

**GIS-BASED ASSESSMENT OF PHYSIOGRAPHIC AND
HYDROLOGICAL PARAMETERS OF WAINGANGA SUB BASIN,
MAHARASHTRA, INDIA**

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ABSTRACT

Water is not only for sustains of life but also determines the quality of life. Assessing water quality is important as quantity in water resources planning and management. It may be observed that the existence of human being a lot of serious problem to disturbance of quality and quantity of water. There are several reasons for scarcity of water and most important things to the increasing population and changing environment condition in the local as well as world level. For sustainable development requirement to that fresh water is indispensable for human survival. Water is being transferred to irrigation and urban industrial uses, putting additional stress on the performance of the irrigation sector. Keeping in mind the scarcity of water resources to cater to the multi various needs of the growing population along the Wainganga River with the vagaries of monsoon precipitation and dearth for quality of water. The purpose of the present research work is to describe the physical condition in Wainganga drainage basin as a system unit resulting from the interaction between landuse & landcover and topography, which is an impact of socio economic condition and surrounding area or region.

Keywords – Physiography, Wainganga, Watershed, river basin etc.

Introduction

Various relief, climatic, watershed and hydrological phenomena is correlated with the physiographic characteristics of a drainage basin such as size, shape, slope of the drainage area, drainage density, size and length of the

contributories, etc. (Kudnar N. S., 2020; Kudnar N.S., 2015, Bhagat R.S. 2015). Application of remote sensing provides a reliable source for the preparation of various thematic layers for morphometric analysis. The digital elevation data is used for generating the

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elevation model of a landscape to any extent. The resolution of the image may vary with respect to the satellite sensors. The processed DEM is used for generating the stream network and other supporting layers (Horton, 1932, 1945; Kale Vishwas S., 1990, 2002; Kudnar, N.S., Rajasekhar, M, 2019). Geographical information systems (GIS) have been used for assessing various basin parameters, providing flexible environment and powerful tool for determination, interpretation and analysis of spatial information related to river basins. Geology, relief and climate are the primary determinants of a running water ecosystem functioning at the basin scale (Kudnar, N.S., 2015; Kudnar, N. S., 2018; Bhagat R.S. 2020).

Scope of the research –

The developing countries are characterized by lack of infrastructure amenities, drainage, water supply, sanitation, transportation and social services etc. There are many examples in the villages, cities and mega cities which are characterized by aggravation of this problem due to occurrence of some natural events and hazards. The vulnerability is high in rural and urban center due to disaster. Recently, Wainganga is one of the major rivers flowing in that area. Like as a drought when a summer season. The demand has increased in the quantity and quality of infrastructure facilities and services. The ignorance of guided planning, fast and haphazard development may emerge this result in many problems. It is essential to find out physiographic situation in given condition. This problem is more acute in the areas under strong monsoon regime where 80 percent of the total rainfall is received in just three months.

Objectives-

The main aims of proposed research paper are:

1. To understand physiographic condition of the river i.e., Physiography and relief, climate, vegetation etc.
2. To study spatial and temporal changes of meteorological condition in the Wainganga river basin.
3. To prepare drainage map of Wainganga Watershed region.

Study Area-

The Wainganga River rises at El 640.0 m in the Seoni District of Madhya Pradesh from the Western slopes of Maikala Ranges which is continuation of the Satpura Ranges in Central India. The Wainganga River receives numerous tributaries on either 8 bank and drains the western, central and eastern regions of the Chandrapur, Gadchiroli, Bhandara, Gondia and Nagpur districts of Maharashtra. (Kudnar N.S., 2012 ; Bisen D.K and Kudnar N.S.,2019).

