APPLICATION OF GEO-SPATIAL TECHNOLOGY FOR ANALYSING IMPACT OF ANTHROPOGENIC IMPACT ON BHIMA RIVER PUNE DISTRICT

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ABSTRACT

This study aims to analyse the impact of unregulated and unplanned development on river Bhima in Pune district. Geospatial tool in the form of Toposheet and Satellite imagery was used for the present investigation. Total 8 human activities on the basis of nature and role in polluting river of study area are identified. The Base map was prepared through Arc GIS Software (16.2 Version). Metadata of all parameters was taken from published and unpublished reports and gazetteers. Layers of anthropogenic forces was prepared and exposed over the base map. These maps presented issues and consequences of haphazard human development in the study region. Land use and land cover of the study region proliferated to rise in build up and agricultural area. Aggregation of population in towns and cities increases density especially around the bank of Bhima and their tributary rivers. It is evident that the release of partially and untreated sewage in riverine ecosystem within study region was greater and the major contributor for Bhima river pollution. Unprecedented growth of industries thrive additional contaminants in river Bhima. It can be concluded that undue urbanisation and industrialisation are the key agents for polluting Bhima and tributary rivers.

Key words- Bhima River, river pollution, Pune district, Geospatial, urbanisation.

INTRODUCTION

In India, rivers are seen in religious terms and are a part of prayers and ritual worship. About 14 major rivers, 55 minor rivers and more than 100 small rivers are found in India (Priyadarshini, N., 2003). In India out of 445 rivers monitored by the Central Pollution Control Board (CPCB) within 29 States and 6 Union Territories, almost 275 rivers are ranked as ‘polluted’. The number of polluted rivers rose from 121 (2009) to 275 (2015) (Lapointe, B.E., et al., 2015). Like to other river Bhima is also categories as severely polluted. Therefore, present article reveals salient features of Bhima river pollution. The river Bhima is an important streamline in the southwest of India and tributary of the Krishna River.

STUDY AREA

The study area covers Bhima river from its origin to Ujjani reservoir which lies in Pune district of Maharashtra in India. Bhima River originated at 19°04’2 033 N 073°33’003 E near the Bhimashankar temple in Bhimashankar hills on Western Ghats. This river basin receives water from the south west monsoonal rainfall. Bhima river basin annually receives heavy rainfall up to 300 mm to 2000mm/year (Pune District Gazette, 2014). The river Bhima sloping west (450m) to east (100m) has varied physiographic and agro climate. Geographical area of Upper Bhima Basin was 45,335 Km$^2$ which extended to Ambegaon, Junner, Khed (Rajgurunagar), Haveli, Maval, Daund, Mulshi, Indapur, Shrigonda, Karjat from Pune and Ahmednagar districts. Ujjani has the terminal reservoirs on the river Bhima of Upper Bhima Basin region located at the nook of Pune district. Ujjani reservoir spread over 1,472 Km$^2$ and irrigates 259500 hectares of land. Gross and live storage capacity of this reservoir is 3,320 m$^3$ and 1,517m$^3$ respectively. Ujjani reservoir was the source of water for more than 300 villages and 13 towns. Length of Bhima river from its origin to Ujjani reservoir is 284 Km.
Tributary rivers of Bhima

The Bhima River originates at Bhimashankar near Karjat on the western side of the Western Ghats at an altitude of 945 m above sea level. Bhima River flows in the southeast direction for 745 kilo meters covering the states of Maharashtra, Karnataka and Telangana. In Maharashtra, Bhima River drains an area of 48,853 km² and has a length of 451 km. It joins Krishna on the Karnataka – Andhra Pradesh border near Kudlu in Raichur District. The major tributaries of Bhima River around Pune are Kundali, Ghod, Bhama, Indrayani, Mula, Mutha and Pawana.

Pollution status of Bhima river

River Bhima since its origin upto Ujjani reservoir have distress with heavy load of pollutants. Many scientific reports, articles, review notes and newspaper clippings validate the issues and consequences of Bhima river pollution. Kodarkar, et al. (2008) extensively studied Upper Bhima Basin up to Ujjani reservoir and illustrates the extent of phenomenal urbanisation in the Upper Bhima basin which not just raises stress over the available water in the tributary rivers and their reservoir but also is a noted concern of pollution. Disproportionate ratio of waste water generation and their treatments causes severe problem of water pollution in the tributaries, which then transfers it into river Bhima and finally at Ujjani reservoir. Water Quality Assessment Report (2016) of United Nation’s Environmental Programme (UNEP) noted the increasing pollution in Bhima river. Therefore, these problems seek to find the role of human induced activities for the pollution of Bhima River.

MATERIALS AND METHODS

Toposheet of study area findings at 47F, 47I, 47N and 47O with scale 1:50000 for Pune district was collected from GSI, Pune. Those topo-sheets were scanned with the help of computer and scanner. These were joined together through Arc-GIS Software 16.2 Version. Study area’s (i.e. Upper Bhima Basin) base map was prepared through Arc-GIS software and was further used for drawing various maps. Satellite image (Scale 1:50000) is taken from the Indian Space Research Organisation’s National Remote Sensing Centre (ISRO-NRSC, Hyderabad. Standardization of map was done with correct latitude and longitude. Different layers of maps were exposed over the base map and metadata to find the various geomorphological features within study region.

