Assessment of Water Yield in a catchment

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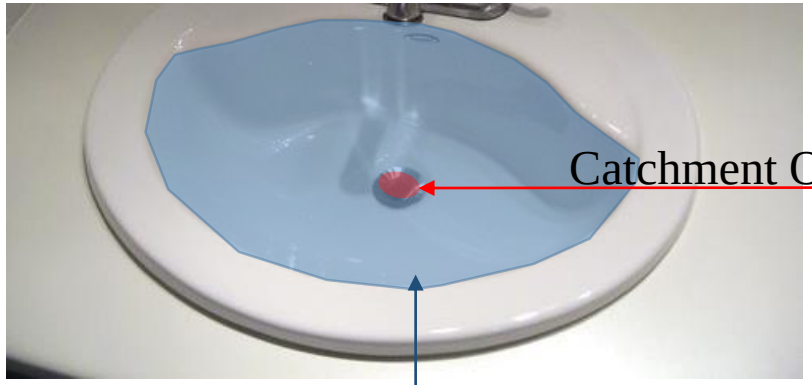
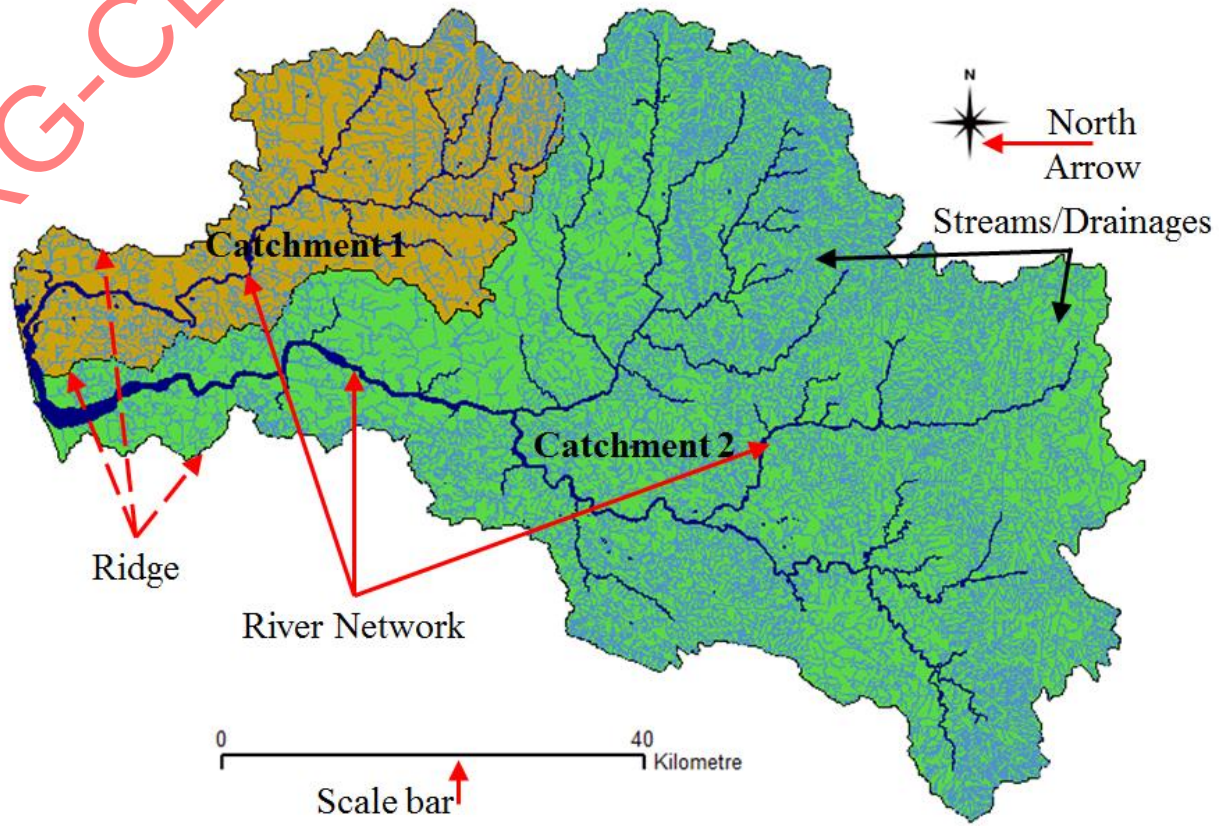
Catchment

- Area of the land that drains water into a water body.

