



Norwegian University
of Life Sciences

Bachelor's Thesis Autumn 2022 15 ECTS

Faculty of Landscape and Society

Department of International Environment and Development Studies (Noragric)

How religious tourism affects water security in the pilgrimage town Vrindavan, India

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Abstract

This paper analyses how religious tourism affects water security in the pilgrimage town Vrindavan, in India. I used qualitative methods to show how the rapid influx of visitors exerts immense pressure on the infrastructure of the town and thus increases the population's vulnerability to water scarcity. The empirical data consists mainly of observations and interactions with the local population at the site and is complemented with secondary data from relevant literature, news articles, government reports and census data. To assess how and to what extent tourism is affecting the water availability in Vrindavan, a framework by Gössling et al. (2012), is used, which looks at the i) spatial and temporal aspects of water use, ii) changes in water quality, and iii) competing water uses. The results show that tourism is substantially contributing to a decrease in water quality and quantity which threatens the water security of the town. The town's infrastructure developments and civic services are unable to support the high floating population which in turn leads to water pollution and decreased water supply. With climate change decreasing rainfall and the state of Uttar Pradesh further increasing the number of domestic visitors, through policies and tourism developments, pilgrimage towns such as Vrindavan are in a vulnerable position. Especially the poor are affected by the negative environmental consequences of tourism. Results have also found that the unsustainable tourism practices in Vrindavan conflict with the Sustainable Development Goals 3, 6, 11, 14 and 15. Immediate action to decrease the population's vulnerability to water scarcity is advised by better regulating the tourist sector and investing in infrastructure developments that decrease groundwater depletion and pollution.

Contents

Abstract	1
1. Introduction	3
2. Motivation	3
3. Conceptual Framework & Literature Review	4
3.1. Water security	4
3.2. Tourism and Environment	4
3.3. Water Security and Tourism	5
3.4. Water security vs. economic development	7
4. Analytical Framework	7
5. Methodology	8
6. Case study	9
6.1. Uttar Pradesh	9
6.2. Vrindavan	10
Religious Tourism in Vrindavan	11
7. Discussion	12
7.1. Spatial and temporal aspects of water use	12
7.2. Changes in water quality	14
Yamuna	14
Groundwater	17
7.3. Competing water uses	18
7.4. Sustainable tourism and Environmental degradation	21
7.5. Unsustainable tourism and SDGs	23
8. Conclusion	24
References	25
Appendix	30

1. Introduction

Tourism is known for its positive effect on economic growth and poverty alleviation. Many countries, especially in the Global South are thus trying to increase the number of visitors by investing in new infrastructure and development projects (Sofronov, 2018). While sustainable tourism is also promoted by the United Nations in their Sustainable Development Goals (SDGs), unregulated and mismanaged tourism can lead to environmental problems (United Nations, 2015). With countries expanding their tourist sector to increase their economy, it is important to assess whether this is done sustainably. It is of special importance to analyse how water security is affected since the water availability of already water-scarce regions is further expected to decrease due to climate change (Gössling et al., 2012).

The Indian Temple town Vrindavan, in the state of Uttar Pradesh (UP), is an example of a pilgrimage/tourist destination that suffers from periods of water scarcity (Vrindavan Today, 2022). This case is especially interesting since it has not been a water-scarce region historically. The pollution of its main surface water source the Yamuna River has led to the exploitation of groundwater reserves which increased its vulnerability to water scarcity. As the state of UP is further pushing the expansion of its tourist sector it is important to assess how this affects the water security in one of the most important pilgrimage sites in India.

This paper will start by examining the contemporary literature on the tourism and water nexus and define important concepts used in the discussion part. It then will present the methodology used to answer the research question: *How and to what extent does (religious) tourism affect water security in Vrindavan?* The case of Vrindavan is then presented and connected to the topic. The paper then uses a qualitative framework to discuss the research question and examines how the findings affect the local population. It will be concluded by looking at how tourism developments can both support and constraint the achievement of the Sustainable Development Goals.

2. Motivation

My first visit to Vrindavan in 2012, drastically changed my perception of the world by confronting me with extreme poverty and environmental problems. This confrontation kindled my interest in the environment and development field. Vrindavan is a town where modernity meets tradition, poverty meets wealth, pollution meets the sacred. I have visited the town numerous times and a lot has changed over the last 10 years. I could somehow experience first-hand, the rapid expansion and modernization, the influx of visitors and the environmental

degradation. When talking with some of the locals about the environmental problems, several responded that they are mainly caused by visitors. After a field course in Jaipur and Kerala about “State and Civil Society in Development and Environmental Governance in India”, I wrote my term paper about water resource management in Rajasthan, which also made me think about water security issues in Vrindavan. This motivated me to examine how vulnerable Vrindavan is to water scarcity and how visitors are contributing to it.

3. Conceptual Framework & Literature Review

3.1. Water security

The term water security in the literature has seen a substantial increase in the last decade since climate change is expected to further decrease the water availability of water-scarce regions (Cook & Bakker, 2012). While there are various definitions of water security, most commonly it relates to the availability of water resources, which includes quantity and quality as well as access and affordability (Cook & Bakker, 2012). Most of the literature uses quantitative methods to assess whether there is a gap between the demand and supply of water (Cook & Bakker, 2012). A smaller gap between the demand and supply of water means that the community has high water security (UNICEF, 2021). Identifying and monitoring external pressures that lead to increased water demand or decreased water supply can help in reducing the water insecurity of vulnerable regions. As the population of some countries like India are rapidly increasing, so does their water demand which can cause water security issues (Rakhyani, 2022).

India is depleting its groundwater reservoirs, which can provide water supply during times of low rainfall, faster than any other country some of its regions are becoming more vulnerable to water scarcity (Hawley, 2019, p. 304). While population growth is often discussed as the main reason for increased water demand, tourism's impact is often not considered. With some states in India, pursuing an expansion of their tourist sector it is necessary to examine whether this further adds to vulnerability to water scarcity. While there is literature about how climate change and tourism, individually affect water availability, there is a gap in research that looks at its combined effect on water security (Cole et al., 2020).

