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Impact Of Tourism On Water Resource: A Case Study Of Pernem Taluka, Goa

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Abstract

Tourism stands as the fastest-growing sector in this millennium, offering economic opportunities to millions worldwide. However, it also contributes to water scarcity and inequality in many tourisms dominated areas across the world leading to conflict and resentment among locals. Moreover, the impact of climate change further compounds water stress in densely populated countries. Hence, water sustainability and sustainable tourism emerge as critical pillars of sustainable development

Goa, being one of the most popular destinations not only in the country but globally, is frequented by millions of tourists annually, hence tourism is crucial to Goa's economy, especially in absence of mining. Despite receiving ample rainfall, Goa frequently grapples with water shortages across all talukas. Sustainable tourism becomes imperative to ensure adequate water availability for both locals and tourists, both presently and in the future. The state needs sustainable tourism to ensure sufficient availability of water for locals and tourists, both now and in the future.

The present study has been prepared to highlight the potential threat of water stress in Pernem taluka and emphasise the need for sustainable tourism to sustain the water resources. Data has been collected from secondary sources to support the study.

Keywords

Tourism, Water consumption and stress, Sustainable tourism growth, water conservation.

Introduction

Water, the most sacred resource on Earth has become the centre of concern among environmentalists over the years as the effect of climate change is engulfing the world very rapidly. Scientists are sounding warning alarms regarding significant shift in rainfall pattern and depleting ground water level due to climate change and global warming since the last decade. The United Nations celebrates World Water Day every year to highlight the fast-depleting water resources due to the ever-growing population and rapid climate change. Severe drought, flooding, decreased freshwater and rainfall have become an unfortunate reality in the world. Large numbers of studies are conducted every year to make the world communities aware of this difficult situation stressing on the urgent need for water conservation. Millions of people are already living under severe water stress around the world. The entire biosphere is facing looming threat of survival and in this view, water conservation is the solution to minimise and mitigate the same.

Tourism has evolved and reached a new height in this millennium, binding every corner of the world and stimulating growth. Tourism footprint can even be traced in the remotest corners of the Earth. Marine and coastal tourism are one of the fastest growing within the tourism industry. The impact of this tremendous growth is increasingly visible on the environment and natural resources (Sunlu, 2003). The benefits of tourism are paired with a hefty price, i.e. ecological deterioration including destruction of natural habitats and water scarcity. Though tourism has tremendous potential to create a positive impact by contributing to environmental preservation, uncontrolled and conventional tourism exert severe and substantial stress on existing natural resources and more specifically, water resources. It poses a threat to the average citizen's life in the near future as well (Sunlu, 2003). The fourth edition of the World Water Development Report highlighted the need to involve industry and its unsustainable use of freshwater resource, tourism is a major global industry that is known to be a substantial contributor to local water demand (Becken, 2014).

The additional demand of freshwater for tourism for various purposes like, cleaning, food processing, drinking, may also lead to a water crisis, something that is already being experienced in many places across India. In this context, sustainable use of water resources in the tourism belt of Goa is vital for balanced tourism and regional development.

In light of above statement, the present article examines tourism related fresh water use and potential water tension on local communities due to tourism.as well as significance of sustainable tourism development in one of Goa's tourism-based talukas.

Tourism in Goa

Goa, 'The pearl of the east' is one of the most sought-after tourist destinations in the world, and needs immediate attention towards conservation of environment and natural resources, as it is frequented by masses of tourists annually. Since, tourism is considered to be the major engine driving development of the state, sustainable tourism and development is the key to protect the state from further environmental degradation. Data on tourist arrivals (Table 1) shows a steady increase over the years which is bound to exert severe pressure on natural resources like forest and water.

Table No. 1: No. of tourist arrivals in Goa

YEAR	NO. OF TOURIST ARRIVALS
2018-19	81,08,680
2019-20	78,03,744
2020-21	33,21,031
2021-22	34,41,973
2022-23	79,61,000

Source: Statistical handbook of Goa

Population of Goa was 14.59 lakhs as per the 2011 census, whereas the numbers shot up to 79 lakhs tourists in 2022-2023 as per the economic survey data of Goa in 2023, which is a significant increase for a small state like Goa. This data as well, sheds a spotlight on the urgent need for sustainable tourism practices and protocols.

