Esri International User Conference | San Diego, CA

Technical Workshops | July 12, 2011

Getting Started with ModelBuilder

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Agenda

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

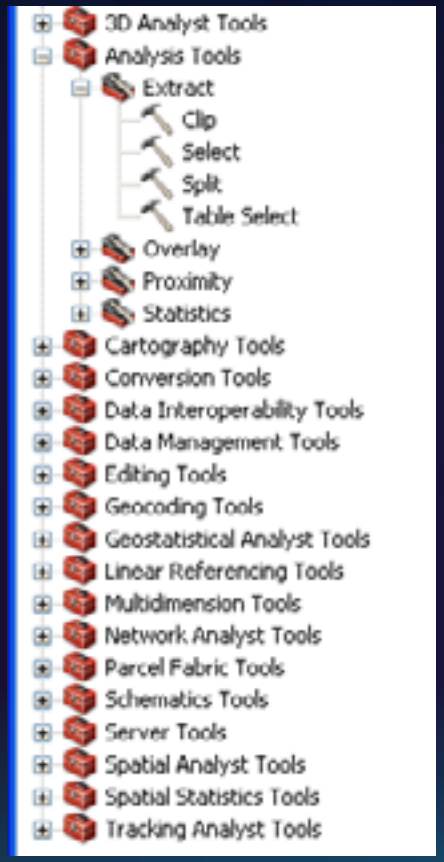
Geoprocessing Overview

What is Geoprocessing?

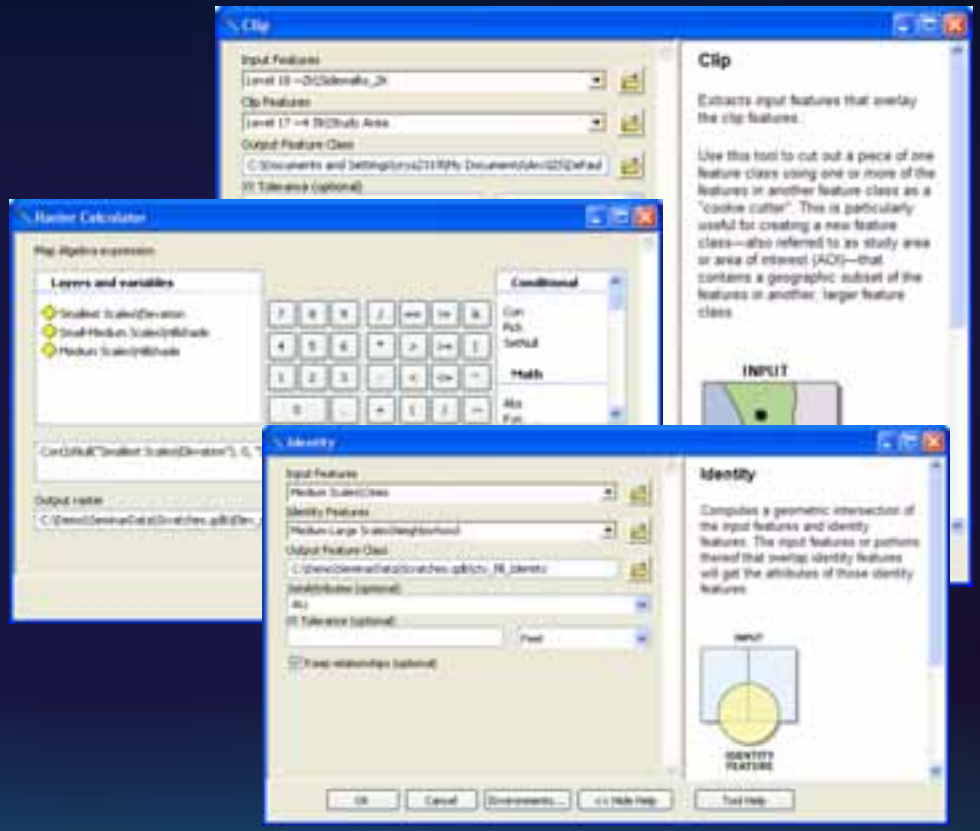
- The ArcGIS *system* for managing and manipulating data
  - Solve real-world spatial problems
  - Model processes and systems
  - Ask questions; get results

