What matters for environmental concerns among university students in Bangladesh? An empirical study

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Introduction: Experts have a well-established consensus regarding the detrimental effects of human activities on the environment, including extreme temperature events, rainfall variability, pollution, deforestation, biodiversity loss, and flood occurrences—all of which significantly stress Earth's natural systems. This study investigates the level of environmental concern among university students in Bangladesh, considering their socio-demographic factors.

Methods: A comprehensive survey was conducted using a self-administered questionnaire targeting 380 final-year bachelor and master's students from various academic disciplines at Shahjalal University of Science and Technology (SUST) Sylhet, Bangladesh. The analysis involved variables such as gender, completion of university courses related to the environment or climate change, disciplinary background, and vulnerability to climate change or extreme weather events in their home locality. Relationships between these variables and the students' environmental concerns were examined using cross-tabulation with the Chi-square test and mean difference with the ANOVA test.

Results: The findings indicate a high level of knowledge and significant concern among students regarding environmental issues, with disciplinary background being the primary determinant of environmental concern level. Additionally, completing university courses on environmental or climate change topics and experiencing vulnerability to such events in one's hometown are significant predictors of environmental concerns.

Discussion: This study highlights the growing environmental concerns among university students and underscores the need for further scientific research to comprehensively understand their impact on population dynamics.

KEYWORDS

environmental concern, socio-demographic factors, disciplinary backgrounds, university students, Bangladesh

1 Introduction

Having a comprehensive understanding of environmental concerns is essential in the contemporary world. According to Cruz and Manata (2020), modern scholars argue that the significance of social and behavioral related to environmental matters has been heightened by the phenomenon of climate change. This has led to significant advancements in the field of environmental studies, paralleling the increase in environmental issues such as pollution, heavy precipitation, biodiversity loss, and extreme temperatures. In developing countries in Asia, rapid urbanization, industrialization, and increased vehicular traffic exacerbate

environmental risks. Bangladesh, one of Asia's most densely populated developing countries, faces significant environmental challenges due to its geography and high population density. According to the World Population Prospects of 2024, Bangladesh's population was approximately 172.5 million in 2024, with a projection of 218.2 million in 2054 (United Nations, 2024). The country, crisscrossed by numerous rivers, grapples with environmental threats like changing weather patterns, rising temperatures, extreme weather events—including floods, storms, heavy rainfall—and rising sea levels.

Bangladesh's low-lying river delta and extensive floodplains, which cover 80 percent of the nation, render it highly vulnerable to the potentially catastrophic effects of climate change (Amin, 2021). The Global Climate Risk Index (Germanwatch, 2021) ranks Bangladesh as the seventh most susceptible country to the impacts of climate change, having suffered economic losses totaling $3.72 billion and experienced 185 instances of extreme weather between 2000 and 2019. An evaluation by the U.S. government in 2018 found that 90 million people in Bangladesh, or 56% of the population, live in "high climatic exposure areas," with 53 million facing "extremely high" exposure (UNICEF, 2021).

Environmental concerns encompass a range of attitudes and values, from specific environmentally appropriate actions to broader value orientations (Arnocky et al., 2012). Major current environmental challenges include climate change, pollution, environmental degradation, landslide, and resource depletion, all of which are driven by human activities, as suggested by researchers like Haq and Ahmed (2020), Fairbrother (2013), Pampel (2014), Ahmed Z. et al. (2022), and Rasool and Ogunbode (2015). These activities influence environmental concerns to varying degrees, depending on the socioeconomic status of individuals. Addressing environmental concerns is integral to all educational levels, and universities play a pivotal role in uncovering and challenging these problems. University students often encounter interconnected ecological issues, climatic disruptions, organic pollutants, population and species losses, emerging diseases, and antibiotic resistance. This study focuses on university students in Bangladesh, recognizing that young people with heightened environmental awareness tend to demonstrate stronger pro-environmental intentions and behavior (Fielding and Head, 2012). Consequently, exploring students' perspectives on environmental issues is essential. This study investigates environmental concerns among university students at Shahjalal University of Science and Technology (SUST) in Bangladesh. It incorporates socio-demographic dimensions to provide a detailed understanding of their viewpoints and concerns.

