



esri





Esri International User Conference

San Diego, California

Technical Workshops | July 25, 2012

ModelBuilder – Getting Started

Leah Saunders



Agenda

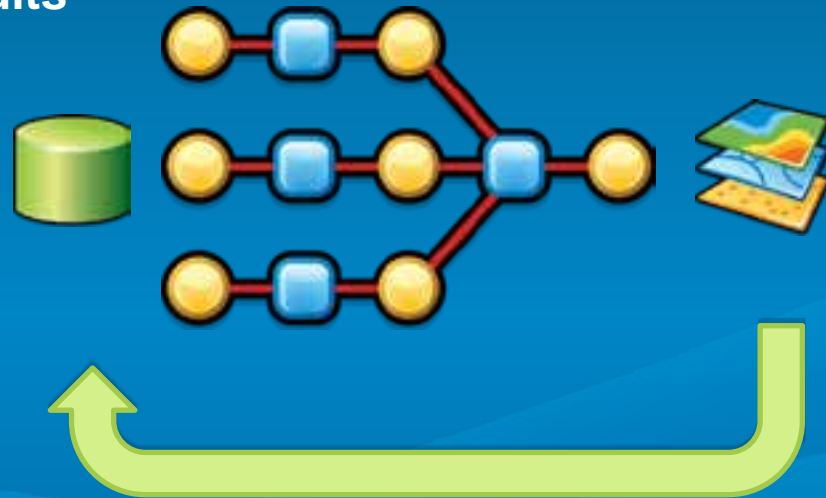
- **Geoprocessing overview**
- **Getting started with ModelBuilder**
- **Creating model tools**
- **Tips for designing and sharing models**
- **Additional resources**

Geoprocessing Overview

The background of the slide is a solid dark blue. At the bottom, there is a decorative graphic consisting of several overlapping, semi-transparent geometric shapes in shades of green and light blue. These shapes are layered to create a sense of depth. Faint, stylized map outlines are visible within some of these shapes, particularly in the green ones on the left and right sides.

What is Geoprocessing?

- The ArcGIS *system* for managing and manipulating data
 - Based on a framework of data transformation
 - Solve real-world spatial problems
 - Model processes and systems
 - Ask questions; get results

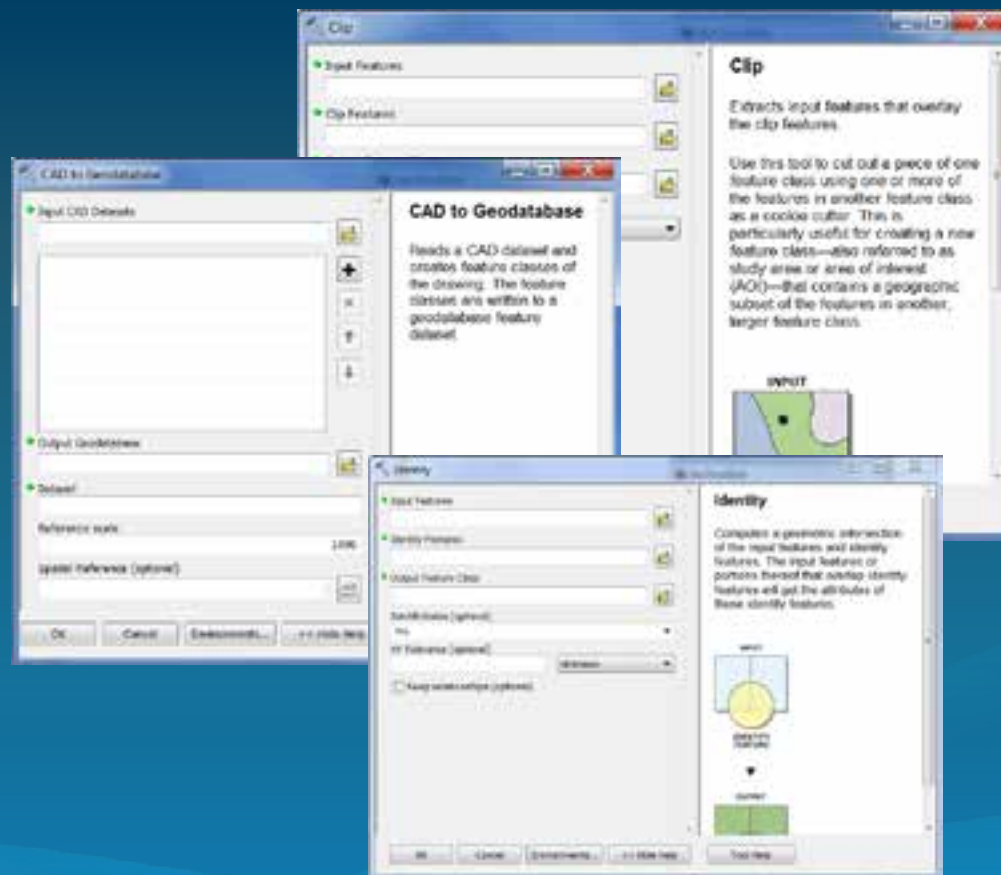


The Geoprocessing Language

Toolboxes

- 3D Analyst Tools
- Analysis Tools
 - Extract
 - Clip
 - Select
 - Split
 - Table Select
 - Overlay
 - Proximity
 - Statistics
- Cartography Tools
- Conversion Tools
- Data Interoperability Tools
- Data Management Tools
- Editing Tools
- Geocoding Tools
- Geostatistical Analyst Tools
- Linear Referencing Tools
- Multidimension Tools
- Network Analyst Tools
- Parcel Fabric Tools
- Schematics Tools
- Server Tools
- Spatial Analyst Tools
- Spatial Statistics Tools
- Tracking Analyst Tools

Tools



The Geoprocessing Framework

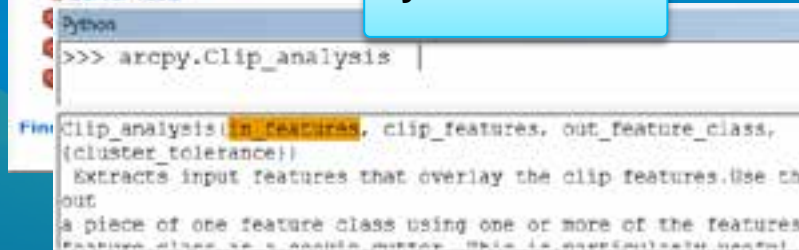
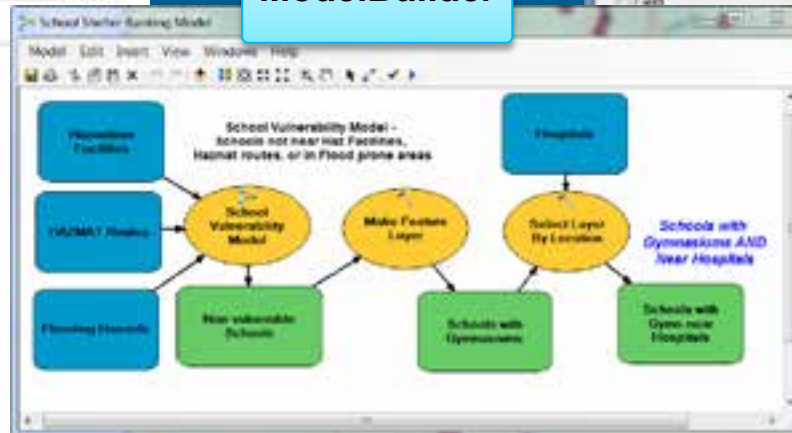
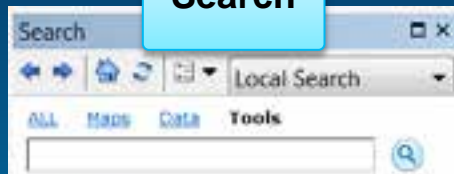
Search

Tools

ModelBuilder

Scripts

Python Window



```
# start try block  
try:  
    arcpy.analysis.Buffer("c:/ws/roads.shp", "c:/outws/roads10.shp", 100)  
  
# If an error occurs when running a tool, print the tool messages  
except arcpy.ExecuteError:  
    print arcpy.GetMessages(2)  
  
# Any other error  
except Exception as e:  
    print e.message
```


Finding Tools

The image displays three different methods for finding tools in ArcGIS, each with a corresponding label in a light blue box:

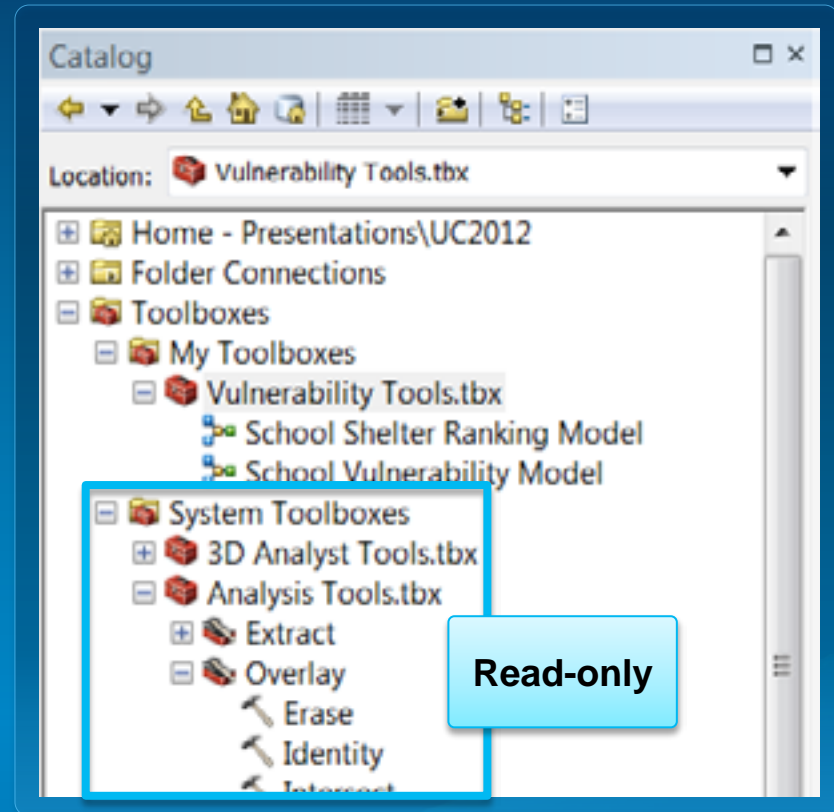
- Catalog:** A screenshot of the Catalog window showing a hierarchical tree of toolboxes. The 'Toolboxes' folder is expanded, revealing various system and user-defined toolboxes like '3D Analyst Tools.tbx', 'Analysis Tools.tbx', and 'Cartography Tools.tbx'.
- ArcToolbox:** A screenshot of the ArcToolbox window, which lists tools in a flat, categorized manner. Categories include '3D Analyst Tools', 'Analysis Tools', 'Cartography Tools', 'Conversion Tools', 'Data Interoperability Tools', 'Data Management Tools', 'Editing Tools', 'Geocoding Tools', 'Geostatistical Analyst Tools', 'Linear Referencing Tools', 'Multidimension Tools', 'Network Analyst Tools', 'Parcel Fabric Tools', 'Schematics Tools', 'Server Tools', 'Spatial Analyst Tools', 'Spatial Statistics Tools', and 'Tracking Analyst Tools'.
- Search:** A screenshot of the Search window with 'buffer' entered in the search bar. It shows search results for 'buffer', including 'Analysis (Toolbox)', 'Buffer (Analysis) (Tool)', 'Buffer (Coverage) (Tool)', 'Buffer 3D (3D Analyst) (Tool)', and 'Make Service Area Layer (Network Analyst...)'. Each result includes a brief description and the path to the tool.

