



Necropolitics, Slow Violence and Environmental Injustice: A Review of Textile Waste Impacts on Bangladesh's Waterways

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Abstract: *The Ready-Made Garment (RMG) industry is a major contributor to Bangladesh's economic growth, employment generation, and export earnings. However, the rapid expansion of textile manufacturing has intensified environmental challenges, particularly the discharge of untreated or inadequately treated wastewater into rivers and other water bodies. This review synthesizes interdisciplinary literature to examine the environmental and social consequences of textile wastewater pollution in Bangladesh through the integrated perspectives of necropolitics, slow violence, and environmental justice. A narrative review of published literature, policy reports, and institutional documents was conducted to analyse the ecological, governance, and socio-political dimensions of textile wastewater pollution. The findings indicate that continuous industrial effluent discharge has severely degraded major rivers, particularly the Buriganga River, resulting in declining water quality, biodiversity loss, public health risks, and adverse impacts on the livelihoods of river-dependent communities. The review further demonstrates that marginalized populations disproportionately bear the environmental and health burdens associated with industrial development because of weak environmental governance and inadequate regulatory enforcement. Comparative evidence from India, Indonesia, and China reveals similar challenges in balancing industrial growth with environmental sustainability. This review contributes by integrating environmental science with critical social theory to provide a comprehensive understanding of textile wastewater pollution and its governance implications. The study recommends strengthening environmental regulation, improving wastewater treatment infrastructure, enhancing corporate accountability, and adopting community-centred environmental governance to promote sustainable and equitable development.*

Keywords: *Textile Wastewater Pollution, Bangladesh, Buriganga River, Environmental Justice, Necropolitics, Slow Violence, Ready-Made Garment (RMG), Environmental Governance.*

INTRODUCTION

The global textile and apparel industry is one of the largest manufacturing sectors, contributing significantly to economic development, employment generation, and international trade [1]. The rapid expansion of textile production, driven by increasing consumer demand and the growth of fast fashion, has simultaneously intensified environmental challenges worldwide [2]. Textile manufacturing processes, including dyeing, bleaching, printing, washing, and finishing, consume large quantities of water and chemicals, generating wastewater containing dyes,

heavy metals, salts, surfactants, and other hazardous pollutants [3]. When discharged without adequate treatment, these effluents degrade water quality, threaten aquatic ecosystems, and pose serious risks to human health and environmental sustainability [4].

Bangladesh has emerged as the world's second-largest exporter of ready-made garments (RMG), making the textile and apparel sector a cornerstone of its national economy [5]. The industry contributes substantially to export earnings, industrial development, and employment, particularly for women [6]. However, this rapid industrial growth has also resulted in significant environmental pressures [7]. Weak regulatory enforcement, inadequate wastewater management, and the inefficient operation of Effluent Treatment Plants (ETPs) have allowed untreated or partially treated industrial effluents to be discharged into rivers and wetlands, causing severe deterioration of water quality and ecosystem integrity [8]. Among the country's major river systems, the Buriganga River represents one of the most severely polluted water bodies due to continuous discharge of textile wastewater, municipal sewage, and other industrial effluents [9]. Studies have reported elevated concentrations of heavy metals, declining dissolved oxygen levels, sediment contamination, biodiversity loss, and widespread ecological degradation [10]. Similar environmental conditions have also been documented in the Turag, Balu, and Shitalakshya Rivers, indicating that river pollution is a widespread environmental governance challenge across Bangladesh's textile-producing regions [11][12].

The consequences of textile wastewater pollution extend beyond ecological degradation and encompass significant social, economic, and public health impacts [13]. River-dependent communities, including fishers, informal workers, women, and low-income households, disproportionately experience the environmental burdens associated with industrial development. Limited access to clean water, healthcare services, and participation in environmental decision-making further increases their vulnerability. Consequently, textile wastewater pollution should be understood not only as an environmental management issue but also as a complex problem involving environmental governance, social inequality, and environmental justice [14].

