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Traditional Water Management Systems and present scenario of water availability in the Wainganga River Basin, Maharashtra

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Abstract:

Traditional water harvesting technology was based on an understanding of the constraints and impact of local ecology, geology, topographical formation and the orographic patterns. Water was treated as a part of ecology and culture and there was a strong concern for inter-generational equity in the technology adopted. Traditional systems have benefited from collective human experience since time immemorial and therein lies their biggest strength. The backward and forward linkages existing in traditional systems ensured stable output and near full employment. Today, we need to re-evaluate the traditional water systems to enable us to find answers to problems of inequity, inefficiency, negative returns and non-sustainability that current water management techniques have inflicted upon rainfall distribution.

Keywords – *Traditional water management, water availability, river basin etc.*

Introduction

India's economy has been predominantly agrarian and since the early beginnings, agriculture has been Vulnerable to spatial and temporal vagaries of the monsoon. From time, immemorial the prime concern has been protection of crops from unpredictable monsoon through efficient management of available water resources. Water resource management has a long and rich history in India. During the British period about 100 large dams were constructed in different parts of the country (National Register of Large Dams, Gol, CWC, 2009) and by now over 45000 large dams have been constructed. Unfortunately, in the post-independence period, the rich heritage of traditional Surface irrigation systems was not supported financially by the Government under the Five-Year Plans, possibly due to its strategy of constructing large- dams for water resource development. Approaches to water resource management become centralized and sectoral and had practically no relevance to the local situation as they envisaged little or no local participation in water resource management. Centralized and fragmented water resource management severed people's connection with traditional community-based, sustainable systems of water use, leading to demand outstripping the supply, and widening the chasm between the water 'haves' and 'have-nots'

Study Region

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 bank and drains the western, central and eastern regions of the Chandrapur, Gadchiroli, Bhandara, Gondia and Nagpur districts of Maharashtra.

Latitude extension- $19^0$30'N to $22^0$30 N'

Longitude extension- $79^0$00'E to $80^0$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 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.