House hold level example of catchment :
Bathroom Sink



Real world example of catchment



Classification of Catchment

- Catchments are classified based on area covered under each catchment
- Cauvery River has a catchment area of over 81000 sq.km, indicating the category to be Basin
- Hemavathy, Arkavathi …etc are catchments of Cauvery
- Bellandur lake has a catchment over 150sq.km hence categorized under sub watershed

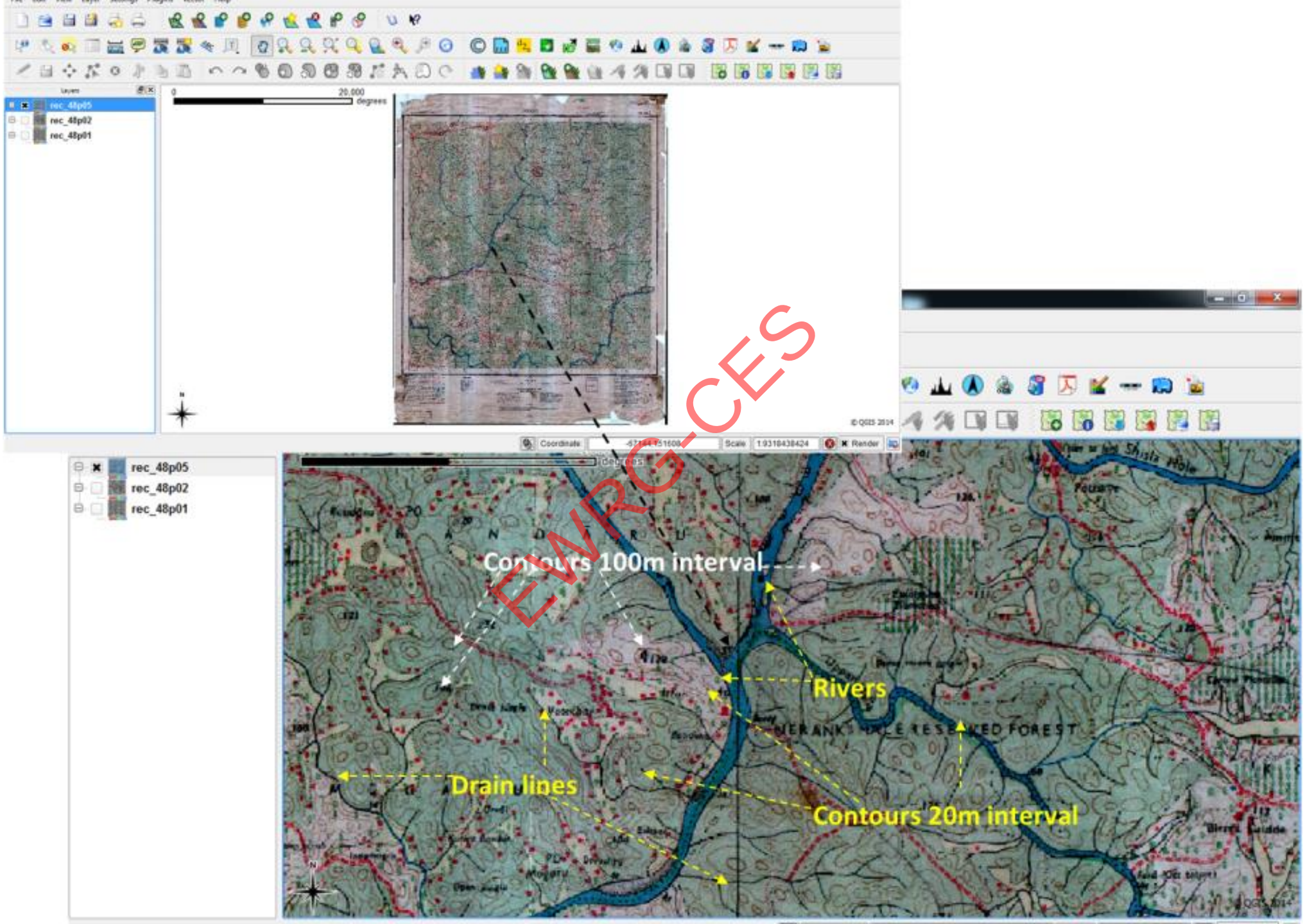
Sl.no	Type of Catchment	Area in 1000 Hectares
1	Micro-watershed	Less than1
2	Milli-Watershed	1 – 10
3	Sub-Watershed	10 – 50
4	Watersheds	50 – 200
5	Sub-Catchments	200 – 1000
6	Catchments	1000 – 3000
7	Basin	3000 – 25000
8	Region	Greater than 25000

Properties of catchment

- Each catchment is separated by a common ridge line
- Catchment Yield depend upon **Rainfall**, Drainage density, Topography, Soil type **Land use** … etc

