ModelBuilder: Tips & Tricks

Kristen Hocutt-Solution Engineer (khocutt@esri.com)

Jeff Pearson-Solution Engineer (jpearson@esri.com)

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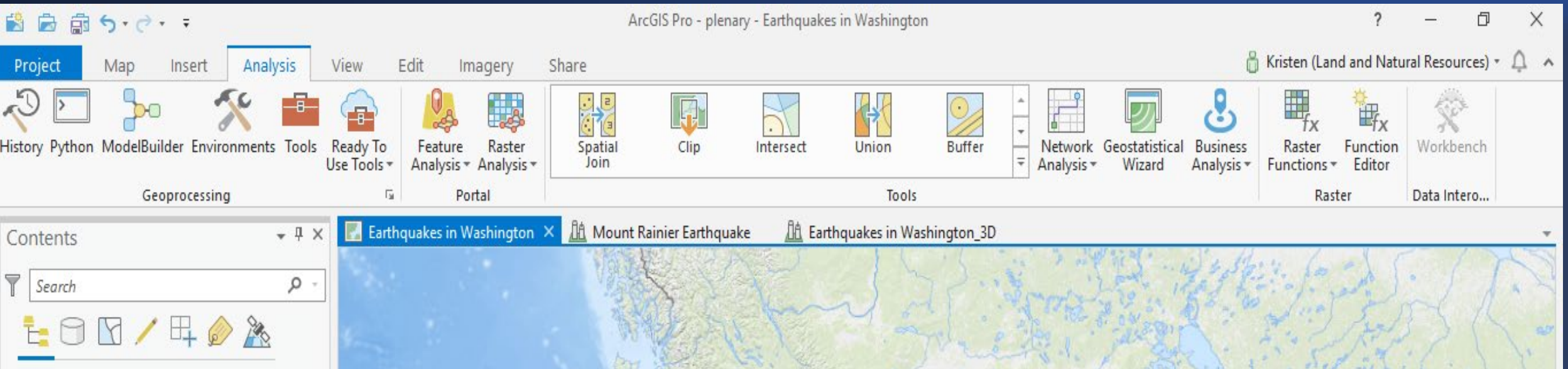
Analysis in ArcGIS Pro

- The Analysis ribbon tab provides access to
  - Gallery of commonly-used tools
  - Suite of all ~800 geoprocessing tools
  - ArcGIS Enterprise and Online analysis tools
  - Geoprocessing History
  - Python Command Line
  - ModelBuilder
  - Network Analysis
  - Imagery Processing/ Raster Functions
  - Data Interoperability Workbench

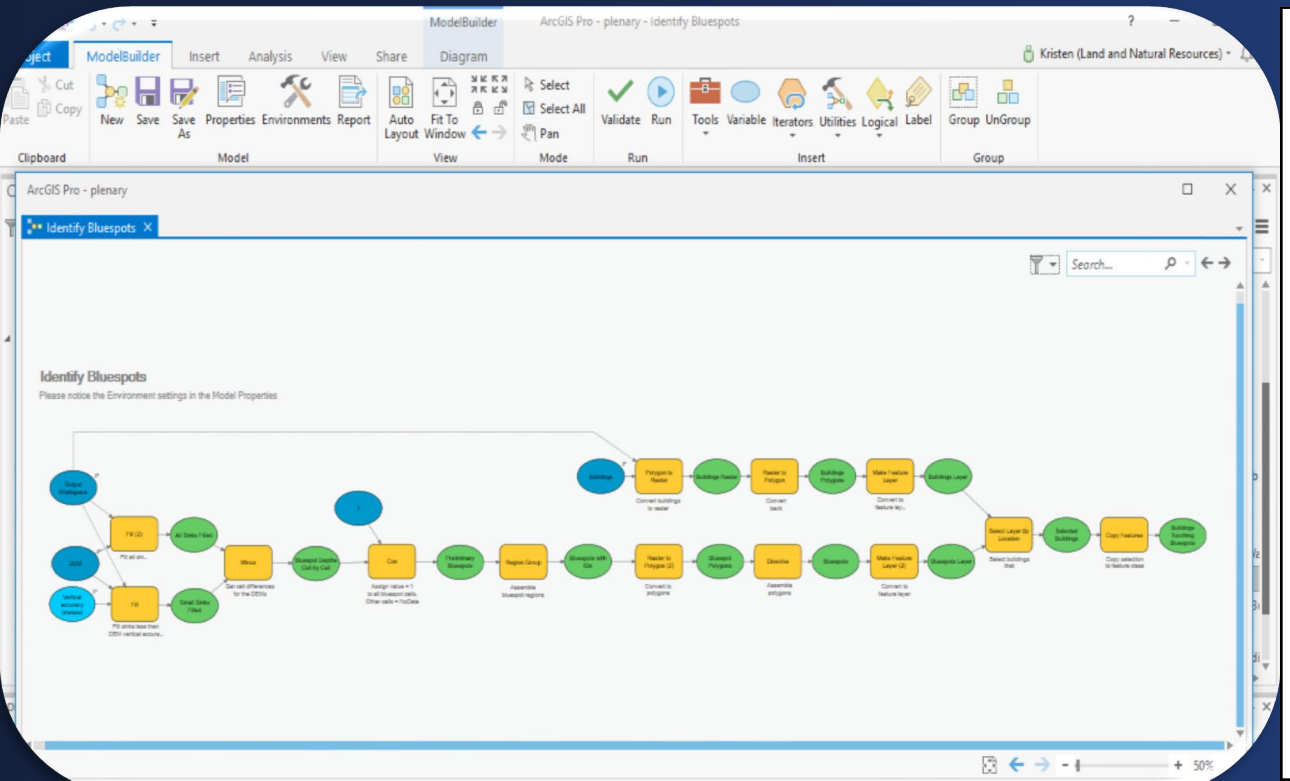


Create a Geoprocessing Workflow

Automate geoprocessing in modelbuilder or a Python script

- Drag and drop tools
- To get started, run the tool in Pro, then command and paste script

```
arcpy.Buffer_analysis(input, output, "10 Miles")
```



Migration to ArcGIS Pro

Differences in ArcMap vs. ArcGIS Pro

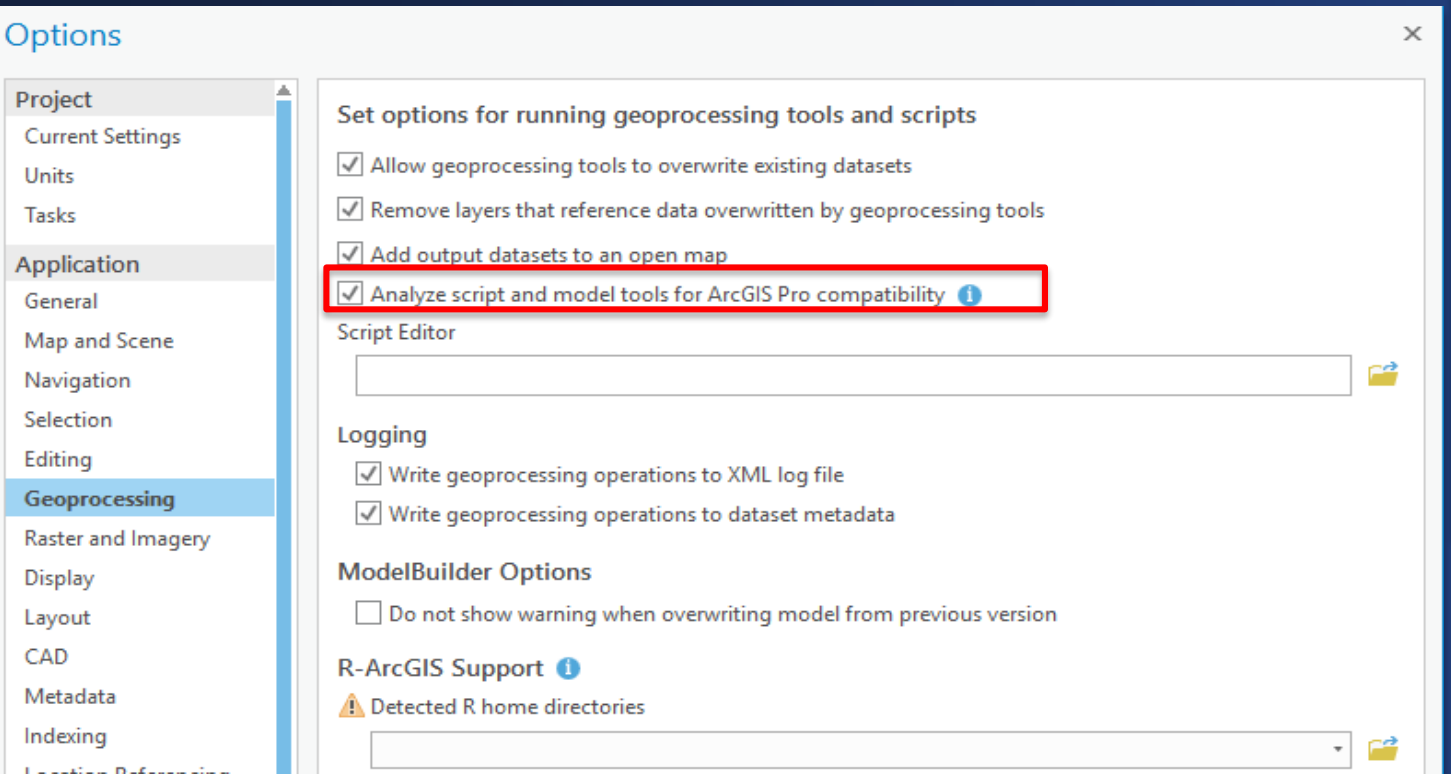
- **Compatibility:** Models created in Pro can NOT be used in other ArcGIS desktop applications. You must save the Toolbox in the correct version to do so. If you edit and save a model in ArcGIS Pro that model will NOT be useable in other ArcGIS Desktop applications. Utilize Consolidate Toolbox GP Tool to assess your tools.
- **Selection, Connection and Navigation:** In ArcGIS Pro, there is a **Select** mode, a **Pan** mode, and **Zoom In** and **Zoom Out** buttons
- **Calculate Field:** No longer supports VB expressions, must use Python or Arcade syntax. Change your Expression Type parameter and rewrite using valid syntax.
- **Intermediate and Managed Data:** These options have been removed
- **Colors, Shapes and Images:** Different color scheme in Pro and can not have custom settings
- **List and Series:** NOT supported in ArcGIS Pro (Use iterators)
- **Feature and Records Set:** Interactive drawing & entering of features/records is NOW supported

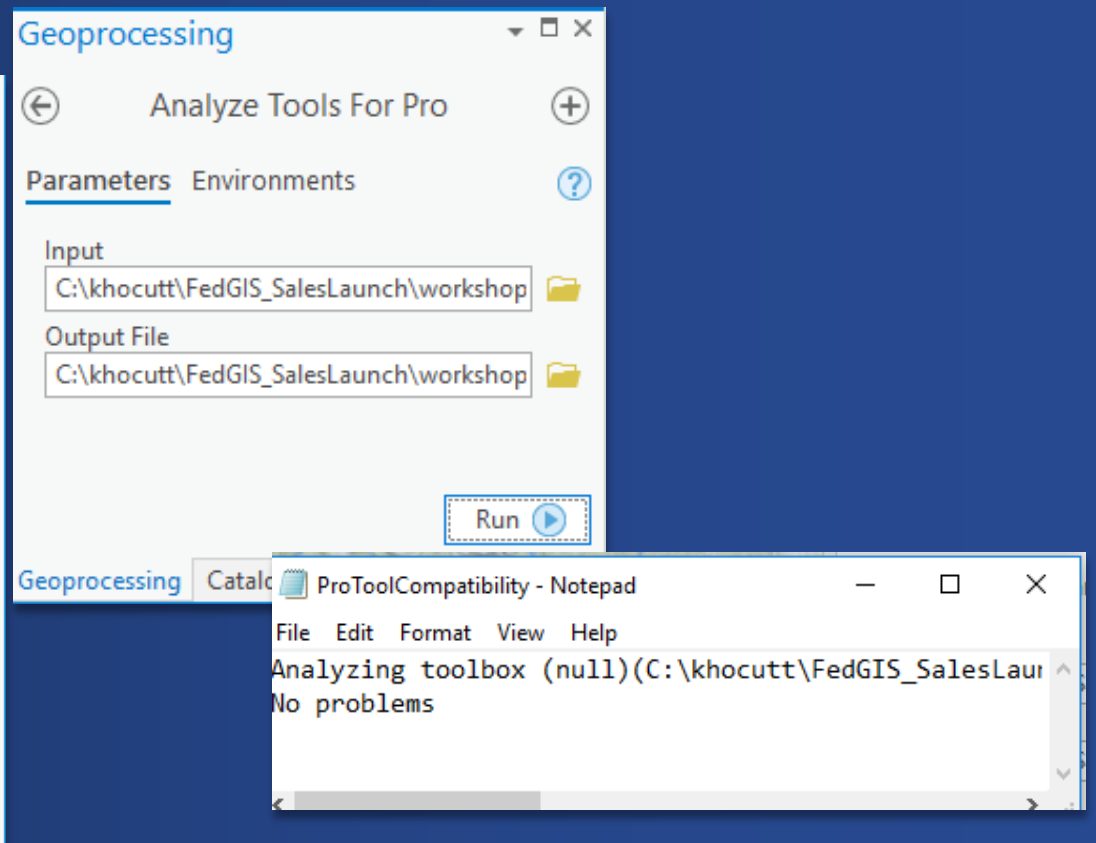
More Information go to the ArcGIS Pro documentation page.

Check Tools For Compatibility With Pro

See if your existing tools or scripts will work in Pro by checking for compatibility one of two ways:

- Check the option to analyze for compatibility on in the Geoprocessing (GP) Options
- Run the Analyze Tools For Pro GP Tool





Foundational Knowledge

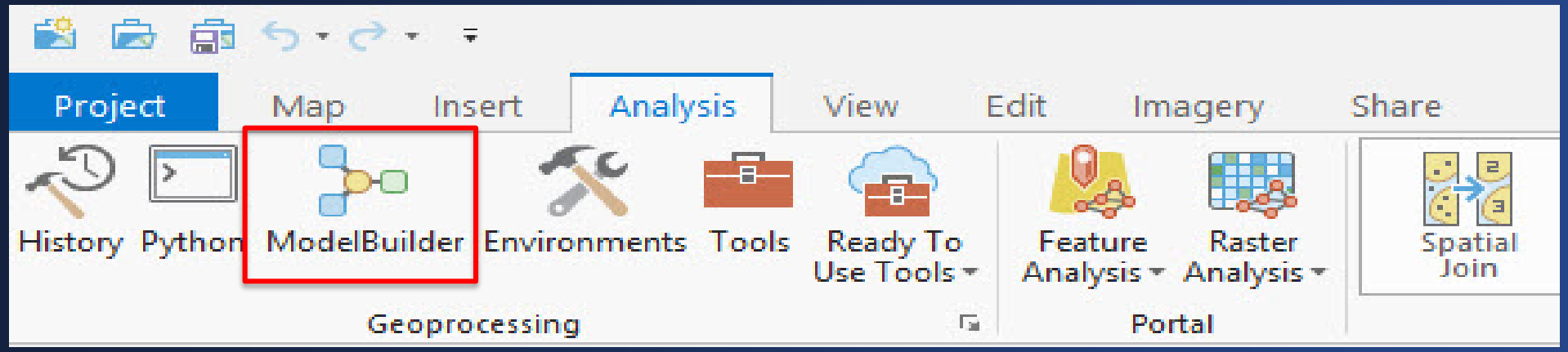
Laying the groundwork

Where to Create a Model

Tip # 1A: – Create your model in the same location as the project file & toolbox you will be using.

