Sediment & Runoff Analysis of Milli Watershed Area in Zaheerabad

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ABSTRACT

Study was performed manual & computerized in delineation & drainage sampling which is useful for the sediment analysis & interrelation between connecting streams. The advanced application of remote sensing & GIS has been applied fir analyzing different parameters. Arc GIS 10.2 is used further preparation of different thematic maps for the study area located at Medak district by using satellite images& toposheets of scale 1:50000 are used for creating drainage maps, drainage density, elongation ratio, circulatory ratio etc. are calculated

Key words: GIS & RS, sediment, land use, land cover, ombrothermic graph, Contour Map, Zaheerabad, Medak

INTRODUCTION

Catchments and water sheds have been identified as planning units for administrative purpose to conserve precision resources. The concept of watershed management recognizes the inter-relationship between land-use, soil and water and the linkage between uplands and downstream areas. Keeping the ever increasing population, food security is needed and it is compulsory to develop water and land resources. The excessive exploitation of natural resources adversely affects the availability of these resources and causes serious threat to the existing eco-system.

Water-shed development programme not only protect and conserve the environment, but also contribute to lively hood .Integrated watershed concept using is easy, simple and affordable. Local technologies are used to mitigate droughts which occur frequently in some places. The basic object is to increase production and availability of food, fodder and fuel. Watershed management is an iterative process of integrated decision making regarding use and modification of land and water with in the water shed. The different parameters were taken like drainage, map, rainfall data, runoff which calculated for Grade's equation for sediment yield was applied. Through R.S meticulous information can be obtained by interpreting, analyzing and monitoring the spatial natural resources. The information combined with spatial data in G.I.S can prove to be a versatile tool giving exhaustive information of a particular area.

OBJECTIVES

- To Study and analyze the sediment yield.
- To calculate runoff in the catchment.
- To identify the main parameters which affects the sediment yield.

Since water becoming the limiting factor for the development more systematic approaches are needed to analyse, uses, depletion and productivity of water. An improved knowledge of the land surface hydrologic states and fluxes, it is urgently needed in many hydrologic studies and water resources management. At present many tools can help for water budget analysis like GIS and RS techniques.

The study area lies between $17^0\,31^{'}30^{''}$ and $17^0\,39'$ North latitude area of 65.82 Km^2, conventional surveys and satellite image data interpretation techniques and GIS technology is used not only to increase results accuracy, but also to reduce the bias on single theme. The satellite data will give the

outline features which are useful to indicate ground water presence. Geomorphology, Geology, Structure and climate are the controlling factors for ground water occurrence, movement, and storage.
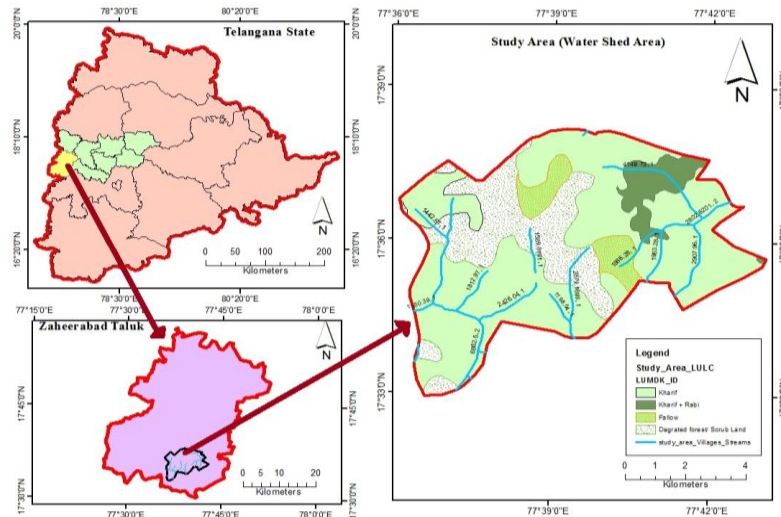

Study Area Figure

These features are not observed with naked eye but easily find through remote sensing .GIS can be used for storing hydrologic data as well as their spatial location.

The study area is situated at a distance of 120 km from Hyderabad the capital of Telangana. The Study area includes 7 villages in Zaheerabad of Medak district .The soil cover is well developed and it contains red Color. Normal rainfall occur in June to September and its average rainfall is 675.8 mm but the rainfall reduced is 438.6 mm with a deficit of 35% .In Medak district there are total 46 mandals out of which 43 mandals fall under deficit. The minimum temperature is recorded in the month of December as $11^{o}C$ and maximum temperature occurs in the month of May as $44^{o}C$

Southwest monsoon create rainfall in the month of June. Cropping pattern is two seasons Kharif and Rabi.