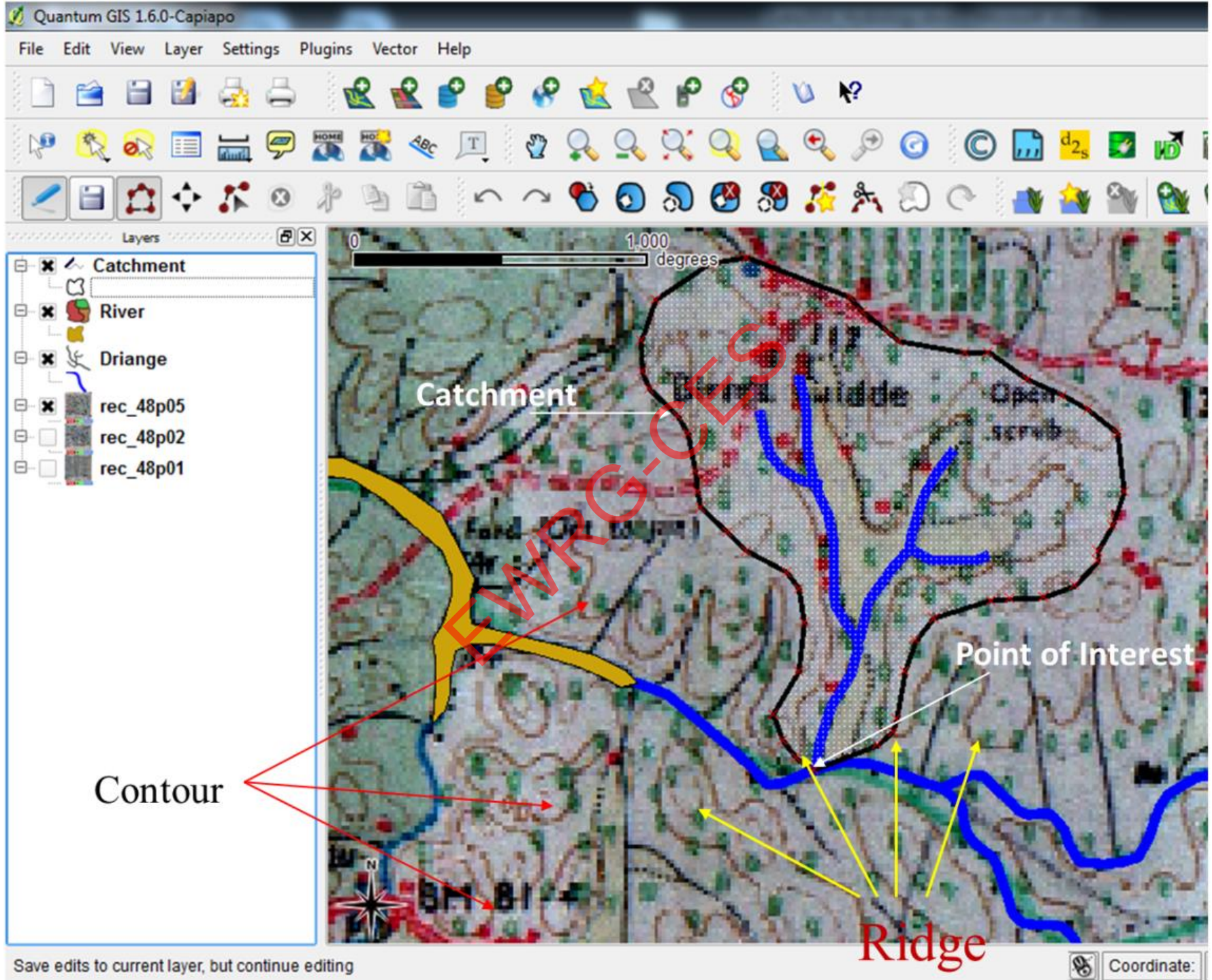
- Ridge is defined as highest land that separates two catchments
- Google earth with **terrain on** or Topographic maps (using contour lines), could be used to delineate the ridges, streams and other features.

- Contours : Imaginary lines on surface of earth with same elevation


rec_48p05
rec_48p02
rec_48p01
Contours 100m interval
Rivers
Drain lines
Contours 20m interval
EWRG-CES

Steps involved in delineating a catchment boundary of a water body

- Identify the water body w.r.t which the water yield needs to be quantified
- Delineate the water bodies (streams, rivers, lakes, ponds) upstream of the study area.
- Using the contours [topo sheets], identify the ridges and draw the basin boundary
- Or use Google Earth to delineate the catchment boundary.
- Estimate the area of the catchment using QGIS