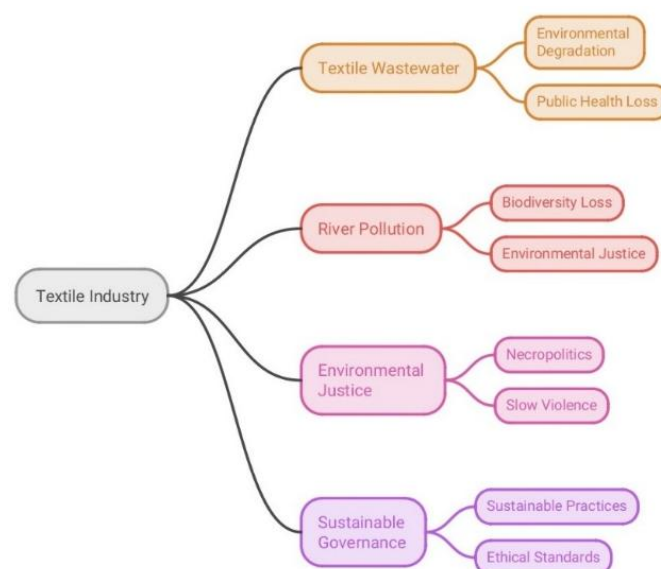


Figure 1: Conceptual framework of textile wastewater pollution and its environmental, social and governance dimensions.

Therefore, this review aims to synthesize interdisciplinary literature on textile wastewater pollution in Bangladesh through the integrated perspectives of necropolitics, slow violence,

and environmental justice. The Buriganga River is examined as the principal case study, while comparative evidence from India, Indonesia, and China is incorporated to identify similarities and differences in environmental governance and industrial pollution management. By integrating environmental science with critical social theory, this review contributes to a broader understanding of the ecological, political, and social dimensions of textile wastewater pollution and provides policy recommendations for strengthening environmental governance, promoting sustainable textile production, and advancing environmental justice within global textile supply chains [15]. Figure 1 presents the conceptual framework of this review. It illustrates how textile wastewater contributes to environmental degradation, river pollution, and public health impacts. The figure further highlights the interconnected roles of environmental justice, necropolitics, slow violence, and sustainable governance in understanding the broader environmental and social consequences of textile wastewater pollution. This framework forms the basis for the thematic analysis presented in this review.

LITERATURE REVIEW

The environmental consequences of textile wastewater pollution have received increasing scholarly attention over the past two decades, particularly in major textile-producing countries such as Bangladesh, India, Indonesia, and China. Existing studies have examined textile wastewater pollution from environmental, technological, governance, sustainability, and social justice perspectives. Although substantial progress has been made in understanding the ecological impacts of textile effluents, the literature remains fragmented across disciplinary boundaries. Most studies focus on pollution monitoring, wastewater treatment technologies, or environmental regulations, while comparatively fewer studies integrate environmental governance with critical social theories to explain the unequal impacts of industrial pollution. This review synthesizes previous research under four thematic areas to establish the current state of knowledge and identify important research gaps.

Textile Wastewater Pollution and River Ecosystem Degradation

The textile industry is recognized as one of the major contributors to industrial water pollution because large volumes of wastewater are generated during dyeing, bleaching, printing, washing, and finishing operations. Textile effluents contain dyes, heavy metals, suspended solids, salts, surfactants, and other hazardous chemicals that significantly degrade water quality and aquatic ecosystems [16][17].

Studies conducted in Bangladesh consistently report severe environmental degradation associated with textile wastewater discharge. River systems such as the Buriganga, Turag, Balu, and Shitalakshya have experienced declining water quality, sediment contamination, reduced dissolved oxygen, biodiversity loss, and increasing ecological stress due to continuous discharge of untreated or partially treated industrial effluents [18-20]. Similar environmental problems have also been reported in India, Indonesia, and China, where rapid industrialization and expanding textile production have intensified river pollution and ecosystem degradation [21-23]. These findings demonstrate that textile wastewater pollution is not only a national environmental concern but also a global sustainability challenge requiring integrated technological and regulatory interventions [24].