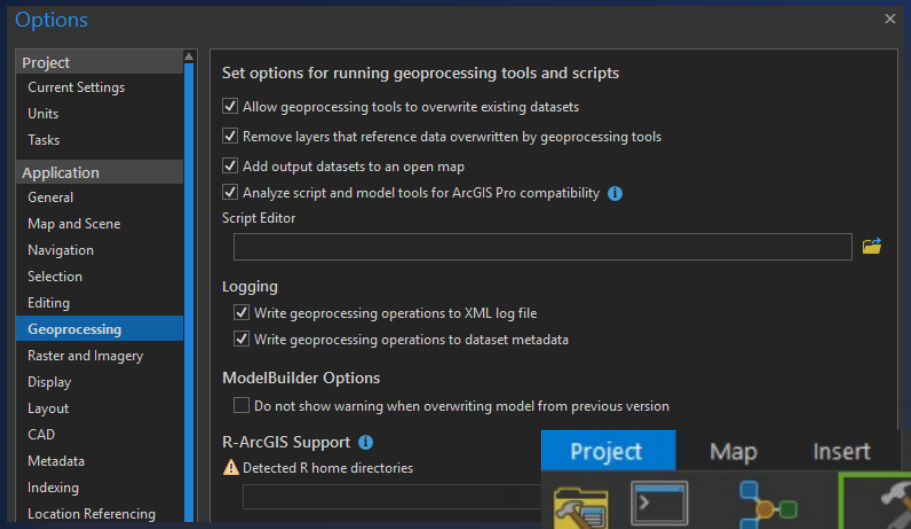
- Switching to Pro requires a shift in mindset from a map centric, to a project centric workflow.

- When you use ModelBuilder in Pro, the application will already be pointed to where your data lives.

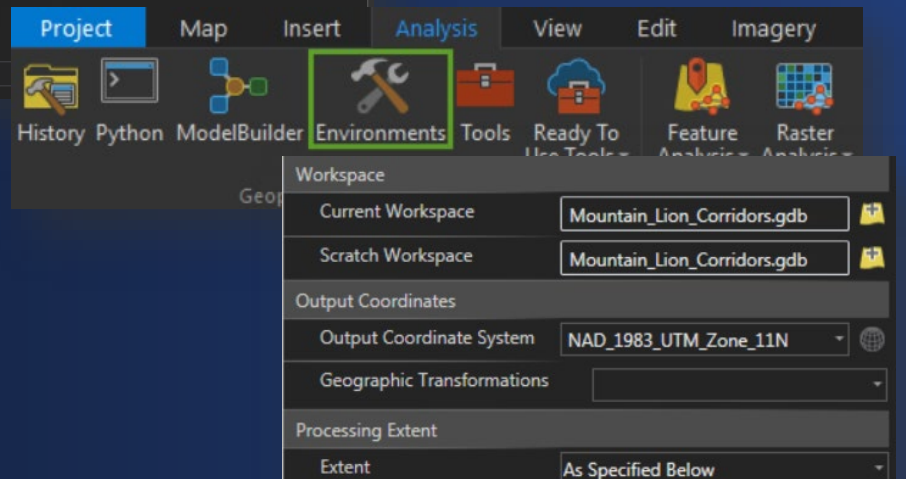


Environment Settings

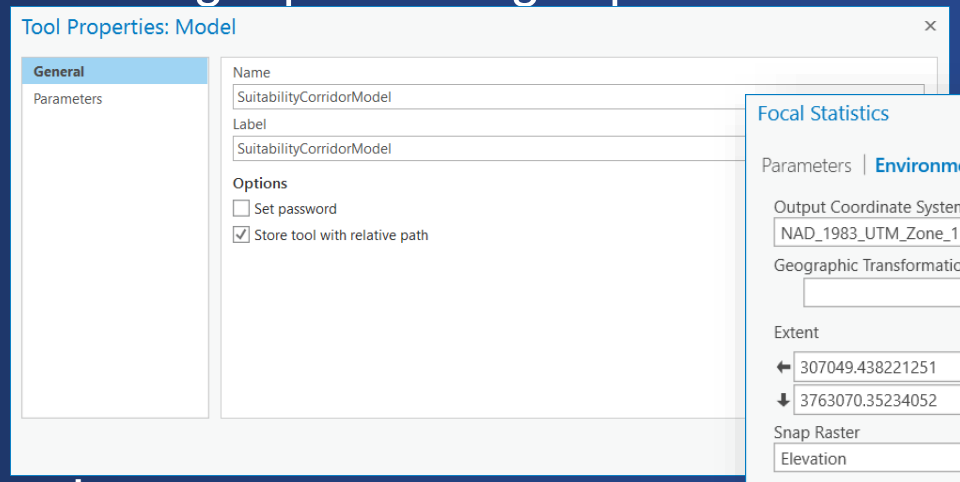
Tip # 1B: – Check your project-level, analysis-level, model-level and model process-level environments before running your model to ensure geoprocessing is performed in an controlled environment..



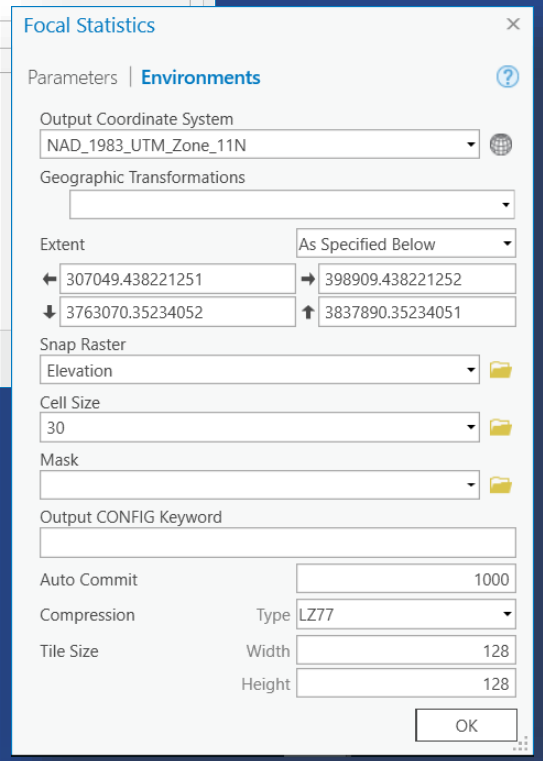
Project-Level



Analysis-Level



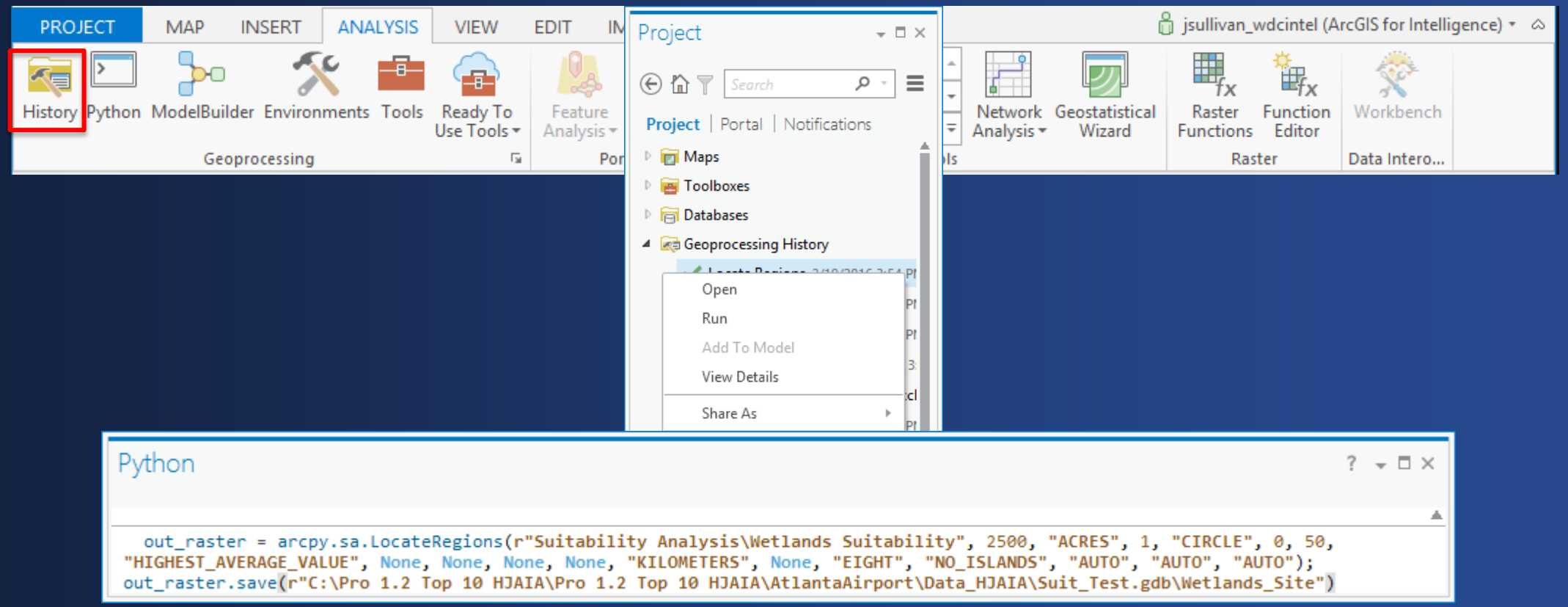
Model-Level



Tool-Level

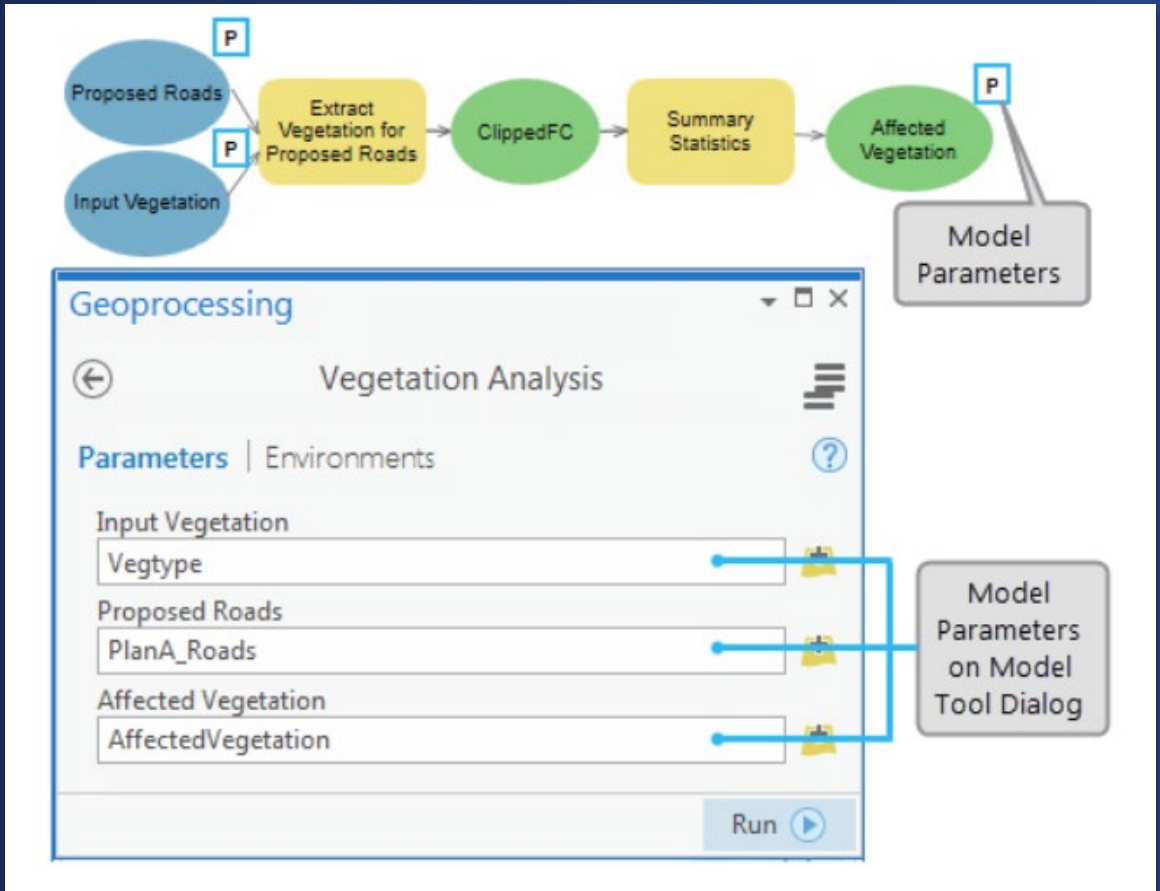
Geoprocessing History

- **Tip # 2A:** – Tools run from inside ModelBuilder are not saved in the project geoprocessing history, except if it's a model parameter.



Parameters

- **Tip # 2B:** – After the model tool runs successfully, only model outputs set as model parameter are added to the map.



Model Properties

Tip # 2C: – Store tool with a relative path

Property	Description
Label	The label of the model. The label is displayed everywhere you see the model, including in the ModelBuilder view, the **Geoprocessing** pane, and the **Catalog** pane.
Name	The name of the model. The name is used when running the model tool in Python.
Set password	You can password protect your model so that a password must be entered before you or others can view or edit the model in ModelBuilder. A password-protected model tool can be run by anyone from the **Geoprocessing** pane.
Store tool with relative path	This option is checked by default. If you move the toolbox containing the model or the data used within the model, this option changes the paths of data variables in the model according to the path, relative to the toolbox.