Quantum GIS 1.6.0-Capiapo
File Edit View Layer Settings Plugins Vector Help
Layers
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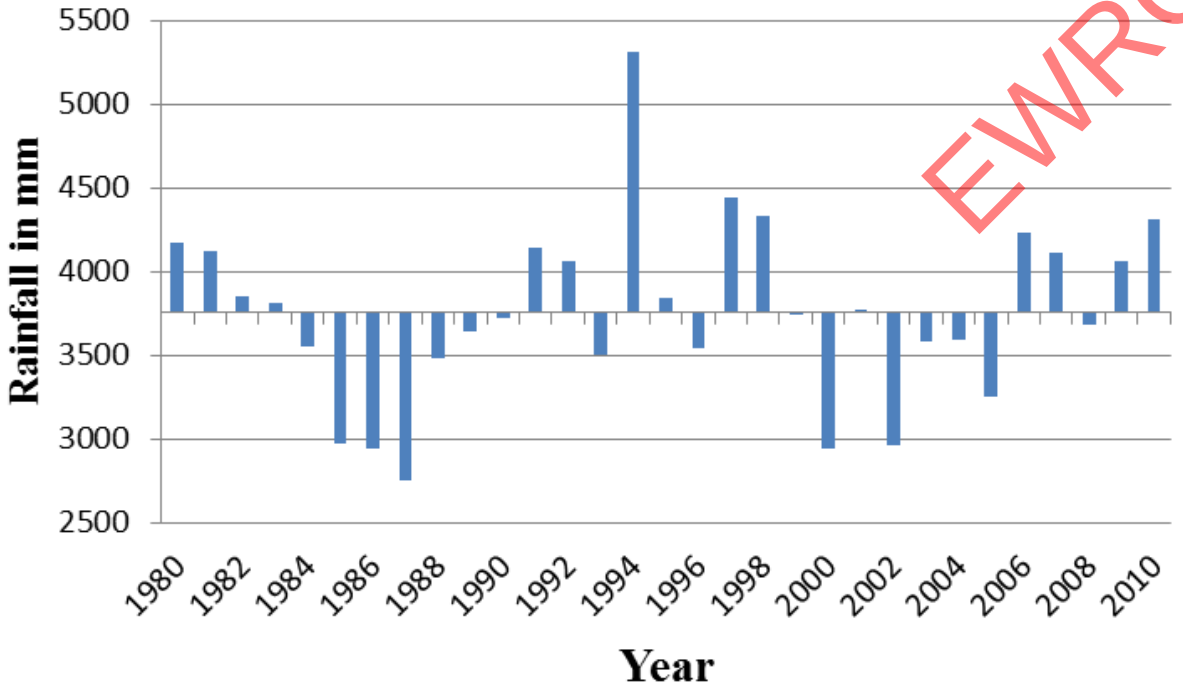
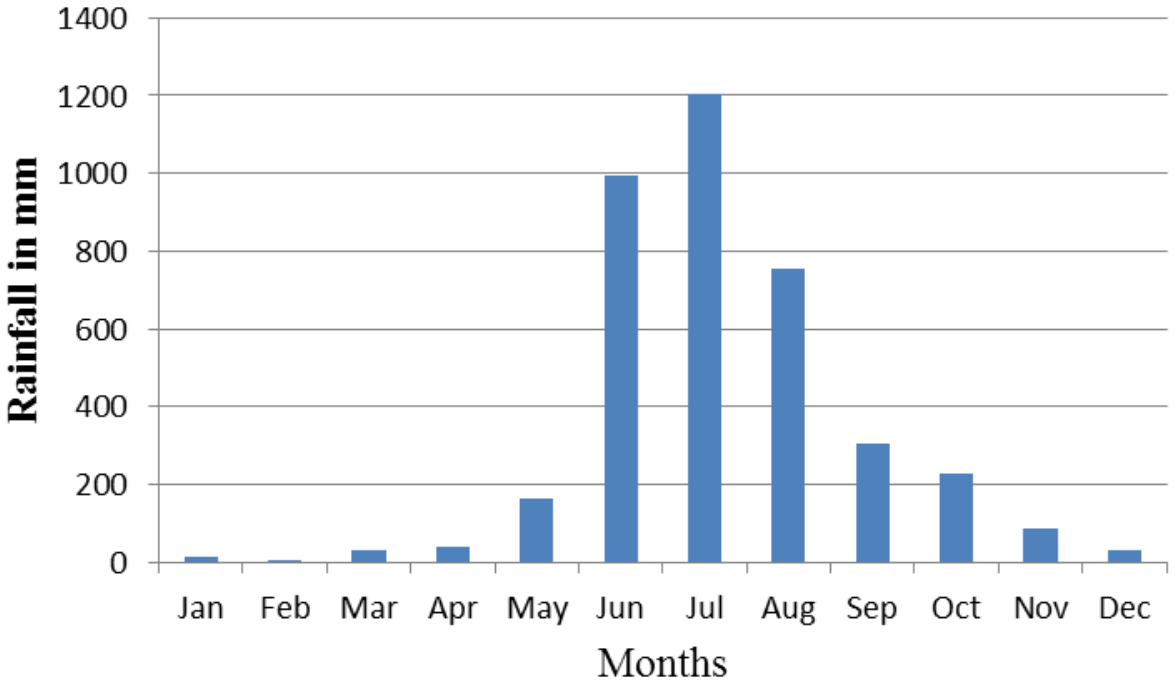
Catchment
Point of Interest
Contour
Ridge
EWRG-CES
Save edits to current layer, but continue editing
Coordinate:

Rainfall

- Rainfall is measured as millimeters (mm) per hourly, daily, monthly or annual basis
- Rainfall is measured and monitored by IMD(India Meteorological Department), Forest Department, PWD (Public Works Department), WRDO (Water Resource Development Department) …etc.
- For trend analysis minimum 15 to 20 years data would be necessary.





Land Use features from Google earth

- The Catchment boundary is saved as kml using QGIS and opened in Google Earth.

- Each feature in the watershed is digitized as polygon feature and is stored separately as a '*xxx.kml*' file.

- Example : Agriculture features as a kml, Water features as a kml and so on..

- All the *kml's* are imported to QGIS and area is calculated under each feature


Agriculture
Image © 2014 DigitalGlobe
Plantation
Image © 2014 DigitalGlobe
Forest
Water
Forest