3.2. Tourism and Environment

Tourism is one of the largest and fastest-growing sectors in the world today, contributing substantially to the global economy and employing more than 313 million people worldwide

(Sofronov, 2018). It is therefore seen as a good tool for bringing development to the developing world by increasing its economic growth and employment rates as well as contributing to the construction of better infrastructure developments (Sofronov, 2018; Yamamoto et al., 2021).

However, tourism does not only bring economic opportunities but also environmental problems if it is not properly managed. According to Aayog (2018), inadequate solid waste management, air pollution, the deterioration of watersheds and water sources, and the loss of natural resources, biodiversity, and ecosystem services are some of the negative impacts of current tourism practices (p. 8). Furthermore, the tourism sector is estimated to contribute between 4 and 6% to global Green House Gas Emissions (Dickinson & Lumsdon, 2012). While the negative effects tourism developments have on the environment are well-researched, they mostly focus on carbon emissions, and not on how it affects water availability (Hadjikakou et al., 2012).

3.3. Water Security and Tourism

On a global level, the water consumption of the tourism sector is not significant as it is less than 1% (Gössling et al., 2012). Even on a country level, its contribution is quite small, as other sectors such as agriculture overshadow it by far, which is one of the reasons why its local impact is often overlooked in the literature (Gössling et al., 2012; Yamamoto et al., 2021). However, several studies point out that it is important to analyse the impact of tourism on water availability at the destination level especially in regions that experience a high number of visitors and low water availability (Gössling et al., 2012; Yamamoto et al., 2021; Hadjikakou et al., 2012).

Several authors agree that the water demand of tourists is much greater than the domestic demand (Aayog, 2018; Cole et al., 2020; Gössling et al., 2012; Yamamoto et al., 2021). It is estimated that the average tourist uses between 84 and 2000 litres per day, which in some cases is more than 10 to 16 times the water demand of the local population (Aayog, 2018; Gössling et al., 2012; Yamamoto et al., 2021). With the growth of the tourist sector, its overall water demand has also increased globally in the last decades.

For example, between 1988 to 2013 the water demand of the tourist sector in Bali increased by 295% (Yamamoto et al., 2021). Yet, in this case, population growth in the domestic sector contributed to the larger increase (70%). It is important to note that Bali is receiving a lot of precipitation and has in general high-water availability which decreases its overall vulnerability to water scarcity (Yamamoto et al., 2021). While the water demand in Bali increased due to

tourism, in the Mediterranean the expansion of the tourist sector led to a reduction of agricultural activity which ultimately decreased the overall water demand (Roson & Sartori, 2014). This comparison emphasizes the importance of analysing the effect tourism has on water demand on a regional level, as it differs substantially from case to case.

The literature points out that it is important to not only look at the water demand of the tourists but also at how their presence affects the freshwater quality. Tourism can contribute positively to water quality with infrastructure developments such as sewage treatment plants and better waste-management systems that decrease water pollution (Gössling et al., 2012). Though this can be observed in some cases most of the literature reports the negative effects tourism has on water quality (Cole et al., 2020). A decrease in water quality can be observed in tourist destinations which lack the necessary infrastructure to manage their solid waste and treat their sewage water (Aayog, 2018). High visitor numbers in these locations do not only severely threaten the surface water but also groundwater reservoirs, which are extremely important to ensure water security, especially in regions with low water availability (Gössling et al., 2012). While the literature reports the problems improper sewage disposal has on water quality, according to Cole et al. (2020), no studies have focused on how tourism sanitation by itself affects water quality. Cole et al. (2020) also note that there is very little literature that looks at how climate change affects water availability in tourist destinations. Even though it is well understood that climate change will reduce the water availability of already water-scarce regions and that tourism, and their water demand is expected to further grow, there is a gap in the literature connecting these two issues (Cole et al., 2020).

The environmental degradation and lower water availability tourism are causing are in some cases also decreasing the number of visitors, especially if the main attraction is the natural landscape. According to Yamamoto et al. (2021), the perceived water scarcity in Bali thought to be brought about by mass tourism could change the popularity of the destination for visitors, thus negatively affecting its economic growth. This thus shows how unsustainable tourism practices which are mainly aimed at profit maximization can negatively affect water security and other ecosystem services on which the tourist industry depends on. It therefore is important to assess the implications an expansion of the tourist industry is bringing with it to help decide whether the benefits outweigh the costs.

3.4. Water security vs. economic development

Since tourism is viewed as a tool to achieve poverty alleviation and other SDGs it is especially important to assess its effect on water availability, SDG #6 (sustainable management of water for all) (Moyle et al., 2022). As developing countries which already experience water scarcity are using tourism to boost their economy it is of topmost importance to analyse how tourism is affecting their water security and whether the economic benefits outweigh the costs of increasing their vulnerability to water scarcity.

The idea that tourism can be used to reduce poverty emerged with the creation of the Department for International Development (DFID) in 1997 and shortly after the term “pro-poor tourism” (PPT) was created and used in the efforts to achieve the Millennium Development Goals (MDGs) (Goodwin & Bah, 2012). While it has been understood for a long time that tourism brings employment and economic growth, the poor are usually not the ones benefitting from it. Therefore, the PPT approach aimed to increase the net benefits of tourism for the poor (Goodwin & Bah, 2012). “Net benefits” means benefits outweigh the costs, which include the economic, environmental, cultural, and social dimensions (Chok et al., 2007, p. 147).

However, the general understanding that tourism can reduce poverty brings up the debate about whether it does it sustainably, especially when looking at the environmental dimension. According to Telfer (2012), it is difficult to control the rapid increase of tourist inflows, which can lead to environmental degradation. He also notes that the sustainability of tourism demand has received less attention and that the new forms of tourism such as ecotourism and nature-based tourism cannot be relied on to make the sector sustainable on a global scale (p. 219). In the context of water availability which is also one of the SDGs (#6), this debate continues as tourism exerts pressure on the water supply which in some regions can lead to water security issues (Cole et al., 2020).

4. Analytical Framework

To assess the impact tourism has on Vrindavan’s water availability I used a qualitative framework from Gössling et al. (2012). As there is a lack of quantitative data that measures tourists' water demand and how they affect water pollution in the area, I chose a qualitative model. One reason for this lack of data is that the coverage of the water supply connection is only at 60.71% and does not have any metering (Nagar Nigam Mathura-Vrindavan, 2021). Furthermore, many hotels and accommodations have private borewells from which they extract their water supply.