Overlaid on the center of these windows is the **Geoprocessing Menu**, which lists the following options:

- Geoprocessing
- Buffer
- Clip
- Intersect
- Union
- Merge
- Dissolve
- Search For Tools
- ArcToolbox
- Environments...
- Results
- ModelBuilder
- Python
- Geoprocessing Options...

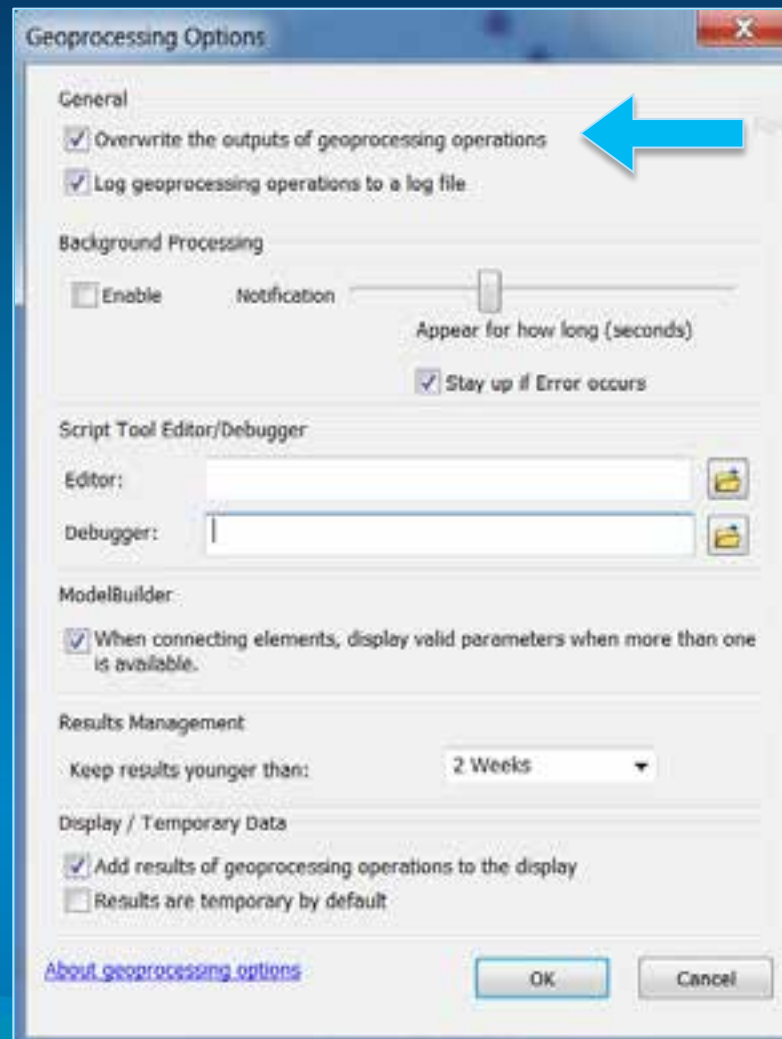
Types of Toolboxes

- System toolboxes
 - Installed with ArcGIS
 - *Read-only*
- Custom toolboxes
 - User created
 - Stored in a folder (.tbx file type) or a geodatabase
- Python toolboxes (10.1)



Geoprocessing Options

- Open *Geoprocessing Menu* > *Geoprocessing Options*
- Settings to control defaults and behavior for geoprocessing
- **Tip:** Enable “*Overwrite the outputs of geoprocessing operations*” to allow interactive re-running of models and tools



Demonstration

Model Example



Workflow for Presentation

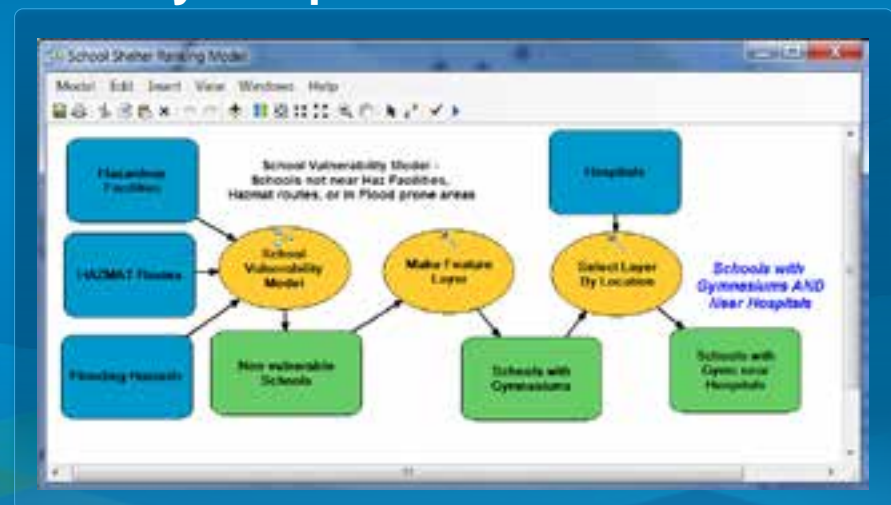
- **Goal:** Prioritize schools for emergency shelter planning
- **Problem:** Which schools are in more vulnerable areas?
 - Schools are used as emergency shelters
 - We need a list of schools that can potentially serve as shelters for citizens in times of need
 - Schools in vulnerable areas are not ideal locations for a shelter



Getting Started with ModelBuilder

What is ModelBuilder?

- Tool for encapsulating workflows
 - Reusable
 - Sharable
- Why use ModelBuilder?
 - Automate and manage geoprocessing workflows
 - Run complex succession of processes as one tool
 - Plug in additional tools and parameters as needed
 - See a visual representation of analysis operations



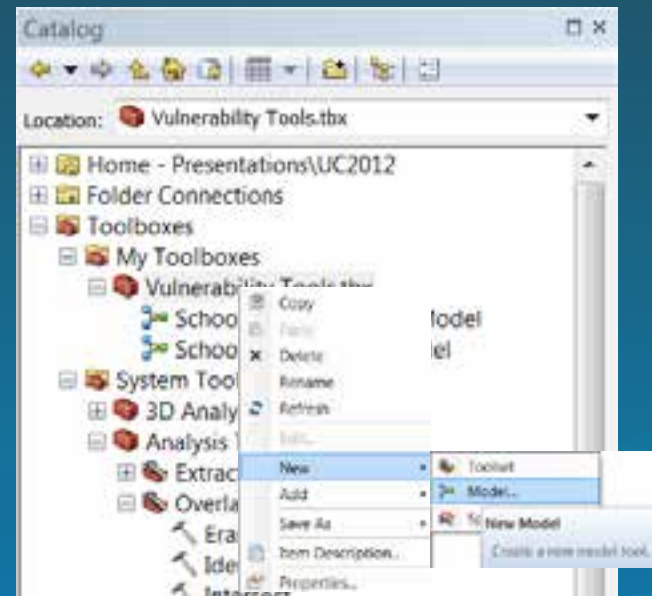
Creating a New Model

- ModelBuilder button ArcMap **Standard toolbar**
 - Launches ModelBuilder with a new, **unsaved** model



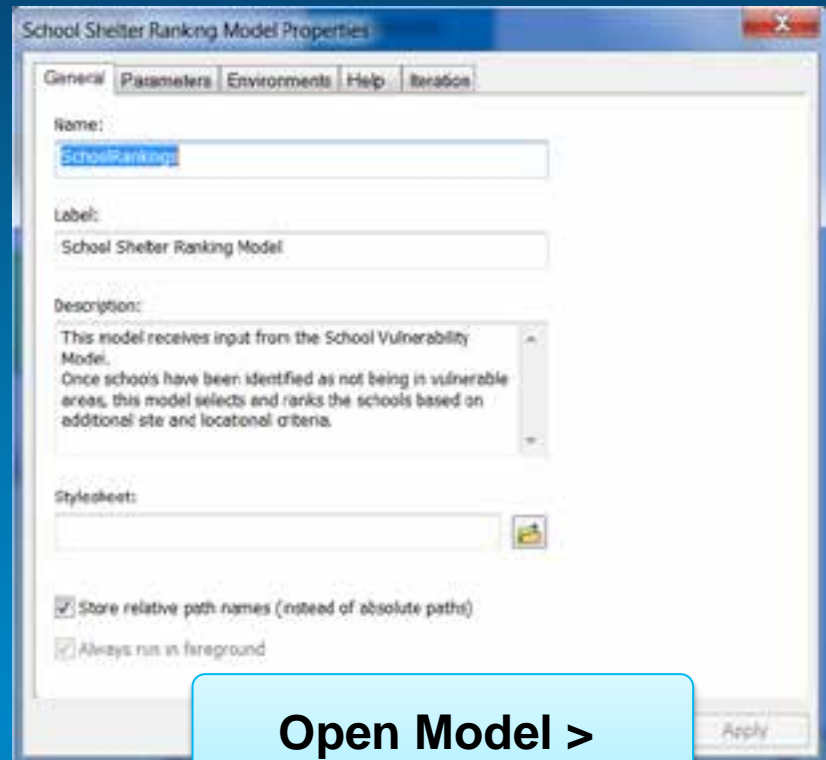
- ModelBuilder button ArcMap **Geoprocessing Menu**
 - Launches ModelBuilder with a new, **unsaved** model

