GIS in Water Resources

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Introduction:

- Geographic information systems (GIS) have become a useful and important tool in hydrology and management of water resources.
- Water in its occurrence varies spatially and temporally throughout the hydrologic cycle, its study using GIS is especially practical.
- Water resource assessment and management are geographical activities requiring the handling of multiple forms of spatial data.
- Various combinations of geographic information systems (GISs) and simulation models can be efficiently used for handling such data.

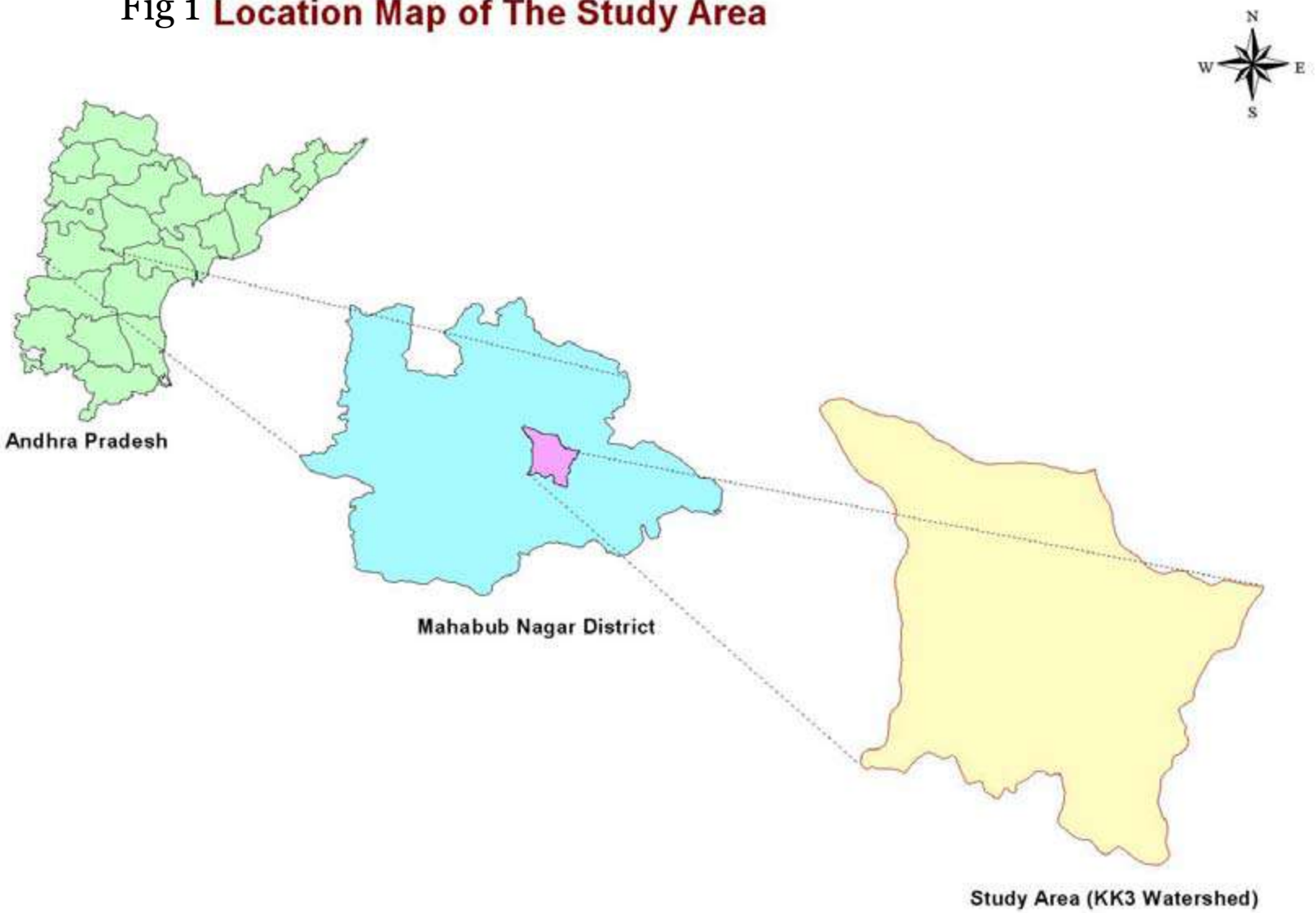
Various Applications:

- Watershed management
- Groundwater Assesment and management
- Flood Management
- Water Quality studies.

Case Study:

- " GIS Based Decision Support System for Watershed Runoff Assessment"
- Study Area: The Kk3 Macro Watershed is in Pedalakothapalle, Kodair and Gopalpet mandals of Mahbubnagar district of Andhra Pradesh, India.
- The geographical extent of the watershed is covered in part by three SOI Toposheets 56 L-6, 56 L-7 and 56 L-11.
- The watershed has an aerial extent of 452 sq.km.

Fig 1 **Location Map of The Study Area**



Developments of the Decision Support System:

- Initiation: Consists of merging of contours from SOI Toposheets, their projection and conversion of relevant layers to coverages. (Coverages are required for ArcInfo Workstation)
- Creating Digital elevation Model (DEM) and Watershed delineation into sub basins (sub watersheds) using ArcInfo Workstation.
- Creating the soil map.
- Creating the land use/land cover map using ERDAS. (Earth Resource Data Anlysis Systems)

- Overlay of soils, land use, Thiessen Polygons and sub watershed layer to obtain hydrologic response units (HRU).
- Computation of runoff for each HRU for rainfall from corresponding rain gauge stations.
- Generation of thematic map of runoff.
- Making a deployable application in VB(Visual Basic).