The Geoprocessing Language

Toolboxes

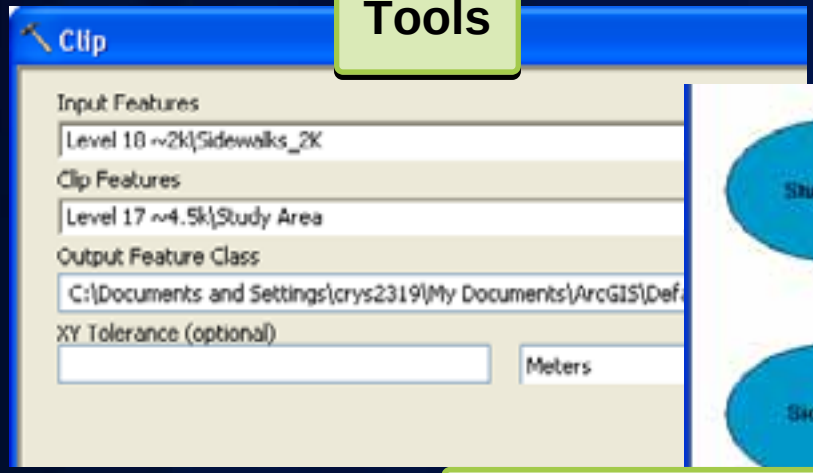


Tools

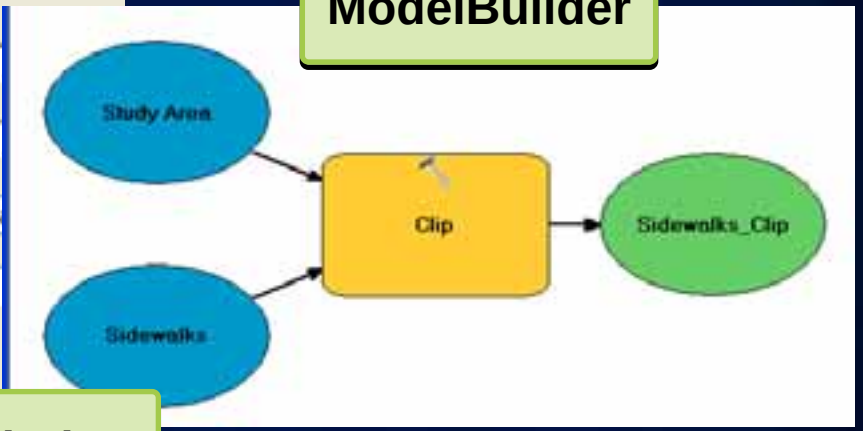


The Geoprocessing Framework

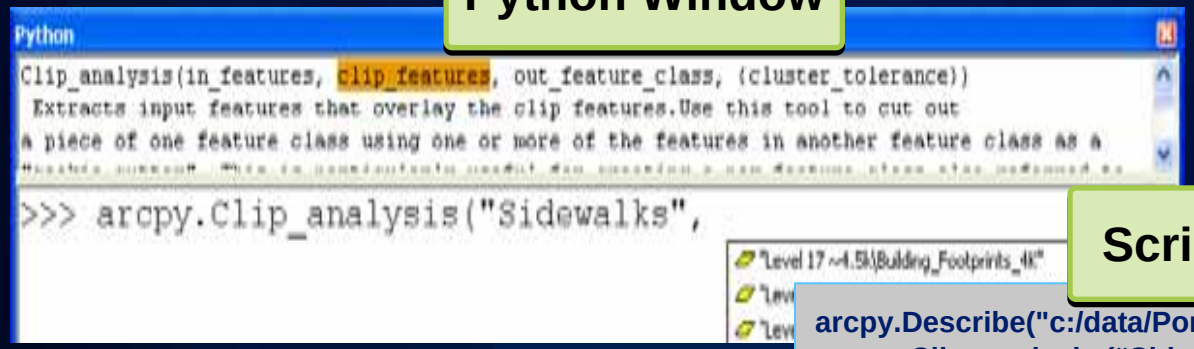
Tools



ModelBuilder



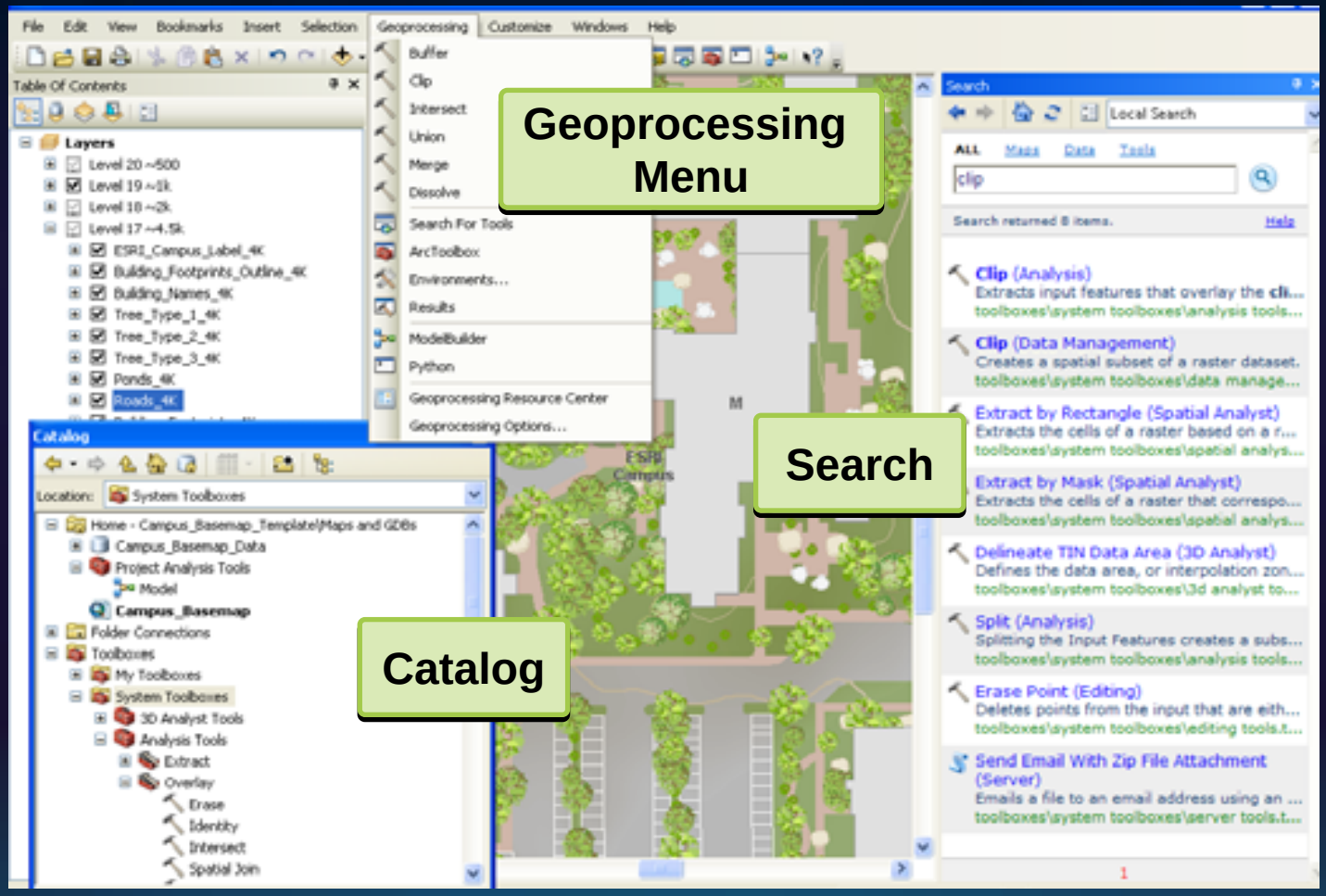
Python Window



Scripts

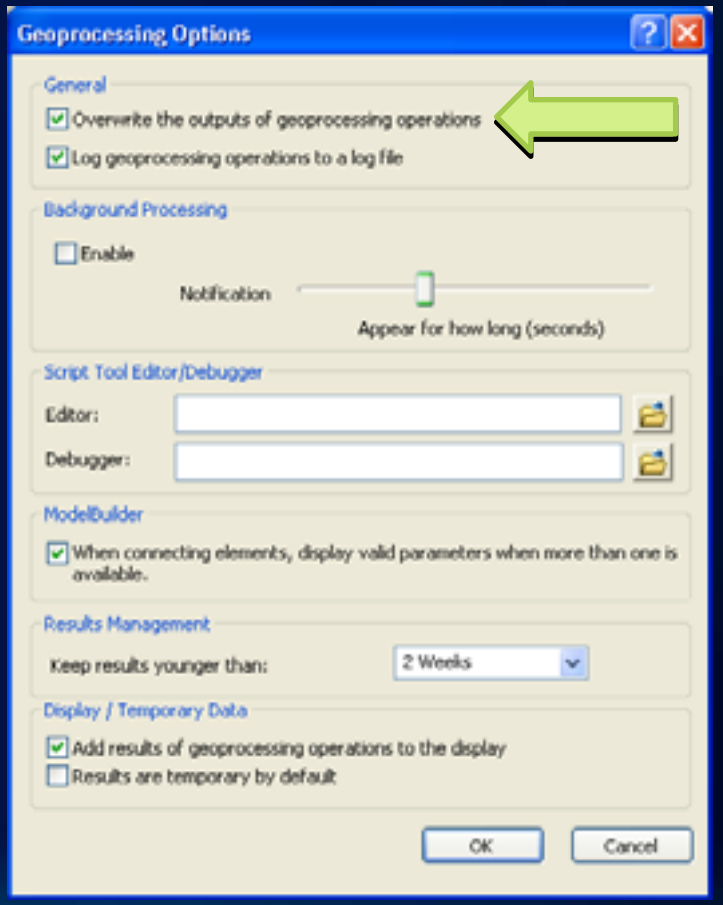
```
arcpy.Describe("c:/data/Portland.gdb/Sidewalks")
arcpy.Clip_analysis ("Sidewalks", "Study Area",
"c:/data/output.gdb/SidewalkClip
```

Finding Tools

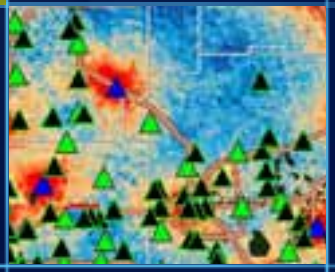


Geoprocessing Options

- 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**



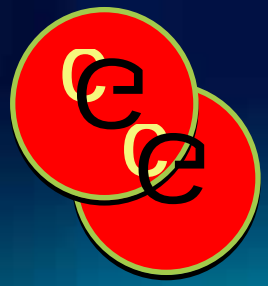
Demonstration: An Example



Workflow for Demonstration

- **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.**

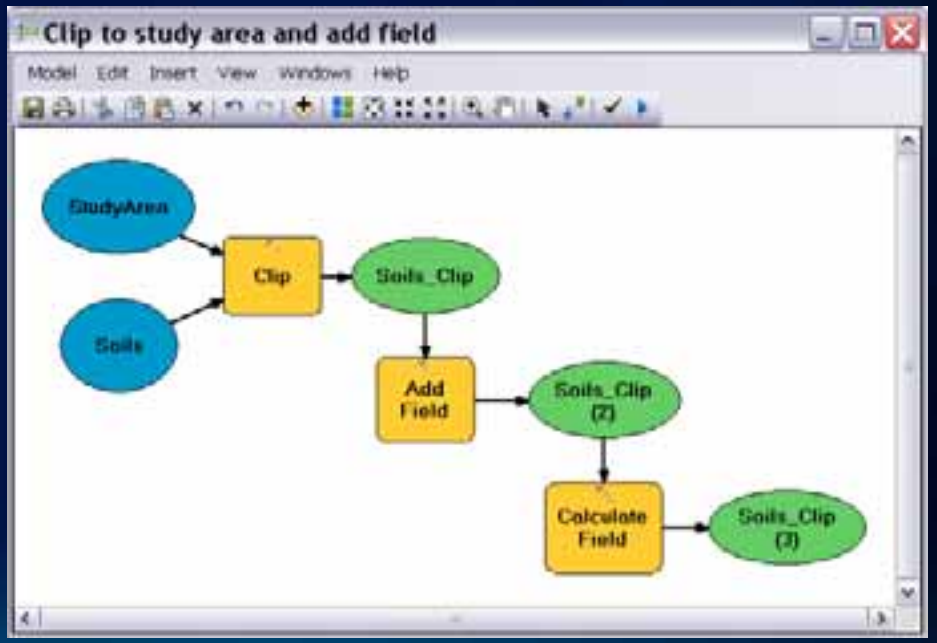
Step 1: Buffer HAZMAT Routes	Step 2:Buffer Hazardous Facilities	Step 3: Overlay with Flood Hazard areas	Step 4: Find schools *NOT* in those areas



Getting Started with ModelBuilder

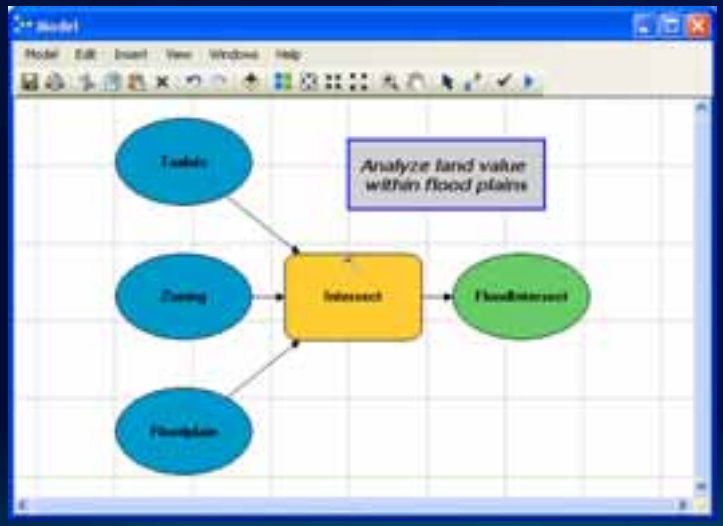
What is ModelBuilder?

- Visual *programming language*
  - Without writing code
- Tool for encapsulating workflows
  - Reusable
  - Sharable



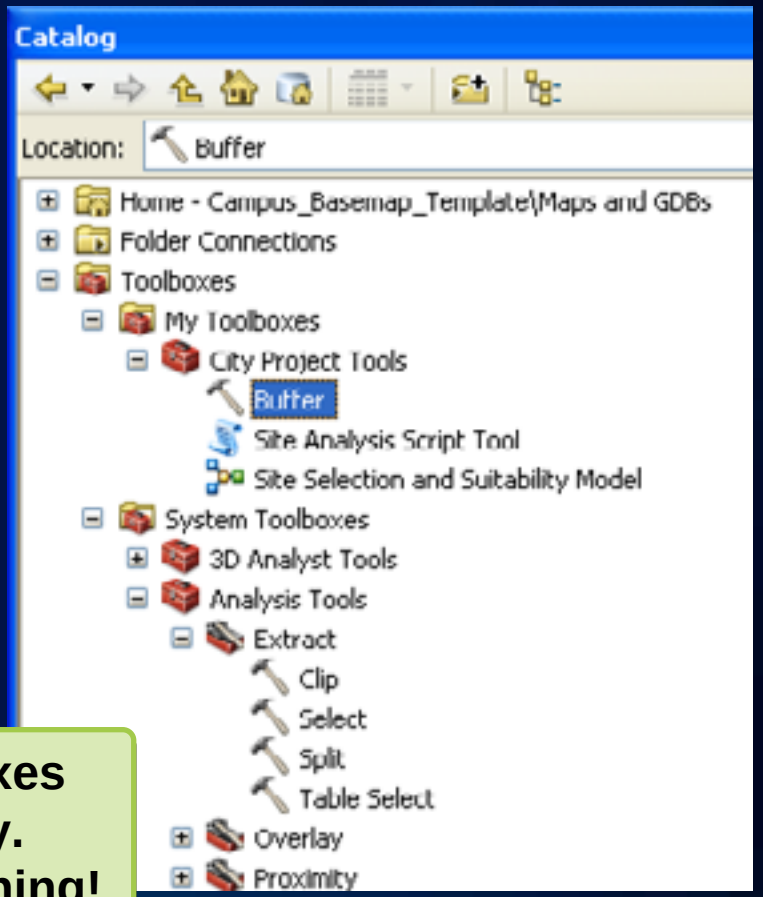
Why use ModelBuilder?

- 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



Types of Toolboxes

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

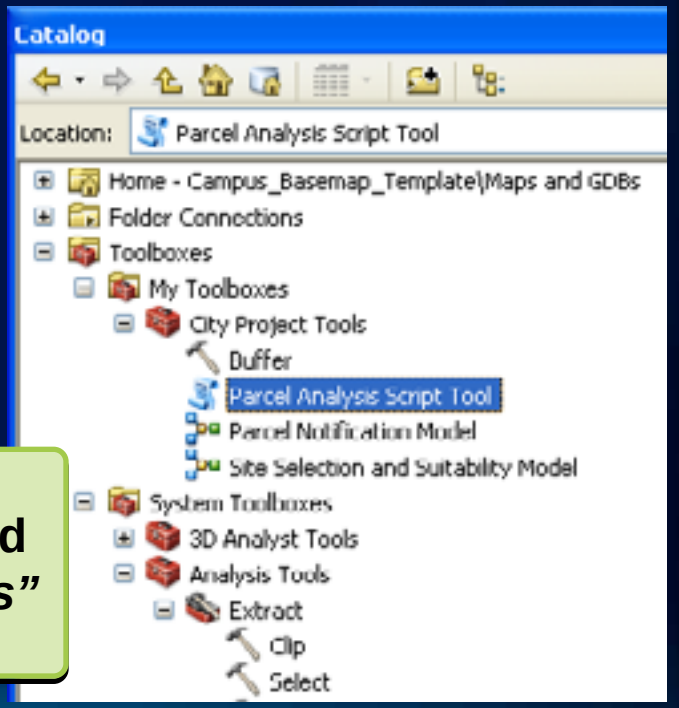


System toolboxes are read-only. This is a good thing!

