Mitigating water Crisis through drought assessment, Case of Latur India

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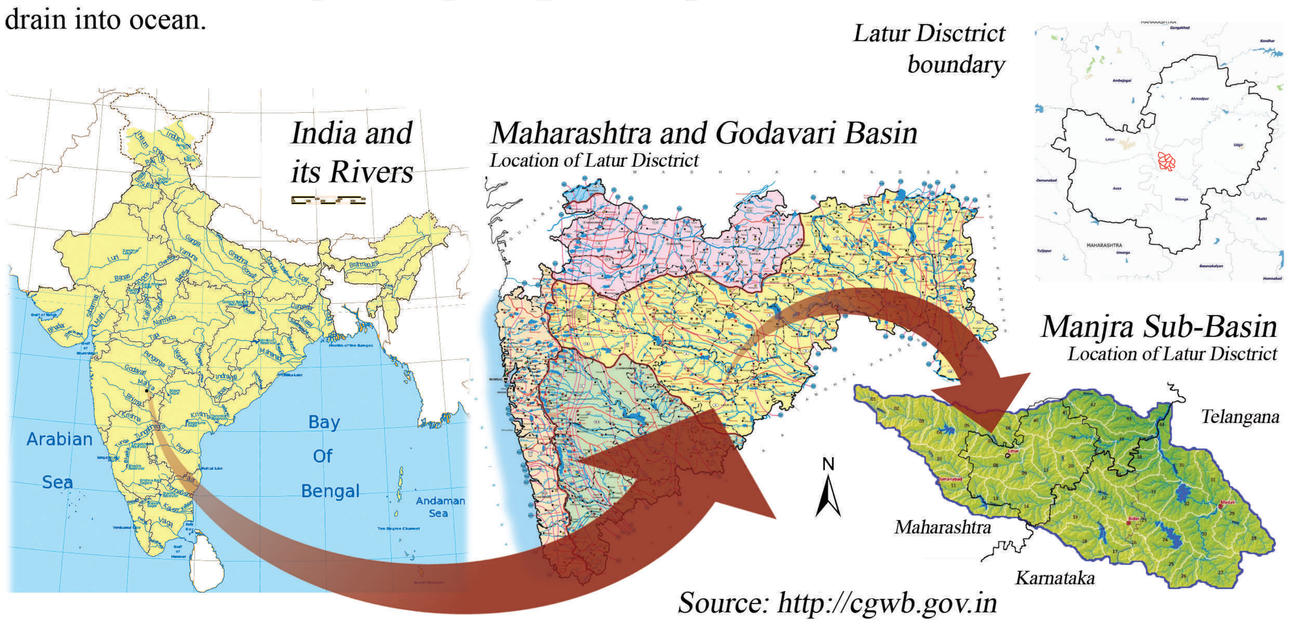
GEOSPATIAL WORLD FORUM
23-25 JANUARY, 2017, HYDERABAD, INDIA

Introduction

Watershed is the area of land where all the water falls in it and drains off of it goes to a common outlet. Tt can be as small as footprint or large enough to encompass all the land that drains water into rivers that drain into ocean.



Source: http://cgwb.gov.in

Water Resources Region delineated boundaries

Basin --- Sub-Basin --- Watershed --- Microwatershed

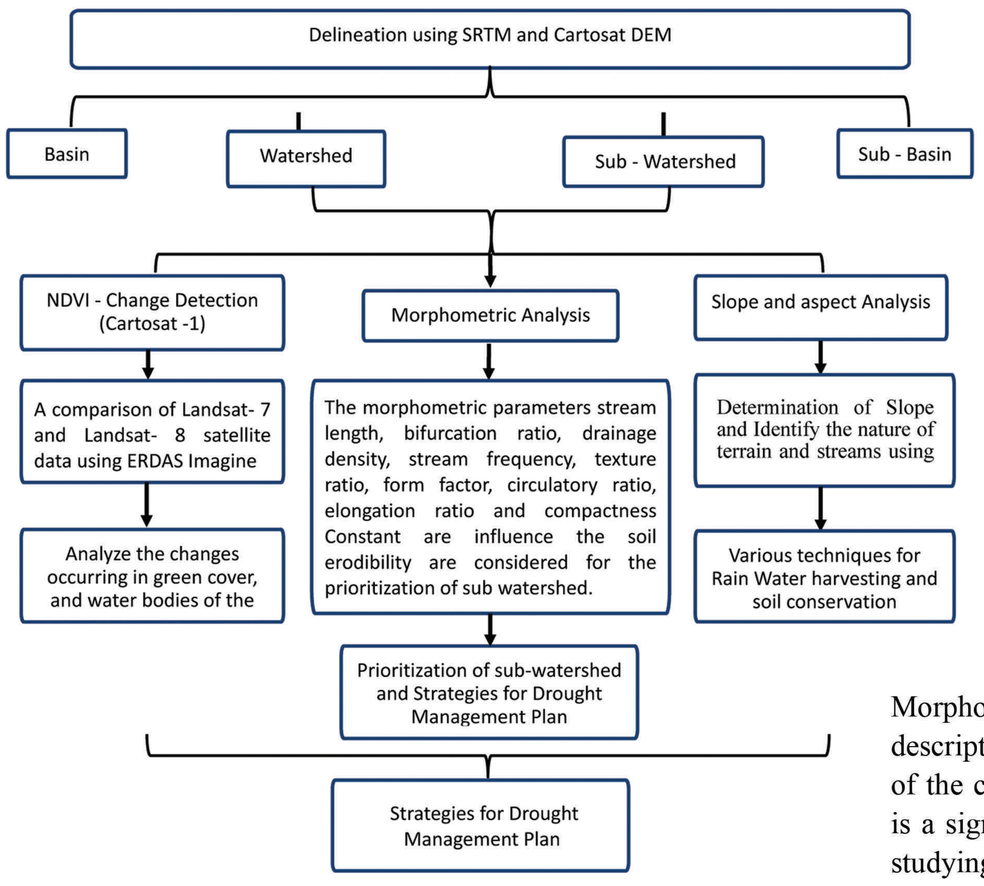
The entire river-system of our country has been divided into six water resources regions, which has been further sub-divided into 35 basins and 112 catchments.