Water resources in Goa

Goa, rich with substantial quantities of ground water as well as surface water resources in the form of rivers, springs, lakes etc. receives an average 300 to 500 cm of annual rainfall. The rivers of Goa have always been and continue to be the major source of potable water and linked with various economic activities. The surface water resources of the state have been assessed at about 2823 M cum with 1465 M cum utilizable (1125 M cum of surface water and 340 M cum of ground water). Surface storages available is about 335.87Mcum in tanks, bandhras etc (Official Gazette, Govt of Goa, 2nd September, 2021). As per the

Central Ground Water Board (2017) the available ground water resources in the state are 38454 hams, whereas the total extraction id 5371 ham. The stage of ground water extraction is 23.63% in 2022.

However, the draft state water policy in 2015 stated that despite a good amount of rainfall, rivers have a very low flow for the non- monsoon months resulting in scarcity of drinking water for the period march to June. Moreover, the narrow width of the state, steep slopes of western ghats, porous sub-stratum, uneven distribution of rainfall over time and space cause temporal imbalance in water availability. Though Goa is situated in high precipitation zones, it has one of the lowest per capita fresh water availabilities (Pradhan, 2016). Draft State Water Policy (2021) states per capita annual availability in Goa is 1807 Cu m but all is not available for human consumption. As per the study of central water commission, the annual average per capital water availability for 2021 in India is 1486 cubic meter (Ministry of Jal Shakti, 12th December, 2022).

Pernem, the Northern most taluka of Goa has been emerging fast as tourism hub in the recent years. With the arrival of the new airport at Mopa, tourism has further been fuelled causing a rapid growth. This rapid and yet sudden growth can potentially lead to severe water scarcity, if efficient management techniques are not applied immediately. Tourism, like most industries is also dependent on resources like water and scarcity of the same can hence be a constraint to the local tourism industry as well as the regional development.

Efforts have been made in the present study to highlight the need for conserving water resource for sustainable tourism and development in future.

Objectives

Two specific objectives have been selected;

1) To study pattern of water resources in Pernem taluka
2) To analyse the relation between available water and tourism growth and need for conservation**.**

Data base and Methodology

Data used for this study is collected from different secondary sources which are as follows; Directorate of Tourism, Economic Survey of Goa, Department of Water Resource, Statistical Handbook of Goa and miscellaneous websites.

Simple statistical method is used for computing the percentage and preparation of graphs.

Profile of the study area

Location: Pernem, the northern most taluka of Goa is surrounded by Vengurla and Sawantwadi talukas of Sindhudurga, on the East, Bardez and Bicholim taluka to the south and Arabian sea on the west. The geographical location of Pernem taluka is marked by 15 43’ 01” N Latitude and 73 47’ 52” E longitude at an average elevation of 47 meters. The total geographical area of the taluka is 251.69 sq Km. it comprises 20 villages and 1 municipality (Figure 1).

Physiography

River Terekhol, a prime river in North Goa geographically separates Pernem taluka from the state of Maharashtra. The relief of Pernem can be explained and interpreted as combination of plateaus plain and hilly regions with a gentle slope along the plateau areas.

Plateaus: Dissected table land and low lateralized plateau is found between the Keri and Harmal village. A fresh water lake is located on the foothills of the dissected tablelands. Another dissected tableland is found separating Mandrem and Morjim village.

Plains: - Pernem taluka is blessed with vast stretches of river and coastal plains. The major coastal plain stretches from Keri village to Mandrem village, dotted with famous beaches of Keri, Harmal, Ashvem, Morjim and Mandrem. Besides, two major rivers bordering the taluka have developed vast river plain comprising alluvial soil. (Claude, 2002).

