The Sombre Case of an Odd Triad — Dolphin, Man and Zoonoses: Revitalisation and Revival of Vikramshila Gangetic Dolphin Sanctuary, Bihar

MANJU RAJEEV KANCHAN
Masters in Landscape Architecture, School of Planning and Architecture, Vijayawada

MINAKSHI JAIN
Director, School of Planning and Architecture, Vijayawada

JYOTI VERMA
Urban River Planner, National Mission for Clean Ganga, Ministry of jal shakti, GoI

Abstract
Microbial activity has been around on this planet since time immemorial, contributing to the emergence of numerous renowned plagues, epidemics and pandemics. What was once a means to sustain the environment today has become an eminent cause of concern as almost 60–75 per cent of the documented infections that affect man are of zoonotic or of animal origin. Studies have further identified a link between zoonoses and factors like habitat fragmentation, biodiversity loss, agriculture etc.; however very few have actually attempted to link them with the discipline of landscape architecture. This research therefore is an attempt to understand how zoonotic resilience can be achieved in an urban riverine landscape using the case of Vikramshila Gangetic Dolphin Sanctuary, Bhagalpur, Bihar. The research outcome is a prototypic design approach and framework that may be scaled and adapted into any ecosystem, followed by a cemented understanding of the fact that landscape architecture is indeed capable of curbing zoonoses at the initial phases itself. However, a combination of design interventions, proactive planning upon consultation with inter-disciplinary experts and policy formulations is needed for success to prevail. Mimicking the natural environment as much as possible is the core strategy to keep zoonotic spillover at bay.

Key words: Landscape Architecture, Zoonoses, Vikramshila Gangetic Dolphin Sanctuary, Braided Rivers, Zoonotic Resilient Landscapes

Introduction

"The clash of human and animal interests may also create friction when wild species from the peri-urban hinterland are attracted to feeding or nesting opportunities in the ever-expanding suburbs." (Atkins, 2016, p. 6)

The above excerpt perfectly highlights the contextual gist behind the research intent in this paper. Zoonoses[1] is slowly turning into a predominant issue of concern within the public health sector as studies indicate around 61 per cent of all human diseases and around 75 per cent of emerging infectious diseases to be of zoonotic origin (Taylor, L. H. , Latham, S. M. , & Woolhouse, M. E. (2001)). The transfer of malignant zoonotic pathogens from sylvatic reservoirs[2] into the human population is truly a rising concern; especially with the ongoing COVID-19 pandemic (Morens, D.M. & Fauci, A.S., 2020).

Generic research studies[3] identify the prominent causes of zoonotic development within the human community to be closely linked with degrading environmental status and the health of our blue–green network infrastructure as well. Studies reveal water bodies as an equivalent pathogenic reservoir for pathogens (Thomas, 2020, September 13 'Potential sea animal reservoirs for coronaviruses') that are either endemic or reach the waters due to improper anthropogenic practices such as open defecation etc. Additional research further recognised the natural presence of human pathogens in wild fauna, inclusive of gregarious species such as dolphins (Thomas, 2020, September 13) and migratory avi–fauna[4] that can turn into potential zoonotic vectors as well.

This calls for effective monitoring and preservation of these water bodies to prevent onward transmission to other wild, domesticated or human species via direct or indirect contact. Understanding the working of predator–prey relationships and existential food webs can help devise strategic design solutions to minimise biodiversity loss without compromising on food security or development.

In a diverse nation such as India, the floodplains of rivers such as the Gangetic watershed are socio-ecological systems, supportive of both man and a plethora of wild species. However today, Indian riverscapes are competing with human interests to sustain a diverse riverine ecology, evident from the degrading quality of these rivers.

The Gangetic riverscape comprising the Ganga – Brahmaputra – Meghna river system is the main habitat of the national aquatic animal of India—the Indian Gangetic dolphin (Platonista gangetica); a key indicator species whose presence indicates the purity of the Ganga River and vice versa.

[1] *World Health Organization (WHO) defines zoonosis as any disease or infection that is naturally transmissible from vertebrate animals to humans.*

[2] *Sylvatic reservoirs indicate natural reservoirs wherein these pathogens are hosted. Only upon encounter with humans do they turn pathogenic in nature. Else they are harmless to their host vectors.*

[3] *An in-depth understanding of zoonotic spillover into the human community was explored in Kanchan (2020), 'Role of landscape architecture in curbing zoonoses—developing a design framework and approach (unpublished Master's dissertation). School of Planning and Architecture, Vijayawada.*

[4] *Avi–fauna/avian fauna refers to bird population.*

Apart from occupying the apex position in the aquatic food chain (a mark of increased biodiversity, hence healthy riverine ecosystem), the downward movement of this species is another indicator of receding water during floods for the local people as well. Additionally, these beautiful blind and semi-gregarious species are known to orient their entire life via echo-location. Upward water movement, a combination of deep and shallow riverine segments are two major character traits of these river dolphin habitats. Within an overall population wavering around 4000–5000, these species have been occupying the International Union for Conservation of Nature (IUCN) endangered list since 1996 (Table 1). Massive sightings in addition to the year-round dwindling dolphin count and vanishing of the species from the majority of previous Gangetic dolphin hotspots have led to the establishment of the Vikramshila Gangetic Dolphin Sanctuary (VGDS).

Despite being a notified sanctuary, the dolphin count here has drastically decreased over the years, which is a huge predicament for the health of the Gangetic Riverine system is closely linked to the survival and presence of the Gangetic dolphins. Moreover, their semi gregarious nature does hold a massive potential for them to host potential zoonotic pathogens, thereby acting as a harbinger of probable global zoonotic pandemics. The project shall provide immense scope for exploration of creating a sustainably enhanced built environment in a natural dolphin habitat with the result being a healthy and zoonotic resilient landscape.

Additionally, the sanctuary is also home to various migratory fish and avi–fauna as well, such as the red-crested pochard, greater adjutant etc. However today, VGDS is in a sorry condition and fails to maintain the ideal habitat needed for any of these species owing to excessive pollution, anthropogenic interferences and intense eutrophication. Which is why it is also important for the design proposal to not just ensure riverine biodiversity protection but also the zoonotic resilience of surrounding landscapes, keeping in mind both the potential scope of a pathogenic spillover into the human community, in addition to affecting the sacred and historic relevance of Ganga.

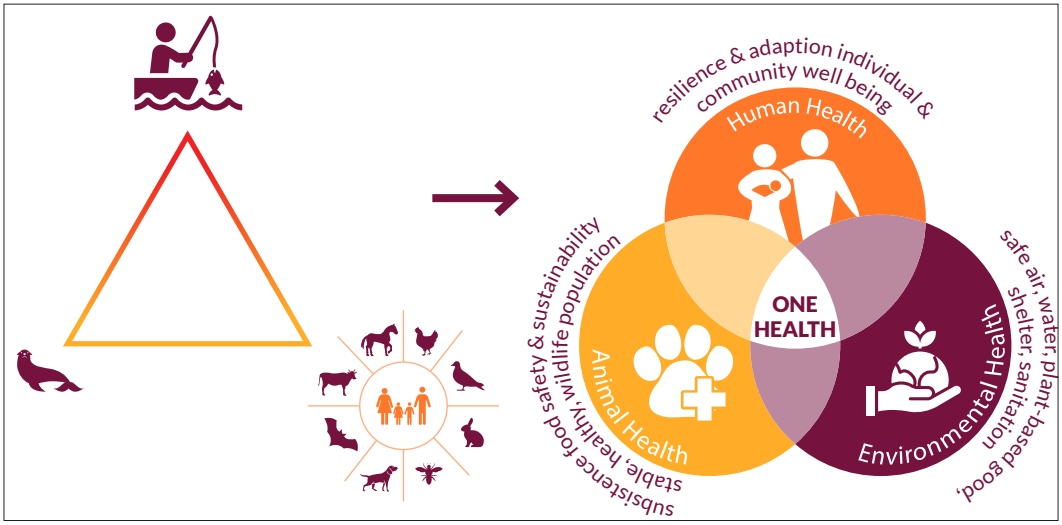
This research paper is a comprehensive document that elucidates the past and present of Ganga River in the context of the Vikramshila Gangetic Dolphin Sanctuary in addition to providing a detailed account of how this sanctuary may be restored and conserved to its best possible glory through strategic design interventions, policies and guidelines. Efforts were made to consider the various aspects associated with a holistic yet sustainable river sanctuary management for the benefit of both the river, its associated dynamics with biodiversity, and the local regional community, while also attempting to establish a consensus between the key unconventional project stakeholders—dolphin, man and zoonoses—each symbolic of a wider canvas (Figure 1).

Table 1: Stretch in the Ganga River System in India Where Gangetic Dolphins Have Been Reported

River systems of Ganga Plain	"Stretch where dolphins have been reported"	Estimates of population size
Ganga River	Between Haridwar, Uttarakhand and Bijnor barrage, Uttar Pradesh	"Completely disappeared WII (2018)"
	Between Bijnor and Narora, Uttar Pradesh	"35–39 (Behera and Mohan 2005; Behera 2006) 56 (Behera et al., 2013)"
	Between Anupshahar and Narora `Barrage, Uttar Pradesh	28 (Bashir et al.,2010)
	Between Narora and Kanpur, Uttar Pradesh	"Nil (Sinha 1999) 3 (Behera et al.,2013)"
	"Between Allahabad, Uttar Pradesh to Buxar, Bihar "	204 (Sinha 1999)
	Vikramshila Gangetic Dolphin Sanctuary, 60 km stretch between Sultanganj to Kahalgaon, Bihar	"81–92 (Sinha et al., 2000) 88–174 (Chaudhary et al., 2006)"
	Between Buxar and Maniharighat, Bihar	808 (Sinha et al., 2010a)
	"Between Maniharighat and Farakka, West Bengal"	115 (Sinha 1999)
	River Hooghly (250 km stretch from Mayapur to Ganga Sagar) in West Bengal	170–180 (Sharma 2010)
	"Waterways in the Sundarbans forest, India-Bangladesh"	196–225 (Smith et al., 2006)

Source: Aggarwal, D., Kumar, N. & Dutta, V. (2020). 'Impact on endangered Gangetic dolphins due to construction of waterways on the River Ganga, India: An overview'. Environmental Sustainability, 3(2), 127. https://doi.org/10.1007/s42398-020-00104-2.

Figure 1: Adapted One Health[5] Diagram – Animal (Dolphin), Human (Man) and Environmental (Zoonosis) Health



Source: Developed and adapted by authors from WHO recognised One Health diagram

Aim

To develop a prototypic zoonotic resilient landscape where humans and fauna (both wild and domesticated) can coexist within the same environment without fear of a pathogenic spillover.

Objectives

To create a safe haven for the endemic species of the region, thereby simultaneously increasing the population count of the Indian Gangetic dolphins.

To design a zoonotically resilient riverine infrastructural landscape for an ecosystem as unique and sensitive as that of the Ganges that exists within the layers of religion, natural sanctum and rapid urbanisation—this can further be adapted to similar Indian riverscapes.

Research Question

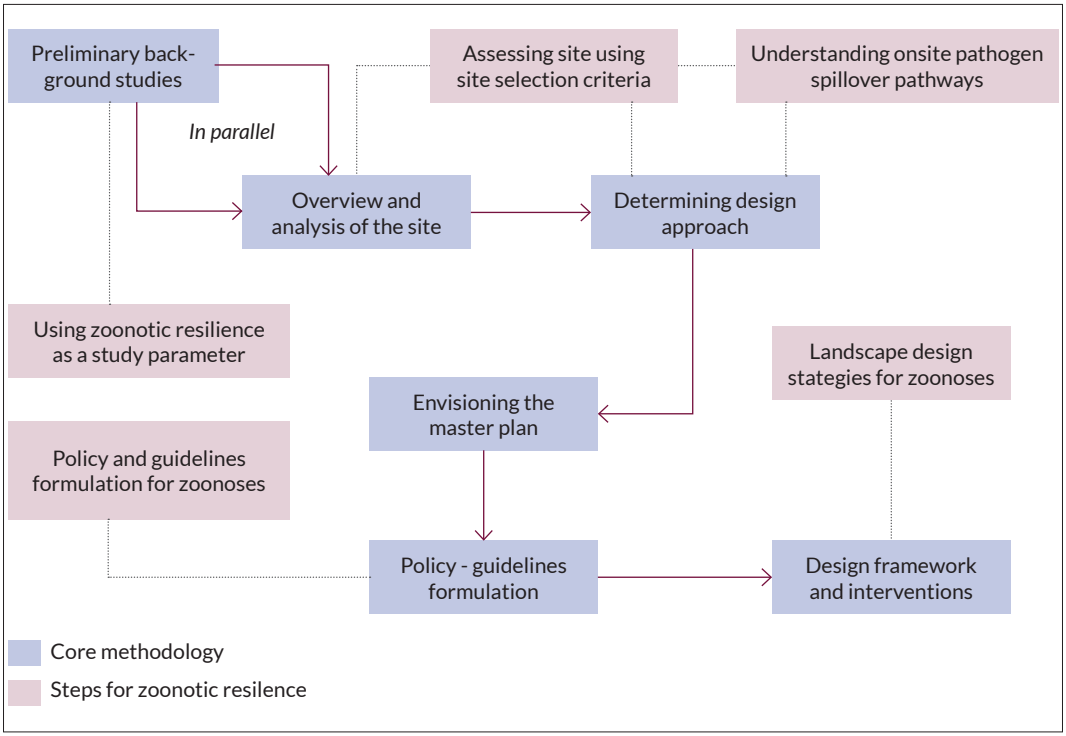
How can we develop a blue-green infrastructural riverine urban landscape, inclusive of the diverse species that exist within the habitat as well as hold potential for a zoonotic spillover into a zoonotically resilient landscape?

Research Methodology

A focused research technique was adopted in order to better understand how such a massive yet critical developmental change such as zoonotic resilience may be brought about within practical limits. This is primarily a descriptive and qualitative approach in order to better influence outcome and empower change through opening a platform for future discussions and research (Figure 2).

[5] *One health approach stands for the unification of the health of the triad namely animal health, human health and environmental health.*

Figure 2: Methodology



Source: Author

Owing to the novelty of research as well as limitations with respect to time and geographical issues, most data presented here is secondary in nature. Therefore, a holistic look at the issue at a macroscopic level was carried out by addressing the zoonotic infections based on vector typology and also limited to the local site context.

Google Scholar was utilised wherein keywords searched were limited to include a combination of 'zoonoses', 'landscape architecture', 'design interventions', 'framework', 'design guidelines' 'Vikramshila Gangetic Dolphin Sanctuary'(VGDS) 'Gangetic dolphins' for research papers and reports published within the domains of landscape architecture, ecology, and health. Searches were carried out from start to end. Likewise individual familiarity of the scientific literature was also relied upon, adding the relevant inputs wherever possible on the basis of generic primary knowledge of the subject.[6] Data search was mostly limited to the recent time frame of 5-10 years, however older relevant publications were not excluded. Likewise, an attempt to understand the origin of the Gangetic River stretch within VGDS dating back to 200 years was undertaken

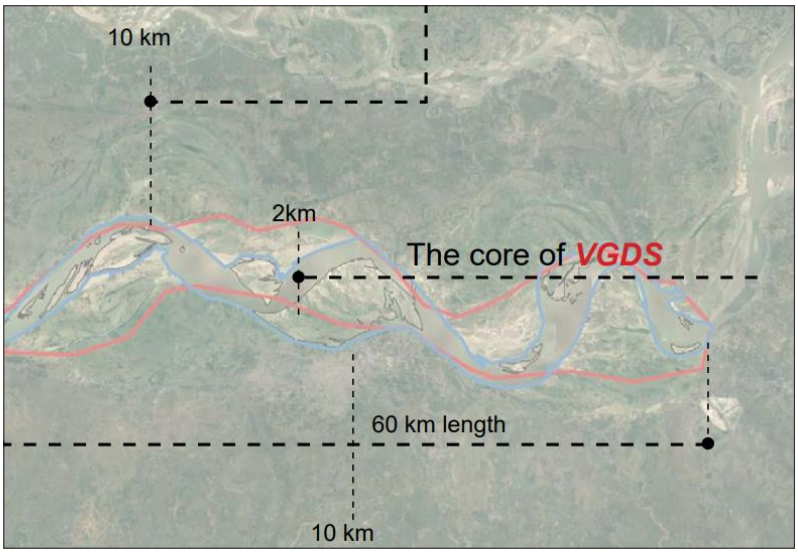
[6] *A major portion of the data with reference to the concept of zoonotic resilience in landscapes was derived from Manju Rajeev Kanchan (2020), 'The role of landscape architecture in curbing zoonoses—developing a design framework and approach' (unpublished Master's dissertation), School of Planning and Architecture, Vijayawada. This paper could be treated as a continuation of the concepts developed from the former cited source.*

through means of Google Earth Historical Imagery and old literature articles so that a site specific solution could be developed. Simultaneously, a reference list of papers identified as a part of the study were also searched of which a few were shortlisted to review further, based on prioritisation and relevance with respect to the study.

Scope and Focus

The actual extent of VGDS (Figure 3) in addition to the novelty associated with the entire topic clearly indicates a wide repository of options to research and work upon. This, owing to the academic research timeline, acts as a constraint, as a result of which the emphasis shall be more towards a holistic outlook of the study at a macroscopic level.