Therefore, a qualitative analysis must be used to approximate how much tourism is adding to the problem of water scarcity in Vrindavan. The framework by Gössling et al. (2012) was originally intended to examine the sustainability of global tourism-related water use by looking at three important aspects: i) spatial and temporal aspects of water use, ii) changes in water quality, and iii) competing water uses (p. 8). While they use it to examine how global tourism is impacting water availability, they emphasize the importance of further examining it on a regional level. Their framework is useful since it examines the three aspects that define water availability. The spatial and temporal dimension looks at how the water supply and water demand in a region are affected over time. This is especially important in pilgrimage places which have peaks in visitor numbers during festive seasons. The second aspect, changes in water quality, is important since water availability is not only defined by how much water is available but if it can be used safely for drinking purposes. The last aspect, competing for water uses, was used in this analysis to assess how the increased water demand of the tourist sector can cause conflicts with the locals. By examining the water situation in Vrindavan under these 3 aspects in connection with tourism the framework allowed me to systematically assess how visitors are affecting water availability.

This framework is useful to give a detailed overview of whether tourism-related water use is sustainable, which allows for approximating its impact on the water security of the destination. The more unsustainable the tourism-water demand, the higher its impact on water availability which also means higher water insecurity.

However, this model is unable to show exactly to what extent tourism is contributing to water scarcity. While it can estimate the severity of its impact, detailed quantitative studies are necessary to give more exact data on the findings presented here. This paper thus primarily aims at analysing whether the impact of tourism on water availability is significant and thus requires more public and political attention or not.

5. Methodology

This paper will use a qualitative approach to answer the research question: *How and to what extent does (religious) tourism affect water security in Vrindavan?* The empirical data consists of observations, conversations, and informal interviews with the local population, during my stay in Vrindavan. I stayed in Vrindavan for more than 9 months to complete university courses and used some of my time to collect empirical data for this paper. Furthermore, I conducted small excursions to relevant sites and documented my findings in the form of pictures which

are used to support my empirical data as well as give a clearer understanding of the current situation in Vrindavan. Additionally, having visited Vrindavan many times as a tourist myself as well as living there for a longer period, has given me valuable insights which gave me a unique perspective on the case. The primary data collected is then compared to secondary data which consists of relevant literature including the analysis of government reports, Census data, World Bank report, and news articles. I have also evaluated quantitative data such as the water supply and demand of Mathura-Vrindavan to support my qualitative findings.

I analysed my primary and secondary data using the framework by Gössling et al. (2012), to assess how and to what extent tourism is affecting the water availability in Vrindavan. I then compare the economic benefits of tourism to the environmental consequences and look at how this is challenging the SDGs.

6. Case study

6.1. Uttar Pradesh

Uttar Pradesh is situated in the north of India, sharing its borders with Rajasthan, Delhi, Madhya Pradesh, Bihar, Haryana and Uttarakhand which used to be a part of Uttar Pradesh before 2000. The state now comprises an area of approximately 240.000 km² with a population density of 800 people per km², which is more than double the national average of 380 (Census Population, 2011). It has been one of the most highly populated and fastest-growing states in India for a long time, with a population of nearly 200 million in 2011 and a growth rate of 20% (Census Population, 2011). 52% of the population are male of which 77,28% are literate while the female literacy rate is at only 57.18%, this also points to higher gender inequality (Census Population, 2011).

The state has the second strongest economy in the country with most of its revenue coming from the agriculture and service sectors (Census Population, 2011). However, the state has one of the lowest per capita incomes and more than 50 million people are living below the poverty line (Narayanan, 2017). Despite of that Uttar Pradesh is aiming to become a 1 trillion-dollar economy by 2027 and is therefore also pushing its tourist sector through new policies and infrastructure developments (Jaiswal, 2019). These efforts lead to an increase from around 288 million visitors in 2018 to 540 million in 2019 (Uttar Pradesh Tourism, 2022). While the tourist sector decreased dramatically during the pandemic it is expected to bounce back and beyond its all-time high which raises questions of sustainability. Especially regarding water availability since annual rainfall is decreasing in all sectors of UP (Deo et al., 2015).

The pilgrimage town Vrindavan is located in the western part of UP and can be used as a good example to assess how tourism is affecting water availability since this region has one of the highest visitor numbers ((Uttar Pradesh Tourism, 2022) and the fastest decrease in annual rainfall (Deo et al., 2015).

6.2. Vrindavan

Vrindavan is a semi-urban temple town in the state of Uttar Pradesh in the district of Mathura with a geographic area of 24 km² (Shinde, 2007). The last census took place in 2011 and confirmed a population of 63.000 inhabitants of which 55% were male and 45% female with an overall literacy rate of 77.77% (Census Population, 2011). However, it is estimated that the population has reached over 100.000 today (Hawley, 2019).

The town is located on the banks of one of the holiest rivers in India, the Yamuna, which is the largest tributary of the river Ganga (Sharma et al., 2021). The name Vrindavan means the forest of Vrinda since it used to be a scarcely populated village in the middle of a forest (Kumar, 2018, p. 74). However, the town today does not reflect its name anymore in its appearance which is mainly due to its popularity as a pilgrimage site and its vast number of visitors. Vrindavan is the core of the famous pilgrimage area called *Braj*. This region encompasses many places where it is believed the Hindu God Krishna, an incarnation of Vishnu, performed his pastimes over 5000 years ago (Shinde, 2012). Vrindavan was established as a pilgrimage place between the 15th and 16th centuries by a Vaishnava saint (Kumar, 2018, p. 51). Vaishnavism is a tradition within Hinduism in which Radha and Krishna, the divine couple are the focal point of worship (Kumar, 2018, p. 51). This tradition was revived by the Bengali saint Sri Chaitanya Mahaprabhu in the 16th century who made Vrindavan the headquarter of the Vaishnava movement (Sullivan, 1998, p. 249). Ever since then, the small village surrounded by jungle, slowly transformed as it attracted more and more visitors.

