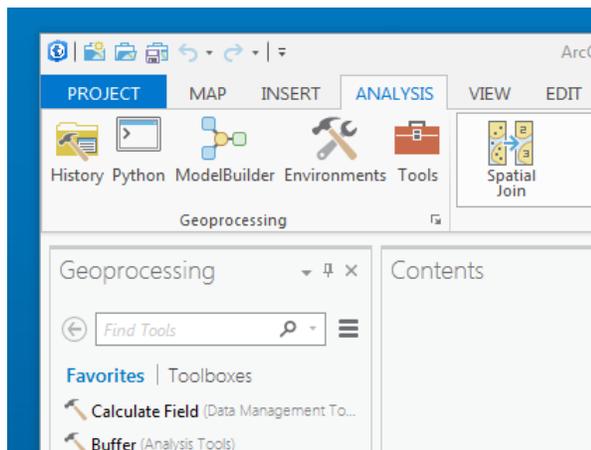


Geoprocessing in ArcGIS Pro is done using one or more of four possible methods:

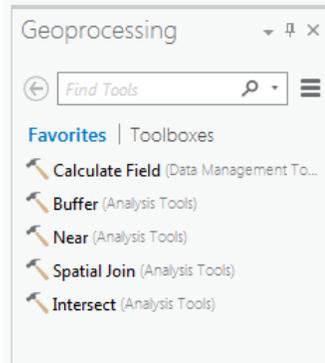
1. Tools from toolboxes
2. Using Python code in the Python window
3. Building a model in ModelBuilder
4. Writing and executing a Python script

You will be exploring each of these methods in subsequent steps. First, you will use tools from a toolbox.

- b. Click the Tools icon,  , to open the Geoprocessing pane. The pane should open next to the contents pane on the left side of the application.

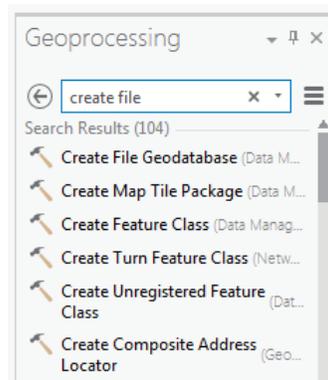


There are two parts to the Geoprocessing pane: Favorites and Toolboxes. Favorites has the Find Tools search dialog and allows you to collect commonly used tools for quick access. It contains a default collection of spatial analysis tools that you can modify by adding or removing tools.

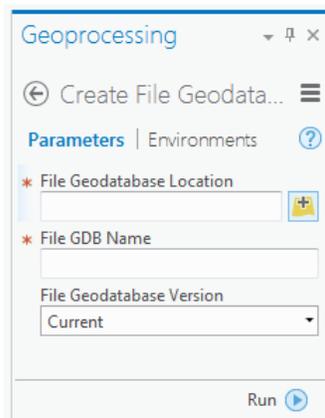


You will need a scratch or temporary geodatabase for geoprocessing that will come later. Use the Create File Geodatabase tool to create the scratch geodatabase.

- c. In the Find Tools dialog, search for the Create File Geodatabase tool. As soon as you start entering text, ArcGIS Pro starts to provide a list of candidate tools, the closest match being first on the list.



- d. Click on Create File Geodatabase in the list of candidates. The Geoprocessing pane changes to show you the input parameters for the Create File Geodatabase tool.



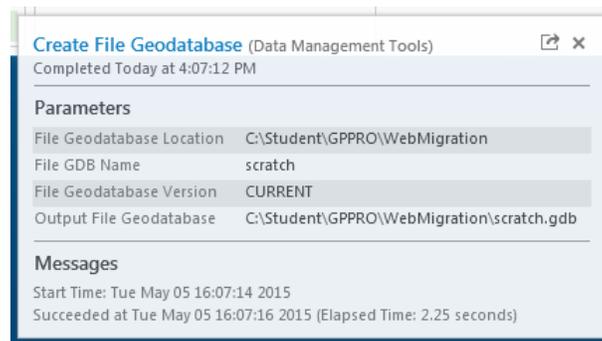
- e. Set the File Geodatabase Location parameter to C:\Student\GPPRO\WebMigration.
- f. Enter scratch for the File GDB Name parameter.