Climate

Goa, surrounded by Arabian sea on the west and the western ghat on the east experiences tropical - maritime and monsoon climate with a strong orographic influence. In Pernem the climate is tropical with notable amount of precipitation during the year. The average temperature of the taluka is 26.4 degree Celsius and average rainfall is 2694 mm. The majority of the rainfall occurs during the month of July with average amount of 874mm. The month of highest relative humidity is July (90.62 %). While January has lowest relative humidity (59.34 %). The wettest month is July and driest month of the year is February.

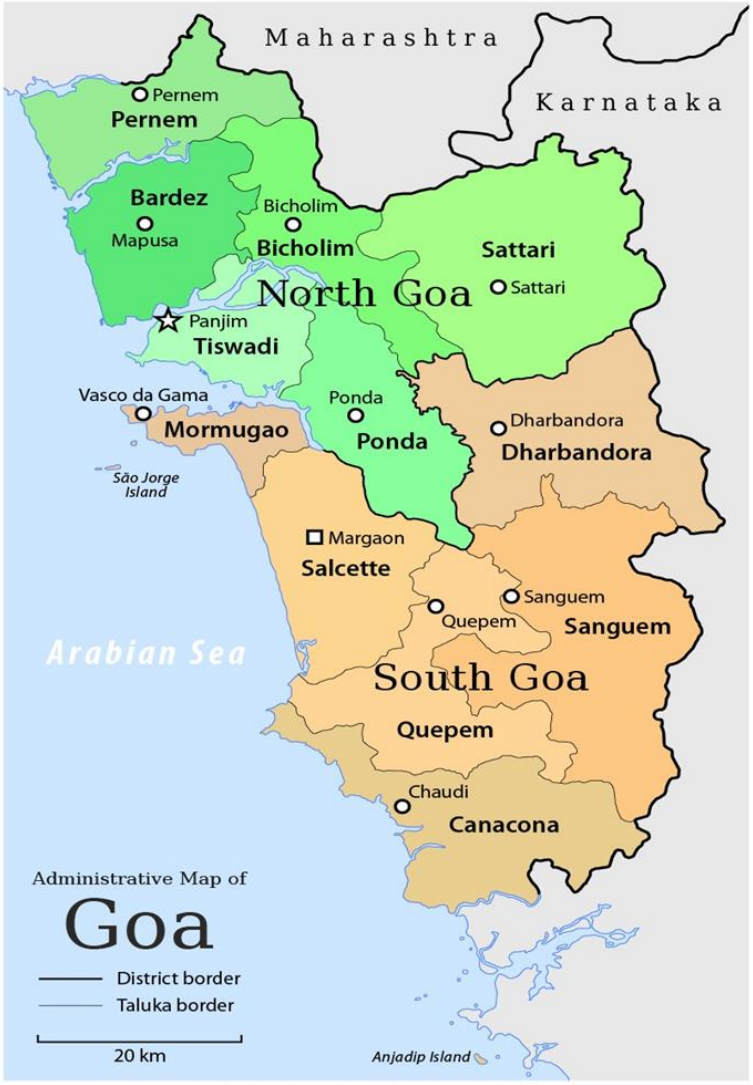

Figure No.1: Location of Pernem Taluka (Source Wikipedia)

Population

Pernem taluka comprises 23 villages and 5 towns with total population of 75,747 as per census, 2011 while population of the four coastal villages, namely Harmal, Mandre, Morji and Keri are 5322, 8336, 6760, 3038 respectively. Large number of people from these villages are dependent on tourism for their livelihood.

Study

Analysis of Water Resources in Pernem taluka

Water, the most unique, sacred and critical resource, water is under severe threat from various human activities that includes tourism. Thus, it is necessary to study the extent of existing water resource in Pernem taluka. Major source of water for domestic, agriculture and industry are groundwater which includes well,

spring, tanks though surface water is available from rivers and streams. However, river water is not suitable for drinking and irrigation much due to higher salt content since all them are tidal rivers.