Since it is located just 150 kilometres south of New Delhi and 50 kilometres northwest of Agra, Vrindavan is an accessible destination for domestic and international visitors. (Shinde, 2007). There has been a massive increase in visitors in the last 70 years. In 1950 there were around 5000 annual visitors which increased to over 6 million in 2005 (Shinde, 2012). While government statistics today estimate that it has risen to about 16 million visitors a year in 2019 (Uttar Pradesh Tourism, 2022). This boom is partly connected to the establishment of the International Society of Krishna Consciousness (ISKCON), which brought Vaishnavism, to the western world and encouraged travel to places like Vrindavan which is considered the centre

of Vaishnavism (Nash, 2012). This rapid increase in its floating population brought many economic opportunities but also caused many environmental problems, especially related to water availability (Sullivan, 1998, p. 253).

Religious Tourism in Vrindavan

There are various kinds of tourism, and what sets them apart from each other is the motivation behind them. The motivations for travelling to a destination also shape the visitor's behaviours. For example, eco-tourism and nature-based tourism exert less pressure on the environment compared to mass tourism and more luxurious forms of tourism (Hadjikakou et al., 2012). In Vrindavan, most visitors are motivated by religious motives which put them in the category of religious tourists. Religious tourism is estimated to be as old as religion itself and is the oldest form of tourism (Rinschede, 1992, p.53). For religious tourism, the reason for travelling to a destination away from one's residence is linked to one's personal beliefs and practices. Rinschede (1992, p. 52) defines religious tourism as “[...] *that type of tourism whose participants are motivated either in part or exclusively for religious reasons.*”. The emphasis here is on the “either in part or exclusively”, this is what sets religious tourism apart from a pilgrimage. While pilgrims are exclusively travelling for religious reasons, and tourists mainly for leisure, the lines between the two types of travelling are getting blurred in today's world (Shinde, 2007).

The main method of transportation used by most visitors coming to Vrindavan is the car, while pilgrims traditionally travel by foot. There is also a difference between visitors who exclusively come for religious purposes or are just partly motivated by it. This can be seen in their consumption behaviour, the number of rituals they do and so on. While before the absence of contemporary cuisine and luxurious accommodations mainly attracted pilgrims with sole religious motives the transformation of the town to a modern pilgrimage place with all commodities contributed to the high influx of religious tourists Hawley, 2019, p. 65).

Since it is practically impossible to quantify how many of the estimated 16 million visitors coming to Vrindavan every year are pilgrims, tourists, or something in between (Uttar Pradesh Tourism, 2022), the above-mentioned definition from Rinschede will be used here to analyse the research question. One of my assumptions in this matter is that, since Vrindavan is a pilgrimage place with over 5500 temples (Kumar, 2018, p. 51), all visitors coming to the town are partly motivated by religious reasons. What strengthens my assumptions is that 94% of domestic travel in India is motivated by religious reasons (Singh, 2001, p, 139). Furthermore,

whether one is categorising the visitors as religious tourists or pilgrims does not change the fact that the vast number of them has a substantial impact on the environment.

7. Discussion

That tourism brings economic growth is well established and the state of Uttar Pradesh has recognized it as one of the main pathways to becoming a one trillion-dollar economy by 2027 (Rawat, 2022). UP already has the largest tourist sector in the country but has plans to further expand it. The state government has implemented a “New Tourism Policy 2018” which aims at attracting 772.32 million dollars per year in investments and achieving a 15% and 10% increase in domestic and foreign visitors respectively (IBEF, 2022). After its implementation, it saw an increase of 87.96% in annual tourist visits from the previous year (Uttar Pradesh Tourism, 2022). It also started a campaign to increase tourism in rural villages which is hoped to decrease unemployment rates and increase living standards. However, if this rapid expansion of the tourist sector is not properly managed it can lead to environmental degradation and water security issues. Especially in regions like Vrindavan which are already prone to periods of water scarcity.

According to Cole et al. (2020), the major causes for the decline in water quality and quantity in rural tourist destinations are the overdevelopment of tourism and groundwater pollution as well as overuse. I will assess whether these two causes are present in Vrindavan and to what extent water security is affected. Furthermore, I will use the framework by Gössling et al., (2012), to analyse the sustainability of tourism-related water uses in Vrindavan by looking at the *i) spatial and temporal aspects of water use, ii) changes in water quality, and iii) competing water uses* (p. 8). The case of Vrindavan can exemplify how the rapid influx of visitors affects water availability in the face of climate change.

7.1. Spatial and temporal aspects of water use

The spatial and temporal dimension of water use is important since tourism is often seasonal and more concentrated in some regions. A region becomes more vulnerable to water scarcity if the number of visitors is highly concentrated in space and time. Gössling et al. (2012), note that peaks in tourism often occur during dry seasons which then further exacerbate the pressure on the local water supply. This spatial and temporal concentration of water use can thus lead to pressure on water availability and result in conflicts between tourists and locals (Hadjikakou et al., 2012).

Tourist destinations which lack the proper infrastructure to treat their sewage water, have low water availability, low aquifer renewal rates and few groundwater and surface water sources, are especially vulnerable to water scarcity if tourism developments are not properly managed (Cole et al., 2020; Gössling et al., 2012; Yamamoto et al., 2021). Vrindavan seems to be a case which has all these variables which put it in a vulnerable position. However, the severity of its vulnerability further depends on the spatial and temporal dimensions of water demand and supply (Cole et al., 2020). I will first discuss the water scenario in Vrindavan and then assess how the spatial and temporal dimensions are affecting it.

Vrindavan has historically not experienced water scarcity like the neighbouring state of Rajasthan. Its geographic location is favourable in the case of water security since it is situated next to a river. However, changes in surface water quality forced the town to exploit its groundwater reserves. This increased the vulnerability of the town to water scarcity. This vulnerability is amplified by other factors such as climate change, population growth and tourism.

Vrindavan today, is already experiencing water scarcity during the hot summer months as government-facilitated provisions are failing. According to the newspaper *Vrindavan Today* (2022), of the nearly 350 handpumps in the city, 100 are non-functional, while of the 14 government-run water booths only 5 are working. This shows how unprepared the town is for times of water scarcity as well as high water demand caused by population growth and high visitor influx. During the summer months, the number of visitors is relatively low which means that the town is already struggling to support the water demands of its local population. This is also confirmed by data from the municipality which states that there is a gap in water availability of 34 litres per capita per day (lpcd) (Nagar Nigam Mathura-Vrindavan, 2021).