2 Literature review

The Intergovernmental Panel on Climate Change (IPCC) (2013) released significant data highlighting the phenomenon of global warming and the substantial influence of human activities on environmental alteration. As global populations and economies expand, there is mounting pressure on the planet's natural resources, leading to a multitude of environmental concerns. These concerns include climate change, energy scarcity, water pollution, deforestation, biodiversity loss, land utilization, chemical contamination, toxic substances, heavy metals, air pollution, waste disposal, ozone layer depletion, and the declining state of oceans and fisheries (Thieme

et al., 2015). Environmental concerns exhibit substantial heterogeneity both within and between nations (Saha et al., 2023). Scholarly literature indicates notable disparities in the consequences of environmental degradation among countries. Researchers have endeavored over several decades to uncover the root causes of environmental problems and understand the contexts in which these serve as indicators of environmental behavior. Among the significant predictors of environmental concern, socio-demographic dimensions have been extensively analyzed (Kollmuss and Agyeman, 2002). Factors such as gender, education, environmental knowledge, environmental or climate-change-related courses taken, involvement in environmental activities, and disciplinary background have been found to influence environmental issues significantly (Cordano et al., 2010; Levine and Strube, 2012; Ahmed M. N. Q. et al., 2022; Ahmed et al., 2021; Ogunbode and Arnold, 2012).

Gender disparities in environmental concerns have been a major focus of scholarly investigation. Studies indicate that females generally display higher levels of environmental concern than males, potentially due to greater emotional sensitivity and responsiveness to environmental degradation (Davis et al., 2019). Zelezny et al. (2000) found that females across 12 North American and European countries exhibited more eco-centric environmental attitudes than males. In contrast, some evidence suggests that women in developing nations may have lower awareness of climate change, although this changes when they access environmental information and extension services (Acevedo et al., 2020). Levine and Strube (2012) found that knowledgeable men were more likely to engage in environmentally friendly behaviors compared to their female counterparts, though higher education levels tended to correlate with positive environmental attitudes across genders.

Educational attainment is another robust predictor of environmental concerns, often surpassing other demographic variables (Davis et al., 2019). Engagement with environmental literature has fostered ecologically responsible behavior (Mobley et al., 2010). Simpson et al. (2021) identified education as the most significant factor influencing environmental literacy, with gender also playing a critical role. Studies in different contexts, including those by Ogunbode and Arnold (2012) and Xiao and Hong (2010) in China, support the premise that higher levels of education and environmental knowledge correlate with greater engagement in environmental behaviors.

In Bangladesh, relatively few comprehensive studies have explored environmental issues or concerns, specifically among different socio-demographic groups. However, existing research has highlighted critical insights. Anzum et al. (2023) examined farmers' viewpoints on climate change and the socio-economic factors influencing their adaptation decisions. Haq and Ahmed (2017) analyzed how flood-affected communities in Sylhet City perceived climate change, revealing significant socio-demographic variations. Similar studies by Huda (2013), Rahman et al. (2011), and Anik and Khan (2012) have focused on climate-related perceptions and adaptation strategies. Yet, a thorough investigation of environmental concerns across various demographics in Bangladesh remains lacking. Recent studies have explored the intersection of socio-demographic factors and environmental concerns among university students. Cordano et al. (2010) compared U.S. and Chilean business students, finding that Chilean students exhibited higher levels of environmental altruism and peer pressure to engage in pro-environmental behaviors. This

reinforces the notion that disciplinary background and educational context influence environmental attitudes. Al-Maliki et al. (2022) observed that media sources significantly influenced Iraqi students' environmental awareness more than university education, suggesting the pivotal role of information dissemination channels.

Given Bangladesh's vulnerability to climate change and environmental challenges, understanding the environmental concerns of its youth is crucial. Young people in the Global South are particularly vulnerable to environmental changes, shaping their perspectives and priorities as they mature. Youth represent a significant portion of the population and are pivotal for achieving sustainable development and the Sustainable Development Goals (SDGs). Their engagement with environmental issues can drive sustainability efforts and shape future responses to environmental challenges. Furthermore, youth often possess unique local and indigenous knowledge essential for developing tailored environmental solutions. This study focuses on university students at Shahjalal University of Science and Technology (SUST) in Bangladesh, investigating whether socio-demographic factors influence their environmental concerns. Understanding these concerns is vital for fostering a more inclusive, equitable, and effective approach to addressing climate change and promoting sustainability. The insights derived from this study can inform policies and initiatives to engage youth in environmental issues, potentially fostering green jobs, sustainable industries, and innovative solutions to economic disparities. The present study hypothesizes that environmental concern varies according to the disciplinary background of university students.