These catchments have been further divided into 500 sub-catchments and 3237 watersheds.

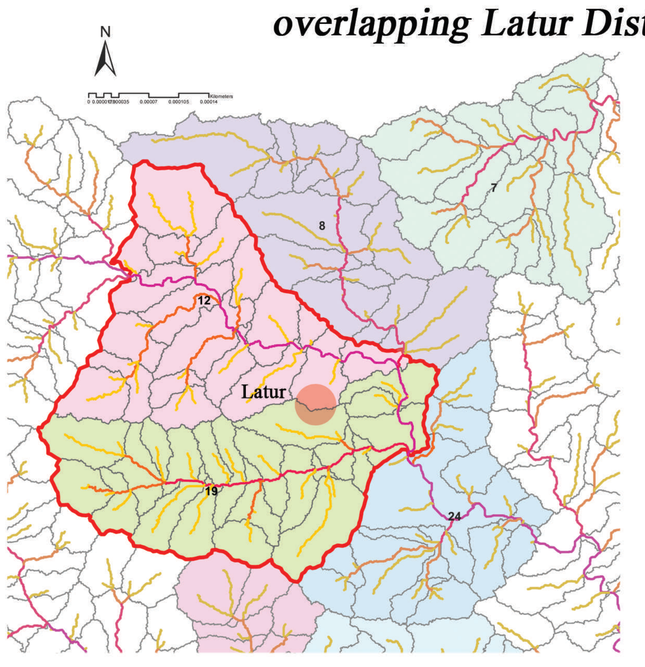
The suggested hydrological units are water resources region, river basins, river sub-basins, watershed, sub-watershed, mini watershed, micro watershed.

The recommended size of the watershed is from 250 - 750 sq.km.