The annual visitors coming to Mathura and Vrindavan in 2019 were ~8.3 million and ~16 million respectively which shows that the effect visitors have on the water availability in Vrindavan is probably more severe than Mathura (Uttar Pradesh Tourism, 2022). Mathura has 5 times the population of Vrindavan and better infrastructure developments while only receiving half of Vrindavan's annual visitors. It can thus be assumed that the reported problems of groundwater depletion and pollution are even more severe in Vrindavan.

Population growth and poor water management practices as well as lacking infrastructure developments can be seen as the main cause for the high-water supply gap and unsustainable use of groundwater reserves. However, the high floating population of religious tourists exerts

further pressure on the towns' water availability. As both Mathura and Vrindavan are pilgrimage places they receive visitors all year round, however, the number of visitors is highly concentrated in space and time during festive seasons (Shinde, 2007). Furthermore, since the motivation for travel is also religious, many visitors come several times a year or even every month (Shinde, 2018). Of the approximately 16 million visitors coming to Vrindavan in 2019, it can be said that most of them came during the holy time of *kartik*, which is a whole month of festivals taking place between October and November (Uttar Pradesh Tourism, 2022). While this points to a high spatial and temporal concentration of water use which exerts enormous pressure on water availability, the peak of visitors arrives right after the monsoon season. This reduces the pressure visitors have on the water availability as the monsoon increases the region's water supply. However, as Vrindavan already has a gap in water availability their impact is only slightly reduced. With climate change lowering annual rainfall, the gap in water availability will further decrease if no countermeasures are taken.

After assessing the spatial and temporal aspects of water use in Vrindavan, it can be concluded that the water demand of visitors is highly concentrated in space and time, as many arrive at the same geographical area during the same period. While this peak in tourist water demand happens during the peak of water supply, the water availability still is severely affected as the town is already unable to provide enough water to its local population.

7.2. Changes in water quality

When talking about water availability not only the quantity of water is important but also the quality which determines whether it can be used for drinking purposes. Polluted water can lead to many health problems and sometimes even death (UNICEF, 2021). I will here shortly present the two water sources of Vrindavan and discuss how the water quality has changed over time.

Yamuna

The Yamuna River flows around the centre of Vrindavan and is one of its most visited religious sites. It can be seen as the lifeline of Vrindavan as it not only served as an important water source but also as the centre of the religious, cultural, and economic life of the village. The river has been worshipped by Hindus for thousands of years and is one of the holiest rivers in India, mainly due to its connection with the god Krishna (Haberman, 2006, p. 4; Kumar, 2018, p. 131). The river is mentioned in holy scriptures such as the *Bhagavata Purana*, which describes Krishna's pastimes and is also worshipped as a mother and goddess of love (Haberman, 2006, p. 95).

Nowadays, the high levels of pollution make the river unsafe for bathing, and the consumption of the water causes health problems (CPCB, 2020). Hawley (2019, p. 19), mentions that while before everyone used to bathe in the Yamuna, nowadays barely anyone does it due to these changes. However, the many homeless living in Vrindavan sometimes have no other option and thus are most affected by the pollution. Every year, local healthcare workers have reported thousands of cases related to waterborne diseases such as diarrhoea, typhoid, cholera, and hepatitis (Kumar, 2018, p. 137). While some of the pollutants can be filtered out, to make it drinkable, high levels of ammonia make the water untreatable (Misra, 2010). It has been found that consumption of water with ammonia levels higher than 0.5 parts per million (ppm), can cause organ failure and brain damage (Misra, 2021). In the Yamuna, the ammonia levels have sometimes reached 6-7 ppm (Misra, 2021).

People are also disproportionately affected by the pollution since mainly the poor rely directly on the water of the river. The pollution is mainly caused by industrial waste, untreated sewage water and agricultural runoff of fertilizers and pesticides (Sharma et al., 2021, p. 949). While many cities are polluting the river, more than 70% of the pollution comes from Delhi (Haberman, 2006, p. 77). This means that when the river reaches Vrindavan which is situated just south of Delhi the water quality poses a threat to not only the locals but also the religious tourists who travel far distances to bathe in the holy Yamuna. According to a recent study (Sharma et al., 2021, p. 948), the Heavy metal Pollution Index (HPI), was higher in Vrindavan (2676.67 HPI) than in Agra (2120 HPI) which is situated further down the stream of the temple town. This indicates that the pilgrimage town's proximity to Delhi puts it in a vulnerable position.

It is difficult to determine how much tourism is contributing to pollution, but it can be said with certainty that it is not the main cause. This is because tourists are mainly adding to the pollution in the form of untreated sewage while industries and the agricultural sector are responsible for most of the heavy metals and toxic chemicals in the water (Misra, 2010). Furthermore, most of the pollution is coming from the capital, which has used the river for the disposal of sewage, industrial waste, and garbage for many years (Haberman, 2006).

It is also difficult to determine how much Vrindavan and its tourist sector are adding to the pollution. However, in general, more people also produce more sewage and waste, which if not properly managed leads to more pollution. India today has a very poor sewage treatment infrastructure that is only treating 20% of its wastewater, the rest is discharged into rivers or deep holes in the ground (Sharma & Agrawal, 2017). Centralized sanitation systems are mostly

only in towns that have more than 500,000 inhabitants, and even then, they are not connected to all households (SCBP, 2019). The sewage treatment plants (STPs) are also either absent or few in number in most cities, due to a lack of funding (SCBP, 2019). Both the lack of infrastructure developments to handle the human waste produced and the inadequate management of existing systems leads to untreated wastewater polluting the environment and water supply.

For example, in Mathura two STPs cover 13% of the population and treat 28 million litres per day (MLD) while 51 MLD of sewage are produced, the remaining 23 MLD are disposed into the Yamuna (CSE, 2013). The situation is similar in Vrindavan, where the two STPs are only treating half of the sewage produced by the “old Vrindavan”, while the wastewater produced by the modern Vrindavan, where most hotels and accommodations are, is still untreated (Hawley, 2019, p. 57; Vrindavan Today, 2021). This also means that since visitors are mainly staying outside the “old Vrindavan”, most of the untreated sewage water polluting the river is coming from them. It can thus be assumed that Vrindavan with its more than 16 million annual visitors is discharging more sewage into the river than the larger city of Mathura. While officially draining sewage into the Yamuna is a punishable offence, 5 of the town’s main sewage drains flow untreated into the holy river (Kumar, 2018, p. 137). Ironically the most pollution came from a pipe just before the famous *Keshi ghat*, where most people perform their river worship (see Figure 1 in Appendix).