3 Materials and methods

3.1 Research design and study area

An explanatory research design was chosen for this study to explain why environmental concerns differ among university students and to predict future trends in such concerns. This design is suitable because it emphasizes understanding the nature and direction of relationships between variables (Sue and Ritter, 2012), which is integral to our study examining the socio-demographic factors influencing environmental concerns. Using a quantitative methodology allows for statistical validation of these relationships, a hallmark of explanatory research. The study was conducted at Shahjalal University of Science and Technology (SUST) in Sylhet, a publicly funded research university in Bangladesh, comprising seven schools, 28 departments, two institutes, and multiple centers. SUST was selected due to recent environmental challenges, such as the severe flooding in 2022 caused by heavy rainfall (The Daily Star, 2022), which has heightened students' environmental awareness. The research involves probability sampling to generalize findings to the broader student population at SUST. Data collection was targeted across the six academic buildings housing the 28 departments, ensuring a comprehensive representation of the diverse academic disciplines within the university. This approach guarantees that each department, distributed over the seven schools at SUST, is included in the study, allowing for a thorough examination of the various socio-demographic factors affecting environmental concerns among students.

3.2 Population and sampling

SUST comprises 28 departments. This study focused on students from academic sessions of 2017–2018 (4th year of Bachelor's program) and 2020–21 (Master's program). At that time, SUST had six schools: Agricultural and Mineral Sciences, Applied Sciences and Technology, Life Sciences, Management and Business Administration, Physical Sciences, and Social Sciences. Senior students were chosen for their advanced understanding and differing individual perspectives on environmental issues, making them better sources of information compared to junior students. Notably, the master's program had not started in four departments: Software Engineering, Petroleum and Mining Engineering, Electrical and Electronic Engineering, and Mechanical Engineering. 2,386 students were enrolled in the relevant academic sessions across the 28 departments. Using Cochran's formula (Cochran, 1977), a representative sample size of 332 students was determined, assuming a 95% confidence level and a 5% margin of error. To bolster the accuracy of the results, data was collected from an additional 380 students, resulting in an expanded dataset. Simple random sampling, facilitated by the "Research Randomizer" software, was utilized to ensure every student had an equal chance of participation, ensuring objectivity and fairness in the sample composition (Thomas, 2020). Thus, the final sample size was enhanced to improve the robustness of the study findings.

3.3 Data collection techniques

This study used the social survey method to gather data, a widely recognized technique for systematically collecting information from large groups (Thompson, 2016). The primary instrument for data collection was a self-administered questionnaire. To facilitate the data collection process, three enumerators were selected from the Sociology Department. These enumerators were divided into two teams: one assigned to the faculties of Applied Science and Technology and Physical Sciences and the other to the remaining faculties. The research objectives and key concepts were explained to students in their classrooms before the questionnaires were distributed. Students were provided with instructions on how to complete the questionnaires and encouraged to ask any questions if they needed clarification. Each participant was required to provide informed consent before participating in the study. Enumerators obtained written consent, ensuring participants that all information provided would remain anonymous and confidential. Participation in the survey was voluntary and posed no risk, and all collected data was intended solely for research purposes. Data collection spanned approximately 3 months, from November 19, 2022, to February 26, 2023. The goal was to collect data from at least 10 individuals per department. However, several challenges were encountered. Specifically, the Master's and 4th-year classes in the Agriculture and Mineral Science Faculty, as well as the Forestry and Environmental Science (FES), Physical Science Faculty (Physics), and Applied Science and Technology Faculty (Chemical Engineering and Polymer Science, CEP) departments, had already concluded their sessions. Additionally, academic semester examinations began, rendering students unavailable for data collection. This period was followed by winter vacation, during which many students traveled or visited relatives. Once classes resumed, considerable time was needed to coordinate and collect the necessary

information. Consequently, the data collection goals for these specific departments were not fully met.

3.4 Instrument

The questionnaire was designed to assess environmental concerns among university students in Bangladesh, guided by established hypotheses from existing literature, particularly the 'New Environmental Paradigm' (NEP) scale (Dunlap et al., 2000). The researchers identified key aspects of environmental concerns to be included in the questionnaire and incorporated student feedback from a pilot survey. The questionnaire was structured into three sections: socio-demographic information, knowledge about environmental issues, and concerns about these issues. To ensure clarity and accessibility, the questions were provided in both English and Bengali. This bilingual approach catered to the native Bengali-speaking students, facilitating their understanding of the concepts, while the inclusion of English ensured that the questionnaire was accessible to any international students.