- g. Click the Run button, , at the bottom of the pane.

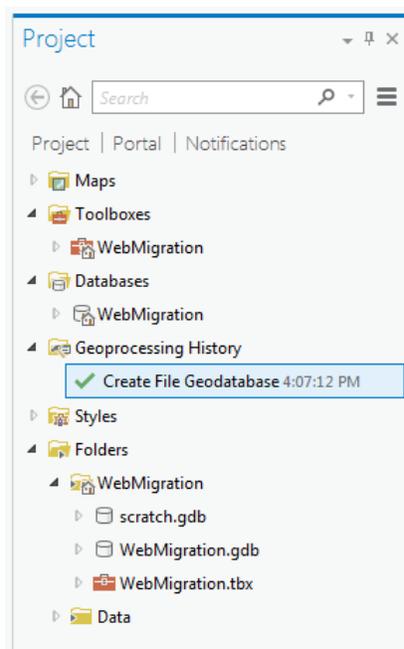
In the space directly below the Run button you will see any messages that the tool returns while executing, a success or failure message messages when the tool completes processing.



- h. Let your mouse hover over the success message Create File Geodatabase with the green checkmark. You should a window open with the input parameters details and processing messages returned when the tool executed.



- i. Return to the Project pane and expand the new entry labeled Geoprocessing History. You should see Create File Geodatabase listed there, and letting your mouse hover over it displays the same geoprocessing details viewed in the Geoprocessing pane.



**Note:** History in the Geoprocessing group of the ANALYSIS tab also opens Geoprocessing History in the Project pane.

Next you will use the geoprocessing environment settings to establish default scratch workspace and output projection for your project.

### Step 3: Set default geoprocessing environment

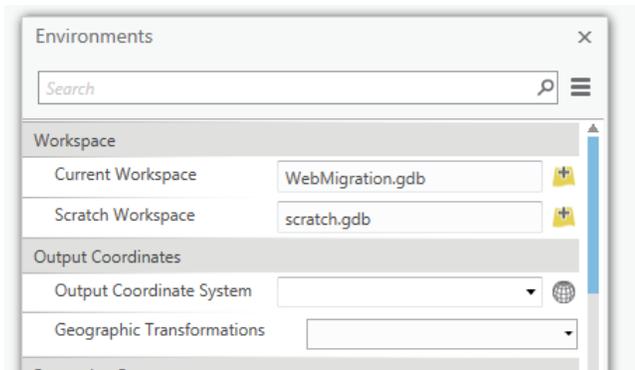
To ensure that all the spatial data used by the Hamilton County Land Trust, you will establish a default geoprocessing environment. ArcGIS Pro's environment settings allows you to control how and where datasets are created.

Before migrating the data to the production geodatabase, you need to make certain that all the data is in the standard spatial reference used by HCLT – Indiana State Plane East NAD 1983.

- Geoprocessing environment settings are set in the Environments pane.
- To open the Environment pane, click the Environments icon in the Geoprocessing section of the ANALYSIS tab.
- Scroll through the settings listed in the Environments pane. These settings allow you to control where data is stored, the coordinate system used to store the data, its resolution, and many other characteristics of the data.

First, you will set the scratch workspace and the current workspace. The scratch workspace used as a temporary workspace for storing intermediate data during geoprocessing. The current workspace is used as the default location for inputs and outputs from geoprocessing tasks.

