Lab 11 Part A
Creating a Capability Model
Using Model Builder in ArcGIS Pro

Labs 11 and 12 will cover the final 4 weeks of this course. Each lab is allotted two weeks, and is worth 25 points. During these two labs you will create a habitat-based *capability/suitability model* for a transgenic organism called *Lepus octopedis*. In ArcGIS Pro, Model Builder is a graphic scripting tool set that can be used to string together a series of processes into a single, larger model that allows the operator to automate spatial analysis. In Lab 11A, you use Model Builder to identify all those polygons that are **capable** of supporting *Lepus octopedis.* Next week, in Lab 11B you will conduct a suitability analysis that will rank the capable areas from worst to best for successfully raising *Lepus octopedis.*

Procedures

This lab will be accomplished through the following five steps: 1) database setup; 2) flow charting; 3) introduction to Model Builder; 4) building and running a model; and 5) symbolizing features.

Database Setup

1. Copy the *lab_11* folder from the class data directory into your workspace. This folder should include: *Coronado*, an ArcGIS Pro project containing spatial and attribute data for the Sierra Vista Ranger District in southern Arizona and a 6 band Landsat TM image.

2. Start ArcGIS Pro, navigate to the Coronado project and open it.

3. Create a new map **[4]** and name it Capable Areas **[7]**.

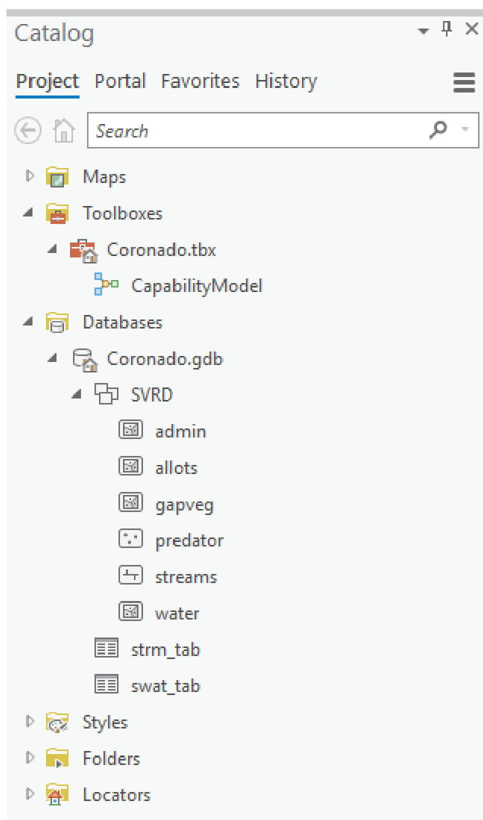
4. Add all the feature classes in the geodatabase to the map **[19]**.

5. Symbolize the feature classes in a way that makes sense and pleases you **[40]**.

6. In this lab, you will use ModelBuilder to create a model that will be used to identify those areas capable of supporting *the species of interest*, *Lepus octopedis*. The final step in setting up the geodatabase is to add a new model to the toolbox (note, at this point the model is *empty*, you will add data and processes later).

   - In the Catalog pane, locate the Coronado toolbox and create a new model. **[66]**.
   - Select *Properties*, and make sure **both** the name and the label are set to *CapabilityModel*. On the model properties dialog check the box to store relative path names.
   - Save the Model **[72]**