Sewage is not the only pollutant which Vrindavan is adding to the problem. Vast amounts of garbage are discharged into the river as well and can be seen floating by when wandering the rivers banks (see Figure 2 in the Appendix). Many of the sewers flowing into the river also bring large quantities of garbage with them (see Figures 3 & 4 in the Appendix). While the acceptable threshold of solid wastes is set at 100mg/L the Yamuna has levels between 1000 to 10,000mg/L (Misra, 2010). Only recently trash cans were installed at *Keshi ghat*, where most visitors encounter the river. However, this is just a cosmetic measure which does not address the root of the problem which is an increase in population and lacking infrastructure developments. In Vrindavan, the main contributor to the vast amounts of solid waste and sewage running into the river are its 16 million annual visitors (Shinde, 2012; Uttar Pradesh Tourism, 2022). Especially in festival seasons, the pressure on the town’s infrastructure and environment is enormous, as discussed before.

The infrastructure is not suited for the rapidly increasing floating population. This is true for the sewage system but also the waste management. One can observe how plastic waste is

clogging the open drainage system, which leads to sewage water filling the streets and ultimately flowing into the river (see Figure 5 in the Appendix).

Poignantly, the rituals practised worshipping the river goddess also contribute to substantial amounts of plastic waste being disposed of in the holy waters. During my many visits to Vrindavan, I could also see a shift from the usage of biodegradable *donas*, which are used for offering flowers and ghee candles to Yamuna, to ones made of plastic. According to the vendors, this shift took place since the plastic-lined ones are perceived to be of better quality by the visitors. Now thousands of these bowls can be seen floating down the river's current adding to its pollution (see Figure 6 in the Appendix).

Furthermore, the problem of water availability also increases the amount of garbage getting into the river. As visitors are struggling to find sources of drinking water, they consume large quantities of bottled water. Due to the lack of recycling facilities and waste management systems plastic bottles also end up in the river, further contributing to its pollution.

With the high pollution of the river, Vrindavan is not only losing a valuable surface water source but is also threatening its groundwater supply, as the pollution of the river mixes with their aquifers. According to Krishan et al. (2017), approximately 90% of the groundwater in the Mathura district is composed of water from the Yamuna. While some natural filtration is taking place when the water is flowing to the deeper aquifers, the groundwater quality still is also affected by the quality of the river water.

Groundwater

According to La Vigna, (2022), urban groundwater can both be an asset, as it is a valuable source of drinking water, and a problem, if the pollution of the water causes health risks. By being overly dependent on aquifers one creates even more issues as the region then becomes more vulnerable to periods of water scarcity. India currently uses more of its groundwater resources than any other country in the world, and the rate of depletion has increased by 23% between 2000 and 2010 (Hawley, 2019, p. 304). However, this data does not consider pollution rendering aquifers unusable for drinking water purposes. According to a study by Ahmed et al. (2019), the groundwater in the Mathura district is severely contaminated with heavy metals and thus poses chronic health risks. In this study, the groundwater in Vrindavan is described as very poor.

Tourism developments can increase water quality with the construction of sewage treatment plants and better waste management infrastructure (Gössling et al., 2012). However, higher

visitor numbers can lead to more groundwater pollution if these developments are not properly managed or cannot keep up with the increased number of tourists. This correlates with findings from Cole et al. (2020), who have identified the over-development of tourism as well as the pollution and reduction of the groundwater reserves as the major causes of decreased water security and environmental degradation.

In Vrindavan developments linked to the influx of visitors increase groundwater depletion and pollution. Many new accommodations constructed for the steadily increasing flow of visitors and residents coming to Vrindavan have adopted the practice of pumping their wastewater in deep bore wells, thereby severely polluting the region's aquifers (Shinde, 2012). A more recent study by Ahmad et al. (2022), concluded that consumption of groundwater in the Mathura district poses a high non-carcinogenic health risk, especially to children and infants, due to the high levels of heavy metals and other pollutants. While the measured pollution levels were greatest in the shallow aquifers all three depths in which groundwater can be found were polluted to a degree that consumption of the water poses a serious health risk.

What is adding to this problem is that government projects are mostly aimed at cosmetic solutions, which do not solve the problem of depleting groundwater reserves but rather add to it (Vrindavan Today, 2022). For example, the fundament under the *ghats* has been renovated with a new system consisting of 20-meter-long vertical girders, which unfortunately disrupted the aquifers and even caused the water level in Vrindavan to sink by around 20 meters in 2016 (Hawley, 2019). This development has not only decreased the aquifer renewal rate but also made it harder to access the groundwater supply.

In conclusion, the water quality of both the surface and groundwater supply has decreased over time. While this qualitative analysis cannot show how much tourism is contributing to the pollution it is certain that the lack of infrastructure in the town coupled with an unregulated increasing number of visitors adds significantly to the problem. If the floating population continues to increase and climate change further reduces the precipitation of the region, water scarcity is to be expected.

7.3. Competing water uses

In Vrindavan, most of the locals directly or indirectly benefit economically from the tourist sector (Kumar, 2018). While some surrounding villages that are dependent on agriculture might have to compete with the high-water demand of the tourist sector, I would argue that the main competition for water uses is between the local population and the visitors. In this section, I

will first present the current situation of water availability and then discuss how it is affected by the floating population.

While there is no exact data on the water demand and supply of Vrindavan, data exists that grouped Mathura and Vrindavan together as well as data on Mathura city which can be used to make assumptions about the situation in Vrindavan. Both Mathura and Vrindavan rely mainly on groundwater as well as the Yamuna River (CSE, 2013). However, since the river is heavily polluted and in the dry season is only a narrow stream it is only fulfilling 21% of the water demand (Nagar Nigam Mathura-Vrindavan, 2021). In Mathura, which has a population of around 0.5 million, the water demand is around 59 million litres per day (MLD), while the water supplied after deducting leakage is 27 MLD, the gap in the water supply is thus also fulfilled with groundwater from private borewells (CSE, 2013). The city of Mathura thus heavily relies on its groundwater reserves which are rapidly decreasing. This trend is also observable in Vrindavan, as submersible pumps are steadily decreasing their aquifers (VINA, 2016). The district of Mathura has the highest overexploitation of the state's groundwater reserves (Ground Water Department U.P., 2020, p. 66). Currently, only 60% of its aquifers are considered safe while 10% are considered semi-critical, 10% critical and 20% are overexploited (Ground Water Department U.P., 2020, p. 72). Groundwater can be seen as a safety measure that prevents water scarcity in times of droughts and low rainfall. Overexploitation or pollution of a region's aquifers can greatly impact the overall water availability and increases the population's vulnerability to changing precipitation patterns.