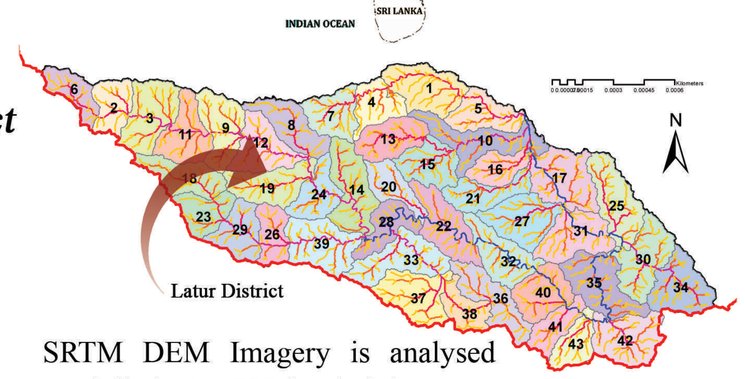
Methodology for Research



Delineated Watershed overlapping Latur District



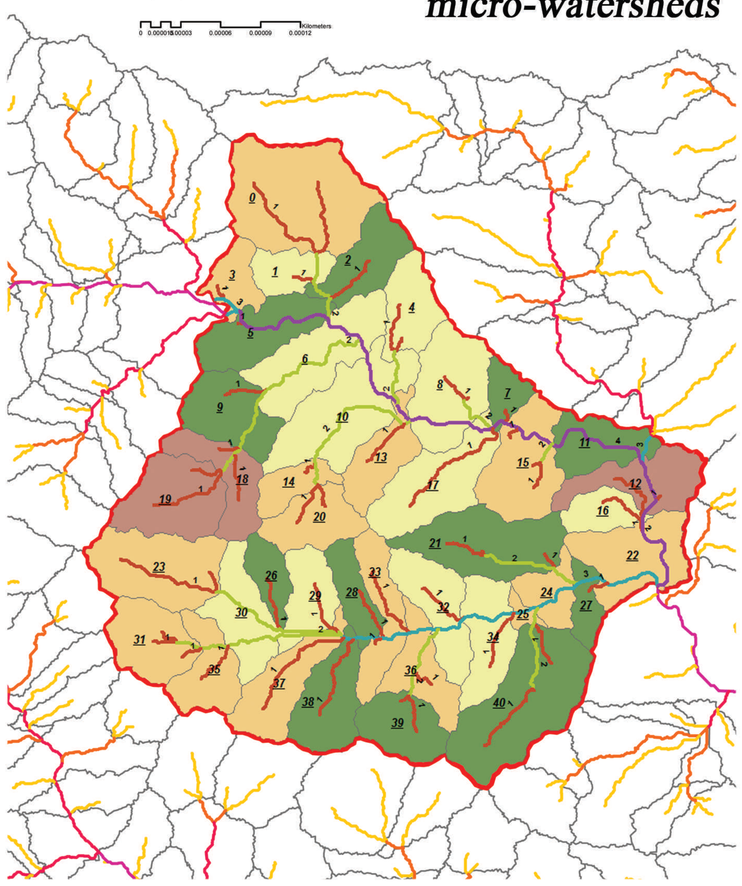
Selected Watersheds for Micro-analysis



SRTM DEM Imagery is analysed spatially in ArcGIS for deriving map.

Extraction of drainage network and watershed boundary from a Digital Elevation model using spatial analysis

Priority Map of micro-watersheds



Morphometric Analysis

Morphometric analysis of a watershed provides a quantitative description of the drainage system which is an important aspect of the characterization of watersheds. Morphometric analysis is a significant tool for prioritization of micro-watersheds by studying different linear and aerial parameters of the watershed even without the availability of soil maps.

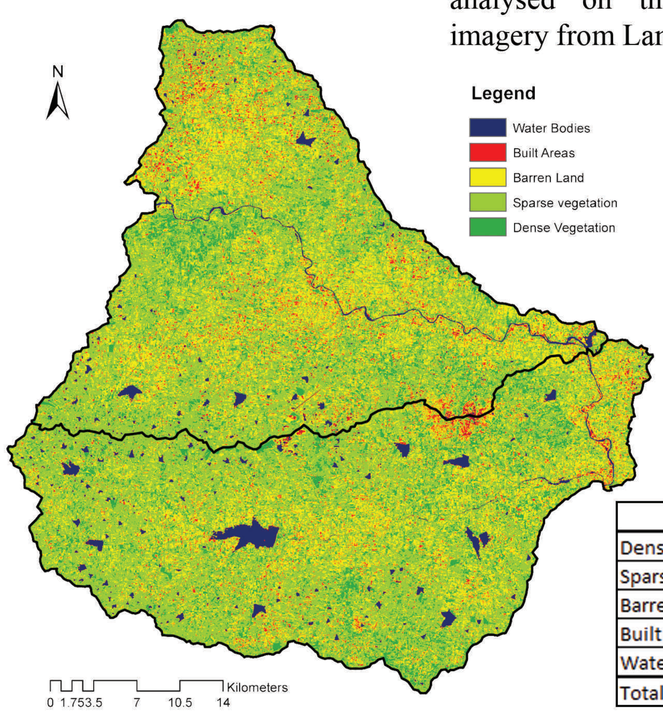
The various morphometric parameters such as stream length, bifurcation ratio, drainage density, stream frequency, form factor, texture ratio, elongation ratio, circularity ratio and compactness constant were computed. The linear parameters such as drainage density, stream frequency, bifurcation ratio, texture ratio have a direct relationship with erodibility, higher the value, more is the erodibility. Hence for prioritization of mini watersheds, the highest value was rated as rank 1, second value was rated as rank 2 and so on, and the least value was rated last in rank. Shape parameters such as elongation ratio, compactness constant, circulatory ratio and form factor have an inverse relationship with erodibility9, lower the value, more is the erodibility. Thus the lowest value of shape parameters was rated as rank 1, next lower value was rated as rank 2 and so on and the highest value was rated last in rank. Hence, the ranking of the mini watersheds has been determined by assigning the highest priority/rank based on highest value in case of linear parameters and lowest value in case of shape parameters.

