Watershed Mapping in QGIS for Minnesota

This file is to describe things I have done in the example PineWatershedExample. This watershed is not particularly nuanced; it's a **demo** model with no ground truthing and only a rough shapefile for part of the watershed itself.

GIS data for Minnesota Counties

The State of Minnesota has a Clearinghouse for GIS data located at:

http://www.mngeo.state.mn.us/chouse/data.html

From here you can find a number of data types including Lidar, Topographic, Soil, and more. In this example I use Lidar and Soil data. Soil data is also available the Web Soil Survey by the USDA: https://websoilsurvey.nrcs.usda.gov/app/. ArcGIS has an extention put out but the USGS called Soil Data Viewer, which is easy if you have that software. More information at the end on how to make that data usable if you have ArcGIS.

You can also find GIS topo maps and other things from the USGS national map service: https://viewer.nationalmap.gov/services/

Download a Lidar Map of interest

- Go to http://www.mngeo.state.mn.us/chouse/elevation/lidar.html
- Click on the graphical interface link for mnTOPO
- Zoom to your area of interest. Select your area by drawing a polygon around it. Tips:
    - Make sure that the area you are interested in is on the left side of the image.
    - Do not make your area too big or it will be hard to process
- Choose "Open Source" when requesting the data
- Look for the email and download the zip file. Unzip the file in your work folder.

Converting a Lidar map to feet instead of meters

Many mapping uses in this country are in feet instead of meters, which is the default for Lidar imagery. MN State provides contours already in feet, but in case your area doesn't, here's how to convert.

- Load your Lidar image (either drag and drop into a new project, or go to Layer → Add Layer → Raster Layer, or click on the "Add Raster Layer" in the left menu)
- Go to Raster → Raster Calculator
    - double click on the raster band you want to convert. This will add it to the calculation box.
    - Multiply by 3.2808
    - Add an Output Layer Name. (e.g. append _ft instead of _m)
    - Make sure the output layer is in the correct coordinate system (it should default to the original but it's good to check).
    - Make sure "Add result to project" is checked
    - Click "Ok"
- If you are not going to use the meter layer, now is a good time to delete it (right click on the layer, then remove)

Using Lidar data to make contours

Regardless of whether you are using your Lidar in meters or feet, you can make contours. Each Lidar has an elevation shown by brightness of pixel and QGIS uses that value to calculate contours. Thus if there are artifacts in your image (like this one!) you will find some weird contours in places.

Caution!

- Calculated contours will not be smooth. Do not use to computer process the watershed CN. You can see this if you zoom in a lot.
- If you are not careful about your contour selection, it will be computation-intensive and it will crash.

To calculate your contours:

- Click on Raster → Extraction → Contours
- Be sure you have the correct input raster file
- Set the output name (e.g. inputfile_contours)
- Choose the interval. I chose an interval of 10.000 here. Units are the units of the map (in this case feet)
- Be sure load into canvas when finished is checked

Creating a watershed region shapefile

To create a new shapefile

- Either click on "New Shapefile Layer" in the left menu, or go to Layer → Create Layer → New Shapefile Layer in the menu.
- Select "Polygon"
- ENSURE THE COORDINATE SYSTEM MATCHES YOUR LIDAR IMAGE
- The New Field is if you want to add additional attributes to the layer. We'll see this later.
- Click "Ok" and name your file (e.g. watershed1.shp)

Next you need to add points to your file.

- In the layers panel, click on the shapefile.
- Go to the pencil to start editing.
- Start at your designated design point (e.g. where your outflow measurement would be). Click to add a point.
- Continue adding points staying perpendicular to the contours. Watch for saddles; you will need to be careful how the water might flow on those. Follow ridges, etc. Go up and around the watershed region.
- When you are done placing points, right click to end. Give your region a number identifier.
- Save your shapefile and click the pencil to stop editing. (Clicking the pencil will ask you to save if you haven't)
- You can change parameters / styles of your shapefile by right clicking on it in the layers panel
- If you don't like a node you can use the "node tool" in the edit menu

Soil Data Viewer in ArcGIS

The basic license will let you use this; download the extension from USGS. To get it installed and running:

- google soil data viewer installation instructions
- download from NRCS (keep this page open, you will need the directions)
- Extract the file and run it (you will need admin privileges to install)
- Register as an add-in by following the instructions on the web page. It will *not* automatically add
- Open up ArcGIS. The add-in is in the upper right
- You need a soil database **before** you can use the add-in

Getting a Soil Data Viewer database (you will need MS Access for this)

- Go to Web Soil Survey
- Go to the tab that says Download Soils Data
- Click on either your area of interest, or for Soil Survey Area (this is useful to get a whole county)
- Download the zip file and extract it
- Open the .mdb file (database file). You do want to use macros so just x out the window
- Enable content (since you downloaded the file)
- Type in the directory (or copy-paste) where your tabular data is and click “ok”
- Once the data is loaded save the database and close it

Loading the spatial data into ArcGIS

- Go to the folder where you saved the data
- Open the Spatial folder
- Look for a polygon shape file and load into layers (drag and drop into the workspace)

Start the Soil Data Viewer

- Click the add-on
- Choose your soil shape file
- Choose the database that you just saved
- Now you can find the “hydrologic soil group” and click “map”