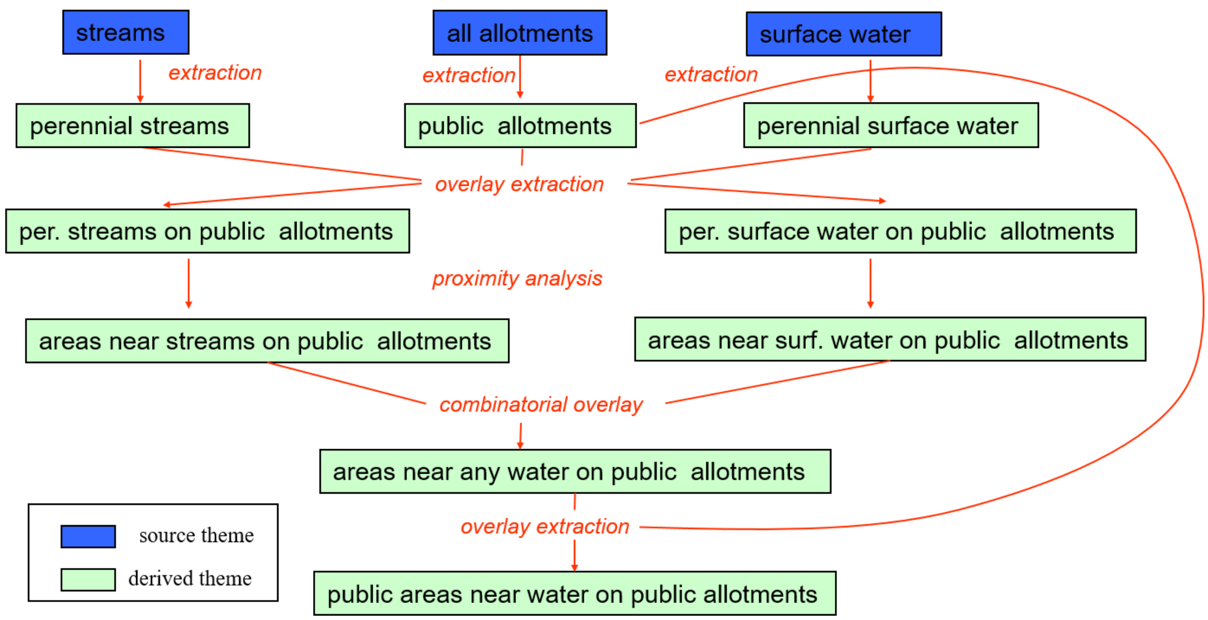
7. When you reach this point, your Catalog pane should have all the components seen in the graphic to the right.



8. Save your project

Flowcharting

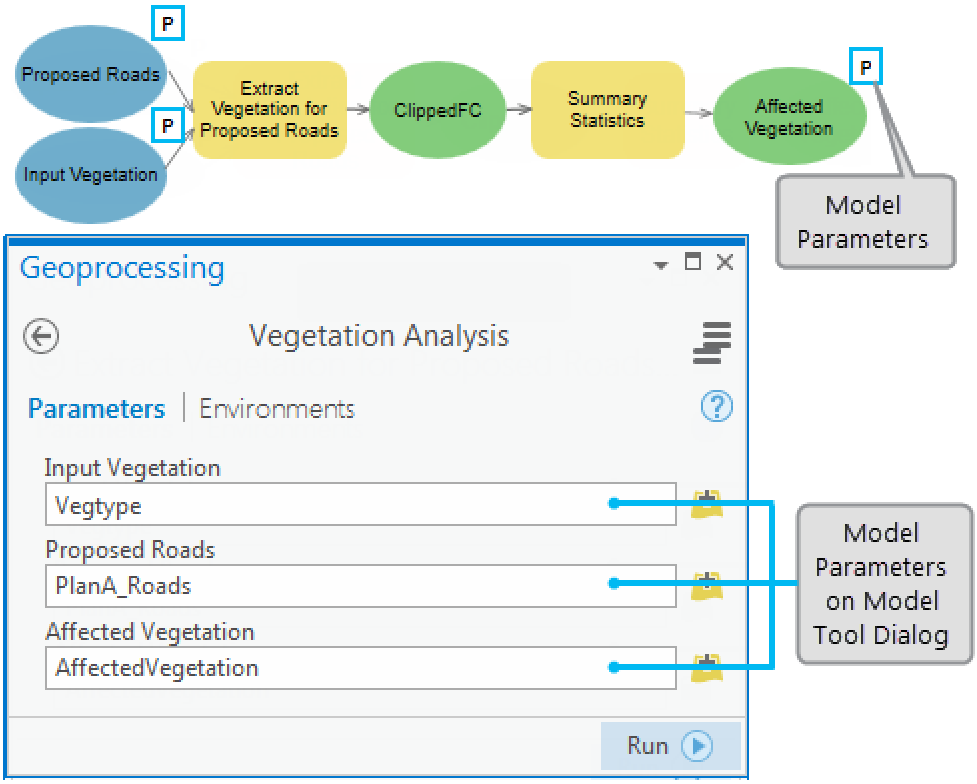
Let's take a step back from the computer for a moment and consider what will need to be done in order to identify those areas capable of supporting *Lepus octopedis*. To aid in this effort you have been given a conceptual model schematic (below) that you can use to create and run the model in the Coronado project. This schematic takes you through a series of steps using source and derived data themes to identify capable areas. The flow chart also has generalized process descriptions (the red text) for operating on these themes, but is missing the specific tools that are needed to complete each step. To figure out which tool to use, you should a) read through the information provided in the lab material on *Lepus octopedis*; and 2) read the help files on the tools and tool trays in the Analysis Tools toolbox. For example, in the chart below you will find references to *extraction*, *overlay*, and *proximity tools.* In the geoprocessing pane, navigate to the toolboxes, locate the *Analysis Tools*, and there you can look at the different tools in the *extract*, *overlay*, *and proximity* tool trays. You can also use ArcGIS help files to get information on specific tools **[52]**. Finally, you should keep notes about the tools you want to use as you step through the flow chart.



