Exercise 6 – Sampling Design

Session Objectives - At the conclusion of this session you will be able to:

- ❑ Create systematic and random sampling designs to inventory wildlife populations and their habitats.

Materials created by: Eric Kelchlin (Jan 2013)

Revision: November 2013

Software: GME v 7.1 (optional), ArcGIS 10, SP5

Directory Path: CSP7200\Exercise6

GDB: Exerc6.gdb

MXD: Sample_Design.mxd

Imagery: 28Apr12_402.img (UTM 43N, WGS84)

SECTION 1 – Creating Sampling Points, Plots and Transects

You will be asked to generate sampling points, plots or transects across a study area at some time in your career. With the help of ArcGIS and GME (Geospatial Modeling Environment) you can easily create a sampling design for a wide array of inventory and monitoring applications. Best yet, you can then upload this data into your GPS unit and laydown the sampling design in the field.

All data are located in the Exercise6 folder unless otherwise stated.

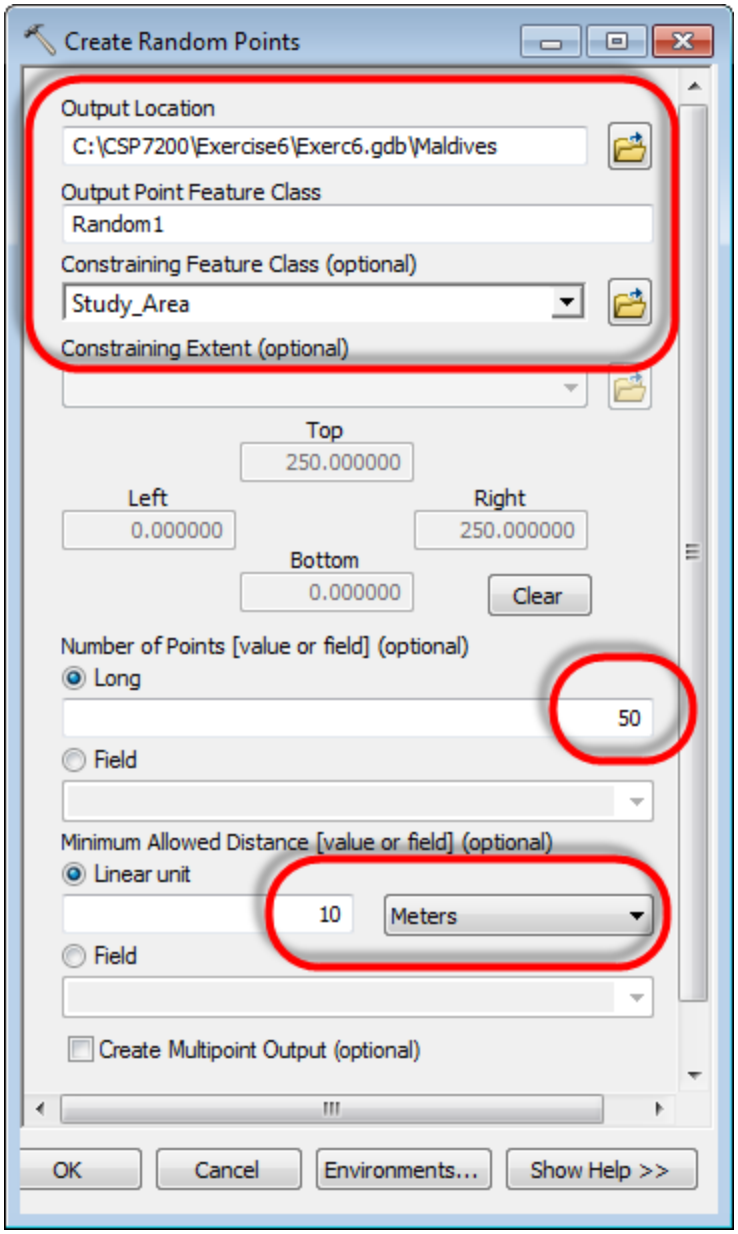
TASK 1 - Create a Stratified Random Sample of Points

1. Launch ArcMap and open the **Sampling_Design.mxd** map document.

2. Create a stratified random sample of points within the study area. Save all your data in the Maldives feature dataset of the Exerc6 geodatabase.