Environmental Governance and Industrial Regulation

Environmental governance has become an important research theme because effective regulation is essential for reducing industrial pollution and protecting freshwater ecosystems.

Previous studies emphasize the importance of wastewater treatment technologies, particularly Effluent Treatment Plants (ETPs), cleaner production practices, environmental monitoring, and strict enforcement of environmental regulations to minimize industrial wastewater discharge [24][25]. Although Bangladesh has established environmental regulations requiring textile industries to install and operate ETPs, several studies indicate that regulatory implementation remains inconsistent. Weak institutional capacity, inadequate monitoring, financial constraints, and poor compliance have reduced the effectiveness of existing environmental policies, allowing untreated or partially treated wastewater to continue entering river systems [25][26]. Consequently, strengthening environmental governance remains essential for achieving sustainable textile production and protecting freshwater ecosystems.

Environmental Justice, Necropolitics and Slow Violence

Recent interdisciplinary scholarship increasingly applies critical theoretical perspectives to explain environmental inequalities associated with industrial pollution. Environmental justice emphasizes that environmental risks and benefits are distributed unequally across society, with marginalized communities often experiencing disproportionate environmental burdens while having limited participation in environmental decision-making [27]. Necropolitics explains how political and institutional power influences unequal exposure to environmental hazards and determines which communities receive environmental protection and which remain vulnerable to pollution [27]. Likewise, the concept of slow violence explains environmental degradation as a gradual and cumulative process whose harmful effects become visible only over extended periods [28]. Continuous discharge of textile wastewater gradually contaminates rivers, sediments, groundwater, and agricultural land while progressively affecting ecosystem health and local communities. Although environmental justice, necropolitics, and slow violence have each been examined independently, relatively few review studies have integrated these complementary perspectives to explain textile wastewater pollution in Bangladesh. Their combined application provides a broader understanding of how environmental degradation, governance failures, and social inequalities interact within industrial production systems.

Sustainable Textile Production and Global Supply Chains

Growing international concern regarding environmental sustainability has encouraged researchers to examine the relationship between global textile supply chains and industrial pollution. The expansion of fast-fashion production has substantially increased resource consumption, wastewater generation, and environmental pressures in developing countries serving as major manufacturing hubs [29]. International organizations advocate cleaner production technologies, circular economy principles, sustainable resource management, wastewater recycling, responsible supply-chain governance, and corporate environmental accountability as essential strategies for reducing the environmental impacts of textile manufacturing [30]. Despite these developments, implementation remains uneven because of technological limitations, economic constraints, and inconsistent environmental governance. Consequently, balancing industrial competitiveness with environmental sustainability continues to be one of the major challenges facing textile-producing countries.

Research Gap

The reviewed literature demonstrates that considerable progress has been made in understanding textile wastewater pollution from environmental, technological, engineering, and regulatory perspectives. However, three important research gaps remain. First, limited review studies integrate the concepts of environmental justice, necropolitics, and slow violence

into a single analytical framework for examining textile wastewater pollution. Second, comparative evidence from major textile-producing countries has not been sufficiently synthesized to identify common environmental governance challenges and sustainable policy implications. Third, greater interdisciplinary research is required to combine environmental science with critical social theory to explain how industrial development contributes to environmental inequality and long-term ecological degradation. This review addresses these gaps by synthesizing multidisciplinary literature and providing an integrated understanding of textile wastewater pollution in Bangladesh and its implications for sustainable textile production.

RESEARCH METHODOLOGY

This study adopts a narrative review approach to synthesize interdisciplinary literature on textile wastewater pollution in Bangladesh through the theoretical perspectives of necropolitics, slow violence, and environmental justice. A narrative review was considered appropriate because the objective of the study is to critically examine and integrate existing knowledge from environmental science, sustainability studies, political ecology, and environmental governance rather than to conduct a quantitative meta-analysis.