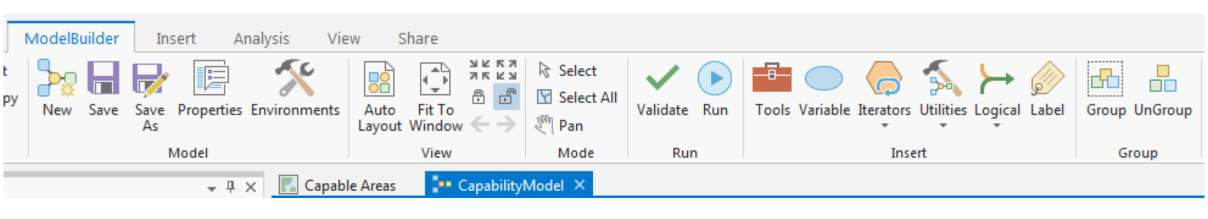
Introduction to Model Builder

The geoprocessing tools in ArcGIS make it *relatively* easy to create spatial models; however, when there are many geoprocessing steps involved in your model it can be difficult to keep track of the assumptions, tools, datasets, and other parameter values you have used.

One of the easiest ways to author and automate your work flow and keep track of your geoprocessing tasks is to create a *model* in ModelBuilder. Using ModelBuilder you can automate your workflow by stringing data and tools together in a graphic environment to create a model. You can then run the model and all your geoprocessing steps will be automated. Models can be stored in geodatabases, along with spatial and other data types. A model consists data and tools that operate on the data (below).



When you open a *ModelBuilder* model for editing, a model window opens along with a context sensitive ribbon. This is the interface you use to create models in ArcGIS. The display window is where you build a model, while the ribbon includes a number of tools that allow you to interact with the model diagram (below)



Building and Running a Capability Model

In this section of the lab you will be locating perennial surface water (mostly tanks) on non-privately-owned USFS allotment areas. You will also do some processing to subset the features to the limits of the study area. **To do this, you need to know the values the attribute containing the surface water types (e.g. "intermittent", "perennial") that represent permanent water sources**. You also must be able to isolate privately held allotments (parcels of land) that will not provide water sources or be a part of the habitat analysis.

9. Begin reducing features, based on attribute values, to match the musts of the capability model – must have a perennial water source and must be on FS allotments.