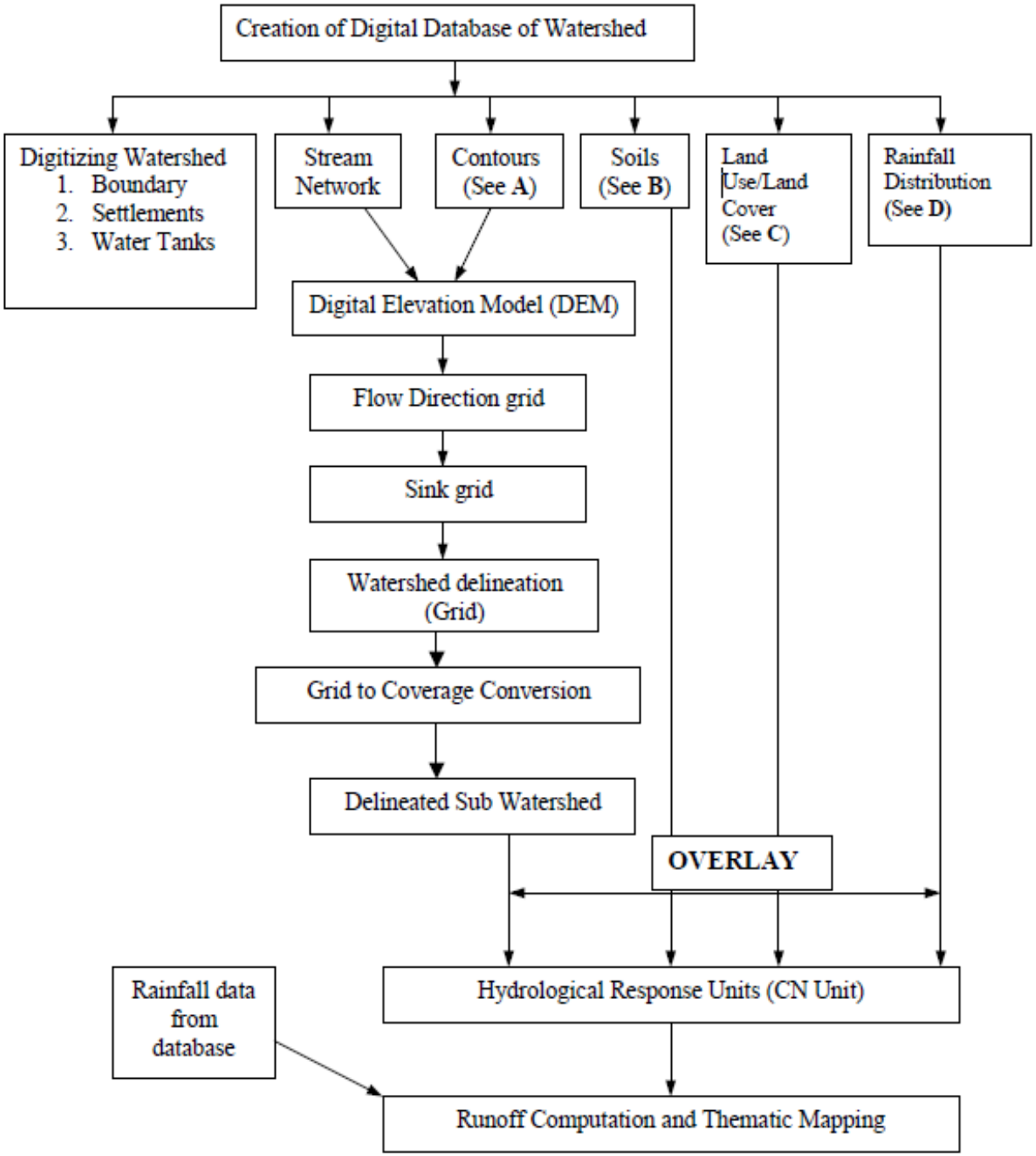


Fig 2. Project Work Flow Chart

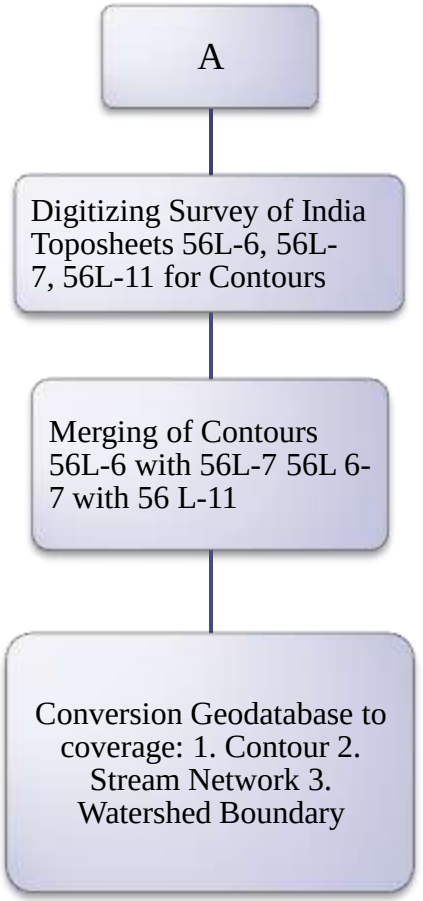


Fig 3. Creation of contour Map

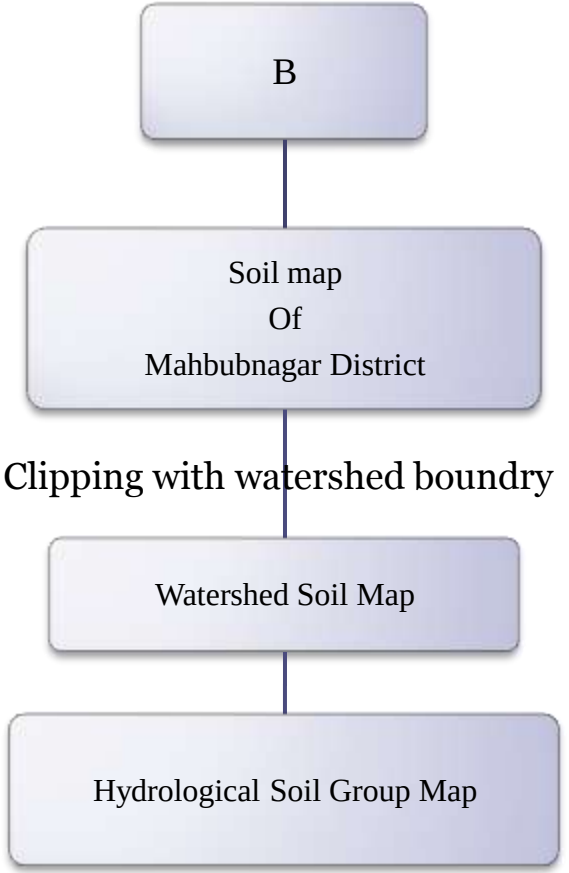


Fig 4. Creation of Soil Map

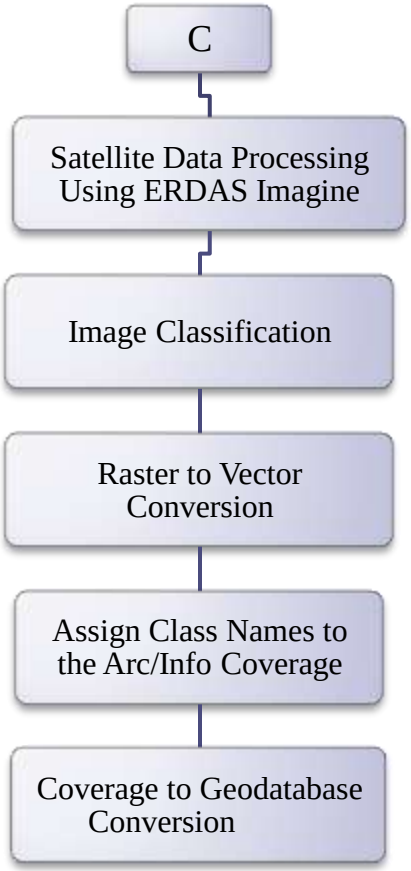


Fig 5. Creation of Landuse/land cover Map