   - From ArcToolbox on the side bar open the Create Random Points tool (**Data Management Tools → Feature Class**). Fill in the fields as shown here and click OK.

   - NOTE: you will get an error message if the inter-point spacing (i.e., minimum allowed distance) is too large for the number of random points you want.



3. Notice how the data were automatically stratified within each unit/polygon. If you wanted only 50 sampling points throughout the entire island, how would you do this?

4. Repeat the process and create a second layer (i.e., **Random2**), but this time change the number of random points and spacing to something different AND do not allow the points to occur on the **Island** polygons. Use the Select by Attribute query to help you out on this.

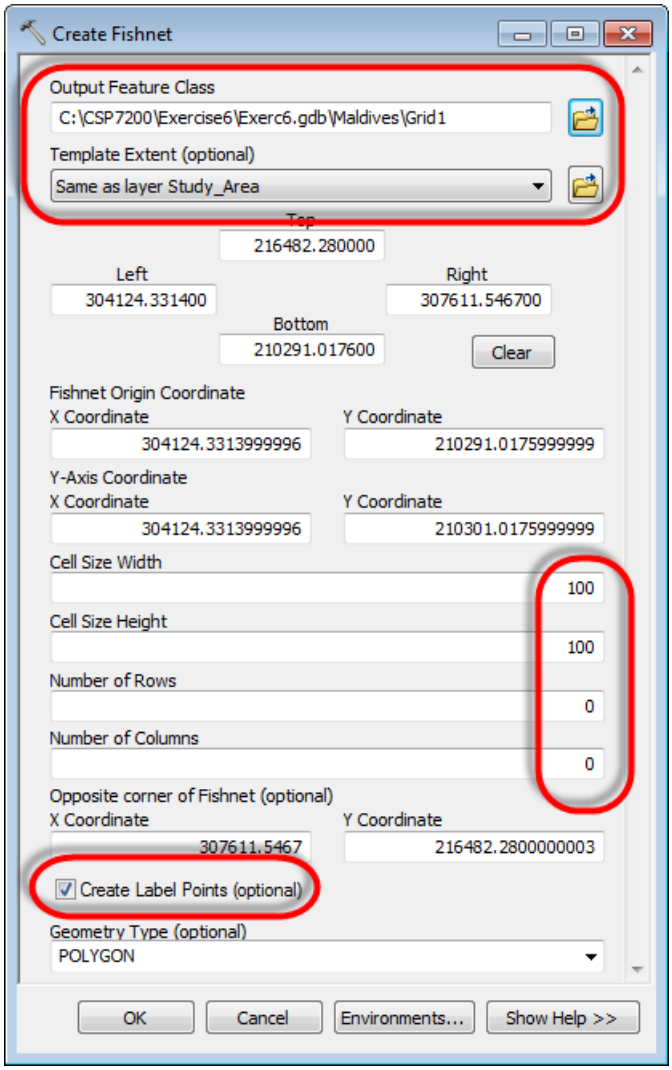
TASK 2 - Create a Systematic Sample of Points

The Fishnet Tool in ArcToolbox is a great way to create a systematic arrangement of points across an entire study site or small areas of interest. This tool automatically creates a grid (i.e., fishnet) of polylines or polygons. We're only concerned with making points, so make sure to check the box "create label points" at the bottom of the tools dialog or else no points will be generated

1. Remove the random point layers from the TOC.

2. Create a 100 x 100 meter point grid across the entire study site using the Fishnet Tool.

   - Launch the Create Fishnet Tool (**Data Management Tools → Feature Class**) in ArcToolbox. Fill in the fields as shown here. Name the feature class **Grid1**.