Model Report

Tip # 3A: – AutoSync your model reports

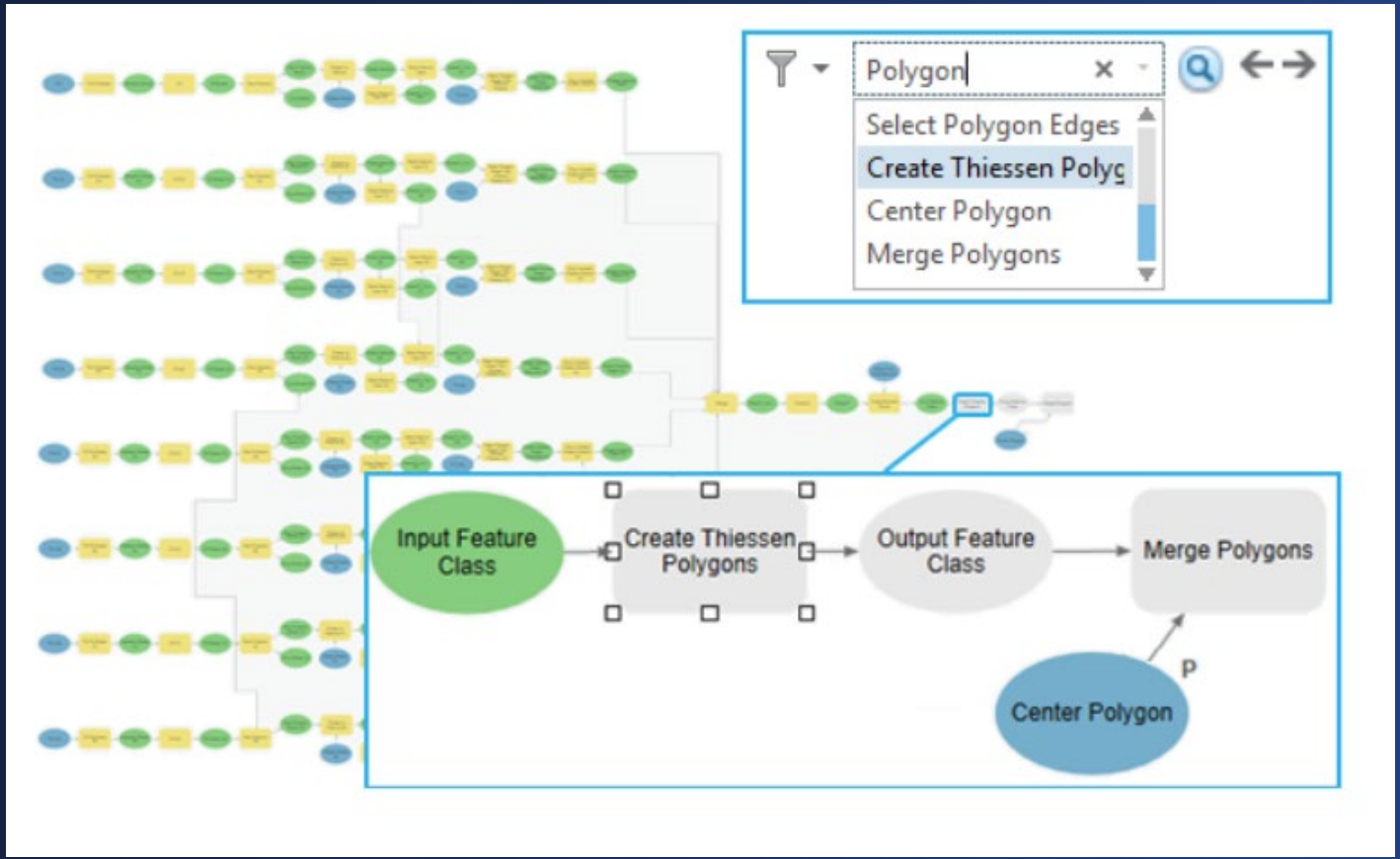
Mountain Lion Study Area | Analysis Criteria | Analysis Steps | SuitabilityCorridorModel | SuitabilityCorridorModel-Report

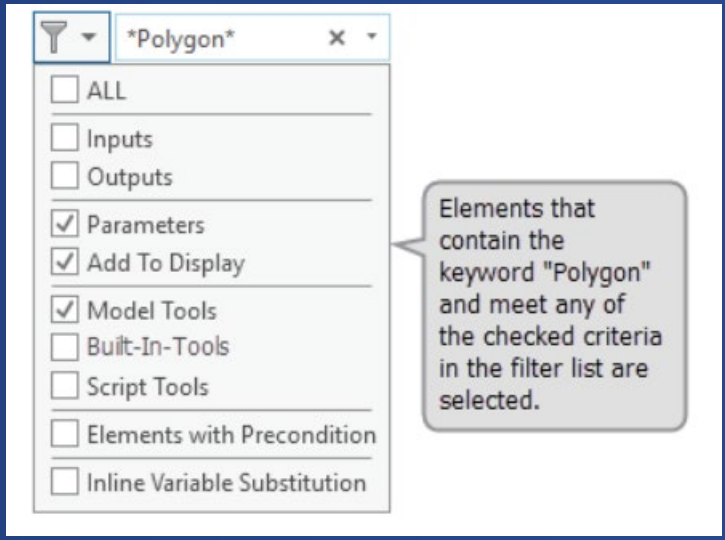
Export | Views: All | Inputs | Outputs | Parameters | Tools | Errors | AutoSync

Element	Data Type	Value	Parameter Type	Direction
Model				
Variables				
Roads	Feature Layer	Roads		
Output direction raster	Raster Dataset			
Core Mountain Lion Habitats	Feature Layer	Core Mountain Lion Habitats		
Elevation	Raster Layer	Elevation		
ruggedness	Raster Dataset	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
Ruggedness_reeclassified	Raster Dataset	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
distance_to_roads	Raster Dataset	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
Distance_to_Roads_Reclassif	Raster Dataset	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
Land Cover	Raster Layer	Land Cover		
LandCover_Reclassified	Raster Dataset	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
Protected Status	Raster Layer	Protected Status		
ProtectedStatus_Reclassified	Raster Dataset	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
Suitability_Surface	Raster Dataset	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
MountainLionCorriders	Feature Class	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
Mountain_Lion_Corridors_Ad	Feature Class	C:\khocutt\Presentations\FedGIS2018\ModelBuilder\data\Mountain_Lion_Corridors		
Processes				
Euclidean Distance				
Messages				
Information		Executing (Euclidean Distance): EucDistance Roads C:\khocutt\Presentations\FedGI		
Information		Start Time: Monday, March 12, 2018 8:37:00 PM		
Information		2018-03-12T20:37:01.172: Initialization Phase ...		
Information		2018-03-12T20:37:04.404: Iteration Phase ...		
Information		2018-03-12T20:37:05.935: Completion Phase ...		
Information		Succeeded at Monday, March 12, 2018 8:37:07 PM (Elapsed Time: 6.92 seconds)		
Parameters				
Input raster or feature	Composite Geodataset	Roads	Required	Input

Search and Filter Elements

Tip # 3B: – Depending on the size of your model it may be difficult to find an element with a specific name or type. You can search and filter to find a specific element in ModelBuilder.



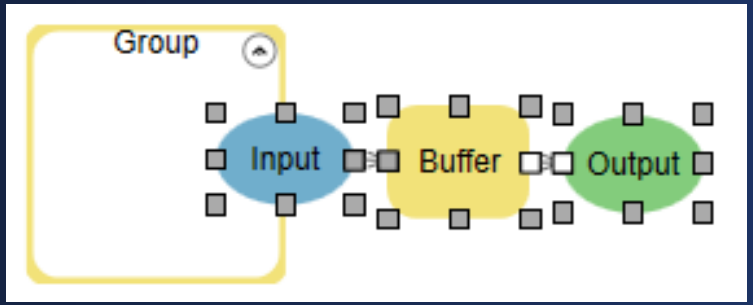


Grouping

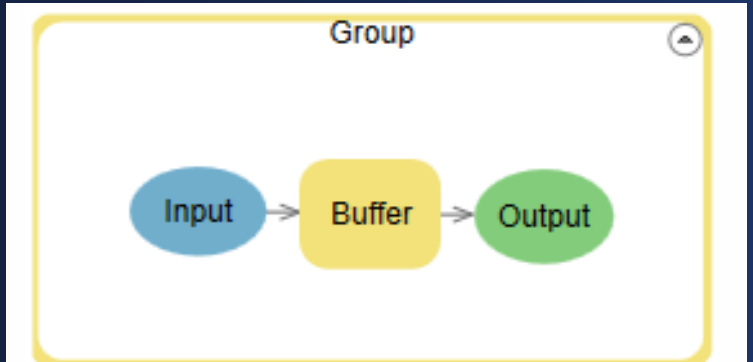
Tip # 3C: – Grouping in a model allows you to assemble processes into logical units. These groups can be collapsed to maximize visual space or expanded to edit the processes within the group

Examples:

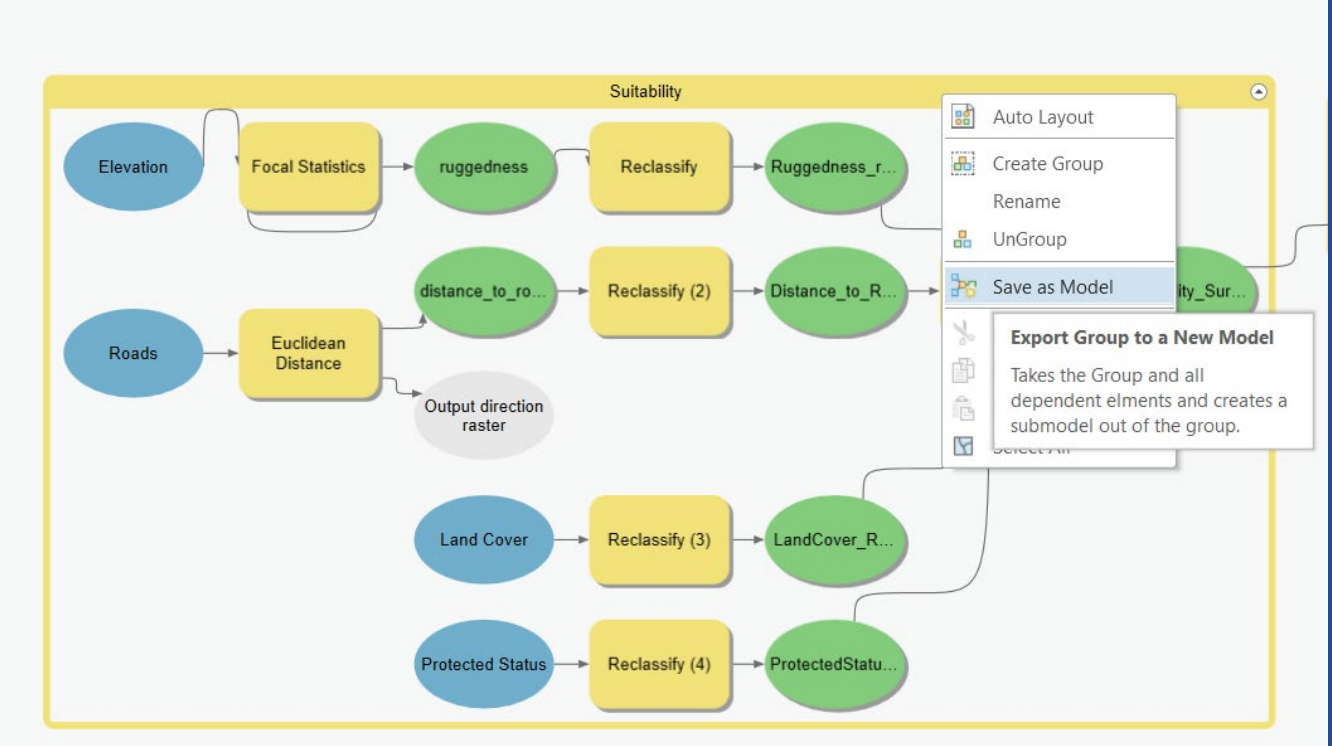
Add an Empty Group to the Model

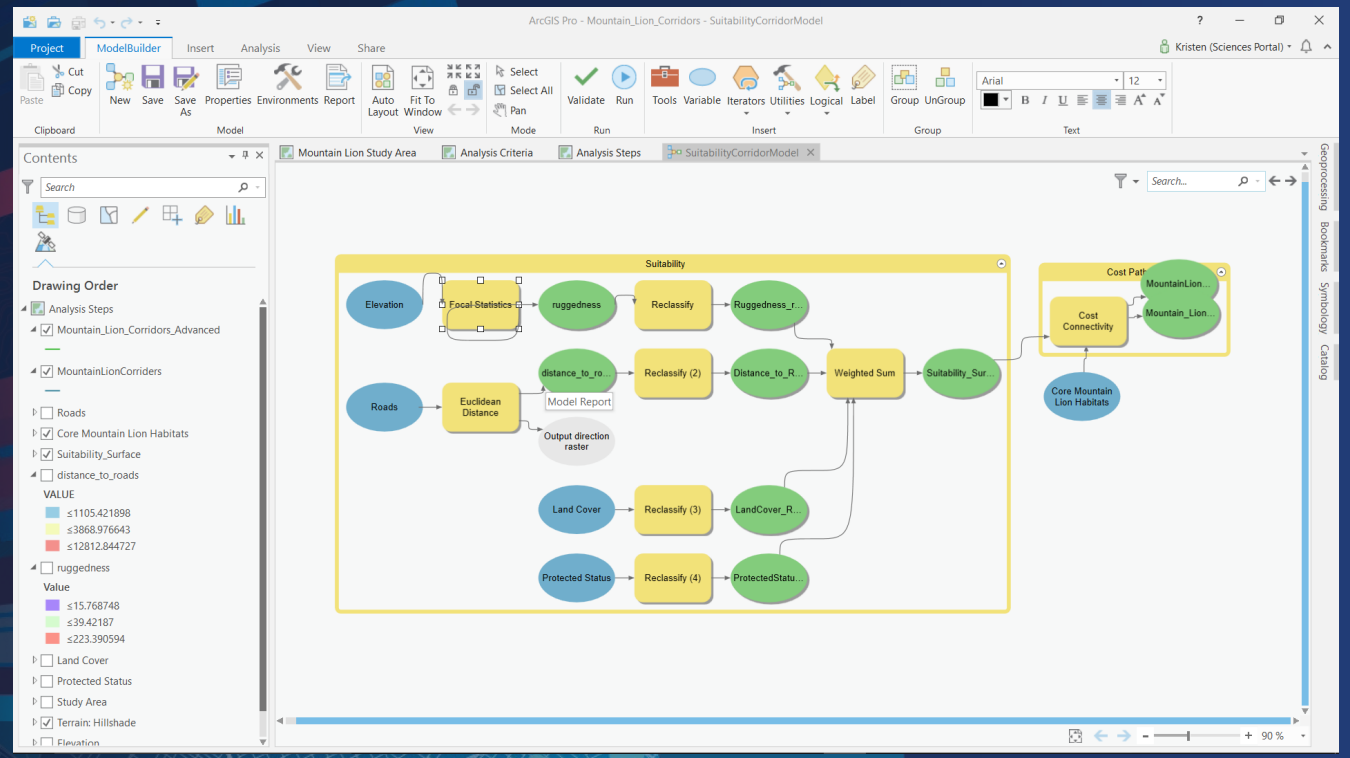


Select an existing model element and make it a Group



Save Grouped Model as a new model



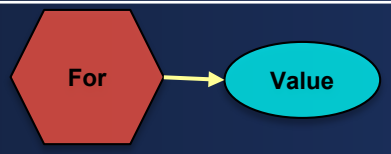


Foundational Knowledge

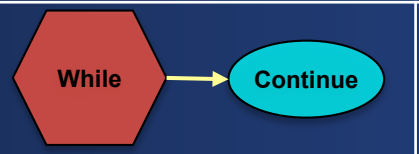
Getting back to the basics

Iterators (Looping)

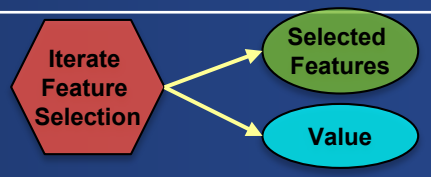
Repeat a Process



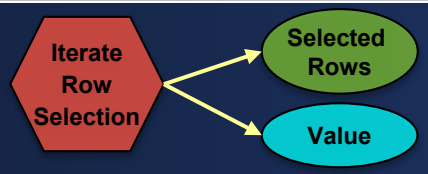
Iterates over a **starting and ending value** by a given value.