Figure 3: Aerial Extent of Vikramshila Gangetic Dolphin Sanctuary



Source: Modified by the authors from Google Earth. (n.d.). Vikramshila Gangetic Dolphin Sanctuary. Retrieved December 15, 2020, from https://earth.google.com/web/search/Vikramshila+Gangetic+Dolphin+Sanctuary,+Bhagalpur,+Bihar, OpenStreetMap. (n.d.). Vikramshila Gangetic Dolphin Sanctuary. Retrieved December 15, from https://www.openstreetmap.org/#map=11/25.3487/86.8696, Behera, Mishra, & Sinha. (n.d.). Vikramshila Gangetic Dolphin Sanctuary. BirdLife Data Zone. Retrieved December 15, from https://datazone.birdlife.org/site/factsheet/vikramshila-gangetic-dolphin-sanctuary-iba-india

Analysis

In order to propose a viable solution that addresses the three stakeholders of concern as cited in the title, it is imperative to start from scratch. Therefore, the studies undertaken may be categorised under the following subheads:

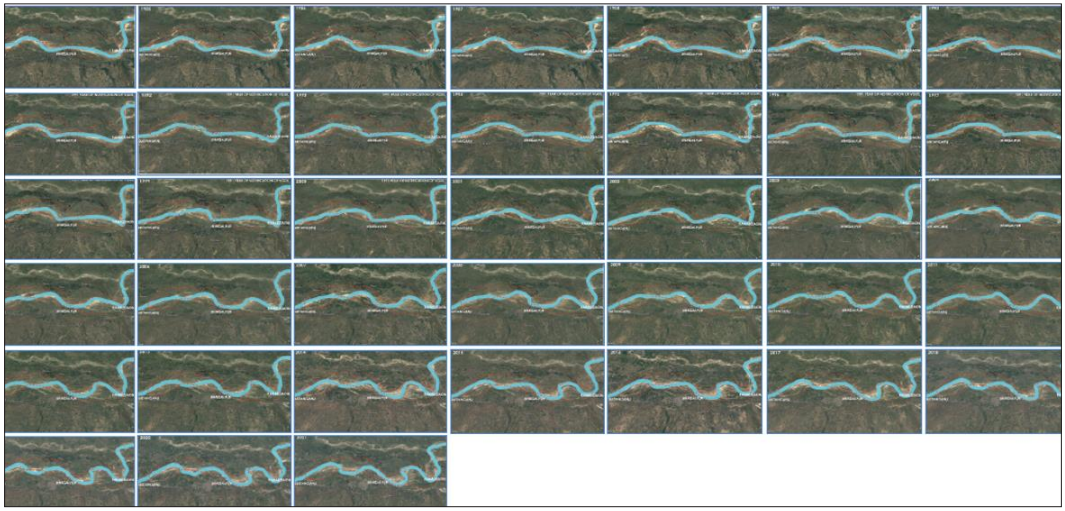
- Fluvial studies and dynamics
- A Gangetic perspective
- A holistic overview of zoonosis

Each subhead critically addressed the organic scenario of how natural ecosystems functioned in an environment devoid of human interventions, which ultimately paved the way for some critical understandings. These studies were utilised as a stepping stone to critique selected case studies that were near similar to the proposed site extent and this generated fruitful inferences for taking forward the entire study.

To start with, the stretch of Ganga from Bhagalpur (Bihar) to Jangipur (West Bengal), inclusive of the site extent, adopts a braided river character, forming a series of mid-Channel Islands or diaras (local terminology) which are primarily landscapes in flux, always changing with time. These diaras are separated by a series of interweaving channels or 'braids' which together form the main river channel of the Ganga. In a process that continues to date, when there is an increased and fast-paced flow of water during periods of intense precipitation, these braids fuse and leave behind a network of riverine and sand-gravel islands that reveal themselves with the recession of water.

To the common man, this process may seem like regular floods, however it is not, as it is this phenomenon that defines the very essence of what a braided river is all about. A braided river in its natural form is four-dimensional, i.e., unlike other lotic water systems, this river does not stay confined within relatively stable banks and a similar width–depth range over long periods of time. Rather, it is a landscape feature of flux known for changing its form, location, channel depth and diara planforms within a short span of time (Figure 4). This phenomenon is dependent on a variety of parameters both natural and anthropogenic.

Figure 4: Evolution of Ganga in VGDS from 1984–2021 (Left to Right)



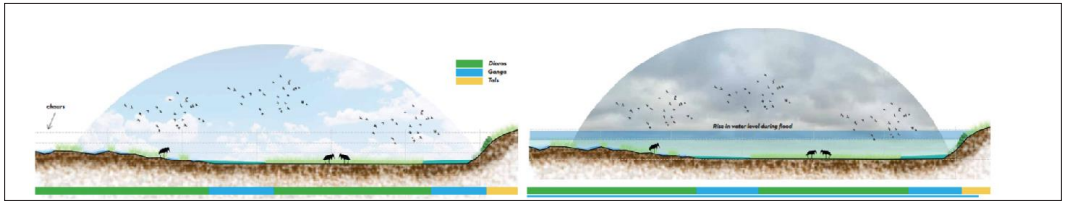
Note: This clearly indicates the evolution of braided character.

Source: Adapted from Google Earth by authors (Google Earth n.d.). Vikramshila Gangetic Dolphin Sanctuary. Retrieved December 26 2020, from https://earth.google.com/web/search/Vikramshila+Gangetic+Dolphin+Sanctuary,+Bhagalpur,+Bihar/@25.30462976,86.93091181,32.14081942a,52122.55085729d,35y,0h,0t,0r/data=CigiJgokCSfh6U9lJTNAESjh6U9lJTPAGa4pHvubUT9AIQZx5aVPLVHA,

Each braided river is unique. It is easy to demarcate the extent of braid plains within higher elevations as they are majorly confined by glacial valleys but as the river flows on to the region of plains, there is no factor that confines the river channels, as a result of which they carelessly wander across the area, thereby further complicating the regional dynamics (Figure 5).This behaviour causes these rivers to be recognised as being wild and largely untameable, owing to which they need to be looked at from a different lens and therefore provided with alternative levels of protection and conservation.

Due to the mobile nature of braided rivers, as they shift both laterally and longitudinally, figuring out the exact extent of a specific braid plain with respect to a river is complicated and, in some cases, not even possible for a myriad reason.

Figure 5: Generic Schematic Section of How the Site Extent Functions in Dry vs. Monsoon Periods



Note: Landscapes like diaras, chaurs and tals are a result of fluvial/riverine processes whose constant state of flux implies a healthy riverine ecosystem.

Source: Author

Braided river plains are unique fragile ecosystems (Braidplains: Habitat Loss, n.d.) that offer numerous life supporting ecosystem services; some of which even act as buffers against some of the drastic impacts of climate change. Many times, their natural presence defines the critical infrastructure in addition to maintaining the equilibrium of the surrounding lands. Yet, a lack of clear demarcation makes it difficult to preserve the braided rivers and their plains the way they ought to be as these ecosystems often succumb to a state wherein they compete against versatile human interests and evolving anthropogenic needs. Coupled with a lack of defined riparian boundaries, the resultant scenario is pretty obvious yet catastrophic as the anthropogenic functions like rapid urbanisation, intensive agriculture etc. slowly encroach over the very systems that offer the core ecosystem services vital to our sustenance, thereby destroying the equilibrium of the processes that drive the functioning of braided river ecosystems. This calls for a need to strike a balance between anthropogenic needs and conservation of these eco-sensitive systems.

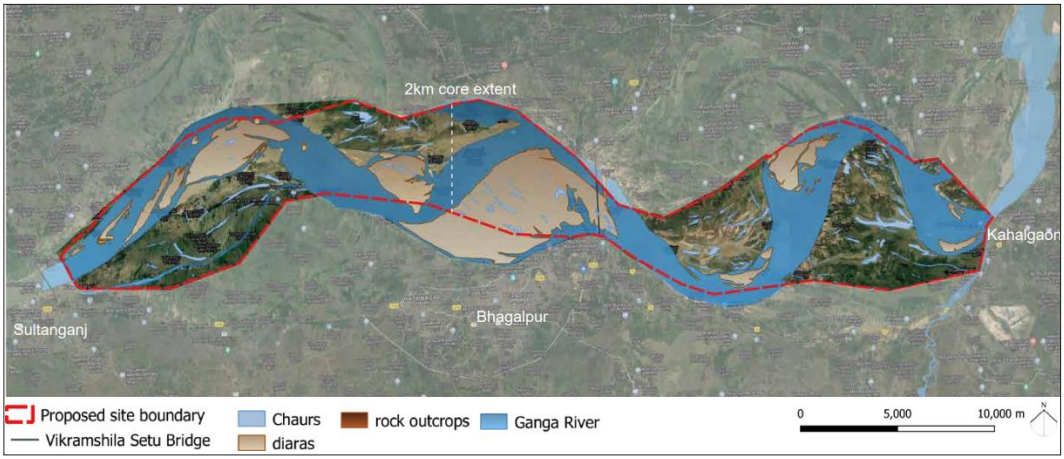
One way of defining the aerial extent of these braid plains is to look back over the course of a century to see how much space these rivers and their plains have actually occupied when devoid of any anthropogenic interventions—also referred to as active floodplain zones. This can help us carve out an average extent that has to be preserved on a priority basis for the healthy sustenance of the braided river ecosystems.

Meanwhile zoonotic spillover in its actual form alone is a serious predicament on its own, as seen in the case of the ongoing COVID pandemic. So, in the case of a fragile ecosystem such as a braided river the outcomes are only going to magnify tenfold. To and fro pathogenic transfer between humans and faunal species is a product of a multitude of factors, namely, climate, ecosystem ecology, changing land use, deforestation, habitat destruction and fragmentation, agriculture and food insecurity, socio-economic factors and landscape interventions. This makes it all the more important to have a clear understanding of the same before attempting to resolve any of the existing site issues. Adopting a nature-based design approach with ecological interventions is the ideal way to control the magnitude of a zoonotic spillover while preventing potential pandemics or epidemics in the future. It is not about the number of interventions or barriers proposed to counter the issue but rather the time and space in which the favourable barriers may coincide. Likewise, the nature and character of the intervention site also plays a relevant role in determining the degree of zoonotic spillover or ensuring zoonotic resiliency through means of strategic ecological interventions.

Likewise, the extensive literature studies were taken forward to critique some of the existing site similar case studies, which proved quite instrumental in delivering a few characteristic inferences of which the core takeaways would be the omnipresent understanding that things happen for a reason in addition to strengthened emphasis on the fact that the relationship between healthy landscape and resilient species are correlated.

Vikramshila Gangetic Dolphin Sanctuary — An Overview

Figure 7: Base Map Showing the Extent and Natural Landform Diversity of the Proposed Site



Source: Modified by the authors from Google Earth (n.d.). Vikramshila Gangetic Dolphin Sanctuary. Retrieved December 15, 2020, from https://earth.google.com/web/search/Vikramshila+Gangetic+Dolphin+Sanctuary,+Bhagalpur,+Bihar/@25.30462976,86.93091181,32.14081942a,52122.55085729d,35y,0h,0t,0r/data=CigiJgokCSfh6U9lJTNAESjh6U9lJTPAGa4pHvubUT9AIQZx5aVPLVHA, OpenStreetMap. (n.d.). Vikramshila Gangetic Dolphin Sanctuary. Retrieved December 15, from https://www.openstreetmap.org/#map=11/25.3487/86.8696, Behera, Mishra, & Sinha. (n.d.). Vikramshila Gangetic Dolphin Sanctuary. BirdLife Data Zone. Retrieved December 15, from https://datazone.birdlife.org/site/factsheet/vikramshila-gangetic-dolphin-sanctuary-iba-india

The actual extent of VGDS spans a radius of 10 km from the Ganga River edge. However, here the research shall only deal with the sanctuary core that covers a radius of 2 km from the Ganga River edge (Figure 7). The actual core of the sanctuary spans a distance of 60 km from Sultanganj to Kahalgaon within Bhagalpur district, Bihar, covering an aerial extent of approx. 5000 ha (12355.27 acres). Being a braided riverine habitat, its boundary and expanse undergo constant change due to the altering geomorphology of the Ganga River.

A Zoonotic Perspective

The diverse biological profile of the region accompanied by a juxtaposition of biological diversity and intense urbanisation right at the river edge makes the region of Bihar a natural reservoir of pathogen carrying zoonotic vectors, and therefore a potential zoonotic spillover. A careful overview of the Annual Communicable Disease Surveillance Report, 2011, Bihar, and National Vector Borne Diseases Control Programme clearly showcase an ever-increasing graph of multiple zoonotic cases of both vector and waterborne diseases of which a greater percentage has only resulted in subsequent deaths in the region of Bihar (State Health Society, 2011).

Additionally, Gangetic dolphins are also host to human pathogens that may not be limited to Cyclorchis campula, Echinochasumus andersoni, Anisakis simplex, and Contra caecum lobulatum (Swinton, J., & Gomez, W. (n.d.)). This in addition to improper anthropogenic practices and inferior sewage (anti pollution infrastructure) renders the proposed site extent capable of a zoonotic pathogen spillover into the riverine ecosystem.

However, keeping in mind the vast diversity of zoonotic diseases and their vectors, this paper shall address those infections predominant in the region, namely:

- Vector-borne (Malaria, Acute Encephalitis Syndrome, Japanese Encephalitis, Kala-azar, Chikungunya, Dengue, Filaria)
- Enteric, Food and Waterborne Diseases (Acute Diarrhoeal Disease, Bacillary Dysentery, Typhoid fever, Cholera Shigellosis)

Route to Solutions

"Sometimes not intervening is also landscape architecture."

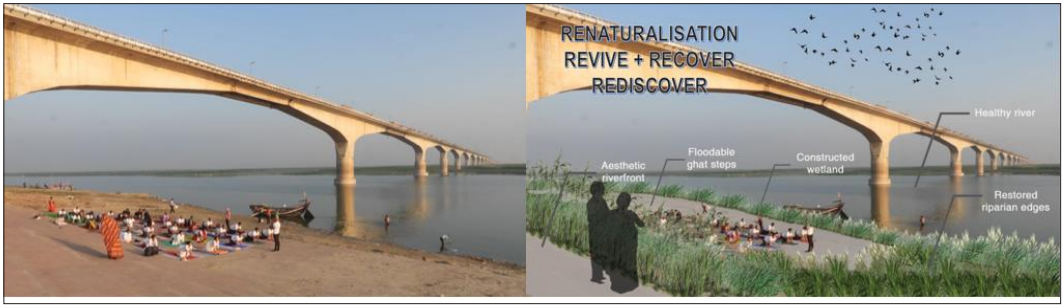
The above statement explains the approach chosen so as to combat the prevailing issues in the proposed site extent.

The Ganga is a dynamic river with a personality that is strong, fluid and expressive Allowing her to express herself to the fullest is perhaps the best way to ensure that natural equilibrium is restored. The sustenance of braided river ecosystems is heavily dependent on the proper equilibrium with which the associated ecological processes such as abrasion, siltation, erosion etc. take place. Making room for the river is the ideal way to ensure the proper sustenance of the braided river ecosystem while minimising extensive loss of life and property during floods.

One of the major methods of achieving a unified health resilient Gangetic riverscape within the VGDS area is to increase the population of Gangetic dolphins and similar such key indicator species for this will help strike a solution with respect to a majority of the problems faced by the different Gangetic riverscapes. By revitalising the river stretch, not only will the biodiversity thrive but at the same time the project shall also help tourists and locals understand the relevance of the presence of Gangetic Dolphins in the river.

The design proposal therefore pitches the concept of rewilding—a package theme comprising three sub themes: Renaturalisation, Revive + Recover, and Rediscover (Figure 8). Rewilding is an innovative yet quite a simplistic approach of resolving perhaps the most complex of problems prevalent in the region by allowing the natural ecological processes to take over and etch the destiny of the fluvial landscapes, as a result of which the braided river ecosystem can thrive and prosper. Further, this shall also help tackle and therefore resolve practically all the urban challenges faced by the proposed site extent such as improper / absent tourism infrastructure, urban encroachments, urban floods, arsenic and fluoride poisoning, declining fisheries etc. while creating aesthetic yet functional open spaces to be used in harmony by both humans and other species prevalent in the region—therefore a win-win situation for all.

Figure 8: Photomontage Showing Before and After Implementation of Strategies under the 3Rs Concept at Barari Ghat under the Vikramshila Setu, Bhagalpur

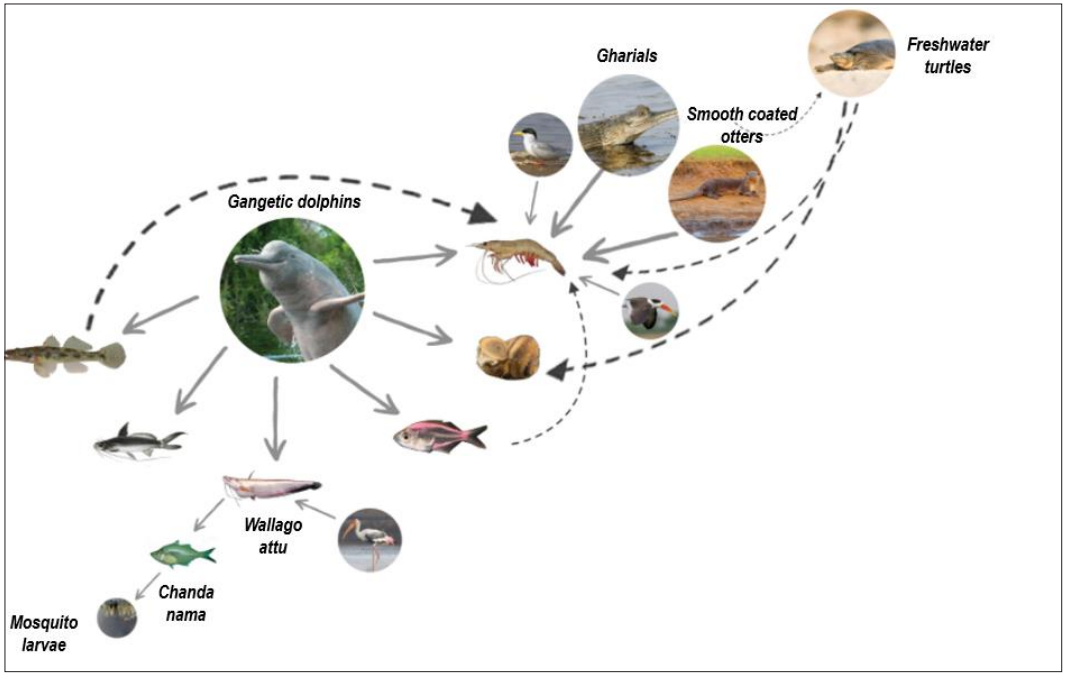


Note: The photo has been captured by Deepak Kumar. The photomontage on the right side has been prepared by the authors over the photo

Source: VGDS biodiversity conservator, Deepak Kumar

Each of the proposed sub themes strategically target the prevalent challenges associated, thereby effectively revitalising the area of the sanctuary. Additionally, this proposal adopts an indirect approach towards establishing a sanctum for the Gangetic dolphins (Figure 9) as sometimes the key to resolving multiple problems might lie in fixing just one instead of trying to find many solutions for all. Rather than purely focusing on developing just the dolphin habitat, the design proposal focuses on restoring the habitat of key indicator species (gharials, smooth coated otters etc.) and those species that these dolphins depend upon as bottom feeders which are a major prey source for them. This way the river's health also improves while simultaneously improving the quality of life for all the species in question.