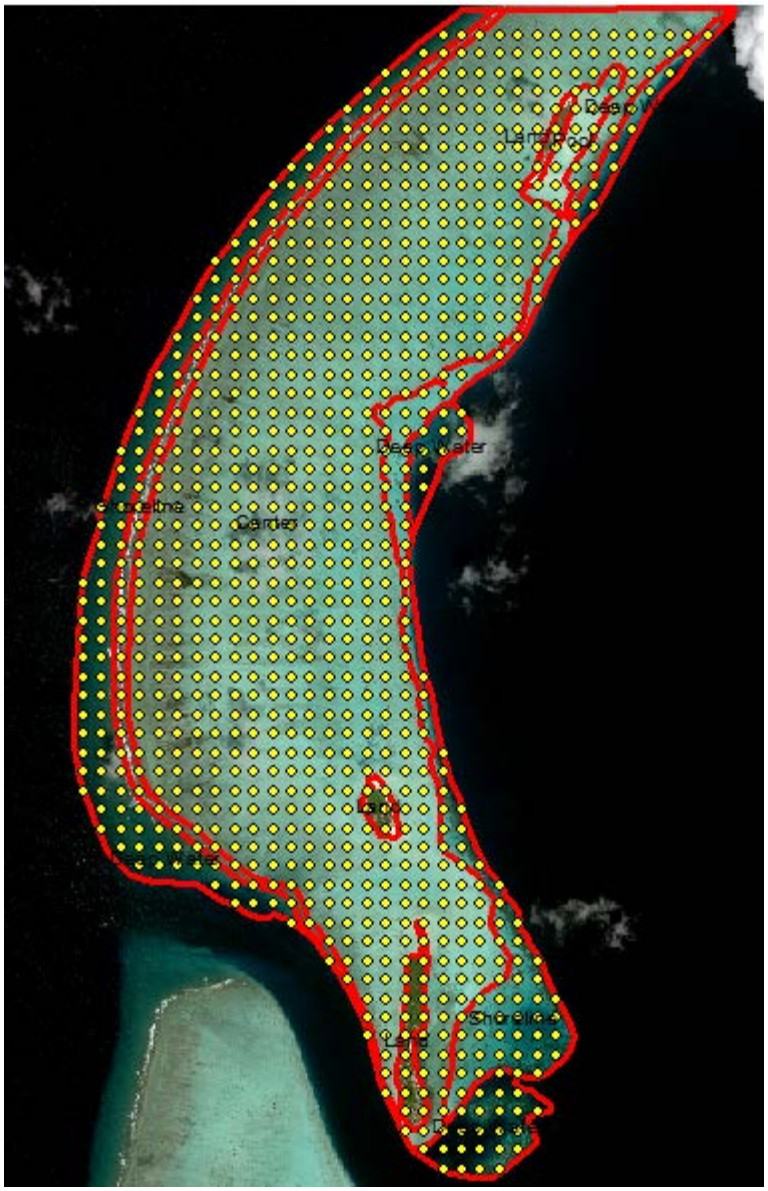
3. Next, use a Select by Location query to select only those points (from the Grid1_label layer) that intersect the Study_Area.

4. Export the selected points and save as a new feature class.

    - Right-click on Grid1_label and select **Data > Export Data**.

    - Name it **Grid_100m**.

5. Remove the other grid layers from the TOC.



TASK 3 - Create Sampling Plots

Once you created your random points or point grid, it's common that the sampling strategy requires an area to be sampled at those point locations. Estimating percent cover of plant species, for example, is commonly done within a square frame known as a quadrat. These quadrats are small, ½ to 1 meter square, and although we can easily create them, it would be rather pointless to upload such small quadrats into GPS units for field use. Just bring the real quadrat out to the field and navigate to the sampling points.

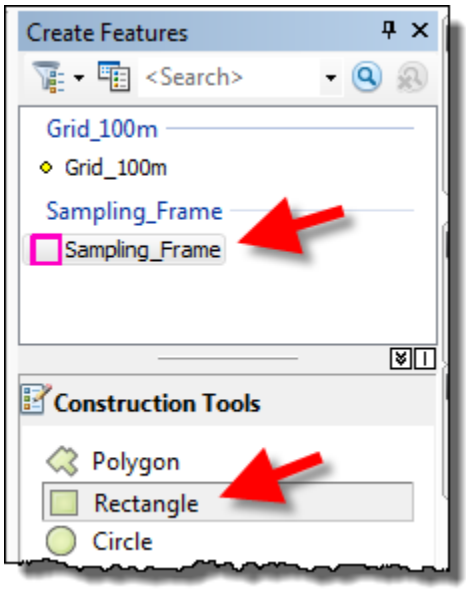
However, when you want to create a large plot with a specific dimension and sample within the plot, then GIS and GPS can help. Why take the tape measure in the field when you have the plots and sample points uploaded into the GPS unit?