Creating a New Model

1. ModelBuilder button on ArcMap Standard toolbar launches ModelBuilder with a new, *unsaved* model

2. Inside a Custom toolbox > right click > *New Model*

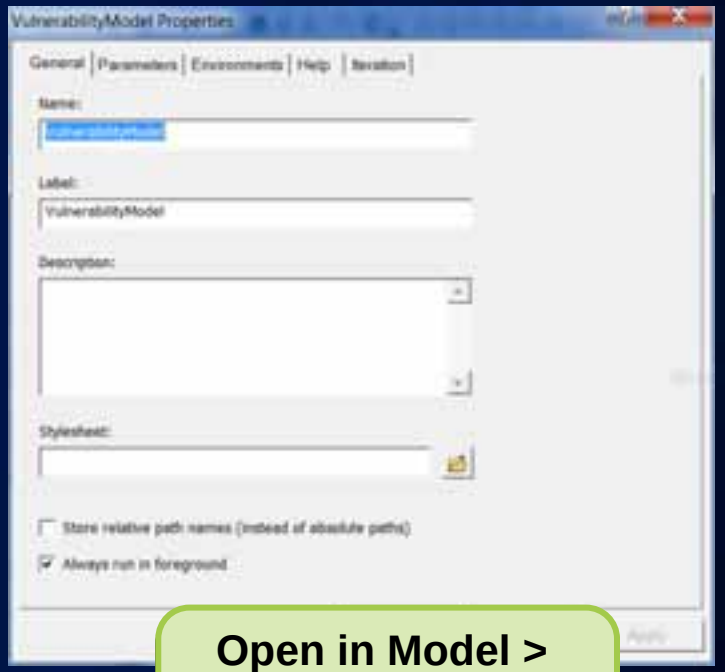


Models are created or saved in *custom* or *"My toolboxes"*

Model Properties

- Name
  - Cannot have spaces
- Label
  - How it appears in Toolbox
  - Can include spaces
  - Tip: Succinct, but meaningful!

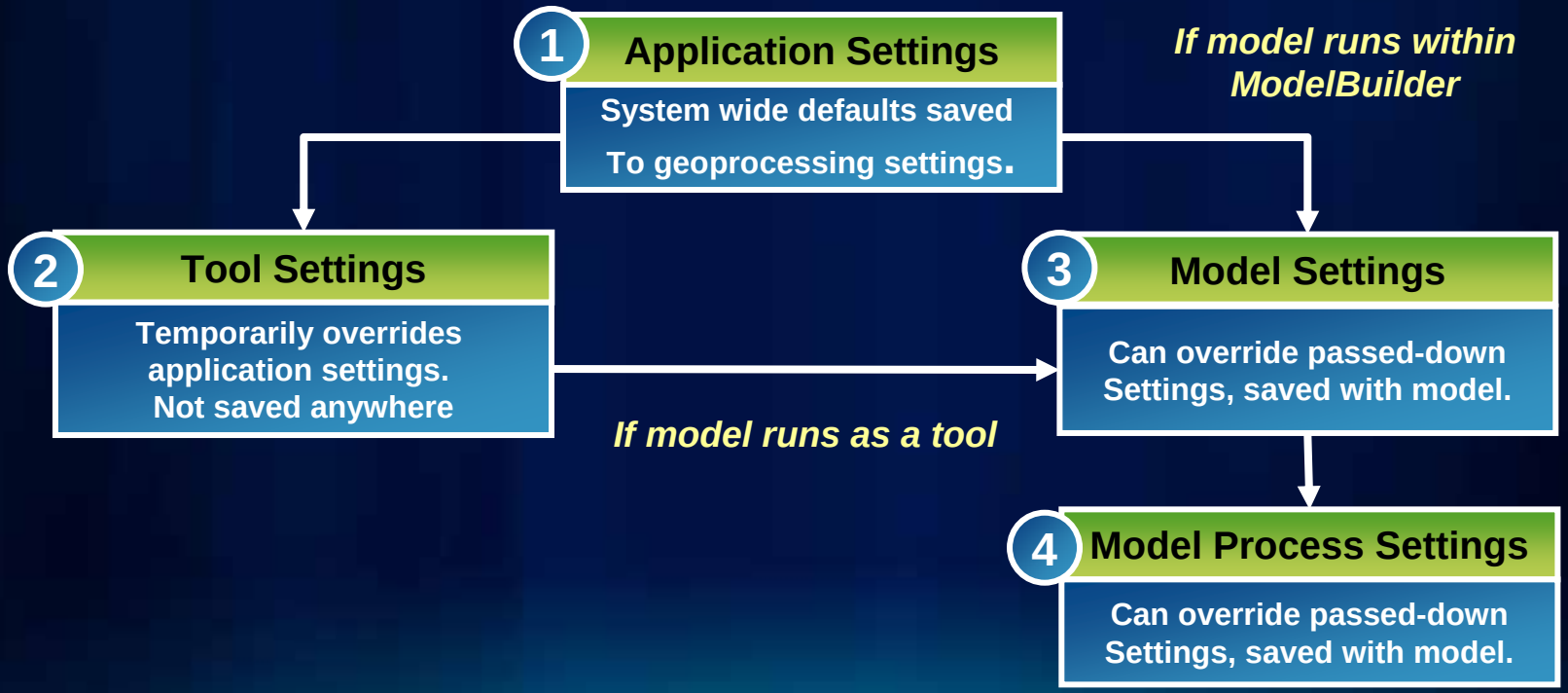
  (*i.e. “Model_1”?)*
- Description
  - Good practice for sharing
- Relative paths
  - Great practice for sharing



Open in Model > Model menu > Model Properties

Environments: Settings

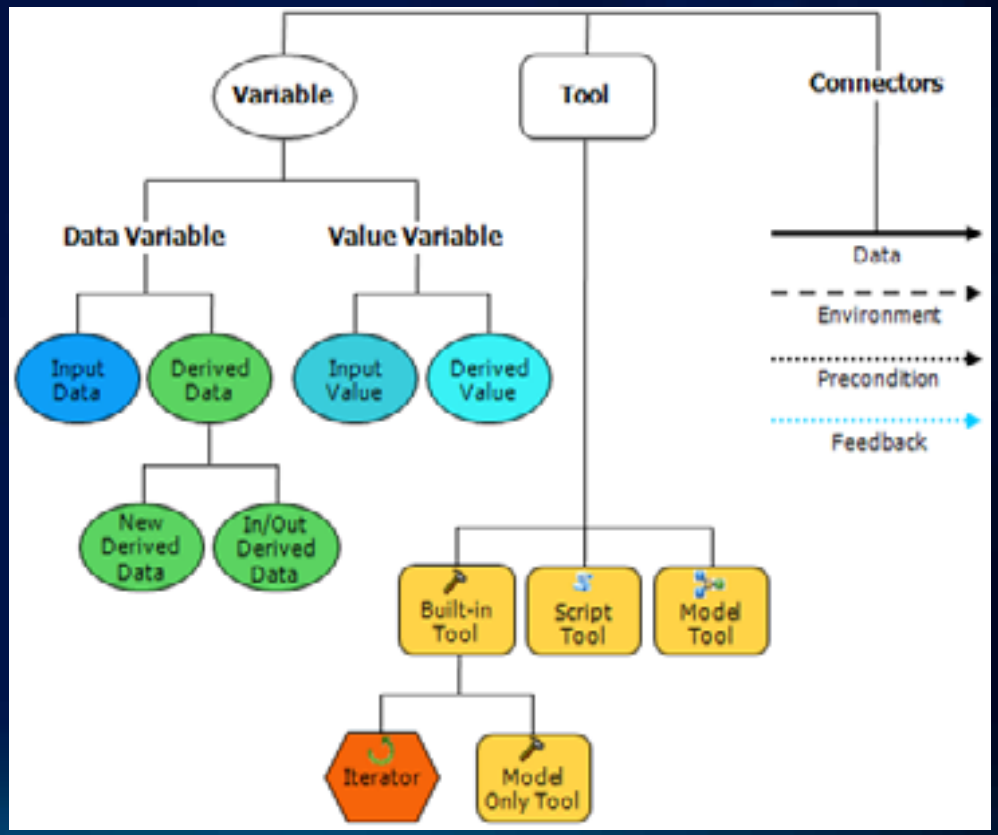
- Settings can be set at different “levels”
- Environments are passed down to tools and processes
- At each level, you can override the passed-down environment settings



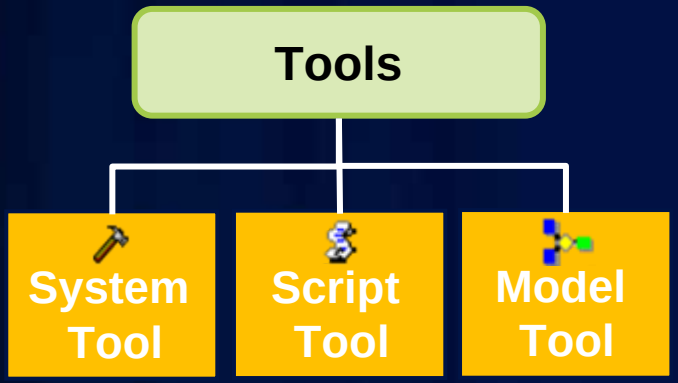
Demonstration: Creating a Model

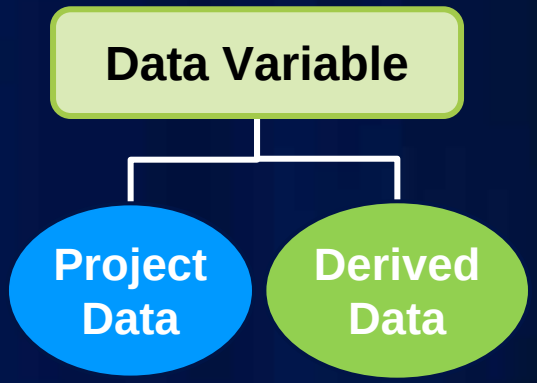
Model Elements

- There are three basic types of elements:
  - Tools
  - Variables
  - Connectors