3.5 Pilot survey

Before conducting the full-scale survey, a small-scale pilot survey was implemented to ensure the clarity and comprehensibility of the adapted questions. The pilot survey involved a carefully selected group of fourth-year undergraduate and master's degree students to achieve a comprehensive representation of the university's student body. One class representative from each of the six faculties—Social Science, Physical Science, Agriculture and Mineral Science, Applied Science and Technology, Life Science, and Business Administration—was chosen based on their availability. Twelve students participated in the pilot survey. The researchers provided a detailed explanation of the study's objectives and questions to ensure that the participants fully understood them. After completing the survey, the students offered feedback on the questions and their overall impact on the questionnaire. Based on this feedback, the researchers made necessary modifications to improve the clarity and effectiveness of the questions and items in the final questionnaire.

3.6 Measurement and analysis

This study's dependent variables were knowledge and concern about environmental issues. The assessment of these variables was guided by a combination of items from the NEP scale and additional questions developed by the researchers. The original NEP Scale, introduced by Dunlap and Van Liere in 1978, is a widely used measure of pro-environmental orientation. Dunlap et al. (2000) revised the NEP Scale to enhance its reliability and comprehensiveness. The NEP Scale seeks to gauge the level of agreement with a pro-ecological worldview through questions that address themes such as growth limits, the balance of nature, human dominance over nature, the possibility of an ecological crisis, and the belief that humans are subject to nature's laws. For this study, four items were adopted from the NEP Scale: "Humans have the right to modify the natural environment to suit their needs," "Humans are severely abusing the

environment," "Plants and animals have as much right as humans to exist" and "Humans will eventually learn enough about how nature works to be able to control it." Additionally, six items were developed by the researcher based on relevant literature about environmental issues and their perceived impact (Table 1).

Students' environmental knowledge was assessed through a series of questions, which were coded and analyzed using IBM SPSS Statistics Version 26. The outcome variable, knowledge about environmental issues, was categorized for analysis. To measure concerns about environmental issues, a five-point Likert scale was employed, consistent with the approach used by Dunlap et al. (2000). Respondents were asked to indicate their level of agreement with each item, with scores ranging from 1 to 5: a score of 5 for strongly agree, 4 for agree, 3 for neutral, 2 for disagree, and 1 for strongly disagree. Higher scores indicated a greater level of environmental concern.

The independent variables for this study were selected based on established literature, which indicates that socio-demographic factors significantly influence environmental concerns. Factors such as gender, religion, disciplinary background, completion of environment-related academic courses, and home locality vulnerability to climate change or extreme weather events were included in the analysis. For statistical examination, these predictors were coded into categorical variables: gender (male = 0, female = 1), home locality vulnerability to climate change or extreme weather events (no = 0, yes = 1), faculty of study (life science = 1, applied science and technology = 2, management and business administration = 3, physical science = 4, social science = 5), and completion of environment-related academic courses (no = 0, yes = 1). This systematic coding enabled a comprehensive cross-tabulation analysis to explore the relationships between these socio-demographic factors and environmental concerns among the students.

This study utilized a Sankey diagram to visualize the distribution and contribution of various causes to specific environmental issues. The diagram illustrates the influence flow, with wider lines representing higher contribution percentages. To read the diagram, trace each environmental issue to its respective causes, noting the width of the connecting lines to understand the proportion of each contributing factor. Furthermore, this study employed cross-tabulation with a chi-square test, factor analysis, and mean difference analysis using the

TABLE 1 Item regarding concern about environmental issues.

Items	Concern about environmental issues
1	Environmental issues are affecting human health.
2	The weather pattern is generally changing.
3	The issues of environment are currently very important.
4	Environmental issues are possible to tackle.
5	People have to change their lifestyles to protect the environment.
6	Environmental problems are increasing due to human changes.
7	Humans have the right to modify the natural environment to suit their needs.
8	Humans are severely abusing the environment.
9	Plants and animals have as much right as humans to exist.
10	Humans will eventually learn enough about how nature works to be able to control it.

ANOVA test. The chi-square test was used to assess the association between socio-demographic determinants and knowledge about environmental issues. The researchers performed factor analysis and the ANOVA test to investigate environmental concerns. The factor analysis identified two factors: concern for environmental degradation and concern for environmental action. Subsequently, the items corresponding to these two factors were summed, and an ANOVA test was conducted to analyze the mean differences. This aimed to determine whether socio-demographic determinants influence students' concerns about environmental degradation and environmental action.