1. We're going to create a 200 x 200 meter square plot using common editing techniques in ArcMap.

    - Create a new polygon feature class in the Maldives feature dataset.
    - Name the new layer **Sampling_Frame**.
    - Change the symbology fill to no color and increase the line size and line color to improve visibility.

2. Start an editing session and zoom into a section of the lower island.

    - Select **Sampling_Frame** in the Create Features dialog to initiate editing, and then select the Rectangle Construction Tool.



- Hover over the map with your mouse. You should now see that your arrow has turned into a "**+**" symbol with a small box in the bottom right corner.

- Right-mouse click and select Length. Type in 200 and hit the enter key.

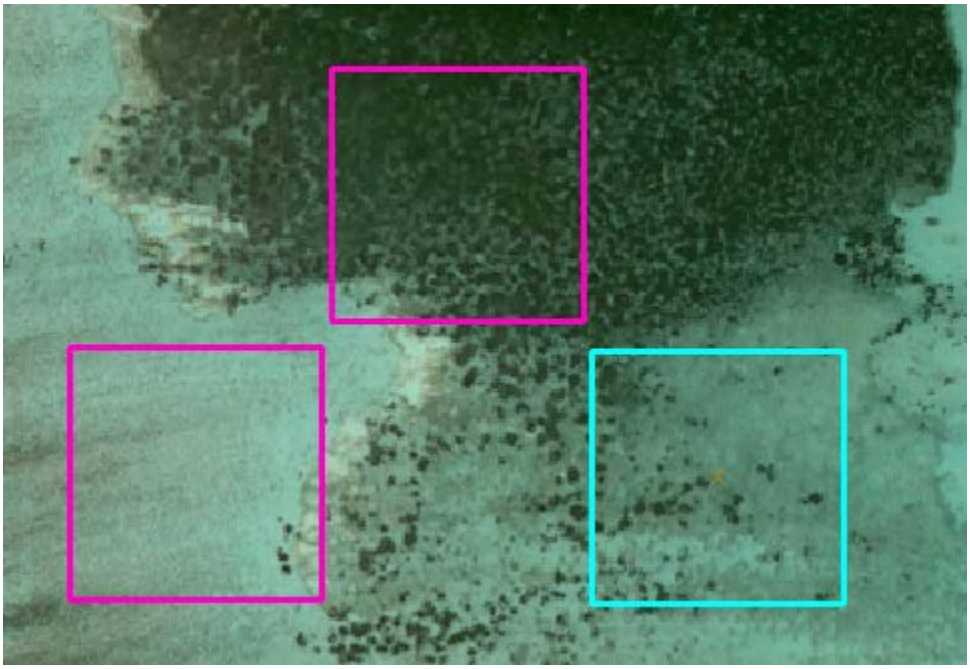
- Right-mouse click one more time, and select Width. Type in 200 and hit the enter key. You should now have a 200 meter square plot.

3. Make two more 200 meter square plots. The quickest way to do this is to use the Editor Tool arrow on the Editor Toolbar.

   - Using the Editor Tool arrow, right-click on the plot and select Copy, then right-click and select Paste twice! This makes two copies of the plot directly on top of each other. Click OK to have the Sampling_Frame layer be the Target each time.

   - Move each plot by holding down the left-mouse button and dragging the plot to another location. You'll need to do this twice.

   - Stop Editing and save your edits.



4. Now you could easily create random or systematic points within each plot. Give it a shot of you have extra time.

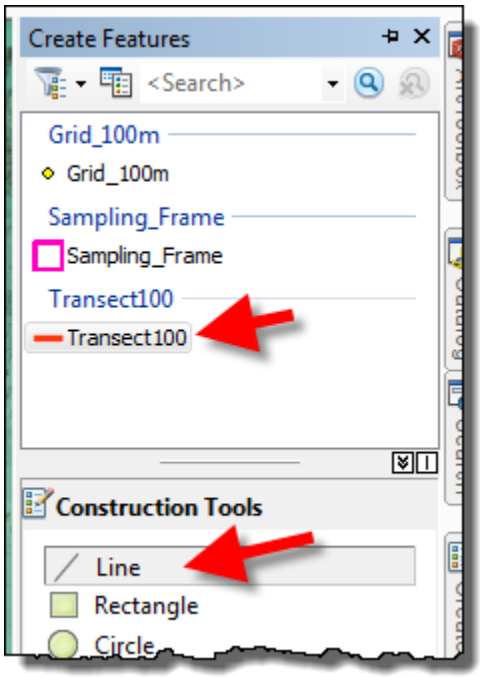
TASK 4 - Create Sampling Transects

In this last section were going to create 100 meter long transects and generate systematic points along these transects. This sampling design is often used for bird point count transects and point-line-intercept vegetation surveys.

