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Original Article

A Study on Water Conservation Strategies in the Maratha Era with Historical Insights into Indigenous Governance and Environmental Planning

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Abstract

Water scarcity in the Deccan region and the importance of water conservation during the Maratha time period. The current study examines strategies for water conservation that were installed during the Maratha reign (17th to 18th century AD) with a special focus on indigenous engineering, governance structures and environmental planning concepts. The various uses of water by the Maratha are evidenced through historical research from primary sources, archaeology and secondary literature and are shown to have developed elaborate water systems such as rock-cut cisterns, artificial lakes, stepwells, underground waterways and aqueducts. They were backed with a decentralized government model, involving water distribution based on ranks, engagement of communities, sustainable utilization of resources, etc. The Marathas came up with sophisticated water conservation measures, combining native technology, ecological consciousness and administrative preeminence. Water-harvesting technologies on forts were designed with reference to geographical landscape, water availability and so on. No specific technology was used by Shivaji. He utilized natural resources available. The systems ensured water security for the military and civilian population. Sustainability through ecological harmony, social equity and engineering durability. A glimpse into our rich past will have much to tell us about the way our ancestors adapted to changing weather and to the demands of water by forming water-harvesting structures based on the unique nature of the land. The systems gave useful insights for modern water conservation difficulties, decentralized water management and climate-resilient infrastructure design.

Keywords: *Water Scarcity, Maratha Era, Indigenous Engineering, Environmental Planning, Rainwater Harvesting, Sustainability*

Introduction

In Maharashtra, the already stressed water resources are under tremendous stress due to periodic droughts [1]. Many insights from our past will be gained on how our ancestors had coped with varying weather patterns and water needs [2]. Marathas have contributed many important aspects to the construction and maintenance of rural drinking water systems [6]. In the early days the Marathas were able to build high-elevation forts in the Western Ghats that harvested rainwater in cisterns and reservoirs built in the rocks, under the leadership of the charismatic king Shivaji [6]. The use of ancient water harvesting technologies is important for irrigation and adaptation to climate change, especially in arid regions [4]. His careful construction of reservoirs, stepwells and underground canals to bring water played an important role in the sustenance of the Maratha empire [3]. Water harvesting systems designed on these forts were designed keeping in view the water sources available and geography [5]. Under the Maratha Empire, what were the main methods for conserving water? What were the effects of indigenous systems of governance on the way water was managed? How much of environmental planning did the Marathas put into their water system? What knowledge can be gained from past techniques to inform current water management? [3]. The geographic area includes all the Maratha region of western and central India (mainly Maharashtra [5]). It is limited in time to the 17th-18th century (reign of Chhatrapati Shivaji Maharaj till the Peshwa period) [6]. Poor archaeological information and reliance on secondary historic sources [7].

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Historical Context and Environmental Challenges

The Marathas contributed a number of important contributions to rural drinking water system development and operation [6]. Early Maratha forces, led by a king who was charismatic, Shivaji, built the forts on heights around the Western Ghats, which collected rainwater in rock-cut cisterns and reservoirs [6]. Abundant rainfall received over the Western Ghats was not able to increase infiltration time, water retention on the ground, or water availability in season [6]. Further east, the semi-arid central Deccan area (Marathwada region) registered less average rainfall, greater fluctuations in rainfall, occasional droughts and devastating famines [6]. The Maratha kingdom was ruled by the Peshwas, who controlled a considerable part of the Indian subcontinent from 1674 until 1818 [9]. During this period, they developed several small-scale water systems, like canals, step wells and temple tanks across Western India, notably in Pune [9]. All the regional empires that altered the landscape of early modern India distinguished themselves through their cultures of leadership, battlefield organization, water and administration across different regions [7]. The problem of water scarcity is not new to India and has taken alarming proportions nowadays [1]. Availability of water for day-to-day activities of life as well as its usage as a strategic resource for military purposes and civilians' nutrition [8] made water conservation a major topic for the Maratha empire. The decentralized form of government in the Marathas contributed to them in building rural drinking water systems and managing them with numerous important contributions [6].