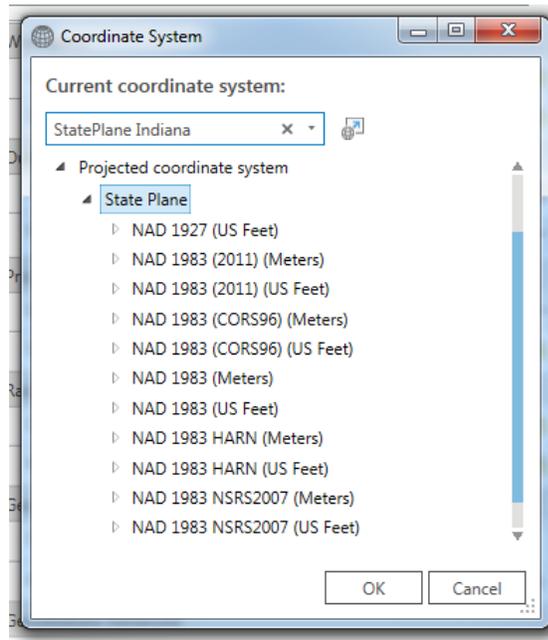
- Set the Current Workspace to your WebMigration geodatabase and the Scratch Workspace to your scratch geodatabase.



The default spatial reference for HCLT is Indiana State Plane East NAD 1983. All data that will be included in the final production geodatabase needs to be in this spatial reference before it is move to production, so you'll set the Output Coordinate System to Indiana State Plane East NAD 1983.

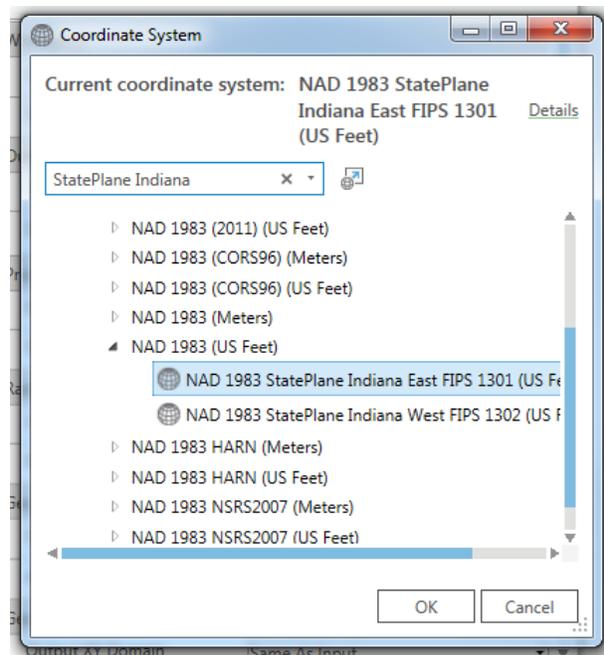
- In the Environments pane, click on the globe next to the Output Coordinate System text box. This opens the Coordinate System dialog.
- In the Search box, enter StatePlane Indiana and press Enter.

g. Expand Projected coordinate system and State Plane



h. Expand NAD 1983 (US Feet)

i. Select NAD 1983 StatePlane Indiana East Fips 1301 (US Feet).



j.

k. Click OK in the Coordinate System dialog.

l. Click OK in the Environments pane.

You have now set the default spatial reference and output geodatabase you will use in the succeeding steps.

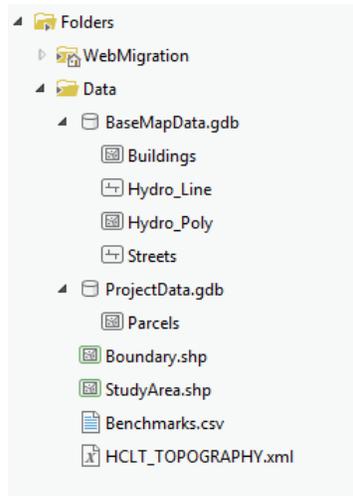
## Step 4: Working with geoprocessing tools

Geoprocessing tools perform single operations on GIS data. Think of a tool as a single processing step or a unit of work in what is usually a larger workflow. The tool takes data as an input along with other parameters specifying how the tool should act, performs an action on the data, and returns the results of the action as an output. The output can, in turn, be used as an input to another tool.

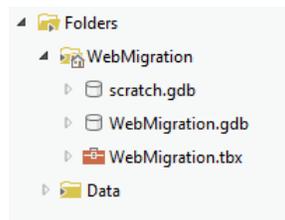
The simplest way to perform geoprocessing on data is to find and use individual tools from ArcGIS's many toolboxes. In this step you will use several tools to process data. Your first task is start populating the WebMigration geodatabase with datasets needed to support web mapping services.