- Inside a *Custom toolbox*
 - **Right-click > New Model**



Model Properties

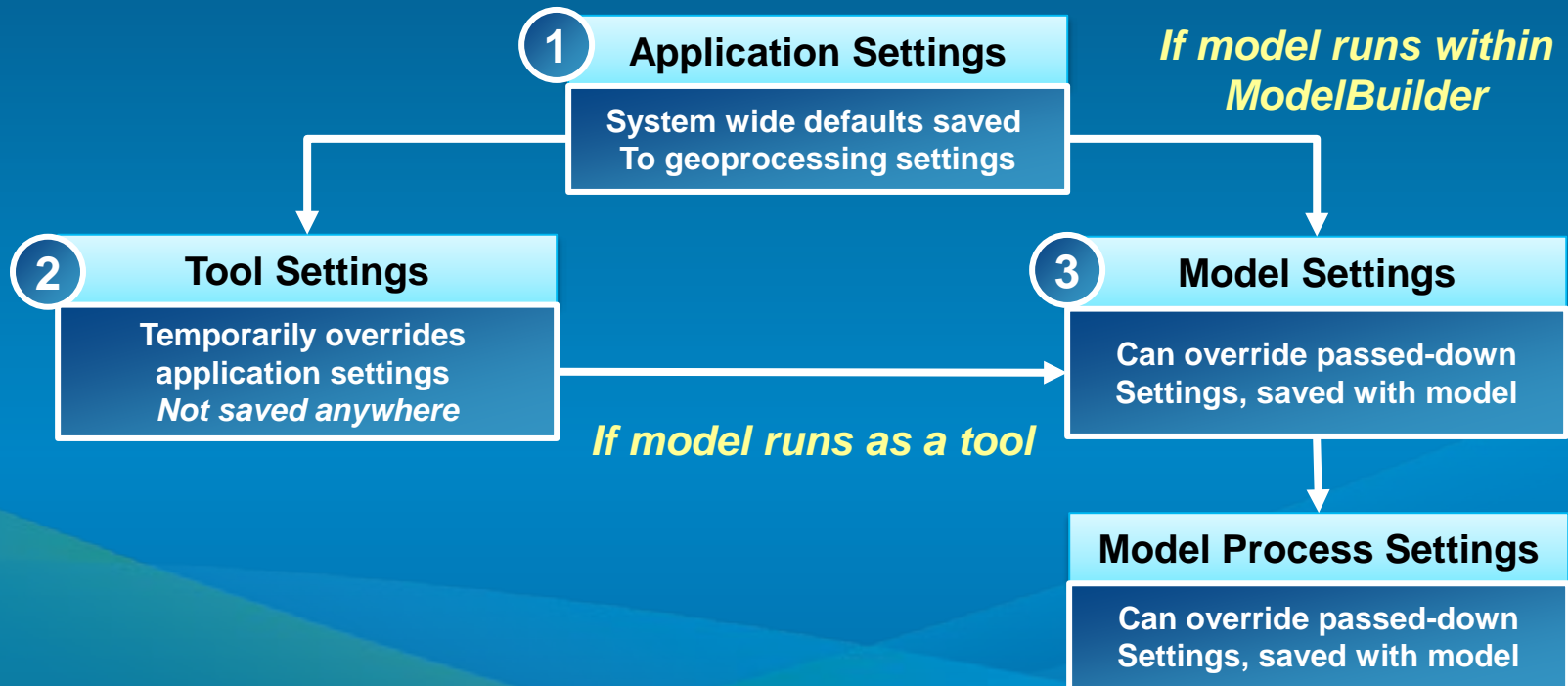
- **Name**
 - Cannot have spaces
- **Label**
 - How it appears in ArcToolbox
 - Can include spaces
- **Description**
 - Detailed information about the model
 - Good practice when sharing
- **Relative Path**
 - Good practice when sharing



**Open Model >
Model Menu >
Model Properties...**

Environment Settings

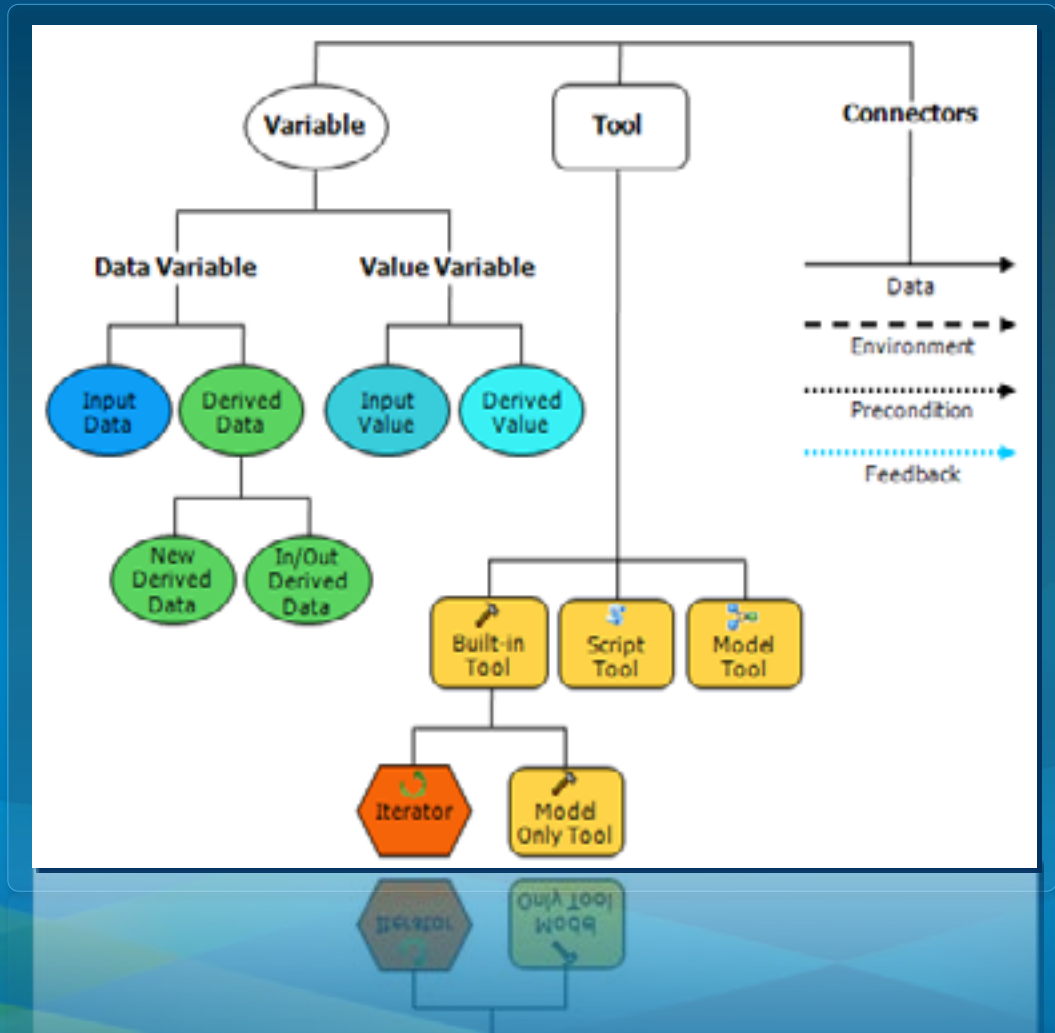
- Can be set at different “levels”
- Environments are passed down to tools and processes
- At each level, you can override the passed-down environment settings



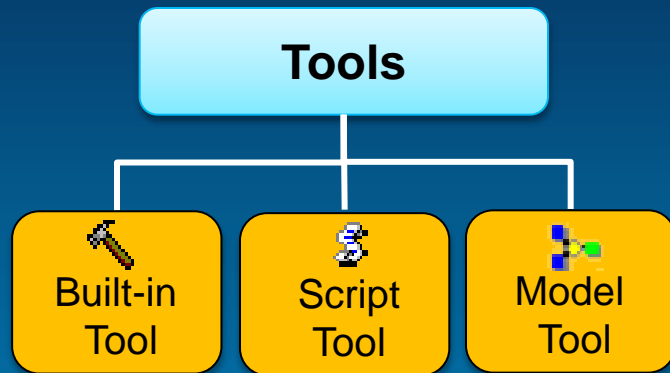


Model Elements

- Three types of elements
 - Variables
 - Tools
 - Connectors

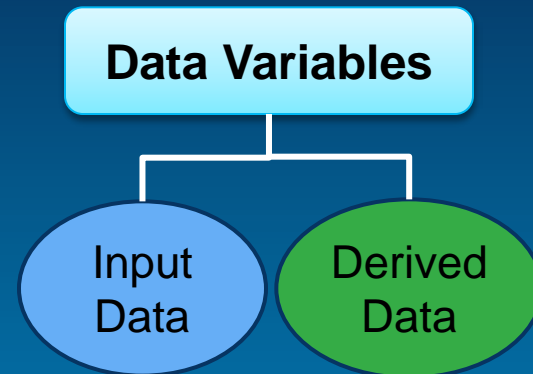


Adding Tools and Data to a Model



- **Tools**

- Drag and drop from Catalog
- Drag and drop from Search
- Drag and drop from Toolbox
- Use Add button in ModelBuilder
- Use Insert menu in ModelBuilder