Drainage system, also known as river systems, are the patterns formed by the streams, rivers, and lakes in a particular drainage basin. This is determined by the topography. It has immense role in maintaining hydrological cycle and sustaining the ecosystems of the taluka as well as contributing greatly in people's life. Following is the available surface river water in Pernem taluka.

Pernem taluka is bordered by two river, Terekhol and Chapora which acts as boundary as boundary between Goa and Maharashtra and Pernem and Bardez taluka respectively.

Terekhol river system: Terekhol is the northernmost river which originates in the Manohargad in the Sahyadris and runs along the boundary of Goa and Maharashtra in a south-westerly direction. The river enters Goa at Patradevi and continues 27.5 kms within the taluka till it merges in Arabian sea near Terekhol village. Its basin comprises with three tributaries namely Torxe, Khadshi and Pedne covering an area of 435 square Km. The maximum width of the river is one km while average discharge is 20.9 cubic meters / second. Terekhol sustain the traditional livelihood of thousands of people of Pernem.

Harmal River: Another small stream emerges from mixed jungle of Corgao hilly area, flows westward. It discharges into Arabian sea at Harmal after covering 11 kms.

Mandrem river: Another small stream also emerges from Corgao and joins Arabian sea at Mandrem beach after flowing 7.75 kms through Corgao. These small streams are very significant in maintaining village ecosystem and groundwater level((Claude,1993).

Chapora River system: River Chapora, another tidal river, originates at Ramghat hills in Belgaum district of Karnataka and ends at Chapora village after covering the distance of 31.5 kms in Goa.

This surface water is not much used directly by the locals unless supplied as treated by the PWD from Tillary project. Thus, ground water is one of the dependable sources of water for all needs. The following table presents the details of ground water situation in Pernem taluka.

The available data (Table 2) clearly indicates gradual increase in ground water extraction and decrease in available ground water for future as the water supplied by the PWD is not enough to meet the increasing demand. This increase in demand for water can be attributed to both rising tourism activities and population growth. The analysis on tourism and population growth can put more light on the issue.

Table no.2: Status of Ground water Availability in Pernem taluka

Year	Annual Extractable Ground Water Resource (Ham)	Ground Water Extraction for Irrigation Use (Ham	Ground Water Extraction for Industrial Use (Ham)	Ground Water Extraction for Domestic Use (Ham	Total Ground Water Extraction (Ham	Annual GW Allocation for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future Use (Ham)	Stage of Ground Water Extraction (%)
2004	3712.95	243.45	-----	-----	417.98		3469	11
2017	778	159	-----	166	324	184	454	42
2020	3040.62	470.07	8.09	241.42	719.59	263.02	2299.43	23.67
2022	2899.26	507.33	6.96	296.78	811.07	315.06	2069.91	27.98

ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF GOA STATE . Source:GWRA,2017, 2022

Tourism Growth and Water availability in Pernem Taluka

In view of limited industrial and agricultural growth, tourism has become the crucial backbone of the local economy of Pernem taluka. The new airport at Mopa as well as four lane highway are supposed to boost the tourism growth significantly along the coast of Pernem. However, without a proper planning for sustainable development this anticipated growth can bring environmental disaster and cause unimaginable damage to the existing natural resources specially water beyond repair.

As per report published in various newspaper, Pernem already reels under water scarcity and pose a challenge to the authority to provide sufficient amount for daily uses. Many villages do not have 100% coverage of tap connection. For example, Keri village has only 20 to 25% tap water connection while Harmal, Morjj record 30%-40% tap connection.

Water treatment plant in Chandel treats 15MLD drinking water to 22 villages. Out of that 3MLD is supplied to each beach villages—Harmal, Mandrem, Morjim, Keri which has tourist influx (*O HERALDO, 18TH October, 2020).*

The Goan network, in their publication on 10th April, 2023 reported the similar view**.** It attributed the water problems to ever increasing tourism in the tourism belt. One 15 MLD plant to cater Palyem and Keri. The increasing number of tourists has skewed the demand supply balance. Report published in Times of India on 12th January, 2019, Pernem getting only 12 MLD against the demand of 22 MLD.

