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The eco-theological paradox: Assessing socio-cultural barriers to sustainable waste management at major Indian pilgrimage destinations

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Abstract

Background: The religious heritage sites in India stand as among the most concentrated human congregations in the world, setting up a distinctive and dynamic link between intense religious fervor and rapid environmental degradation. In India, the natural world has always been sacred, but this shift in a theology towards mass-scale religious tourism has led to an unprecedented ecological crisis.

Introduction/Objectives: This review paper deals with the "Eco-Theological Paradox", the systemic contradiction between the intrinsic sanctity of nature in the Indian Philosophies and the tremendous externalities which are created in the environment due to the contemporary pilgrimage. The study is to critically evaluate the socio-cultural, behavioral and institutional constraints which prevent sustainable waste management (SWM) at the major shrines in India and to develop a multi-disciplinary policy framework for intervention.

Methodology & Key Findings: Use of a systematic review of the last 10 years, in this study, analysed empirical data from various sites of high density such as Vaishno Devi, Varanasi and Sabarimala. The findings show that there is a concept of Nirmalya (ritual offerings) and a strong cognitive dissonance between 'Sacred Purity vs Secular Filth', which poses a huge mental obstacle in effective waste segregation. Moreover, institutional arrangements are often identified as weak, not taking into consideration the different temporalities of "floating populations" that characterize pilgrimage cycles. One of the key research gaps is the absence of longitudinal studies of behaviour, and models that embed the concept of "Circular Economy" in the framework of valorisation of ritualistic waste.

Conclusion: Technocentric and top-down solutions are not enough to cope with the crisis. Rather, adoption of a 'Faith-Based Environmentalism' approach where the waste management can cater to the pilgrim's spiritual journey is necessary to ensure the sustainability of India's holy locations.

Keywords: Eco-theology, Nirmalya, circular economy, sustainable waste management, India, cultural barriers, religious tourism.

1. Introduction

In India, the juxtaposition of the holy and the polluted in sacred spaces is one of the most challenging environmental issues of the twenty first century. The process of rapid urbanization in the subcontinent has transformed the traditional Yatra, which was austerity and minimalistic footprint, into a commercialized and a mass scale religious tourism phenomenon. As per recent domestic tourism data, about 60% of domestic tourism is driven by religious reasons, and there are an estimated 500,000 religious sites in India. This "spiritual vitality" is a vital point for the economy, but has ultimately led to a serious environmental emergency. Today, the major pilgrimage centres produce thousands of tons of waste per day, much of which is non-biodegradable plastic and ritually sensitive material that are incompatible with conventional waste disposal.

The "Eco-Theological Paradox" is at the heart of this crisis. This is a term for the "creedal" blindness towards nature that exists in India today between the sacredness of nature in the scriptures and its physical neglect. In many instances, environmental stewardship in practice is quite lacking at established pilgrimage sites, despite the importance of the elements in Hindu, Sikh, Buddhist and Jain traditions. Although the elements are considered sacred in Hindu, Sikh,

Buddhist and Jain tradition, they are personified as goddesses (Ganga Ma), trees (Vriksharopan), and mountains, and are the focus of pilgrimage, there is a surprising lack of environmental stewardship at established pilgrimage sites National Mission for Clean Ganga, 2021^[8]. This paradox is not simply a lack of infrastructure but a socio-cultural dichotomy in which the "ritual purity" (Saucham) is considered more important inside the temple space, and the outside space is considered a secular and disposable space.

The "floating population" is the unique characteristic of the Indian context, which differs from the global heritage sites. While permanent urban centers have relatively slow population fluctuations, pilgrimage towns such as Haridwar, Puri or Sabarimala witness high temporal variations. Here, a small town's resident population can increase by 500% to 1000% in a day on the auspicious festival days (Pandey & Singh, 2022)^[9]. This demographic flexibility puts undue strain on fixed municipal systems, resulting in the failure to collect waste and ultimately the dumping of waste into sacred water bodies or into sensitive forest ecosystems (Central Pollution Control Board, 2022)^[2].

The current governance initiatives, such as the Swachh Bharat Mission (Urban) 2.0 and the PRASHAD (Pilgrimage Rejuvenation and Spiritual, Heritage Augmentation Drive) scheme, have made efforts to address these concerns through funding and promoting a uniform waste management system. Yet even in the face of these abstract policy actions, the disconnect between "sanctity" and "sanitation" is still enormous. These top-down models frequently fail to have "site-specific elasticity," and do not reflect the ritualistic nature of the waste stream (Nirmalya), to which adherents are culturally inclined to bring rather than to a dustbin.