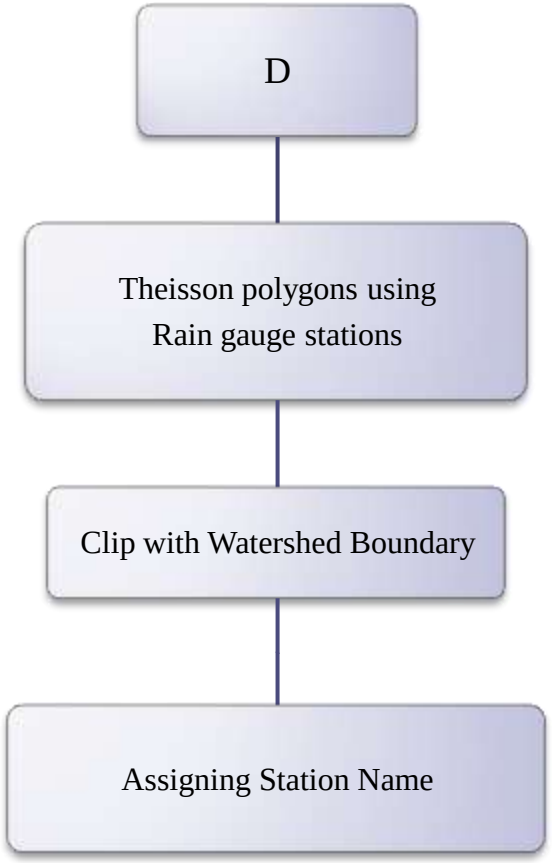


Fig 6. Creation of Rainfall Distribution Map

Fig 7

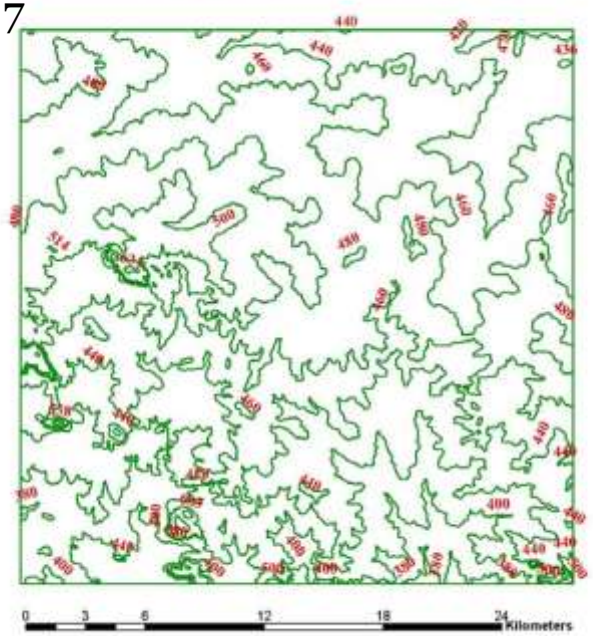

Contours of SOI Topo Sheet No 56L7
0 3 6 12 18 24
Kilometers

Fig 8

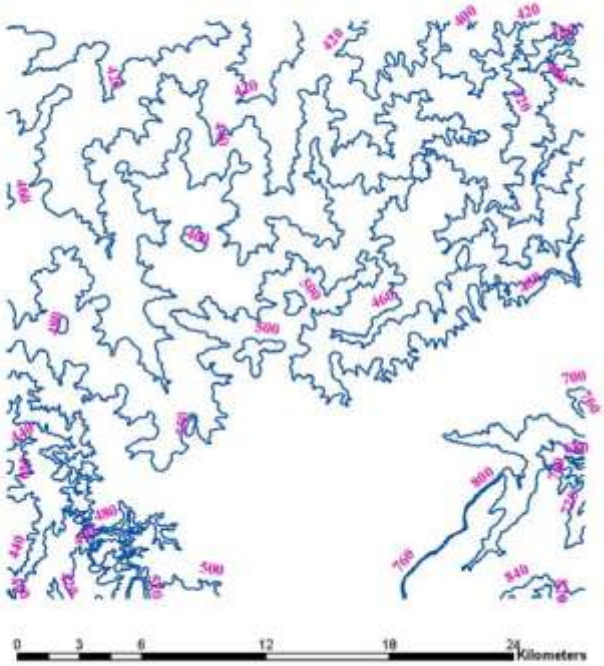

Contours of SOI Topo Sheet No 56L11
0 3 6 12 18 24