Figure 9: Gangetic Dolphins as the Apex Predator



Note: A food web representation indicating the importance of Gangetic dolphins as the apex predator in the food chain and how it indirectly contributes to escalating or reducing zoonotic spillover. Its presence and absence alone can modify the natural equilibrium equation drastically

Source: Author.

Project Implementation and Stakeholders

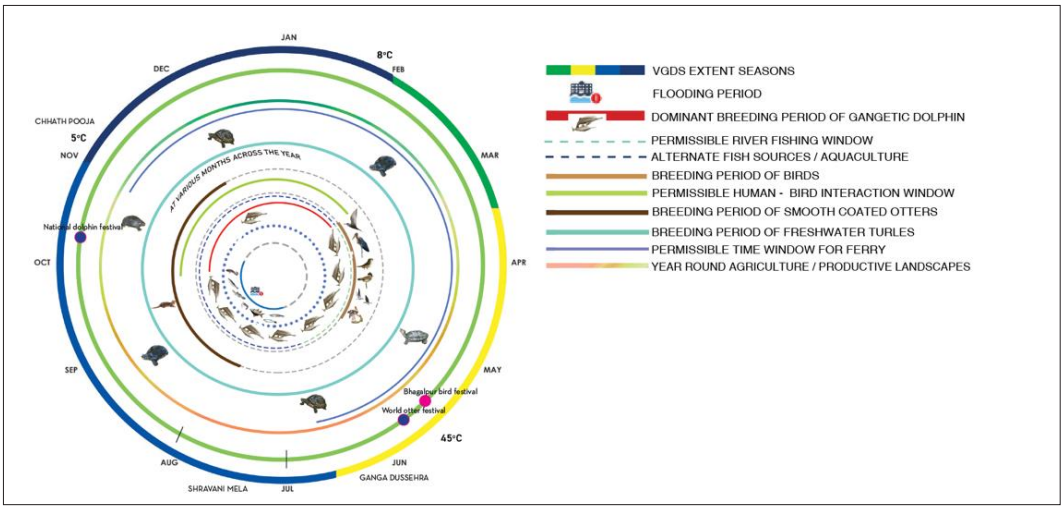
The proposal envisages three major phases in line with the 3Rs concept so as to achieve an output for the holistic health and functioning of the VGDS. To extort the fullest site potential, the entire proposal has to be executed in a strategic and careful manner on the basis of annual monitoring, evaluation and implementation of key lessons learnt. The strategies proposed as part of the design proposal are also aligned with the SDGs proposed by the UN which is an added benefit. The main areas of work that shall be addressed as a result of this proposal include:

- River health protection, environment preservation and landscape conservation
- Recreation, religion and sustainable tourism
- Local livelihood and awareness
- Management and organisation

The proposal further visualises the setting up of a Programme Steering Committee (PSC) at both national and state level. The holistic project however shall be governed by National Mission for Clean Ganga (NMCG) and National Institute of Urban Affairs (NIUA) , who will each follow their own pre-established mechanisms of governance and if need arises may constitute their own monitoring and steering committees for overseeing the project. At a micro level, the local communities need to be made a part of the entire project execution for it is only their involvement that determines the success or failure of this project. Active involvement by the local communities can help conserve the natural landscapes through means of best practices to be incorporated as part of their livelihood routines, in addition to being active role-players in imparting awareness of the local biodiversity to the visitors accessing the river.

As discussed above, a comprehensive landscape development master plan (Figure 11) based on the 3Rs concept has been conceived along with a design programme that decides the permissible and proposed activities within the sanctuary extent (Figure 10).

Figure 10: Design Programme Wheel on an Annual Basis



Source: Author.

Core strategies proposed as part of Renaturalisation:

- Establishing a designated active floodplain region.
- Restoring and daylighting the natural hydrological connections to the main river channel.
- Conservation, preservation and diversification of the natural mid-channel islands or diaras.
- Establishing riparian corridors with effective soil erosion control and bank stabilisation strategies.
- Introducing subtle modifications of faunal habitats of species such as smooth coated otters, fishes etc.

Core strategies proposed as part of Revive + Recover:

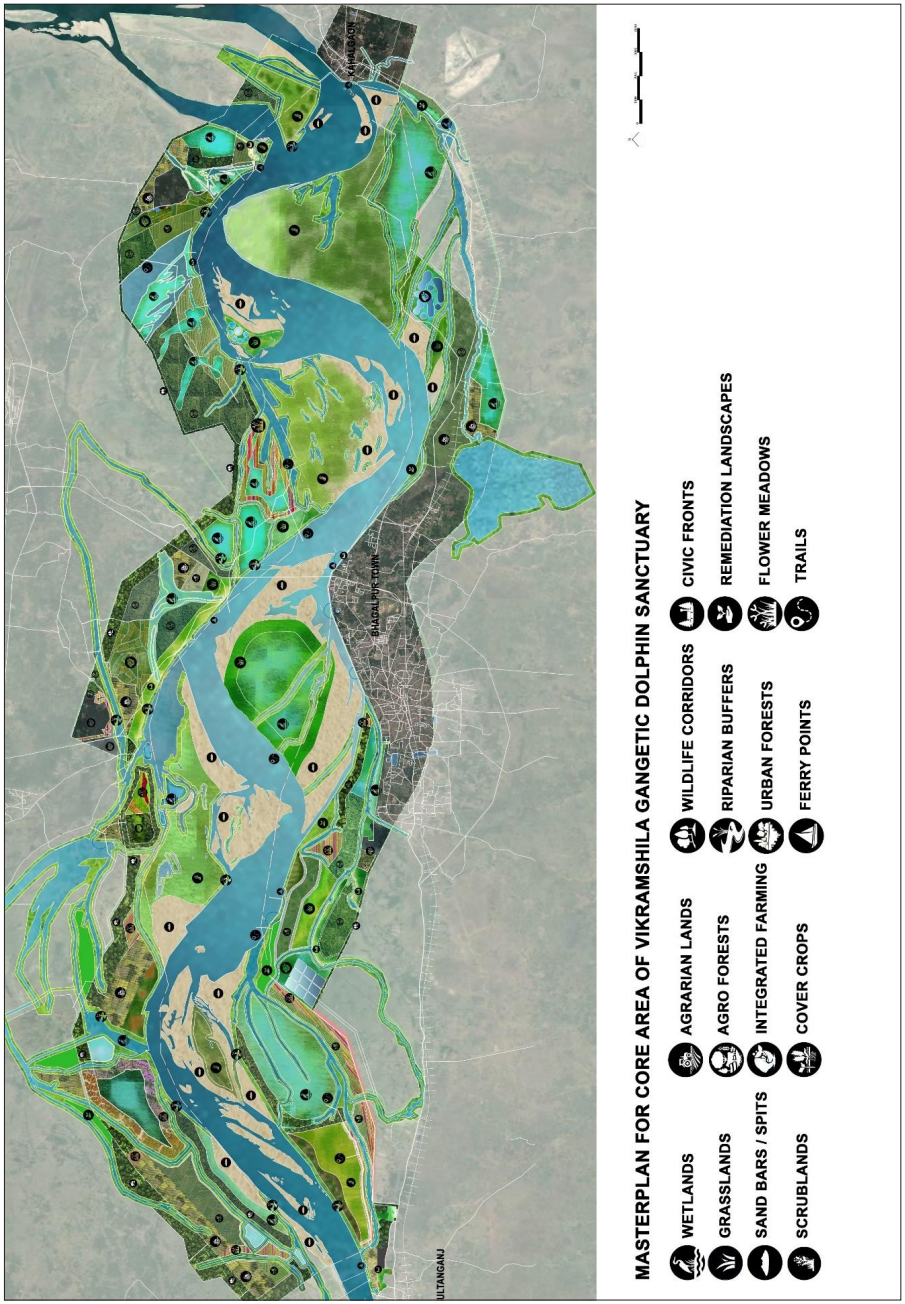
- Installing trash boom barriers at the mouth of the meeting points of lower order water channels with the main river channel to counter solid waste accumulation.
- A series of remediation glades, riparian buffers and natural and constructed wetlands with phytoremediation abilities to counter issues like arsenic and fluoride poisoning.
- Revamped agro site zoning for the entire sanctuary extent considerate of the site ecological sensitivities.
- Designated 'No Fishing' zones and natural hatchery ponds on diaras in an attempt to develop sustainable fisheries in the region.
- A scientific design-oriented approach to control prevalent zoonoses in the region through strategic planting and interventions such as urban forests, flower fields and pollinator fields based on the two core concepts—zooprophylaxis, and introducing floral species with higher sugar level content.

Core strategies proposed as part of Rediscover:

- Modified ghats design.
- Eco-sensitive nature trails and floating footbridges.
- Ferry points.
- Watchtowers.
- Innovative signages as part of species awareness programme.

The design proposal is based on ideologies like adaptive reuse and retrofitting of the natural environment owing to which the strategies proposed are majorly cost-cutting in character through measures such as incorporating native regional species majorly etc

Figure 11: Comprehensive Landscape Development Master Plan



Source: Author

Zoonotic Resilient Landscapes

The paper has already addressed the basics of zoonosis and the extent to which zoonosis is prevalent in the site as well, however this is yet to be explored further on the concept of turning an environment into a zoonotically resilient landscape. Although the design proposed is carried out with a penchant for ensuring a balance within the eco-sensitivity associated with the site of concern, yet it is imperative to explore the extent to which zoonotic resilience has or hasn't been achieved through means of strategic design interventions. At the same time, it is also essential to understand the benefit of these interventions in the grander scheme of things.

Ensuring a continuous landscape ecosystem with minimal human intervention and interferences contributes a great deal to zoonotic resiliency. However, that alone is not sufficient to achieve an ideal zoonotic resilient environment as there still persists a chance for a potential zoonotic spillover as the urban towns of Bhagalpur, Kahalgaon and Sultanganj are quite close to the sanctuary core. To control this spillover, strategies like urban forests, wildlife corridors, flower fields, pollinator hotels etc. were proposed. But this too will work only to an extent within the sanctuary core.

What about the urban settlements then? How can accidental spillovers be controlled there?

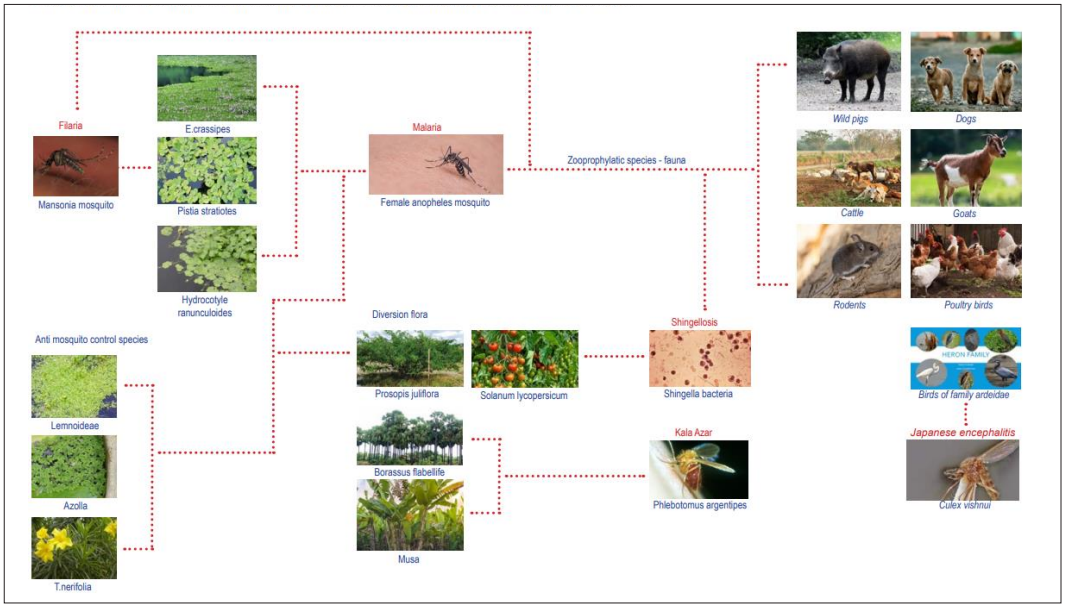
What needs to be understood here in this context is that more often than not humans are not the primary meal option for most zoonotic vectors like mosquitoes (the dominant zoonotic vector in VGDS). Rather they end up as a meal due to lack of options mainly in addition to other influencing parameters. This is quite a valuable piece of information that landscape architects and designers may exploit in the design and this is exactly what has been attempted here as well. An environment for alternate faunal species and natural reservoirs of zoonotic vectors have been established as a zooprophylaxis[7] control strategy to redirect the mosquitoes away from humans (Figure 12). Likewise, a planting palette composed of species with high sugar levels can help to redirect the mosquitoes away from humans by offering another optional meal source as mosquitoes are known to feed on sugar rich plants and flowers in the absence of human presence in the region. Spraying sugar solutions on plants such as banana (musa) is also a tried, tested and proven technique (Poché, D. M., Torres-Poché, Z., Garlapati, R., Clarke, T., & Poché, R. M. (2018)).

Further, in the urban centres, it is important that the plant species be based on a carefully curated palette as there are species known to be quite essential just for the mosquito lifecycle alone to be completed! For instance, plants like water lettuce, floating pennywort, water hyacinth etc. are known to be favourable for the survival of female anopheles mosquitoes responsible for malaria (Stone, C. M., Witt, A. B. R., Walsh, G. C., Foster, W. A., & Murphy, S. T., (2018)) while dense planting of duckweed, aquatic ferns or using anti plasmodium plant sources like T.nerifolia (Hien, D. F. d. S., Dabiré, K. R., Roche, B., Diabaté, A., Yerbanga, R. S., Cohuet, A., Yameogo, B. K., Gouagna, L.-C., Hopkins, R. J., Ouedraogo, G. A., Simard, F., Ouedraogo, J.-B., Ignell, R., & Lefevre, T., 2016)

[7] *Zooprophylaxis is the use of wild or domestic animals, which are not the reservoir host of a given disease, to divert the blood-seeking malaria vectors from human hosts. Basically a diversion strategy.*

can hinder mosquito growth. Simultaneously it is important to be aware of the ecology that gets established as a result of a certain environment before proposing landscapes like fragmented urban forests etc. so that sylvatic species may be avoided. Sylvatic species are infamous as vector hosts of numerous zoonotic infections and they thrive in coexistence with human life and resources. This, when supported by non-design strategies like vaccination etc. is what zoonotic resilient landscapes are all about.

Figure 13: Schematic Flowchart Citing Examples for Planting and Animal Reservoirs



Note: This schematic flowchart is used to understand how zoonotic resilience may be achieved in the proposed site extent.
Source: Author

Discussion

"Maybe zoonoses are like animals—fighting to be the survival of the fittest trying to face the man who is devastating their homes." (Mallavolu, 2019)

The primary aim of the study was to explore and identify if the idea of developing a zoonotically resilient landscape is possible or not with a site as dynamic as Vikramshila Gangetic Dolphin Sanctuary and it can be safe to say that it is possible. However, it can be effective only if the proposals and interventions are based on inputs from professionals of various disciplines, supplemented with policies at a regional level. It is essential to recognise and elucidate the causal zoonotic drivers so as to adapt the landscape epidemiology knowledge into effective public health interventions. Strategic and prioritised calls need to be taken in addition to ecological interventions that complement the conventional interventions for attaining higher success rates.

The case studies carried out have made it transparent that the zoonoses are mostly an outcome of anthropogenic drivers.

Although notified in 1991, VGDS remains a protected sanctum for the Gangetic dolphins only on paper. The proposed findings are a result of a deep and intensive study of the natural ecological conditions of the entire VGDS site keeping in mind the socio-economic-cultural scenario as well. Therefore, the solutions so proposed also majorly focus on ecological river sustenance, its associated systems and biodiversity, which indirectly can help promote a better quality of life for humans as well. The outcome is a prototypic design approach and framework that may be adapted into any manner of waterscapes across the country or lay a foundation for advancements at a global scale.

Incorporating the element of zoonoses into the research paradigm only assists in further exploring a river-sensitive development prototype that is resilient to potential pandemic or epidemic scenarios, which in the light of the ongoing COVID-19 global pandemic makes further investigation and study imperative. The strategies covered here follow the One Health approach that credits the positive health of our planet to the health of humans, animals and the environment, which offers multiple benefits such as increased blue-green infrastructure, enhanced quality of life, improved river health and increased awareness of man of the existence and importance of nature and its ecosystem services.

Likewise, another integral component of this study is an attempt at documentation of the existing research relevant to the maintenance of Vikramshila Gangetic Dolphin Sanctuary, thereby acting as a database for future research in this region and for similar databases to be developed for the river in its entirety. The solutions offered in this paper are merely a starting point which, when implemented shall offer an environment with resilience as its foundation for existence. Only so much can be covered within a constricted frame of time and words. Yet it is anticipated that the successful implementation of the strategies and interventions cited here would be seen as a trailblazer for many similar waterscape projects to unfold at both a national and a global scale in the immediate future.

Owing to the novelty associated with the chosen topic of research, a sliver of possibility persists with respect to developing an ideal design output as this is an ongoing area of research. However, a key limitation that lies in the fundamental understanding of disease emergence is the complexity involved because of the unknown ecology in unknown hosts. This is quite a fundamentally ecological problem that demands large-scale field studies in addition to interdisciplinary collaboration between ecology and health. The spillover is an outcome of a series of barriers that a pathogen overcomes from the host reservoir to human settlements. Although our knowledge about mosquitoes and other potential vectors is increasing by the day when it comes to disease ecology basics, strategies to control and manage the spillover in humans is quite limited. There may be a multitude of ways to achieve zoonotic resilience apart from all that is proposed here but understanding pathogen persistence in abiotic environmental reservoirs provides scope for introducing simple interventions that operate on multiple interacting levels to manage zoonotic

spillover risk in a landscape. However, targeting the interface of contact can perhaps offer solutions in the most unexpected ways. Which is why the question here is how we can integrate ecology, health and a multitude of other parameters that influence a zoonotic spillover because that is the way to design landscapes resilient to zoonotic attacks.