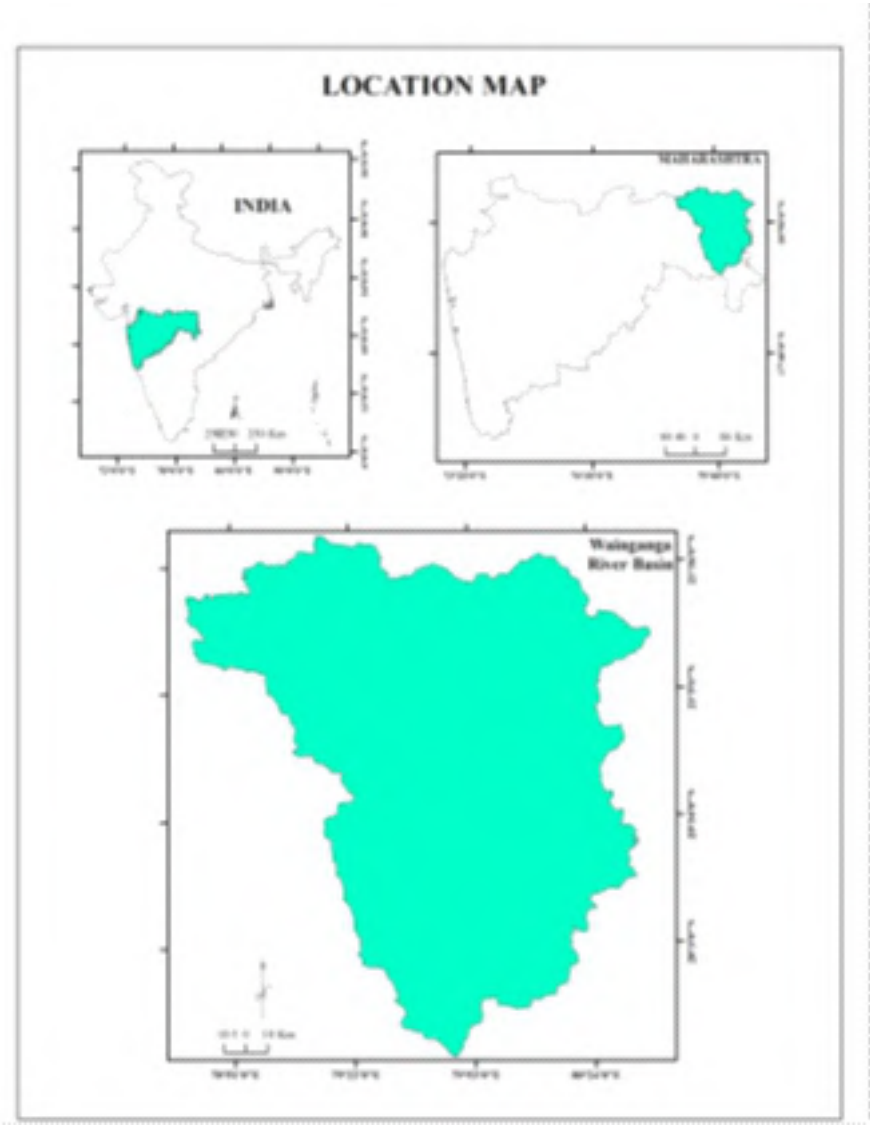


Fig 1 Location Map of Wainganga River

Objective –

1. To understand the historical context and evolution of traditional water management systems in the Wainganga river basin.
2. To examine the various traditional water harvesting and conservation techniques in the Wainganga river basin sin.
3. To investigate the current status of water availability in the Wainganga river basin.

Database and Methodology –

The database for this research paper will primarily consist of primary data, secondary data, and geospatial data collected from a range of sources. This will include quantitative and qualitative

information related to traditional water management systems, current water availability etc. Field visits to study the traditional water management systems (e.g., ponds, check dams, kunds) in the study region. Such types of historical data use of water management systems in the Wainganga Basin, such as reports, books, and publications by local historians, environmental organizations, and governmental agencies. Existing hydrological studies on the Wainganga river and its tributaries. This includes annual river discharge data, rainfall data.

Result and Discussion

The Malguzari tanks of the Kohlis

Malguzari tanks of Wainganga basin were the result of collective efforts of the Kohli Community from the Bhandara district in Maharashtra, where the flow of water emerging from small hillocks and mountain ranges was harnessed and used on the plains in this region. It deals with the numerous tanks found in Bhandara district of Maharashtra and the technical ingenuity of the Kohli community who built them almost 400 years ago and still could be developed as the largest source of irrigation in the Bhandara district. Bhandara had a cropping pattern that was far superior to that of the rest of the State and had the lowest proportion of barren and uncultivable areas and fallow lands. The traditional tanks built by the Kohlis can be found from the Balaghat district of Madhya Pradesh, to the Drugwada district of Andhra Pradesh and almost till Sironcha in Gadchiroli District of Maharashtra.
Apart from the tanks, the Madia tribes had developed a system of harnessing the water of perennial streams in the hills, which were guided into the tanks for 'Jhilan cultivation'. Due to the construction of tanks and for tapping the springs in every tehsil of the region, the proportion of irrigated area was considerably higher as compared to the rest of Maharashtra during the pre-colonial and colonial era. Even today, the impact of tanks is such that the region has the largest proportion of land irrigated by tanks in Maharashtra, where 78% of net irrigated area in the region depends on 43,381 tanks in all. The district proportions of lesser value crops are very low and those of the "richer" crops like rice, tur, wheat etc. are much higher as compared to the rest of the averages for the state.

Types of tanks

The tanks are of two types: 1) Bandh (the larger tanks) and 2) Bodi (the smaller tanks). Large tanks have mainly been constructed in the hills of the Gaikhuri range and the Navegaon and Palasgaon hills. The catchment areas of these tanks range from 1 to 40 sq. km. It is interesting to note that the actual bund of Navegaon bandh is only 330 ft in length, built between two hillocks and forms a large reservoir of 15 sq. km. Apart from this, Itiyadoh in Gondia District and Asolamendha in Chandrapur District are some of the largest tanks in the region. However they have now been renovated by increasing the height of the dam. The smaller tanks are much larger in number. These are generally found at the bottom of slopes, foothills or on the gentle slopes of the valley side, by putting an earthen embankment a few meters high at its lower end. Though some of these smaller tanks fail to supply water during summer or during years of low rainfall, a large number of smaller tanks are perennial and they play an important and vital role within the region. Besides irrigation, these tanks are extensively used for fresh water fisheries.