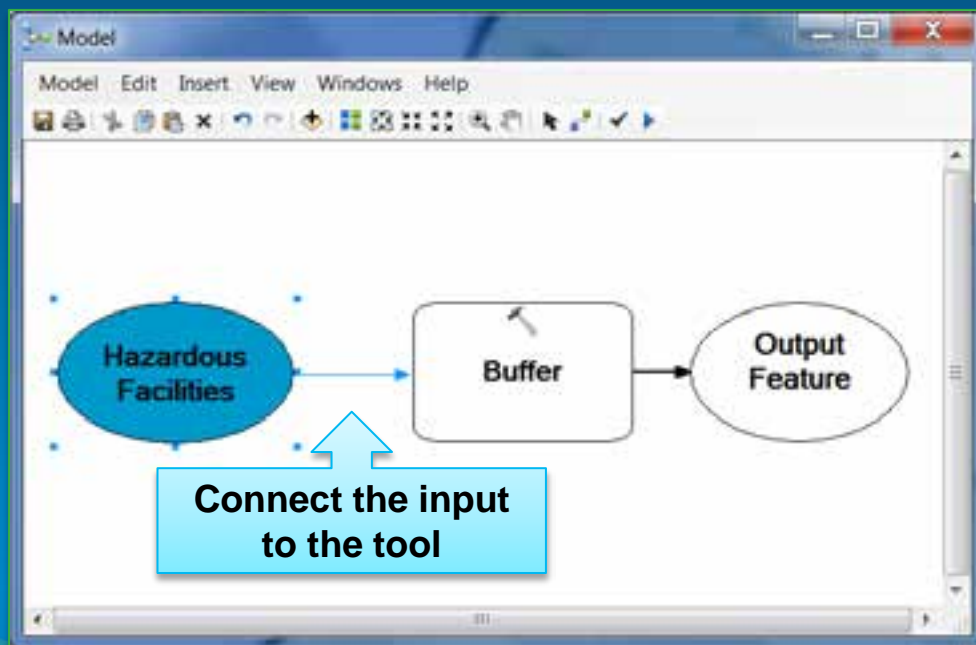
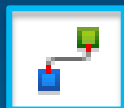


- **Data**

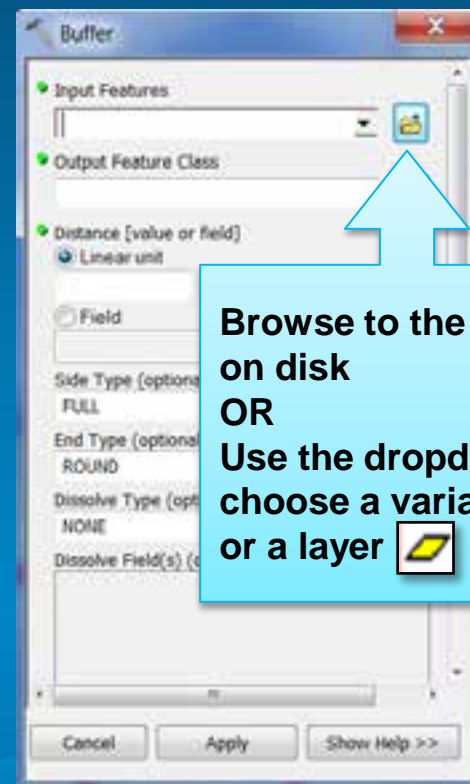
- Drag and drop from TOC
- Drag and drop from Catalog
- Drag and drop from Search
- Fill in dialog
- Use Add button in ModelBuilder
- Use Insert menu in ModelBuilder

Connecting Elements

1. Connect Tool

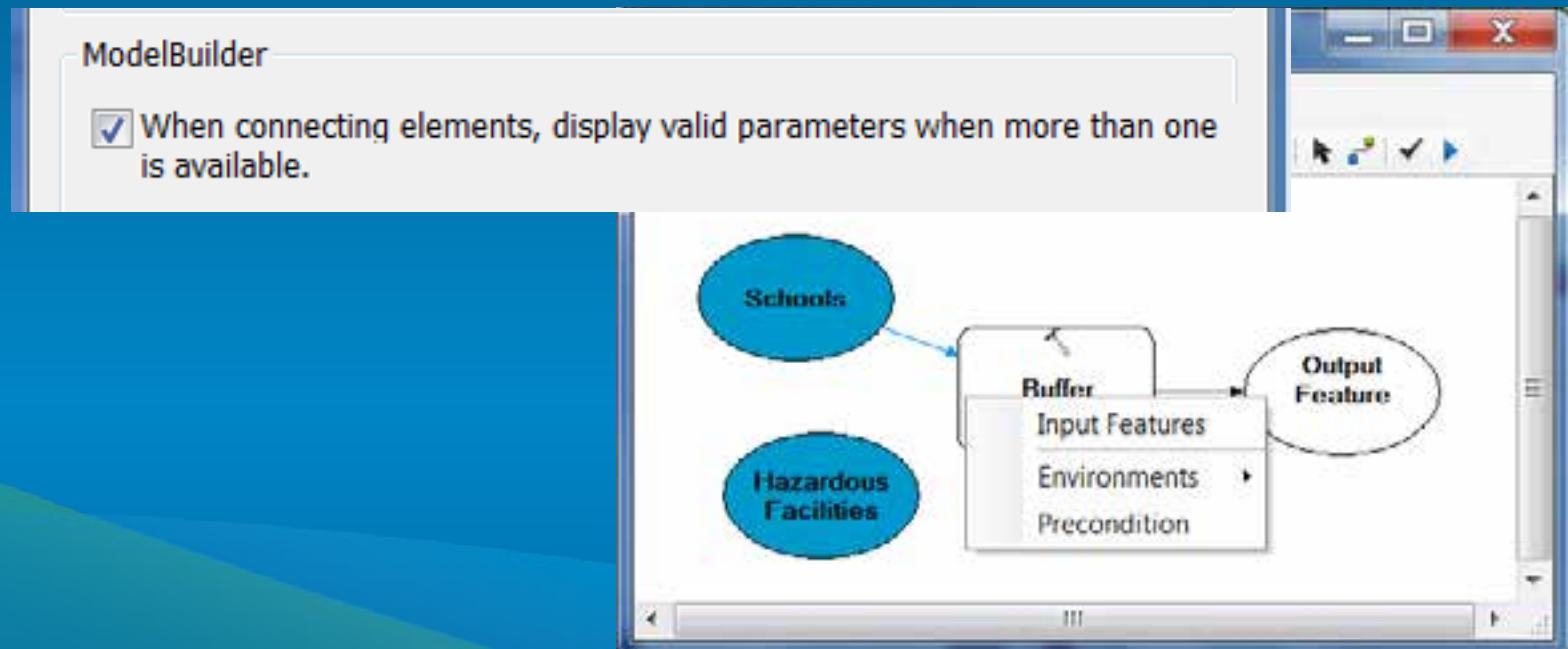


2. Tool Dialog

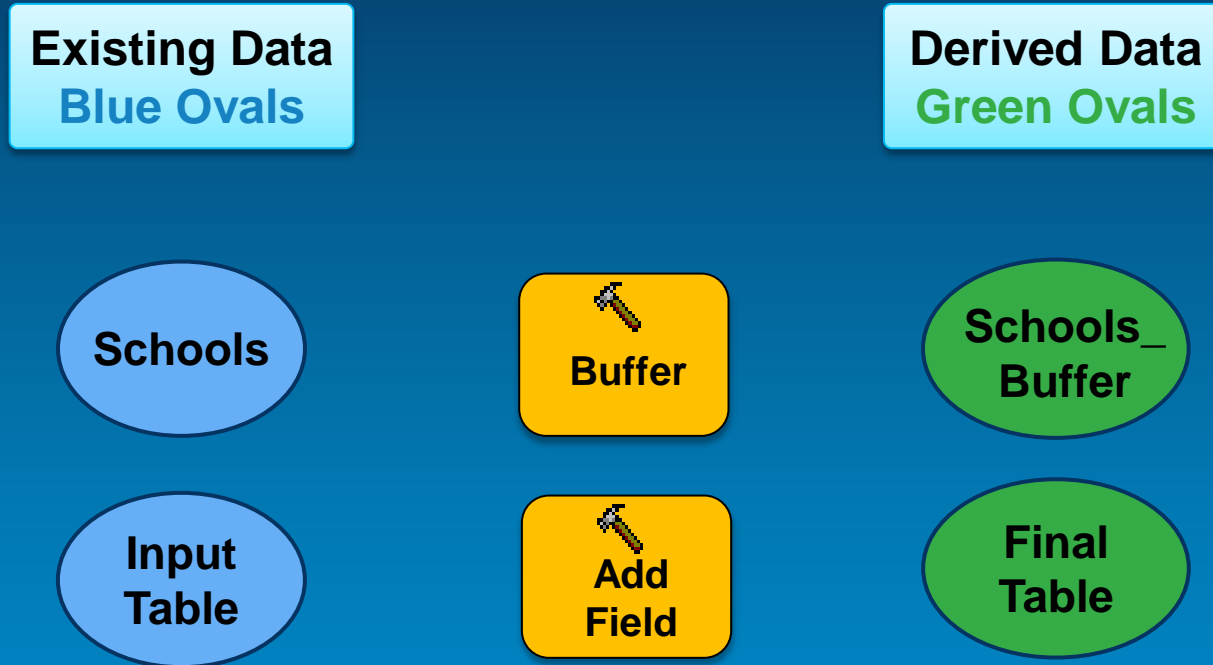


Connect Tool Tip

- Enable Geoprocessing **Menu > Geoprocessing Options > ModelBuilder** to display valid parameters
 - By default, a list of valid parameters appears when connections are made



Derived Data is Created by Processes

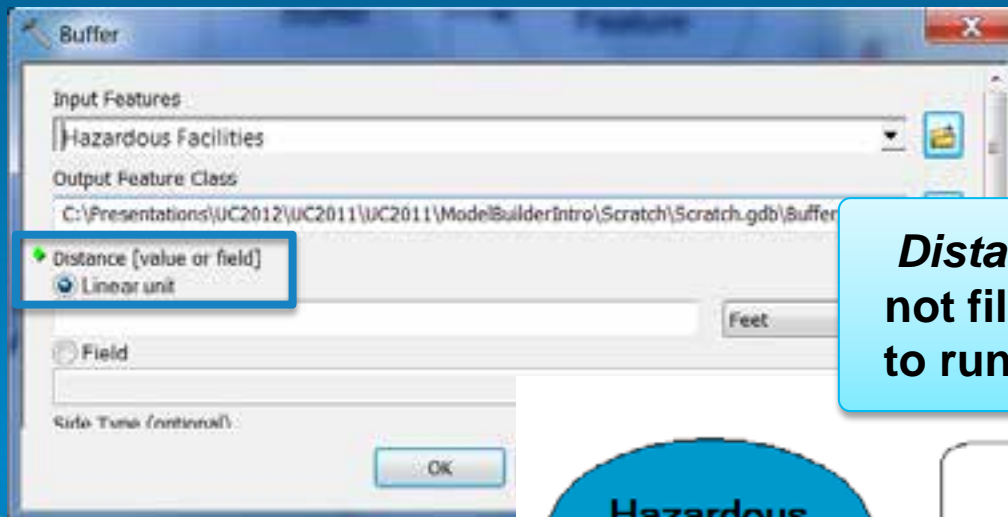


- **In/Out Derived Data**

- Input will be altered/updated when the model is executed
- Data will have the same name as the input data with a unique number appended at the end