Indigenous Water Conservation Strategies

In the hill fort of Sinhagad at Pune, different containers used for water are present within the framework of the fort. These are in fact rock-cut catchment cisterns, known as "takes" or "tanks," which collect and store rainwater [2]. These tanks were constructed at the time of excavation of the boulders needed to build the forts [2]. In all, there are 48 such takes that one can see in the fort [2]. The quantity of water in these tanks was stored for 4-6 months post-rainy season [5]. Three different types of cisterns used for water are installed on forts: some of them are not covered, others are installed in caves dug out of the rocks and some are dug down and along the slopes, under the earth [2]. In other scenarios, cisterns were set up in aggregations so that the rainwater from the surface was channeled into the cisterns, allowing improved recharge and storage of the water [2]. The cisterns from Dev that take in the Sinhagad fort are a case in point [2]. The water streams, which are generated with the rain, reunite at particular areas on the lower plains of the fort grounds, forming the artificial lakes [5]. The natural lakes are prevalent in the foothills, where they get a continuous water supply from the surface and subsurface. In addition, these lakes are also supplied by natural springs [5]. These lakes are believed to form on impervious soil and rocks where there is not a large amount of water seepage [5]. In the area there are basalt rocks, which are considered to be waterproof and have some percolation ability [5]. Some of the good examples of all-weather type lakes are located on the Raigad Fort [5]. Siege-proof water systems within fortressess, called Panhala Fort and Andhar Bavadi (Hidden Well) [10], were constructed. The gullies and streams are starting from the summits of the hills or mountains and are merged on the lower flat base—on the plateau where huge amounts of water can be stored [5]. A historic rainwater collecting system, including a rain gauge on Raigad Fort [5], was identified by conservationists. In the fort, the natural slopes and gradients on the top of the fort were utilized to collect and store rainwater for use [11]. All tanks of the fort have been constructed based on a slope investigation, which ensures that the tanks have water [5]. We saw a rain gauge house in the vicinity of Kushavarta talao [5]. In Marathas it was common to irrigate by patashala (aqueduct) [6]. Villages used to store rainwater in the dams to be utilized for irrigating their farms using aqueducts [6].

Strengthening and accountability can the objective of speedy justice be realized preserving public confidence and ensuring that “justice is not delayed” nor denied or diluted.

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Figure 1: Typology of Maratha-Era Water Conservation Structures [2], [5]

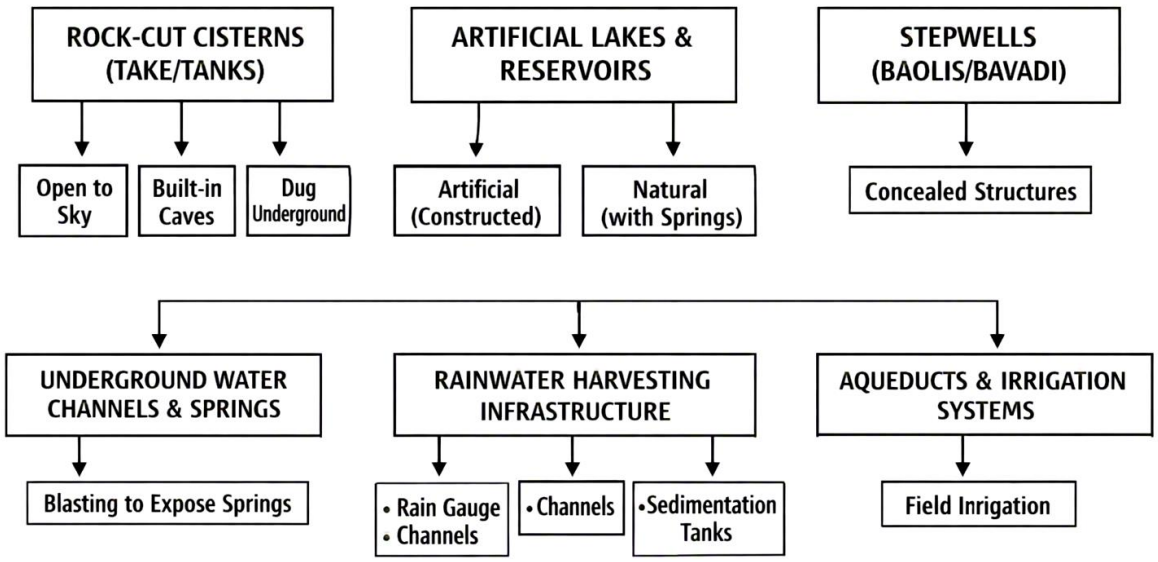

Table 1: Comparative Analysis Of Water Systems Across Major Maratha Forts [2], [5], [8], [10], [11]