The Gonds

The entire Wainganga region fell within the boundaries of Deogad, Mandla and Chanda kingdom of the Gonds. The Chanda king was a powerful chief amongst the Gond kings. King Hirshah, a Gond king of the 16th century, in order to strengthen and spread his kingdom, released a "farman" which said, thus was established the local Malguzari system, through which the kingdom was able to generate constant revenue. It is believed that the Kohlis were brought to Bhandara from Varanasi by one of the Gond kings of Chanda to capitalize and consolidate the communities' knowledge in building tanks. Thus the Gond Kings played an important role in laying down the institutional framework

required to evolve and establish such a system.

The Kohlis

A small caste of cultivators, the Kohlis are found in the Marathi speaking tracts of the Wainganga valley, comprising of Bhandara, Chanda, Gadchiroli districts in Maharashtra and Balaghat district of Madhya Pradesh. It was due to the tireless efforts of this community that the chronic dependency of farmers on rain could be overcome. The Kohli community, with their ingenuity and hard work, constructed numerous tanks so that they could harvest at least one assured crop of rice or sugarcane in a year. Sugarcane, although a water-intensive crop, was a favorite in this region and was used to make gud (jaggary or raw sugar), which formed an important nutritional supplement to the local diet.

Bunds were constructed invariably with black cotton soil (Kanakar matí) as this soil is considered to be hard, with remarkable water holding capacity. After selecting the most appropriate site, a small bund, a few feet in height was first constructed. The subsequent process of increasing the bund height would run into several stages, spread over a number of years. The water trapped this small tank hardened the bund and provided strength to the structure, this process also aided in deciding the height to be raised in the consequent years. The eventual height of the bund was finalized after careful observation for several years at different places. Where water pressure on the bund was high, the foundation was made by pitching stones using a mixture of soil, stones, lime a binder. The presence of dykes in the area was obviously crucial to the success of the tanks. Smaller tanks were constructed at the foot of the hills or across the general slope of the valley, by putting an earthen embankment, a few meters high at the lower end. The hills would drain off the overflow from the tanks into the rivers. The main river course of the Wainganga has practically no tanks because of the very gentle slopes and there is little scope for bunding and storage in these alluvial soils.

Techniques for Drawing Water

The mechanism of drawing water from the reservoir for irrigation is called Tudum or Monga. Different mechanisms were employed, depending on the size of the tank. For a small tank or a Bodi a straight tunnel across the base of the bund was constructed using stones. A log was placed at the mouth of this tunnel and plastered with clay. This log was removed whenever water was required. For medium and large tanks, a straight tunnel across the base of the bund was constructed using stones over which staircase-like (monghad) structure was constructed, with a hole (daccha) in each step, The size of the tank determined the number of steps to be constructed. This hole was blocked with either a stone slab or a wooden log and carefully plastered with clay. Water could be drawn out by removing the stone slab or the wooden log. Another method employed was to use a hollow tree trunk across the base of the tank that was attached perpendicular to another hollow tree trunk with holes at regular distance. These holes were plugged using wooden logs and could be removed to draw water from the tank. But this method required frequent repairs as the tree trunk would not and very few "tudums" of this kind are found today. However, due to stringent forest laws making tree felling difficult, this technique has now been improvised by using brick channels.

Every care was taken while constructing a tank or a canal to prevent damage to the structures due to the force of flowing water. For this reason "Kutans" were constructed adjoining big tanks to minimize the force of water released from tanks.The "Kutans" were the smaller structures constructed wherein a bund of 3 to 4 ft height was constructed which would arrest the stronger currents and prevent damage to the primary bund.

The Present Situation

Before the promulgation of the Malguzari Abolition Act, the tanks were under the control of the Malguzars and the majority of agricultural lands were owned by them. But, today because of the

Land Ceiling Act, Malguzars have lost proprietary rights of tanks and on most of their agricultural fields.