Further, as discussed earlier, the stretch of Ganga that passes within the VGDS site is of braided character. Effective sustenance of such ecosystems is possible only when the natural ecological processes happen in the way it should be. Also, most of the issues experienced in the proposed site extent are a result of a multitude of activities that occur both upstream and downstream, which is why, if the proposed site is to truly tap into its potential, it is imperative to resolve those issues such as damming rivers, sewage influx into the rivers, construction of barrages on rivers such as the Farakka Barrage etc. prior to dealing with the proposed site challenges. Moreover, it is now more important than ever to look at alternative solutions to those already proposed as a means to resolve current problems as for each intervention so proposed, there may be issues that may be arising somewhere outside of the intervened zone. Last but not least, the key to protecting the Gangetic dolphins through the development of a sanctum lies in the holistic revitalisation of the region to support the key indicator species of the region as this will indirectly help sustain the habitat of the Gangetic dolphins by ensuring that the factors essential for their survival such as clean river water, necessary amount of fish supply, residential areas such as river meanders etc. are present. This is a classic case of hitting multiple birds with a single stone, or rather, a motive in this case. The biggest advantage of the same being the fact that the proposed idea is scalable and can be adapted along the other stretches of the Ganga or anywhere in the world. Further, almost all the Sustainable Development Goals (SDGs) can be achieved upon the successful completion of the project interventions.

The vast repository of data waiting to be uncovered and the complexity associated with living systems is in itself a boon and a limitation in this research. There are multiple directions in which this research may be taken forward in future. The solutions offered here are only a mere possibility of the scope and potential of this project and there may be numerous ways in which this idea may be explored further while keeping the essence intact.

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Conflict of interest

The authors declare no conflict of interests.

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Integrated Sustainable Tourism Development: A Case Study of Ayodhya City

MUDDUKRISHNA A.S.
Masters in Urban Planning, School of Planning and Architecture, Delhi

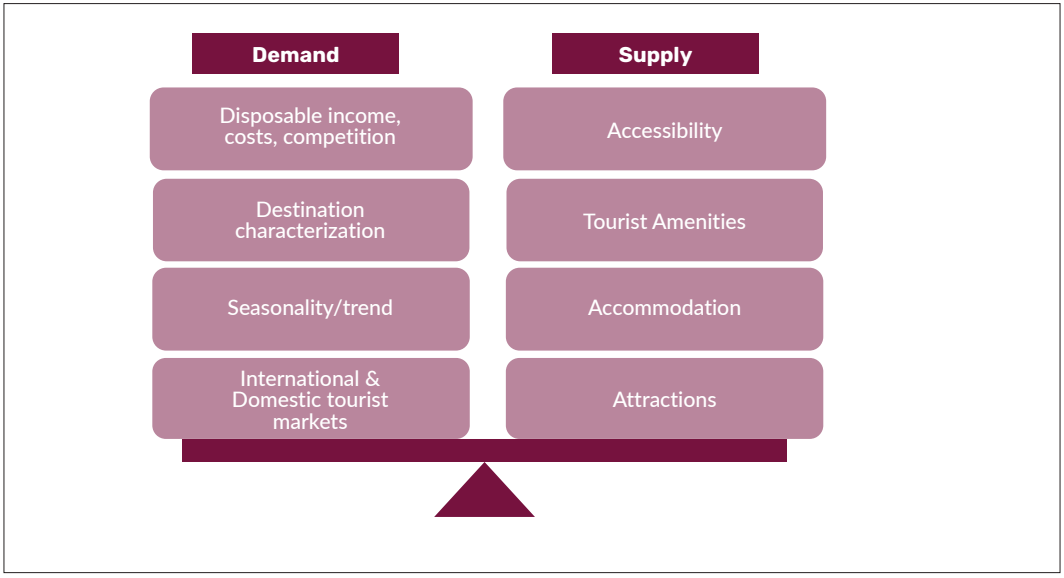
KARAN BARPETE
Assistant Professor, School of Planning and Architecture, Delhi.

LOVLESH SHARMA
Sector Coordinator, National Institute of Urban Affairs.

Abstract
The cross-cutting nature of tourism that connects multiple facets of the 17 UN SDGs has resulted in it evolving globally from being a tool of leisure to being a tool of comprehensive development. This change has propelled planners and public policymakers to adopt the concept of 'Destination Development through Tourism'. This, in turn, has led to the development of multiple approaches, ranging from an issue-oriented approach that ponders on the principle that addressing existing infrastructural gaps would automatically develop tourism destinations, to a thematic approach that hypothesises the theme/character as central to the tourist's decision making, acknowledging that addressing infrastructural issues/gaps in destination development is not just a need but a necessity. Although these approaches foster a broader tourist base leading to greater market capitalisation, the exclusion of social and environmental dimensions calls out for an inclusive, sustainable approach to tourism that is integrated in nature. This is the context within which this paper attempts to formulate an integrated sustainable development approach that collates the 5A's (Accessibility, Accommodation, Attractions, Activities, Amenities) and the travel trade using Ayodhya as a case study.

Introduction
Travelling, once viewed as an essential tool for survival that served the crucial needs of food, water and shelter, in the modern world, has transformed into a need driven by the desire for experiencing– a change that can be attributed to psycho-sociological proponents. The entry of the middle class across the broader spectrum of the consumer market in the post-neoliberal era has given rise to a significant multisectoral industry generating USD 8.9 trillion globally (i.e. 10.3% of global GDP, (Suri, n.d.). With one out of ten people employed in a tourism affiliated industry, the need to channelise the sector through planning for a sustainable world is clear (World Tourism Organization (UNWTO) & United Nations Development Programme (UNDP), 2017).

Figure 1: Demand and Supply Factors of Tourism



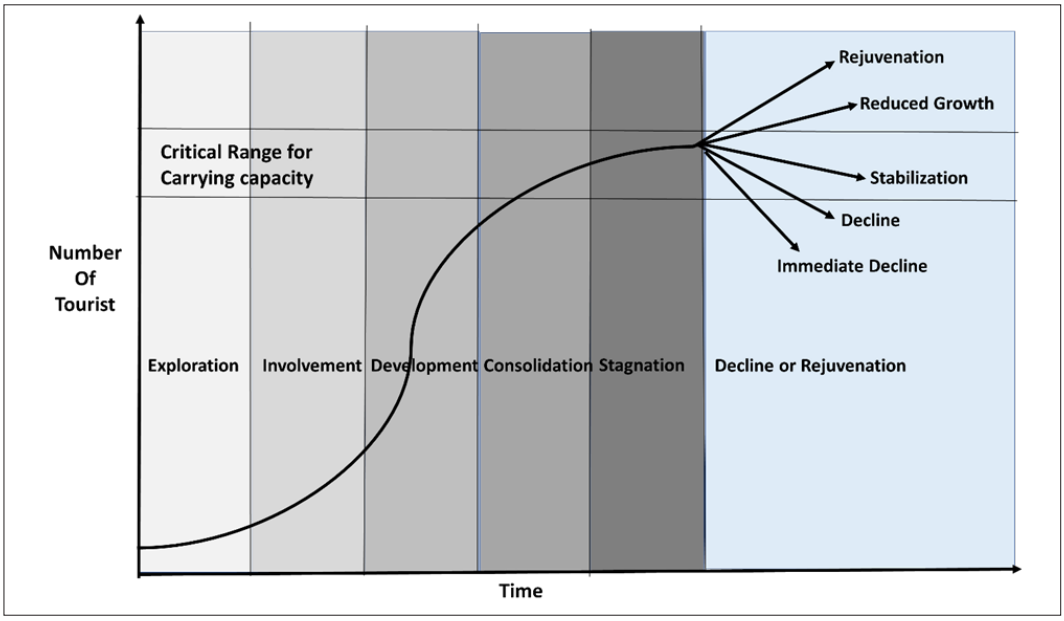
Source: Authors summarised from contemporary research

The tourism industry, like every other industry, also operates on the micro-economic principles of supply and demand as depicted in Figure 1. Supply is determined by tourist attraction, accessibility, tourist amenities and accommodations, whereas aspects such as disposable income, cost competition, seasonality/trends, destination characterisation, as well as the international and domestic tourist markets comprise the demand that frames tourist choices at a broader level.

Butler's model (Sahli,2020) namely, exploration, involvement, development, consolidation, stagnation and decline or rejuvenation. In each stage of the life cycle, the destination undergoes a series of changes defined by the author. The purpose of this study is to apply the TALC model to the tourism destination Hammamet (Tunisia tries to capture the life cycle of tourism through phases from exploration to decline/rejuvenation by analysing its relationship with time and number of tourists. The model suggests that when a destination evolves on its own, there comes a stage when intervention is required to sustainably channelise tourism development based on critical carrying capacity, while suggesting that the direction the destination takes towards rejuvenation or decline is determined by the approach adopted.

The evolution of approaches to tourism in modern planning began with an issue-oriented planning approach, wherein it was assumed that tourist destinations would spontaneously develop when core infrastructural issues were resolved. However, it failed to stand the test of time because of dynamism in the sector. In the late 1990s it was realised that there was a need to emphasise an approach based on 'character' or the attraction, around which a thematic approach was developed, where the market caters to the demand created by special interests (Gunn, 1994; WTO, 1994; Wilkinson, 1997; Timothy, 1999).

Figure 2: Butlers' Tourism Development Model



Source: Butler's model (Sahli, 2020)

The significant issue with this approach is that it emphasises only financial benefit in catering to market demand, characterised by tourist wants over destination area development. As such, it overlooks the local community and other stakeholders and, as a result, ignores social and environmental costs. Further, because it is market-driven without a cap or threshold, it turns out to be exploitative in the long term as it fails to include the factor of sustainability.

Tourism sector, acknowledged for its valuable contribution towards achieving the 17 SDGs (UNDP, 2017), It becomes even more crucial to develop a comprehensive perspective, beyond the secluded thematic tourism approach, which could lead to the formulation of an integrated, sustainable tourism development approach by integrating the 5A's (Access, Accommodation, Attractions, Activities, and Amenities) through enabling actions.

This research intends to develop a planning approach that is inclusive and integrated in nature, acknowledging interdependencies in channelising the mass religious tourism potential of Ayodhya with river tourism and ensuring sustainability through an integrated tourism approach.

Significance and Need for the Study

Located on the banks of the river Sarayu, the city of Ayodhya extends its significance over the social-cultural, environmental, as well as the economic spheres. Socio-culturally, the city is recognised as one of the seven (sapta puri) sacred cities of Hinduism and is the gateway of the government of India's most ambitious Ramayana circuit. Being an ancient historic capital, of the kingdom of Kosala and also the nawabs of Awadh, its significance is recognised across religions

and cultures with more than 105 Hindu religious and historic heritage structures concentrated in the Ayodhya zone (UP Tourism). Ayodhya also stands out as pivotal to Jainism, as it was the birthplace of five tirthankaras and visited by Mahaveer himself, and so its Jain heritage goes back 2500 years. Built upon as the first capital of the nawabs of Awadh, it is a vital destination of the Sufi sect of Islam encompassing significant places such as Bahu Begum ka Maqbara, Gulab Bari, Imam Bara and others. It is also of significance to Sikhs with gurudwaras such as Bramha Kund and Nazarbagh whose establishment can be traced to Guru Nanak Ji and Guru Tej Bahadur Ji. In addition, cultural links between Ayodhya and Korea that date back to AD 48 through Queen Huh Hwang-Ho, have initiated the development of an inter-cultural repository in the form of a memorial and Korean cultural centres.

Ayodhya is the first major city on the banks of the river Sarayu, and it is urbanising at a tremendous rate. There is a critical need to sustain and channelise the resources that support the mass tourist influx through necessary action plans mindful of its environmental significance. The Sarayu's rich natural landscape, across which lies a heart of faith and heritage with more than 25 ghats each engulfed in historical and spiritual significance, has to be conserved while increasing the potential of developing river-based tourism. The city, transforming at a stage of development and consolidation on Butler's tourism development model scale (as depicted in Figure 2), makes essential the need to look into the critical range for carrying capacity.

Looking at economic significance, with the construction of the Ram temple, Ayodhya is projected to be the epicentre of mass religious tourism, with an expected tourist footfall of around 3.96 crore/ year by 2031 as per UP Tourism (Anon, n.d.). The state and center government have proposed spending more than INR 2000 crore to comprehensively develop Ayodhya as a religious-cultural hub and the epicentre of the Awadh circuit. Additionally, the expected growth of tourists is set to increase by three-fold over the next 11 years (Anon, 2020), which makes channelising a strategy for effective implementation of feasible solutions critical.

Study Area Profile

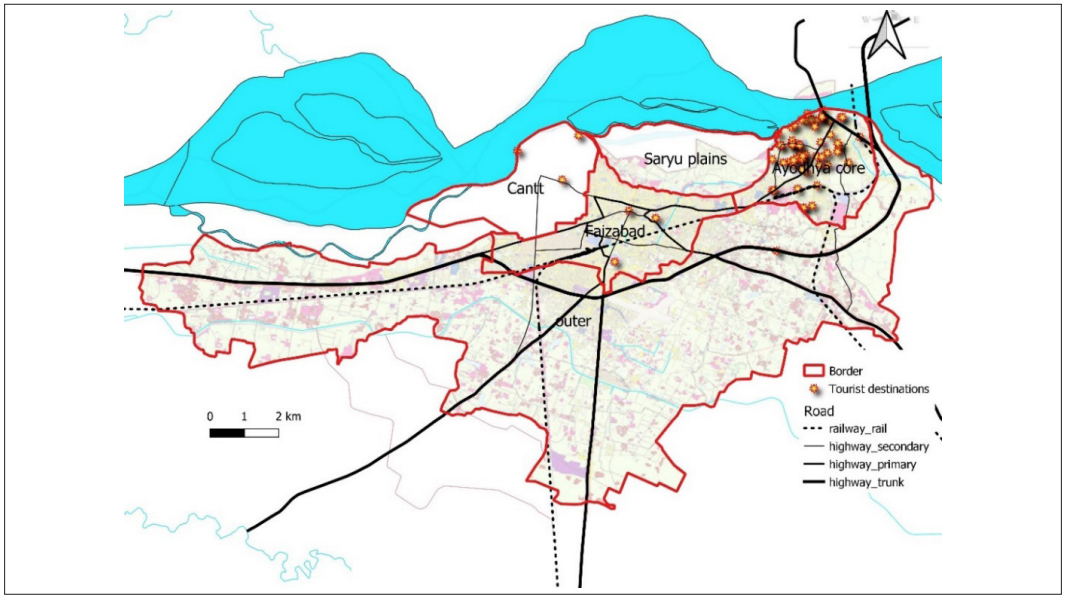
Location and Regional Connectivity

The city of Ayodhya, located in the state of Uttar Pradesh on the banks of the river Sarayu, has emerged as a regional hub with regard to the transportation sector because of its historical and current significance. Situated at the cross junction of roadways connecting Lucknow, Gorakhpur, Prayagraj and Varanasi, the city already has well-established road and rail connectivity. The international airport, currently under construction, will make the town an ideally connected tourist destination. It has frequent bus and tempo services, catering to not just tourism but also industries, including the agricultural sector. With rapid urbanisation of the city, connectivity can act as a boon for both tourism and investors.

Destination Profile

The study area encompasses the jurisdiction of Ayodhya Nagar Nigam and the Cantonment area. It is classified into five different zones (Figure 3) with varied characteristics for analysis-based destination characteristics as briefed below:

Figure 3: Zonal Profile of Ayodhya



Source: Ayodhya Development Authority.

- **Ayodhya core:** Located in the north-eastern part of Ayodhya, the zonal boundary was previously administered as Ayodhya. The zone covers most tourist spots and heritage structures, and the built structures can be categorised as high-density, low-rise developments.

- **Faizabad:** Administered previously as Faizabad Nagar Palika Parishad, this zone encompasses major Islamic shrines, commercial spaces and Awadhi style structures. The built structures here are noted to be high-density, medium-rise developments.

- **Cantonment:** Located on the north-western boundary of Ayodhya, the zone encompasses touristic places of religious and cultural significance with serene landscapes such as Guptar Ghat and Military Mandir. Entry is restricted, with all rights reserved by the army.

- **Sarayu Plains**: The zone has the lowest population density and is located in the central stretch of the study area along the Sarayu River. Notably, the sparse agricultural landscape with village settlements is linked to the fact that the zone was not previously under development.

- **Outer zone:** The outer zone comprises areas newly added to Ayodhya Nagar Nigam, which were previously under the Ayodhya Development Authority. It is majorly agricultural in use, and the increasing urbanisation observed can be attributed to commercial, industrial uses across transits.

Methodology

The study seeks to develop an integrated, sustainable approach for destination development through tourism by analysing the active and passive impacts of factors such as attractions, activities, amenities, accommodations, accessibility, geophysical character, demographic trends, land use, tourist profiles, destination profile, as well as psychometric profiles of both tourists and locals. With Ayodhya as a case study city, a framework consisting of primary and secondary surveys was formulated to capture the data. Secondary data was captured through reports of the Ayodhya Development Authority, Town and Country Planning Organisation, statistical data from UP Tourism, the Sarayu Action Plan Report, as well as Bhuvan satellite imagery, and open street maps. The primary survey captures the strengths, challenges and potential of tourism in the city from multiple stakeholders through:

- **Departmental survey:** Here development prospects with respect to destination and tourism were captured from Ayodhya Nagar Nigam, Ayodhya Development Authority, UP Tourism and the police department.
- **Local resident survey:** Around 100 local residents across all the five zones were surveyed to assess the impact of tourism on the daily lives of locals along with place attachment, from a conservationist's perspective.
- **Commercial establishment survey:** This was conducted for 50 establishments across major markets of Hanumanghari, Ghanta Ghar and the weekly Thursday market to understand the dynamics of travel trade profiling of tourist markets and tourism products.
- **Accommodation survey:** This was conducted across 40 ashrams, hotels and dharamshalas, the survey captures occupancy and stay patterns along with consumption and generation trends across water, power, sewerage and solid waste.
- **Accessibility survey:** This was conducted to capture the travel pattern and plight of auto rickshaw/e-rickshaw/bus/car/taxi/boat from the operators' perspective.
- **Tourist survey:** Between February 2021 to March 2021, 120 tourists were surveyed to characterise the profile of tourists based on nature of a tourist, experiences and perspective andissues based on which tourist characterisation, service quality assessment, image intensity analysis was developed.
- **Non-participant survey:** This survey was conducted online with a sample size of 120 across multiple states and age groups to identify and analyse issues faced by potential tourists, and to assess their awareness, perceptions and preferences from a psychological perspective.