- a. In the Project pane, expand Folders, then expand Data. The Data folder contains the datasets you will eventually import into the WebMigration geodatabase.

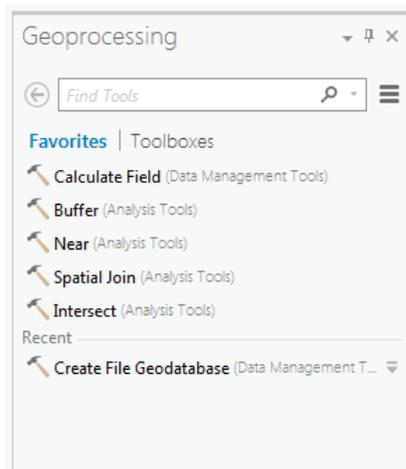
The Data folder contains file geodatabases with feature classes, shape files, a CSV, and an XML Workspace document.



- b. Expand the WebMigration folder. As stated earlier, the WebMigration geodatabase is the ultimate destination for all the spatial data. You will first stage the data to the scratch geodatabase before moving it to the WebMigration geodatabase.

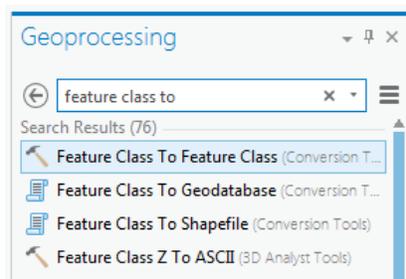


- c. To get started geoprocessing data select the ANALYSIS tab and click on the Tools icon. The Geoprocessing pane should open to the Find Tool search window and current Favorites.
- d. Notice that the Geoprocessing pan now includes a Recent section showing the Create File Geodatabase tool you used earlier.



Your first task is to import the Hamilton County Land Trust boundary and study area shape files to the WebMigration geodatabase.

- e. In the Find Tools window, search for “feature class to feature class.” Notice that after a few clicks the Feature Class to Feature Class (Conversion Toolbox) tool rises to the top of the Search Results list.

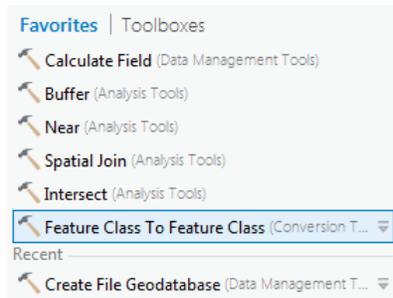


- f. Click once on Feature Class to Feature Class in the Search Results list. The Geoprocessing pane changes to show the Feature Class to Feature Class tool. You will use this tool to import the HCLT boundary and study.
- g. Click the browse button, , next to Input Features to open the Input Features dialog.
- h. In the Input Features dialog, under Project, click Folders and then open the Data folder.
- i. Select the Boundary.shp file and click Select.
- j. In the Project pane, expand Folders > WebMigration. Click on the scratch geodatabase and drag it to the Output Location text box. Geoprocessing tools support drag-and-drop as a method for providing inputs.
- k. In the Output Feature Class text box enter Boundary for the feature class name.
- l. In the Field Map section, move your mouse over SHAPE\_Leng and click the red X to remove it. Do the same for the SHAPE\_Area field. ArcGIS automatically adds measurement fields to imported datasets.

m. Click Run.

The Boundary shape file is imported into the scratch geodatabase as the Boundary feature class.

- n. Click the back arrow to the left of the tool name to return to the Search Results. Click the back arrow a second time to return to the Geoprocessing pane. Notice that Feature Class to Feature Class now appears in the Recent section.
- o. Right-click on Feature Class to Feature Class in the Recent section and select Add to Favorites. The tool is now added to the end your Favorites list. You can remove the tool by right-clicking on it and selecting Remove. This allows you to create a customized list of commonly used tools for easy access.