This is especially problematic since climate change is further reducing the precipitation of some regions thus decreasing the aquifer renewal rates. In Uttar Pradesh, the annual rainfall is already declining across all sectors and the fastest decrease is taking place in its western part where Vrindavan is located (Deo et al., 2015). Villages and towns like Vrindavan, which have relied on the river's water supply for millennia did not need to develop extensive rainwater harvesting structures which are common in other drought-prone states such as Rajasthan (Nakil, 2021). This lack of communal knowledge and preparedness could increase their vulnerability to water scarcity and thus stresses the importance of better water and tourism management practices.

While some water harvesting structures exist in Vrindavan, the step wells (*bawari*) and tanks (*talab, kund*), are not properly functioning due to mismanagement (VINA, 2016). The tourism department has renovated some of those *kunds* to make them more attractive for visitors, thus rendering them useless for their intended purpose (VINA, 2016). It seems that tourism

developments in Vrindavan are mainly aimed at increasing visitor numbers while not thoroughly considering the negative environmental consequences. This also shows that the problem of water scarcity in Vrindavan is not taken seriously by the authorities.

The estimated gap in water availability (in Mathura and Vrindavan combined*¹) for the local population is 34 litres per capita per day (lpcd) (Nagar Nigam Mathura-Vrindavan, 2021). However, the calculation to determine the water availability per capita used the population data from 2011, which skews the reality of the results.

Furthermore, these calculations do not even consider the additional water demand of its approximately 24.3 million annual visitors*² (Uttar Pradesh Tourism, 2022). The tourist water demand can also be 10 to 15 times higher than the local demand (Aayog, 2018). Even with conserved estimates considering the low infrastructure developments and the low water availability, the pressure tourism exerts on Vrindavan's water supply could lead to conflicts with the locals. According to Yamamoto et al. (2021), in Bali, the smaller population of tourists uses more water than the much larger local population which already led to conflicts between them. However, in Vrindavan, the tourist population sometimes far exceeds the local population which creates an even bigger problem, since their water demand is also higher than that of the locals.

People are also disproportionately affected depending on their financial situation. During times of water scarcity in Vrindavan, locals had to rely on tankers and tourists on bottled water, which is both only accessible to people who can afford it (Vrindavan Today, 2022). The homeless and poor who rely on the river and handpumps for their water supply are the most affected by water scarcity. They are thus not only benefitting the least economically from the tourism industry but are also most affected by its negative environmental consequences.

This section looked at the water availability in Vrindavan and how visitor's water demand is affecting it. It can be concluded that the town is already vulnerable to water scarcity as it is unable to provide adequate water supply to its local population. It currently heavily relies on groundwater supplies which are rapidly being overexploited. The additional pressure of visitors' water demand is not considered in government reports which means the actual gap in water availability is even higher than the 34 lpcd (Nagar Nigam Mathura-Vrindavan, 2021). Since no quantitative data exists on the water demand of tourists in Vrindavan the exact contribution to

¹ Data only exists from the Nagar Nigam Mathura which is the municipality of both Vrindavan and Mathura.

² Tourism visits in Vrindavan and Mathura 2019

decreased water security is unknown. However, it can be assumed that its impact is significant, and steps should be taken to reduce the towns vulnerability to water scarcity.

7.4. Sustainable tourism and Environmental degradation

Tourism is contributing more than 10% to the global GDP and thus is seen as an optimal tool to help achieve the SDGs (Sofronov, 2018). According to Tourism and SDGS (n.d), all the targets could either directly or indirectly benefit from tourism. Sustainable tourism has been included in Goals 8, 12, and 14 on inclusive and sustainable economic growth, sustainable consumption and production and the sustainable use of oceans and marine resources, respectively (United Nations, 2015). While sustainable tourism practices are said to help achieve the SDGs, unsustainable forms of tourism can jeopardize them.

In the case of Vrindavan, tourism brought economic opportunities, new infrastructure developments as well as environmental degradation. I will discuss here whether the benefits outweigh the costs and explain how the tourist sector is challenging the SDGs.

The definition of sustainable tourism given by Aayog (2018, p. 34), *“Sustainable tourism is tourism that takes full account of current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities.”* From the above analysis, the conclusion can be drawn that the current form of the tourist sector in Vrindavan is unsustainable. This is also supported by Shinde (2018, p. 65), who argued that the social, cultural, and environmental situation in Vrindavan worsened due to the high number of visitors and the poorly regulated “free for all” market.

The state government of Uttar Pradesh seeks to increase the number of religious tourists with the help of several development projects and festivals (Jaiswal, 2019). These efforts almost doubled the number of visitors between 2018 and 2019 (Uttar Pradesh Tourism, 2022). While government policies are one reason for this increase, the modernization of the town and the new commodities and comforts that came with it also attracted more visitors. This increase in visitors and the transformation from a small village to a town drastically changed the natural landscape. Between 2001 and 2008 the area of Vrindavan grew from 4.1 km² to 15.8km², by replacing forests with buildings and other infrastructures (Kumar, 2018, p. 53). This transformation also contributed to the increase in visitors.

According to Shinde (2007), there has been a shift in the main reasons for visiting Vrindavan. Before what attracted pilgrims to the sacred place was to see the forests and groves where their

idol of worship spent his youth and adolescence (Shinde, 2007). The pilgrims did not require special facilities such as guesthouses with swimming pools or fancy restaurants with food from around the world. The absence of these facilities therefore also only attracted visitors who were exclusively motivated by religious reasons, which were not only fewer in numbers but also required less facilities and had hardly any material demands. The environmental footprint of the visitors was thus very minimal. With Vaishnavism gaining worldwide popularity with the establishment of the ISKCON movement in the 1960s the amount of domestic and international visitors coming to Vrindavan increased drastically (Nash, 2012). Visitors coming from the upper- and middle-class and their consumption patterns thus shaped the goods and services as well as the infrastructure in many pilgrimage towns like Vrindavan transforming them into more touristic places (Kumar, 2018, p. 39). This did not only increase the environmental footprint of the visitors but also their numbers.