Kilometers

Fig 8 **Strem Network of The Study Area**

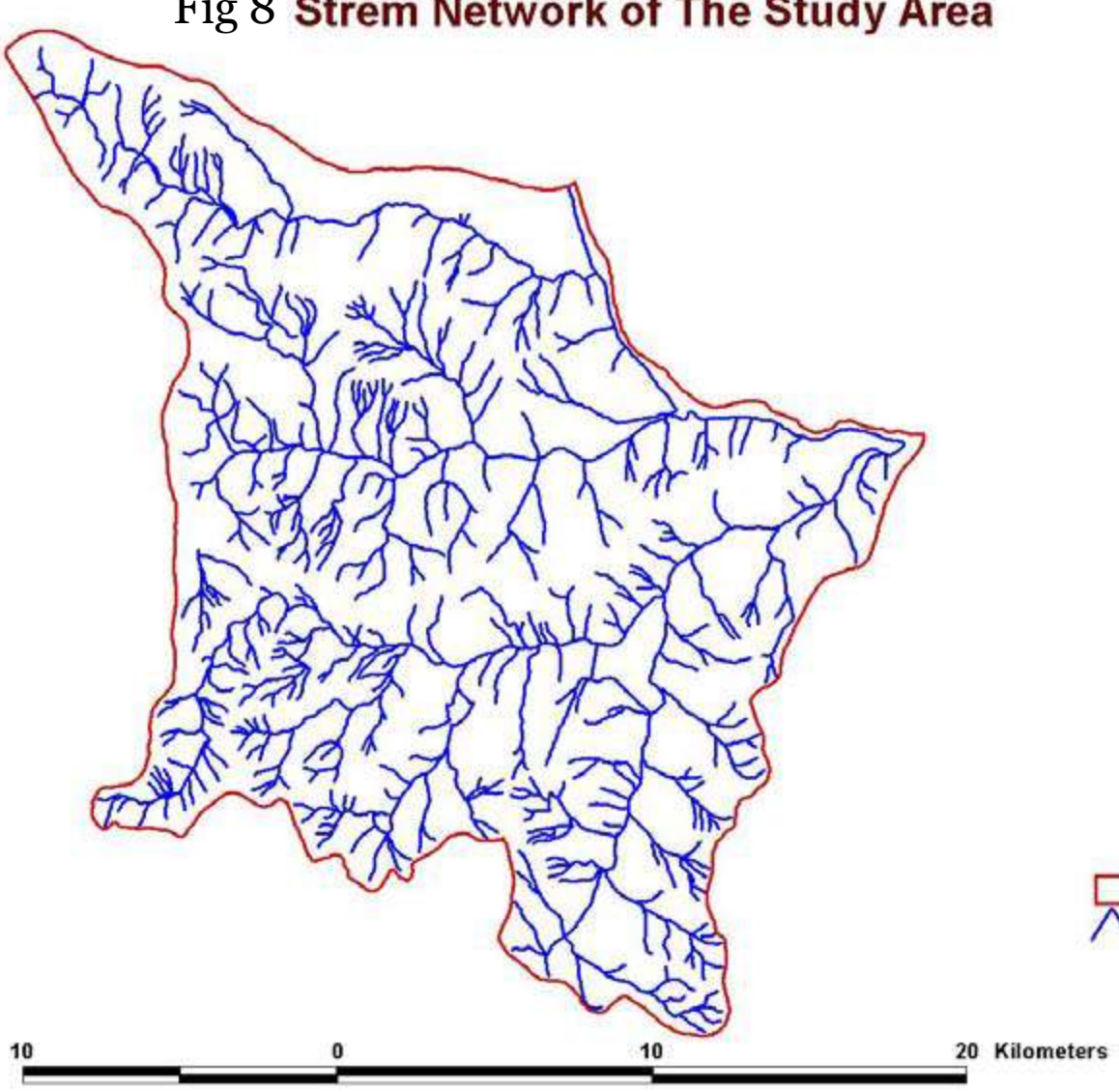


Fig 9 **Rainfall Distribution Map**

Fig 10 Soil Map of Mahabub Nagar District

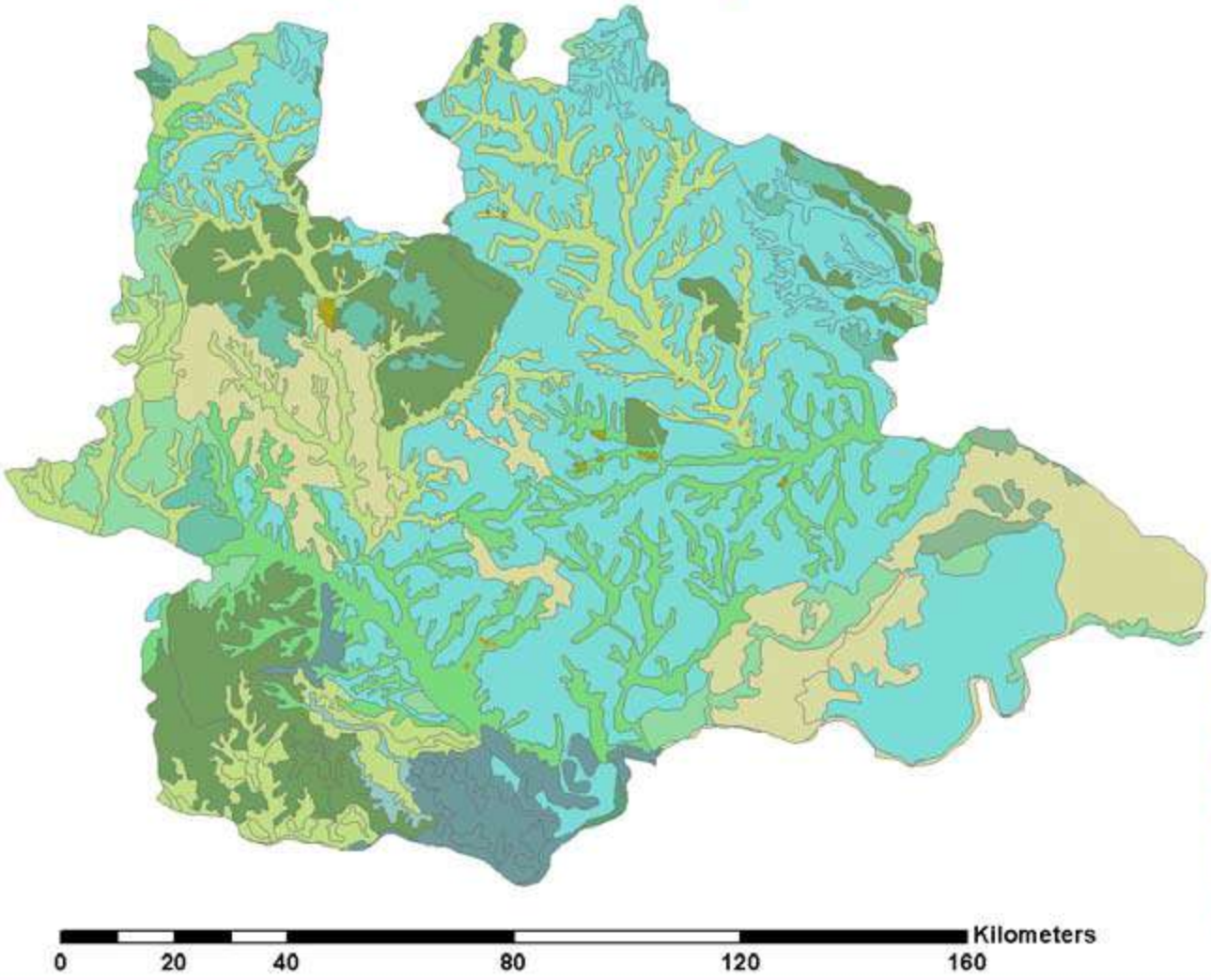


Fig 11 **Land Use/Land Cover Map**

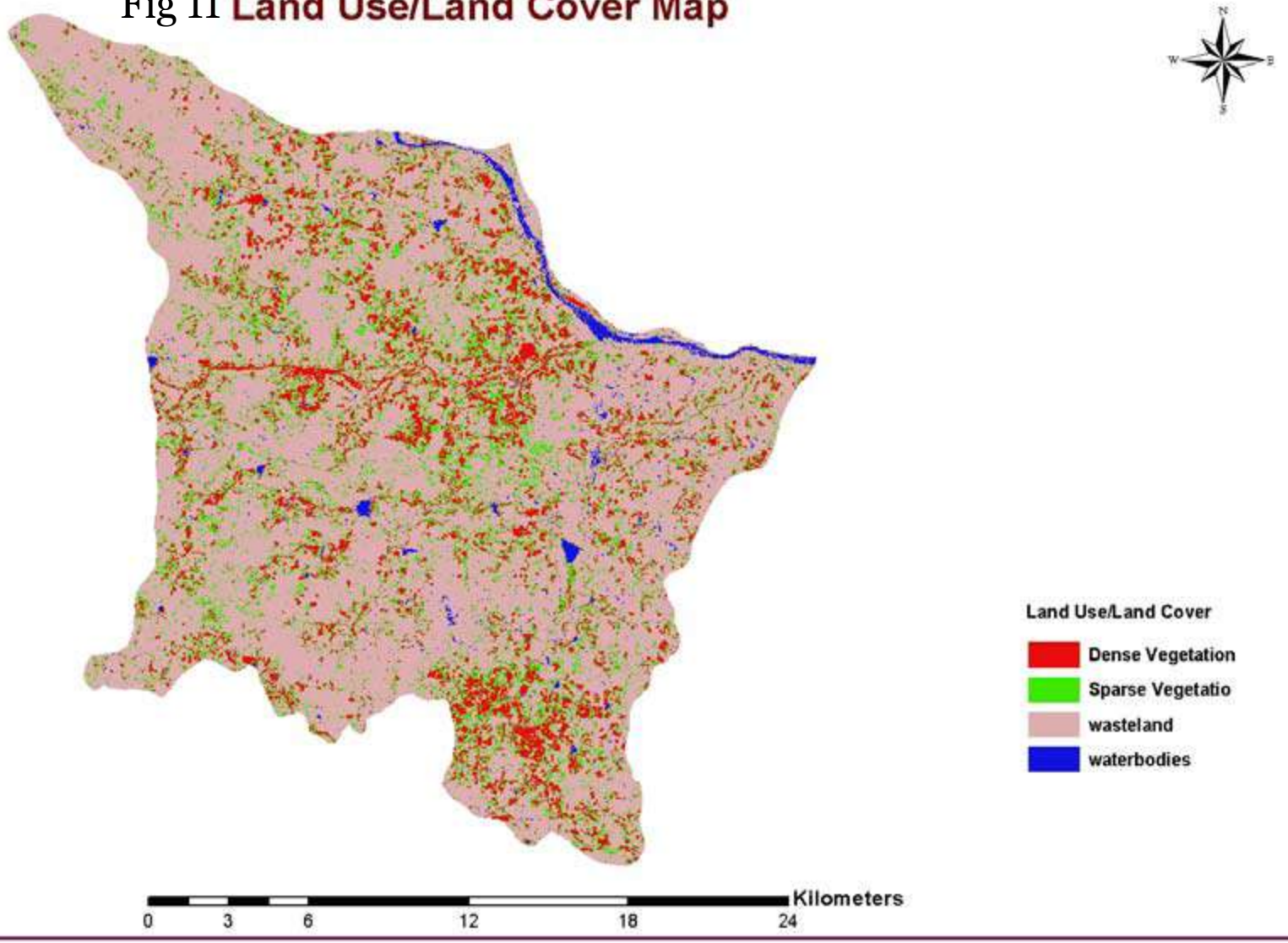