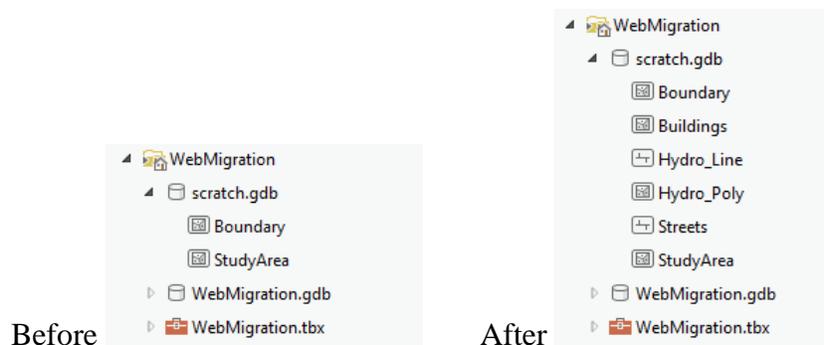


p. Repeat these steps to import the StudyArea shape file.

## On your own

The Feature Class to Geodatabase tool allows you to import multiple source datasets in a single operation. Your task is to:

- Search for the Feature Class to Geodatabase tool
- Use it to import into the scratch geodatabase the four feature class is the BaseMapData geodatabase.
- Review the processing results.
- Add the Feature Class to Geodatabase tool to your geoprocessing Favorites.



## Step 5: Using the Python window

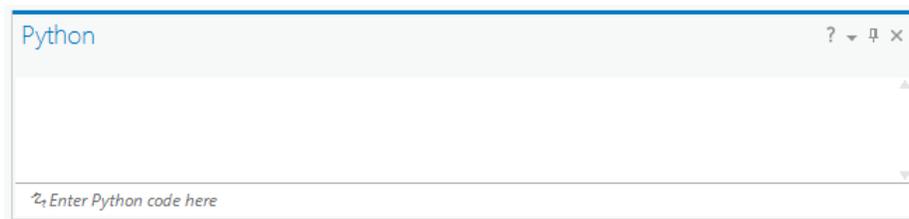
The Python window makes it possible for you to start scripting your geoprocessing tasks. Geoprocessing is accessible through Python using the ArcPy site package that is part of ArcGIS. Scripting with ArcPy and Python allows you to access additional Python modules written by GIS professionals and professional programmers from other disciplines.

In this step you will import data from a file geodatabase, a CSV file, and an XML workspace document.

- a) To open the Python window, select the ANALYSIS tab and in the Geoprocessing section



click the Python window icon, `Python`. The Python window should open in your ArcGIS Pro application.



There are two parts to the Python window. The lower part where you enter the tool you want to run and all its parameters.



And the upper part where tool runs and the results are displayed.



Your first task is to import the Parcels feature class from the ProjectData geodatabase into your scratch geodatabase.

- b) Each geoprocessing tool entered into the Python window begins with `arcpy`. In the lower portion of the Python window, start by typing `arc`. As you type notice that a small window opens and intelligent guesses as to what you are typing are provided. Using your mouse, click on `arcpy` and the code is entered into the window.



```
Python
arcpy.CreateFileGDB_management("c:/Student/GPPRO/WebMigration", "scratch")
<Result 'c:/Student/GPPRO/WebMigration\\scratch.gdb'>
arcpy.|
```

- c) You will use the Feature Class to Feature Class tool to import Parcels. Continue typing after the period the first few letters in the tool's name. Notice that a small window again provides you with candidates. Select FeatureClassToFeatureClass\_conversion from the list. Once again the correct code is entered into the window and your cursor is placed between the parentheses.



```
Python
arcpy.CreateFileGDB_management("c:/Student/GPPRO/WebMigration", "scratch")
<Result 'c:/Student/GPPRO/WebMigration\\scratch.gdb'>
arcpy.FeatureClassToFeatureClass_conversion(|)
```