Prioritization rating of all the micro watersheds of watershed was carried out by calculating the compound parameter values. The micro watershed with the lowest compound parameter value was given the highest priority. The various indicators which have been used in the prioritization of watershed are described in table:

MW(FID)	A (sq.km)	P (Perimeter)	Total (Linear Parameter)	Total (Shape Parameter)	Total	Cv	Priority
0	76.67	21.60	28.09	3.06	31.15	3.11	1
1	17.23	29.80	59.99	3.06	63.05	6.31	3
2	28.17	23.70	77.35	2.97	80.32	8.03	4
3	16.20	23.60	36.74	2.96	39.70	3.97	1
4	25.19	28.20	61.34	2.91	64.25	6.43	3
5	35.08	30.10	78.67	2.98	81.65	8.17	4
6	47.05	23.70	60.79	2.95	63.74	6.37	3
7	11.64	23.40	81.79	2.94	84.73	8.47	4
8	43.60	36.00	63.76	2.93	66.68	6.67	3
9	32.94	29.80	68.89	2.97	71.86	7.19	4
10	57.17	32.90	65.91	2.94	68.85	6.89	3
11	25.68	33.40	85.41	3.15	88.56	8.86	4
12	32.40	39.00	28.27	2.85	31.12	3.11	1
13	25.73	29.70	36.56	2.95	39.51	3.95	1
14	15.09	36.90	40.39	2.96	43.35	4.34	2
15	42.13	19.80	32.52	3.00	35.53	3.55	1
16	16.05	27.40	36.50	2.98	39.49	3.95	1
17	44.89	16.40	44.18	3.04	47.23	4.72	2
18	27.00	28.50	42.15	2.91	45.05	4.51	2
19	41.05	26.00	48.31	2.93	51.24	5.12	2
20	26.58	42.60	43.20	2.97	46.17	4.62	2
21	49.17	32.00	60.76	2.89	63.65	6.37	3
22	41.10	28.50	90.85	2.97	93.82	9.38	4
23	48.45	25.80	48.57	2.98	51.55	5.16	2
24	16.71	34.00	38.79	3.08	41.86	4.19	2
25	4.03	27.80	37.67	3.03	40.70	4.07	2
26	15.09	26.40	70.82	2.98	73.81	7.38	4
27	11.92	30.20	72.97	3.09	76.05	7.61	4
28	17.72	32.60	74.88	3.02	77.90	7.79	4
29	23.72	19.90	62.47	3.01	65.48	6.55	3
30	32.27	11.50	64.26	3.26	67.52	6.75	3
31	31.91	19.00	65.85	3.02	68.87	6.89	3
32	32.55	19.20	40.98	3.03	44.01	4.40	2
33	28.04	18.60	66.61	3.09	69.71	6.97	3
34	31.16	22.00	90.70	3.03	93.74	9.37	4
35	26.53	29.50	37.17	2.91	40.08	4.01	2
36	26.26	18.80	60.36	3.00	63.36	6.34	3
37	33.84	34.20	60.30	2.93	63.23	6.32	3
38	33.05	27.00	102.67	2.93	105.60	10.56	4
39	26.91	21.30	99.84	2.96	102.80	10.28	4
40	69.08	38.50	110.34	2.86	113.21	11.32	4

NDVI Analysis

Normalized Difference Vegetation Index was analysed on the basis of Multispectral imagery from LandSAT 7/8 imagery.



The DN values of the derived analysis can be utilised to derive pixed by pixel classification of various land covers; viz. Water bodies, built areas, barren lands, sparse vegetation or forest, dense vegetation or agriculture land (healthy plantation).

	2006	2016	Change
Dense vege	219.16	531.80	312.64
Sparse	73.11	3.40	-69.71
Barren	539.16	281.73	-257.44
Built Area	131.95	196.82	64.87
Water	296.61	246.25	-50.36
Total	1260.00	1260.00	

Change Detection of land cover for Watershed area of Latur (2006-2016)

Land-cover change for 2006 - 2016 was derived to study the spatial deviations for water resource manaagement anomalies.

Conservation of Soil and Water Resources

Contour - Contour trenches trap rain water, enable it to percolate to underground aquifers and break the speed of fast moving water.

Gully control - Gully plugs help to control the flow of water, sedimentation and recharge ground water aquifers.

Stone bunds - Building stone and nala bunds across the slope arrest the flow of water and control erosion in areas where soil work is not possible.

Alley cropping is regarded as an effective erosion control measure but is not practiced on farm in Nigeria as this technology is very labor intensive and the benefits on soil fertility did not materialize as expected.

Conclusion and Inferences

The present study demonstrates the usefulness of remote sensing and GIS for morphometric analysis and prioritization of the sub-watersheds of Manjra watershed of Latur district. The results shows that the morphometric parameters derived from CartoDEM data provide good and satisfactory information about the catchment delineation and its characteristics. The values of drainage density for the present case ranges between 3.11 and 33.82 which are very high confirming that the study area is having a not flat terrain with light vegetative cover and low resistance with impermeable soil.