

## **CIE5401 GIS and Remote Sensing for Water Resources Management**

### **Assignment 3: Terrain Analysis & Watershed Delineation using QGIS with GRASS**

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Due date: 5th March 2018

*Please submit your assignment via Brightspace*

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#### **Goal:**

The goal of this exercise is to delineate the Volta basin from a DEM, and to map the Volta River, its tributaries and the extent of Lake Volta.

#### **Data source:**

We are going to use the Global Multi-Resolution Terrain Elevation Data 2010 (GMTED2010) from the United States Geological Survey (USGS).

Instructions to download the DEM data via EarthExplorer are given in "*Howto\_DownloadDEMdata.pdf*"

#### **Assignment Instructions:**

- Read the lecture notes for Lecture 3: Watershed Delineation in QGIS and GRASS
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- Read the tutorial "*Howto\_DownloadDEMdata.pdf*"
- Read the tutorial "*GettingStarted\_WatershedDelineation\_QGIS\_GRASS.pdf*"

#### **Task 1: Terrain Analysis**

Follow the instructions in *WatershedDelineation\_QGIS\_GRASS.pdf* to produce a shaded relief map of the West African region surrounding the Volta River basin. Vary the transparency of the overlying DEM map to produce a nice 3-D effect topography map.

#### **Task 2: Outline Volta Basin**

Follow the instructions in *Getting\_Started\_WatershedDelineation\_QGIS\_GRASS.pdf* to produce a raster map of the Volta Basin (i.e. the entire watershed).

Convert this raster to a vector (polygon), and add it to your shaded relief map so that the polygon is transparent with a solid boundary. Note that you can also edit layer symbology of GRASS maps in QGIS projects using standard QGIS tools.

### Task 3: Outline the main Volta sub-basins

Identify appropriate pour points, and repeat the procedure to produce polygons of the Black Volta, White Volta and Oti sub-basins (See Figure 1).

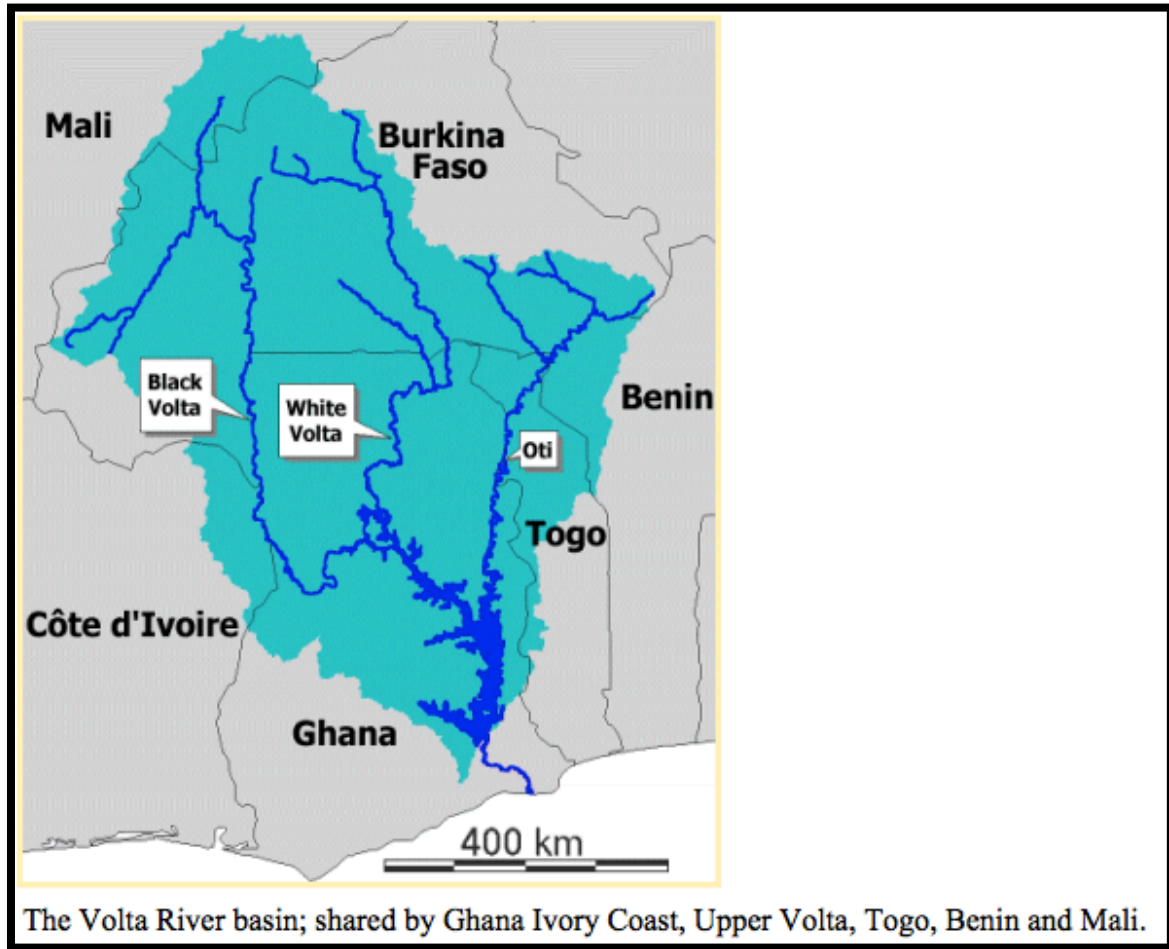


Figure 1: Volta basin from <http://www.weap21.org/downloads/ADAPTVolta.pdf>

### Task 4: Stream

The length of the stream displayed depends on the threshold you set in the r.watershed tool. Use an appropriate threshold to produce a stream map that includes the main tributaries to the Volta River. Include screen shots in your report to justify your final threshold.

“Thin” your stream raster, convert it to a vector (line) map and add the stream as a blue line to your shaded relief map. Label/annotate the main tributaries in your map.

### Task 5: Include Lake Volta

Finally, use r.lake to add Lake Volta to the map. The point (0.11 deg E, 7.63 deg N) lies within the lake. Assume the lake level is at 80m elevation. Use the map calculator to set all non-null values of your lake raster to a single value so that you can add a simple blue raster layer to indicate the lake extent.

**Your report:**

Include

- 1) A final map from Print composer that shows
  - 1) elevation imposed on a shaded relief map
  - 2) Volta outline
  - 3) Outline of the Black Volta, White Volta and Oti sub-basins
  - 4) Streams of the main Volta tributaries
  - 5) The extent of Lake Volta
- 2) A list/summary of all of the tools used to perform each task, including screenshots where appropriate (e.g. Task 3, Task 4).