The purpose of this review is to offer a multi-disciplinary perspective on these socio-cultural, institutional and operational barriers Sharma & Joshi, 2020^[11] This paper aims to integrate 15 years of research on environmental science and on heritage management to shift from descriptive description of pollution to a resilient policy framework. It proposes a shift from 'secular waste management' to 'sacred circularity' as a way to reconcile the modern ecological imperative with the ancient theological values so that the religious heritage of India can survive amidst ecological collapse.

2. methodology

A systematic literature search was carried out in the databases Scopus, Web of Science and Google Scholar from 2005 to 2025 to ensure a comprehensive synthesis. Primary search phrases were "Religious Tourism", "Sustainable Waste Management", and "Eco-Theology". Sources have been screened according to their relevance in the Indian regulatory framework.

3. The psychology of the "sacred" vs. "profane" in waste disposal

Much recent literature has been devoted to Indian pilgrimage and the cognitive dissonance that lies within it. Shinde (2021)^[12] suggests that the moment the word 'sacred' is made with the usage of the term 'sacred' it is seen as an 'externality' in the sense that the devotee feels no moral responsibility towards the surrounding environment. It is substantiated through the studies conducted on Vraj mandala Parikrama that the main focus of pilgrims is on spiritual "inner purity" rather than "outer environmental sanitation" (Singh & Rana, 2023)^[13].

In addition, the subject of "Ritual Purity" (Saucham) has been reconsidered in relation to the modern notion of

environmentalism. The traditional focus on cleanliness is complemented by scholarship that argues that modern ritual products made of plastic have surpassed the tradition of the "self-cleansing" power of sacred sites. However, as the movement from biodegradable to non-biodegradable materials (clay, leaves, incense wrapped in plastic, laminate photos) has occurred, the existing socio-cultural structure has failed to address this "material disconnect" as stated by Bhatt (2024)^[1].

4. The Logistics of the "Floating Population" and Temporal Surges

Indian pilgrimage has its own unparalleled logistical difficulties which are found in the literature of the world. The data obtained from the last Kumbh Mela of Prayagraj in 2019 is the basis to measure "mega-event" waste management. During these peaks, food waste and single-use plastics are the most dominant types of wastes, with waste generation rates reaching almost 0.6 kg per capita per day in the temporary settlements, according to Zafari *et al.* 2025^[20] and Central Pollution Control Board, 2025^[3].

In contrast, research for high-altitude temples such as Kedarnath and Amarnath shows another problem - the 'geographical barrier' (Singh, 2023)^[13]. However, the absence of decentralised processing units in sensitive terrain in the Himalaya results in "invisible burial" of wastes in the valley which poses threats to water quality downstream, as documented by Rautela and Kauthola (2021)^[10]. This literature shows that there is a huge lacuna, as the PRASHAD scheme is funded only for infrastructure, but is not flexible enough for the population surge of 500% during the peak season of Yatra.

5. A Shift Towards the Circular Economy From 'Nirmalya' to 'Value-Added Products'.

One of the more promising moves that the literature has made over the past few years is Sacred Circularity. Researchers have begun to explore the "Waste-to-Wealth" possibilities of ritual offerings. The 'flowercycling' business model developed by Phool.co is a main topic in sustainable entrepreneurship journals (Verma & Mishra, 2024^[17]). The study by Dwivedi and Sharma (2022)^[11] indicates that locally in the temple areas diverting floral waste (Nirmalya) to essential oil extraction units can decrease the level of BOD (Biological Oxygen Demand) in the Ganges by as much as 15%. But, there's a debate about the "Sacredness of the Byproduct. Some traditionalist scholars say that if it is presented to a God it can't be "re-sold" as a commercial product, even if it's brought back into use. This means that there is a compelling socio-legal dynamic (Gorakhpur Municipal Corporation, 2023)^[4]. The counter-narrative comes from literature on Tirumala Tirupati Devasthanams (TTD) that suggests an uplift in pilgrim engagement into waste segregation when the religious institution "sanctifies" this process (e.g., by using flowers of the temple to make 'divine' incense) (Vyas *et al.*, 2020)^[18].

6. Comparative Analysis: global vs. Indian sacred spaces

Comparing the Indian context to global sites reveals distinct "Governance Models."

- **The Saudi Arabian Model (Hajj):** Literature focuses on top-down, high-tech interventions, such as underground vacuum waste collection systems in Mecca.
- **The Japanese Model (Ise Jingu):** Scholarship emphasizes "Shinto Environmentalism," where the periodic rebuilding of shrines using sustainable timber fosters a culture of deep ecological respect.

- **The Indian Model:** Currently characterized as "Reactive and Fragmented." Literature suggests that unlike the Hajj's centralized control, Indian sites are managed by a complex web of Temple Boards, Municipalities, and NGOs, often leading to "policy paralysis" during peak events.