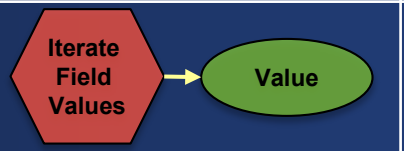
Iterates **"while" a condition is true or false**.



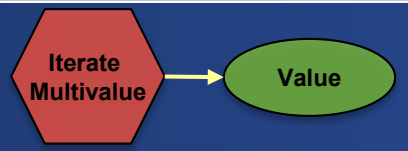
Iterates over **features** in a feature class.



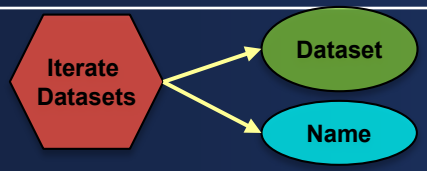
Iterates over **rows** in a table.



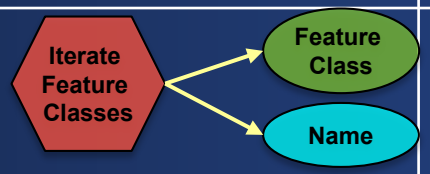
Iterates over **each value in a field**.



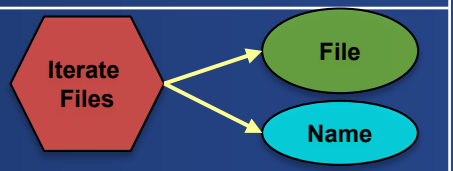
Iterates over a **list** of values.



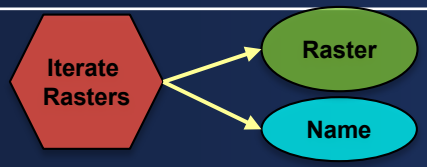
Iterates over **datasets** in a Workspace or Feature Dataset.



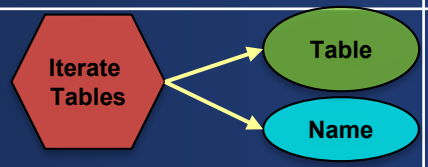
Iterates over **feature classes** in a Workspace or Feature Dataset.



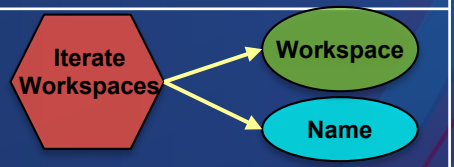
Iterates over **files** in a folder.



Iterates over **rasters** in a Workspace or a Raster Catalog.



Iterates over **tables** in a workspace.



Iterates over **workspaces** in a folder.

Accessing the iterators in ModelBuilder

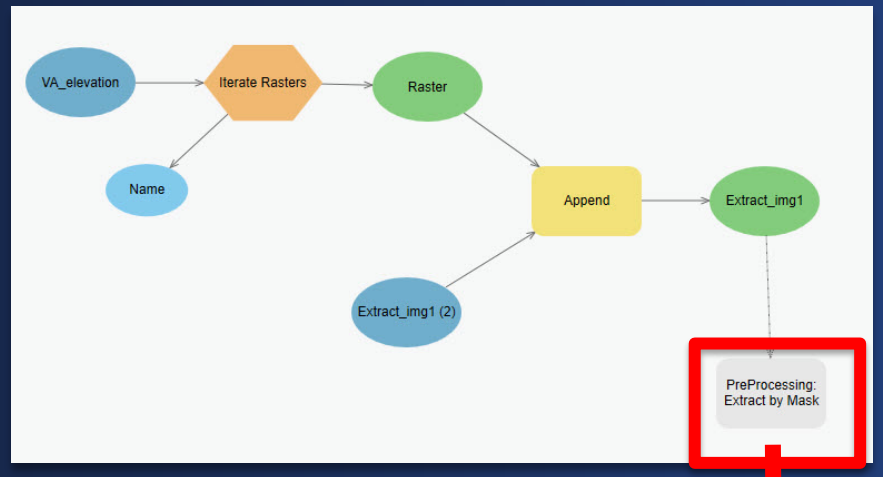
Tip # 4A: – Only one iterator can be used per model. The button to add another iterator will be disabled if one iterator exists in the model.

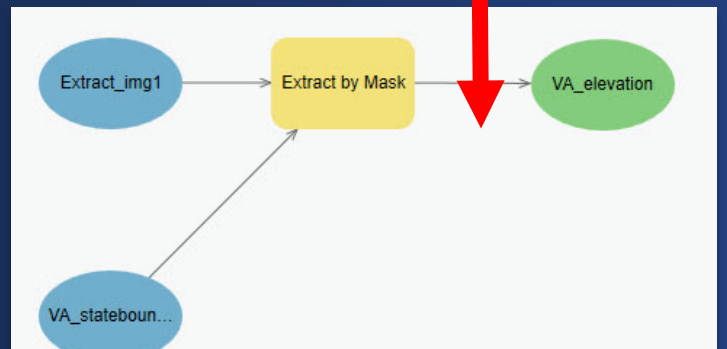
Accessing the iterators in ModelBuilder

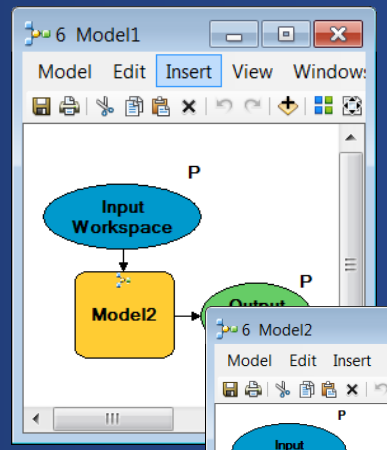
Tip # 4B: – If an iterator is added to a model, all tools in the model iterate for each value in the iterator. If you do not want to run each tool in the model for each iterated value, create another model and add only the iterator and processes that you want to run multiple times, save it, and add it as a model tool into the main model.

Nested Models

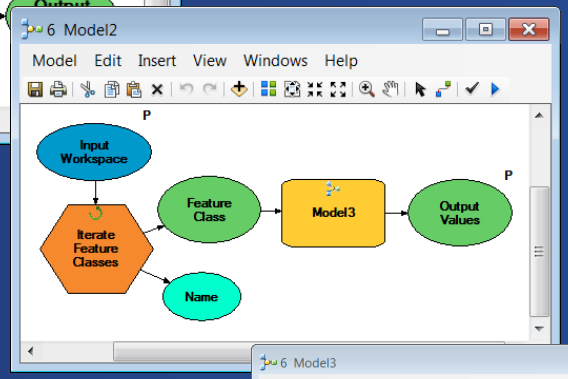
Model within a Model



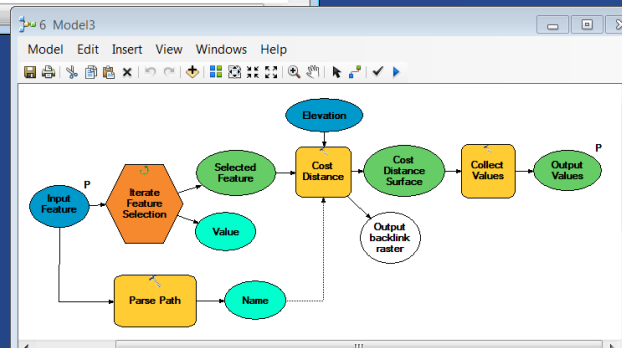




Model 1



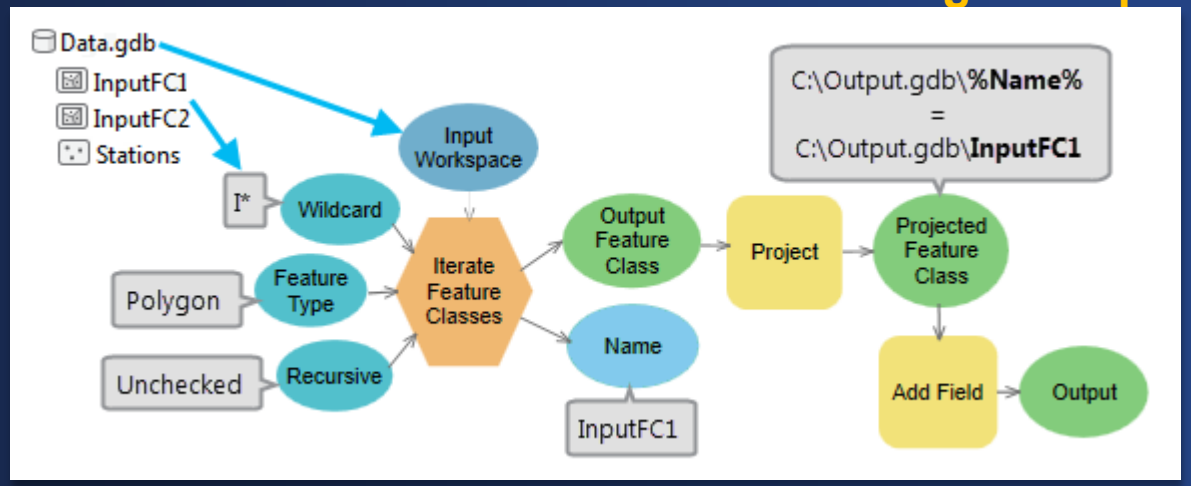
Model 2



Model 3

Naming with Iterators

- **Tip # 4C:** –The output of any tool connected to the iterator can have (if required) a unique name for each iteration to avoid being overwritten by Inline Variable Substitution
  - Using the system variable **%n%**
    C:\Sctatch\scratch.gdb\output_%n%
  - Using the **Name or Value output of the iterator**
    C:\Sctatch\scratch.gdb\output_%Name%
    C:\Sctatch\scratch.gdb\output_%Value%
  - Using **any other variable** in the model as an inline variable
    C:\Scratch\scratch.gdb\output_%XYZ%



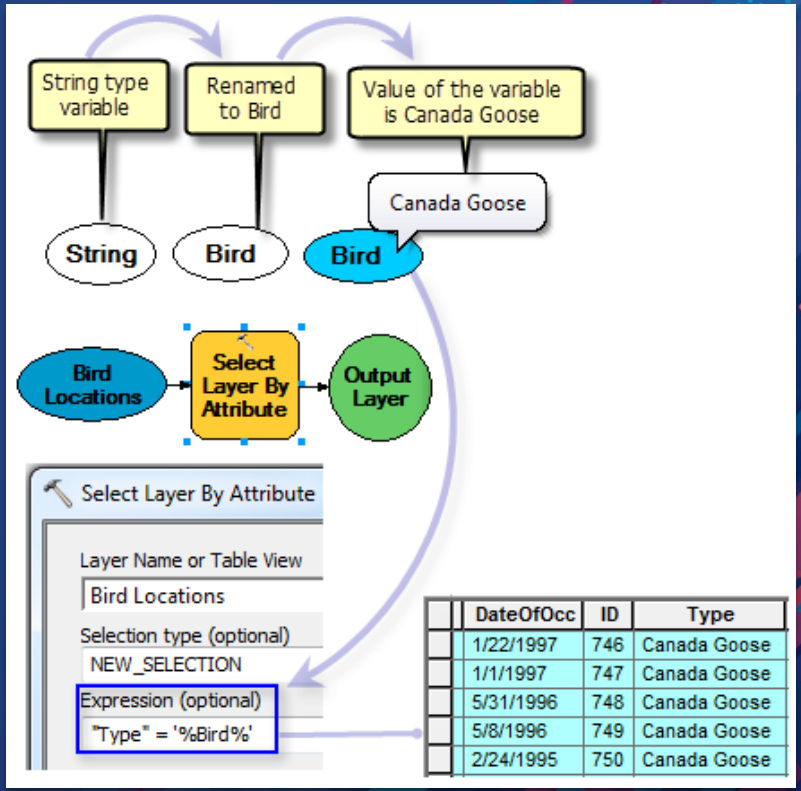
Python Equivalent of Iterators in ModelBuilder

- **Tip # 4D:** – The **script will not include the iteration logic** if a model with an iterator is exported to a Python script.

```python
# import modules
import arcpy
import os

# define a function
def main(inputTable, groupByField, skipNullValue):
    """Iterate row selection."""
    arcpy.env.overwriteOutput = True

    # if field/s for grouping is/are provided
    if groupByField:
        # keep track of null values for each group field in a dictionary
        nullDict = {}
        for field in groupByField:
            nullDict[field[0]] = field[1]

        # Create two empty lists to read and keep track of all unique value pairs
        valueList = []
        curValues = []

        # open a searh cursor to iterate over each row
        with arcpy.da.SearchCursor(inputTable, nullDict.keys()) as cursor:
            for row in cursor:
                curValues = []
                # for each field in groupByField parameter if there is a null value, set it to a string "Null"
                for field in groupByField:
                    if skipNullValue and row[nullDict.keys().index(field[0])] == nullDict[field[0]]:
                        curValues.append("NULL")
                    # else append the value in the ValueList
                    else:
                        curValues.append(row[nullDict.keys().index(field[0])])
                valueList.append(curValues)
                curValues = []
```

Inline Variable Substitution

The value of any variable can be used in the tool parameters by enclosing the name of the substituting variable between the percent signs (%)



Inline variable substitution: %VariableName%

- **Tip # 5A:** –In SQL expressions - Name = '%Value%'

If string put "quotes" around your inline variable substitution, if it's a number you don not need quotation marks.