Fig 12 **Boundary of Merged Contours**

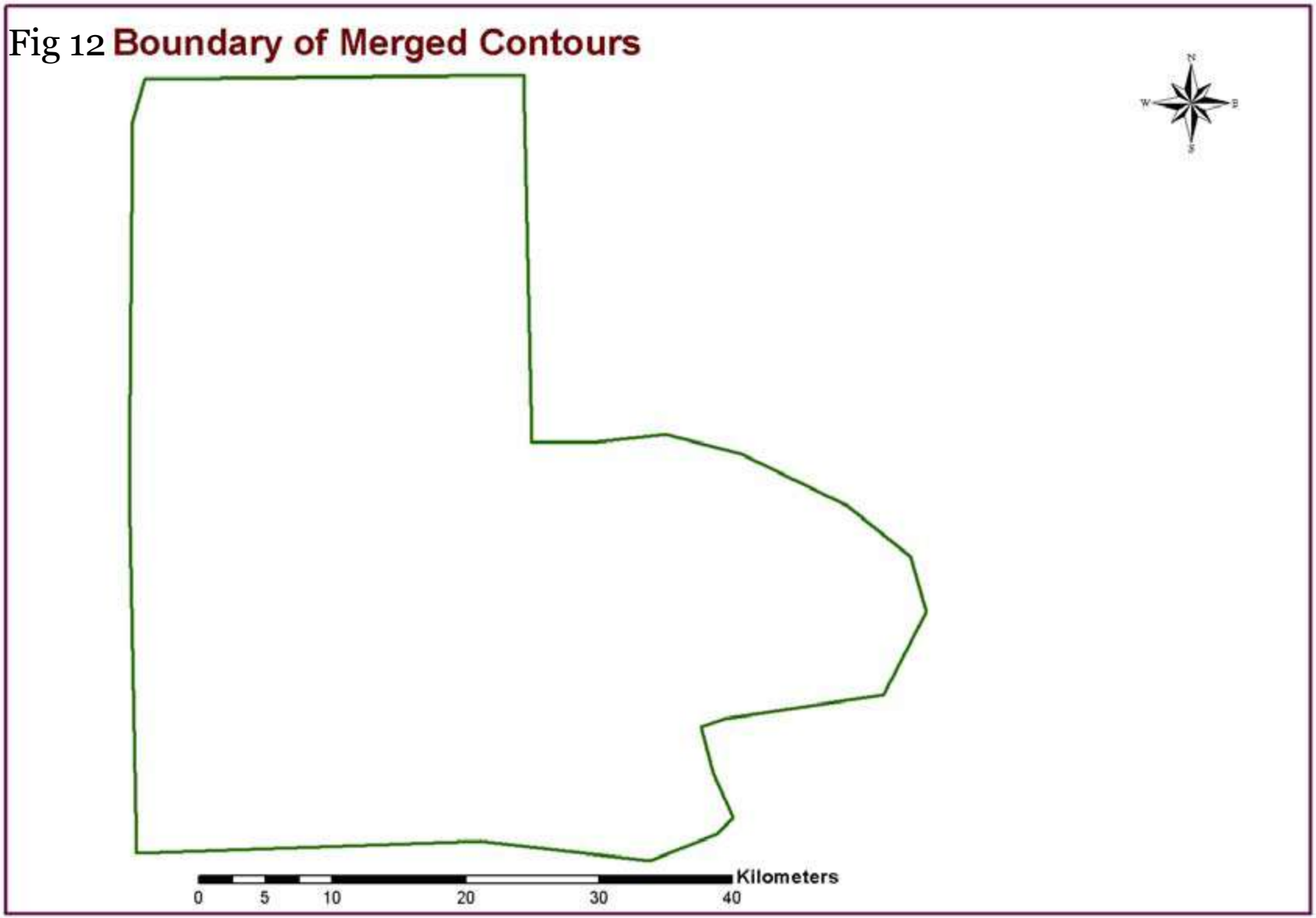


Fig 13 **Merged Contours of Topo Sheets 56L6,56L7 and 56 L 11**

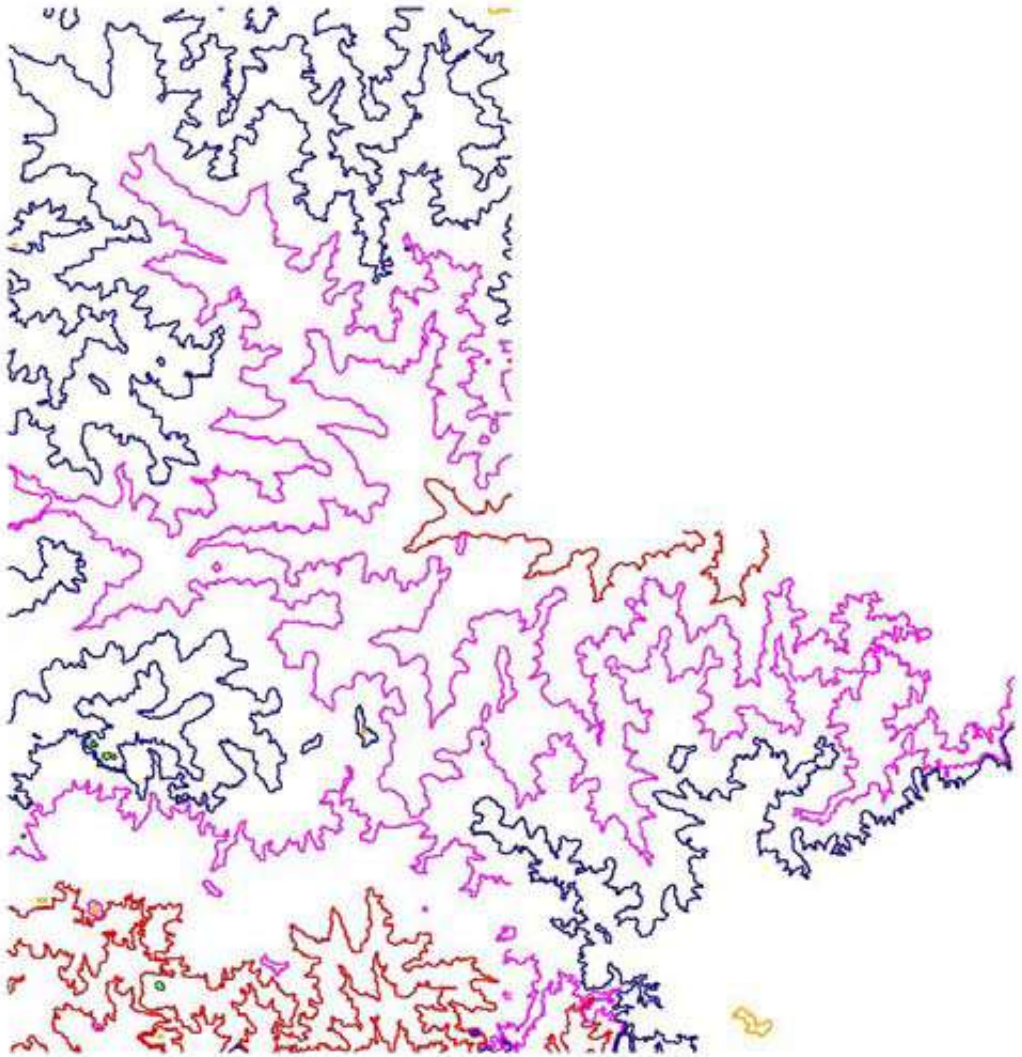


Fig 14 **Digital Elevation Model**

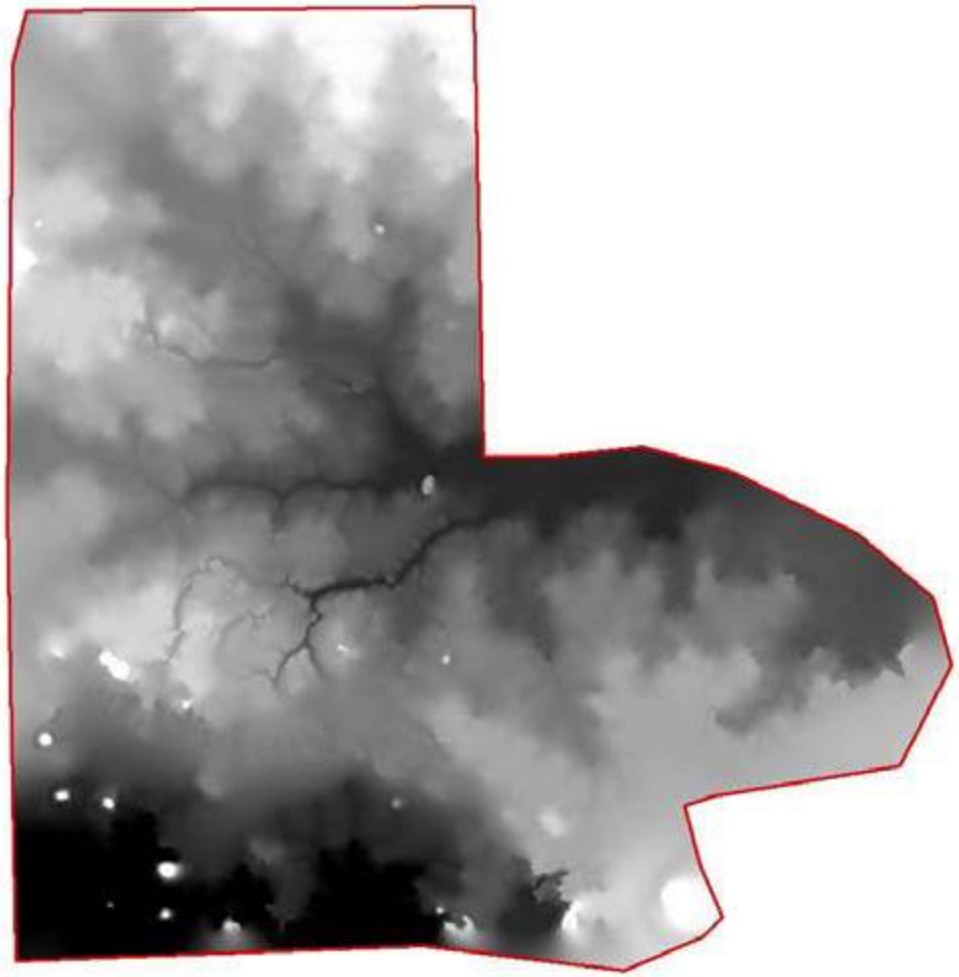


Fig 15 **Sub Watershed Boundary**