Adding Tools and Data to a Model





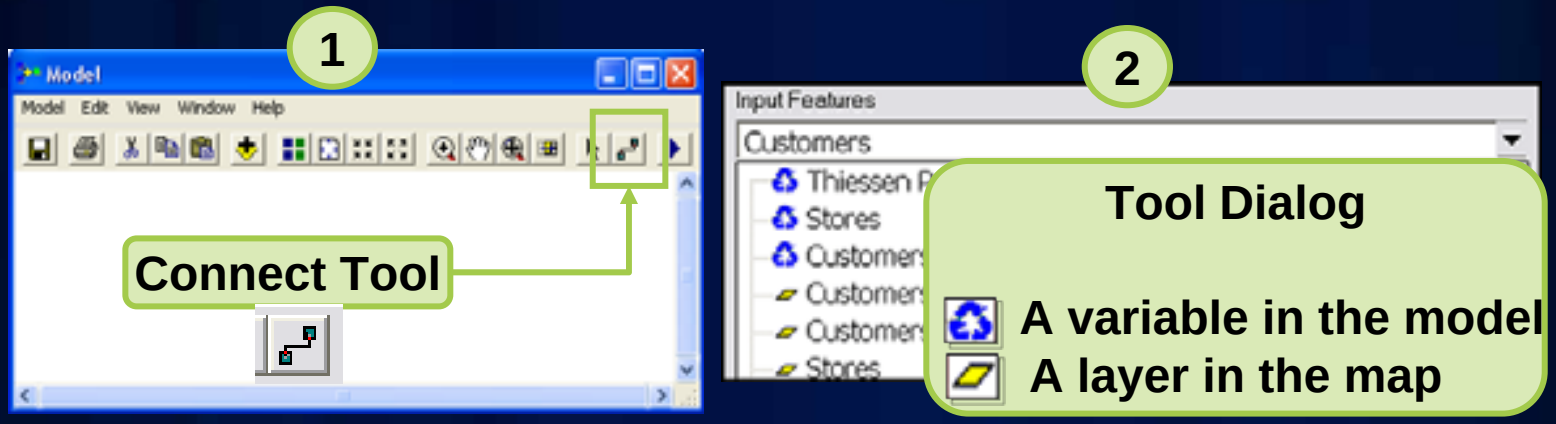
Tools

- 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

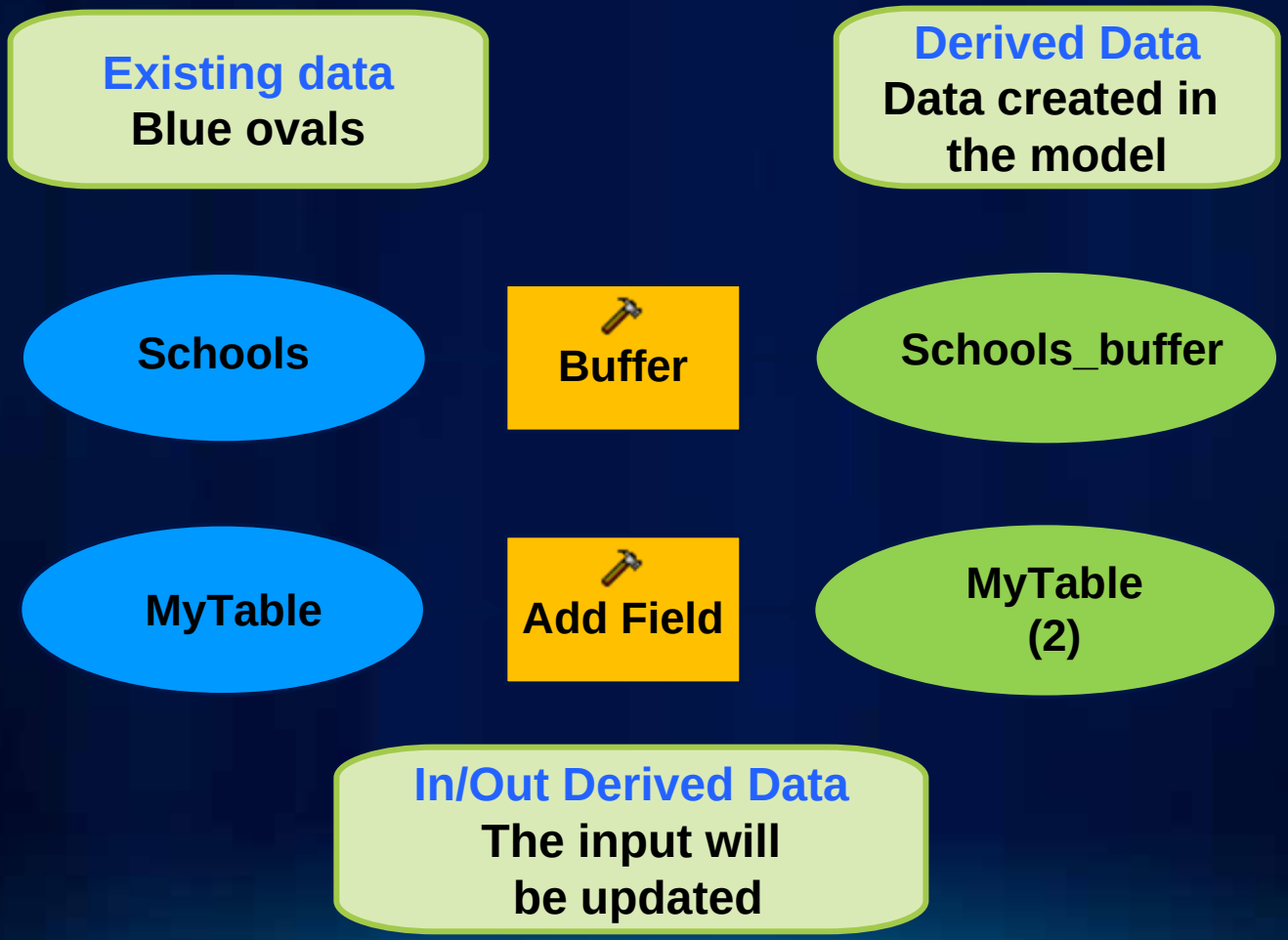
- Drag and drop from TOC
- Drag and drop from Catalog
- Drag and drop from Search
- Fill in dialog
- Use Add button in ModelBuilder
- Use Insert menu in ModelBuilder

Two Ways to Connect Elements



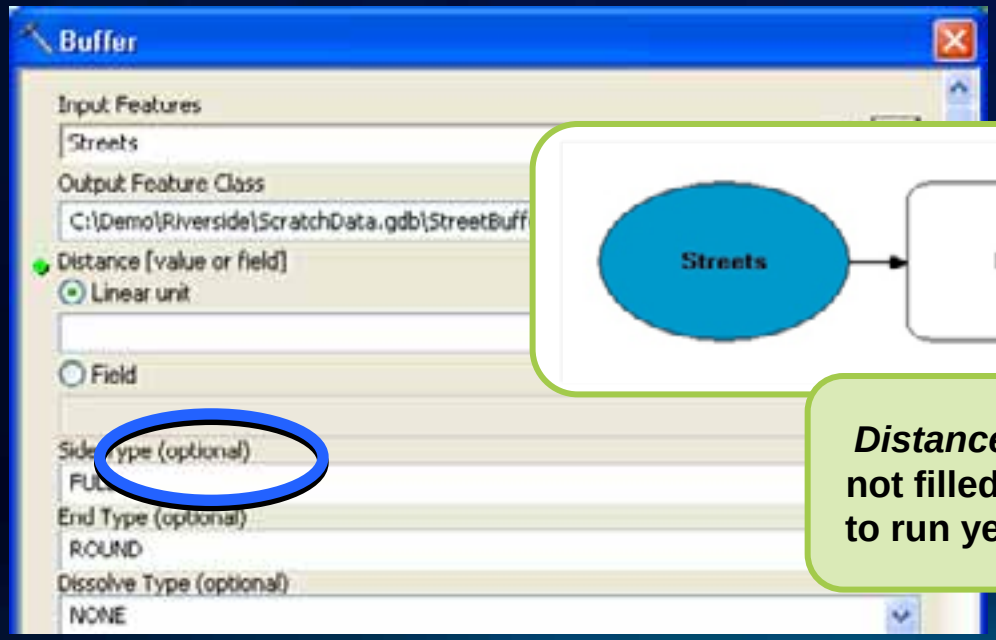
To connect processes, link the output of one process to the input of another using the Connect tool

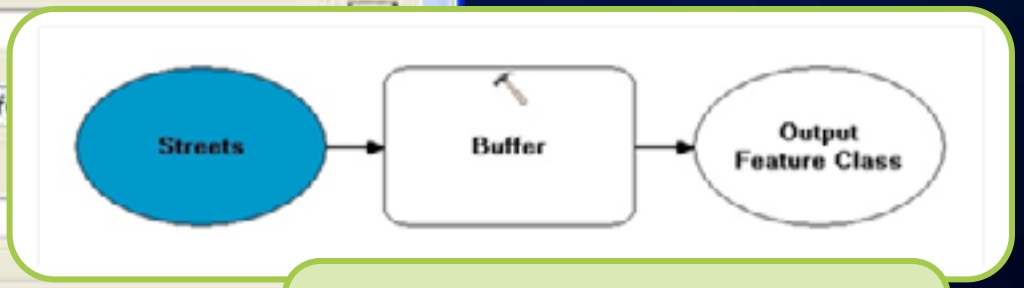
Derived Data is Created by Processes



Tools and Parameters

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

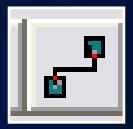


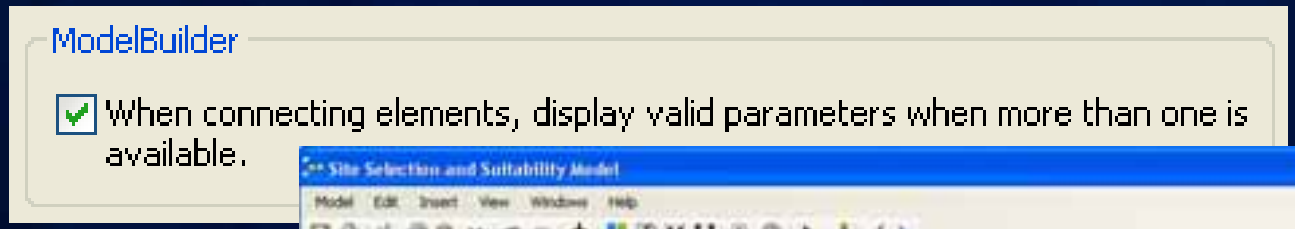


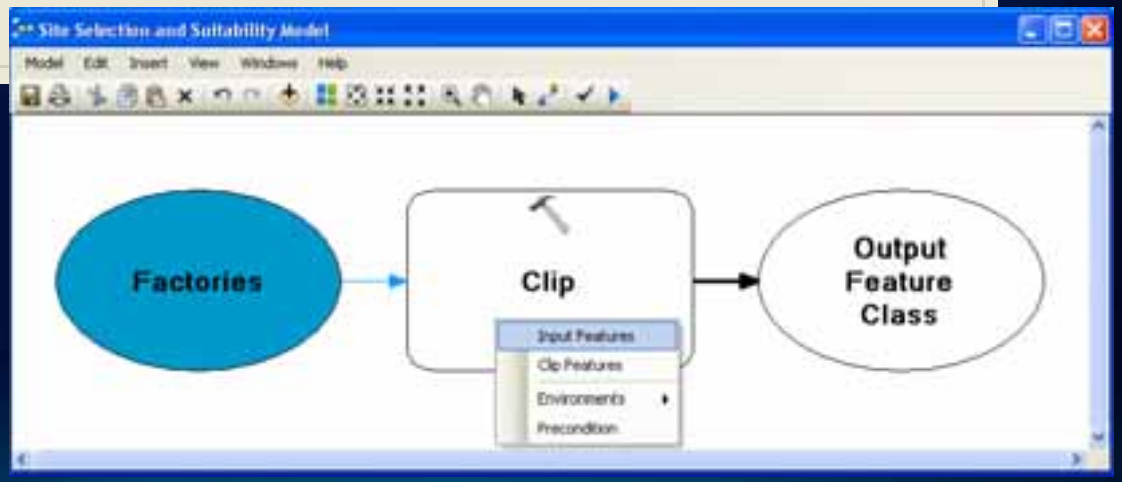
Distance **(required parameter) is not filled out; the tool is not ready to run yet and is "empty" colored**