Example Workspace: C:\Data.gdb

Output Workspace: %Data Workspace%\Projected

Example Calculate Value: Value = 4 & Value = 760kg

Expression: %Number of Residents% * %Waste Per Person Per Year% = 4 * 760

Example Iterator: Name

Output Feature Class: C:\Data\Output.gdb\P_%Name%

Example System Variable Substitution: %n%

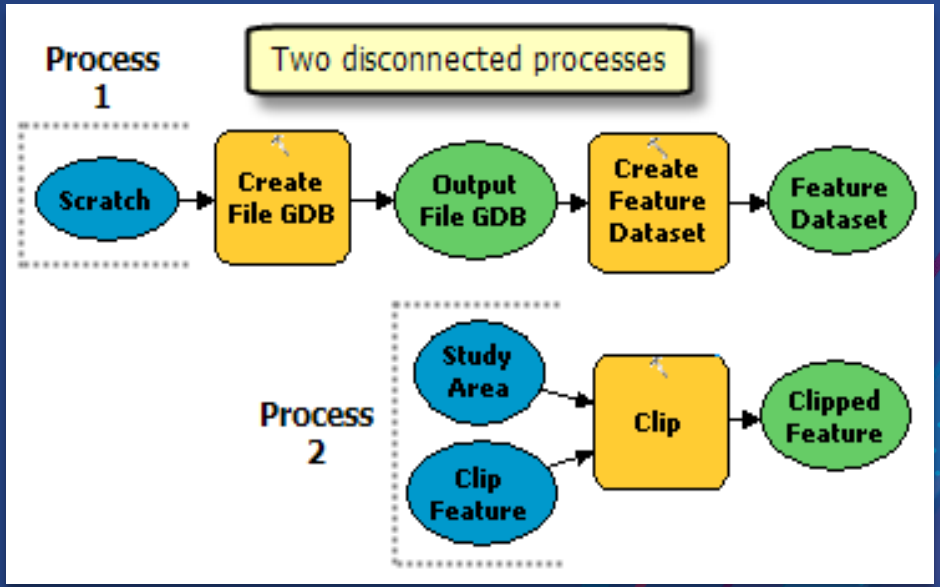
Output Feature Class: C;\Output.gdb\Buffer%n%

Example User Input: Parcel ID= 9(String type variable)

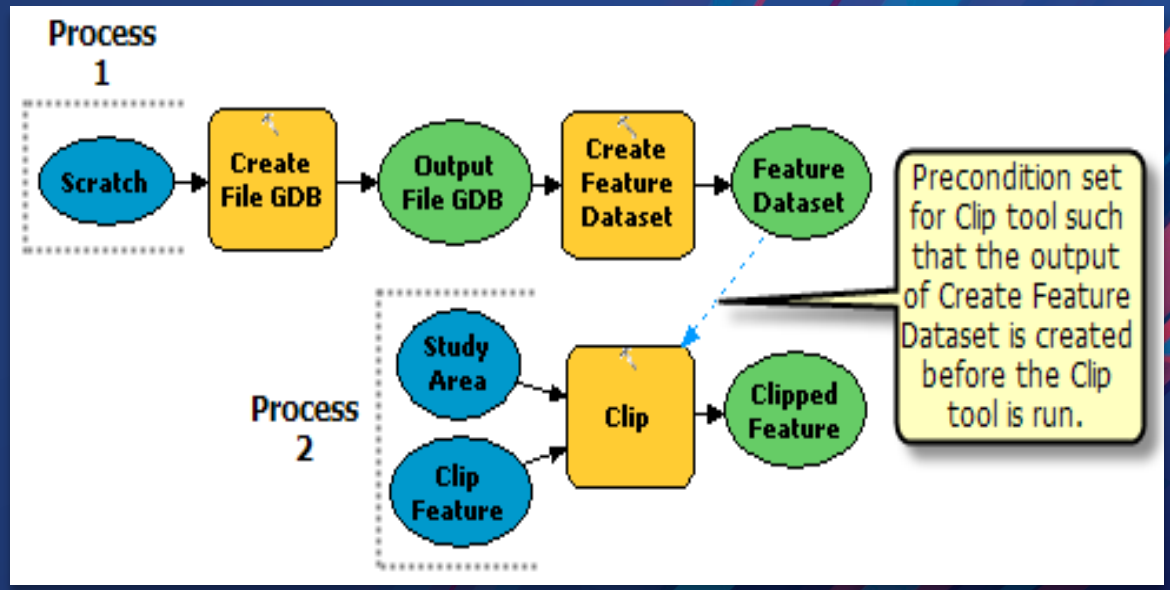
Expression Select Layer by Attribute: "Parcel" = '%Parcel ID%'

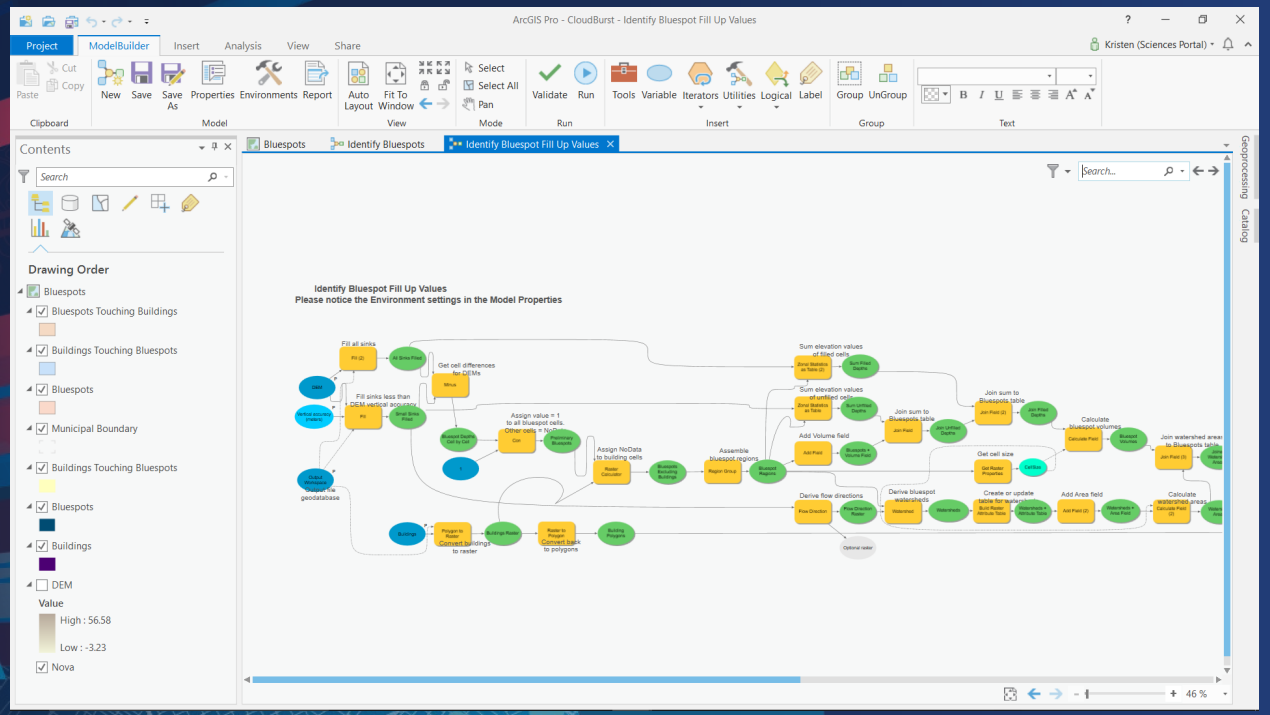
Preconditions

Explicitly Controls the order of operations in a model



- **Tip # 6A:** –Remember any variable can be made a precondition to tool execution and any tool can have more than one precondition.



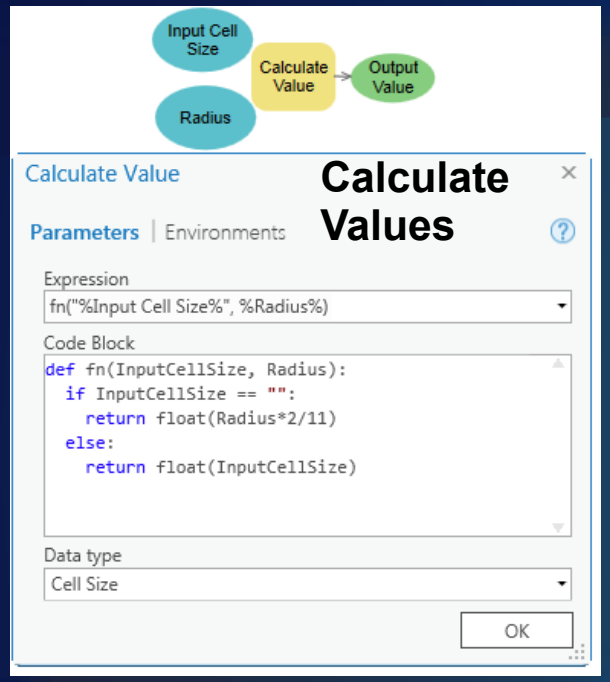


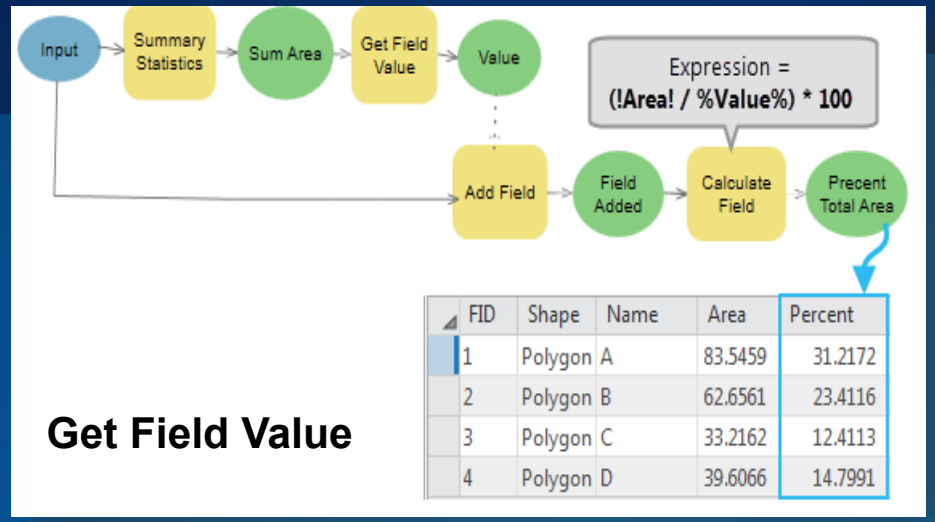
Iteration, Inline Variable Substitution & PreConditions

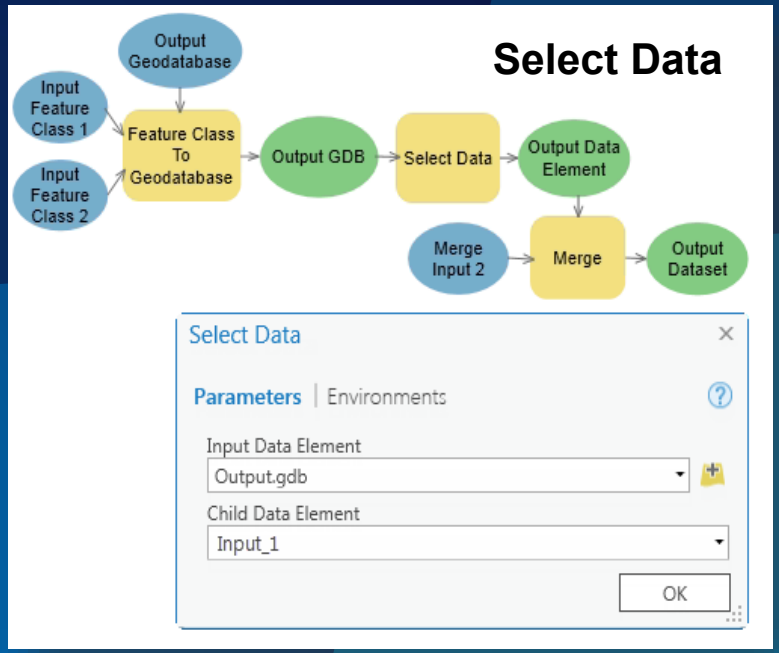
Heart of Analysis

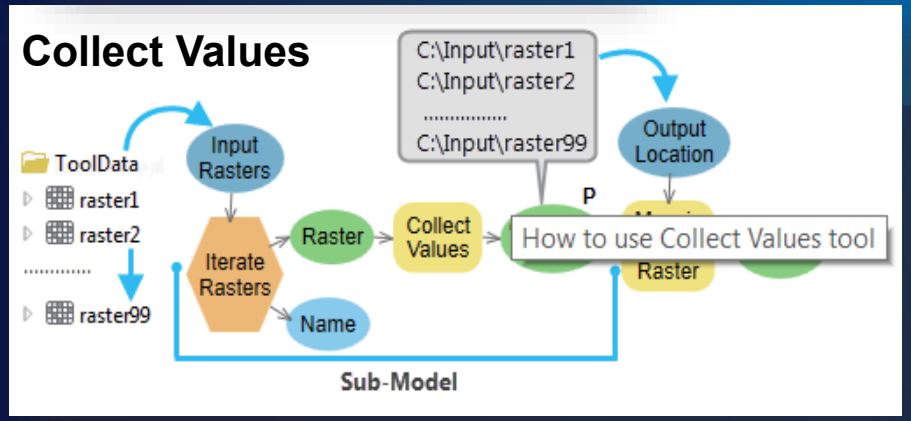
Utilities

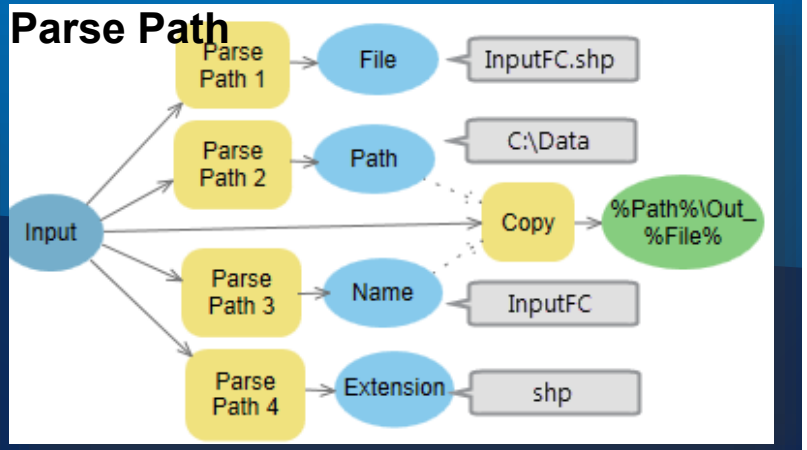
Tip # 7A: Utilize ModelBuilder utilities to your advantage.