1. Create a new line feature class and name it **Transect100**.

2. Change the symbology of the line to better see the line as it's digitized on the on the imagery. I chose the Highway Ramp symbol.

3. Start an editing session and create the 100 meter long transect.



- Left-mouse click once on the image. Drag the mouse down and right-mouse click. Select Length in the pop-up menu. Type 100 and hit Enter on the keyboard.

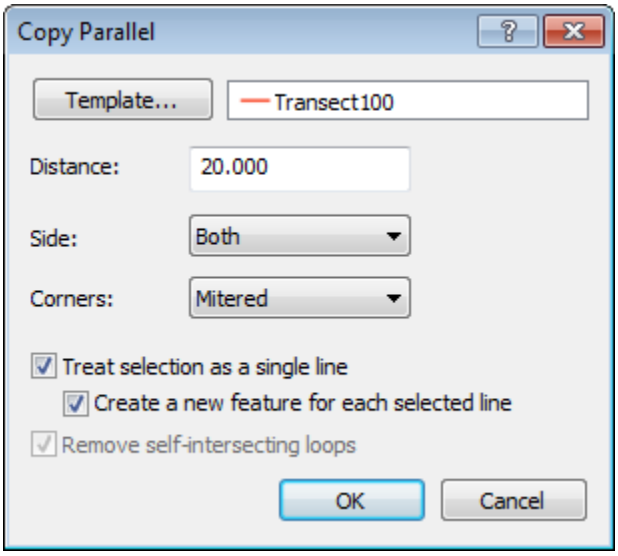
- Drag the mouse in the direction you want the transect follow and left-mouse click to create the second point.

- Right-click and select the Finish Sketch button on the Feature Construction Toolbar, and you're done.

4. Make two more 100 meter transects that run parallel to the first using the Editor Toolbar.

   - Click on the Editor button on the Editor Toolbar and select Copy Parallel.

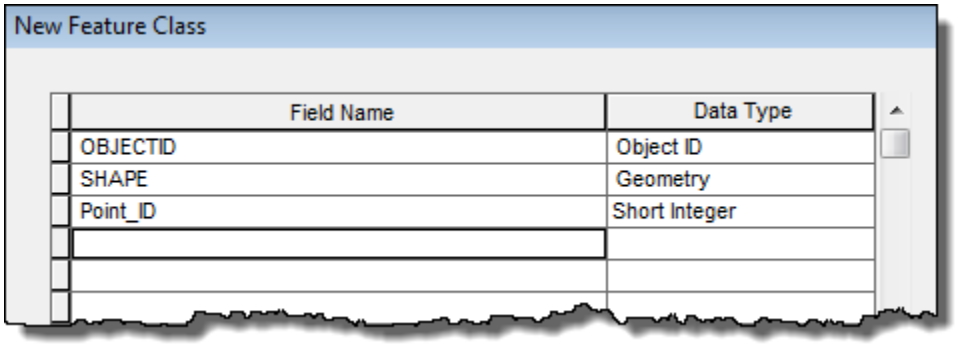
   - Use a 20 meter distance shown below and click OK. You should now have 3 transects, each one paralleling the other at a 20 meter distance.



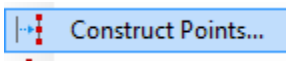
   - Stop editing and save edits.