Connect Tool *Tip*

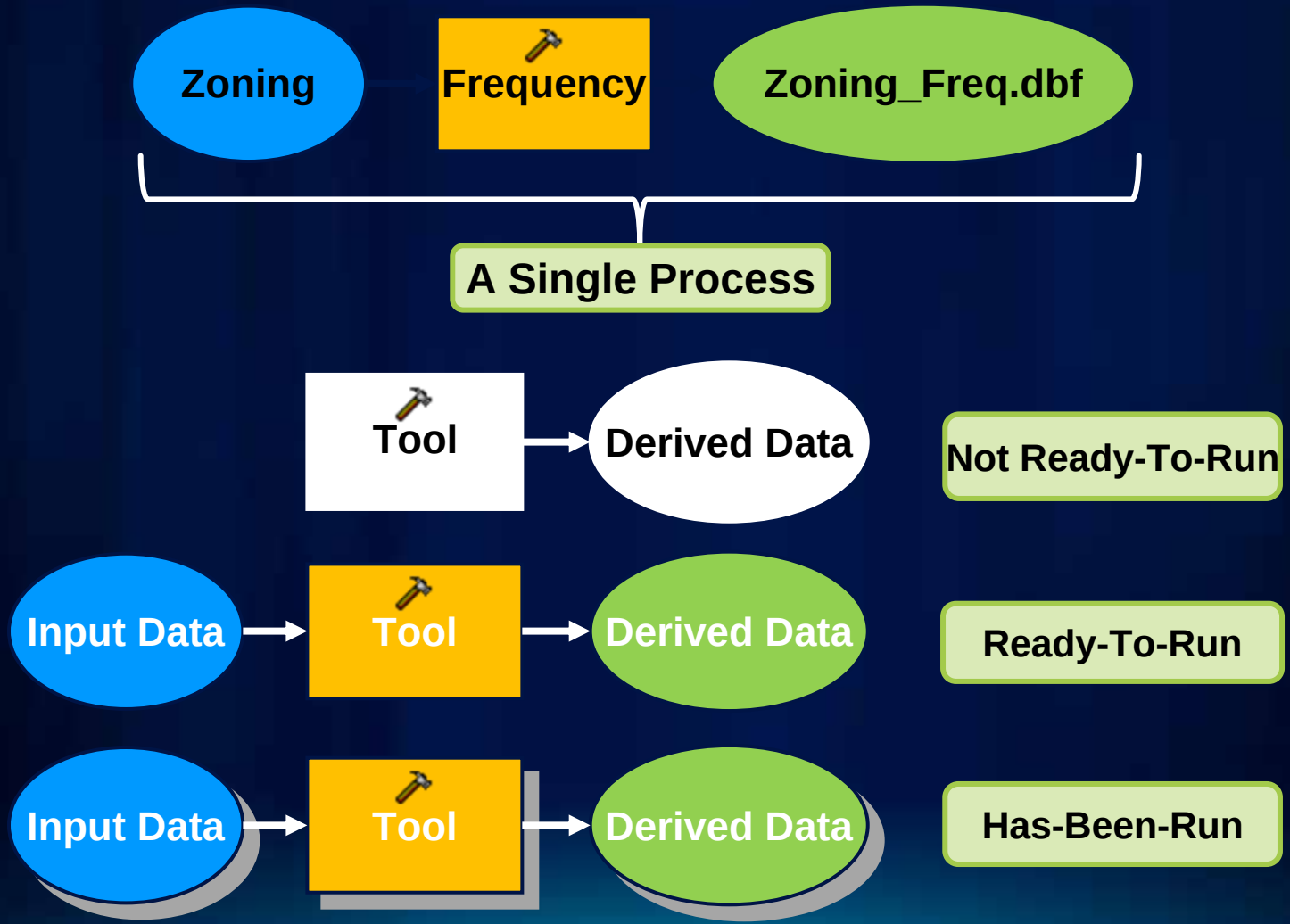
- **Enable *Geoprocessing menu > Geoprocessing Options > ModelBuilder* to display valid parameters**
  - **By default, a list of valid parameters appears when connections are made**





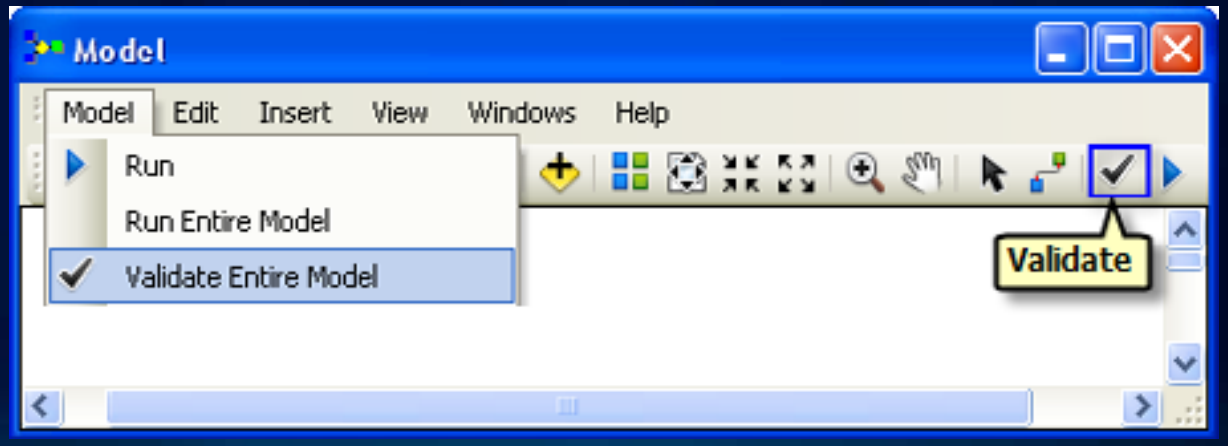


Model Process States



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 N*ot-Ready-to-Run* state



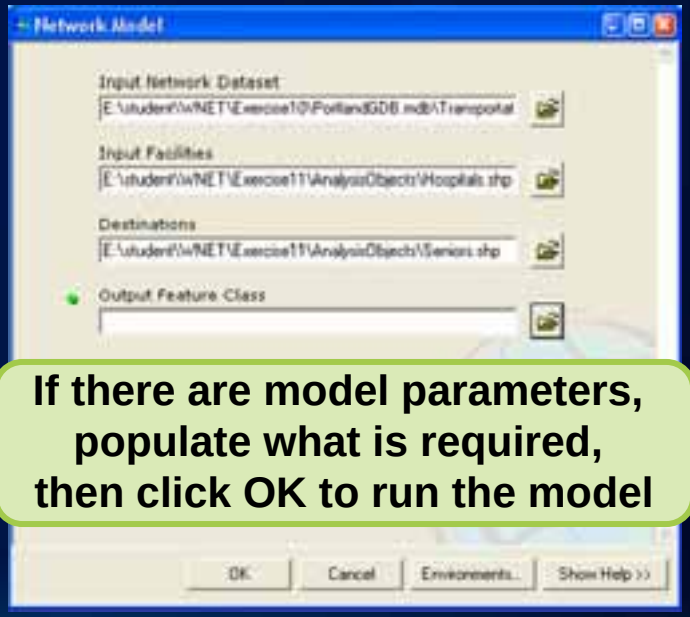
Creating Model Tools

What Does This Mean?!

Running a Model as a Tool

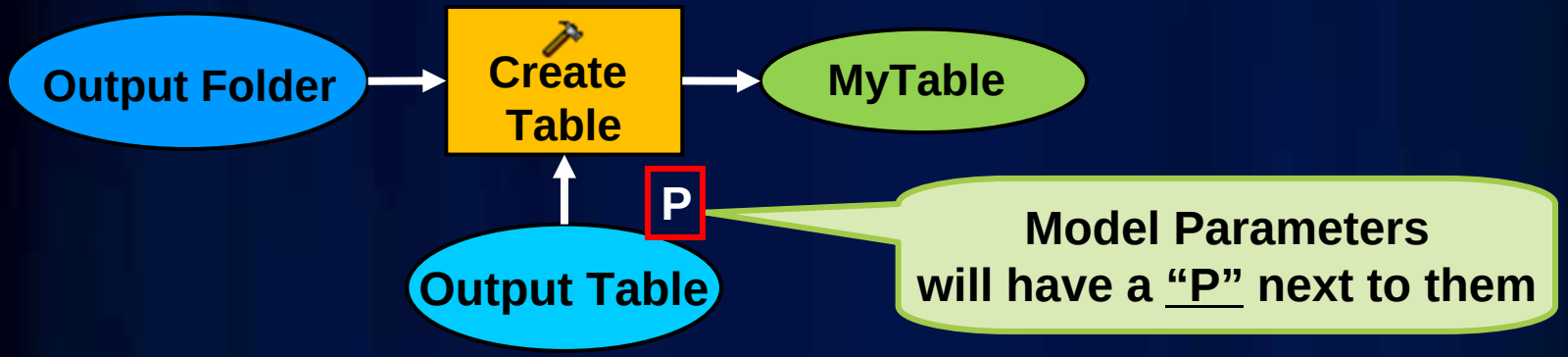
- **"*Double-clicking*" or *Right-click > Open* a model from its toolbox opens the model tool dialog**
- ***These ARE models:***