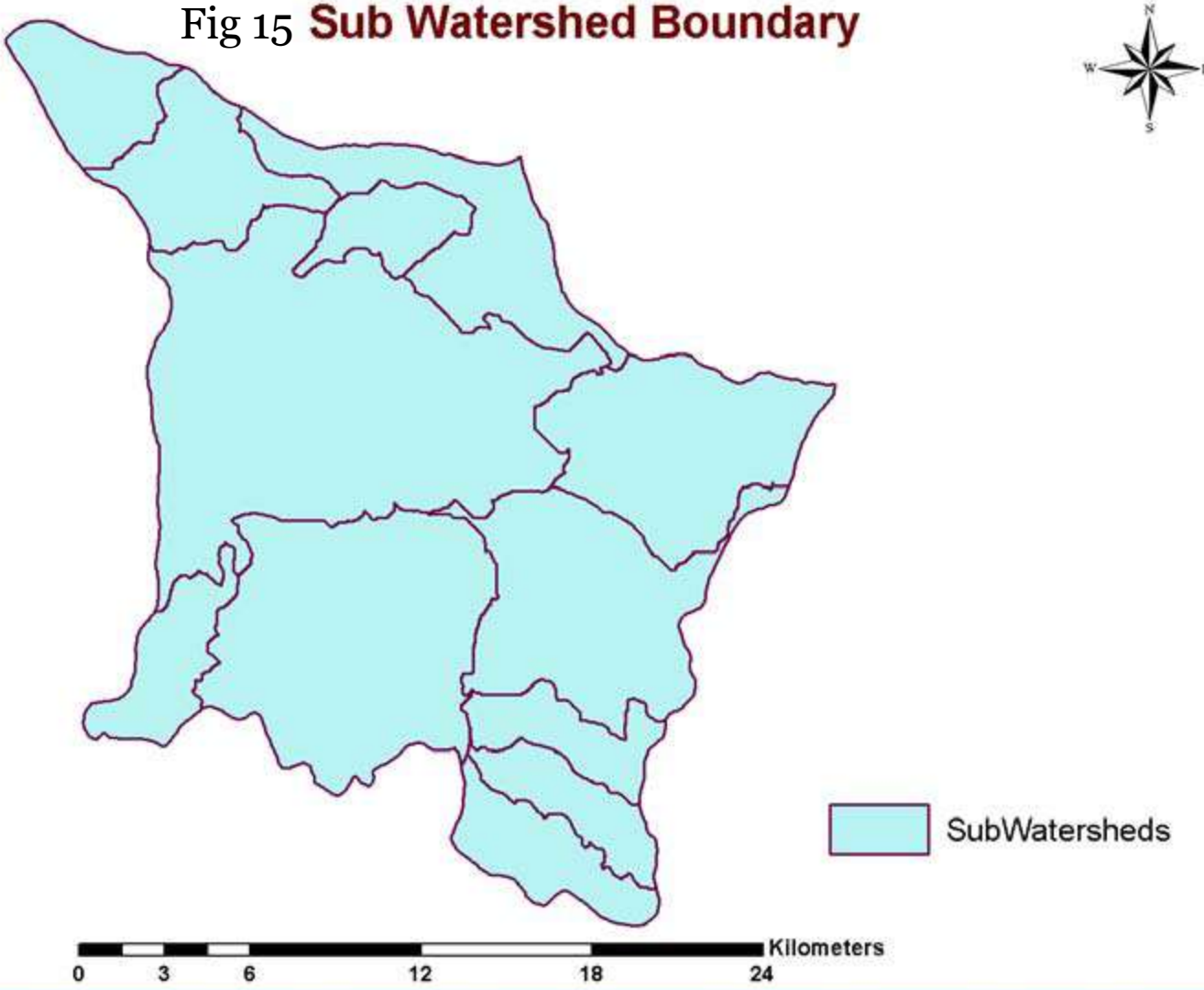


Fig 16 **Soil Map of The Study Area**

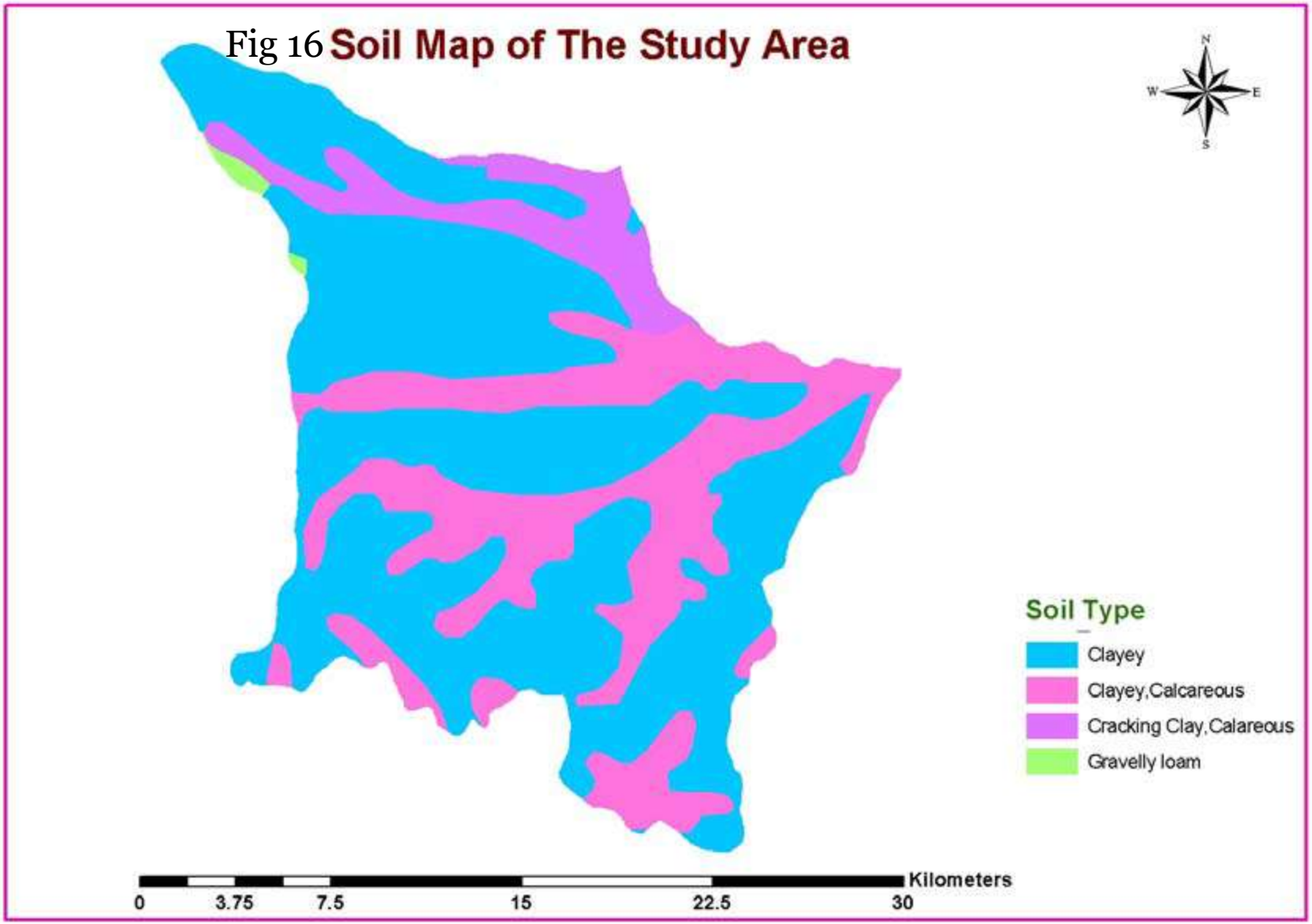


Fig 17 Hydrological Soil Group Map

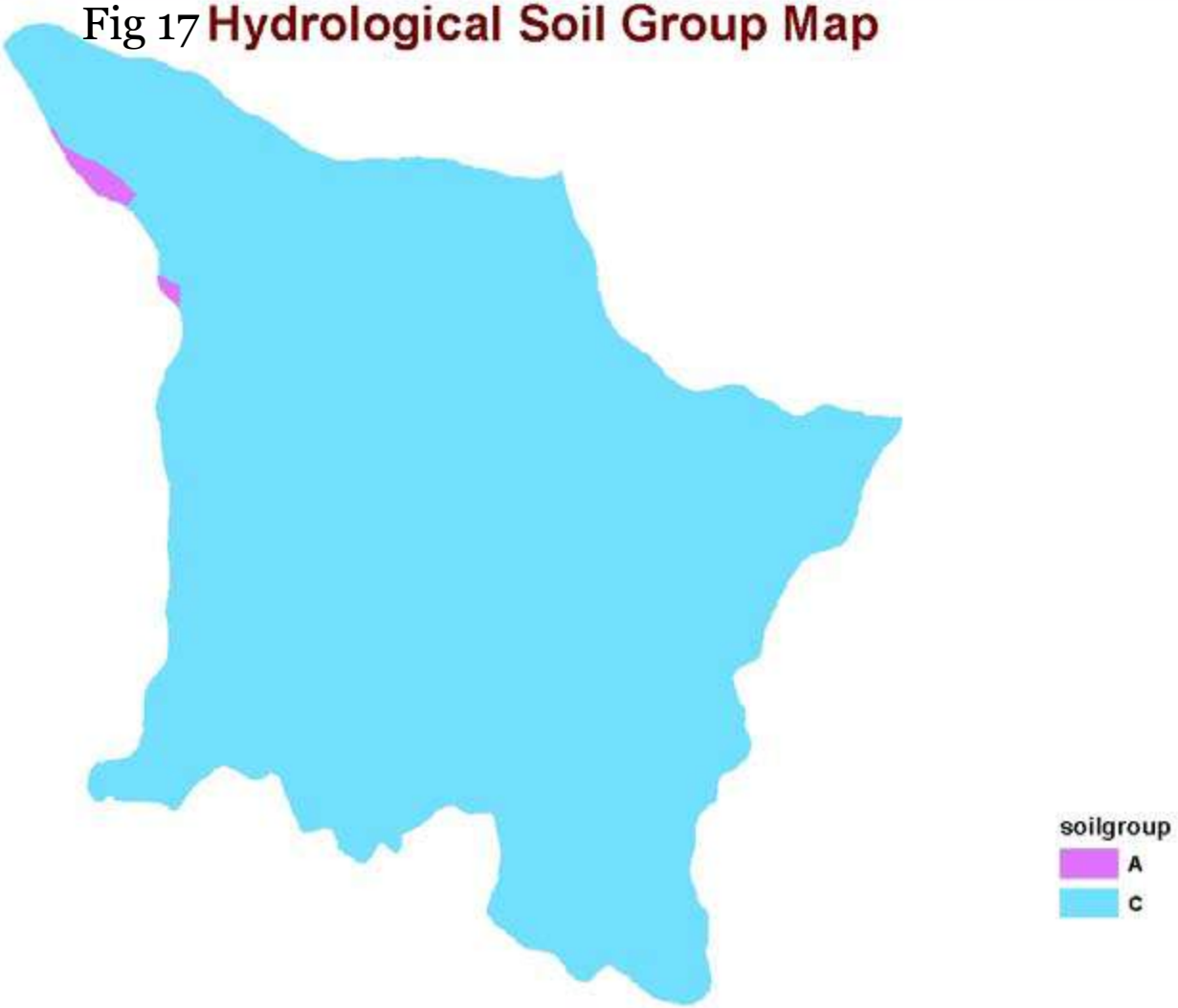


Fig 18 **Land Use/Land Cover Map**

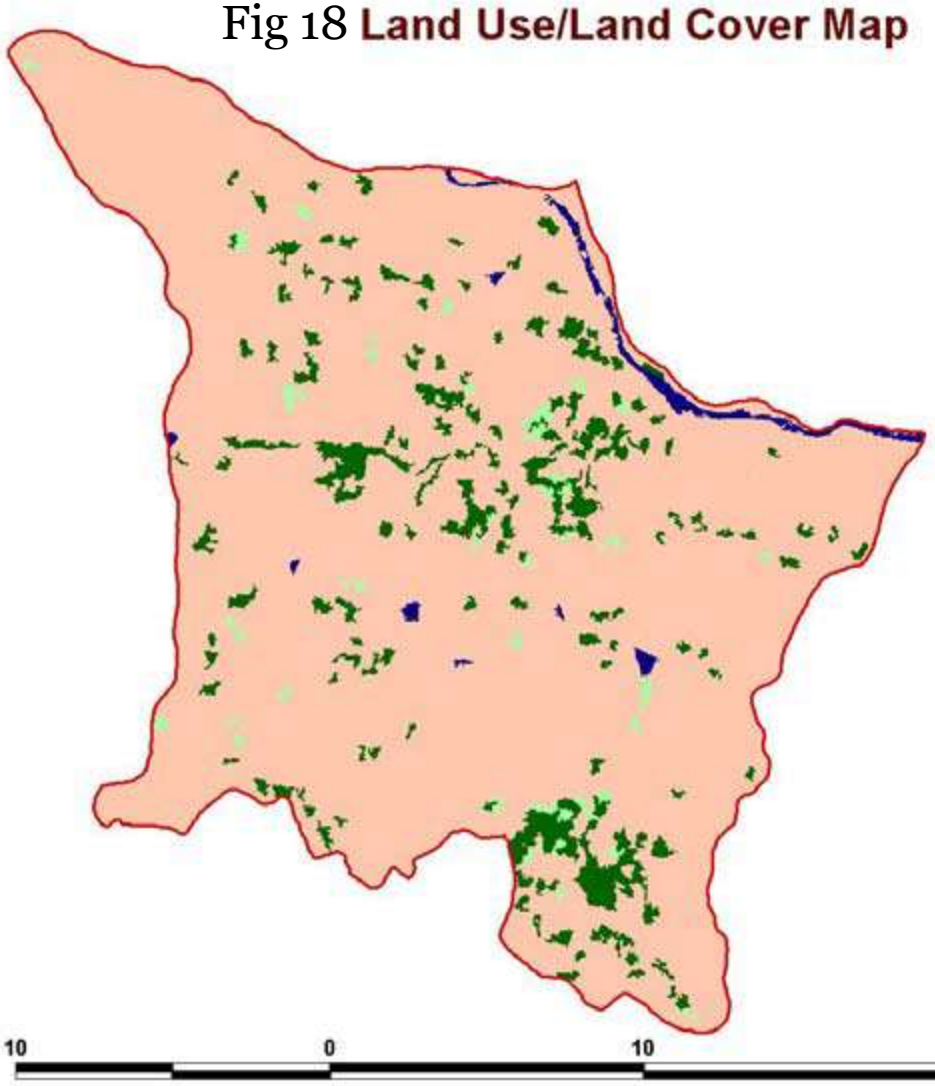


Fig 18 **Overlay Map**