Analysis

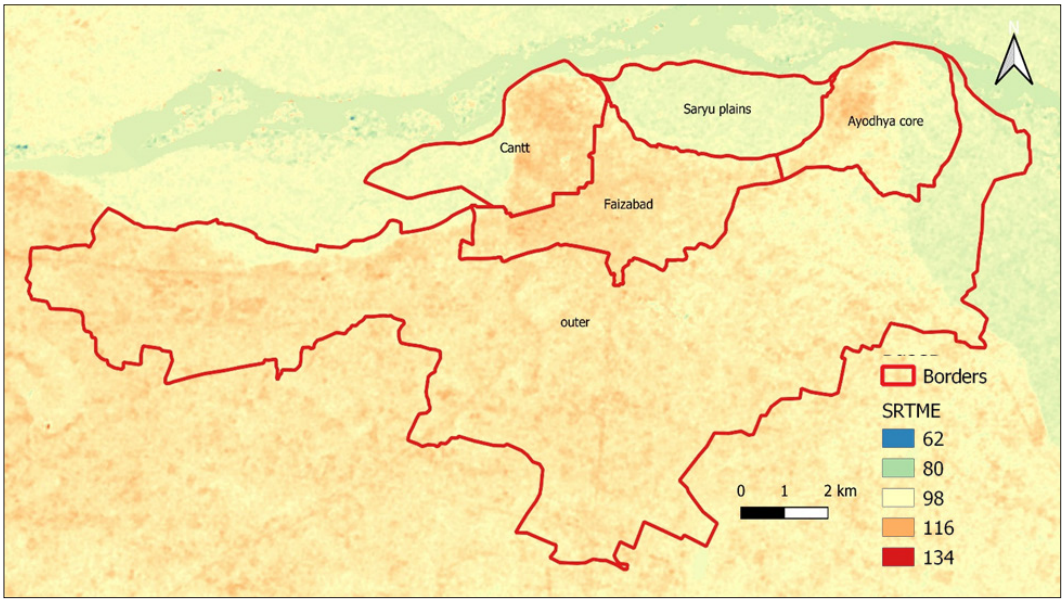
The components with active and passive correlation to the aspect of tourism were identified with an intent to capture the destination's profile in terms of challenges, potential opportunities and gaps through comprehensive integration (cross-analysis of components), underlining the concept of sustainability in approach.

Geophysical Character

An objective analysis was carried out of geophysical components that indirectly impact the city's ecological and tourist character. This analysis considered elevation analysis, state of thermal discomfort, and an overview of solar potential and rainfall trends to derive sustainable strategies to cater to the predicted drastic growth in demand.

Elevation

Figure 4: Elevation Map, Ayodhya

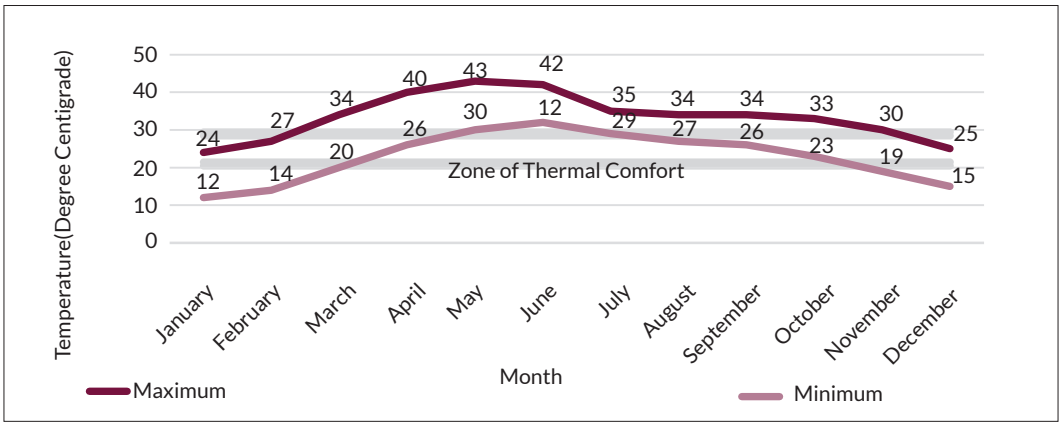


Source: Prepared from bhuvan-app3.nrsc.gov.in (Anon, n.d.)

The city slopes from west to east (Town and Country Planning Authority, UP, n.d.). The eastern part of Ayodhya and Sarayu plains are prone to flooding because of the lower elevation and, as depicted in Figure 4, the prominent tourist destinations of the Ayodhya core, Sarayu plains and Cantonment lie within this region. Hence, the need to develop a flood-resistant strategy to conserve the tourist destination as well as maintaining the beautiful landscapes.

Temperature

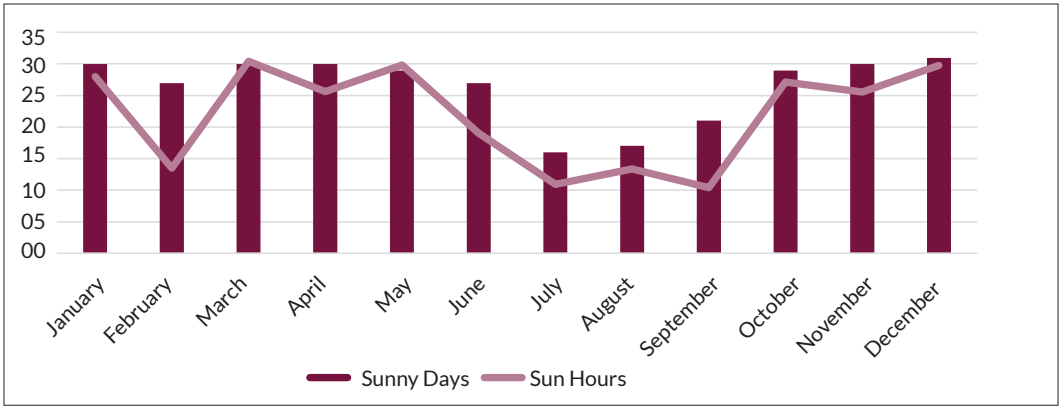
Figure 5: Average Temperature Graph for Ayodhya



Source: worldweatheronline.com (average of 2010–2020)

The average temperature was analysed over the thermal comfort zone to derive inferences as to the correlation between thermal comfort and tourism (Wang et al., 2022). The impact on tourist decisions on visiting season, duration of stay, and mode of intracity travel was clearly visible. Tourist influx and thermal comfort can be seen to be interdependent where tourist influx dropped during months with higher temperatures. During April to June, high temperatures and humidity rise to 43°C, resulting in thermal discomfort, but this coincides with the tourist season (Ram Navami, Hanuman Jayanthi, Holi), which leads to a need for dynamic shading and heat proofing techniques. There exists a high potential to tap solar energy. Ayodhya has up to 240 hours sun hours (Monthly average) with higher sunny days distributed across the year as shown in Figure 6.

Figure 6: Average Sun Hours Graph for Ayodhya



Source: worldweatheronline.com (average of 2010–2020)

Rainfall

Figure 7: (a): Rainfall Trend by Months in Ayodhya

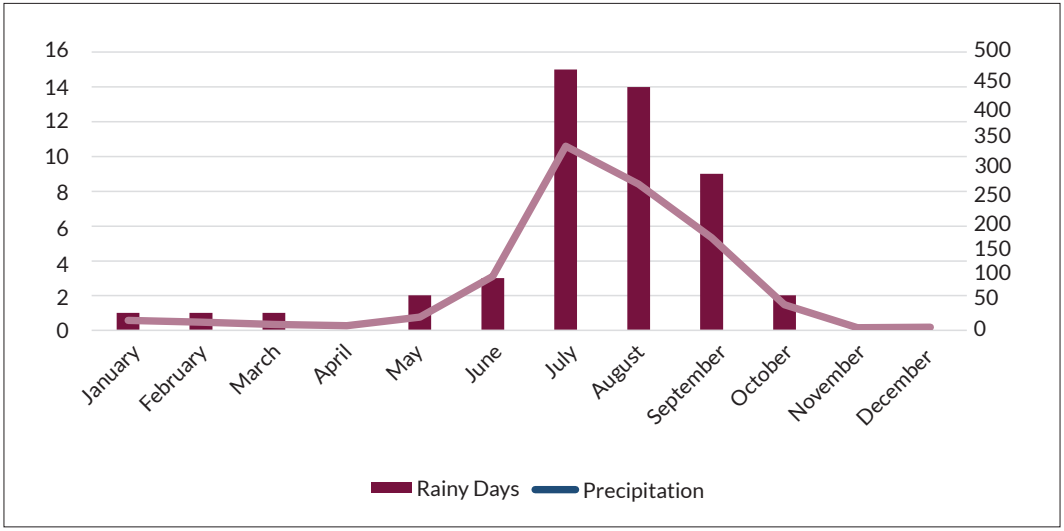
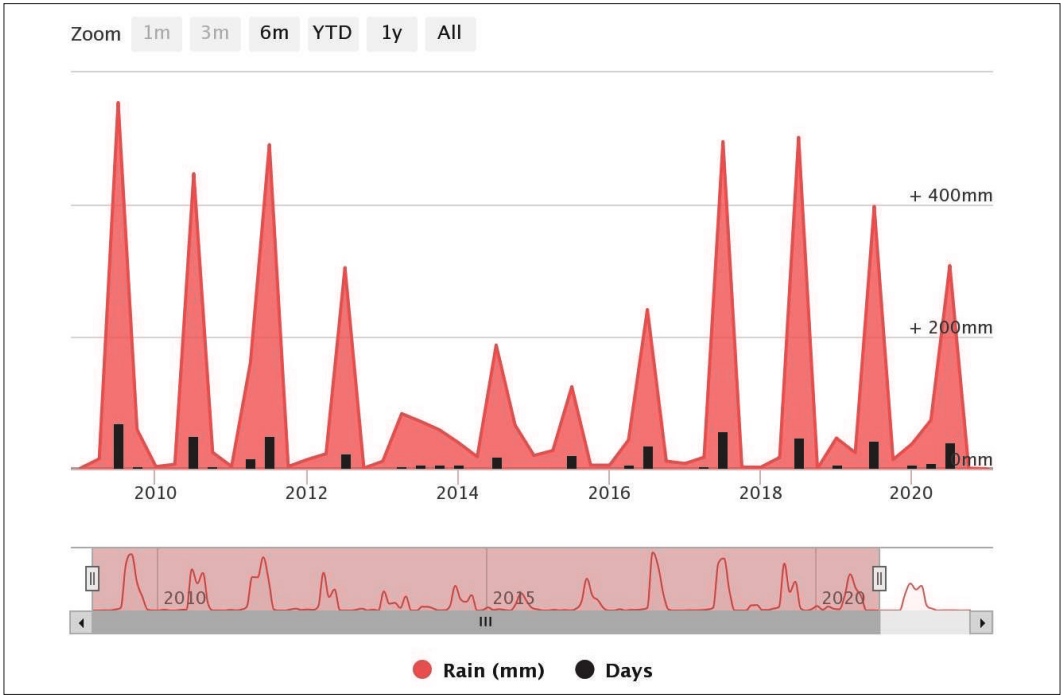


Figure 7(b): Average Rainfall Amount (mm) and Rainy Days



Source: worldweatheronline.com (average of 2010–2020)

An inconsistent and decreasing rainfall trend is observed. with July and August having the highest precipitation, followed by flood-like scenarios emerging across the Sarayu plains. The increasing dependency on groundwater to meet the increasing demand for water underlines the need to conserve rainwater as a sustainable practice.

Land Use Analysis

A qualitative analysis of the impact of tourism on urbanisation and required land use intervention is depicted in Table 1.

Table 1: Land Use Analysis in Comparision with URDPFI's Ideal Developable Area in Ayodhya

LAND USE	Area (in ha)	Percentage Area (Ayodhya)	Ideal Developable Area % (URDPFI)
Residential	1531.21	11.46	35–40
Commercial	21.14	0.16	5–7
Industrial	216.55	1.62	4–5
Institutional	299.37	2.24	-
Public & Semi Public	37.16	0.28	10–12
Recreational	254.42	1.90	10–12 (includes water bodies)
Public Utilities	2.10	0.02	-
Transportation	583.67	4.37	12–14
Other	107.76	0.81	-
Agricultural	7417.29	55.49	-
Rural	605.92	4.53	-
Specific Land Use	4.75	0.04	7–10
Vacant Land	870.60	6.51	-
Waste Land	842.68	6.30	-
Water Bodies	539.18	4.03	10–12 (Includes iecreational use)
Wetlands	33.19	0.25	-
Total	13367.00	100	-

Note: Land Use Analysis based on (Urban and Regional Development Plans Formulation and Implementation) (URDPFI) comparing URDPFI's ideal developable area percentage in a tourist city with Ayodhya

Source: URDPFI (Urban and Regional Development Plans Formulation and Implementation) and Ayodhya Report TCPO UP.

The impact of tourism on urbanisation and required landuse intervention was derived from the land use analysis above. Notably, agricultural land use stands out as significant, primarily due to newly added areas reflecting the state of urbanisation and future scope of expansion.

'Specific land use' can be increased to conserve the core heritage zones, which are currently not covered under zonal restrictions. Wetland degradation attributed to rapid expansion and urbanisation remains a crucial concern. Existing recreational use classification is limited. However, an expanding user base driven by internal casual tourists from the sub-regional areas and expectations of a more significant influx are indicative of the excellent potential of increased recreational use. Hence, increasing recreational land use would cater to the existing population and diversify tourism in the city. It would expand the stay and trickle-down economic benefits to a larger local economy.

With traditional water conservation in the form of kunds gradually declining, kund rejuvenation and reconstruction would add environmental benefits and socio-cultural value. Additionally, accessibility being a concern specially across the Sarayu plains and the outer zone developing transportation networks use would positively change tourism sector.

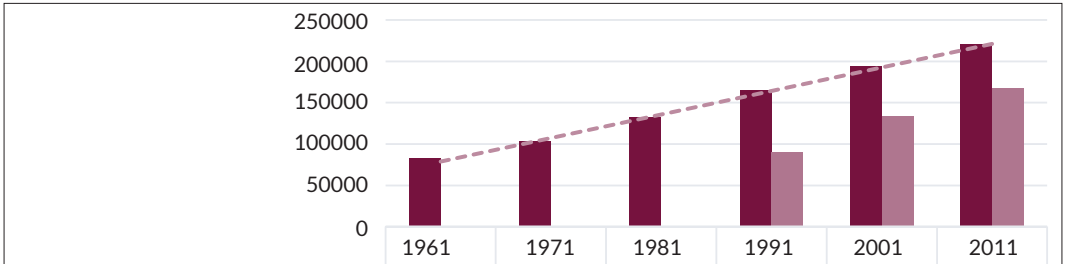
Administrative Structure

A functional profile of administrative organisations involved in Ayodhya's touristim development was carried out wherein crucial administrative, organisational and financial issues were inferred:

- The authority was excessively dependent on grants because of low revenue generation. What this means is that there is a need for newer revenue-generating models.
- Zonal regulations/restrictions were absent in and around heritage sites.
- Land acquisition issues and a need for dynamic pricing models had arisen primarily due to rapid expansion due to acquisition of land in and around the city.
- Interdepartmental coordination issues and limitations of PMU (Project Management Unit) are listed.

Demographic and Tourist Trends

Figure 8: Population Trend, Ayodhya



	1961	1971	1981	1991	2001	2011
Population of Ayodhya Nagar Nigam	83177	102835	132373	165079	194122	221118
Ayodhya Rural Area (Under Development Area)	0	0	0	90500	134292	167216

Source: Town and country planning authority UP (n.d.)

The analysis is based on census and UP Tourism data showing the drastic growth rate of local and floating population promoted by tourism, reflecting potential in terms of international tourists. It could help to develop an activity-based strategy for tourist redistribution and deal with quantum of challenges that could emerge in future.

Up until 2011, the city of Ayodhya witnessed gradual growth (as depicted in Figure 8). This growth rate is set to increase in upcoming years because of the opportunities generated by urbanisation. According to the 2011 census, the population of 65 villages within the Ayodhya Development Authority boundary was 1,67,216. Of these, 41 villages have been merged into the Nagar Nigam. The steady growth of 8.2 percent can be observed from 2009 to 2019 in tourist influx, as depicted in Figure 11. The sudden dip of -234 per cent observed in 2020, can be attributed to the COVID-19 pandemic should be temporary.