Forest
Image © 2014 DigitalGlobe


Open Space

Water Yield

- The water received through rainfall and that drains into the water bodies within a catchment is called runoff.
- The total quantity of water that can be expected in a stream in a given period of time such as monthly, annual etc… is referred to as Runoff Yield
- Runoff yield is estimate empirically as

$$Q = (C*A*P)/100$$

Q = Yield in kilo cubic meters per time

C = Runoff Coefficient of a land use

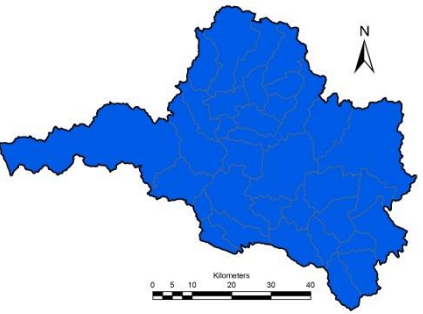
A = Area under the land use in Hectares

P = Rainfall in mm

Land Use	Runoff Coefficient
Forests	0.1 – 0.2
Plantations	0.2 – 0.6
Agriculture	0.4 – 0.7
Open Spaces, Grasslands	0.5 – 0.8
Built-up	0.7 – 0.9
Rocky Areas	0.8 - 1.0

Case Study

Rainfall in mm



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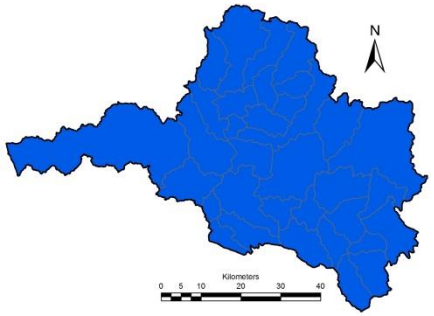

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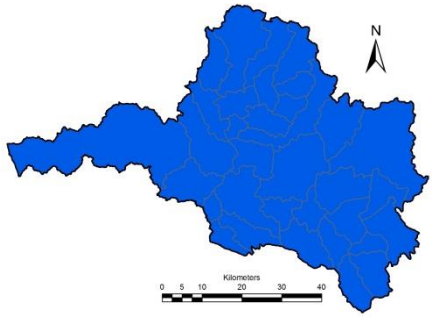

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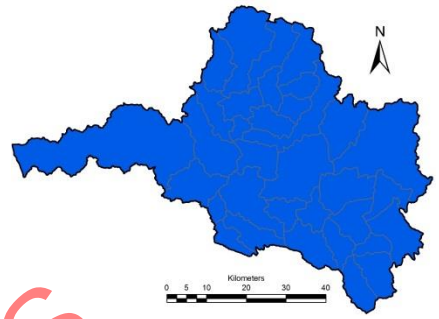

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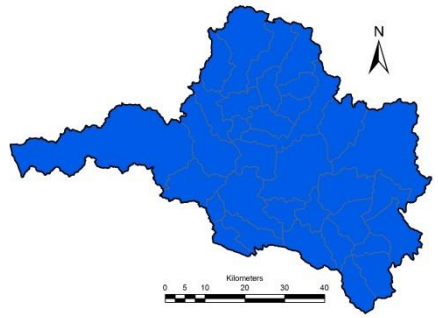

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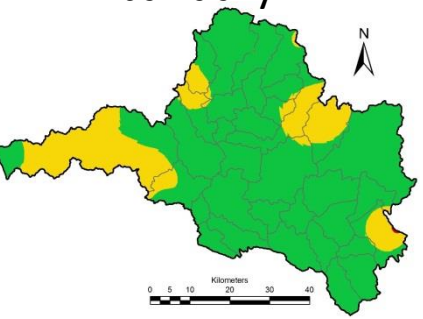

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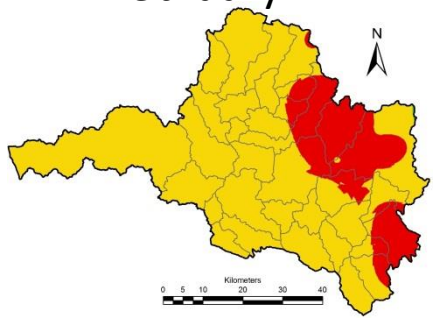

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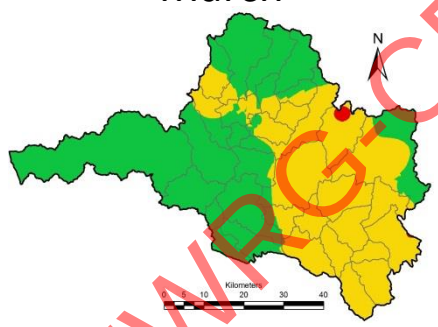

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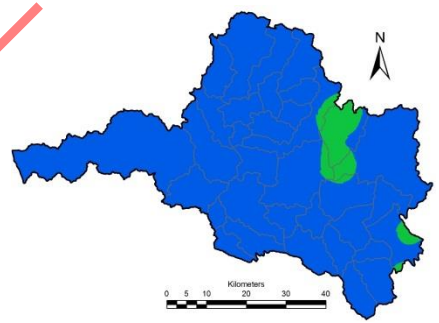

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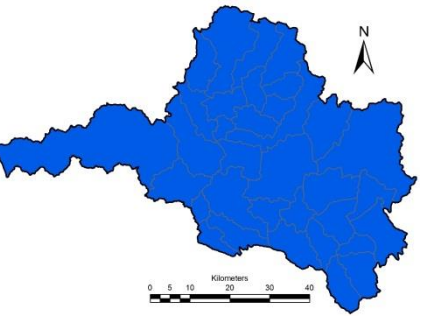