(Latitude extension- $19^{\circ}30'N$ to $22^{\circ}30' N$ & Longitude extension- $79^{\circ}00'E$ to $80^{\circ}30' E$)

The river in its initial reaches flow westwards and thereafter southwards in M.P. State and continues to flow Southwards in Maharashtra State. It is joined by the Wardha River at a place called Gundapet flowing from the west, draining the major portion of the Maharashtra Plateau. Thereafter the river is known as Pranhita River. The climate of the sub-basin is characterized by hot summer from March to May with rainy season from June to September



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although the area has some rains in post monsoon season also. The upper catchment area lies in the high rainfall range of 2000-4000 mm. The Pranhita River joins the Godavari River on the left bank which drains the Eastern Coast in Andhra Pradesh and flows out to the Bay of Bengal (Kudnar N.S., 2016, Bhagat R.S. 2015).

Hypotheses-

Identifying the mountain, plateau and plain region and its affect on adjoining village or settlement.

Research Methodology –

The data required for the present study comprises of topographical maps, satellite images, and utility services data details. For the present studies of drainage map and physiographical region data have obtained from one inch topographic map of Survey of India (1:63,360 or 1:2, 50,000). They are toposheet No. 55K, 55O, 55P, 56M, 64C, 64D, 65A. Includes sorting of data, digitization of various layers, preparation of maps, statistical analysis and other GIS/RS techniques, like Georeferencing, Data attachment. The various maps were formed using ArcGIS and ERDAS imagine software (Horton, R.E., 1932 & 1945; Kudnar N.S. 2015).

Analysis and Interpretation –

1. Physiography –

Wainganga basin is enclosed by higher lands from the three sides which carve out a distinct regional entity separated from the hilly Satpura on the north, the Maharashtra Plateau on the west and Chhattisgarh plain on the east.

Wainganga river basin forms a part of Wardha-Wainganga basin which further constitutes the Satpura ranges and Vidarbha Plain.

Mountain Region [Above 280m]

The Wainganga river basin total calculated Mountain Region is in Maharashtra 15.02 % and it is expanded in 3956.90 area sq.km. The south part of Mandala district, Chhindwara and Seoni District it is occupies the south eastern portion of the Satpura Range and the upper valley of the Wainganga River. Tamia hills are around 45 km from Chhindwara Mahadeo and Chaura Pahad in the background Tamia is a pleasant place as it is in hilly range at 1,148 m (3,765 feet) height above Mean Sea Level. The west of Khamla is highest point 1137 m an msl in the entire country and forms the part of Gwagarh hills. The Vindhyan Range up to Katangi, Kaimur Range, northern and western portions include the plateaus of Lakhnadon, the eastern section consists of the watershed and elevated basin of the Wainganga and in the south-west is a narrow strip of rocky land known as Dongartal. The plateaus of Seoni and Lakhnadon vary in height from 1,800 to 2,000 ft. They are well cultivated and clear of jungle. Their temperature is always moderate and healthy. The highest points in the hills of Lanji 760 m, Tepagarh hill, about 790 m and Bhainsaghat range, about 910 m above the sea. (Bhagat Ravindra, 2019; Bhagat Ravindra and Bisen Devendra, 2015; Kudnar N.S. 2015; Bhagat, V. S., 2012; Bisen, D.K.; Kudnar, N.S., 2013).

Plateau Region [196 to 280m]

The Wainganga river basin total calculated plateau region is in 42.36 %. It is



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expanded area in 11,159.60 sq.km. Physiographically the plateau region has been divided broadly into two main geomorphic units. (Bhagat Ravindra, 2019)

Satpura Plateau

The hill ranges lying in the northern part of the study area district belong to the Mahadeo hill ranges of the Satpura mountains stretching. The lofty plateau, situated the Raigarh Bichhia tract, comprises of irregular ranges of hills which are broken into numerous valleys, and which generally are running from east to west.