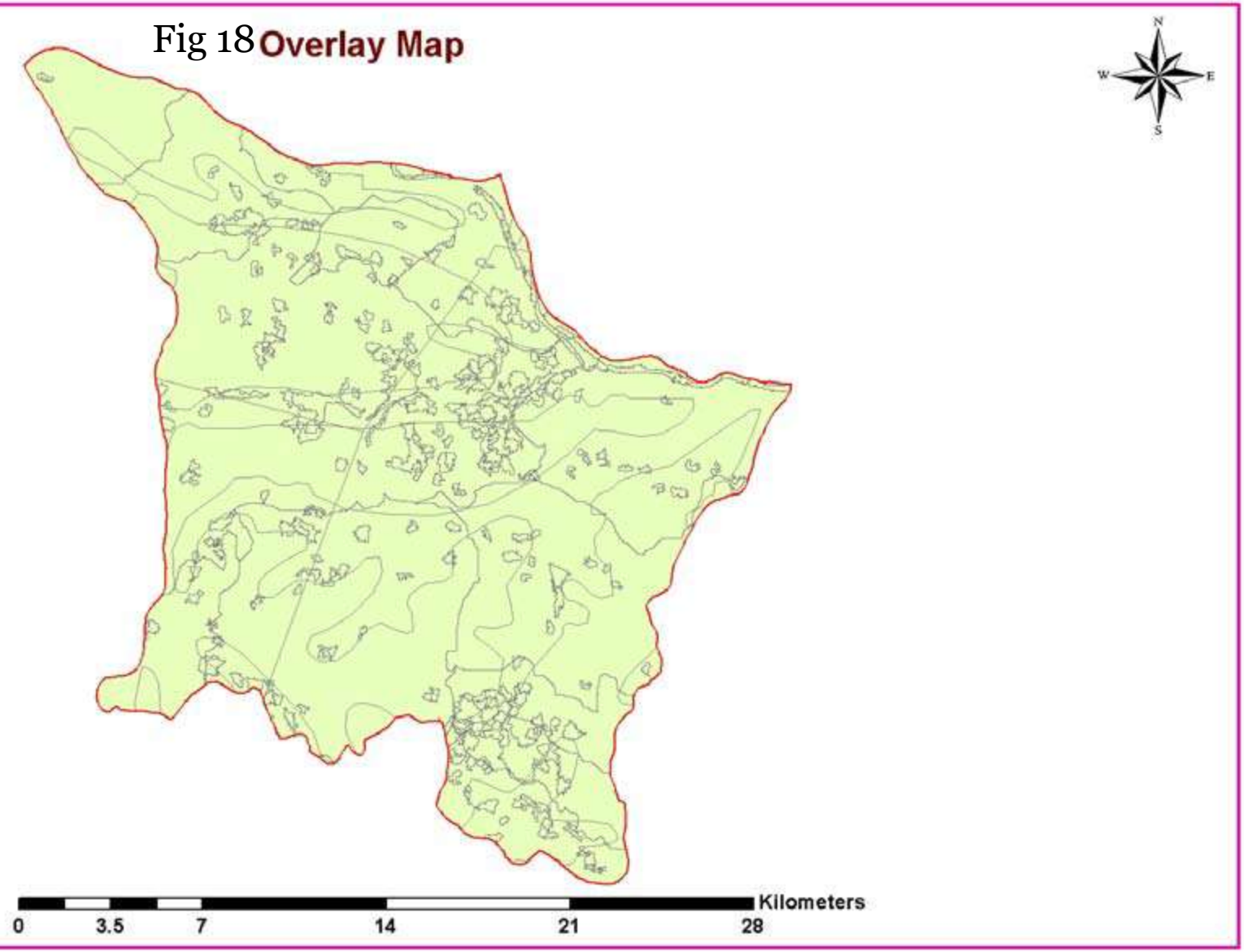


Fig 19 Hydrological Response Units Map

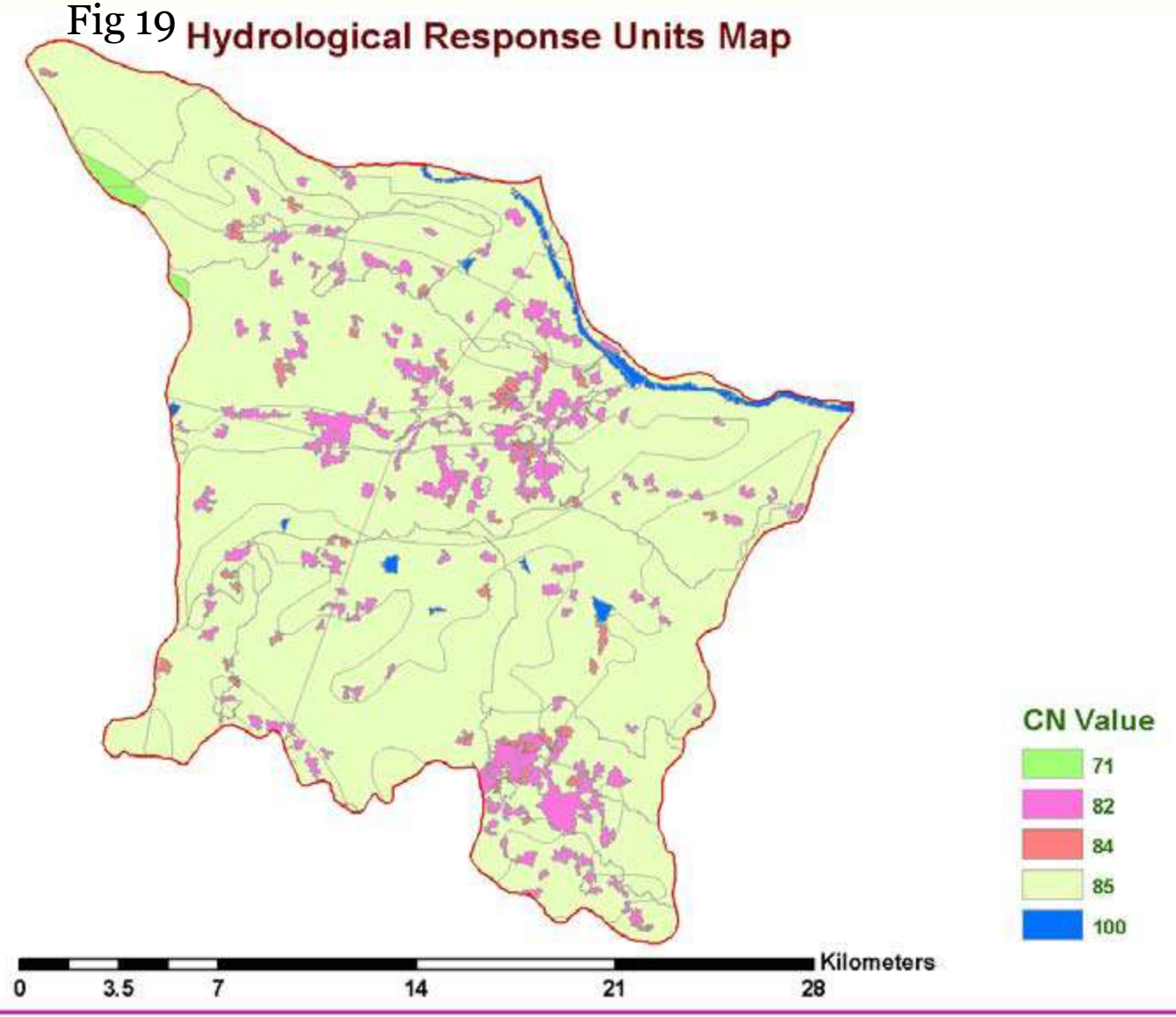


Fig 20

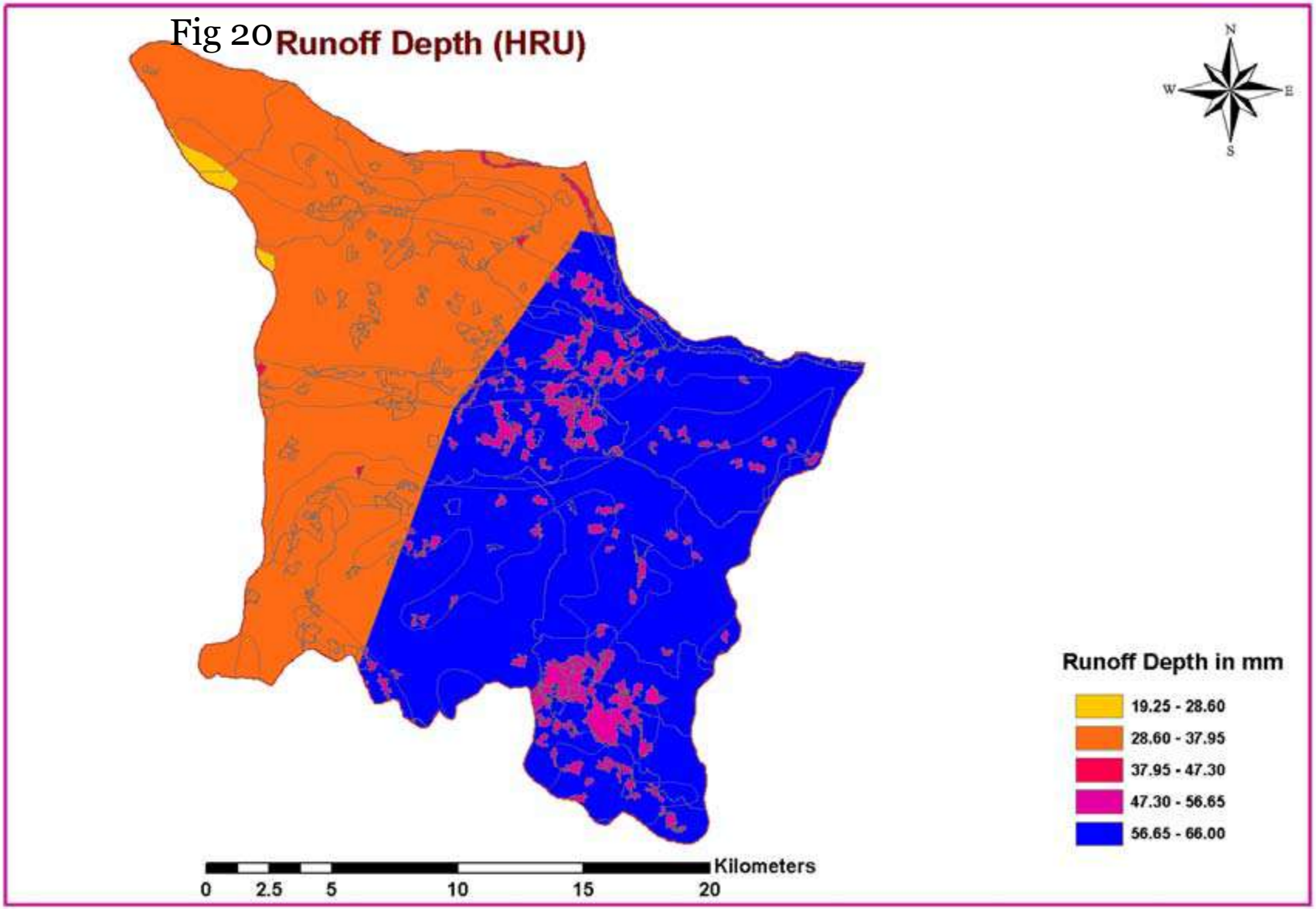

Runoff Depth (HRU)
N
W
E
S
Runoff Depth in mm
19.25 - 28.60
28.60 - 37.95
37.95 - 47.30
47.30 - 56.65
56.65 - 66.00
Kilometers
0
2.5
5
10
15
20