The central and state government have in recent years also launched numerous major development projects to provide better amenities for the tourists coming to Vrindavan (Kumar, 2018, p. 18). Many of these projects are mainly aimed to increase the number of visitors as well as bringing more benefits to the poor (Narayanan, 2017). One example of these projects is the “*Rehabilitation of the Banke Bihari Temple Area*” which is a project from the state government with support from the World Bank (Narayanan, 2017). The project aims at constructing and renovating tourist facilities to improve the visitor experience as well as bringing more benefits to the poor around the most visited temple in Vrindavan. In the Environmental Assessment report, it is stated that the pro-poor tourism objective would be met if shopkeepers' and vendors' livelihood opportunities are improved by the renovation and construction of tourist facilities (Narayanan, 2017, p. 61). As pro-poor tourism is defined as increasing the net benefits for the poor, which also includes the environmental dimension, such developments could ultimately lead to a disadvantage for the poor. As the poor are the ones most dependent on ecosystem services and rely on unfiltered ground and surface water, they are the most affected by environmental degradation and water scarcity. According to the World Bank report (Narayanan, 2017), almost half of the local population is living in slums and low-income settlements without access to urban and social services (p. 7). This means that around half of the population is especially vulnerable to water insecurity as they mainly draw water from underground or the river since their houses are not official and thus not connected to the water supply network of the municipality. The overdevelopment of tourism is thus partly responsible for reducing the availability of clean drinking water as well as adding to the poor sanitation situation in Vrindavan.

From what has been discussed so far it has become clear that the economic benefits tourism in Vrindavan brings are only enjoyed by the few while the negative consequences are affecting everyone. As someone that has been living in Vrindavan for 9 months, I can say that the life of the locals is affected by the high number of visitors. During weekends and festive seasons, it becomes impossible to navigate through the market as traffic congestions reach far beyond the city centre. This creates problems for locals to access food and other essential items. Additionally, the high number of visitors also substantially adds to the pollution of the air, water, and soil. Furthermore, while visitors can usually afford clean bottled water, many locals must either use polluted water from the river or less polluted groundwater. There are many more issues which will not be discussed here but in general, one can say that the social, cultural, and environmental consequences of tourism in Vrindavan far outweigh the economic benefits and thus efforts should be made to make the industry more sustainable and decrease the number of visitors.

7.5. Unsustainable tourism and SDGs

While the United Nations promote sustainable tourism to achieve the SDGs, unsustainable tourism has the reverse effect as the example of Vrindavan can show. Unsustainable and unregulated expansion of tourism is thus challenging following SDGs in Vrindavan:

- SDG 3 - good health and well-being
- SDG 6 - clean water and sanitation
- SDG 11 - sustainable cities and communities,
- SDG 14 and 15 - life below water and life on land

(United Nations, 2015). From what has been discussed so far it has become quite clear how tourism is affecting goal number 6 and 14 (see Figure 7 in the Appendix). As the lack of clean water and sanitation is known to cause health problems it challenges efforts to achieve goal number 3. The impact tourism has on the town's infrastructure is also challenging SDG 11. The rapid urbanisation of the town which was mainly caused due to its popularity as a pilgrimage place caused high rates of deforestation which in turn challenged SDG 15 (Shinde, 2012). One could also argue that increased water insecurity in the face of climate change and further increased visitor numbers can eventually lead to conflicts between locals and tourists which would challenge SDG 16. While the scope of this paper does not allow a more detailed discussion of this matter, it has become apparent that action must be taken to make tourism in Vrindavan more sustainable and to increase the town's resilience to water scarcity.

8. Conclusion

This paper aimed at answering the research question: *How and to what extent does (religious) tourism affect water security in Vrindavan?* It has been found that the high number of visitors negatively affects the water security of the town by substantially adding to the water demand, which the region is already unable to fulfil for its local population. Furthermore, religious tourism also exerts immense pressure on the poor sewage and waste system, which adds to the surface and groundwater pollution thus further decreasing water availability. As the river Yamuna, which used to be the primary water source, became increasingly polluted the region started to exploit its groundwater reserves at an alarming rate. This puts Vrindavan in a vulnerable position as the number of visitors is expected to increase and climate change is further reducing the already low aquifer renewal rates.

While it is difficult to assess to what extent tourism is contributing to reduced water availability it has been shown to be one of the main causes. The case of Vrindavan thus shows how unregulated and mismanaged tourism can lead to decreased water security and jeopardize many of the Sustainable Development Goals. The central and state government are therefore urged to better regulate the tourist sector, encourage sustainable tourism practices as well as invest in infrastructure projects that are aimed to increase the long-term water security of Vrindavan and other tourist destinations.

For further research, a quantitative study that looks closely at the extent to which tourism affects water availability in Vrindavan could help better understand the severity of the issue. Furthermore, the effect tourism has on water security in water-scarce regions should be explored in other pilgrimage towns and tourist destinations. While water security is a well-researched topic it is not often brought up in connection with tourism and climate change. Especially in the post-pandemic world where tourism is expected to increase and climate change is exacerbating the vulnerability of water scarcity, it is necessary to identify vulnerable destinations and increase their resilience. Moreover, research should be done on how unsustainable tourism is affecting the Sustainable Development Goals.

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Appendix

Figure 1 Open sewage drains in front of Keshi ghat (18.11.2022)



Figure 2 Garbage at Keshi ghat (18.11.2022)



Figure 3 sewer filled with garbage flowing towards Yamuna (18.11.2022)



Figure 4 garbage and sewage flowing into the Yamuna (18.11.2022)



Figure 5 Garbage clogging the open sewage drain in the centre of Vrindavan (18.11.2022)



Figure 6 Plastic donas for offering and garbage left behind a Yamuna, close to Keshi ghat (18.11.2022)



Figure 7 Dead fish floating at the bank of Keshi ghat (18.11.2022)





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