Figure 9: Tourist Footfall, Ayodhya

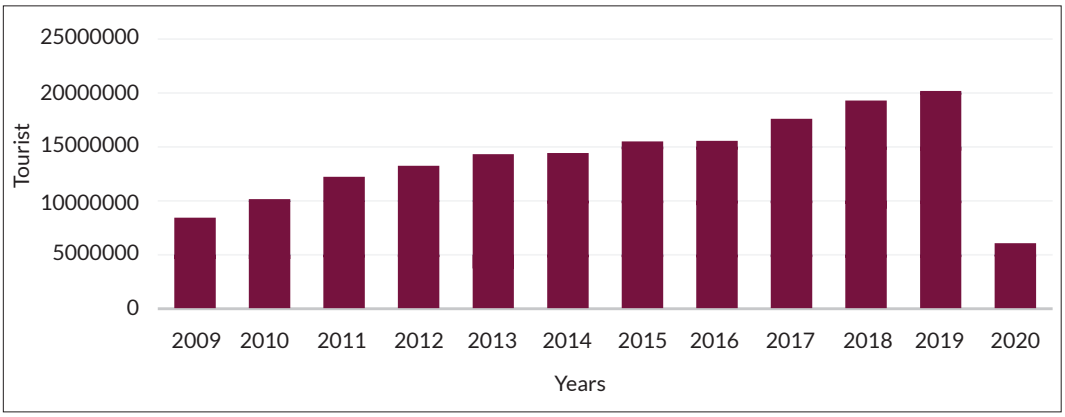
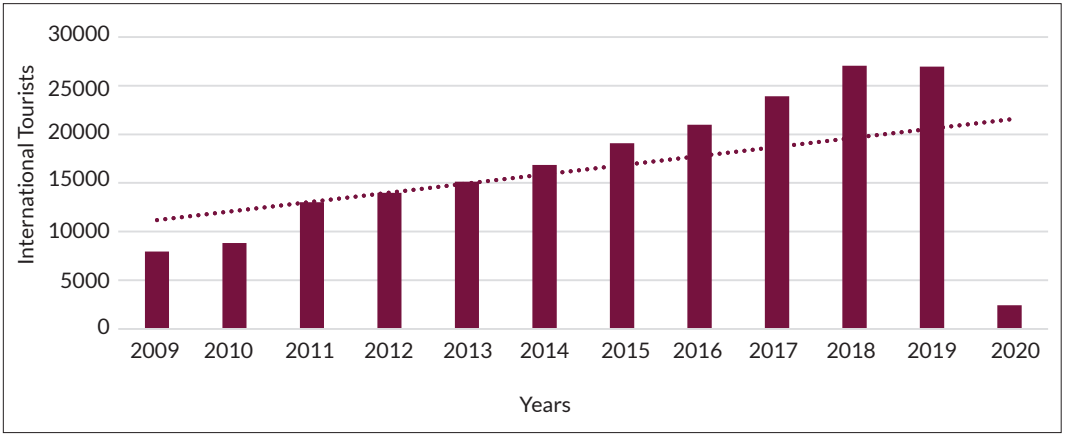


Figure 10: International Tourist Footfall, Ayodhya

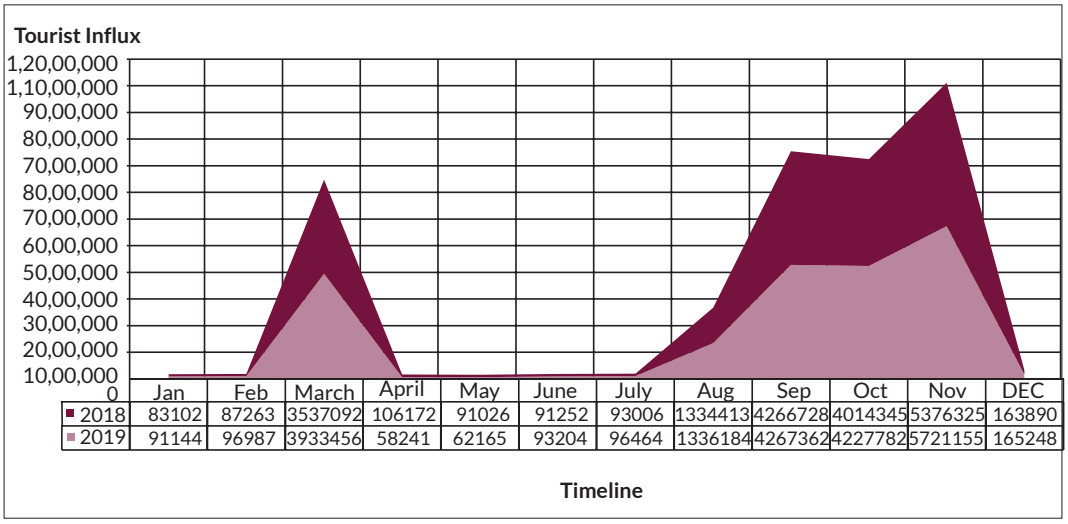


Source: Tourism Directorate, UP Tourism

International tourists comprise less than 0.2 per cent (Figure 10), which indicates that the city's tourism is entirely driven by the domestic religious tourist. However, an average rise of 11.1 per cent points at a considerable potential to be tapped, to which the regional integration of Varanasi and the mainstreaming of existing locations with diverse character would provide a boost.

The major tourist spikes were observed across the months of February to March (attributed to Holi, Mahashivaratri and Ram Navami) and September to November (Dussehra, Deepotsav and Parikrama) as Figure 12 shows. The dip months in between can be attributed to less important events and the scorching heat.

Figure 11: Tourist Influx—Monthly Variation, Ayodhya



	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	DEC
2018	83102	87263	3537092	106172	91026	91252	93006	1334413	4266728	4014345	5376325	163890
2019	91144	96987	3933456	58241	62165	93204	96464	1336184	4267362	4227782	5721155	165248

Source: Tourism Directorate, UP Tourism

Tourist Destination Profile

Destinations are profiled for the zones in line with intracity travel patterns. Divided in zones, the places are characterised based on the nature of the place, issues and potential opportunities. The destination profiles are created through a lens focusing on how tourism centres around the Sarayu River contribute to the socio-cultural character of Ayodhya and make the river more than just a component in the city's tourism profile.

Tourist destinations in the study area are categorically profiled based on their character into the Ayodhya core, Faizabad zone, Cantonment, outer zone and Sarayu plains.

Ayodhya Core

The core of Ayodhya city is located on the north-eastern side of Ayodhya on the banks of the river Sarayu. This zone acts as the epicentre of tourism with significant places of touristic, religious and heritage significance, such as Ram ki Paidi, Hanuman Ghari, Dashrat Bhavan, Ram Janam

Bhoomi and Kanak Bhavan. With the religious and cultural character being the attraction, new development along the river stretch also caters to leisure activities for locals and others..

The issues inferred from primary surveys prominently revolved around (i) parking (ii) pedestrian and vehicle conflicts, and (iii) accessibility issues for the elderly and differently-abled. These issues call for design interventions. There have been concerns about heritage loss around the essential part of the temple ecosystem. Also of concern is the lack of public toilets, while the absence of public drinking water facilities in market spaces leads to a dependency on bottled water.

It is observed that despite Ram ki Paidi being developed for bathing purposes, certain devotees still prefer to take a holy dip at Naya Ghat in the main-stream flow of the Sarayu, causing an overlap between the ghats and boat docks. The lack of changing room facilities at Ram ki Paidi pushes ladies to use only Naya Ghat, which is 200 metres away, negating the usefulness of a ghat that was primarily constructed for that purpose. Design elements such as steep steps and lack of ramps at Ram ki Paidi lack inclusivity towards the differently-abled, propel this section of people towards the main stream as well.

Faizabad, Cantonment and Outer Zone

Located away from the core zone, Faizabad caters to tourists seeking heritage/leisure/shopping through places such as Gulab Bari and Bahu Begum ka Maqbara. Tourists often spill out from the core with an interest in exploring the cultural heritage, as well as for other leisure activities.

The Cantonment with all entry rights reserved with the army consist of Guptar Ghat, Military Mandir and Company Gardens, and cater to religious, nationalistic and leisure audiences.

Sarayu Plains

This area comprising more than 25 ghats and different heritage structures in the form of ashrams, dharamshalas and havelis remains the most under-explored place in the city.

The primary issue is accessibility with only Faizabad zone easily accessible through IPT. The areas inside Cantonment and the outer zone are highly dependent on private transport. The Sarayu zone is the most inaccessible, resulting in a smaller trickle down of tourists from the zone, although they remain culturally integrated.

Non-Mainstream Places

It is to be noted that with greater influx come greater challenges for which redistribution should be adapted as a strategy for destination development. The destination is predominantly characterised by non-mainstream places at local and regional levels, which plug in to a high potential for expansion of the itinerary provided the required intervention is made.

Many of these non-mainstream places were identified through primary surveys and are usually left out in the mainstream tourist itinerary. They have excellent potential to redistribute and retain tourism to ensure social and economic sustainability, while simultaneously acting as a tool for conserving heritage and boosting tourism.

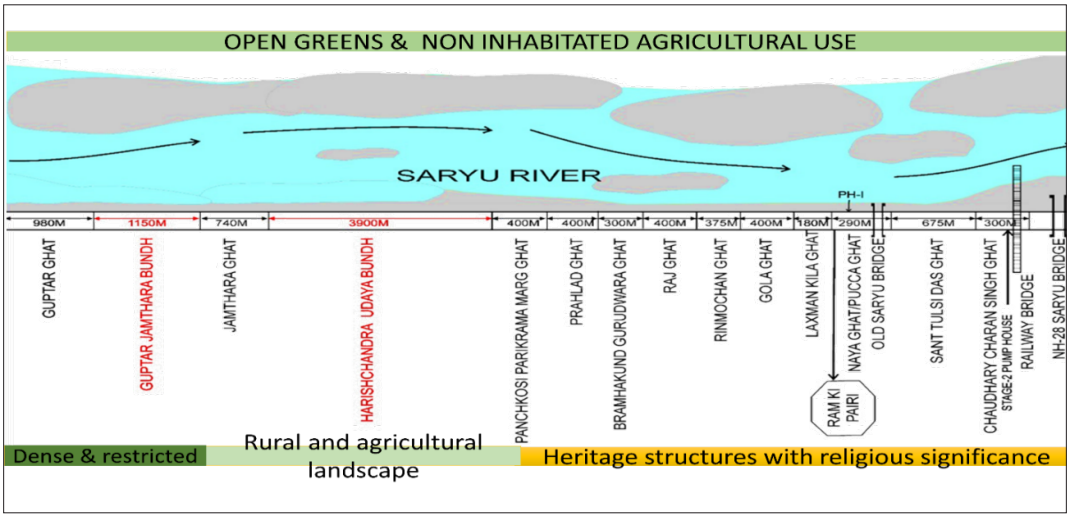
These sites consist of the galis of Ayodhya, heritage ashrams of Ayodhya, Korean Park, tomb of Bani Khanam, Gumnami Baba's resting places across the zones along the river, along with Mani Parvat and Chowk Mosque (the base of Ahmadullah Shah, known as the maulavi of Faizabad, one of those who spearheaded the revolt of 1857) within the city limits, and Kamakhya temple and Imambara at regional level bridging the Gaghra and Gomti rivers.

Sarayu Characterisation

The various features of the river Sarayu across Ayodhya's city stretch were analysed.

Activity Mapping

Figure 12: Line Diagram of Riverside Activities, Ayodhya

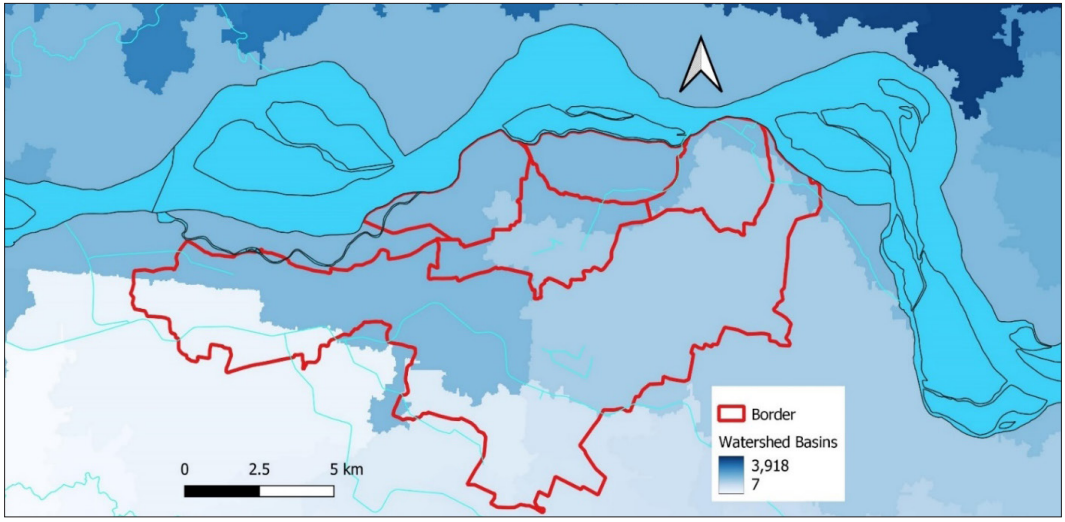


Source: Primary Survey & Irrigation Department, UP

The river Sarayu creates varied landscapes along the zone of interactions that have been developed simultaneously with Ayodhya's rich socio-cultural spaces. Ancient heritage-rich elements can be observed till the stretch of Prahalad Ghat along the core zone. From here till Cantonment, the landscape transitions towards natural heritage against a rural and agricultural backdrop, with settlements of the fishermen community at Rajghat. The Cantonment has a backdrop of denser vegetation and cultural richness, with places such as Company Garden and Guptar Ghat while the northern bank is primarily agricultural. The upper bank remains uninhabited with the Sarayu changing its basin over the years, as depicted in the line diagram.

A catchment area profile was analysed to derive conservation strategies. It was observed that increasing urbanisation was a cause for concern in the watershed across the Sarayu plains, with the northern banks being of primary concern. There is a need for policy and spatial interventions to conserve these areas.

Figure 13: Watershed Basin of Ayodhya



Source: bhuvan-app3.nrsc.gov.in (Anon, n.d.)

As a part of capturing the cultural approach towards water conservation, the status of canals and kunds that sprawl across the city was observed. It was noted that despite the kunds being acknowledged not only for harvesting water and from a religious perspective, they continue to face extinction, creating a need to conserve them.

Rapidly changing flood lines across the year remain a critical concern. With tourist spots, the major tourist and local ecosystem being most vulnerable, there is an urgent need to stabilise the flow of the river The hydrological profile shows areas where difficulty in navigation indicates a need for desilting. Solid waste disposal and sewage were identified as the primary concern. A recent Sarayu action report (UP-PCB, 2019) identified dumping sites and sewerage as cause water pollution. With tourism as a significant contributor, these issues must be addressed at inception itself.

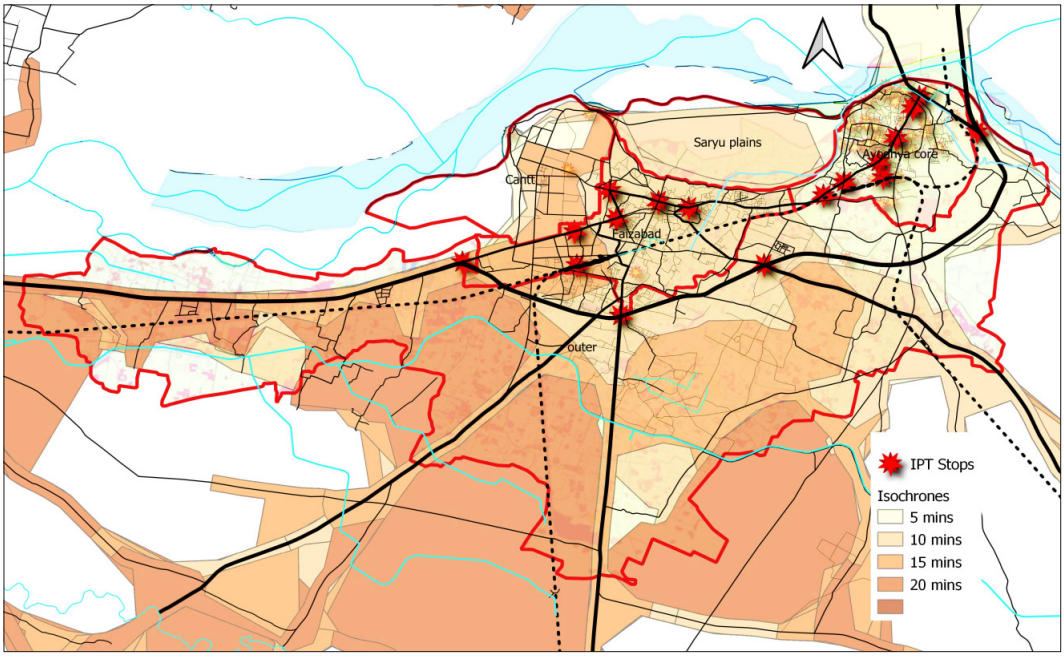
Accessibility

A detailed profile of existing connectivity in Ayodhya in terms of modes of transport and routes such as personal transport, IPT encompassing Vikram autos (diesel-powered), general auto rickshaws (CNG), e-rickshaws, walking etc. were analysed. The character and issues of each mode were identified through primary surveys and secondary analysis.

Isochronal Network Analysis was done based on 17 significant stops of IPT. Ayodhya core zone was observed to be the most accessible. The outer zones and Sarayu plains where IPT was found to be least accessible can be cross-interpreted with the tourist approach towards Guptar Ghat and Bharath Kund.

IPT routes majorly covered Naya Ghat towards Shahadat Ganj, Shahadat Ganj towards Sohawal, Naka towards Sultanpur, Naka towards Bara, Devkali to Maya, Naya Ghat to Nawab Ganj.

Figure 14: Isochronal Network Analysis, Ayodhya



Source: Authors (bhuvan-app3.nrsc.gov.in) (Anon n.d.)

Further, it was observed that IPT acts as the central spine of intracity transport in Ayodhya, and the increasing trend of residents moving towards private modes of transportation indicates a need to strengthen the public transport system.