Tool Parameters

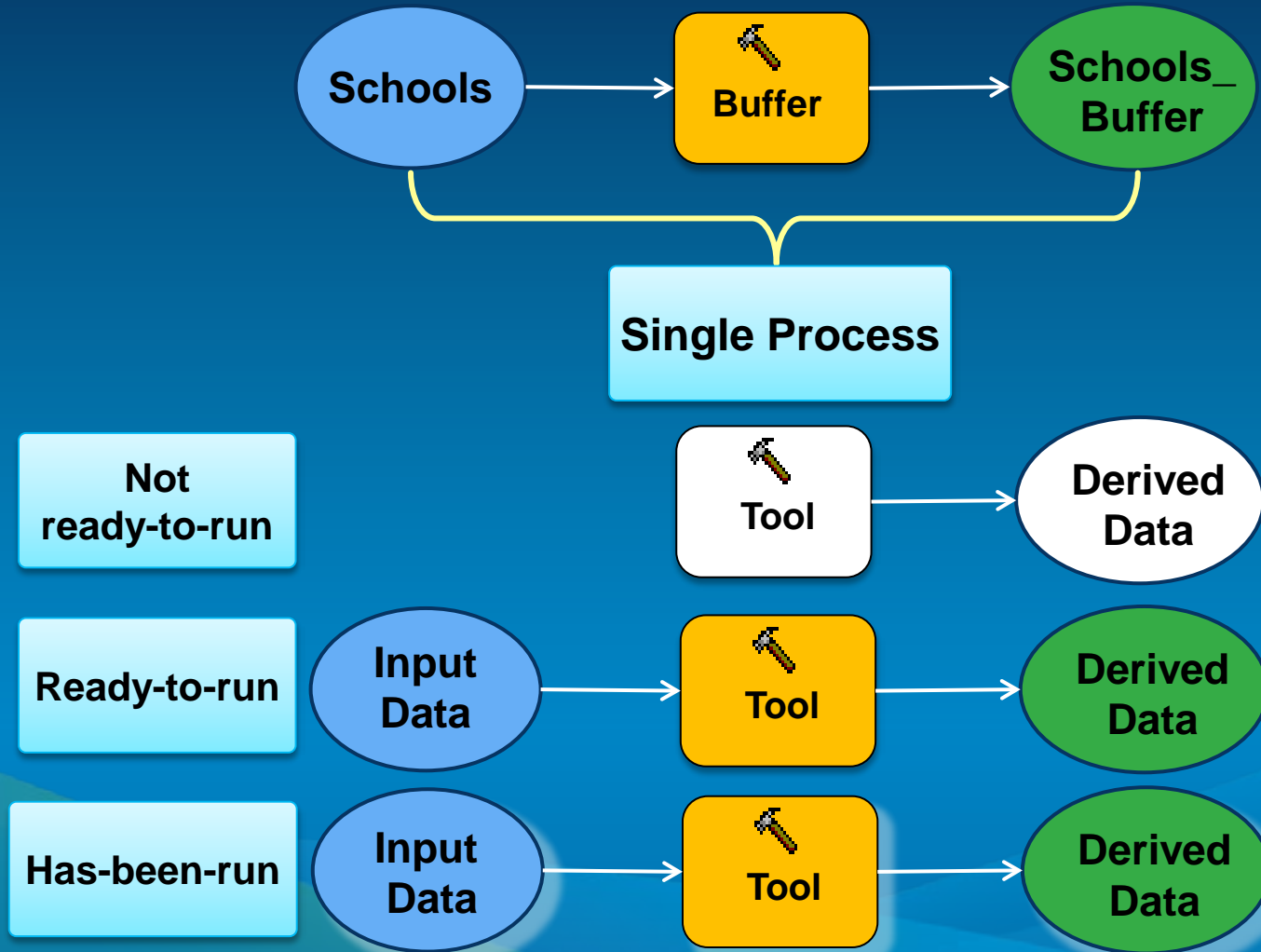
- Inputs and outputs of a tool
- Required and Optional parameters
 - Required must be filled out before tool process can execute in the model



Distance (required parameter) is not filled out; the tool is not ready to run yet and is “empty” colored

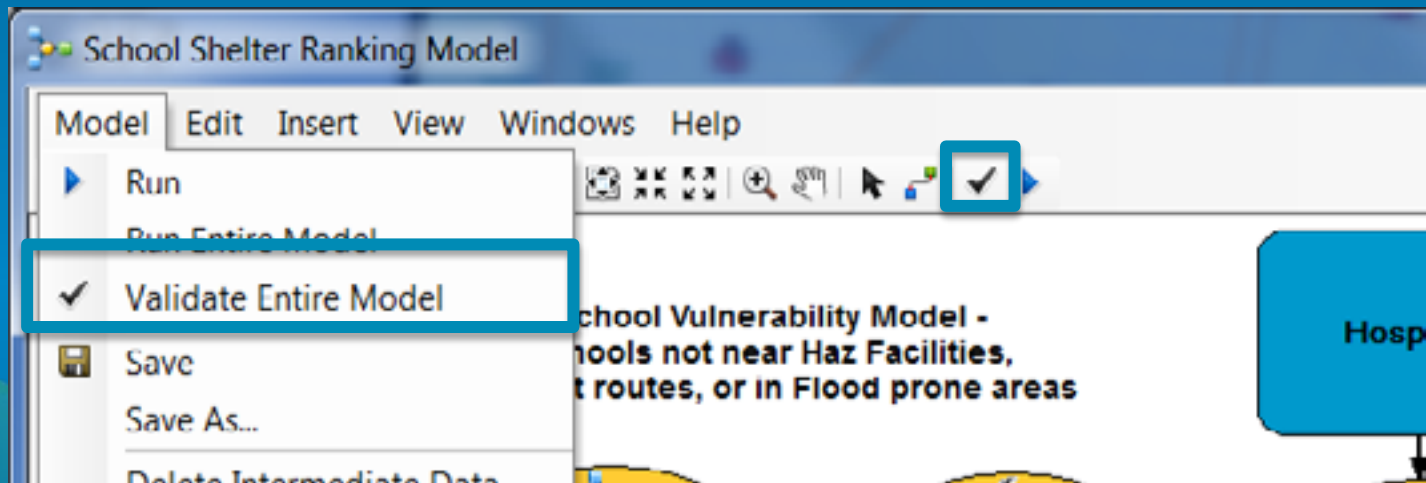


Model Process States



Validating

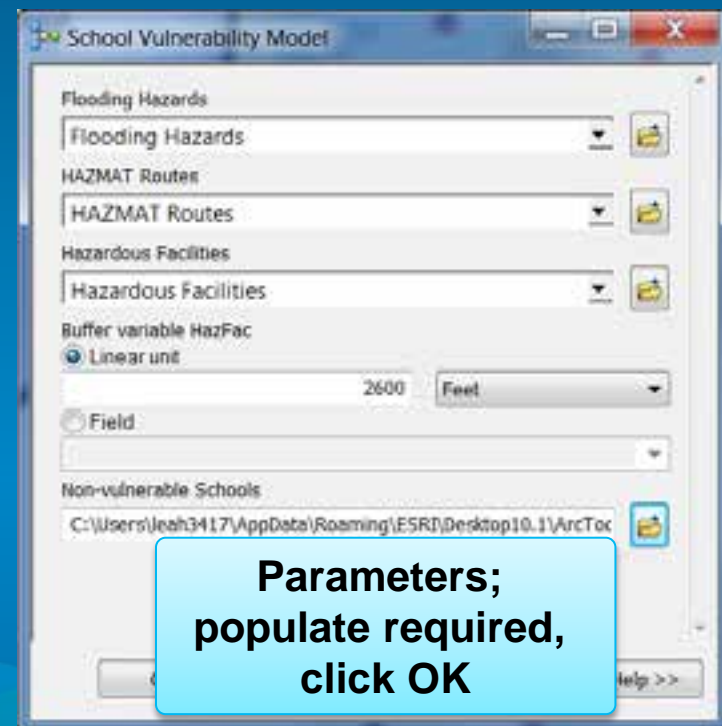
- Verifies all data elements and parameter values are valid
- Success: Returns model from Has-Been-Run to Ready-to-Run state
- Unsuccessful: Model elements may turn to Not-Ready-to-Run state