MATERIAL AND METHOD

DEM is generated for the satellite data, toposheets, slope map, rainfall data, temperature, etc. The drainage network was analyzed by Garde's formula and digitization was done with GIS.ARC GIS 10.2 was used for generating different layers.
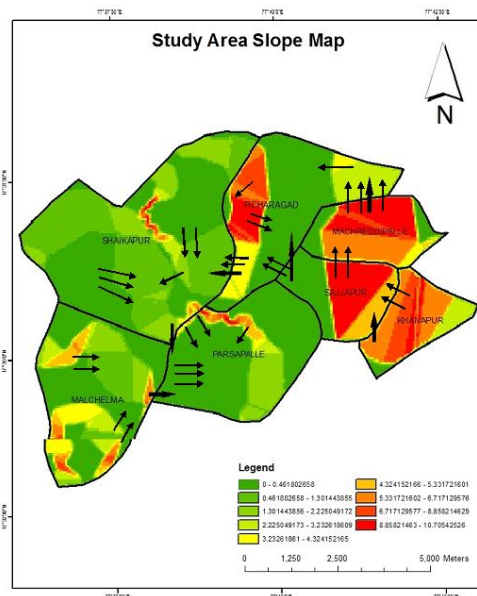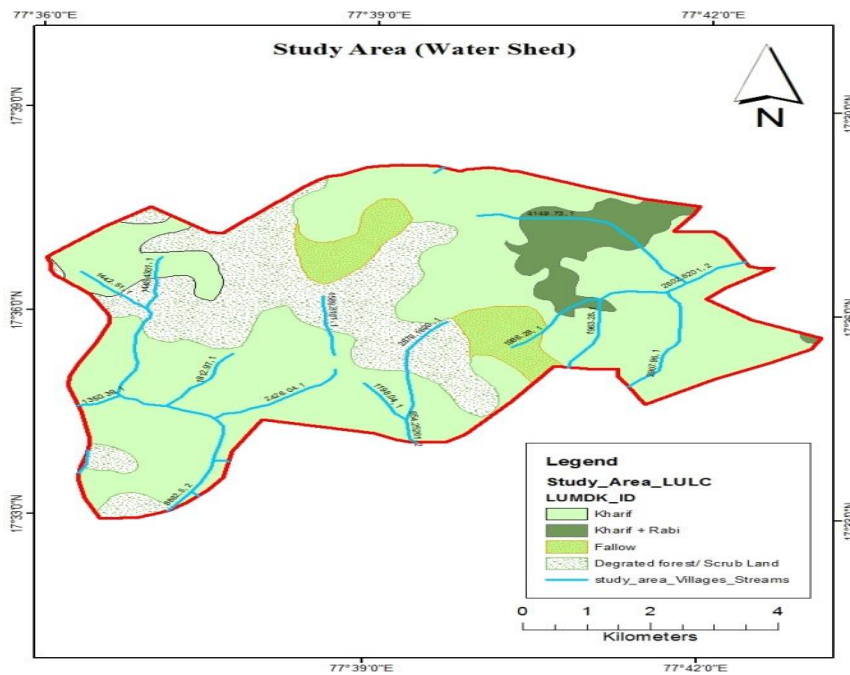

Slope Map

Linear aspects	Aerial aspect
Stream order	Drainage density
Stream Length	
Bifurcation ratio	

Drainage density $D_d = \frac{L_u}{A} = 0.519$ (Horton)

	DRAINAGE TEXTURE ANALYSIS		
01	Stream Frequency	Fs	0.27
02	Drainage Density	Dd	0.54

Land use Land Cover Figure

Temperature

Year	Temperature		
	Max. Temp ^{0}C	Min. Temp ^{0}C	Average
2001	36.2	13.1	24.65
2002	37	14.3	25.65
2003	36	13.4	24.7
2004	38	12.5	25.25
2005	37	13.1	25.05
2006	35	14.6	24.8
2007	37	14.6	25.8
2008	34	14.4	24.2
2009	37	14.4	25.7
2010	38	13.5	25.75

$$FC = \frac{0.2 F_1 + 0.2 F_2 + 0.6 F_3 + 0.8 F_4 + F_5}{F_1 + F_2 + F_3 + F_4 + F_5}$$