- d) Place your cursor between the parentheses and click once. You should now see a small window displaying the parameters of the Feature Class To Feature Class tool. Required and optional parameters are listed, the optional ones surrounded by curly brackets.
- e) The first parameter is the path and name of the input dataset. All parameters in the Python window are quoted, so begin to enter the path by typing in a double quote. Notice you are automatically provided with a closing double quote.
- f) The path to the Parcels dataset is "C:/Student/GPPRO/Data/ProjectData.gdb/Parcels" Notice that forward slashes (tops to the right) are used to delimit the folders in the path.
- g) Once you have entered the path between the double quotes, click once to the right of the last double quote and enter a comma. A small window should open showing you the tool's parameters, the next one you need to enter in bold italics. This is the path to the scratch geodatabase. Once again, enter a double quote and type "C:/Student/GPPRO/WebMigration/scratch.gdb" paying attention to the direction of the slashes.
- h) Click once outside the right-most double quote and enter a comma. A window opens once again, indicating the next parameter is the output feature class name. Enter "Parcels" in double quotes.

You have now entered in all the required parameters. Your input should look like this:

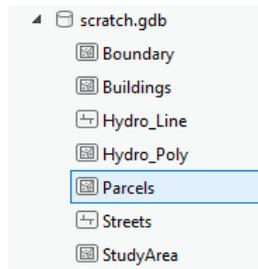


```
arcpy.FeatureClassToFeatureClass_conversion("C:/Student/GPPRO/Data/ProjectData.gdb/Parcels", "C:/Student/GPPRO/WebMigration/scratch.gdb", "Parcels")
```

- i) Click once outside the right-most parentheses and hit the Enter key on your keyboard. The tool should immediately execute and show you the results.

```
Python
arcpy.FeatureClassToFeatureClass_conversion("C:/Student/GPPRO/Data/ProjectData.gdb/Parcels", "C:/Student/GPPRO/WebMigration/scratch.gdb", "Parcels")
<Result 'C:/Student/GPPRO/WebMigration/scratch.gdb\\Parcels'>
```

j) Expand the scratch geodatabase to verify the Parcels feature class has been added.



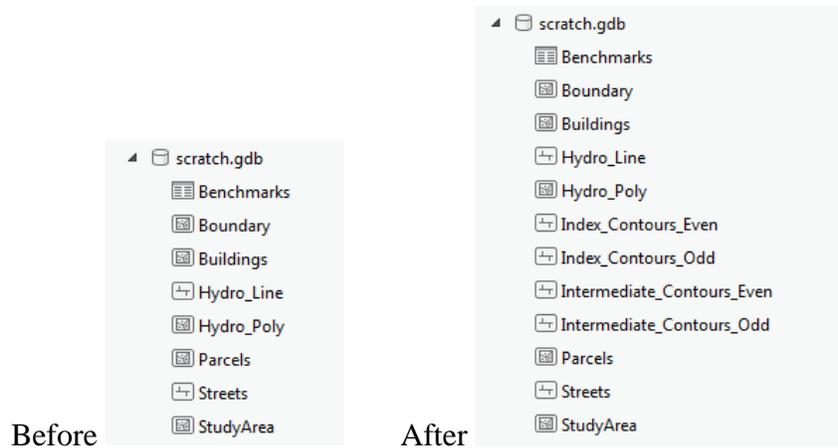
k) Repeat the process using the Table to Table tool to import the Benchmarks.csv file in the Data folder as a table to the scratch geodatabase



### On your own

The Import XML Workspace Document tool allows you to import the contents of XML workspace document into an existing geodatabase. Documents are created using the Export XML Workspace Document to export a geodatabase and all it contains to XML format. Your task is to:

- Determine the path to and name of the HCLT Topography XML file.
- Determine the path to the output scratch geodatabase
- Use the Import XML Workspace Document tool in the Python to import the XML file.
- Review the processing results.



## Step 6: Geoprocessing with ModelBuilder

With ModelBuilder you can create, edit and manage models – workflows that string together a sequence of geoprocessing steps, using the output of one step as the input to the next. The steps are the geoprocessing tools you have already been using in toolboxes and the Python window.

In this step you will create a model which takes the feature classes in the scratch geodatabase, projects them to web Mercator and writes the to the WebMigration geodatabase.

