Watershed Delineation in QGIS: A Summary Guide

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1 Useful Plugins Tools

1. SRTM Downloader
2. OSM (OpenStreet Map)
3. SAGA GIS
4. Coordinate Capture

2 Watershed Delineation in QGIS

To delineate a watershed in QGIS, follow these steps:

1. **Download the DEM** to the workspace.

2. **Raster Reprojection**:

- Navigate to the raster table and choose the *Wrap Projections (Reproject)* option.
- Select the DEM raster as the input file.
- Set the target projection (e.g., EPSG:26914 for NAD83 / UTM Zone 14N).
- Define resampling method as *Nearest Neighbour*.
- Set no data value to -9999.000.
- Adjust output resolution based on the DEM resolution.
- Save the reprojected raster as a *tif* file.

3. After reprojecting, remove the original DEM file.

4. Perform a subset to the region of interest:

- Choose *Extraction* in the raster tab.
- Select *Clip Raster by Extent* using the reprojected DEM.
- Define the clipping extent by drawing the region of interest.
- Save the clipped raster with a meaningful name and in the appropriate directory.

5. **Filling Sinks**:
   - Upload the DEM and perform filling sinks (Wang & Liu).
   - Adjust the minimum slope to 0.01.
   - Disable flow direction and watershed basins.
   - Save the flow-filled raster with a relevant name and directory.
6. Visualize the filled raster:
   - Duplicate the filled raster.
   - Display one in hillshade mode and the other using pseudocolor with a chosen color ramp.
   - Ensure a classification with equal intervals.
7. Compute the stream ordering method using **Strahler Order** in SAGA:
   - Utilize SAGA's terrain analysis package.
8. Visualize Strahler Order:
   - Use single-band pseudocolor to classify or define a color ramp for the Strahler output.
   - Set values to actual Strahler order values, use the color blue and ensure equal intervals.
9. **Filter Small Streams**:
   a. Use raster calculator to create a new raster where Strahler order is greater or equal to a specified value.
   b. Save the result in the directory.
10. Adjust Strahler symbology:
    - Rearrange Strahler output with pseudocolor band.
    - Keep only 2 classes with equal intervals.
    - Set transparency for no data value to 0.
11. Display **Channels and Drainage Basins**:
    - Launch the Channel Network and Drainage Basins plugin.
    - Input the filled DEM and choose a threshold based on Strahler order.
    - Adjust symbology for better insights into watersheds and channels.
12. Determine **Catchment**:
    - Use the *coordinate capture* plugin to find the projected coordinates of the chosen pour point.
    - Use Upslope Area in SAGA plugin with the obtained coordinates.
    - Display catchment with transparent fill style and a red, thick perimeter.

13. Polygonize Watershed:

- Use the *Polygonize (Raster to Vector)* tool in the Processing Toolbox.
- Choose the delineated watershed raster as the input.
- Specify the output vector file format as a shapefile.
- Save the polygonized watershed in the desired directory with a meaningful name.

Note:

The polygonized watershed may include small, unwanted areas or artifacts. If so, performing a cleanup or filtering step may be necessary to remove these unwanted features.

14. Remove Small Areas:

- Open the attribute table of the polygonized watershed.
- Add a new field to the table for area calculation (e.g., named "Area").
- Use the field calculator to calculate the area for each polygon in the new field.
- Sort or filter the table based on the calculated area field.
- Identify and select the rows corresponding to small unwanted areas.
- Delete the selected rows.
- Save the edited attribute table.

15. Clip Streams:

- Use Geoprocessing tools under the vector tab.
- Select *Clip* and use channels as input over the watershed polygon layer.

16. Visual Enhancements:

- Use *Clip Raster by Mask Layer* for the filled DEM over the watershed polygon.
- Copy the original DEM style and paste it into the clipped DEM.
- Optionally, duplicate the DEM and display it as a hillshade for better geomorphological views.

17. Compute Polygon Area:

- Go to the attribute table.
- Toggle the edit function.
- Use the field calculator with $\$area$ or $\$area/1000000$ for meter unit CRS.

References

[1] H. van der Kwast, "Stream and catchment delineation in qgis 3." Exercises QGIS for Hydrological Applications, 2018. YouTube video.