Tutorial 1

Morphometric Analysis using ARCGIS

Stepwise Procedure

a. Catchment and drainage network delineation

1. Load the DEM data in ArcMap.
2. Open Arctoolbox from the standard toolbar and choose system toolboxes.
3. Open **Spatial Analyst Tools** from Arctoolbox and choose **Hydrology**.
4. Use **Fill** tool to remove the sinks from DEM.
5. Calculate flow directions using **Flow Direction** tool.
6. Calculate **Flow Accumulation**.
7. In Arctoolbox, choose **Spatial Analysts Tools -> conditional->con.**
8. Specify constant value as **1** and in expression use the condition **VALUE > 1000** name it as **streams**
9. To delineate a watershed, choose from Arctoolbox **Hydrology->watershed**
10. Select **BhakundeBasinOutlet** as Input raster or feature pour point data, and name theoutput raster as **WS_raster**
11. Convert the raster watershed into polygon using **Conversion Tools** name as **watershed**
12. Clip **streams** with watershed boundary and name it **streamnet. Data management tool->Raster-> Raster Processing -> Clip**
13. Clip **BhakundeBasinDEM** with the watershed boundary and name it as **clipDEM Data Management Tool -> Raster-> Clip**

b. Computation of Morphometric Parameters

1. Right click on the **watershed** shapefile in Table of contents, click on **Open Attribute Table**.
2. From the drop down menu  , Select **Add field**. Give Name as Area, type as **Float**.
3. Right click the newly created field Area (i.e. column name) in Attribute Table, **Calculate Geometry**, click **yes**.
4. Select Property as **Area**, and units as kilometres, and click ok.
5. Again from the drop down menu  , Select **Add Field**. Give Name as Perimeter, type as **Float**.
6. Right click the newly created field Perimeter (i.e. column name) in Attribute Table, **Calculate Geometry**, click **yes**.
7. Select Property as **Perimeter**, and units as **kilometres**, and click **ok**.
8. In ArcToolbox, choose **Spatial Analysts Tools -> Distance->EuclideanDistance.**
9. Select **BakhundiBasinOutlet** as Input feature source data, output name as **AllDistance**.
10. Select **environment** set processing extend as **watershed_p,** Click **OK** press **OK.**
11. Clip **AllDistance** with **watershed_p** boundary using **Data management tool>Raster-> Raster Processing -> Clip** and name it **DistOutlet,** Click **OK.**
12. Open **DistOutlet** properties, select **Symbollogy**, **Classified in 2 class**, first **0 to Max-1** second max value integer. Note the Max Length.
13. In Arctoolbox, choose Spatial Analysts->Hydrology->Stream Order. Select **streamnet** in the Input Stream raster, and the flow direction raster.
14. For Output Feature class, click on folder icon  , browse your folder, give it name **Streamorder**, click save, then click ok.
15. In Arctoolbox, choose Conversion **Tools->From Raster->Raster to Polyline**
16. In the Input raster, select **Streamorder** from the drop-down menu.
17. For Output Feature class, click on folder icon  , browse your folder, give it name **Streamorder_P**, click **save**, then click **ok**.
18. Now right click **on streamorder_P, go to** properties, go to symbology, then go to categories and select unique values, in the value field select grid code. Click on **add all values**.
19. Open Attribute Table of **streamorder_p**. Add new Field, Give name **stream_leng** Type as **Float**.
20. Right-click on stream length calculate geometry property **Length** Units **Kilometre(km)** and click OK

21. Select **grid_code** right click go to **summarize** select **stream_leng** and select all parameter. Save in your folder, click OK and then Yes.
22. Open new added table and note **Sum_stream_len** for all the order.
23. Select **streamorder_p** go the Attribute table, **select by attribute** by clicking  . Select **Grid code = Get Unique value select 1** click Apply.
24. Start Editor select **streamorder_p** click OK. Go to **Editor** click on **Merge**. Click OK.
25. Open **Customize> Toolbar> Advance editing tool**.
26. Write **"grid_code" = 1 OR "grid_code" = 2** in Select by Attribute, click apply and select **Explode** in  Advance Editing tools.
27. **Apply** in select by Attributes, and select **Planarize lines** in  Advance Editing tools. Click OK.
28. Do step 23-26 for grid Code 2 and 3.
29. For **grid code 4 Only Merge**. And stop editing.
30. Open attribute Table streamorder_p. Select **grid_code** right click go to **summarize** select **stream_leng** and select all parameter. Save in your folder, click OK and then Yes
31. Open new table and note down the **Count_grid_code** for all order.

c. Hypsometric Curve:

1. In Arctool box, choose **3D Analyst tools->Raster Reclass->Reclassify.**
2. Select **clipdem** as input raster from drop down menu. Click on classify then select Defined interval as 500. Click ok. Then define new values as 1000, 1500, 2000 etc…upto 8500.
3. For the output Raster, click on folder icon  , browse to your folder, give it name **reclassifydem,** click ok.
4. Now go to **Conversion tools->From Raster-> Raster to Polygon.** Select **reclassifydem** as input raster from drop down menu. For the output Raster, click on folder icon  , browse to your folder, give it name **reclasspoly,** click save**,** click ok.
5. Go to editor, Start editing. Right click on **reclasspoly,** open attribute table then right click on the field **grid code** then select **sort descending.** Select the rows with value of 1000, go to editor and merge them. Similarly perform for all other values. Then Go to editor, **save edits**, **stop editing**.
6. From the drop down menu  , Select Add filed. Give Name as **Area**, type as **float**.
7. Right click the newly created field **Area** in Attribute Table, Calculate Geometry, click, yes.
8. Select Property as **Area**, and units Square Kilometres, and click ok.

9. From the drop down menu  , click on Export, name it hypsometric**, Save** it as a dBASE file.
10. Open the **hypsometric** file in excel. Enter the elevation values according to each grid code. Calculate the percentage of areas in each latitude interval.
11. Calculate cumulative area and arrange in chronological order according to elevation. Draw the **Hypsometric curve** between Cumulative percentage of area (x axis) and elevation (y axis).