Fort Name	Type	Water Structures	Key Features	Current Status
Raigad	Hill Fort	84 tanks, Gangasagar Lake, rain gauge	1,300 acres; capital fort; watertight basalt rock	Under RDA conservation [5]
Sinhagad	Hill Fort	48 rock-cut cisterns (take)	Dev Take with perennial water; group of 24 cisterns	Functional [2]
Rajgad	Hill Fort	2 large lakes, ~39 rock-cut cisterns	First Maratha capital	Partial ruins [8]
Shivneri	Hill Fort	Ganga-Jamuna springs, Badami Talav	Birthplace of Shivaji Maharaj	Functional [11]
Panhala	Hill Fort	Andhar Bavadi (3-storey), multiple baolis	Concealed water source for sieges	Functional [10]

Indigenous Governance and Water Management

The Marathas made many important contributions towards the construction and operations of rural water supply systems [6]. It had a complex administrative system that resembled that of the Mughals but with different terminology at its capital in Pune [6]. State (ruled by Maratha kings and Brahman administrators (peshwa)) and then district (prant) headed by a kamavisdar, block (taluka) headed by a deshmukh and village (gaon) governed by a patil (headman) and a kulkarni (record keeper) [6]. The logical pattern of each governmental level was having an executive officer and a financial record-keeper [6]. The water system in use at Shivaji's time is almost the same on all the forts. A definite amount of water was given to each human based on his role in administration [8]. This water would physically be taken out of tanks or lakes and carried to people or homes by water carriers called 'panke' who were paid as per labor [8]. The decentralized control of the Maratha Empire, the equitable tax system and the ingenious water conservation at both micro and macro levels are lessons for equitable resource utilization and environmental management [9]. Water infrastructure developed in this period has been put under the spotlight in terms of gender- and caste-based discrimination while not neglecting the focus on community and geomorphology [3]. Leakages in tanks, such as Hatti talao (lake), were being mended with lime as in old days (Maratha era) [5]. Regular cleaning and de-silting [5], incorporation of natural topography in system design [2] and use of locally accessible materials, other than imported materials such as basalt rock & lime [5], ensured the longevity of the water system.

Environmental Planning Principles

No specific technology was used by Shivaji. He took Nature's help, whatever was available. He never violated nature, as we do today [5]. The planners demonstrated remarkable foresight of Shivaji's time. Where nature was favorable, it was decided to construct lakes. The geometry of water capture systems in these forts was designed based on environmental and water availability [5] and has had a minimum of impact on the environment due to using the natural topography [2]. His emphasis on rainwater collection, equitable distribution and sustainable use of water resources is extremely relevant to the current water issues in the world [3]. His great contribution to the conservation of water, like

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careful construction of reservoirs, stepwells and built underground water canals, has played a great role in supporting the Maratha Empire [3]. The watertight geological conditions, like the basalt rock, ensured long-term functioning [5] and redundancy by many water sources [8] ensured effectiveness during sieges. Groundwater was tapped: Blasting was carried out in stone quarries, later repurposed for lake formation [5]. At times, once the requirement for the stones to build the fort was met, the excavated area on the ground was blasted at a deeper depth to create subsurface fractures to produce groundwater in the form of springs in the cistern [5]. The ability of indigenous Maratha engineers was advanced with strategic positioning of tanks on slope analysis [5] and the concept that forts were being built for strategic advantage over the enemy [8] was demonstrated.