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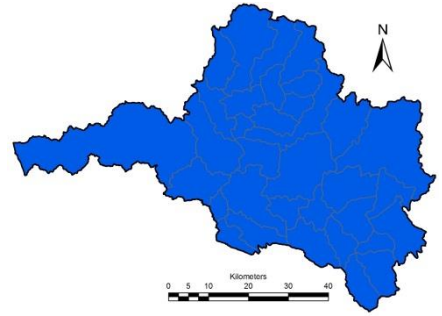

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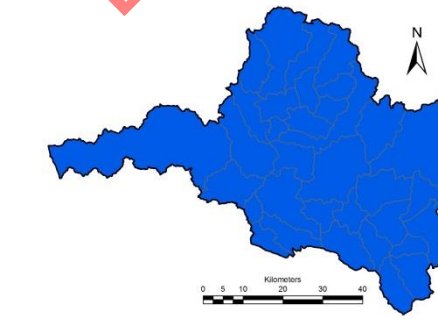

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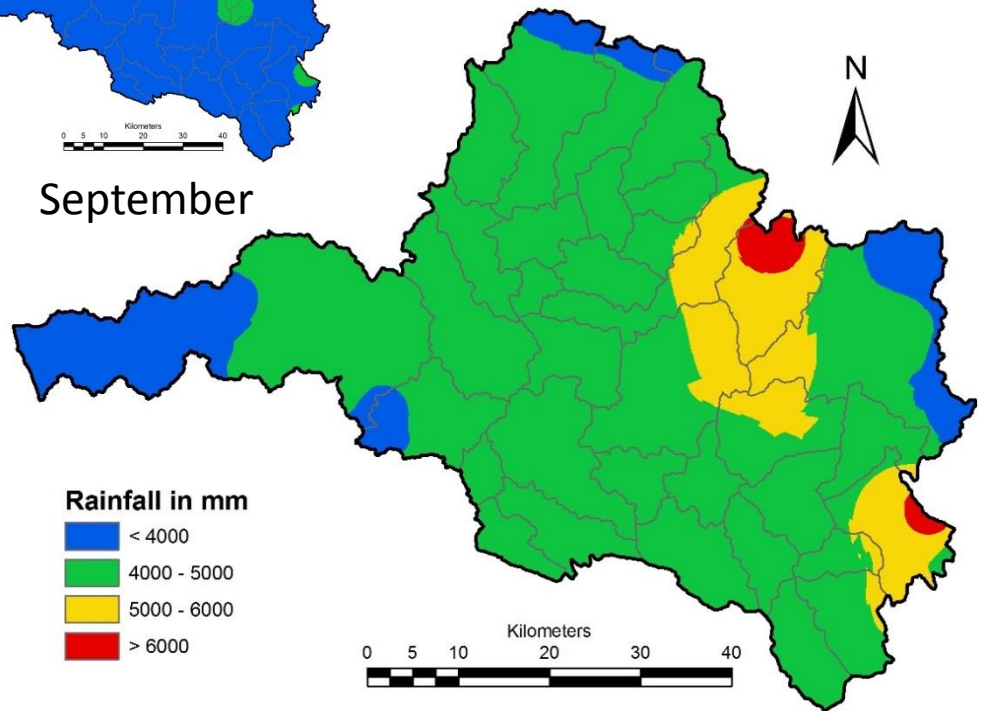
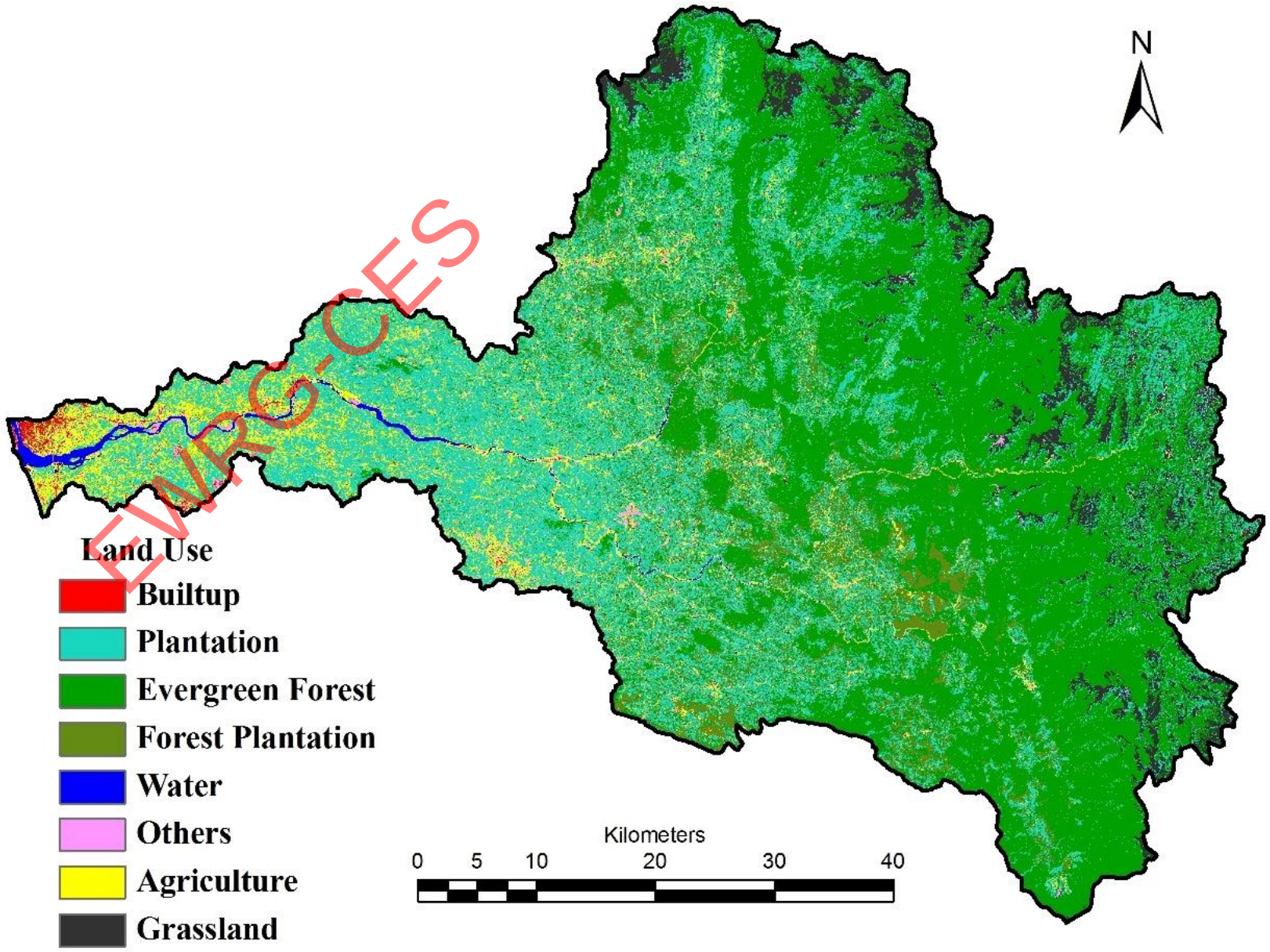