In view of the above-mentioned report published in different newspapers it can be easily ascertained that the local community of the taluka are facing shortage of water every year. Therefore, it is important to look into the population and tourism growth in Pernem taluka to assess the demand and supply of freshwater as well as address the gap. Total population and annual number of tourist arrivals is added together to get the figure of total consumers of fresh water per year as indicated below (Table 3).

Table no.3: Population and Tourism growth in Pernem taluka

Year	Total population	No. of tourist arrival	Total no of fresh water consumer/year
2018-19	75,747	634,632	710,379
2019-20	75,747	618,210	693,957
2020-21	75,747	277,068	352,815
2021-22	75,747	3,76,982	452,729
2022-23	75,747	79,61,000	8,036,747
2023-24	75,747	--------	--------

The table 4 represents data on daily consumption of water on the basis of water supplied by PWD only since data on ground water consumption is not available. In view of this, we have analysed per capita water consumption/year through PWD water supply in the following table to assess the gap between the need and supply.

It is very interesting to note that, total daily consumption has decreased significantly between 2019 to 2022 in spite of increasing number of meter connection indicating low demand due to low tourist flow during that pandemic period. This will definitely reflect in per person annual water consumption.

As per ministry of Jal Shakti minimum daily requirements for water is 145 Liters per person in India. Considering this figure, we have calculated per capita annual water requirements for assessing the shortfall (Table 5).

Table No.4: Consumption of water in Pernem taluka

		Daily average water consumed (cu m)		
Year	**No. of meter connection**	**Consumed by individual (cu m)**	**Consumed by public tap**	**Total water consumed**
2018-2019	**17848**	**13,595**	**0**	**13,595**
2019-2020	**18306**	**14,656**	**0**	**14,656**
2020-2021	**18635**	**13,461**	**0**	**13,461**
2021-2022	**18812**	**11,147**	**0**	**11,147**
2022-23	**----**	**----**	**------**	**--------**

Statistical handbook of Goa (PWD)

Table No.5: Annual Water Requirements and Consumption

Year	Total no. of consumers	Total consumption/year (cu. m)	Total consumption/person/year (cu m)	Need/person/year (cu m)	Annual shortfall (cu m)
2018-19	710,379	49,62,175	6.985	52.925	45.939
2019-20	693,957	53,49,440	7.7086	52.925	45.216
2020-21	352,815	4,913,265	13.925	52.925	39
2021-22	452,729	40,68,655	8.986	52.925	43.939
2022-23	8,036,747	Not available	--------	-------	

As per the table, a huge shortfall in water supply exists in Pernem taluka which is compensated by well water. Stages of ground water extraction in table no. 2 justifies this fact. It can be noted that consumption of water has been reduced significantly from 2020-2022, marked as the pandemic period, which has surely attributed to low tourist footfall. However, the huge tourist influx in 2022-2023 and possibly even since then has ignited the demand for water and caused further strain on ground water reserve. Thus, it can be stated that there is increased pressure on surface and ground water by fast growing tourism activities. In the light of present climate change scenario, the water resources of Pernem taluka need efficient and sustainable water management to keep the threat in control.

Conclusion

The present study underscores the potential harm of uncontrolled tourism growth on local areas, particularly with regards to the strain it places on natural resources such as water. While Goa, including Pernem, is placed under safe zone in terms of ground water reserve till now, a changed climate scenario may alter the situation very fast. In spite of significant contribution to economy a large influx of tourism is bound to put pressure on the uses of surface water, and hence the ability to retain the same. Thus, immediate action plan is needed to mitigate the strained water situation in future.

The present supply of 15MLD from Chandel treatment plant is needed to be upgraded to 30 MLD to cater the demand. Besides, water conservation should be practiced rigorously in entire Pernem taluka and Goa. The taluka neither the state can afford to allow its water resources to be depleted by uncontrolled tourism activities leading to total disaster in future. All the stakeholder, locals, tourists, and government have to be worked together responsibly to achieve the goal of conserving the precious natural resources and sustainable tourism development for a safe and shining future.

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