Nagpur Plateau

Large basaltic rock formation exists throughout Nagpur plateau region. The districts of Gondia, Bhandara, Gadchiroli, and Nagpur fall in earthquake zone which is considered safest in India. The Wainganga and its major tributaries like Bagh, Bawanthadi occupies most of the area of the district chiefly in the north-western side. Low hills are found at few

places within the district. These hills spread in a group or in isolation at varying heights. Maikal (Darekasa) hill lies at eastern end of the district on the border of Maharashtra and Chhattisgarh. The elevation of these hills is higher than the western hills. Towards the west of Darekasa hill, Ambagad hill is situated (Kudnar N.S., 2017). This is an extreme outlier of the Satpura ranges running with W-N and E-SE trend, separating Valley of Bawanthadi River with Wainganga. The average elevation of Ambagad hill is 200 meter with a width of 3 km and overall length of 30 km (Kudnar, N.S., Rajasekhar, M, 2019, Kudnar N.S., 2015) Navegaon and Pratapgarh hills rise to the highest elevation of the region. Chichgad hills situated at southern part of the district represent a higher elevation than Palasgaon hills. North-western part of the district is occupied by Wainganga and its tributaries Bagh and Chulband rivers (Bhagat, Ravindra and Bisen Devendra, 2015; Kudnar N.S. 2015; Bhagat, V. S., 2012; Bisen, D.K.; Kudnar, N.S., 2013).



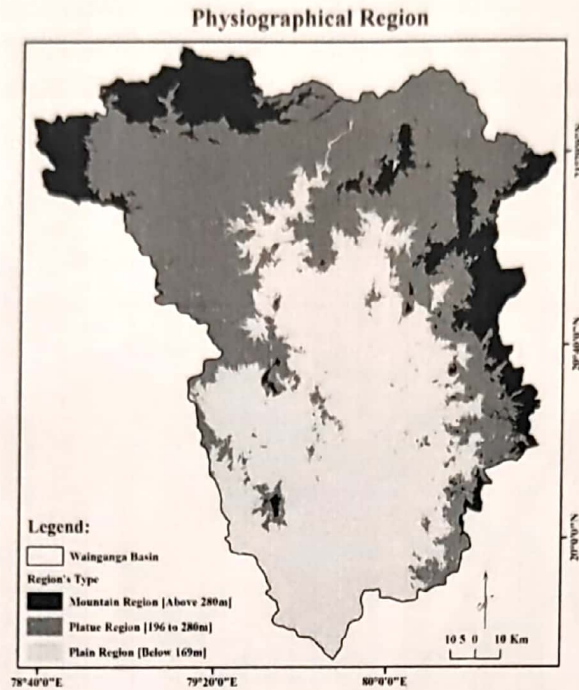
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Map No. 1 – Physiographical Region



Plain Region [Below 196m]

The Wainganga river basin total calculated Plain region is in 42.62% and expanded in 11,229.92 area sq.km. The southern lowlands, a slightly undulating plain, comparatively well cultivated and drained by the Wainganga River and its tributaries. A number of Sub Rivers and tributaries in piedmont plateau region developed narrow cultivated land. Central and southern part of the study region is a very large and important in the Wainganga river basin. Here soil depth is very deep and this soil region is fertile. Bhandara, Chandrapur, Gondia districts are located in this area. In north direction the natural boundary is formed by Kanhan river basin. The Kanhan narrow basin is irrigated area having high productivity. In this valley Nagpur district is located. (Kudnar N.S.,2015,

2018, 2019, Kudnar, N.S., Rajasekhar, M, 2019
2. Bhagat, Ravindra and Bisen Devendra (2016).

2. Drainage

The Wainganga River originates at Partappur (21056'32.05"N, 79033'29.18"E) in Seoni District of Madhya Pradesh from the foot of Ambagad range, an outlier of the Satpura Mountains, at an altitude of 1350 m above MSL. It meanders northwards, then northwest and turns southward after the Sanjay Sarovar Dam (80 km from origin) at Bhingarh (22.37 N 79.66 E) and then rushes through Seoni and Balaghat regions and enters the State of Maharashtra. In the upstream regions, the river sometimes becomes wide and shallow at places, while at some it becomes narrow and deep. After it enters the comparatively plain