The Theory of Planned Behavior

TPB is a very important tool to use for understanding the cognitive predictors of waste disposal in high-density religious settings. In this context, a pilgrim's decision to undertake SWM is influenced by three main variables: personal attitude towards cleanliness as spiritual merit (Punya), subjective norms that are related to collective norms of the faith community, and perceived behavioural control (Kumar & Gupta, 2021) [15]. This review suggests that religious zeal can lead to constructive attitudes toward the 'sacred', but that such zeal is often undermined by the lack of perceived control over the behavioural consequences (Srivastava & Tripathi, 2021) [14]. If the infrastructure is unable to grow along with the surge in the number of pilgrims, then the spiritual purpose is lost and the locate of disposal facilities becomes more important than the spiritual intention of the pilgrimage, even if that intention is to honor the site (TERI, 2019) [15].

Durkheimian Dissonance: The Sacred and The Profane Spatiality

The psychological analysis is complemented by Durkheim's Theory of Sacred and Profane, which provides an explanation of the boundaries of space in environmental responsibility. In the devotee's consciousness, the Garbhagriha (inner sanctum) is the absolute "Sacred"—a territory where the actions are ritualized, and purity is all important. But there's a deep spatial incongruity at the threshold of the temple, its surrounding streets and ecosystems might be considered "Profane" and "Secular". Environmental mismanagement is morally understood as acceptable in this profane space, while the sanctum's boundary is the limit of the devout's moral responsibility (United Nations, 2022). Theoretical framework for the "Eco-Theological Paradox", in which the divine is divinized, but the physical space on which the pilgrimage is conducted is regarded as a subordinate, expendable tool, with the result that the surrounding area is littered with ritual packaging materials close to the holy shrines.

The Circular Economy (Ce) and "Sacred Cycles" of Materiality

This paper uses the Circular Economy (CE) Model to help tie the sociological behavior to the environmental need, which has been adapted for "Sacred Cycles. This concept is designed to shift away from a linear "take-make-dispose" model of industry

towards the valorization of organic ritual waste, Nirmalya. Ritual waste is redefined as a "biological nutrient" rather than pollutant by the way the CE principles are framed in a theological context. This model is able to convert waste flowers into carbonates which can be sold for incense or bio-compost and coconut stalks into activated carbon (Ministry of Housing and Urban Affairs, 2023) [23]. This "Waste-to-Wealth" approach has two sustainable outcomes: it relieves the burden of waste logistical processes on city infrastructure and produces a local "Sacred Economy". This can be described as a continuum of the ritual cycle, which helps to strengthen the socio-economic resistance and the ecological quality of the heritage site.

The "nirmalya" Challenge: Devotional offering to ecological debris

The process of handling Nirmalya (the leftover matter of the pujas which include flowers, vermillion, fruits and textiles) is perhaps the toughest socio-cultural hurdle in the path of sustainable waste management in India. However, certain practices, like throwing them in the Ganges River in Varanasi, are not considered as littering but as an integral part of the religious ritual, meant to fulfill the cycle of worship. This "sacred disposal" has created an ecological problem as thousands of tons of organic matter are decomposed anaerobically in riverine ecosystems, which has led to a depletion of the dissolved oxygen (DO).

But the latest data evidence suggests there is a strong counter-narrative to institutional intervention. The Golden Temple (Amritsar) and Tirumala Tirupati Devasthanams have been studied to find the maximum diversion of floral waste stream from landfills in the shrines by concentrating the collection at the point of use. The waste is thus "re-sacralized," changing its status from pollutant to sustainable economic value, when these materials are converted into high-value secondary products, like bio-compost and essential oils.

The Temporal Surges, and the Crisis Of Infrastructure Elasticity

Indian pilgrimage locations are characterized by extreme non-linearity in waste production, unlike regular urban centers, where waste production goes linear along a relatively predictable path. These "peaks" are determined by lunar phases or festivals like Makar Sankranti or "Amarnath Yatra" causing "infrastructure shock". This comparison shows how the quantity of waste fluctuates between the various pilgrimage models.