Models, like geoprocessing tools, are kept in toolboxes. When you create a project using ArcGIS Pro, a project toolbox is created for you.

NOTE: A working copy of the model you will build is available in the GPTools toolbox in the Data folder.

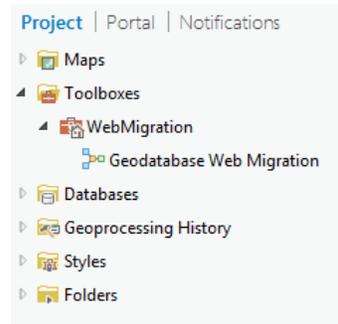
- a) In the Project pane, expand Toolboxes.

The project toolbox has the same name as the project.

- b) Right-click on the WebMigration toolbox and select New > Model. The Model opens up as a new tab in the central display pane.
- c) Expand the WebMigration toolbox. Right-click on the Model and select Properties.

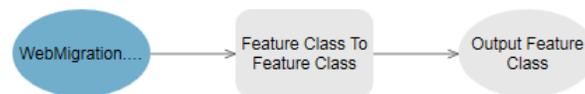
The properties dialog allows you to set the model's name and label, as well as manage input and output parameters.

- d) In the Name field, set you model's name to GeodatabaseWebMigration. Make sure you don't put any spaces between the words in the model's name.
- e) In the Label field, set your model's label to Geodatabase Web Migration. You can put space in model labels.
- f) Click OK. Notice how the model now shows the label you just entered.



The next step is to build your model. You will use the Feature Class to Feature Class tool to project the data as it copies it to your WebMigration geodatabase. You will use Iterate Feature Classes to loop through all the feature classes in the scratch geodatabase.

- g) In the Geoprocessing pane, under Recent, click-and-drag the Feature Class to Feature Class tool on to the model canvas.

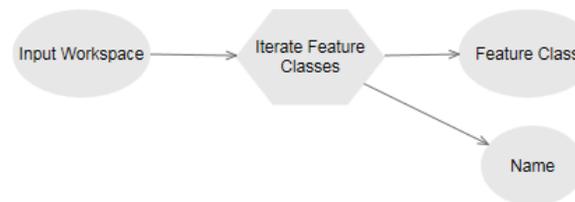


The muted colors indicate tool parameters have not been set. Blue indicates a ModelBuilder variable.

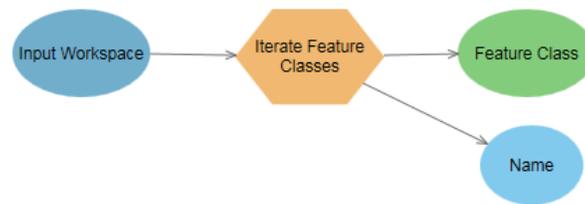
- h) From the Iterators menu, select Iterate Feature Classes. The iterator is usually added on top of existing items. Simply drag it to a new location.
- i) Click anywhere on the white space around your model elements to unselect the iterator.

The Iterate Feature Classes iterator allows you to specify a workspace containing feature classes you need to process. You will set that as a model variable.

- j) Right-click on Iterate Feature Classes and select Create Variable > From Parameter > Workspace or Feature Dataset. This allows you to set the input workspace as a variable.
- k) Click on the Workspace or Feature Dataset model variable and rename it Input Workspace.



- l) Double-click on Input Workspace and set it to your scratch geodatabase. The iterator should change from gray to blue, green, and orange. Blue indicates a ModelBuilder variable, orange indicates a processing step, and green indicates a data set.



The iterator is now setup to loop through a workspace and provide a feature class and its name as inputs to geoprocessing tools. The next step is to setup the Feature Class to Feature Class geoprocessing tool.

The workflow is to copy a feature class from the scratch geodatabase to the WebMigration geodatabase, projecting it as it is copied.

- m) Right-click WebMigration.gdb variable and select rename. Rename the variable Output Workspace.

The data needs to be projected to Web Mercator as it is copied, so you will create a variable for the output coordinate system.