5. Finally, we're going to add sampling points at regular intervals along each transect.

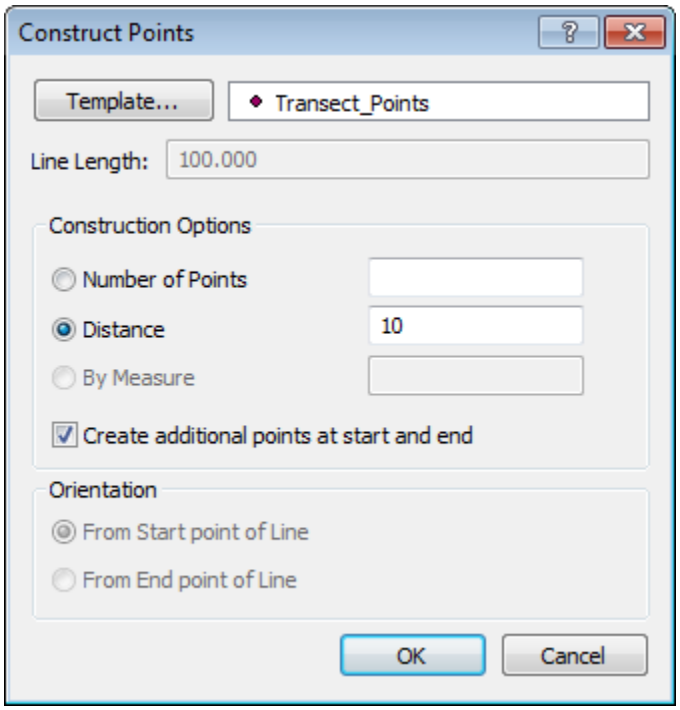
   - First, create new point feature class and name it **Transect_Points**. Create a short integer field in the attribute table and title it **Point_ID.** We'll use this field for labeling the points later on.



- Start a new editing session.
- Use the Editor Tool arrow to select one of the transects.
- Click on the Editor button and select **Construct Points**.



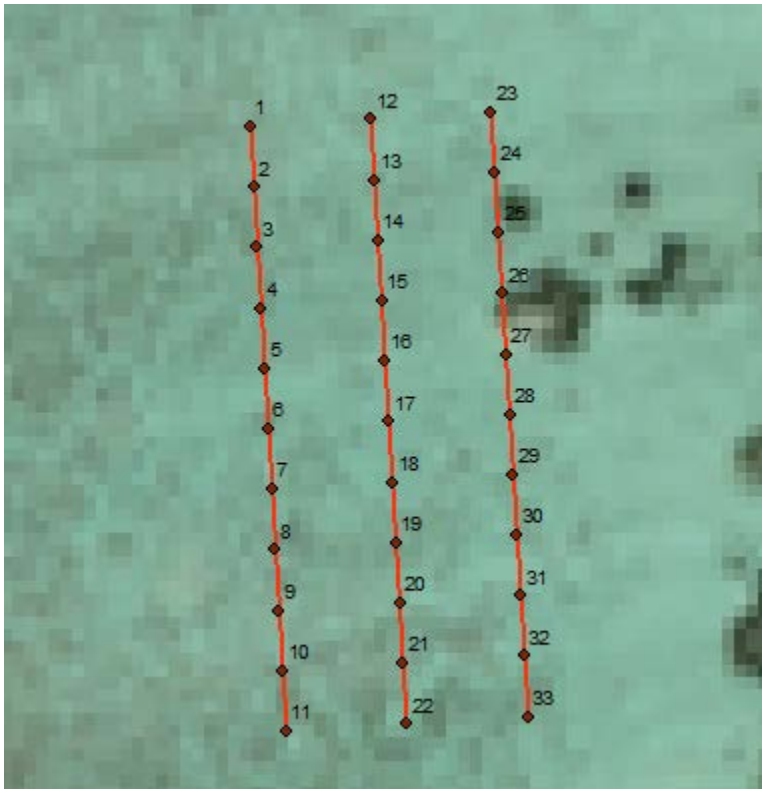
- Create a point every 10 meters, starting from the beginning of the transect. See the example below. Make sure you're using the right Template.



- Repeat this process for the other two transects.

6. Label the **Transect_Points** layer using data from **Point_ID** field. But, first create the data!

- Open the Transect_Points Attribute table and use the Field Calculator to create a sequential list of numbers in the Point_ID field.
- Right-click on the Transect_Points layer and select Label Features.
- Change the field to Point_ID in the layer Properties if needed.