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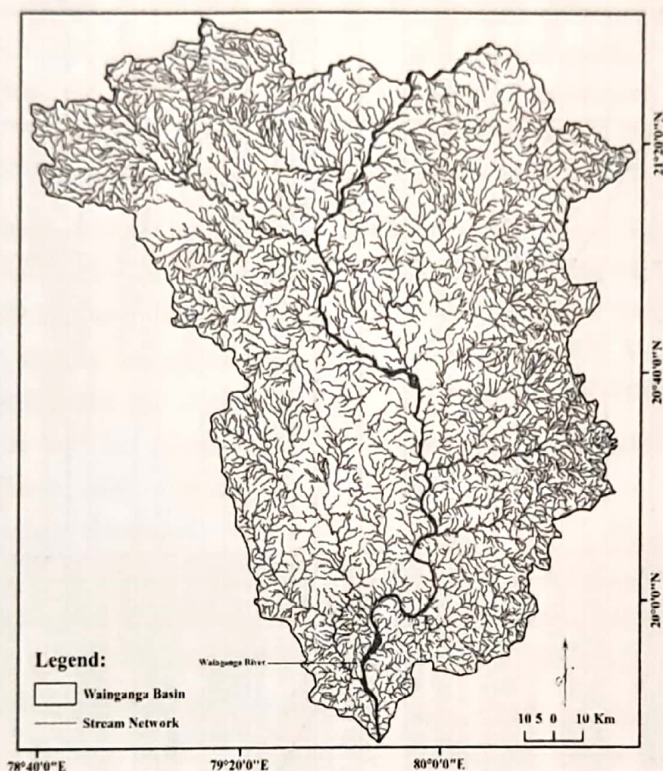


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and slightly undulating lands of Maharashtra, and flows through Gondia, Bhandara, Nagpur, Chandrapur and Gadchiroli. It meanders, splits and reunites at several places creating an almost braided structure. The width of the

Wainganga River varies from 100 m to almost 1.5 km near. Its confluence with Wardha near Chaprala elevates 140 m above MSL in Gadchiroli distric (Kudnar N.S.,2015, 2018, 2019, Kudnar, N.S., Rajasekhar, M, 2019)

Map No. 2 – Drainage Map
Drainage Map



Source:
1) Survey of India (SOI) Toposheets Scale 1:250000

The total length of the Wainganga River is 638.91 km, of which 270.2 km lie in Madhya Pradesh. It then travels 32 km along the border between Madhya Pradesh and Maharashtra and the rest of 368.7 km lie in Maharashtra. The Wainganga has 24 tributaries. Twelve of them lie on its left bank, and other 12 are on the right bank. Of these rivers such as Halon, Sagar, Hiri and Nahar join the Wainganga in Madhya Pradesh across Seoni and Balaghat districts. However Bagh (at

Birsola, 283m above MSL), Chandan and Bawanthadi (at Bapera, 275 m above MSL) join the Wainganga on the borders of Madhya Pradesh and Maharashtra. And finally 17 rivers, namely, Sur, Gaimukh (Nala), Ambagad (Nala), Bodalkasa, Chulband, Maru, Pohar (Nala), Kanhan, Gadhvi, Khobragadi, Andhari, Kathani, Mandoli (Nala), Satti/Wainlochana (Nala), Dina, Ambi, and Mul join the Wainganga River in Maharashtra (Kudnar N.S. 2015).



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The rivers on the left bank of the Wainganga lie in the high rainfall zone within the basin and are major contributors to the yield of the Wainganga Rive (Kudnar N.S. 2019). Chulband, the longest tributary of Wainganga traversing 109.15 km, flows through Gondia and Bhandara districts. The rivers Gadhvi (69.18 km) and Khobragadi (76.94 km) flow through the Gadchiroli district, and traverse (Kudnar N.S., 2015, 2018, 2019, Kudnar, N.S., Rajasekhar, M, 2019).

Conclusion

The Wainganga river basin total calculated Plain region is in 42.62% and it is expanded in 11,229.92 area sq.km. The southern lowlands, a slightly undulating plain, comparatively well cultivated and drained by the Wainganga River and its tributaries. A number of Sub River and Tributary in piedmont plateau region developed Narrow cultivated land. The main rivers along with their tributaries drain the area and are seasonal rivers. While passing through the plains they flow in meanders and at times form ox-bow lakes.

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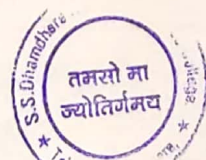
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