The data shows that the municipal systems which are built for a town's base population simply cannot handle such "surges. The absence of this "infrastructure elasticity" creates a system-wide failure in waste collection, causing waste to pile up in ecologically valuable buffer zones and in the edge of forest areas

Destination	Event Type	Waste Surge (%)	Primary Waste Component
Sabarimala	Seasonal (Nov–Jan)	400%	Polyethylene bottles, discarded apparel
Varanasi	Daily / Festive Peaks	150%	Floral Nirmalya, single-use ritual plastics
Puri (Rath Yatra)	Annual (Short-term)	600%	Food waste, biodegradable leaf plates (Pattals)

The Psychological Barrier: The "Guest" Mentality and Responsibility Diffusion

One of the most significant psychological challenges to the management of sacred sites is the general attitude of the pilgrims (Yatris) which is known as the "Guest Mentality". Often the pilgrimage is seen as a 'transient trip' a short-term move away from the secular world so the devotee doesn't acquire a feeling of long-term stewardship of the local area. This leads to a

"diffusion of responsibility" as the responsibility for maintaining the environment is defined strictly as a state or municipal responsibility, and not a personal religious responsibility.

In this cognitive structure, the "Sacred Duty" is rigidly segmented and starts and ends with the act of worship (Darshan or Pooja) but is not applied to the stewardship of the physical environment. The mass scale of religious tourism adds to this behavioural gap, as the individual's sense of responsibility is

further diminished by the anonymity of fellow travellers who are part of a much larger group. This barrier will need to be overcome through a paradigm shift that places environmental protection at the heart of the pilgrimage, shifting the pilgrim from "temporary guest" to "sacred stakeholder".

7. Research Gaps and Future Directions

Behavioral Quantifications: Most studies are qualitative; not much quantitative data exist on the relationship between "religious intensity" and "waste disposal patterns".

2. Product Life Cycles: There is virtually no research on the life cycle assessment (LCA) of the "Religious Souvenir Industry," that significantly adds to the long-term plastic pollution at heritage sites.

4. Policy Integration: There is no mention of "Site-Specific SOPs" (Standard Operating Procedures) for ancient heritage towns with narrow lanes not suitable for motorized transportation.

Although there is much written on urban waste there is a lack of "Faith Based Behavioral Intervention" data. The majority of studies are descriptive instead of prescriptive. There is a lack of: Data collected over the course of time regarding the effectiveness of religious leaders' endorsements on waste segregation.

Specific LCA of Ritualistic products (e.g., carbon footprint of a Kumbh visit).

Indigenous knowledge integrated in modern SWM approaches.

8. Challenges and Emerging Issues

Accountability voids are created due to Institutional Fragmentation where multiple stakeholders (Temple Boards, Municipal Corporations, Forest Departments) have overlapping jurisdictions.

Operational Hardships: Many sites (e.g., Kedarnath) are in ecologically sensitive areas at high altitudes where transport of waste is very difficult physically.

Rural "pilgrimage towns" in India are often plagued with technological mismatch where waste management systems, used in Western "Smart Cities", have been unable to function because of the low width of the streets, high humidity (presence of organic waste) and the large volume of 'unsegregated' waste offered.

Ucl's Role in Advancing Innovation and Global Best Practices

The Tirupati Model: Massive biogas plant for transforming food waste collected from Annadanam (free meals) into cooking gas for the temple kitchens (Yadav & Rai, 2020)^[19].

Pioneering Indian startup Flower Upcycling (Phool.co) is collecting floral waste from the temples to make charcoal-free incense and "Florafoam" (degradable foams, an alternative to Styrofoam).

Green Pilgrimage Network (GPN): An international movement which has now started gaining momentum in India, bringing together the concept of environment protection and the "Sacred Journey" story.

9. Future Research Directions

- 1. AI and Predictive Analytics:** Creating a model for estimating the number of wastes with the help of lunar calendars and astrological calculations which influence pilgrim flow.
- 2. Socio-Psychological Studies:** Research on the motivational aspect of Dharma for environmental conservation.
- 3. Decentralized Processing:** Small-scale, site-specific

anaerobic digesters for remote shrines in the Himalayas.

10. Conclusion

The conclusion and policy implications are presented. Conclusion and policy implications are presented.

Technology alone is not going to solve the problem of waste management in Indian pilgrimage places, it needs a firm understanding of the socio-cultural values.

11. Policy Recommendations

In line with the Sabarimala "Punyam Poonkavanam" model where pilgrims have to spend 10 minutes to clean the environment, the same model is to be replicated across the country as a mandatory "Green Protocol".

Extended Producer Responsibility (EPR): imposing a "Green Cess" on the products sold in temple areas for the purpose of providing SWM facilities in the area.

Religious Endorsement: Enlisting the help of Gurus and Mahants to see "Cleanliness as Godliness" literally, ecologically. In the end, what is needed is a change in the Indian consciousness, from "Secular Waste" to "Sacred Duty," one in which preservation of the Tirtha is considered to be as meritorious as the pilgrimage itself.

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Competing Interests

There is no conflict of Interest.

Consent

Not Applicable

Ethical approval

Not Applicable

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