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Analysis of Rainfall Erosivityin upper Ghod Basin using GIS Techniques

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Abstract

The most vulnerable time for erosion is the early part of the wet season when the rainfall is high but the vegetation has not grown sufficiently to protect the soil. Thus the erosion peak precedes the rainfall peak. The Ghod river source part covers high altitude including Ahupe, Ttirpad, Asane, Amboli, Aghane, MalinMidagulwadi,Amehatviseetc villages cover thick vegetation so rainfall erosivity has high. The Kukadi, Mina, Gohe, Ghoherinadi and Bubra are the tributary of the Ghod River. The rainfall erosivity is highest, recorded as 491 in source of Ghod basin and lowest rainfall erosivity is 247 in confluence of Ghod and Kukadiriver.

Keyword : *Rainfall erosivity , GIS*

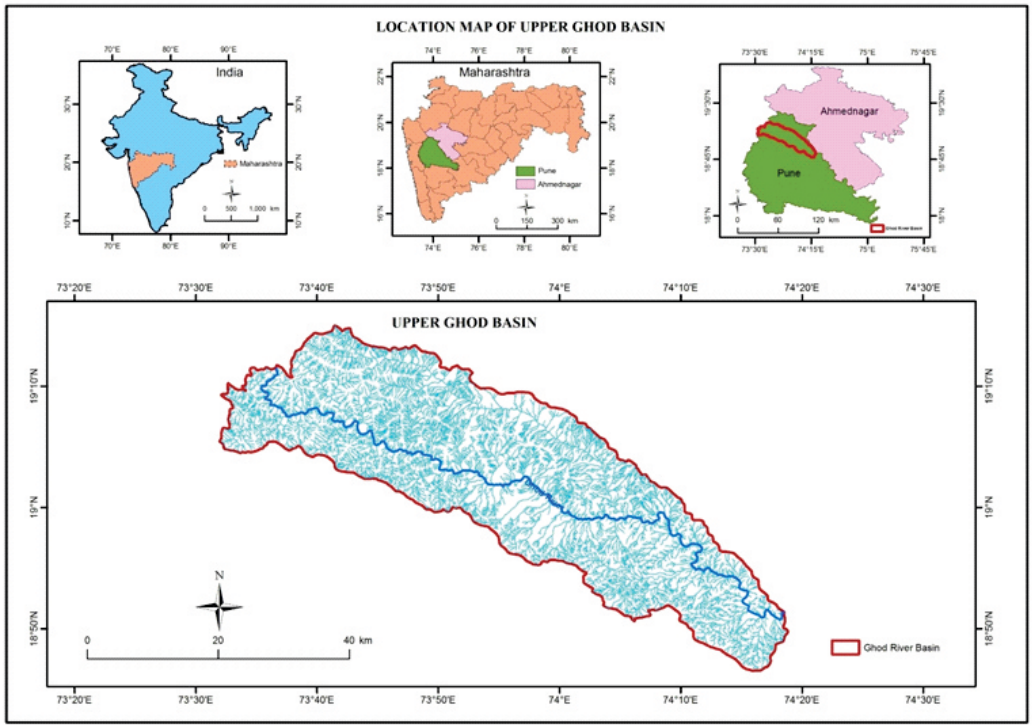
Introduction

Rainfall erosion the interaction between rain and soil have been responsible for creating gullies and rendering millions of hectares of productive land into unproductive wastelands. Ravines are glaring examples of such type of erosion. The concept of rainfall erosivity was introduced by Wischmeier and Smith in 1958 to encapsulate the climatic influence on soil erosion in such a way that, when other variables are held constant, rate of soil loss is directly proportional to the level of rainfall erosivity.

Potential ability of rain to cause erosion is known as erosivity (R – factor) which is a function of the physical characteristics of rainfall. Raindrops while falling acquire kinetic energy and on impact, the kinetic energy is used up in detaching the soil particles. Energy is required to break the soil aggregates, splashing them and subsequently carrying them with runoff. Surfacerunoff as it flows down the slope, gains kinetic energy, which is responsible for the scouring action on the land surfaces. Several researchers have worked on the rainfall erosivity and methods of computation of erosivity. Hussein M. H. (1986) derived rainfall erosivity values similar to those in the USLE from average monthly and yearly rainfall available for 49 stations in Iraq for the period from 1941 to 1980. Erosion values derived have been used to predict sheet and rill erosion with the USLE, specifically to assess erosion hazards on farm to design proper erosion control measures.

Study Area

The study area located in part of Ambegoan, Junnar, Shirur tehsils of Pune district, Maharashtra. The Ghod River is a tributary of Bhimariver. The Ghod river originated on Ahupe Village, the eastern slope of the western Ghat. Its height is1105 meters an above sea level. It flows in a North West to Southeast direction for approximately 200 km. before the confluence of Bhimariver. The geographical location of the Study area can be expressed from 18o 46' 36" to 19o 15' 08"N latitude and 73o 31'58" to 74o 18' 52"logitude. The present study based on survey of India toposheet no including 47I/4, 47F/13, 47E/16, 47E/12, 47J/1 and 47J/5 at 1: 50000 scale map.



Methodology

Thiessen Polygon

- A point map of Rainfall was created by selecting coordinate system.
- Location points has added in the above map from six stations in the study area using the X and Y coordinates obtained from the GPS survey.
- Thiessen Polygon map was created by Nearest Point method
- Thiessen Polygon Rainfall map was delineated for basin area map of the basin.