    - Locate the tables strm_tab and swat_tab in the Coronado geodatabase and add them to the table of contents.

    - In the catalog pane, navigate to the toolbox that you created in the *Coronado* project.

    - Expand the toolbox and open *CapabilityModel* for edit **[76]**. (If you double-click a model, it won't open for edit, it will try to run the model.)

- Note that when you open the model for edit, it activates the model window and displays the ModelBuilder specific ribbon.

- Find the select (Analysis) tool and drag it to the *CapabilityModel* window **[67]**.

- Double-click the Select (Analysis) tool in the Model Builder window and set the parameters in the dialog box **[68]**. The input feature class is the layer called *water.* Place the output feature class in the SVRD feature dataset and name it *per_water*. You will need to select those features that provide permanent (perennial) sources of water. To do this, you will need to know the meaning of the values of the attribute "swcode" in the feature class. This information can be found in the table called *swat_tab,* which is a lookup table. Use the *Add Clause* button on the dialog to create the appropriate expression.

- Create a second selection set by dragging another instance of the Select (Analysis) tool in ArcToolbox into the *CapabilityModel* window. Set the parameters for this select tool **[68].** The input feature class is the layer *streams.* Place the output feature class in the SVRD feature dataset and call it *per_streams.* You will need to select those features that provide permanent (perennial) sources of water. To do this, you will need to know the meaning of the values of the attribute "CODE" in the feature class. This information can be found in the table called *stream_tab,* which is a lookup table. Use the *Add Clause* button on the dialog to create the appropriate expression.

- Create a third *select* process (using the same drag and double-click procedure) in the *CapabilityModel* window to select public (non-private) allotments from the set of all allotments in the feature class *allots.* Put the output feature class in your *SVRD* feature dataset and call it *public.* Use the *Add Clause* button to build an expression that selects all those allotments for which the attribute *DATA* <u>does not</u> equal the string '0503.PVT' for output. This will give you the non-private (i.e. public) allotments, which are permissible for our use.

10. Spatially subset the perennial surface water sources and stream sections to only those found on public allotments. Find the tool in the *Analysis Tools* toolbox > *Extract* tool tray, that "*Extracts input features that overlay the clip features*." Drag 2 copies of this tool to the *CapabilityModel* window and populate it with the correct parameters.

    - Subset *per_water.* The input feature will be *per_water* and the clipping feature will be *public.* The data variables can be assigned by setting tool parameters **[68]** but it is often better and quicker to connect data to tools interactively **[73]**. Place the output feature class in the *SVRD* feature dataset and call it *public_water.*

    - Subset *per_streams.* The input feature class will be *per_streams* and the clipping feature will be *public.* Place the output feature class, *public_streams,* in your SVRD feature dataset.

11. Save the model **[72]**.

12. Identify those areas that are within the *radius of a circular home range* of Lepus octopedis centered on *public_water* and *public_streams.* Recall from the L. octopedis *Fact Sheet* that the estimated home range for the species is 3 square kilometers. Each square kilometer is 1,000,000 square meters, so three-square kilometers would be 3,000,000 square meters. You need to calculate the radius of a circle whose area is 3 million square meters. The relationship between area and radius is Area = πr^2. You can either use this formula to calculate a radius that will provide an area of 3,000,000 square meters, or find a radius calculator on the internet. This calculated radius value will be used to identify areas in the project region that are within a home range distance of a perennial water supply. To do this, find the appropriate proximity-type tool (from the Analysis Tools set). Drag 2 copies of this this tool onto the model window and populate them with values. This tool should *"create buffer polygons around the input features to a specified distance"*.

- To identify areas around *public_water,* the input features will be *public_water,* the output feature class will be *public_water_buff.* The distance will the radius calculated above. In our database, linear units are meters. Be sure to *dissolve all the buffers together into a single feature* as indicated in the "Dissolve Type" parameter of the tool dialog.