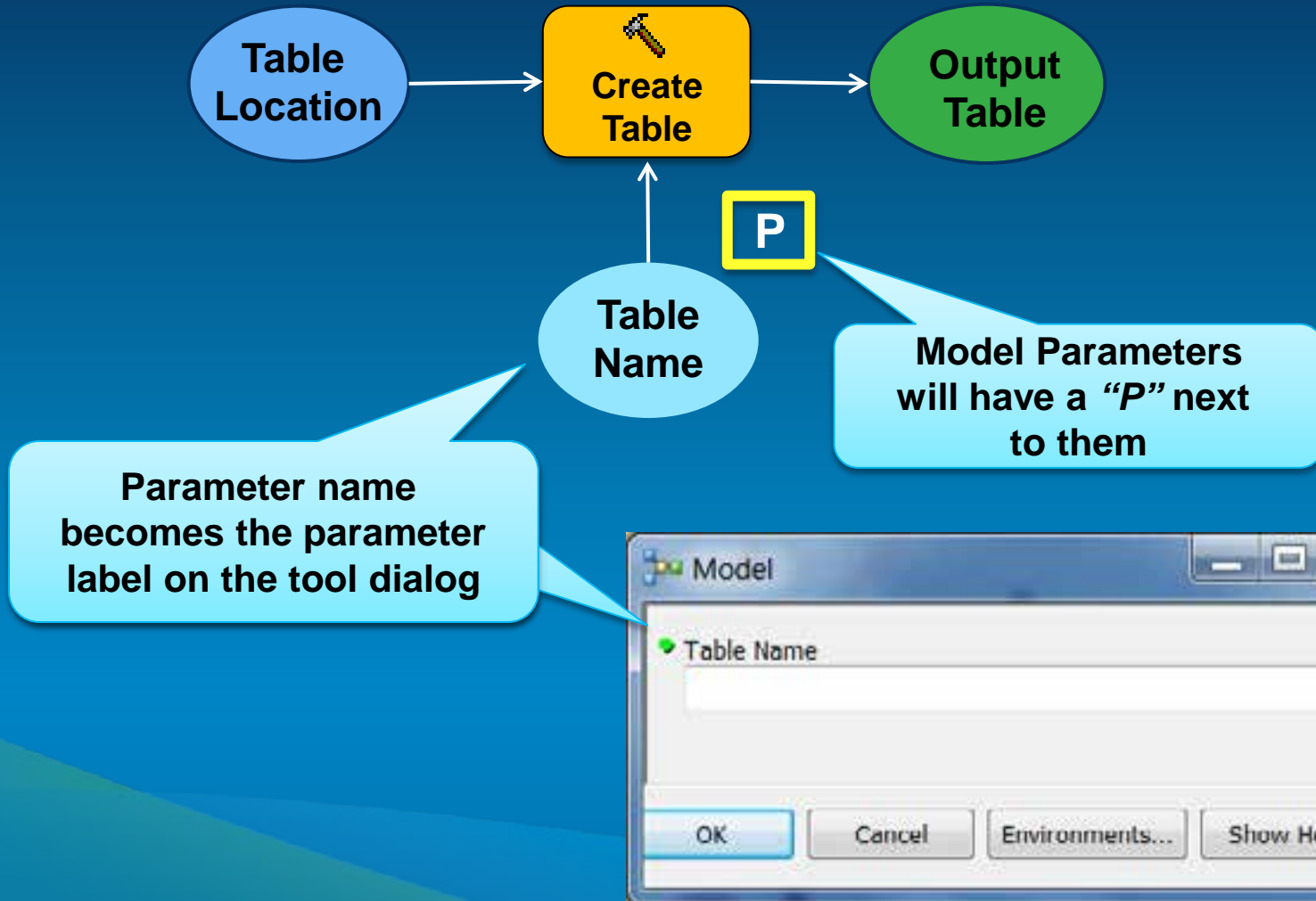
Creating Model Tools

Running a Model as a Tool

- **Double-click tool** or **Right-click > Open** a model from its toolbox opens the model tool dialog
- These ARE models:

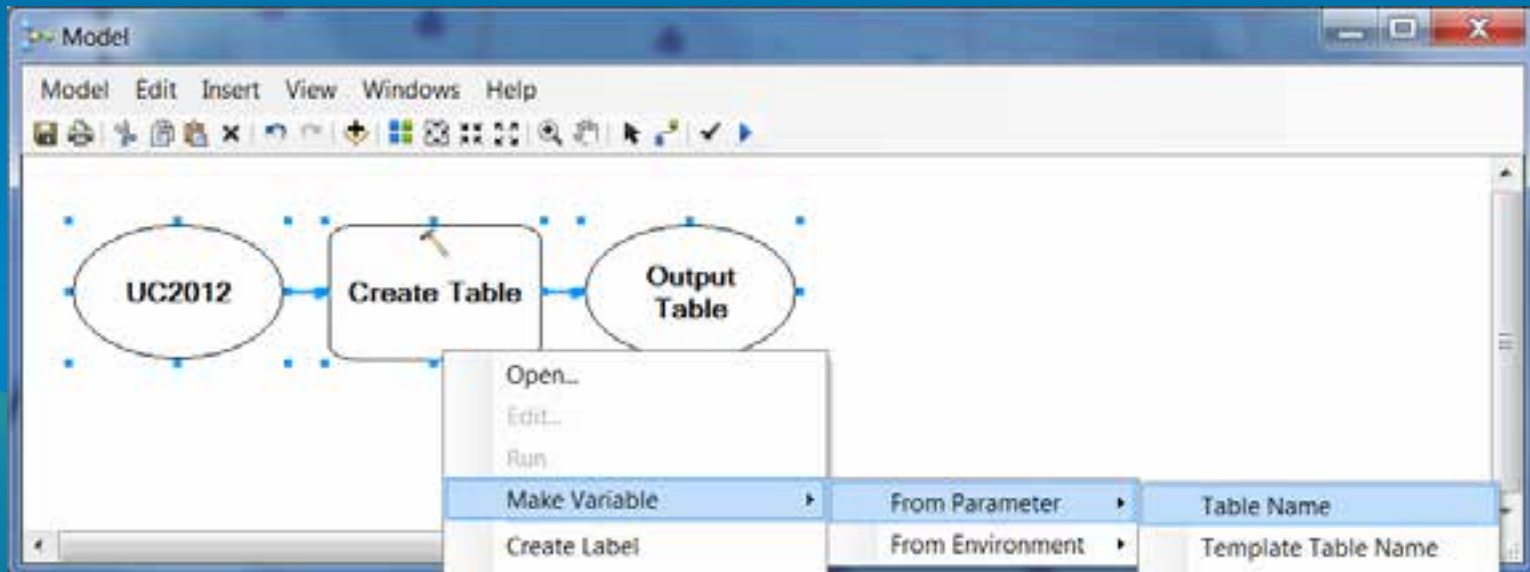


Parameters



Creating Variables from Tool Parameters

- ModelBuilder will create a variable for input and output datasets
 - You decide which tool arguments to expose as variables
 - Any variable can be made a model parameter
- Right-click on tool ***Make Variable > From Parameter***
 - Then set variable as a model parameter



Demonstration

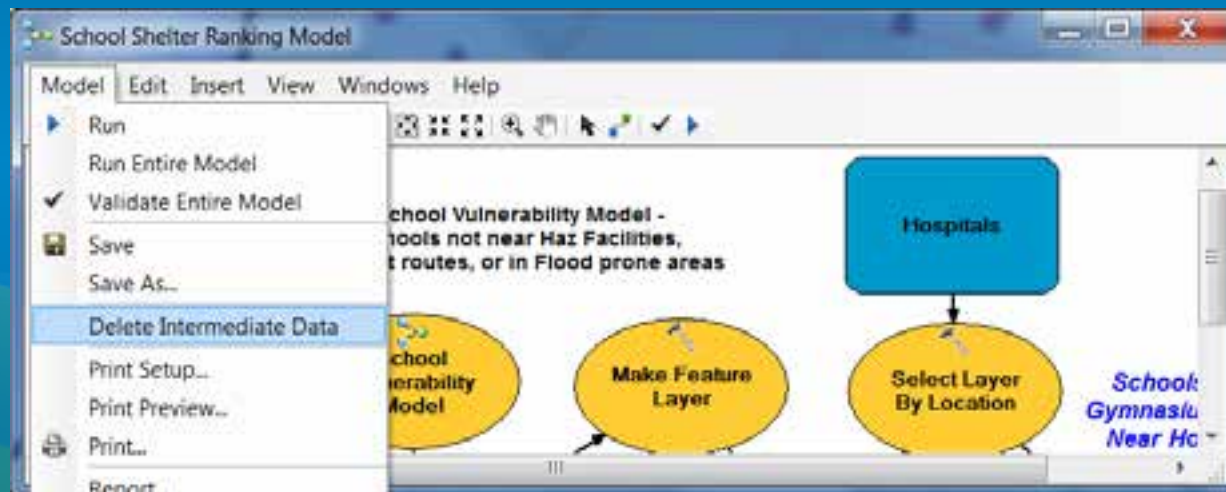
Creating a Model Tool



Tips for Designing & Sharing Models

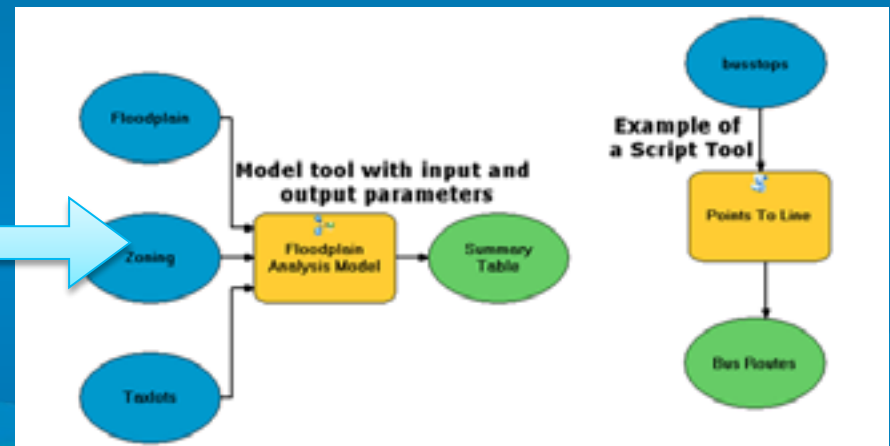
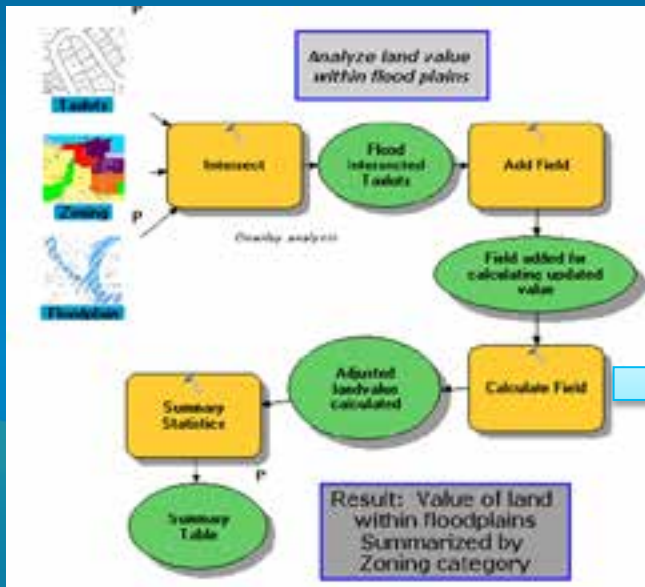
Intermediate Data