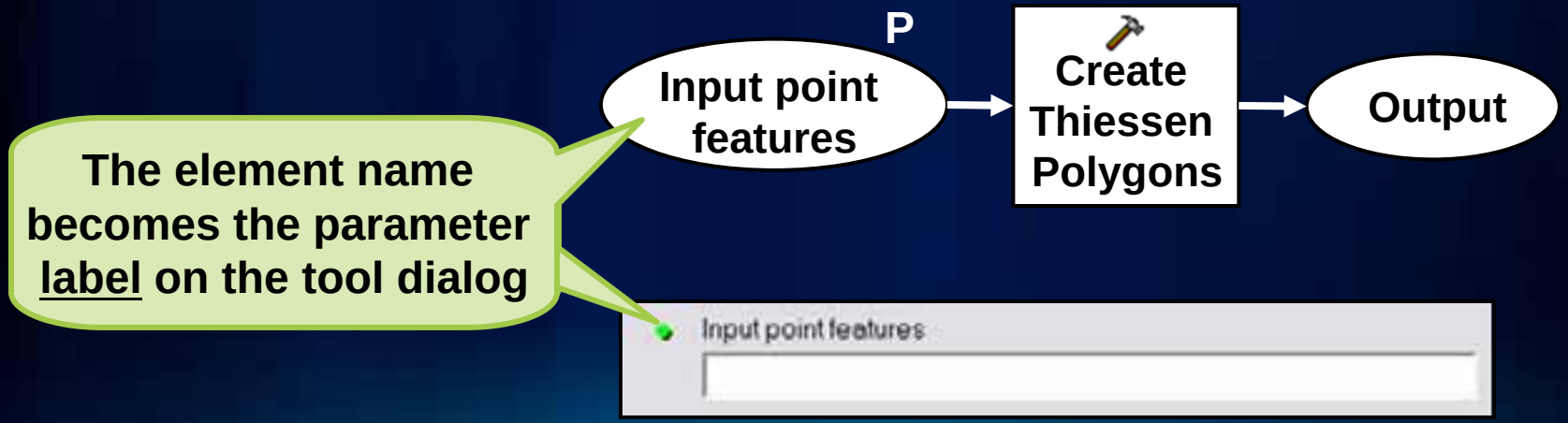
If there are no model parameters, just click OK in the dialog



If there are model parameters, populate what is required, then click OK to run the model

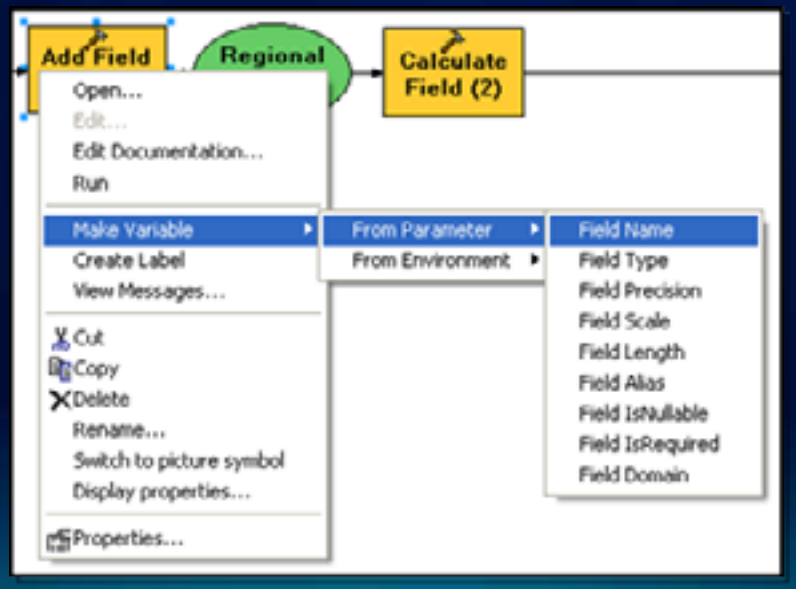
Parameters


Output Folder
Create Table
MyTable
P
Output Table
Model Parameters will have a "P" next to them

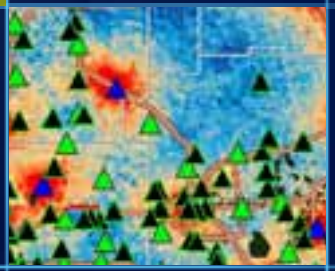

P
Input point features
Create Thiessen Polygons
Output
The element name becomes the parameter label on the tool dialog
Input point features

Creating Variables from Tool Parameters

- ModelBuilder will create a *variable* for all input 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

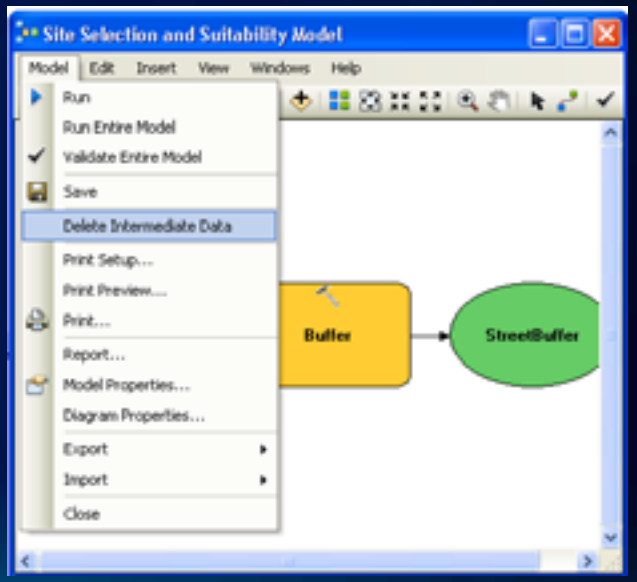


Tips for Designing and Sharing Models

Intermediate Data

- Derived data in a model is set to Intermediate by default
  - Excludes “final” output
- Is not automatically deleted*
  - Manually delete from Model menu > Delete Intermediate data

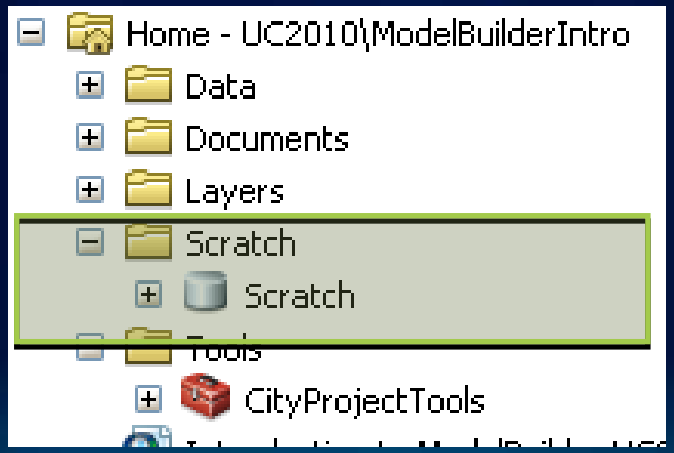
Right click derived data and check/uncheck Intermediate



There are exceptions, see Tips for running models slide

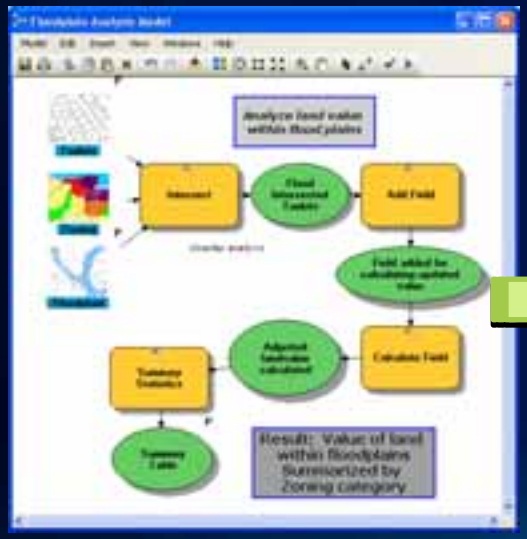
Tips for Managing Intermediate Data

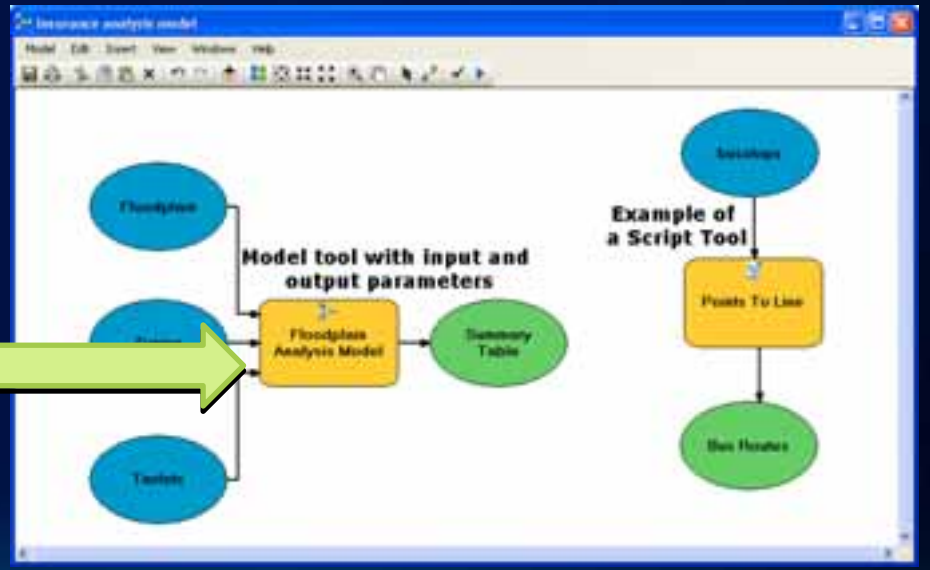
- **Don't:**
  - **Write to ArcSDE geodatabase**
  - **Remote data or networked drives**
  - **Clutter your "permanent" results databases**
- **Do:**
  - **Use *Scratch* workspace wisely**



Models Added as Tools to Other Models

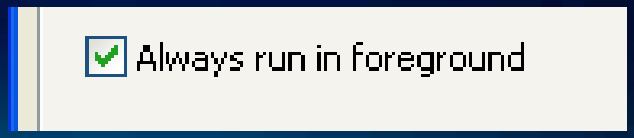
- Models can be added to another model
  - Break down complex models into smaller, perhaps more manageable sub-processes
  - Collaborate with a team where domain experts can work on their model





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



Design Models to be Sharable

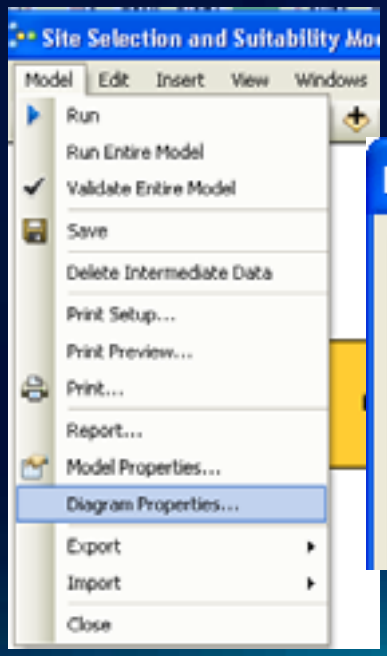
- Flexible
  - Not data-dependent, good folder structure
  - Environments, Relative paths, etc..
  - Parameters & variables
  - Read: Tips for distributing tools
- Clear and easy to read
  - Layout is simple and logical
  - Labels added for clarity
  - Elements renamed and not cryptic
- Documented
  - Item descriptions (*New at ArcGIS 10*)
  - Help documentation