- n) Right-click on Feature Class To Feature Class and select Create Variable > From Environment > Output Coordinate System.
- o) The Output Coordinate System variable usually is placed on top of the output workspace.



Click Auto Layout on the ModelBuilder ribbon to reorganize your model in the display. You may need to use your mouse wheel to re-center the model.

- p) Set the Output Coordinate System by double-clicking on it, then clicking on the wire-frame globe to open the coordinate system search window.
- q) In the search window, enter 'web Mercator', then use the arrows to navigate to and select WGS 1984 Web Mercator (auxiliary sphere).

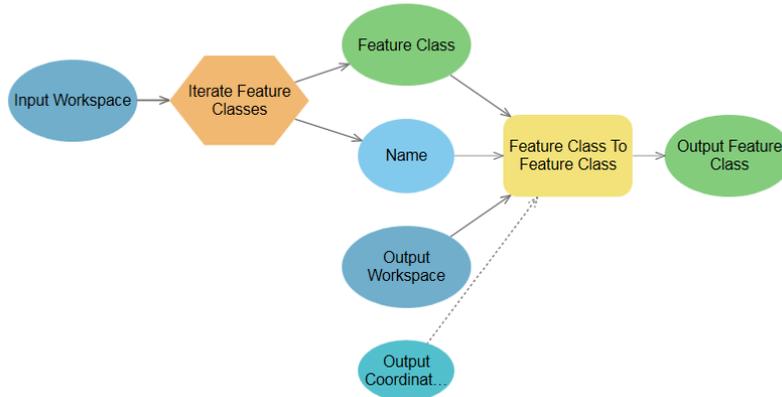
All that is left to do is specify the input and output feature classes in the Feature Class to Feature Class tool.

- r) Double click on the Feature Class to Feature Class tool.
- s) Using drop-down lists set the Input Features to Feature Class and the Output Feature Class to Name. Click OK.



- t) Click on Auto Layout to reorganize your model.
- u) Rename the Boundary output feature class to Output Feature Class.

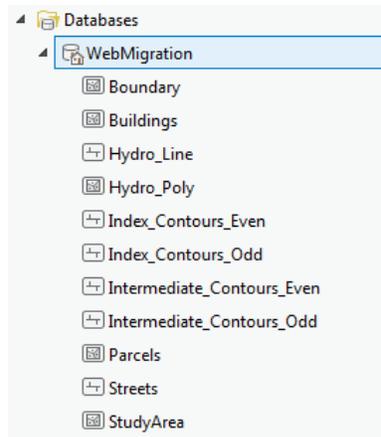
Your model should look something like this:



- v) You're now ready to run the model. In the ModelBuilder ribbon, in the Run section, click on  Run . The model should begin to execute.

As it executes, a text box will open and the processing steps will be listed to it. You should also see each step in the process turn red as it is executed.

- w) Once the model has completed running, close the text window.
- x) In the Project pane, under Databases, right-click the WebMigration geodatabase and select Refresh. You should see each of the feature classes you loaded into the scratch geodatabase has been transferred to the WebMigration geodatabase.



y) Click Save on the ModelBuilder ribbon to save your model.

## Conclusion

In this exercise you experienced how geoprocessing can be accomplished using ArcGIS Pro. The exercise had you use geoprocessing to manage data in a project. Data management is not the only task that you can take on with geoprocessing – Analysis, task automation, and data creation are other areas in which geoprocessing can prove useful.

## References

- [ArcGIS Pro Quick Start tutorials](#) – tutorials on basic tasks and workflows
- [Learn ArcGIS](#) – free online tutorials for ArcGIS Pro and ArcGIS Online.
- [ArcGIS Pro training](#) - ArcGIS Pro tutorials in the Esri Training catalog
- [ArcGIS Pro Home](#) – ArcGIS Pro product website.
- [ArcGIS Pro Documentation](#) – Help pages for ArcGIS Pro.
- [ArcGIS Pro Help](#)
- [Geoprocessing with ArcGIS Pro](#) – ArcGIS Pro Help section on geoprocessing