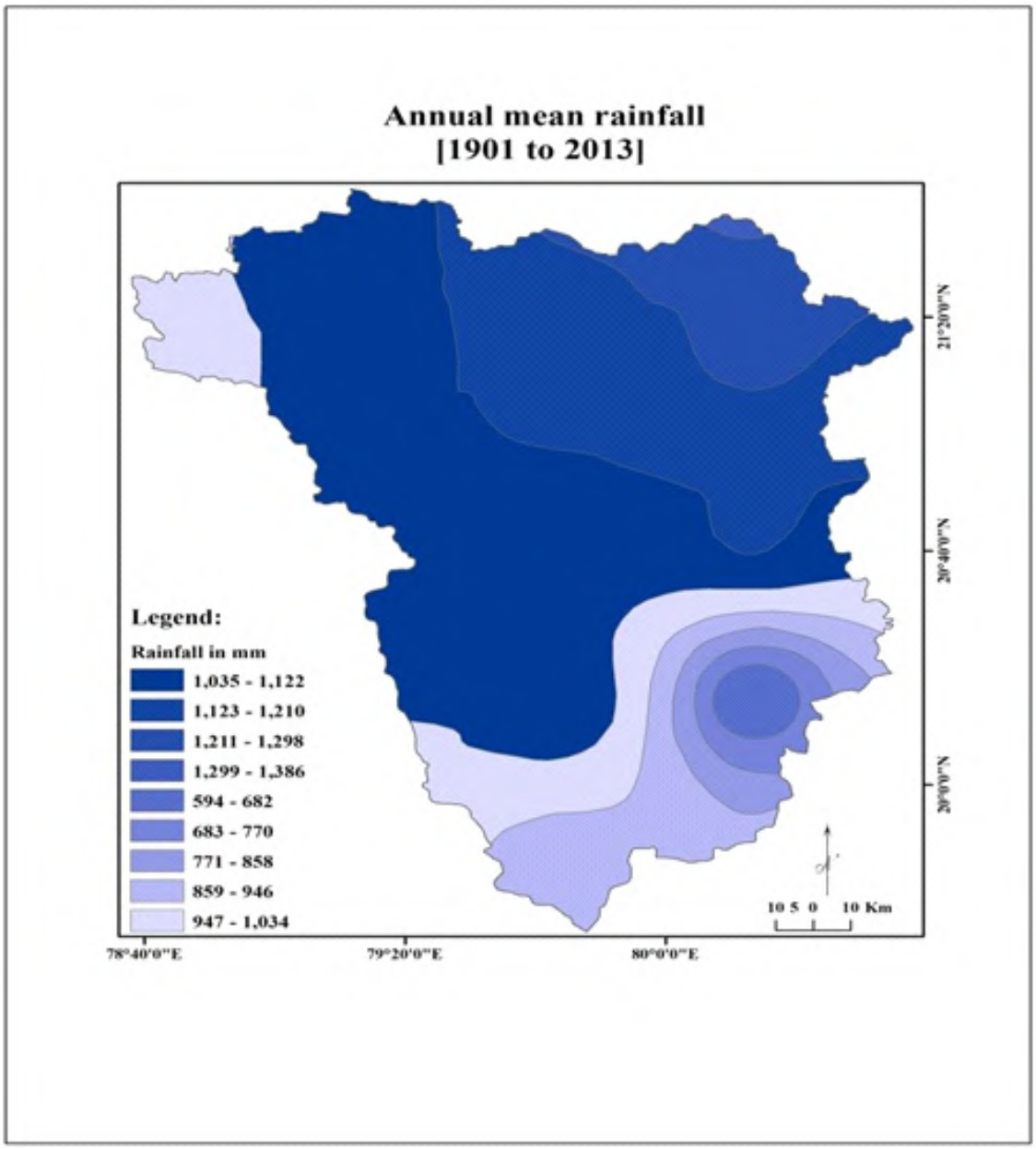
Sugarcane used to be one of the important crops in Bhandara region of the Wainganga basin. Presently, barring a few pockets of Bhandara near Tumsar, sugarcane is not grown at all. There are many reasons for this change, the most important being scarcity of water during s summer. After 1950s, the government increased the length of the canals so that more people could avail of the water from a tank. This naturally decreased the amount of water available for each farmer. Thus, the sugarcane longer a profitable proposition, even for those farmers who are within the immediate Command area of the tanks.