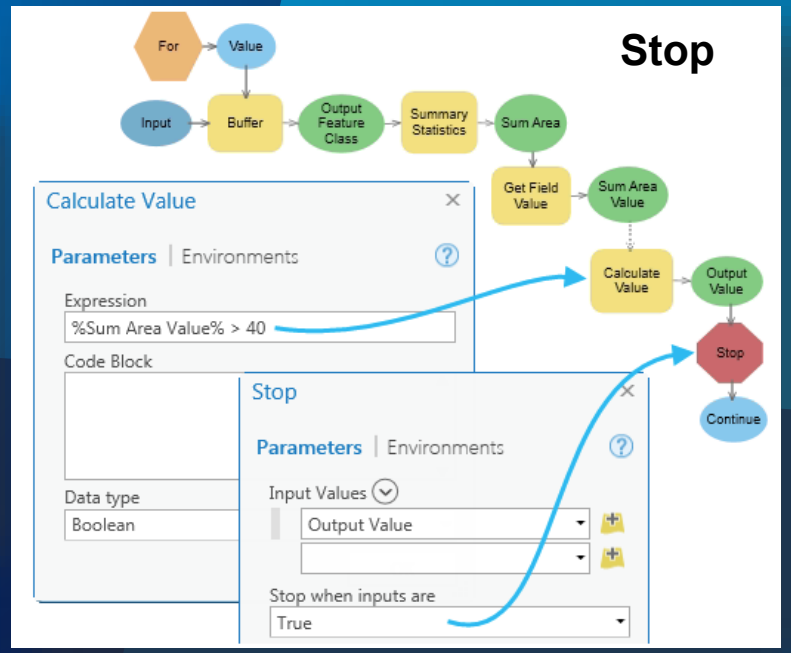










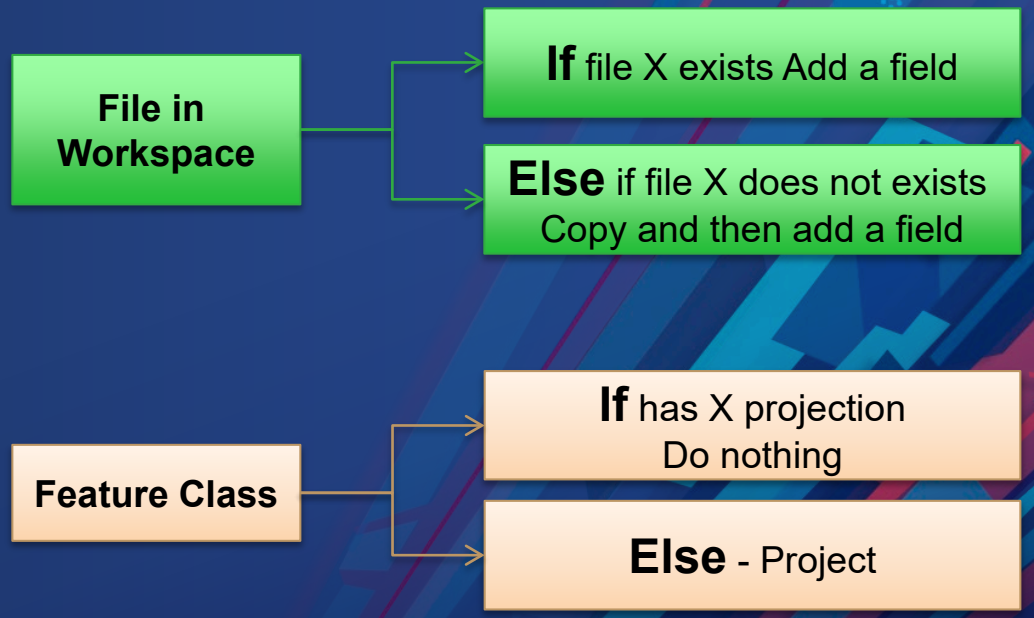


Examples

Branching & Logical Tools

IF some condition is true, THEN
perform an action; ELSE
the condition is false,
perform a different action.

Example:

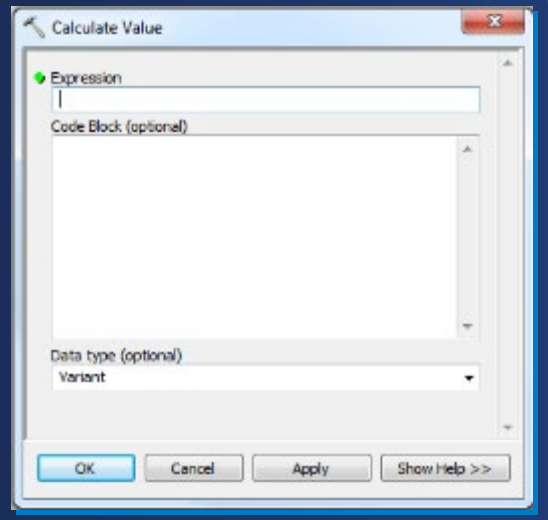


Branching

- **Tip # 8A:** – Three ways to use Branching / The condition - If-then-else……

1
Calculate Value tool

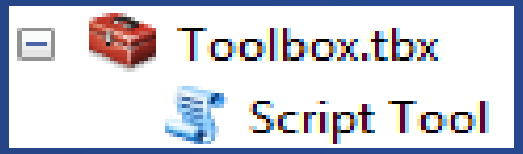
- Where to find the tool
- Python Code
- Data types
- Preconditions in a model
- Inline Variable Substitution
- Merge Branch tool



OR

2
Script tool

- Creating a script tool
- Python code
- Setting script tool properties
- Preconditions in a model
- Merge Branch tool

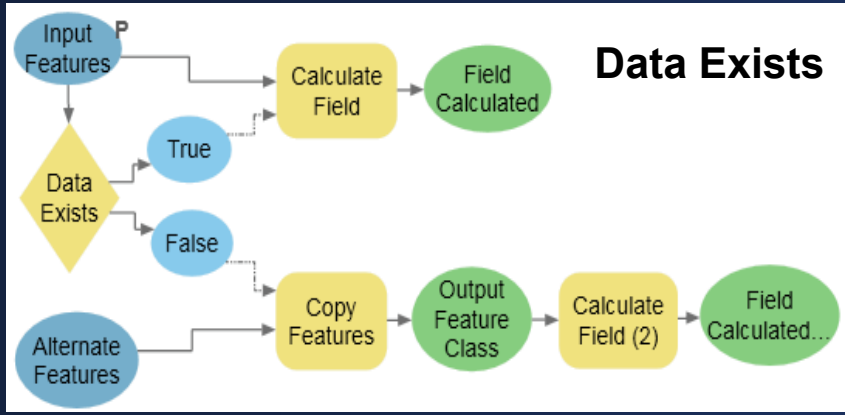


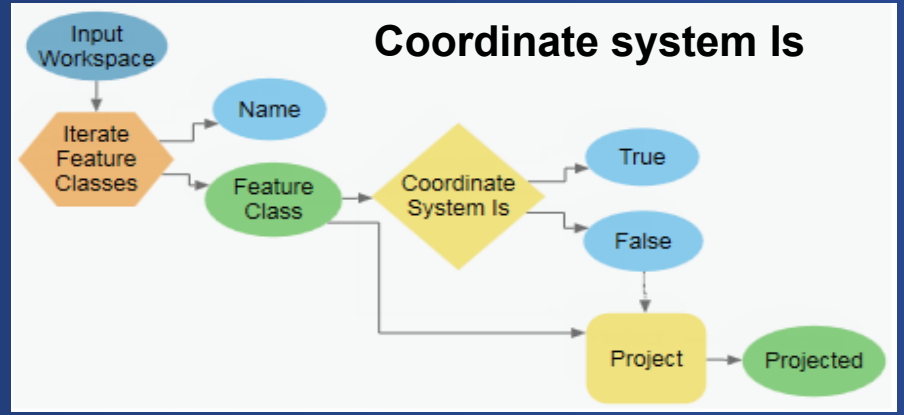
3. Logical Tools

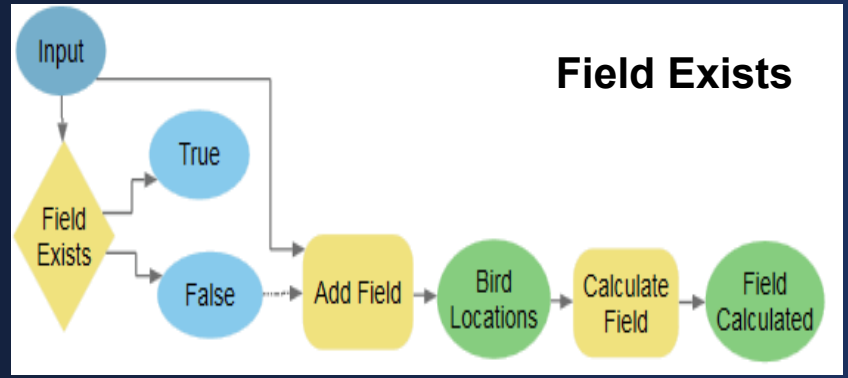
- **Tip # 8B:** –Use Logical Tools help you control the flow of processes in a model and enable if-then-else branching logic.

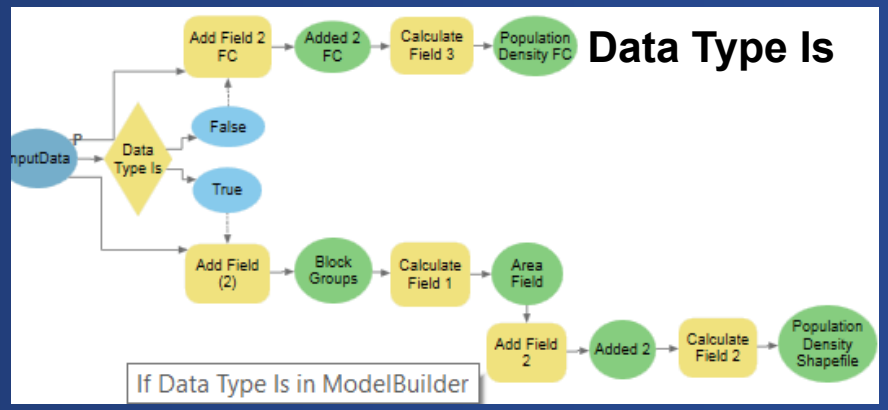
Utility	Description
If Data Exists	Evaluates if the specified data exists.
If Field Exists	Evaluates if the input data has the specified fields.
If Selection Exists	Evaluates if the input data has a selection and if a certain number of records are selected.
If Coordinate System Is	Evaluates if the input data has the specified coordinate system.
If Data Type Is	Evaluates if the input data matches the specified data type.
If Feature Type Is	Evaluates if a feature class is of the specified feature type.
If Field Value Is	Evaluates if the values in an attribute field match a specified value, expression, or second field.
If Row Count Is	Evaluates if the row count of the input data matches a specified value.
If Spatial Relationship Is	Evaluates whether the inputs have a specified spatial relationship.
If Value Is	Evaluates an input value against a single value, a list of values, or a range of values using a defined comparison operator.
Merge Branch	The Merge Branch tool merges two or more logical branches into a single output.
Stop	Stops iteration if all inputs values meet the specified condition of True or False. It is functionally similar to the While iterator but is useful to stop a model if there is one While iterator in a model and no additional iterators can be added.