FC = Vegetative cover

F_1- Reserve and protected forest area = 0

F_2 - Unclassified Forest area = 44.61

F_3 – Cultivated Area = 4.19

F_4 - Grass and pasture land = 0

F_5 - Waste Land = 15.24

FC = 0.389

For India Vegetation Cover factor 0.28-1.0

*Zaheerabad Rain gauge 55E2FD32

Rainfall

MONTHS	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
June	170	136.8	144.8	158.2	159	159	160	147	150	148	142	138.2	146
July	98.3	89.6	160.2	171.6	170	172	170	170	172	177	176	229.2	175
August	170.7	205.4	329.6	348	350	350	348	320	300	310	380	211.1	315
September	204	108	73.8	82	80	80	80	97	80	110	111	165.2	109
October	229	92.4	54	61	58	57	60	80	90	70	31	86.6	65
November	0	0	0	0	0	0	0	0	0	0	0	19.3	0
December	0	0	0	0	0	0	0	0	0	0	0	4.8	0
January	0	0	0	11.6	12	10	20	30	19	20	21	6.5	19
February	0	0	6	0	0	0	0	0	0	0	0	4.9	0
March	0	0	9.4	2	2	3	0	0	5	4	0	9.5	3
April	4	0	11.2	25.2	27	27	28	29	27	25	22	18.8	23
May	0	19	2	8	9	10	9	14	12	0	0	28	0
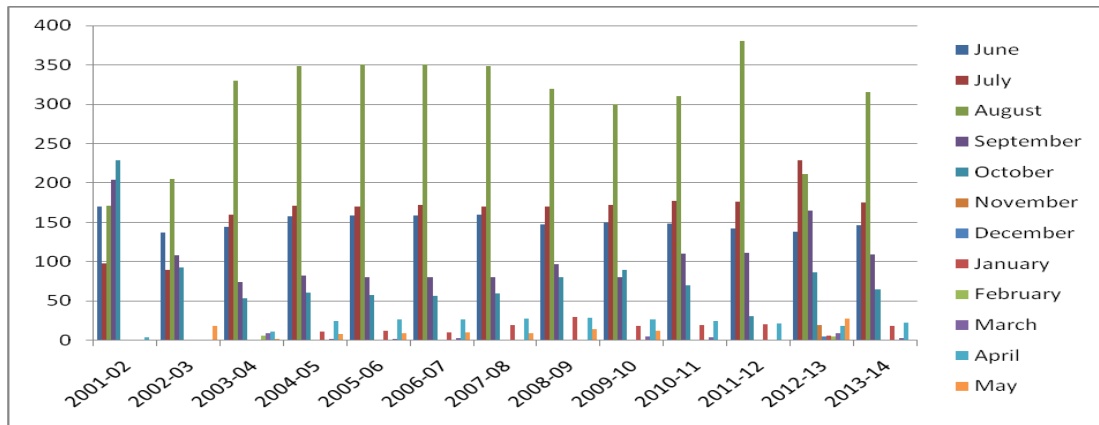
YEAR	PRE MONSOON	MONSOON	POST MONSOON
2001-02	4	623	229
2002-03	19	584.8	82.4
2003-04	22.6	564.4	127.8
2004-05	35.2	759.8	61
2005-06	38	759	58
2006-07	40	761	57
2007-08	37	758	60
2008-09	43	734	80
2009-10	44	702	90
2010-11	29	745	70
2011-12	22	747	31
2012-13	24	742	82
2013-14	26	745	65
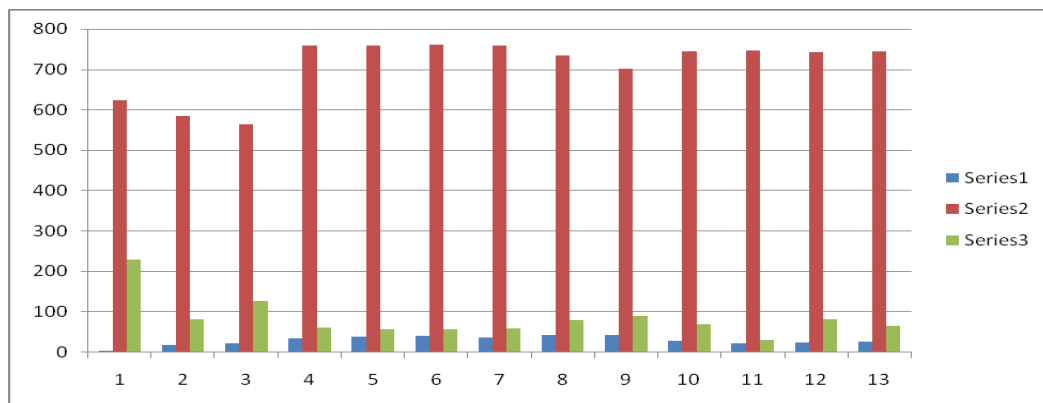
Runoff $Q = \dfrac{FC^{0.49} X (P_m - 0.5 T_m)^{1.59}}{26.5}$ Garde's Equation