The Average Rainfall

	Rainfall Data				
Sr. No	**Station**	**Year**	**Average Rainfall (mm)**	**Latitude**	**Longitude**
1	Wadaj Dam	2001-2014	766.78	° 9' 3"	
2	Dimbe Dam	2001-2014	1131.8	19° 42' 5"	73° 44' 5"
3	Narayangoan	2001-2014	734	19° 7' 2"	73° 58' 2"
4	Shiroli	2001-2014	550.2	19° 3' 3"	74° 7' 4"
5	Javala	2001-2014	487.8	18° 59' 16"	74° 2' 4"
6	Shirur	2001-2014	547.3	18° 51' 4"	74° 19' 0"

Source- Hydrological Department, Pune.

The daily rainfall data of six station was collected from 2001 to 2014 in study area. Then daily rainfall data computed to yearly average. The unique value of every year average rainfall was got from the year 2001 to 2014. Then calculate 14th years average rainfall value of Wadaj Dam, Dimbe dam, Narayangoan, Shiroli, Javala, and Shirur.

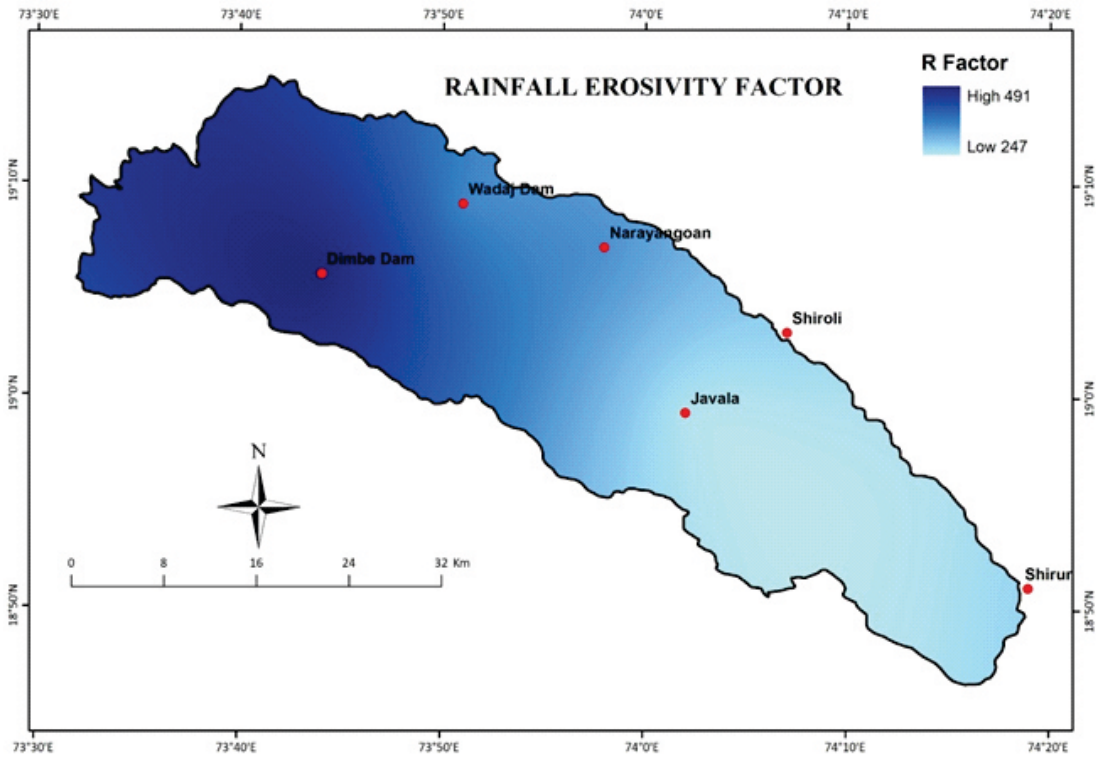
5.4.1 Result and Discussion of R factor

Hydrologists accept that most erosion takes place during events of moderate frequency and magnitude simply because extreme or catastrophic events are too infrequent to contribute appreciably to the quantity of the soil eroded over a long period of time, the dramatic effects of an extreme event. The most vulnerable time for erosion is the early part of the wet season when the rainfall is high but the vegetation has not grown sufficiently to protect the soil. Thus the erosion peak precedes the rainfall peak. The period between plugging and the growth of the crop beyond the seedling stage contains an erosion risk if it coincides with heavy rainfall.

The equations so derived were as follow

$$y = 79 + 0.363 \text{ x (rainfall in mm)}$$

Where, y = Average annual erosion index



In the study area variation in annual mean rainfall of stations in the source region (DimbeWadaj and Narayangoan) and of stations in the downstream region (Javala and Shiroli) could be the result of orientation of ranges. Decreasing rainfall amount from source to mouth is attributed to the rain shadow effect of the Western Ghats on their eastward slopes. It is, therefore, natural that during the given year, maximum and minimum erosivity varies widely in space. Thus in a hilly basin in a monsoon climate, the topographic factors like distance from the water-divide line, slope, aspect and altitude influence the rainfall characteristics and in turn, erosivity potential.

Conclusion

The rainfall erosivity is highest, recorded as 491 in source of Ghod basin and lowest rainfall erosivity is 247 in confluence of kukadi and Ghod river and middle of basin of god basin. The decreasing rainfall amount from source region to mouth of river is attributed to the rain shadow effect of the western ghats on their eastward slopes.

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