Fig 21

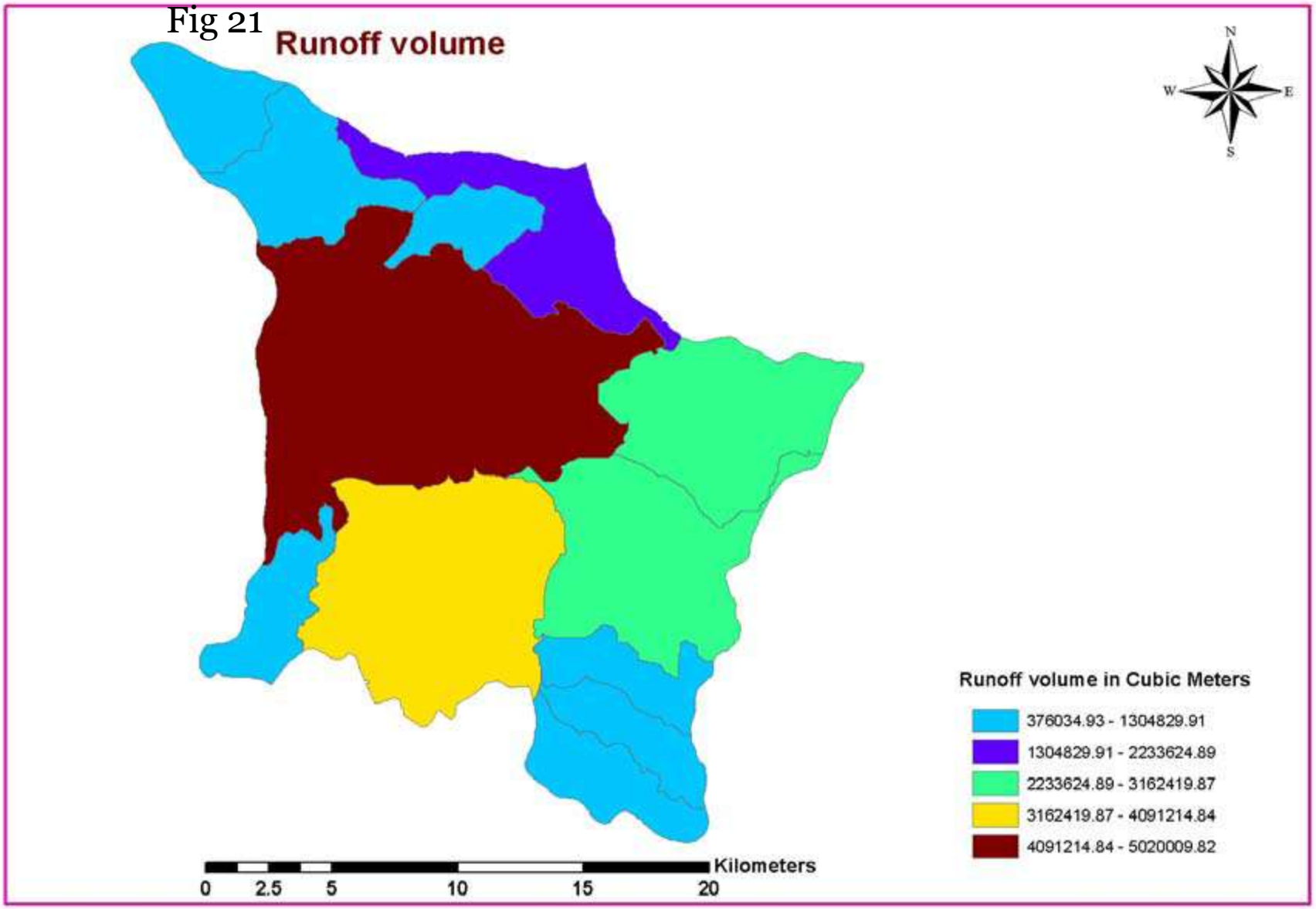
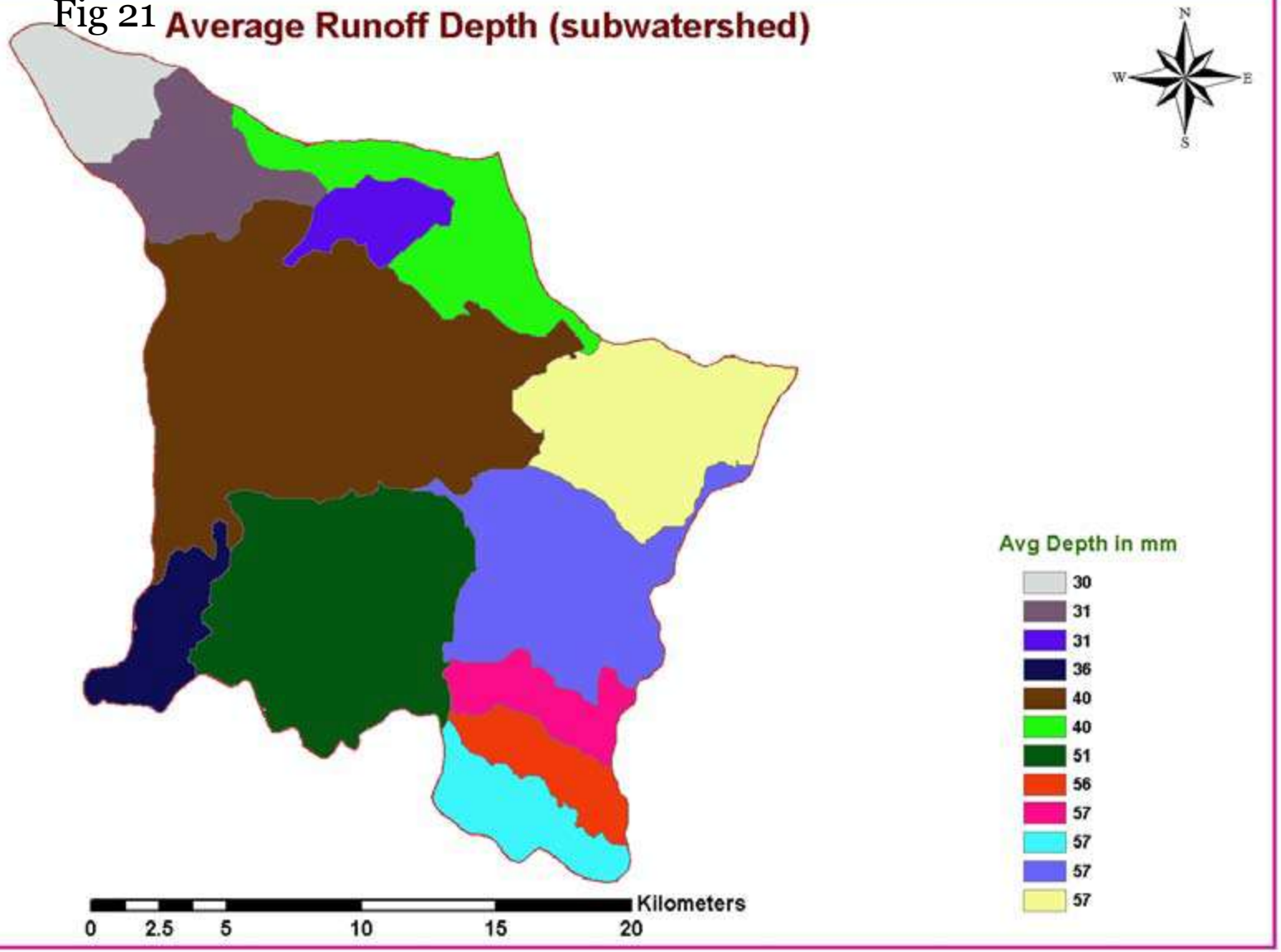

Runoff volume
N
W
E
S
Runoff volume in Cubic Meters
376034.93 - 1304829.91
1304829.91 - 2233624.89
2233624.89 - 3162419.87
3162419.87 - 4091214.84
4091214.84 - 5020009.82
Kilometers
0
2.5
5
10
15
20

Fig 21 Average Runoff Depth (subwatershed)



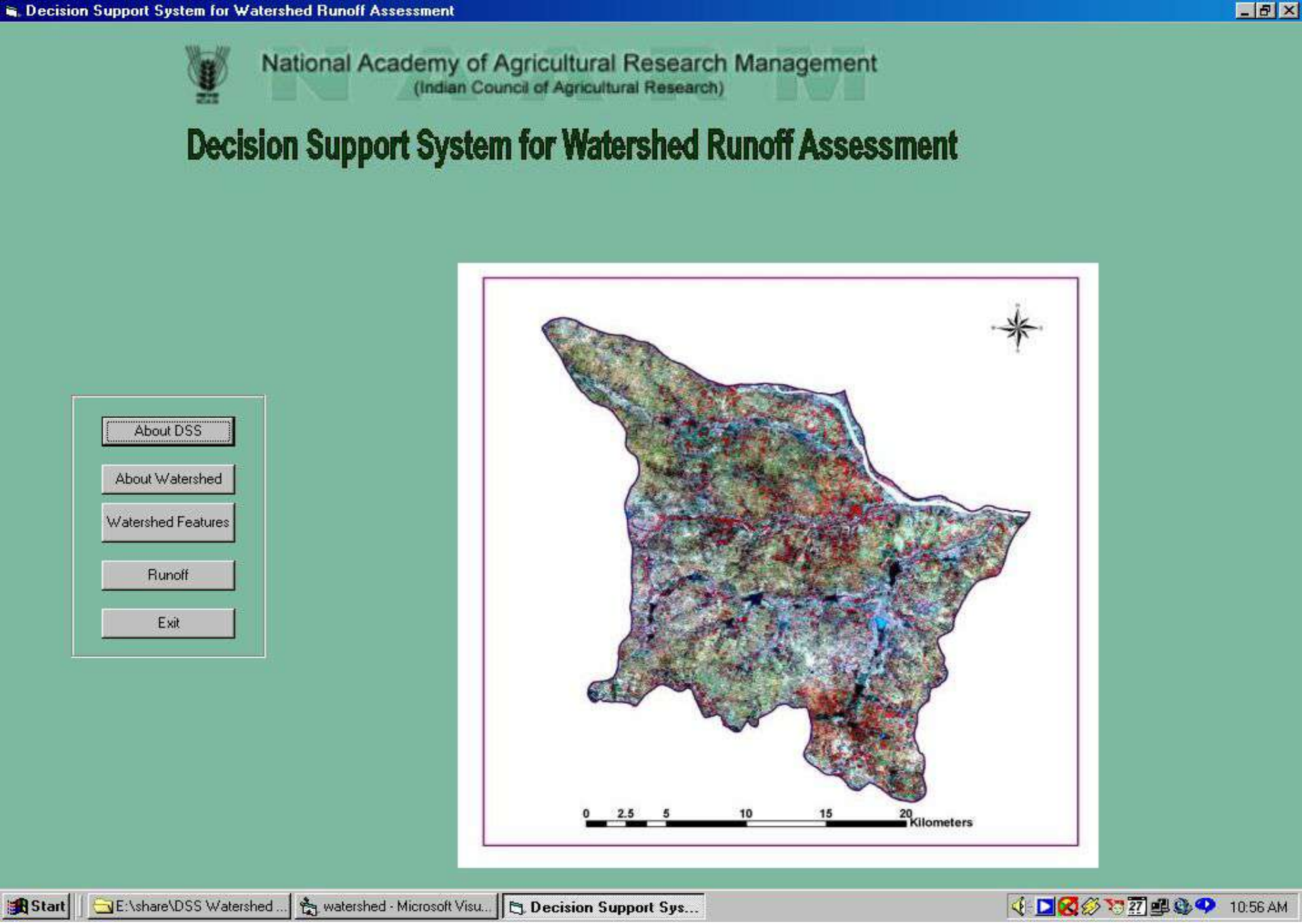


Fig .22 User Interface of Decision Support System

Conclusions:

- The Decision Support System for watershed Runoff assessment is made available as a deployable application so that users can update the rainfall data, and assess the variations in runoff and its spatial distribution over the past or current seasons.

- The present DSS framework can function as the starting point for design of soil and water conservation structures and evaluating the impact of alternate land use and watershed management decisions.

References:

- K.Nagaraju, P.Aruna, K.V.Kumar, A.Nagaraju, M.N.Reddy and N.H.Rao "GIS Based Decision Support System for Watershed Runoff Assessment", National Academy of Agricultural Research Management.

- U. Sunday Tim, Sumant Mallavaram, "Application of GIS Technology in Watershed-based Management and Decision Making", *Watershed Update Vol. 1, No. 5 July - August 2003*

- John P. Wilson, Helena Mitasova, Dawn J. Wright, "Water resource Applications of Geographic Information System" URISA Journal.