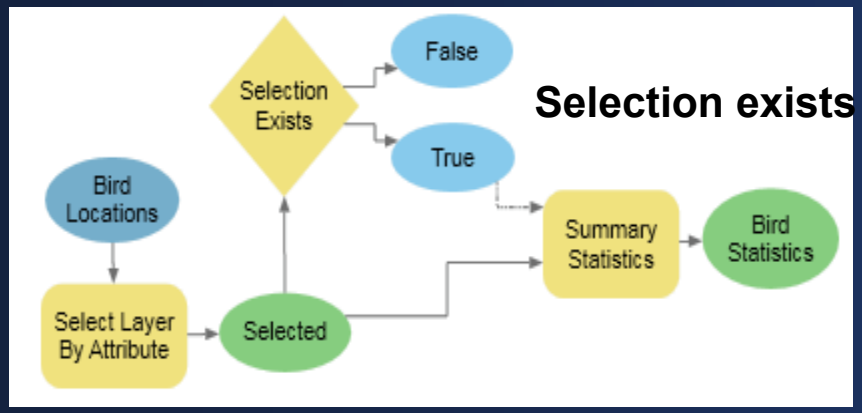
Common Branching Logic

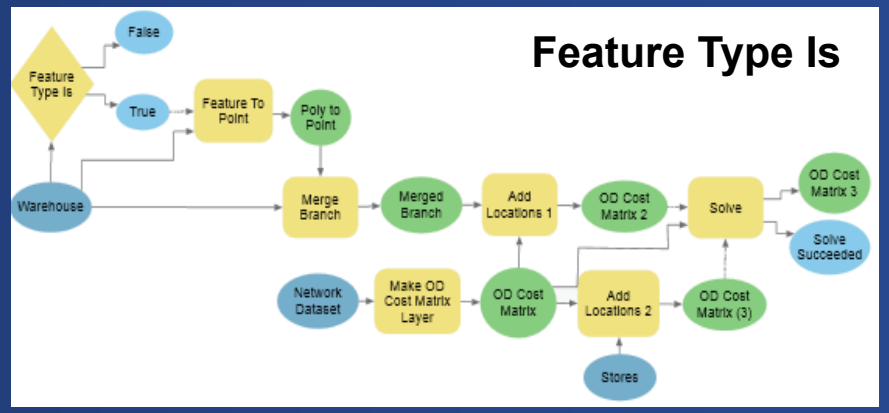


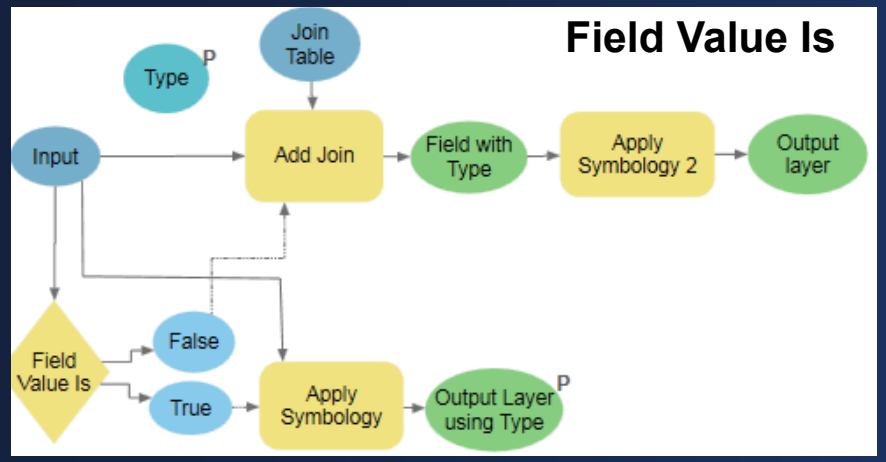


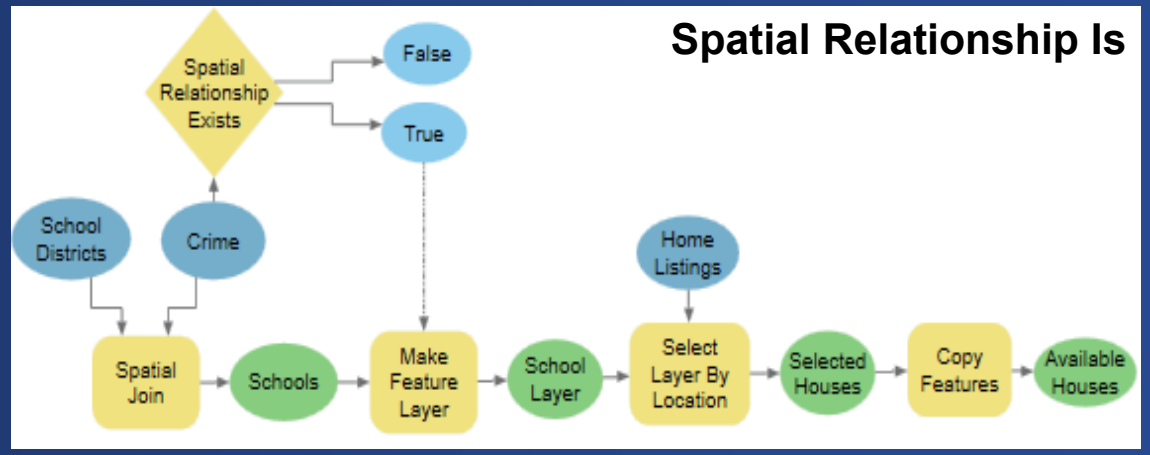




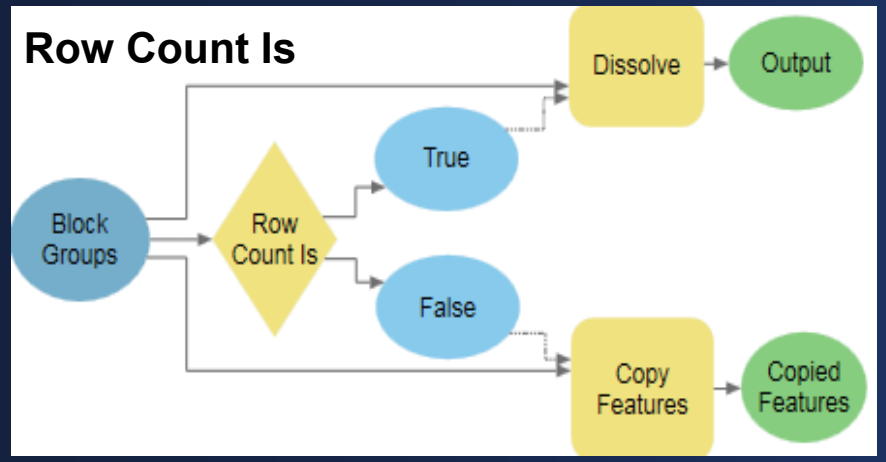


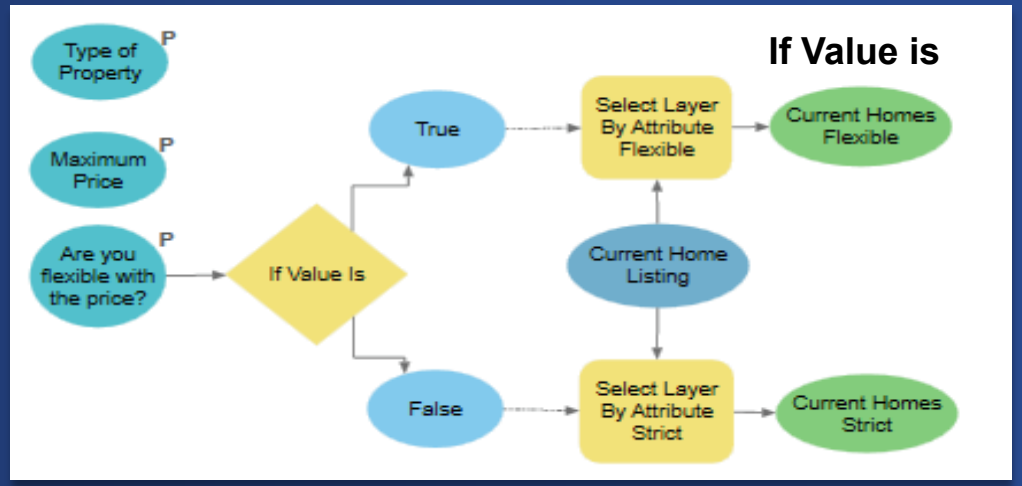



Field Value Is
Type
P
Join Table
Input
Add Join
Field with Type
Apply Symbology 2
Output layer
Field Value Is
False
True
Apply Symbology
Output Layer using Type
P


Spatial Relationship Is
Spatial Relationship Exists
False
True
School Districts
Crime
Home Listings
Spatial Join
Schools
Make Feature Layer
School Layer
Select Layer By Location
Selected Houses
Copy Features
Available Houses

There’s more!


Row Count Is
Dissolve
Output
True
Block Groups
Row Count Is
False
Copy Features
Copied Features


If Value is
Type of Property
P
Maximum Price
P
Are you flexible with the price?
P
If Value Is
True
Select Layer By Attribute Flexible
Current Homes Flexible
Current Home Listing
False
Select Layer By Attribute Strict
Current Homes Strict

Branching Using Script Tool

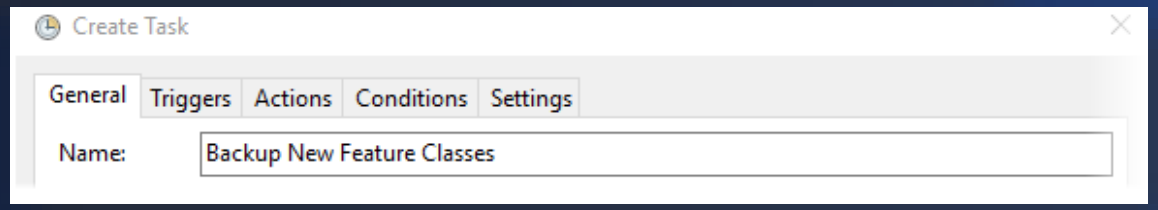
```python
# Import modules
import arcpy
import sys
import traceback

# Set local variables
prj = ""
indata = "C:/ToolData/well.shp"
dsc = arcpy.Describe(indata)
sr = dsc.spatialReference
prj = sr.name.lower()

try:

   # check if indata is in StatePlane, has no PRJ, or one other than StatePlane
   if prj.find("_stateplane_") > -1:
       # Set the Is Unknown parameter to FALSE, and the Is StatePlane parameter to TRUE
       arcpy.SetParameterAsText(1,"false") #The first parameter refers to the "Is Unknown" variable
       arcpy.SetParameterAsText(2,"true") #The second parameter refers to the "Is StatePlane" variable
       arcpy.AddMessage("Coordinate system is StatePlane")

   elif prj == "unknown":
       # Set the Is Unknown parameter to TRUE, and the Is StatePlane parameter to FALSE
       arcpy.SetParameterAsText(1,"true")
       arcpy.SetParameterAsText(2,"false")
       arcpy.AddMessage("To continue, first define a coordinate system!")

   else:
       # Set the Is Unknown parameter to FALSE, and the Is StatePlane parameter to FALSE
       arcpy.SetParameterAsText(1,"false")
       arcpy.SetParameterAsText(2,"false")
       arcpy.AddMessage("Coordinate system is not StatePlane or Unknown")

except Exception as e:
    AddPrintMessage(e[0], 2)
```

Schedule a Model

Tip # 9A: – Create a task to schedule your model.

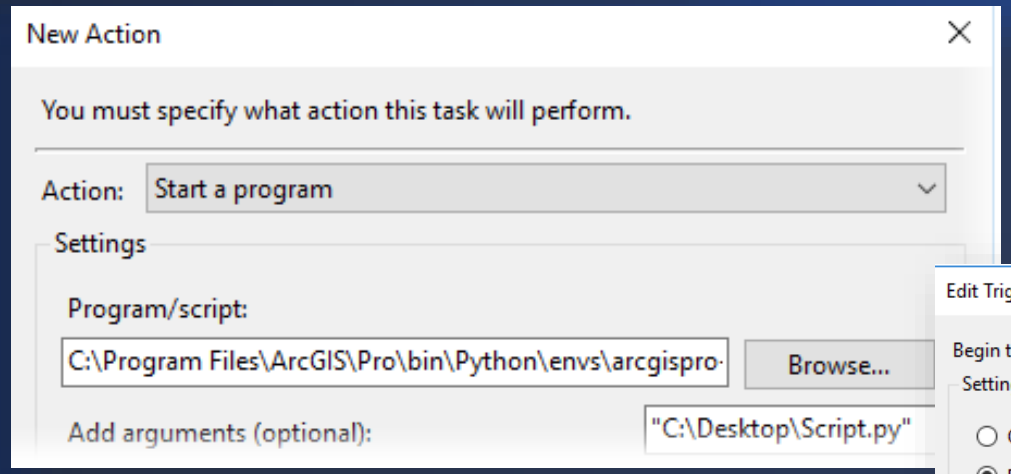
```
import arcpy
arcpy.ImportToolbox(r"C:\path\myToolbox.tbx")
arcpy.myModel(r"c:\pathToInput\inputFolder", r"C:\pathToGdb\output.gdb")
```

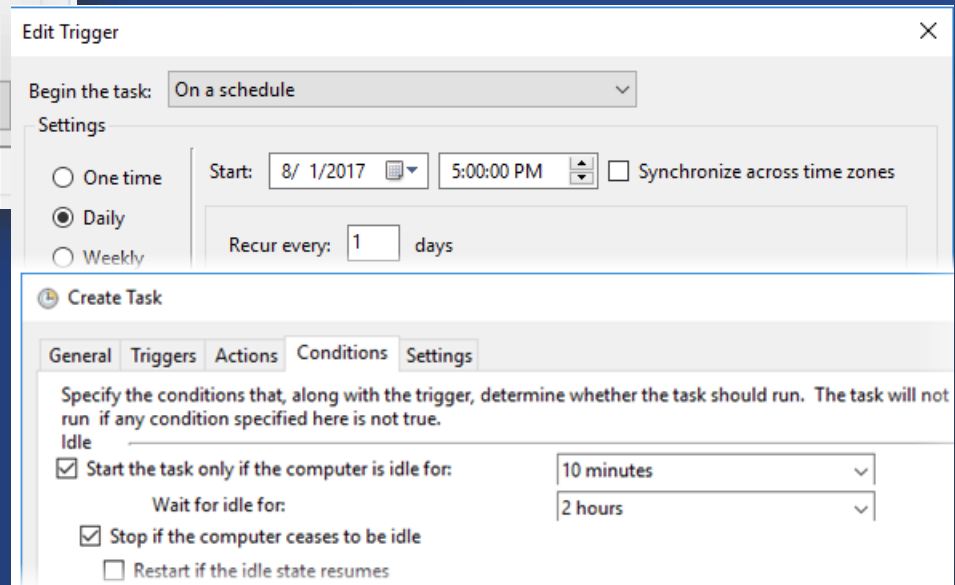
Import a Model with ArcPy



Create a Task in Windows Task Scheduler

Create a New Action to point to your script





Create a new Trigger and optionally Conditions

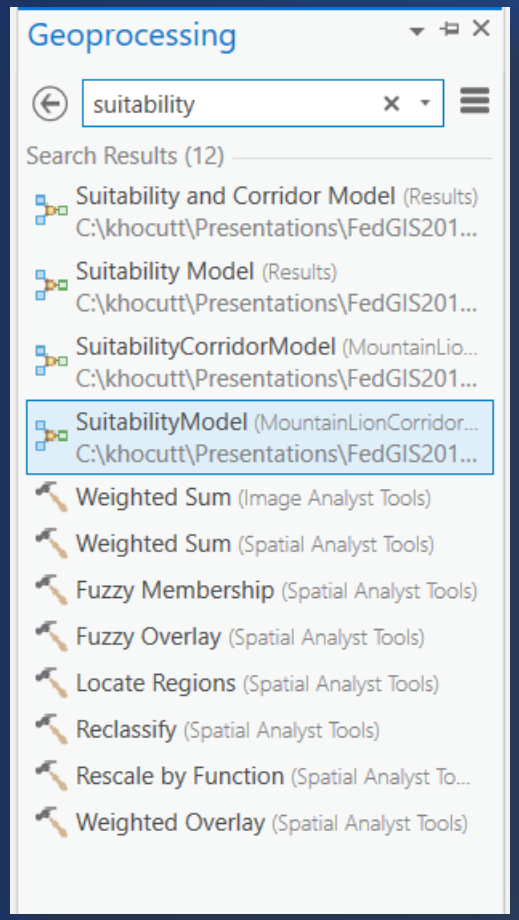
Sharing

Models, Reports and Data as Services

Sharing Tool, Models and Scripts as a Web Tool

Must be connected to ArcGIS Enterprise

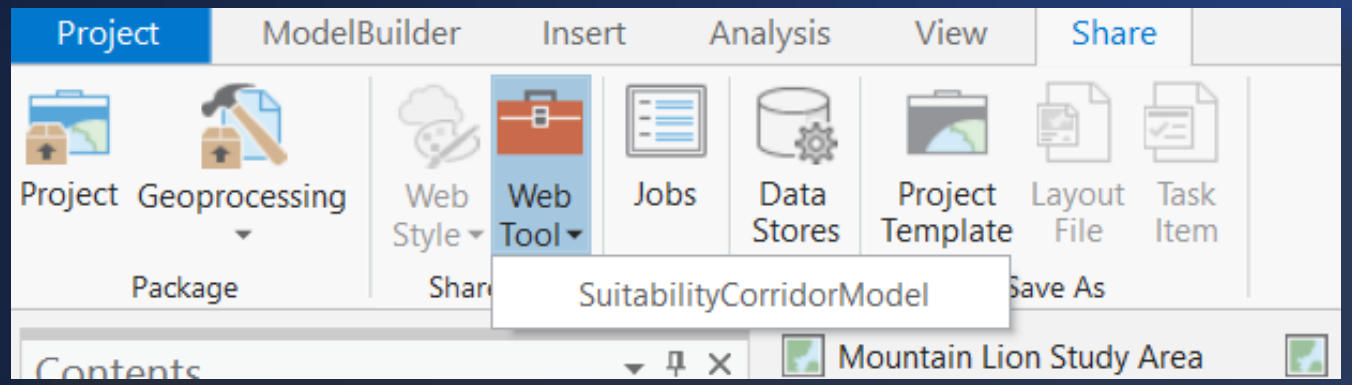
Tip # 10A: – Make sure you have input Parameters and Run Model in the Geoprocessing Pane.