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$Q = 25.5$ Mm^3

Sediment Yield

Sediment yield is calculated for 10 years both for monsoon and yearly bases. For each year sediment yield was calculated by taking average of six years rainfall data and previous data of rainfall during monsoon season. Factors effecting erosion and sediment yield can be grouped in to two types. On representing natural condition including climate, geology, morphology, soil type, vegetation, etc., and second type is human activity. Natural factors are commonly viewed as influencing the basic occurrence and development of erosion. Amount of erosion depends as rainfall depth and intensity. Surface in major morphological element, erosion rate is increases 2-3 times when slope increases from 5^0-25^0.
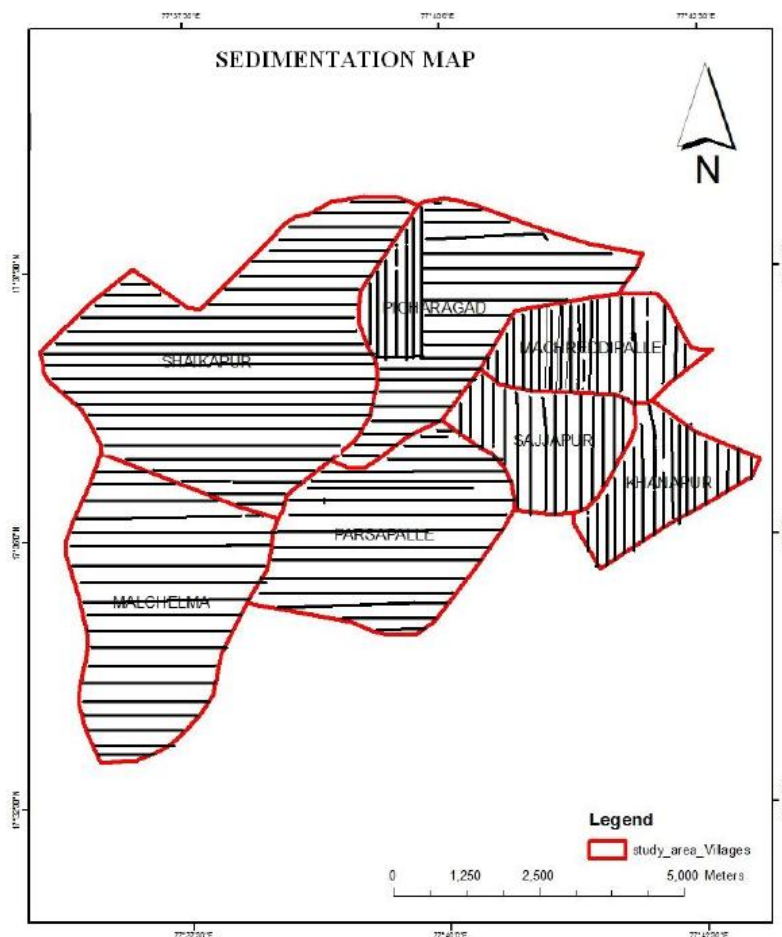
$V_S = 1.182 \times 10^{-6} A^{1.03} P^{1.29} Q^{0.29} S^{0.08} D_d^{0.4} F_c^{2.42}$ Garde's Equation

$= 4.5 \times 10^{-4}$

S- Average Watershed slope

Slope should be less than 1% to 15%

My study area slope is $\frac{650-600}{600}\% = 8.3\%$

Note: *vertical line indicates maximum sedimentation, Horizontal lines indicates minimum sedimentation*

CONCLUSIONS

It was found that heavy rainfall is recorded in the year 2011-12 as 380mm in the month of august. Maximum sediment is estimated as 4.5×10^{-4}. The discharge estimated as 25.5 Mm^3.

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