Literature Search Strategy

A comprehensive literature search was conducted using five major academic databases: Scopus, Web of Science, ScienceDirect, SpringerLink, and Google Scholar. In addition, reports published by international organizations, including the World Bank, United Nations Environment Programme (UNEP), Asian Development Bank (ADB), Organisation for Economic Co-operation and Development (OECD), Bangladesh Garment Manufacturers and Exporters Association (BGMEA), and United Nations Industrial Development Organization (UNIDO), were included to provide policy and institutional perspectives. The literature search covered publications from 2001 to 2025. The search included combinations of the following keywords: textile wastewater, Bangladesh textile industry, ready-made garment (RMG), Buriganga River pollution, industrial effluents, environmental governance, environmental justice, necropolitics, slow violence, textile wastewater treatment, fast fashion, and global textile supply chains.

Inclusion and Exclusion Criteria

The selected studies satisfied the following inclusion criteria:

- Published in English between 2001 and 2025.
- Focused on textile wastewater pollution, river ecosystem degradation, environmental governance, environmental justice, necropolitics, or slow violence.
- Included evidence from Bangladesh or comparative studies involving India, Indonesia, or China.
- Published as peer-reviewed journal articles, books, book chapters, or reports from recognized international organizations.

Studies unrelated to textile wastewater pollution, duplicate publications, conference abstracts without full text, and sources lacking academic credibility were excluded.

Study Selection

The initial database search identified relevant publications through keyword searches. After screening titles, abstracts, and full texts against the inclusion criteria, 30 publications were

selected for detailed review. These publications formed the basis for the thematic synthesis presented in this paper.

Data Analysis

The selected literature was analyzed using thematic synthesis and critical interpretative analysis. The findings were organized into six major themes:

- a. Necropolitics and Environmental Governance
- b. Slow Violence and Environmental Harm
- c. Textile Wastewater Pollution in Bangladesh
- d. Buriganga River as a Sacrifice Zone
- e. Environmental Injustice and Marginalized Communities
- f. Comparative Evidence from India, Indonesia, and China

The thematic synthesis enabled the identification of recurring patterns, governance challenges, theoretical relationships, and policy implications across the reviewed literature.

Limitations

This review is limited by its narrative design and does not include a quantitative meta-analysis or formal quality assessment of individual studies. Furthermore, only English-language publications were considered. Despite these limitations, the inclusion of multidisciplinary literature and reports from international organizations provides a comprehensive understanding of textile wastewater pollution and its environmental, social, and governance dimensions.

RESULTS ANALYSIS

Overview of the Reviewed Literature

The narrative review included 30 publications published between 2001 and 2025, comprising peer-reviewed journal articles, book chapters, and reports from internationally recognized organizations. Most studies focused on Bangladesh, while several comparative investigations examined textile wastewater pollution in India, Indonesia, and China. The reviewed literature primarily addressed textile wastewater pollution, river ecosystem degradation, environmental governance, environmental justice, necropolitics, slow violence, wastewater treatment technologies, and sustainable textile production.

Table 1: Characteristics of the reviewed literature

Characteristics	Findings
Publications reviewed	30
Publication period	2001–2025
Countries	Bangladesh, India, Indonesia, China
Sources	Journals, Books, Reports
Major themes	Pollution, Governance, Environmental Justice, Slow Violence, Sustainability

The thematic synthesis identified six major themes that collectively explain the environmental, social, and governance dimensions of textile wastewater pollution. These themes form the basis of the findings presented in this study.

Major Findings

The thematic analysis revealed six major findings from the reviewed literature.

Table 2: Major findings of the review.