Rainfall in mm < 500 | 500 - 1000 | 1000 - 1500 | > 1500

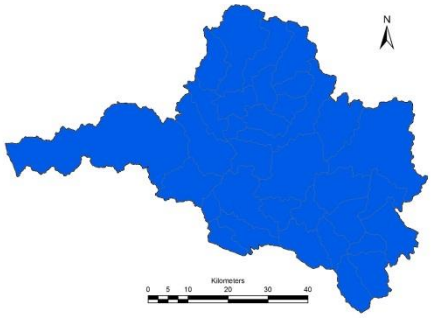
Land Use	Area (Ha)	Area (%)
Builtup	2163.06	0.63
Agriculture Plantation	117,932.85	34.24
Evergreen Forest	146,006.55	42.39
Forest Plantation	24,321.51	7.06
Water	2454.93	0.71
Agriculture	24,748.83	7.19
Grassland	22,554.72	6.55
Others	4217.76	1.22
Total	344400.2	

Accuracy	83.064 %
Kappa	0.755

Land use



Catchment Yield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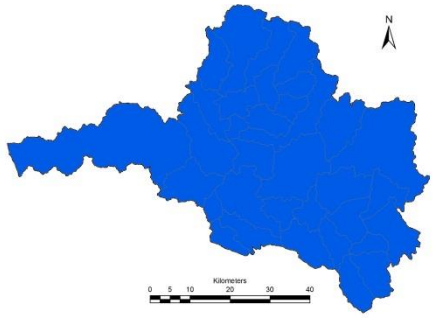
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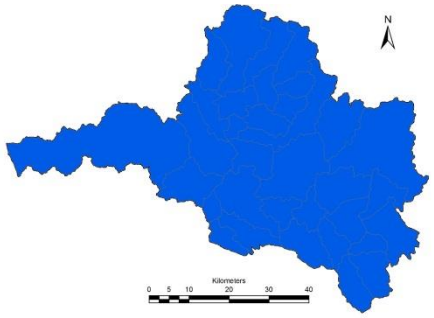
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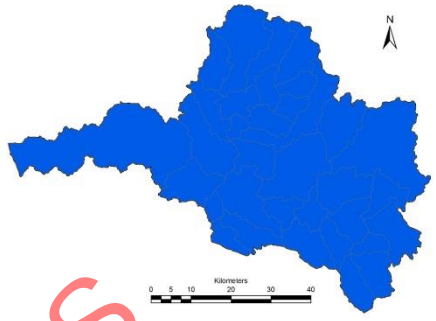
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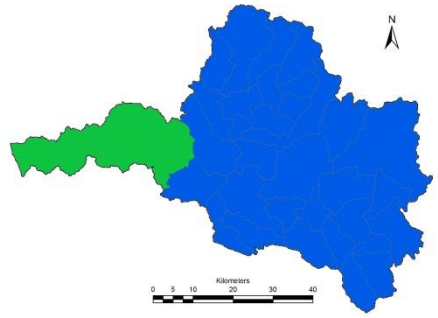