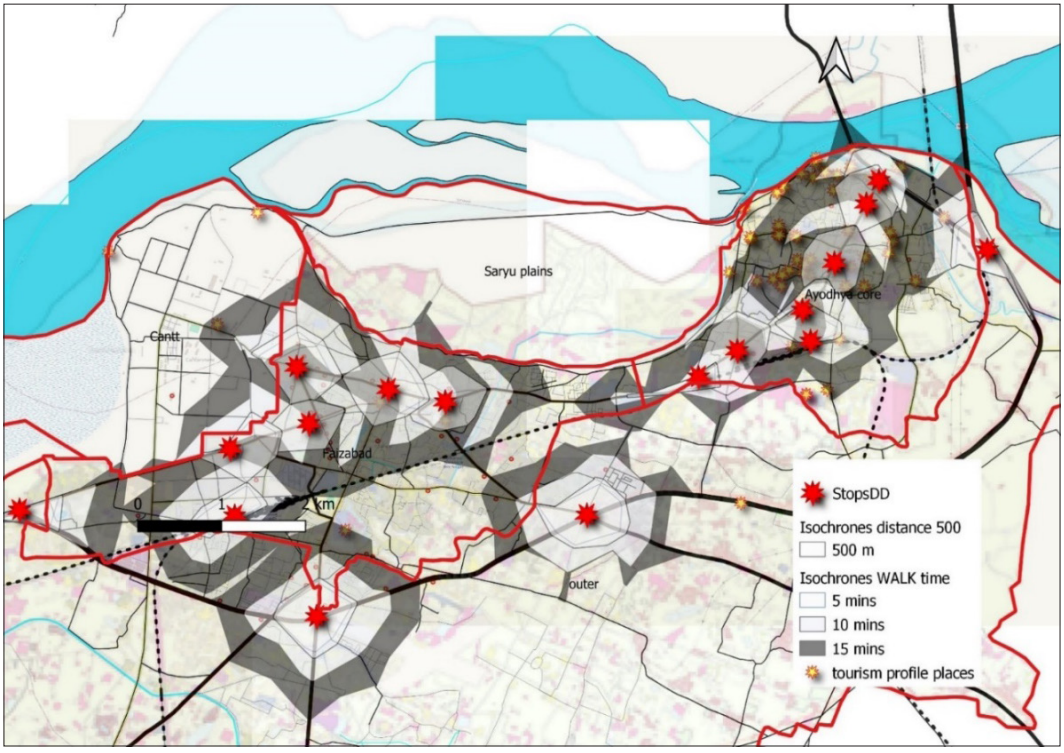
Walkability assessment: The assessment (Figure 17) was done on the standard that destinations should be under 500 metre reach and under 10minutes overlay. The areas where walkability needs to be improved are shown by the overlay method in grey. Scorching temperatures, lack of shade and shelter further affect an already low walkability that needs to be approached through design interventions and planning strategies.

Accommodation

Tourist accommodation is majorly concentrated in the Ayodhya Core in the form of ashrams, dharmshalas and hotels. The state of tourist accommodation was picturised through primary survey and secondary data in terms of:

- **Affordability:** Establishments are mostly non-starred and budget in nature, with ashrams and dharmshalas remaining universally accessible to all. Most charge nothing or a nominal amount and so remain most affordable.
- **Occupancy:** Average occupancy lies between 25 to 50 per cent during the lean season, going up to more than 75 to 100 per cent during the peak season (primary survey).
- **Resource management:** This aspect leaves a significant footprint in Ayodhya's environmental profile. Water consumption ranges from 50 kl to 300 kl per month (primary survey), and is majorly dependent on groundwater. Sewerage, primarily dependent on self-cleaning soak pits, also remains a point of concern. Solid waste, mostly comprising plastic bottles and kitchen waste, contributes to the major unsustainable practices affecting the land and water ecosystem. Around 5000–6000 units of electricity remain the average consumption, increasing during summer months for which the source needs to be decentralised and diversified through sustainable clean energy to cater to the increasing demand.

Figure 15: Walkability Assessment , Ayodhya

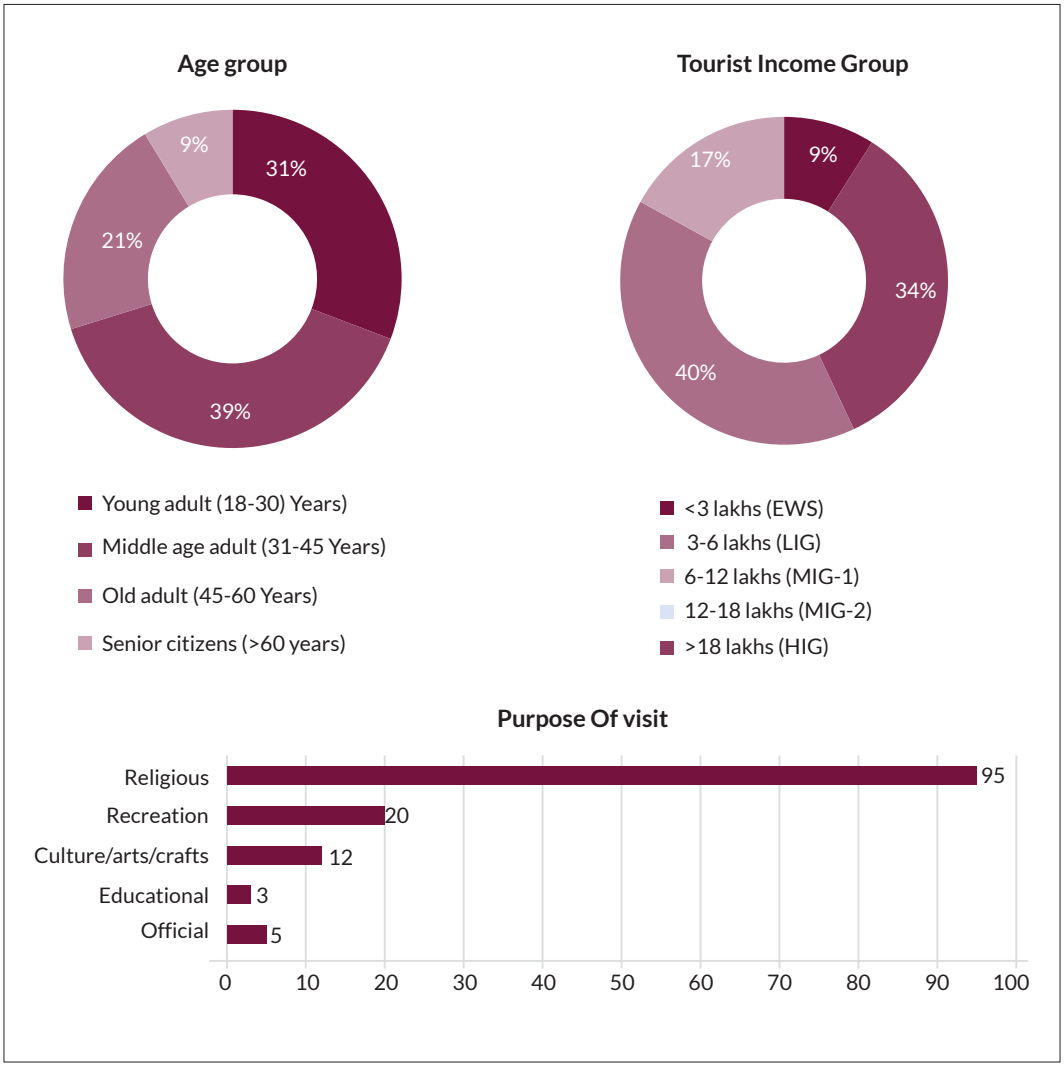


Source: Primary Survey & open street maps, March 2021

Tourist Characterisation

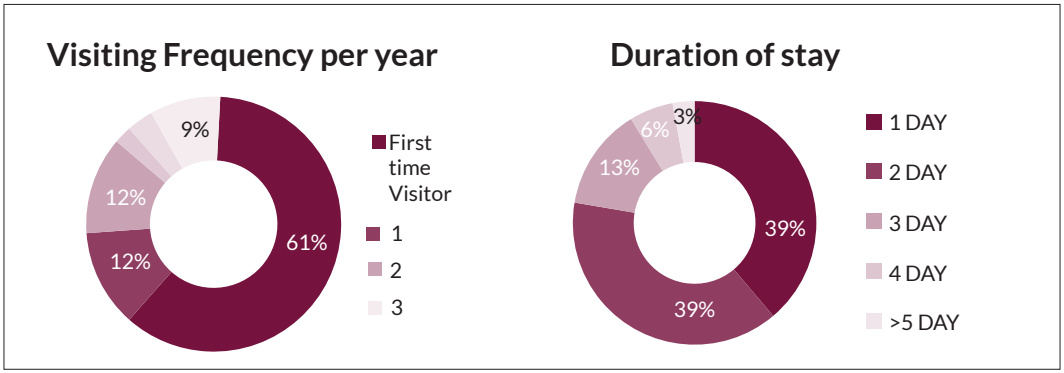
The tourist profile was captured through cross-analysis from primary survey data, which encompasses nature of a tourist and issues perceived. It was observed that: Average grouping was between 2-4, with a considerable proportion of bigger groups as well. The purpose of the visit was predominantly religious and cultural. Locals and a multitude of visitors from surrounding districts subscribe to recreational use alongside religious reasons.

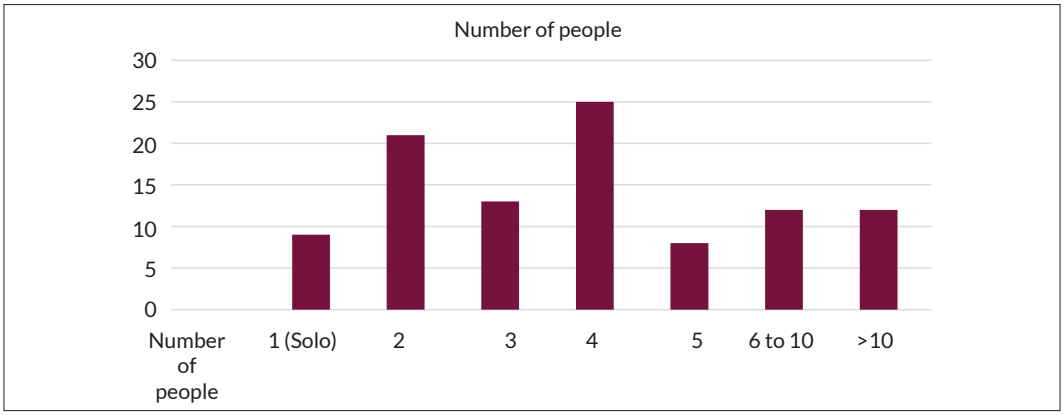
Figure 16 A: Characteristics of Tourists in Ayodhya



Source: Primary survey, February–March, 2021

Figure 16 B: Characteristics of Tourists in Ayodhya



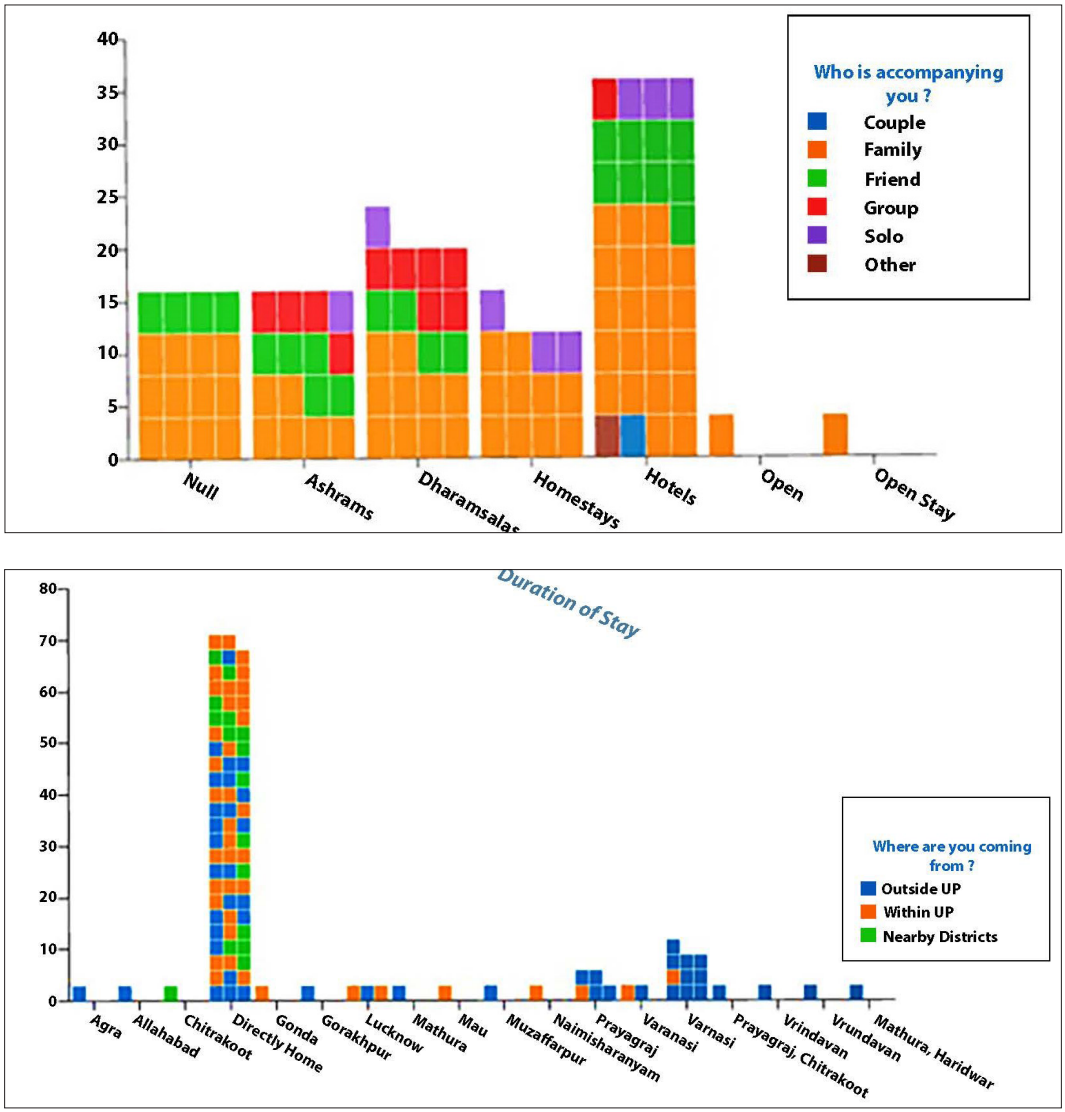


Source: Primary survey, February–March, 2021

Family tourists comprised a significant number, followed by friends and groups. Further classifying the family group based on accommodation, younger couples preferred staying in a hotel; senior citizens and older adults preferred ashrams and dharmshalas. In contrast, middle-aged adults were split between both types.

Tourists belonging to other states tend to cover the regional circuit travelling to Varanasi, Prayagraj and other places. Their duration of stay is limited to a day or two, covering mainstream places. A willingness to explore Ayodhya further was primarily expressed by first-time visitors. Lack of information regarding non-mainstream places was what deterred a major proportion of first-time visitors, revealing a potential for regional integration. The need for redistribution to tackle congestion, as well as solid waste sensitisation issues were majorly highlighted.

Figure 17: Cross Analysis of Tourist Characterisation, Ayodhya



Source: Primary survey, February–March, 2021

Image Intensity Analysis

Image intensity analysis was done to understand the psychological footprint of imageability of spaces and places in Ayodhya. The city's tourism is characterised at a stage between development and consolidation on Butler's scale; there is a higher potential to utilise the places by mapping the unmapped places in people's minds. The analysis could be a basis to formulate redistribution as a sustainable tool to tackle congestion alongside enhancing user experiences.

Figure 18: Image Intensity Analysis

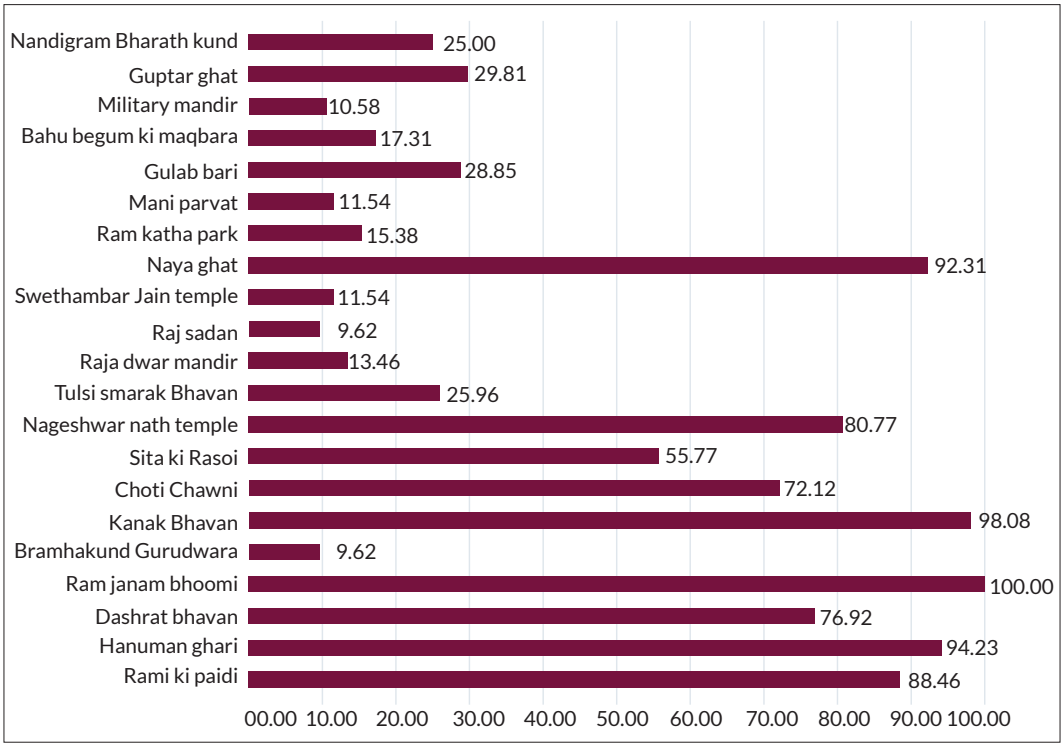


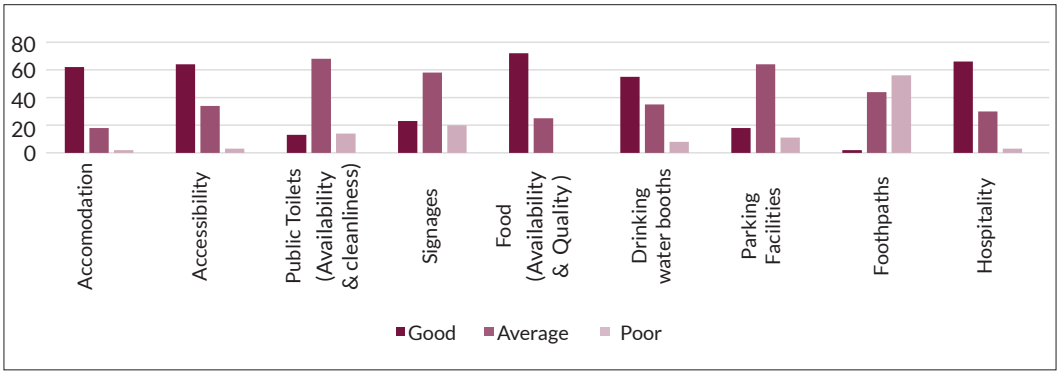
*Image analysis=Recall frequency*100/sample size*

Source: Primary survey, February–March, 2021

Service Quality Assessment

A perception-based service quality assessment was done to identify the critical shortage in services. Issues pertaining to footpaths, signage, parking facilities and public toilets, among others, were identified to be of concern.