For designing various maps,
RESULTS AND DISCUSSION

The Bhima river origin from the Bhima-Shankar and it ends in Ujani reservoir of the district Pune was the locale of the present study. There are 14 talukas (administrative blocks) in the Pune district. However, Bhima and tributary rivers originate and flow among ten (10) talukas, which were selected for inquiry of the varied social, geographical and environmental parameters which contributed to the pollution of the streams i.e. rivers. Through cartographic maps following components are discussed in the content with reference to the Bhima River pollution.

Population Density

According to the 2011 census, the total population of the study area is 82,93,584; out of which 57,01,654 (67.75%) stayed in the urban area while 25,97,930 (32.25%) resided in rural areas. This shows the rise in the density of people in the cities like Pune and Pimpri Chichwad. Map No. 4.1 shows the Population Density and classification of towns in the study region.

Land use and land cover

Agriculture is the major source of income especially in rural region of study area. Land for the agricultural usages in the study area is 52,003 hectare; cultural waste land is 25,617 hectare; permanent pasture and other grazing
land is 36,490 hectare and land under miscellaneous tree crop is 670 hectare. Almost 32% of the land in the study area is under cultivation. Haveli tahsil and Pune city, the areas under residential and non agricultural use has rapidly increased in one and a half decade. Along with this, it is also seen that, built up area also rose rapidly in the Khed, Shirur and Maval tahsil. The demands of increasing population for residential purposes indicate the increasing space of urbanization within Bhima and tributary rivers. Therefore, release of waste water from anthropogenic activities though streams causes pollution of Bhima River.

**Industrial estate**

There are 5 major industrial estates in the study region which is covered over 4,165.92 hectare of area. These industrial estates have Information Technology (IT) parks, Maharashtra Industrial Development Corporation (MIDC), Floriculture Park and Automobile Hubs. The Five Star MIDC’s are located at Talegaon, Chakan, Rajgurunagar, Ranjangaon, Hinjawadi, Pimpri-Chinchwad, Kurkumbh and Indapur. It is interesting to see all of those MIDC’s are situated around the bank of tributary rivers in Bhima River. A total of 3,570 industries are registered in the study region. Out of these, 279 are large industries, 298 are small industries while 4,193 are small scale industries. Pollution of the water streams and rivers by the industries through the release of treated, partially treated and untreated effluents is one of the major sources of pollution within the study region. This direct point source of pollution contributes to the pollution of the Bhima River.

**Sugar industry**

It was pertinent to state that, majority of sugar industries are established in the eastern side of the study region. Sugarcane is a dominant cash crop on the bank of Bhima River and its tributary rivers. Shirur, Daund, Indapur and eastern part of Khen and Ambegaon tahsil have more area under cultivation. Sugar factories generate effluent,
molasses, spent wash and slurry. The distillation units generate spent wash and slurry which contains high amount of inorganic pollutants. However, from the study region, earlier research finding supported the notion the role of sugar factories in releasing the pollutant in Bhima and tributary rivers.

**Generation of domestic sewage**

The cities and towns constituted in the study locale daily generate 720 million liters of sewage. Some of the civic bodies treated this sewage before to release in streams and river. Pune Municipal Corporation generates 420 million liters per day (MLD). Contrary to this, only 380 million liter sewage are treated per day. Henceforth, the remaining sewage is directly released in the river Mutha and then reaches the Bhima River. The second largest domestic sewage is generated from the Pimpri-Chinchwad Municipal Corporation (PCMC). Only 140 Million Liters of sewage are treated daily and remaining are directly released in Mula and Pavana river. Domestic sewage load is continuously increasing because of the growing population and expansion of cities. However, the facilities for sewage treatment are very poor. Both Municipal Corporations (Pune and Pimpri-Chinchwad) and other Municipal council daily release treated, partially treated as well as untreated domestic sewage in the streams and causing pollution to the Bhima river.

**Hazardous waste**

There are 322 industries in Haveli tahsil, which generates 3,446.78 MT hazardous waste, annually. However, from Pune city alone, 41 industries generates 86.11 MT of hazardous waste. Overall, annually 4470 MT of hazardous waste is generated annually out of which 512 MT was recycled while 3517MT is land filled. This may cause serious concerns of polluting the natural streams and rivers. During the rainy season, water seepage in the ground occurs and
runs the possibility to get contaminated with ground water. This can further move through around capillaries which open in ponds, lakes, dug wells, bore wells and some where in rivers.

CONCLUSION

Intensified, unplanned and unregulated human settlements, agriculture and industries are massively transforming the pattern of development around the bank of Bhima and their tributary rives within a short time. This was one of the key contributors not just to pollute the river Bhima as but also destroy the overall ecology of study area. It is concluded that, role of main tributary rivers (Bhama, Indrayani and Mula-Mutha) are vital for depriving the overall quality of water in Bhima river. Integration of organic waste from tributary rivers Mula-Mutha, Indrayani and Bhama are changing the scenario of Bhima River.

Tributary River Mula-Mutha carries dangerous amount of organic, inorganic and toxic waste from Pune metropolitan city. Inadequate sewage treatment facilities in Pune and Pimpri-Chinchwad Municipal Corporation and respective town council drain sewage towards Bhima River.

REFERENCES


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