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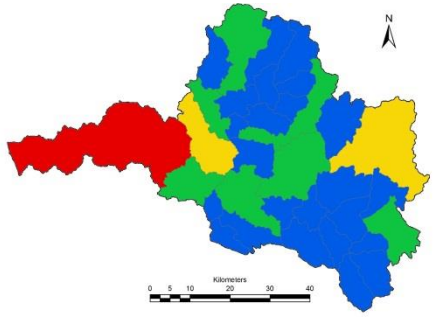
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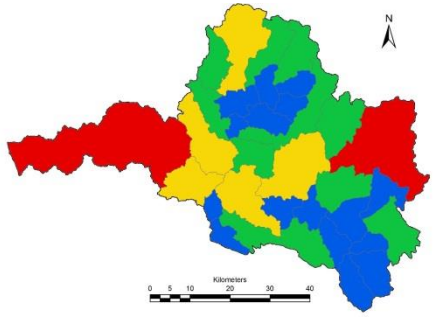
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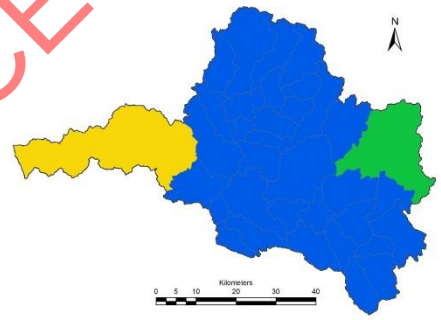
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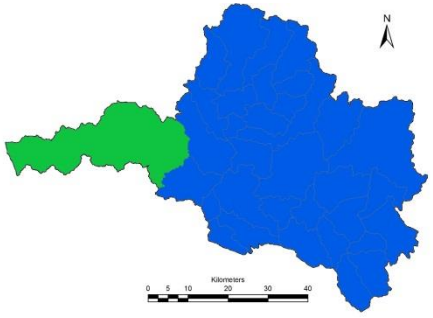
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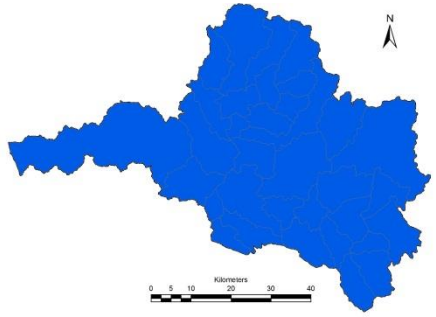
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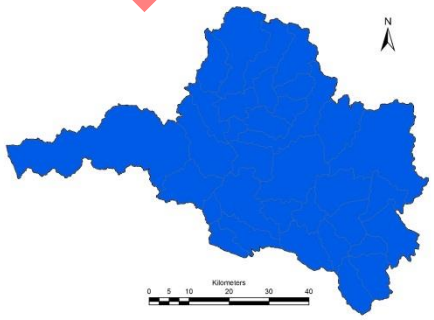
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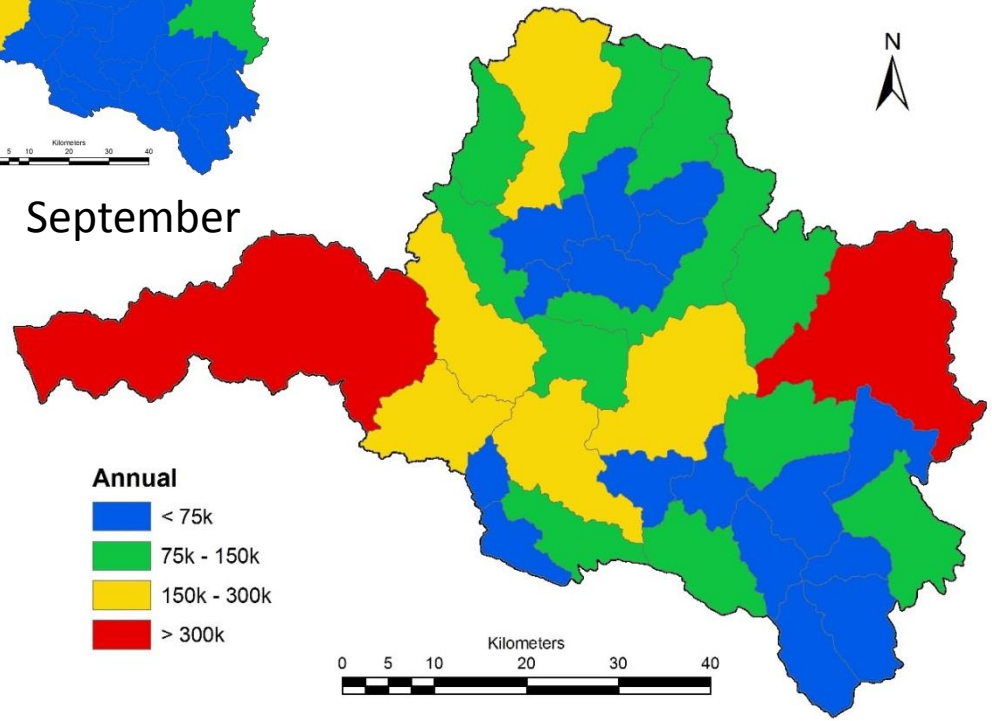

Runoff Yield in Kilo.cum < 25k 25k - 50k 50k - 100k > 100k

Thank You