- For areas around *public_streams* the parameters will be the same, with the exception of the input feature class *(public_streams)* and the output feature class will be *public_streams_buff.* Again, be sure to *"dissolve all the buffers into a single feature…"* as indicated in the "Dissolve Type" parameter of the tool dialog.

13. **Combine the buffer polygons from the waters and the streams.** Since the two buffered feature classes represent a key aspect of the capability analysis, they will need to be combined into a single feature class.

    Use the overlay tool that *"computes the geometric union of the input features"* to combine those areas that are within a home range radius of any water source (surface water or streams). You should call the output feature class *any_water_buff,* as it represents the combination of areas near streams or other surface waters.

14. **Trim the extents of the *any_water_buff* polygons to the study area as represented by the feature class *public.***

    After you have created the "buffer polygons", some of them will extend into private allotments, even though the water source, itself, was on public land. Using the same tool that you used in step 10, trim the buffer polygons to the extents of the clip features in *public*. Again, the data variables can be assigned using the *connect tool*. The output feature class should be in your *SVRD* feature dataset and named *capable_areas.* This step results in the identification of all the areas, within the study area, that are capable.

15. Set the **derived features and layers** from the model to be added to the Capable Areas map when it has finished running **[70]**.

16. **Validate the model [69]**. Validating the model will refresh all data variables, check all parameter values for correctness, and return all processes to their ready-to-run state.

17. Save the model **[72].**

18. Run the model and examine the results in the Table of Contents pane for the Capable Areas map **[71]**. Note also the graphic effect that running the model has on the tool and output feature class symbols in the model window.

Symbolizing Features

Symbolize only the feature classes *capable_areas* and *public.* Turn off all other layers.

19. Symbolize the *capable _areas* feature class with a single green symbol, without outline color, on top of the *public* feature class symbolized in a single yellow symbol with a gray outline color.

20. **Save the project [17]**.

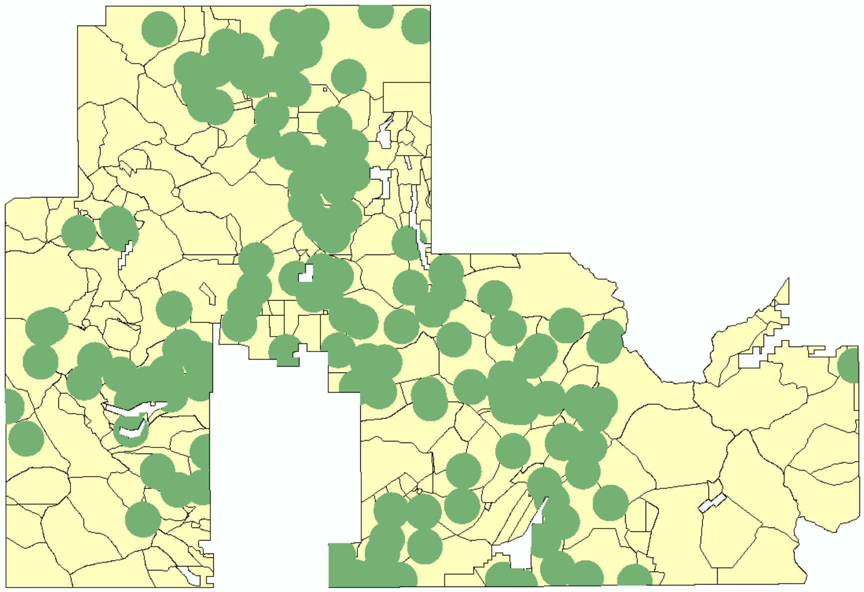
<u>Deliverables – Lab11a</u>

In your workspace, you will need to have

- A completed *Coronado Project* containing
    - a model builder model called *CapabilityModel*
    - a map called *Capable Areas* containing the results of your *CapabilityModel*. The map

document shall be left in the format shown below.

- Finally, a *readme.txt* file will also need to be present in your *lab11* folder.



Capable Areas *Lepus octopedis*