- Can think of Intermediate data as temporary scratch data
- All data variables except existing and final output are set to Intermediate by default
- Can determine where it is stored
 - **Tip:** Should not be set to an enterprise geodatabase
- Is not automatically deleted when run from ModelBuilder window
 - Manually delete from **Model Menu > Delete Intermediate data**



Model Tools in Other Models

- Models can be added to another model
 - Break down complex models into smaller, perhaps more manageable sub-processes
 - Collaborate with a team where domain experts can work on their model



Tips for Running Models

- Running models from ModelBuilder:
 - Intermediate data is not automatically deleted
 - Add to display enabled outputs are added to Map
 - No Background Geoprocessing – always runs in foreground
- Running models from Model tool:
 - Intermediate data is deleted on completion
 - Only parameters are added to display
 - Option to run in foreground (*Model menu > Model properties dialog*) to disable/enable background geoprocessing

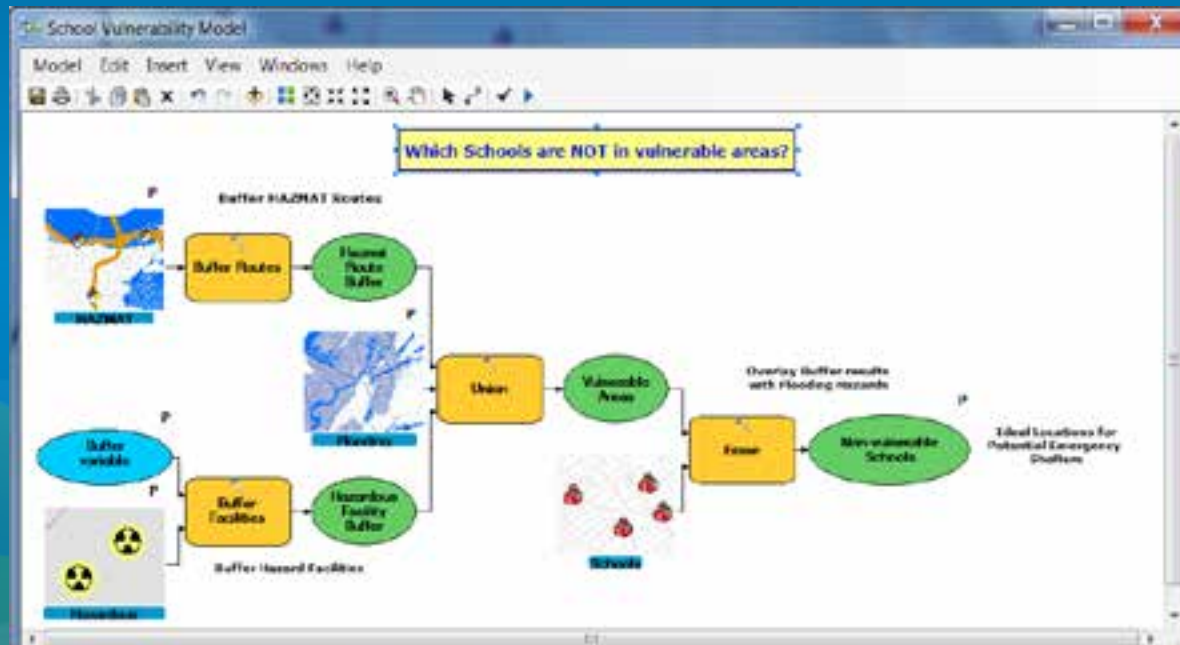
☒ Always run in foreground

Design Models to be Sharable

- Flexible
 - Not data-dependent, good folder structure
 - Environments, Relative paths, etc..
 - Parameters & variables
 - Read: *A quick tour of sharing custom tools*
- Clear and easy to read
 - Layout is simple and logical
 - Labels added for clarity
 - Elements renamed and not cryptic
- Documented
 - Item descriptions
 - Help documentation

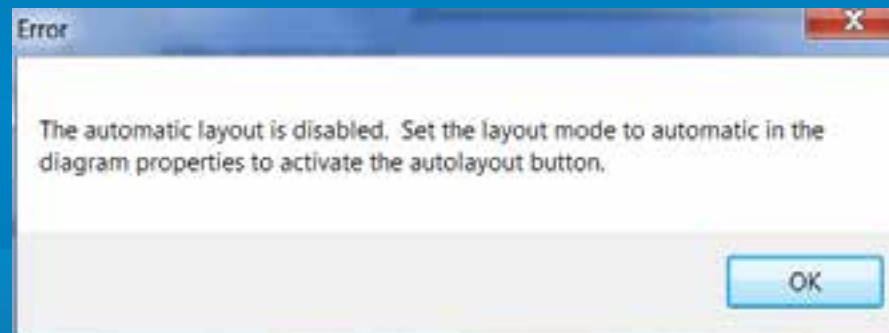
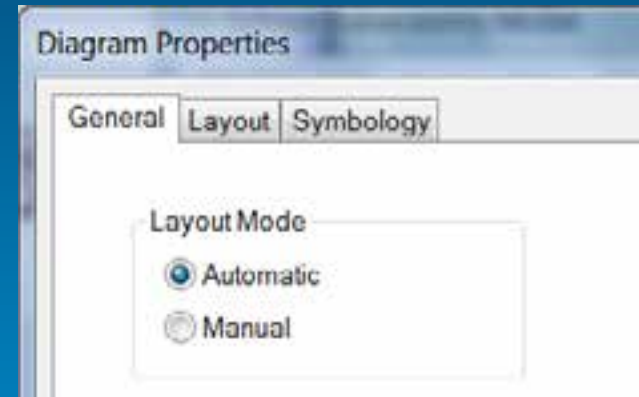
Modifying the Layout

- ModelBuilder provides the ability to:
 - Modify arrangement of elements manually by repositioning and resizing
 - Change the name of elements
 - Apply labels and other text
 - Change symbols of elements
- Does not affect how models run; only their appearance



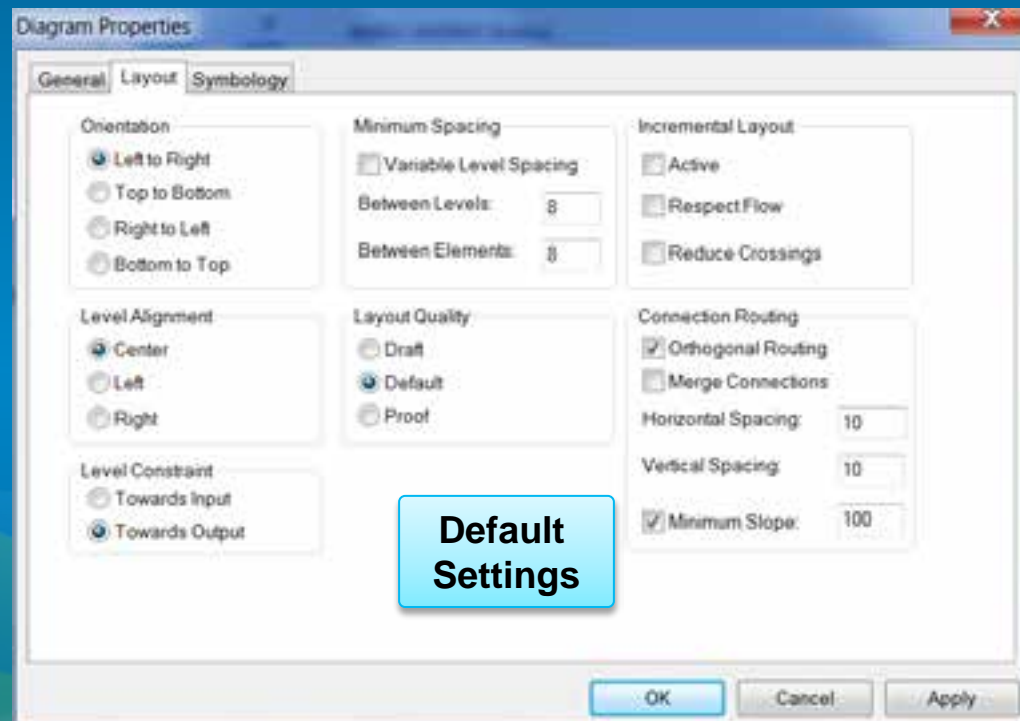
Layout: Automatic vs. Manual

- **Automatic Layout mode:**
 - Enables Auto Layout button
 - Arranges model elements using settings under the Layout tab
- **Manual Layout mode:**
 - Disables Auto Layout button
 - Auto-arranging will not occur
 - This message appears:

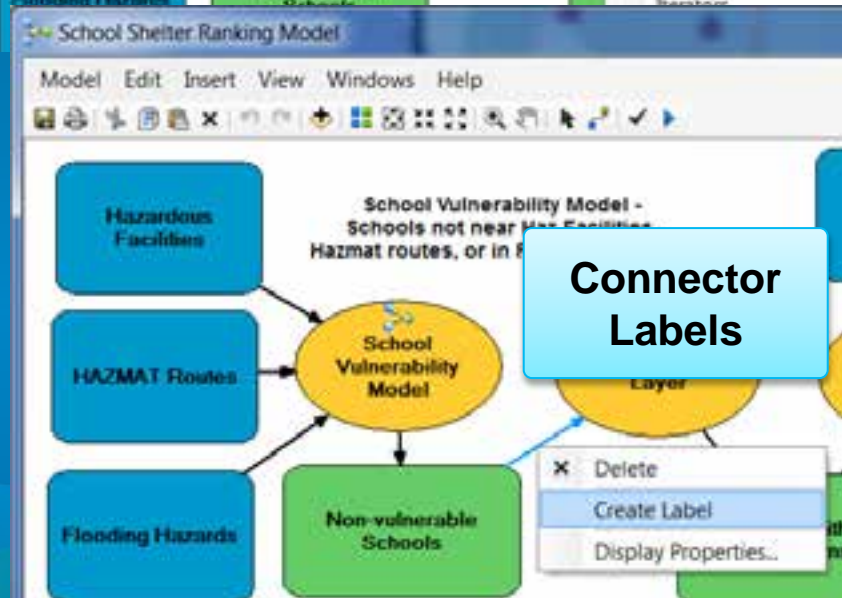
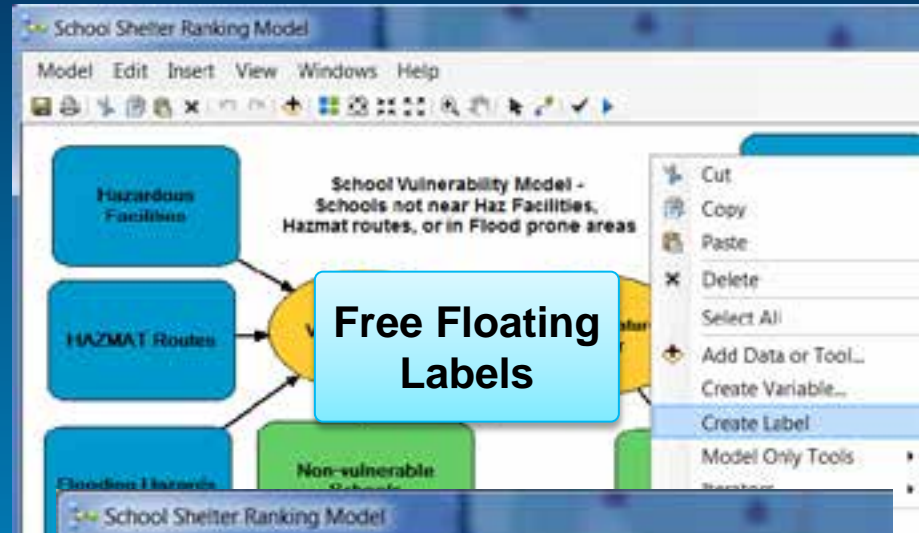
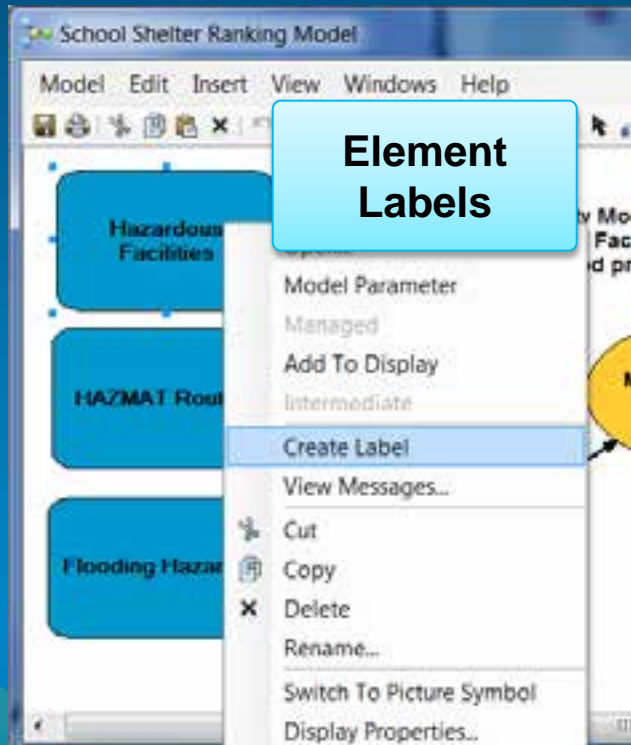


Layout Options

- *ModelBuilder window > Model Menu > Diagram Properties...*
- Orientation of processes, Spacing between elements/connectors, Connector styles
- Clicking Auto Layout button applies *these* options

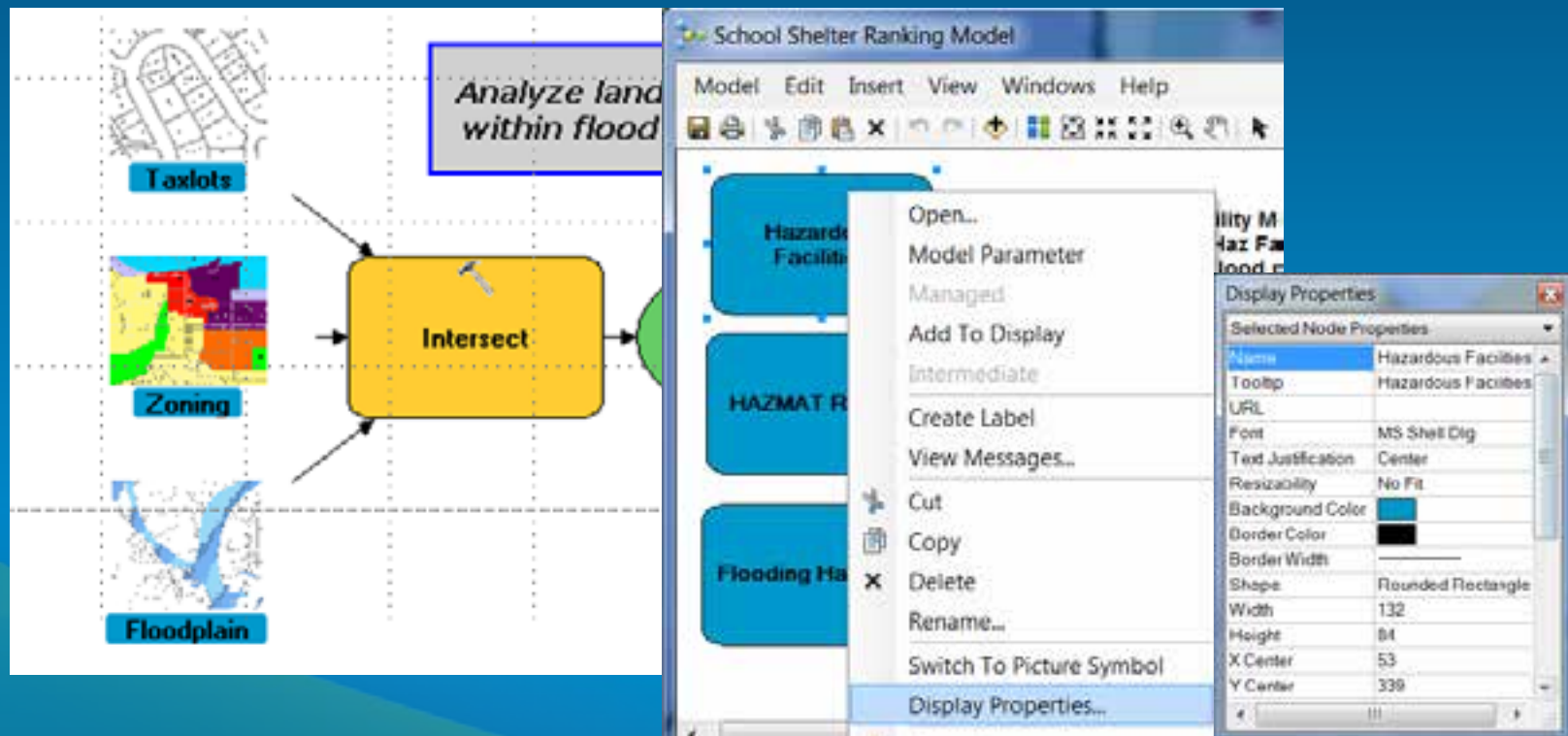


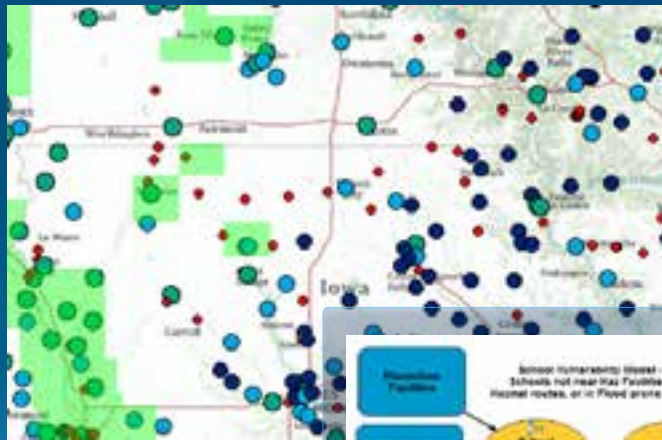
Documenting with Labels



Pictures for Elements

- You can use graphic files for tool and variable elements
- *Right click model elements > Switch to picture symbol*





Demonstration

Designing and Sharing Models



Learning More...

ArcGIS Resource Center

- ArcGIS Online Help
 - <http://resources.arcgis.com/en/help/>
- Communities – Analysis and Geoprocessing
 - <http://resources.arcgis.com/en/communities/analysis/>
- Blogs
 - <http://blogs.esri.com/esri/arcgis/category/subject-analysis-and-geoprocessing/>
- Videos
 - <http://video.arcgis.com/channels>
- Forums
 - <http://forums.arcgis.com/forums/31-Geoprocessing>

Learning More at the Conference

- ***Geoprocessing with ArcGIS for Server***
 - Thursday 8:30AM – 9:45AM, Room 09
- ***Building Tools with ModelBuilder***
 - Thursday 3:15PM – 4:30PM, Ball06 D

And many more....

Learning More After the Conference

- Training

- <http://training.esri.com/gateway/index.cfm>
- Instructor-led, Web Course and FREE Seminars


- Esri Press Books

- <http://esripress.esri.com>
- Getting to Know ArcGIS ModelBuilder
 - Written for ArcGIS 10.0 but still valid for 10.1
 - Covers topics from beginner to advanced



Steps to Evaluate UC Sessions

- My UC Homepage > “Evaluate Sessions”
- Choose session from planner
OR
- Search for session

My UC	
Sessions	Available
 Agenda/Planner	Now
Evaluate Sessions	Jul. 2012

Session Evaluations

Sessions on My Planner

Date / Time / Room	Title	Evaluation
7/24/2012 1:30 PM Ballroom 06 E	The ArcGIS System - Putting it all Together	Evaluate
7/25/2012 1:30 PM Room 24 C	Land	Evaluate

Search Sessions

Session Topic

Date

Type

Conference

Offering ID

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- Thank you for attending
- Have fun at UC2012
- Open for Questions
- Please fill out the evaluation:

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First Offering ID: 695

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