Figure 19: Service Quality Assessment

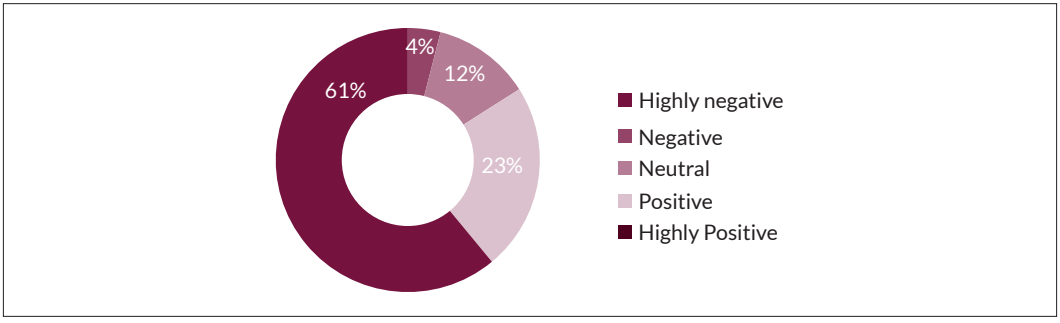


Source: Primary survey, February–March, 2021

Local Resident Characterisation

A local resident survey was conducted across different zones to understand the influence of tourism on quality of life. The majority perceived the influence of tourism as highly positive attributing to socio-economic proponents.

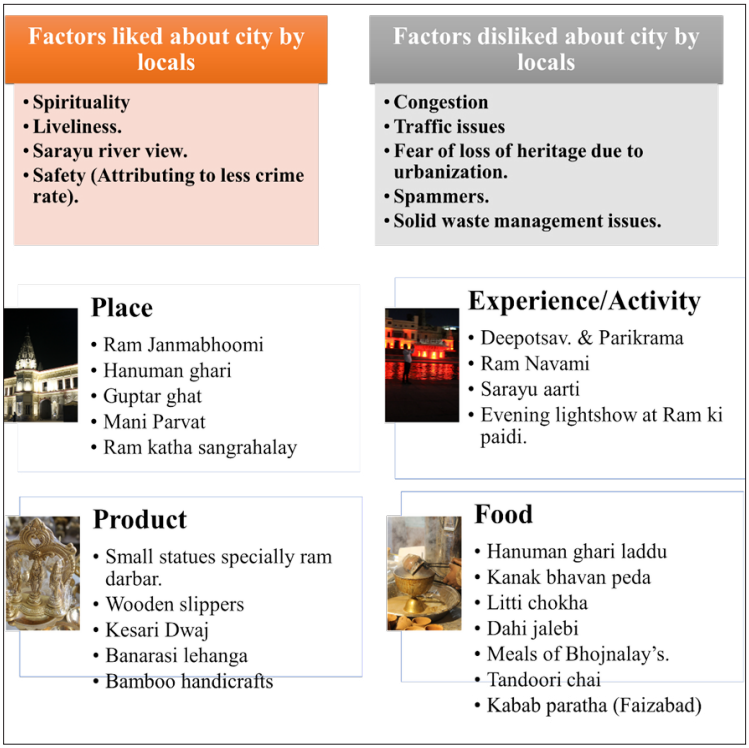
Figure 20: Influence of Tourism on Locals



Source: Primary survey, February–March, 2021

Core characterisation of Ayodhya was done by capturing the attributes locals like or dislike about the city. The Must-Do catalogue depicts a necessary experience a tourist should have from the perspective of the locals and core nature of tourism that must be conserved.

Figure 21: Must-Do Catalogue

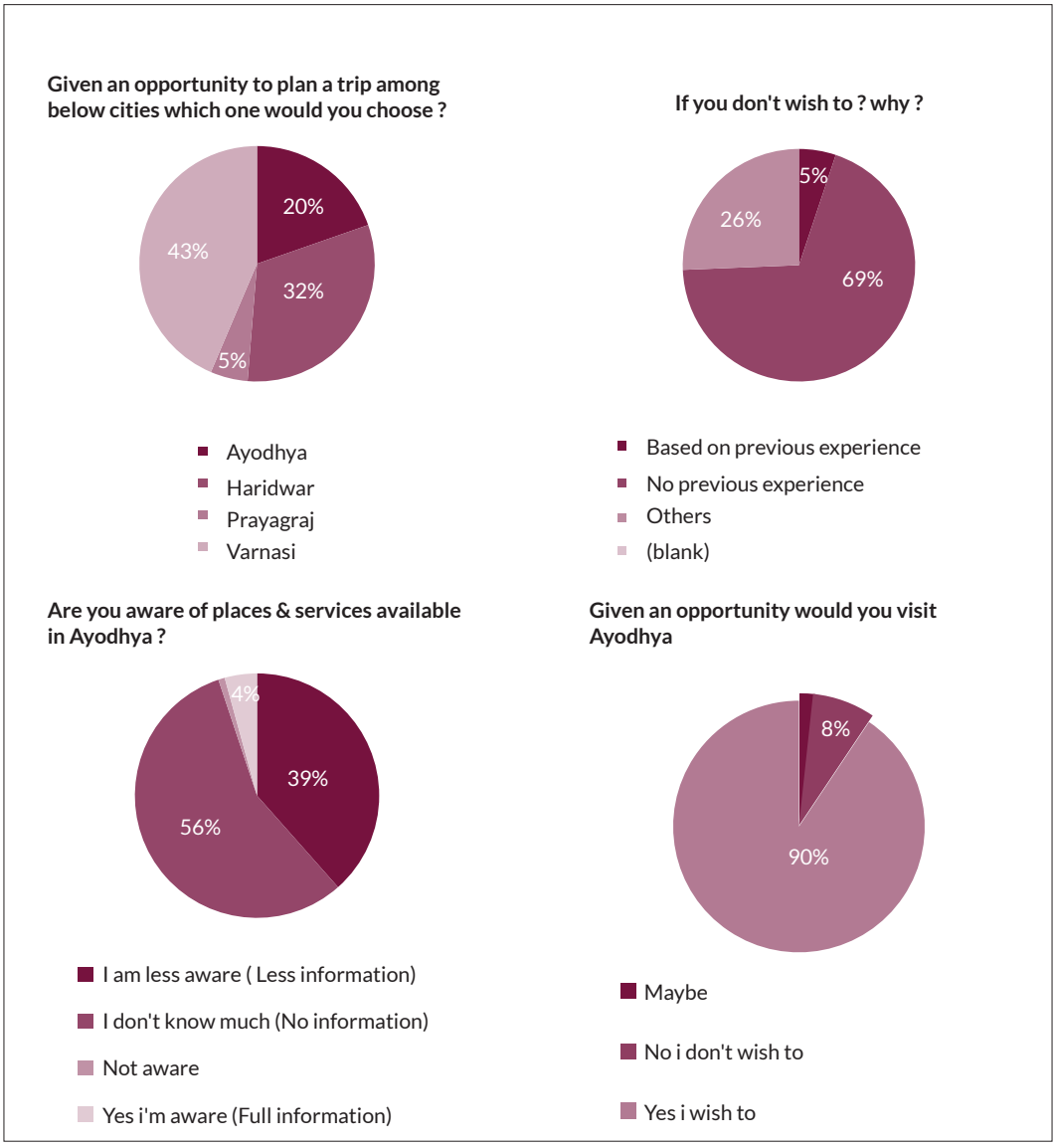


Source: Primary survey, February–March, 2021

Non-participant Survey—Identifying potential tourists (outside Ayodhya)

A non-participant survey was conducted to analyse and extract issues faced by potential tourists based on the psychological paradigm. The issues were captured in terms of: awareness, perception and preferences. Through the non-participant analysis, it was observed that Varanasi is the preferred choice followed by Ayodhya on the basis of spirituality, landscapes, experience and mainstream information availability. From another perspective it can be inferred that tourist integration through regional development is a possibility, as visitors of Varanasi and Prayagraj are potential tourists if the drawbacks are addressed. It is also observed that the lack of information and uncertainty regarding services were among the prime deterrents, pointing to a need to revisit the tourism promotion strategy along with a need to induce a transparent system.

Figure 22: Analysis of Non-Participant Survey



Source: Primary survey, February–March, 2021

Amenities

Amenities such as sewerage, stormwater drainage, water supply, solid waste were individually assessed to capture existing status as well as the contribution of tourism to demand, gaps and potential.

Sewerage

The rapidly increasing tourist influx and its ripple effect on tourism-allied industries, combined with local generation majorly propelled by sugar refineries, oil extracting mills in and around Ayodhya have redefined the challenges. With the existing state of wastewater treatment observed to be managed unsafely as per a study conducted by the Centre for Science and Environment (CSE), the situation poses a catastrophic risk to the Sarayu's riverine ecosystem in the future.

Drainage

The state of drainage was analysed with the help of the Sarayu Action Plan Report and the existence of both open and closed drains was observed. However, along with regular cleaning/ maintenance of drains, underground drainage systems and decentralised treatment plants are required in the city to maintain hygienic conditions and enhance the aesthetics of the tourist city.

Figure 25: State of Drains, Ayodhya

Number of Drains	Type of Drain			Status of Drains			Industries		Sewage Discharge (MLD)			Total Discharge in the river (MLD)
	Domestic	Industrial	Mixed	Tapped	Untapped	Partially Tapped	Number	Treated Effluent	Treated	Untreated	Total	
18	16	2	0	0	18	0	2	7.9	0	23.14	23.1	31.04

Source: Sarayu Action Plan Report, 2020

Water Supply

Tourism activities, often correlated to hydric stress, pose a challenge to the growing demand arising out of increasing influx. Analysis reveals that despite the city being located on the banks of the river Sarayu, it is majorly dependent on underground water, which is supplied through overhead tanks. Though groundwater resources are abundantly available with water tables varying from 20 to 150 feet within the city, the concern of overexploitation persists due to rapid urbanisation.

Tourist demand was estimated to be more than 14.79MLD (Becken, 2014)this research analysed tourism-related water use in 21 countries and compared it with other municipal use. Tourists' water use on a per guest night basis was found to differ substantially, with water usage being highest (up to 956 l per guest night in China (calculated from individual demand based on consumption studies and influx). The need to introduce a sustainable supply system through a conservation approach was derived correlating to this projected demand.

Solid Waste Management

A correlational analysis was done to pinpoint the relation between impact of tourism and solid waste management. Calculated on the basis of a study that states that the Indian tourist, on average, generates 0.9 kg waste (source: Sustainable Tourism Promoting the Environmental Public Health, University of Copenhagen, per day, tourist waste generation was estimated to be 49.31TPD. This constitutes the major proportion of total generated waste in the city, making tourist activity the top solid waste generator. Ayodhya Nagar Nigam (ANN) practises door-to-door collection of MSW, but due to lack of processing facilities, unsegregated solid waste is dumped in open plots or ponds and ow-lying areas. This results in waste toppling down into the riverine ecosystem, additionally contributing to air and groundwater pollution. The plastic waste generated by increased tourist influx was analysed as a major contributor contaminating the river's health, underlining the need for an alternative waste management plan.

Recommendations

The recommendations are derived based on the inter-relational analysis where the multitude of factors analysed and their implications were stitched together to draft sustainable solutions on the lines of:

Administration

It is said that the success of any scheme or project lies in the spirit of implementation. The concerns of coordination and capacity building are addressed by the formulation of a Joint Coordination Committee (JCC) consisting of representatives appointed by the line department and headed by the commissioner, formed under Section 5, The Uttar Pradesh Municipal Corporation Act, 1959. Along with promoting the existing project management unit, in its hierarchical placement under the Joint Coordination Committee, by expanding its scope through creation of sub-units. The project management cell looks into status monitoring, daily reports and benchmarking to set standards and targets. The issue management cell is to be a one-stop destination with respect to any stakeholder issue addressal with regard to to all line departments. The data management cell acts as the centralised data base for all details pertaining to line departments. The tourism and heritage cell is entrusted with short- term action plan preparation, tourist management, heritage conservation, assessing and coordinating line department projects on tourism and heritage. The environment and disaster cell- works on environmental conservation, flood plain conservation, dynamic activity monitoring and, coordinating with line departments' units, acts as an innovation cell introducing sustainable practices through dynamic strategic plans and action reports among line departments.

Land Value Capture

As a part of revenue resource mobilisation to reduce the dependency on grants and increase fiscal autonomy, the introduction of a betterment charge is proposed to reap the benefit of urbanisation and development activities in Ayodhya. Betterment charges proportionate to land value are to be levied on non-agricultural land: on residential plot sale, 0.5 per cent of market value per square metre; on commercial plot and development, 1per cent of market value per square metre; on industrial plot and development, 1.5 per cent of market value per square metre; on other plots

and development, 0.5 per cent of market value per square metre. This is authorised to be levied under the JCC by the UP Municipal Act,1959, where the revenue is deemed as a joint transaction.

Spatial Proposals in River Abutting Zones (Attractions & Activities)

An extended buffer of 500 metre width and 10 kilometre length towards the offside/northern bank of the Sarayu is proposed. This will be a riparian buffer where reforestation caters to the local ecosystem and flood mitigation. The funding drive will be undertaken through CAF (Compulsory Afforestation Fund) along with a remodelling of the Sarayu's riverscape, developing scope for open space sports activities. A voluntary participatory model can be adopted in the creation phase as part of a service to Ayodhya in coordination with other major stakeholders. With Ayodhya being epitomised as a symbol of civilisation, an open sports park of 330 meter*1500 forming 111 acre is proposed, to promote display and practice of ancient as well as with modern sports, adding touristic value and activities towards the northern bank.

As a part of riverfront activity development on the embankment being constructed from the Naya Ghat to Guptar Ghat stretch, a cycle track is proposed, with docks at Lakshman Ghat and Guptar Ghat and activity encouraged through permitting rural cafes and food points though in limited numbers. The stretch would help to redistribute tourists, exposing several non-mainstream heritage structures to recreational and cultural tourists. The growth in tourist influx would increase accessibility to the Sarayu flood plains and also add a mode of revenue generation in the form of viewpoints and cycling through Public Private Partnership (PPP).

Design intervention is proposed at Ram ki Paidi, where soft-scaping is proposed to develop shades and shelters to tackle scorching temperatures, keeping to a coherent design that is inclusive of women and the differently-abled through changing rooms, ramps, audio-visual signages, tactile braille signages, etc.

The normal poles are proposed to be replaced by smart poles in the major tourist destinations to make available facilities such as Wi-fi hotspots, charging port, CCTV monitoring and dynamic billboards for tourists.

A special heritage zone is delineated in the Ayodhya core (abutting the river) to conserve heritage structures. Supervised building destruction and construction permits will be given. A Special Area Heritage Plan has to be prepared to promote adaptable reuse of heritage structures, for example, deteriorating and abandoned heritage buildings can be conserved and used as heritage accommodation in the PPP1 model.

Kund rejuvenation is proposed and as part of the effort to revive ancient water conservation techniques seven kunds have been identified, adding both socio-cultural and environmental value.

[1]*Public Private Partnership*

Accessibility

The upgradation of three docks is recommended (Naya Ghat, Guptar Ghat, Raj Ghat) and two new dock (buffer view and open sports park) are proposed to facilitate better accessibility to different attractions via the river. This will increase the scope of boating from a leisure activity to a mode of transport connecting the Sarayu plains, Guptar Ghat and offside areas once activities are introduced. Additionally, it is proposed that, as in Varanasi, the existing diesel-powered boats be converted to solar, in association with The Energy and Resources Institute (TERI) under CSR.

Accommodation

Based on SDG 12, highlighting the priority of responsible consumption, it is proposed that in commercial accommodation with kitchens, a kitchen waste composter, decentralised waste water treatments (such as an anerobic baffled reactor and planted gravel filter) and the installation of solar power units should be made mandatory to getting permits. A centralised data base of accommodation, hotels, dharmshalas and ashrams, maintained in Realtime by PMU together with a private partner as a part of the open data initiative would ensure transparency.

Amenities

The introduction of Lootels, similar to those in Rameswaram, under PPP is proposed, where tourists, and vendors can avail access to toilets, bathrooms and food at minimal cost. For any new property beyond 1200square feet to be given building design approval it must provide for rainwater harvesting. The enforcement of a strict plastic bottle ban in a phased manner is also recommended. Plastic bottles can be gradually replaced with earthen pot/bamboo/brass bottles. The chronology of phasing out could be, accommodations, restaurants, and then street vendors.

Conclusion

The tourism sector's significance in achieving the 17 Sustainable Development Goals has propelled a development planner to view it as an unparalleled tool for destination development. Prompted by this, the research has attempted to develop a new integrated approach for destination development through tourism. It captures challenges, potential opportunities and gaps through comprehensive integration (cross-analysis of components) by analysing factors such as attractions, activities, amenities, accommodations, accessibility, geophysical character, demographic trends, land use, tourist profiles, destination profile, as well as psychometric profiles of both tourists and locals. As the essence of the proposal is both active and passive, the recommendations are focused on achieving integration by resolving issues through inclusion and ensuring sustainability through being proactive by addressing the issue at its source and predicting its future course.

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Conflict of Interest

None of the authors had any conflict of interest.

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