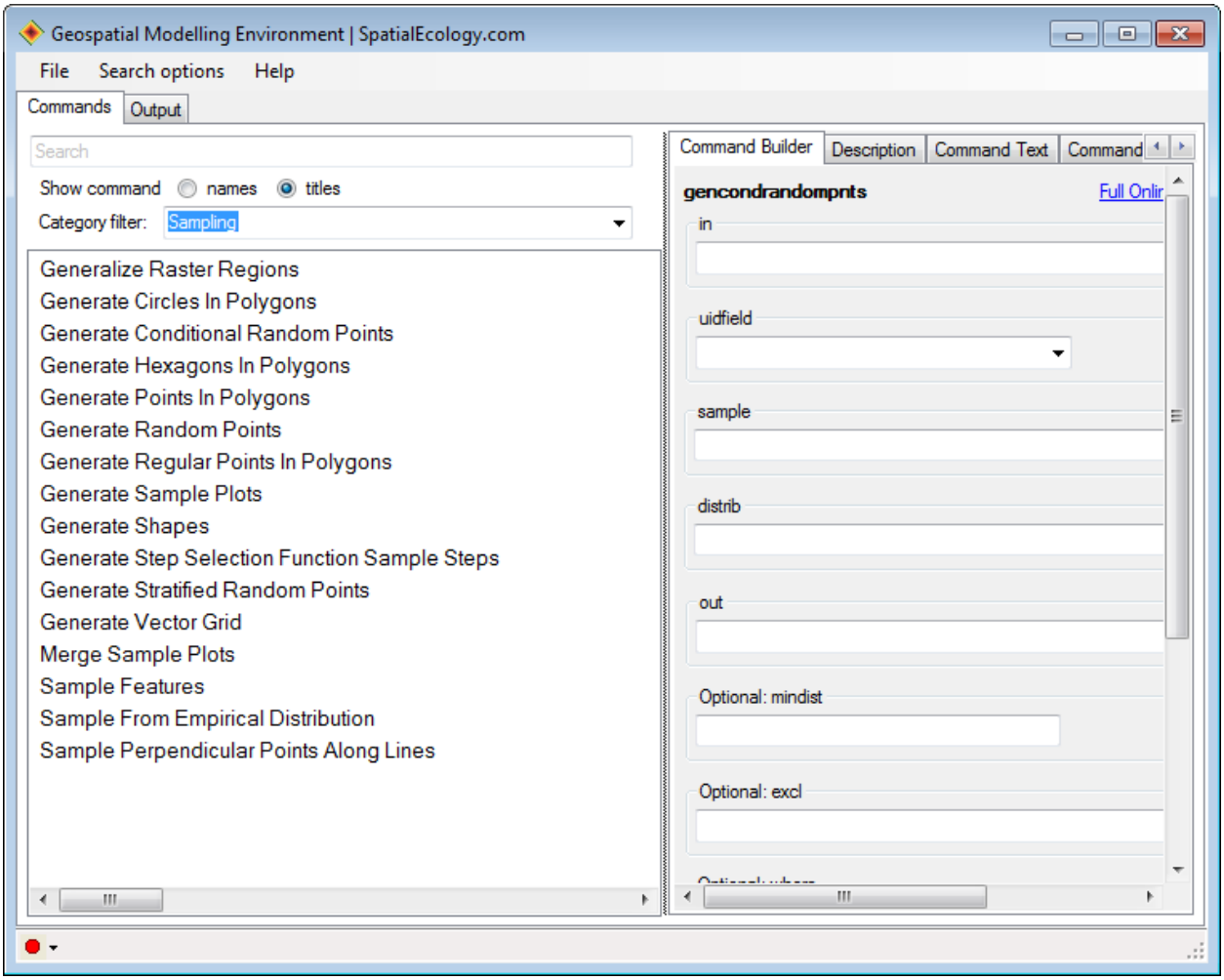
7. Stop editing, save edits, save the map document (MXD) and close ArcMap.

Challenge Exercise: Create another transect and add points to the line at RANDOM distances. What tool(s) did you use_____?

Want More?

For more advanced sampling design tools check-out the free Geospatial Modeling Environment (GME) software. It does not work with geodatabases (only shapefiles), but it integrates R in the background and has some pretty awesome sampling tools.

You can find the software in the Utilities folder if not already installed.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Generate Stratified Random Points
Generate Vector Grid
Merge Sample Plots
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Sample From Empirical Distribution
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