Fig.2 Malguzari tank and irrigation channel through paddy fields

Importance of Rainfall of the Wainganga River Basin

The annual minimum and maximum rainfall of 64 grid zone observation in study region. The evaluation of the average level annual rainfall for 29 meteorological stations located at Bhandara, Gondia, Nagpur, Chandrapur and Brahmapuri from 1901 to 2013.Wainganga basin shows that the maximum rainfall received areas of 11263.23 sq.km. Of 1035 to 1122 mm. which is area covered by east Nagpur, central Bhandra, east Gadchiroli and Chandrapur district.

Annual Mean Rainfall



Distribution of Rainy Season Rainfall

Precipitation records are considered for a period of 54 years from 1961 to 2014 for 49 grid zone in the catchment. Another important aspect of the annual variability of rainfall is the variation in rainy season rainfall for Wainganga basin. The peak maximum of the annual rainfall of recorded 1434 mm to 1487 mm covers area about 129.12 sq.km. But the lowest rainfall during monsoon season ranges between having 1052 mm to 1106 mm its cover area of 751.91 sq.km. Another way of explanation of maximum area is 9200.82 sq.km. area 1216 to 1269 mm of rainfall.

Rainy Season Mean Rainfall with Area in mm (1901 - 2013)

Sr. No.	Annual Rainfall	Area km^2
1	1,216 - 1,269	9200.82
2	1,107 - 1,161	1006.58
3	1,162 - 1,215	2748.54
4	1,434 - 1,487	129.12
5	1,379 - 1,433	668.37
6	1,325 - 1,378	3670.93
7	1,270 - 1,324	8170.52
8	1,052 - 1,106	751.91
Total		**26347.47**

Temporal Distribution of Rainfall

Gridded rainfall data of 0.25°×0.25° resolution was analyzed to study long term spatial and temporal trends on annual and seasonal scales in Wainganga river basin located in Maharashtra during 1961 to 2014. After testing the presence of autocorrelation, Arc GIS has been used to explore spatial patterns of the trends over the entire basin. Though most of the grid points show an increasing and decreasing trend in annual rainfall, only 1972, 1974, 1984, 1987, 1991, 1996, and 2004 years show a significant decreasing trend during 1961–2014. During the study period, overall decrease in annual rainfall is found in the year 1972. The most probable year of highly rainfall change was found to be 1992 in annual and monsoonal rainfall. There is an increasing rainfall trend in the basin during the period of 1961, 1975, 1978, 1990, 1992, 1994, 2001, 2005, 2007 and 2013.

Ground Water Availability

Rainwater infiltration leads to an increase in groundwater level. In order to correctly estimate the availability of water in the Wainganga basin it is important to estimate the water available through groundwater. Ground water forms the major source for drinking water supply and also used for irrigation in the Wainganga river basin. Presence of groundwater aquifers depends on the geological formations and their location with respect to the physiographic condition of the region. Availability of groundwater depends on factors such as, rainfall, porosity of the rocks, area for recharge of groundwater aquifers and the gross groundwater. It also depends on the non-monsoon discharge of groundwater as a 'return flow' to surface water bodies like rivers. Groundwater availability assessments are made at the watershed level by the Groundwater Survey and Development Agency (GSDA) at an interval of three to four years. The assessment for the watersheds in the Wainganga basin has been extracted from these reports and the net availability of groundwater around 1636.95 MCM is found. The stage of groundwater development (i.e. the ratio of groundwater draught to net groundwater availability as a percentage of the gross groundwater availability) is around 44 % which indicates sufficient groundwater availability for the future use. Only two of the 75 watersheds in the Wainganga basin are in critical stage with respect to groundwater draught, while the rest are safe.

Conclusion

This research will shed light on the relationship between traditional water management systems and the present challenges facing water availability in the Wainganga River Basin, Maharashtra. The goal is to explore how historical systems can be revitalized or integrated with modern approaches to improve water security and sustainability in the region, particularly in light of challenges such as climate change, population growth, and industrialization. Different structures such as the village ponds, temple tanks, dams and bhandaras and other such traditional structures which have remained intact and are still in use must be repaired, de-silted, renovated and contemporized maximize the benefits accruing to local communities. At least 5% of the financial allocation for water resource development sector must be allocated and dedicated to the operation and maintenance of traditional structures. By understanding both the historical context and contemporary realities, this study aims to provide a comprehensive approach to addressing water scarcity and ensuring sustainable water management in the Wainganga River Basin

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