Theme	Key Findings
Textile Wastewater	Major source of river pollution
Environmental Governance	Weak enforcement of environmental regulations
Slow Violence	Long-term environmental degradation
Necropolitics	Unequal exposure to environmental risks
Environmental Justice	Marginalized communities most affected
Comparative Analysis	Similar challenges across Bangladesh, India, Indonesia and China

Textile Wastewater Pollution and River Ecosystem Degradation

The synthesis of the reviewed literature demonstrates that textile wastewater is the principal contributor to river pollution in Bangladesh. Most studies consistently reported that untreated or partially treated industrial effluents containing dyes, heavy metals, salts, surfactants, and hazardous chemicals have significantly degraded the water quality of major rivers, particularly the Buriganga, Turag, Balu, and Shitalakshya. These pollutants reduce dissolved oxygen levels, contaminate sediments, decrease aquatic biodiversity, and threaten ecosystem services.

These findings indicate that river pollution has become a persistent environmental challenge due to rapid industrialization and inadequate wastewater management. Similar patterns reported in India, Indonesia, and China suggest that textile wastewater pollution is a common environmental consequence of global textile production.

DISCUSSION OF FINDINGS

Textile Wastewater Pollution and River Ecosystem Degradation

The findings of this review indicate that textile wastewater is the principal source of river pollution in Bangladesh. The reviewed studies consistently reported that untreated and inadequately treated industrial effluents have significantly degraded the water quality of major rivers, particularly the Buriganga River. These findings are consistent with previous studies, which identified textile manufacturing as a major contributor to heavy metal contamination, biodiversity loss, and declining water quality. The review further demonstrates that inadequate wastewater treatment and poor environmental management continue to accelerate ecological degradation.

Environmental Governance and Regulatory Challenges

The findings further reveal that weak environmental governance remains one of the primary drivers of textile wastewater pollution in Bangladesh. The reviewed literature consistently highlights poor enforcement of environmental regulations, inadequate monitoring, and inefficient operation of Effluent Treatment Plants (ETPs). These findings support previous studies, which emphasize that strengthening institutional capacity, improving regulatory compliance, and promoting cleaner production technologies are essential for reducing industrial pollution and achieving sustainable environmental management.

Environmental Justice, Necropolitics, and Slow Violence

The review demonstrates that the impacts of textile wastewater pollution are disproportionately experienced by marginalized communities living near polluted rivers. These findings support the concept of environmental justice by illustrating the unequal distribution of environmental risks and health burdens. Furthermore, the findings are consistent with Mbembe's theory of necropolitics and Nixon's concept of slow violence, which explain how environmental degradation develops gradually and disproportionately affects socially vulnerable populations.

Comparative Evidence from Major Textile-Producing Countries

The comparative findings indicate that Bangladesh shares several environmental challenges with other major textile-producing countries, including India, Indonesia, and China. However, the reviewed studies suggest that stronger environmental regulations, improved wastewater treatment technologies, and effective policy implementation have contributed to better pollution control in some countries. These findings highlight the importance of strengthening environmental governance and sustainable industrial practices within Bangladesh's textile sector.

CONCLUSION

This review highlights that textile wastewater pollution in Bangladesh is not only an environmental issue but also a governance and social justice challenge. Continuous discharge of untreated textile effluents has degraded river ecosystems, threatened biodiversity and public health, and disproportionately affected marginalized communities. The integration of necropolitics, slow violence, and environmental justice provides a broader understanding of the socio-environmental impacts of industrial pollution. Comparative evidence from India, Indonesia, and China underscores the importance of stronger environmental regulations, effective wastewater treatment, and sustainable industrial practices. Future research should focus on empirical studies and long-term environmental monitoring to support environmentally sustainable and socially equitable development in Bangladesh.

Recommendations Based on the Review Findings

Based on the findings of this study, the following recommendations are proposed:

- Strengthen the enforcement of environmental regulations to control industrial wastewater discharge.
- Modernize and ensure the efficient operation of Effluent Treatment Plants (ETPs).
- Promote cleaner production technologies and sustainable textile manufacturing practices.
- Enhance corporate environmental responsibility and transparent environmental monitoring.
- Encourage active participation of local communities in environmental decision-making.
- Support long-term environmental monitoring and further research on sustainable textile production.

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