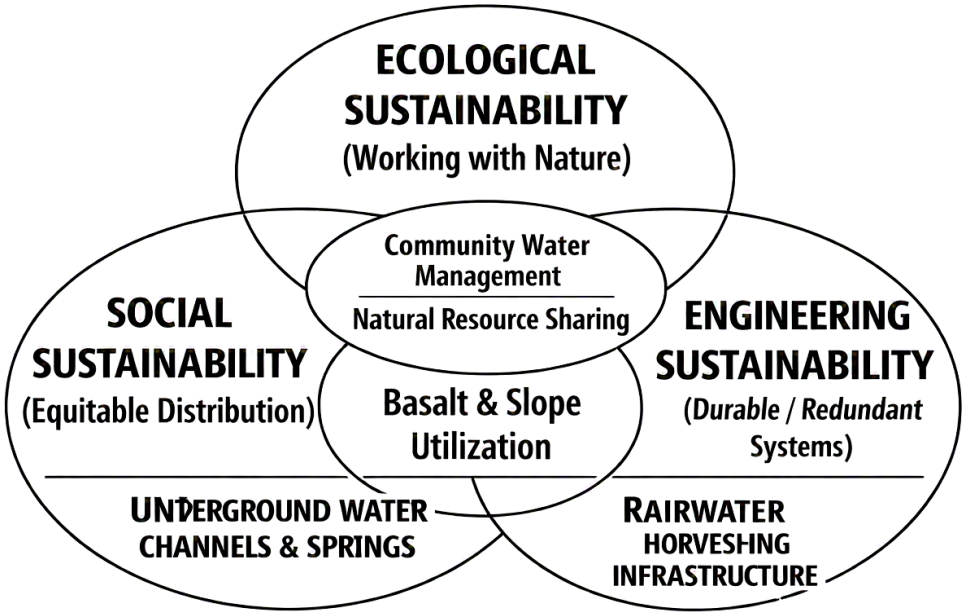

Figure 2: Sustainability Dimensions Of Maratha-Era Water Systems [3,5]

Case Studies

The fort area, comprising about 1300 acres, had about 84 small and big water tanks and reservoirs [5]. The Raigad Development Authority (RDA) is headed by Raigad's Shri Yuvraj Sambhajiraje Chhatrapati [5]. The administration has adopted a scheme that will see Rs 606 crore spent towards the protection and re-discovery of the Raigad fort [5]. Many have heard of Shivaji Maharaj's military tactics and methods, but not many know that he foresaw and had a vision to store and utilize rainwater on forts as well [5]. Of them, twelve are notable, including manufactured and natural ones [5]. Using a rain gauge and sedimentation system [5], Gangasagar Lake was the key water source. The greatest specimens of water tanks are in the Sinhagad fort near Pune, where 48 of them stand prominently [2]. A series of 24 rock-cut cisterns, which can be still seen on the upper structure of the Sinhagad fort [2]. The Dev cisterns in the Sinhagad fort are a case in point [2]. These rock-cut cisterns evolved as results of stone excavation for building [2].

Lessons for Modern Water Management

The need for finding other distributed and local harvesting and water storage methods will be increasingly important [3]. But relocating from a centralized, pipeline-centric approach to a topography-centric approach instead of a uniform approach [5]. This thesis proposes reusing and re-adopting pre-existing resources through the implementation of a civilian-led water corps for designing long-term resilience [3]. Incorporating new experiments in nature-based technology [4] and conservation of old techniques and materials [4] offer good prospects for hybrid-(ownership/operation) systems of indigenous knowledge and contemporary technology [4]. Strategic priorities are water security [8] and involvement of the community in water management [6]. In India, water resources, which include precipitation, surface waters and even ground waters, continue to be significantly affected by the changing climatic conditions [1]. The decentralized administration, equitable taxation and emphasis on water conservation, among other things, provide lessons on just and fair management of resources and care for the environment of the Maratha Empire, which is relevant to UN Sustainable Development Goals (SDG 6: Clean Water and Sanitation; SDG 11: Sustainable Cities and Communities; SDG 13: Climate Action) [4].

Conclusion and Future Research Directions

The Maratha Empire, established well into the 18th century, combined not only well-developed and effective systems of water conservation but also indigenous engineering, ecological sensibility and administrative wisdom. Water-

harvesting technologies on forts were designed with reference to geographical landscape, water availability and so on. There was no specific technology that was used by Shivaji. He took Nature's help, whatever was available. The systems ensured water security for the military and civilian population. Ecological harmony, social equality and engineering durability to attain sustainability. A glimpse into our rich past will certainly teach us many lessons on what our ancestors did to deal with the changing weather patterns and requirements of water and how these were managed with the use of water harvesters appropriate to the unique topography of the landscape. The systems provided valuable input for contemporary water-saving challenges, decentralized water management systems and water-resilient infrastructure design. The focus of future studies should involve extensive archaeological investigations of less documented forts, quantitative estimation of storage capacity, comparison among the various medieval water systems of India and development of the implementation matrix for the adaptation in the modern era.

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