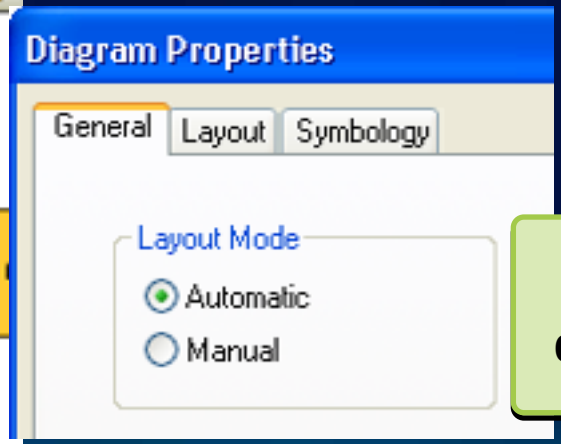
Modifying the Layout

- 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 Mode: Automatic

- **Automatic Layout mode: enables Auto Layout button**
  - **Arranges model elements using settings under the Layout tab**

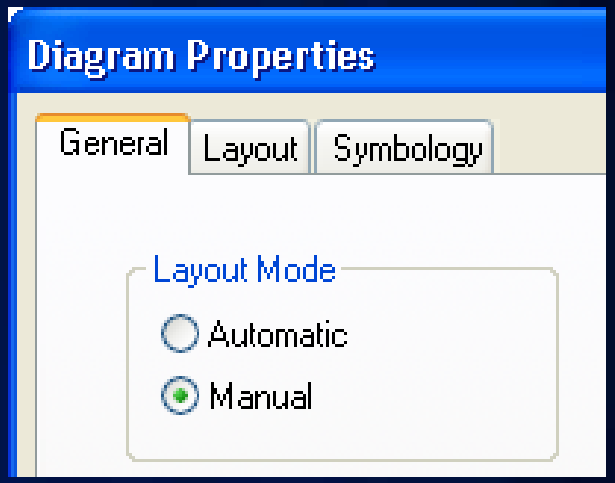


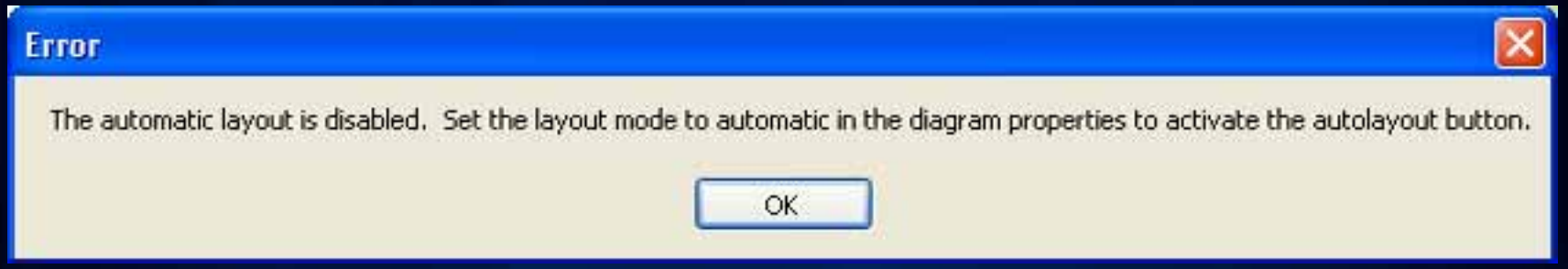


This is the default mode

Layout Mode: Manual

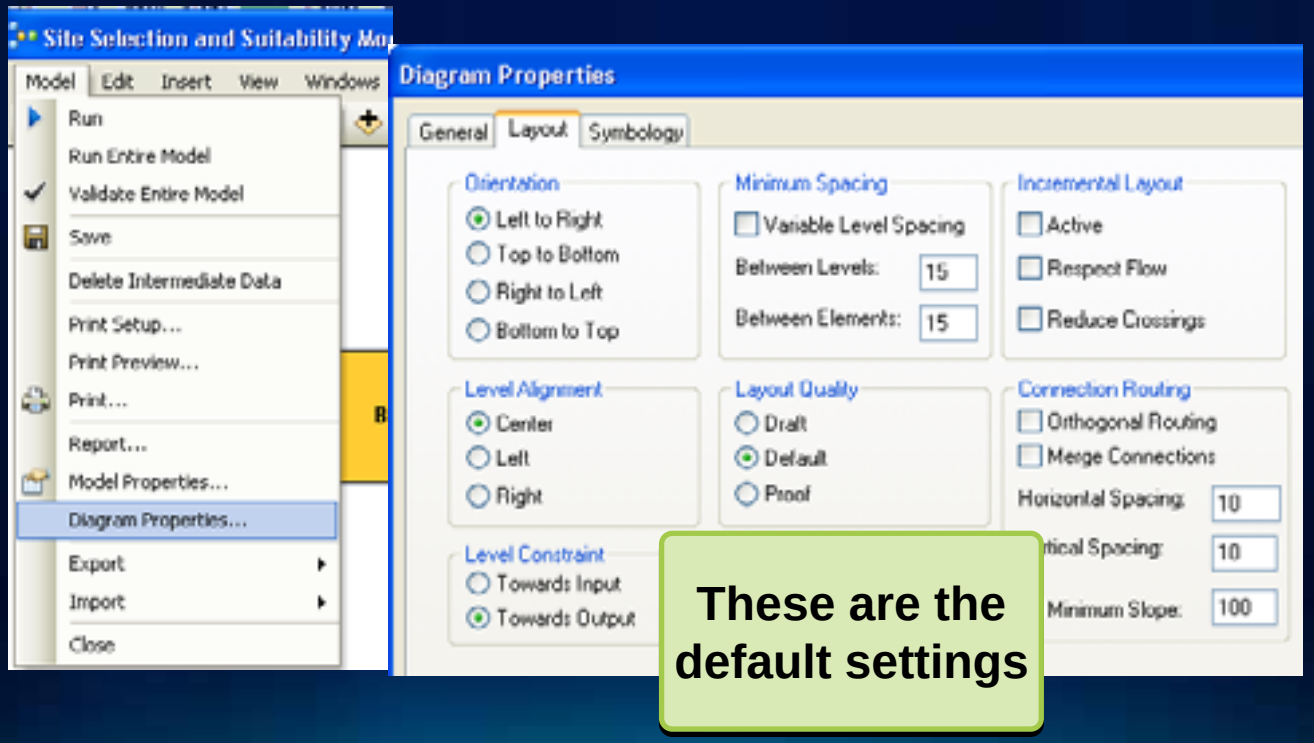
- **Manual Layout mode: disables *Auto Layout* button**
  - **Auto-arranging will not occur**
  - **This message appears:**



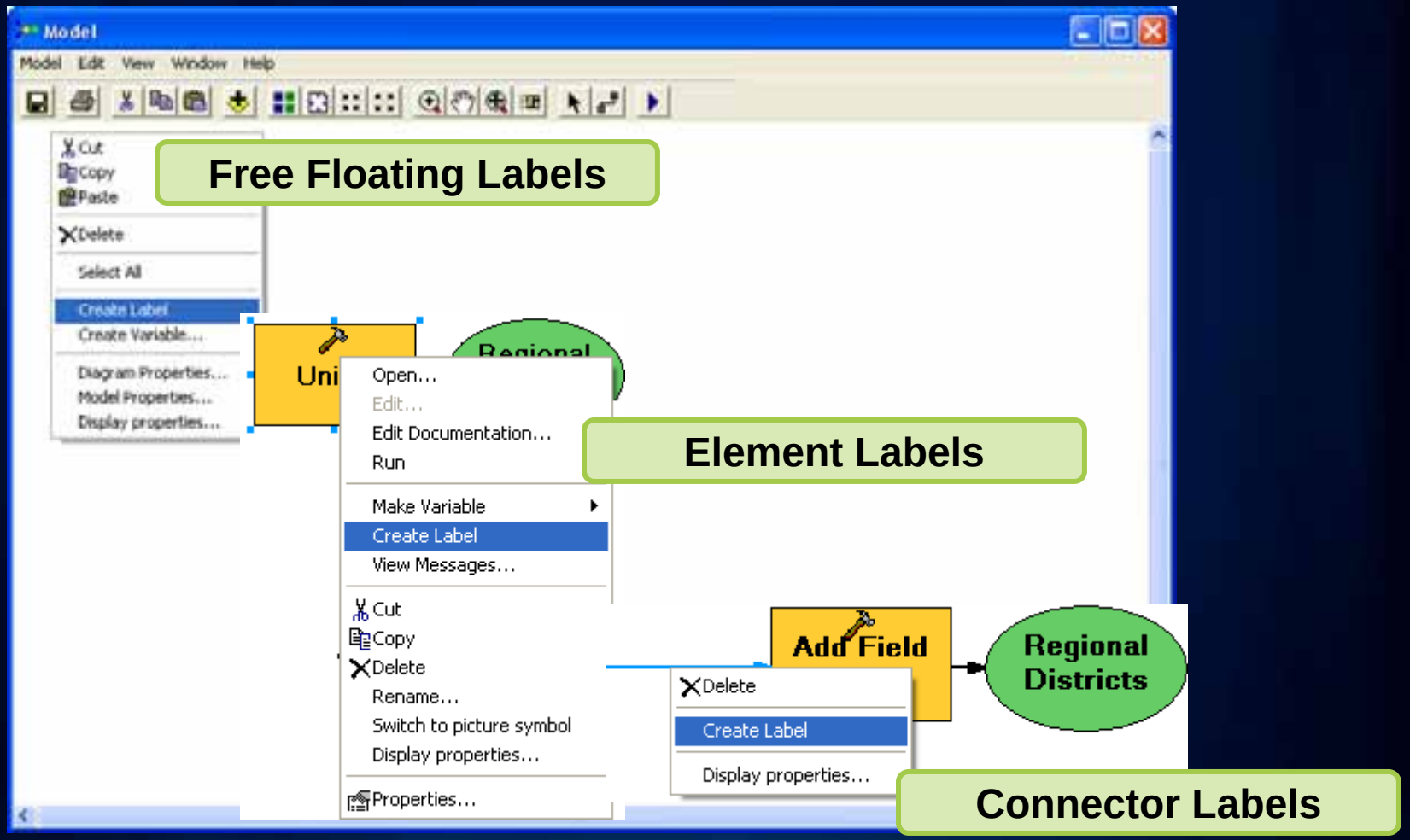


Layout Options

- Orientation of processes, Spacing between elements/connectors, Connector styles
- Clicking ***Auto Layout*** button applies these options