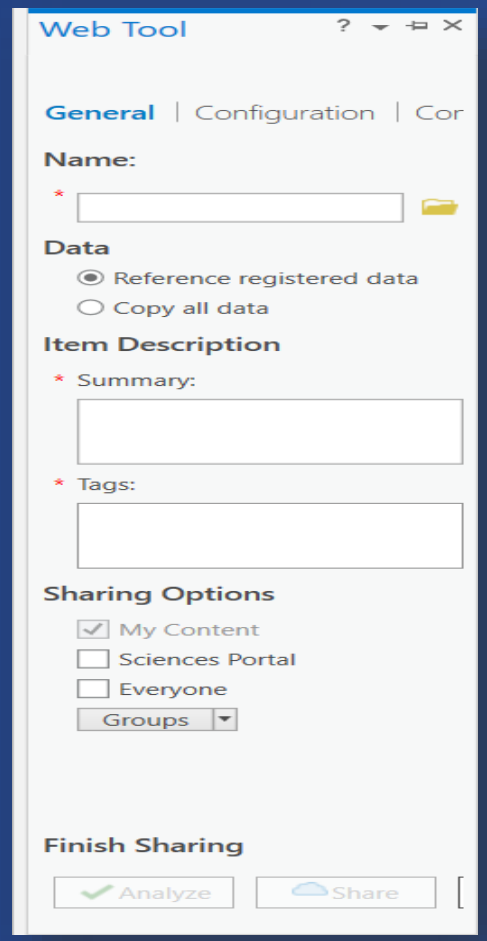


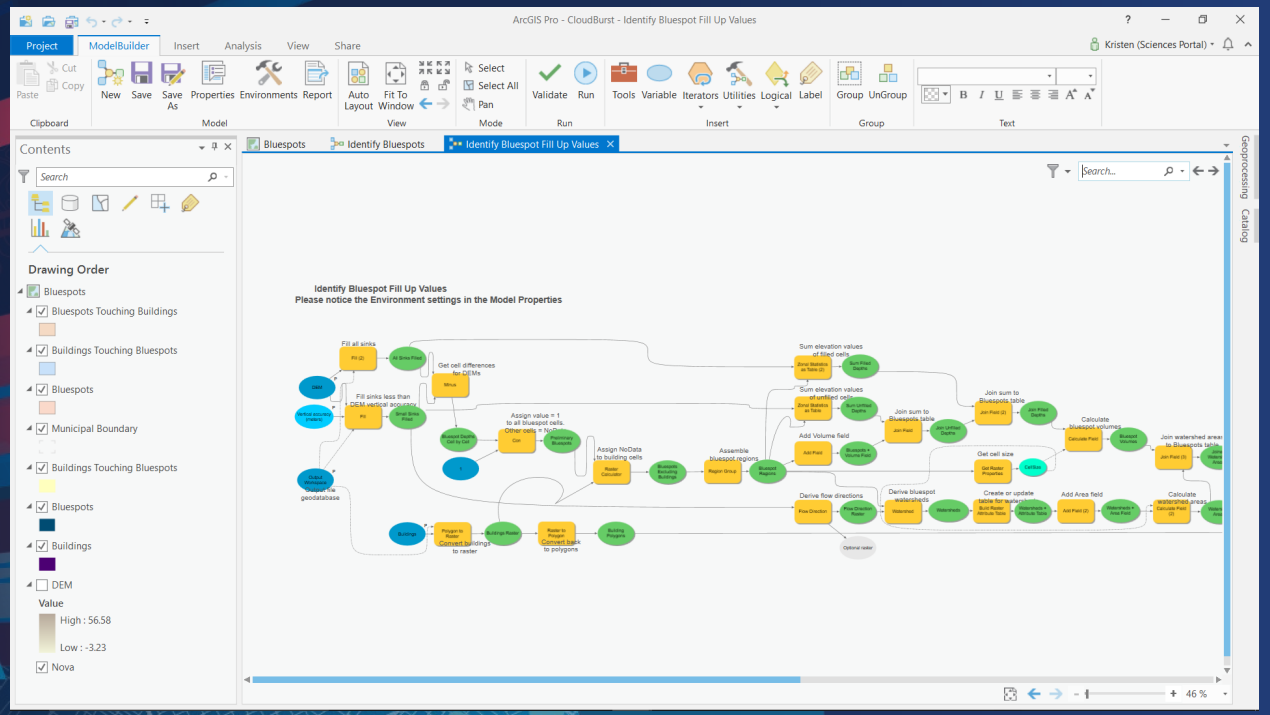
Sharing Tool, Models and Scripts as a Web Tool

Must be connected to ArcGIS Enterprise

Tip # 10B: – Share as a Web Tool, fill in relevant documentation and ensure you have administrative or web tool publisher permissions.







Utilities, Branching, Logical Tools and Sharing

Dissemination to Stakeholders

ModelBuilder: Summary of Updates

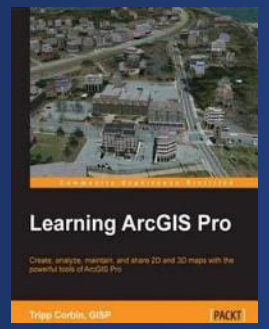
ArcGIS Pro 2.3

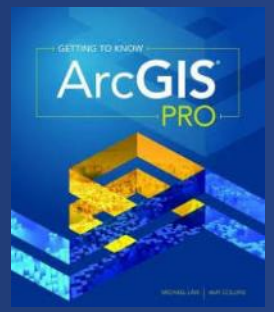
- You can add tools to your model by typing the name of the tool in the search text box and double-clicking the tool in the **Add Tools To Model** window that appears in the model window.
- You can add tools to your model using the new **ModelBuilder > Insert > Tools** menu, which allows you to search for geoprocessing tools directly from the ribbon.
- Custom model layouts and style properties that were applied in ArcMap will be maintained when the model is viewed and used in ArcGIS Pro.
- You can configure interactive feature input to your model tool by setting up a feature set variable and parameter in your model.
- The following new commands are available when you right-click in open space in your model window:
  - Create Variable
  - Create Label
  - Validate
  - Run
  - Auto Layout Diagram
  - Route All Links

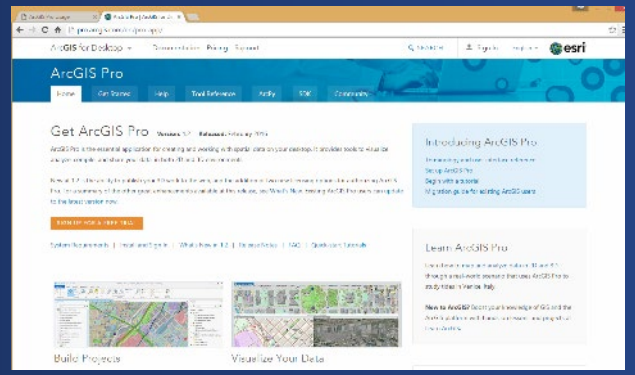
More Information go to the What's New with ArcGIS Pro page.

ArcGIS Pro ▸ Educational Resources

- **Education \ Training**
  - **Instructor Lead Training**
  - **College Courses**
  - **Online**
- **Books**
  - **Learning ArcGIS Pro**
- **Online Resources**
  - **Pro site: Help, Tutorials, Videos**
  - **Blogs**
  - **Learn ArcGIS Exercises**
- **Technical Support**
  - **Not just for bugs**







Analysis and Geoprocessing Tool Gallery

ArcGIS Features Plans Gallery Map Scene Help Sign In

Analysis and Geoprocessing Tool Gallery

Overview Content Members

This group contains models and script tools, packages (.gpk), and services that perform geoprocessing and analysis workflows. Note: be sure to check "Show ArcGIS Desktop Content" to the left of the contents in order to view all content.

owned by ArcGISTeamAnalysis

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Description

See Introducing the Analysis and Geoprocessing Tool Gallery for more information about this group and how to share items.

This gallery is a great resource for beginners and experts alike. By submitting your geoprocessing workflows and tools to this gallery, you'll be helping thousands of users solve everyday problems. We've heard many stories of users who have downloaded entries that have saved them critical hours and days.

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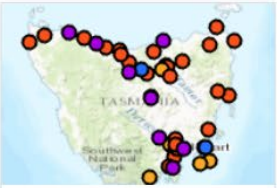

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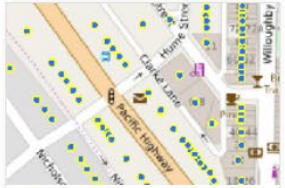

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Hall D

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Hall D

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10:45 am – 5:15 pm
GIS Solutions Expo
Hall D

6:30 pm – 9:00 pm
Networking Reception
National Building Museum

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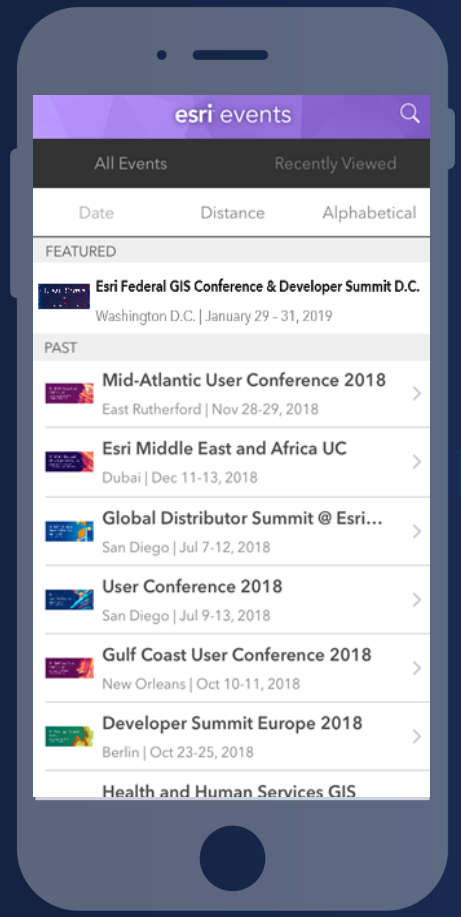

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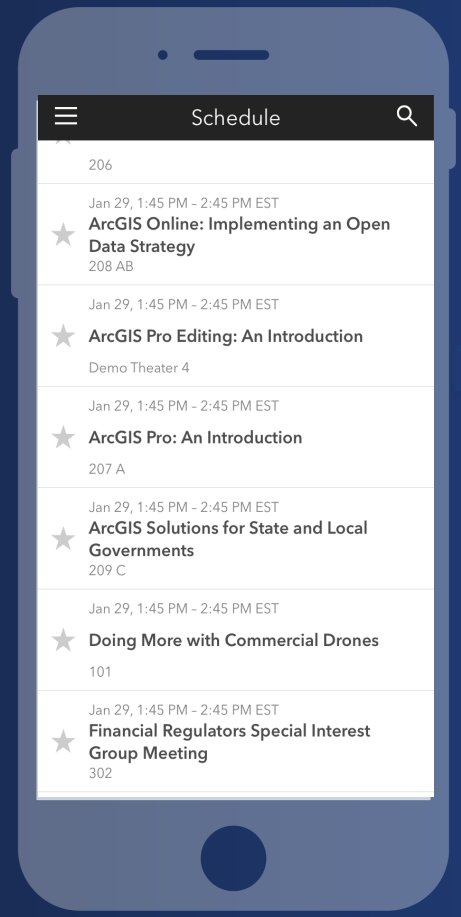

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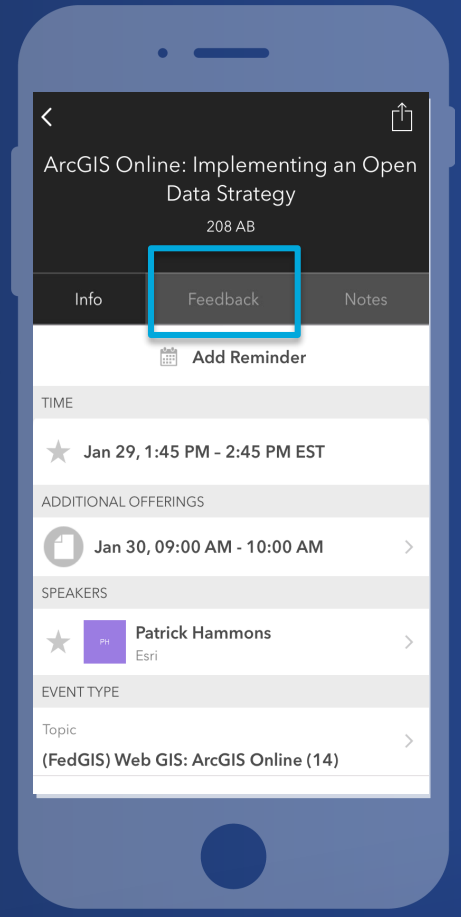
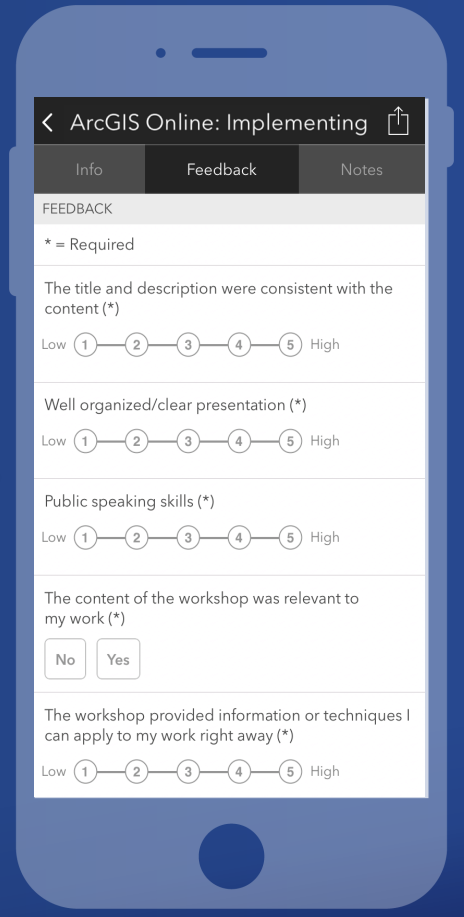


Complete answers and select “Submit”



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