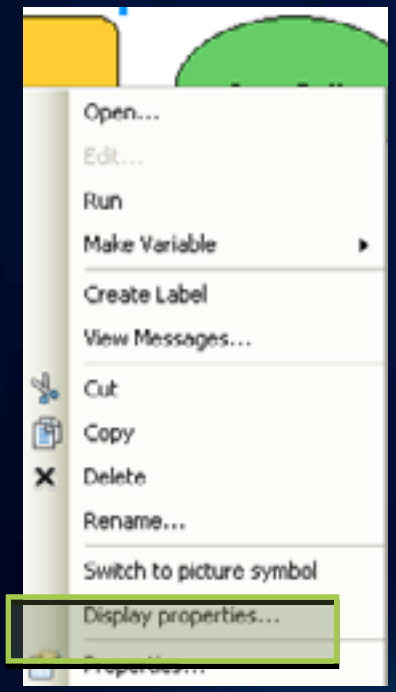


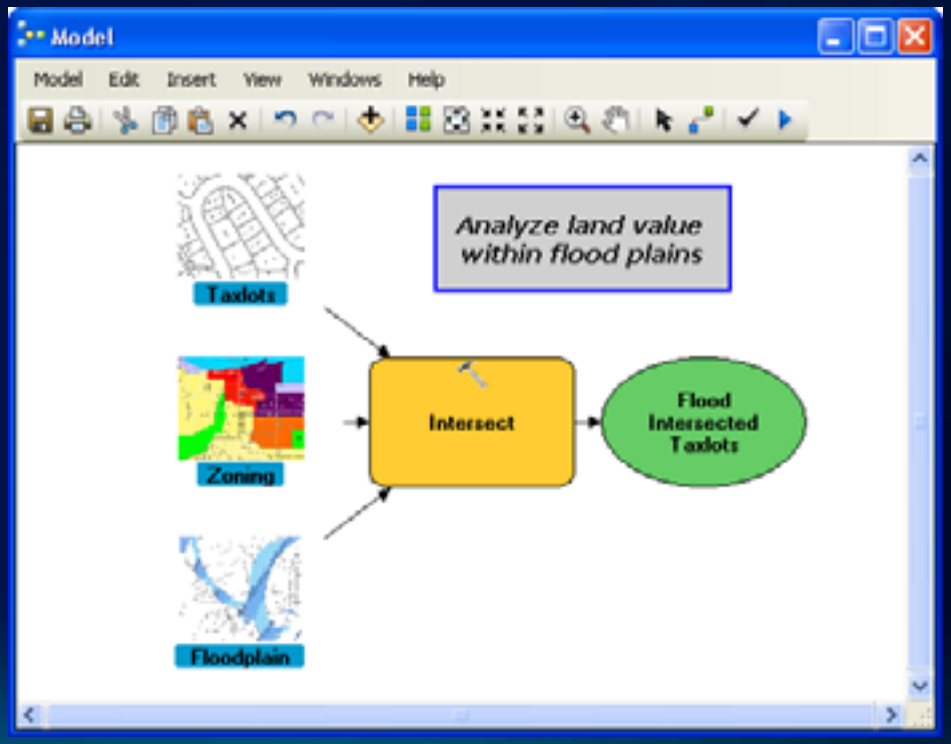
Documenting: Labels



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

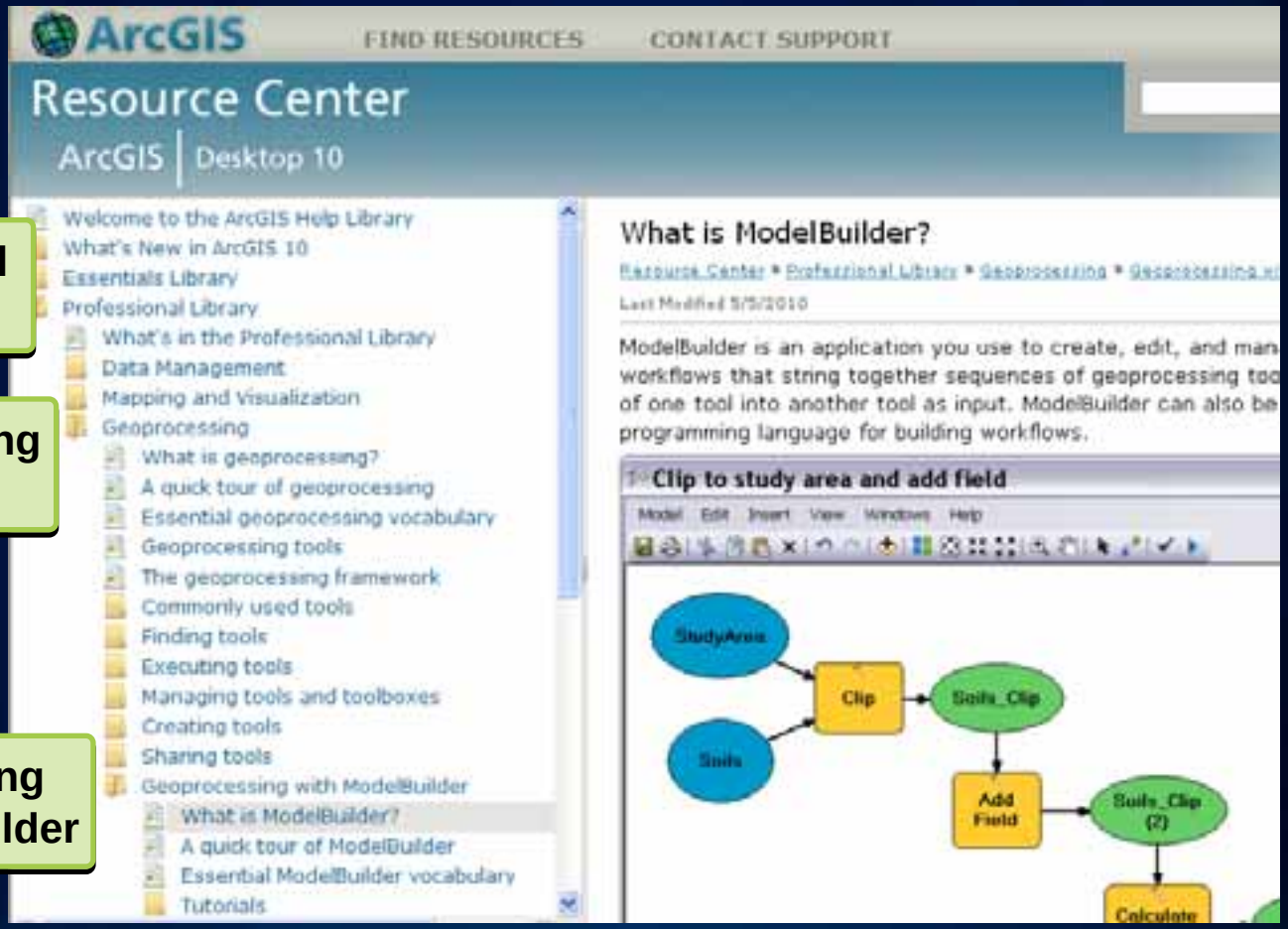
Learning more…

ArcGIS Online Help

Professional Library

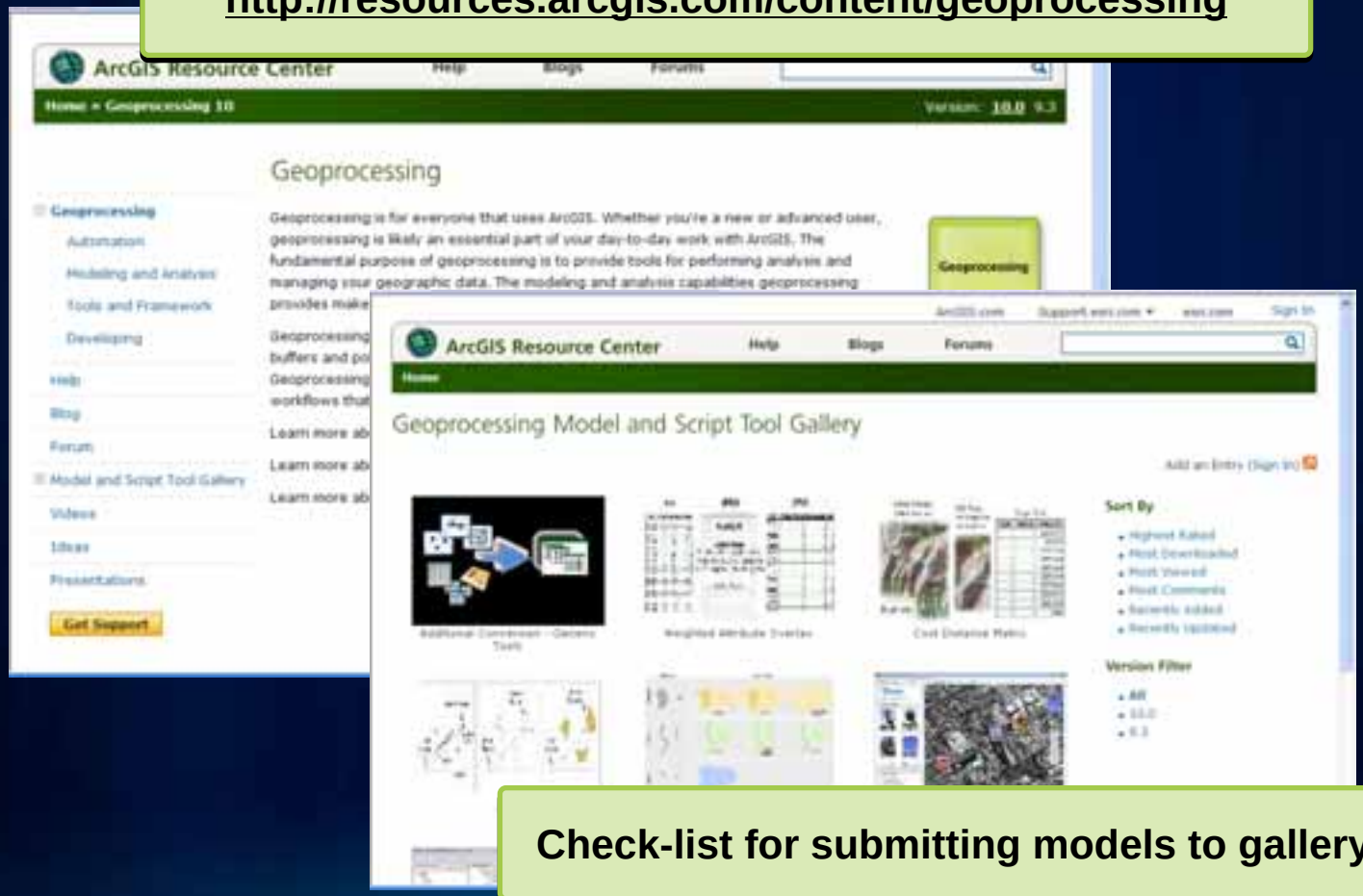
Geoprocessing Book

Geoprocessing with ModelBuilder



Geoprocessing Resource Center

http://resources.arcgis.com/content/geoprocessing



Check-list for submitting models to gallery

Learning more…at the Conference

- **Getting Started with ModelBuilder**
  - Repeated - Wednesday from 1:30PM - 2:45PM, Room 5A/B
- **Building Tools with ModelBuilder**
  - Wednesday from 10:15AM – 11:30AM, Room 14B
  - Thursday from 3:15PM – 4:30PM, Room 4

Come visit us in the Spatial Analysis Showcase

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- **Books**
  - **Getting to Know ArcGIS ModelBuilder**
    - **This book covers all ModelBuilder topics from beginner to advanced.**

Session Evaluation:
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