3.7 Reliability and validity test

The reliability and validity of the instruments used in this study were thoroughly tested. Reliability, which ensures the consistency and lack of bias in an instrument over time, was evaluated using Cronbach's Coefficient Alpha. According to Sekaran (2010), a value of 0.702 indicates good reliability. Validity, reflecting the accuracy of data in representing the intended measure, was assessed through convergent and discriminant validity tests. Convergent validity, confirmed through factor analysis, showed that two components had an average factor loading exceeding 0.70 (Carlson and Herdman, 2012). Discriminant validity was established as the square root of the average variance extracted (AVE) for two components was greater than the correlation between constructs, in line with Fornell and Larcker's (1981) guidelines. These results affirm the reliability and validity of the instruments used.

4 Results

4.1 Descriptive statistics

Table 2 presents the profile of the respondents. Among the students, 51.8% were male, and 48.2% were female. The students' disciplinary backgrounds were diverse, with the majority from Social Science (39.5%), followed by Applied Science and Technology (27.6%), Physical Science (19.7%), Life Science (10.0%), and Management and Business Administration (3.2%). Regarding the completion of environment-related academic courses, 57.1% of the students had completed such courses, while 42.9% had not. When asked about the vulnerability of their home locality to climate change and extreme weather events, 65% indicated that their areas were not vulnerable, whereas 35% reported vulnerability, with 66.7% experiencing moderate vulnerability and 13.5% experiencing high vulnerability.

Figure 1 shows that most respondents reported experiencing various environmental issues in Bangladesh. Specifically, 97.1% indicated environmental pollution, 95.7% reported deforestation, 94.2% reported flooding, 92.4% observed biodiversity loss, 79.2% noted heavy rainfall, and 75.0% experienced extreme temperatures.

Figure 2 presents the extent of the environmental issues experienced by the respondents. Among those who reported flooding, 53% experienced high levels, and 40% experienced moderate levels. For heavy rainfall, 57% reported moderate intensity, and 18% reported high intensity. A significant majority (82%) experienced high levels of environmental pollution, while 14% experienced moderate levels. Regarding extreme temperatures, 42% reported moderate intensity, and 31% reported high intensity. For biodiversity loss, 46% reported

TABLE 2 Descriptive statistics.

Variables	Categories	Percentage
Gender	Male	51.8
	Female	48.2
Disciplinary backgrounds	Life Science	10.0
	Applied Science and Technology	27.6
	Management and Business Administration	3.2
	Physical Science	19.7
	Social Science	39.5
Completion of environment-related course	Yes	57.1
	No	42.9
Vulnerability to home locality to extreme weather events or climate change	Yes	35.0
	No	65.0
Frequency of vulnerability to home locality for extreme weather events or climate change ($n = 133$)	Low	18.8
	Moderate	66.7
	High	13.5

moderate levels, and 45% reported high levels. Lastly, 70% experienced high levels for deforestation, and 23% experienced moderate levels.

The Sankey diagram (Figure 3) shows that heavy rains (51.1%) and overflowing rivers (41.3%) are the primary causes of flooding, while climate change (80.3%) is the dominant reason for heavy rainfall. Environmental pollution is chiefly driven by human activities (49.2%) and population growth (29.5%). Extreme temperatures are largely attributed to climate change (50.5%) and increasing carbon dioxide levels (23.9%). Biodiversity loss is primarily due to overexploitation of natural resources (27.4%) and pollution (26.6%). Finally, deforestation is predominantly caused by urbanization (77.6%), with minor contributions from unsustainable forest management (13.7%) and wood extraction (7.4%). These insights highlight the significant role of human-induced activities and climate change across multiple environmental issues.

4.2 Links between socio-demographic determinants and knowledge about environmental issues

Table 3 presents the associations between various socio-demographic determinants and different environmental issues in Bangladesh. The findings revealed a statistically significant relationship between flood occurrences in Bangladesh and two variables: disciplinary backgrounds and home locality vulnerability to climate change and extreme weather events. Specifically, 60.0% of participants who had not experienced extreme weather events or climate change in their home areas believed in the occurrence of floods, compared to 34.2% who had experienced such events ($p = 0.030$). Moreover, 38.4% of Social Science students acknowledged flood occurrences, compared to 24.5% of students from Applied Science and Technology ($p = 0.048$). However, gender and completion

FIGURE 1
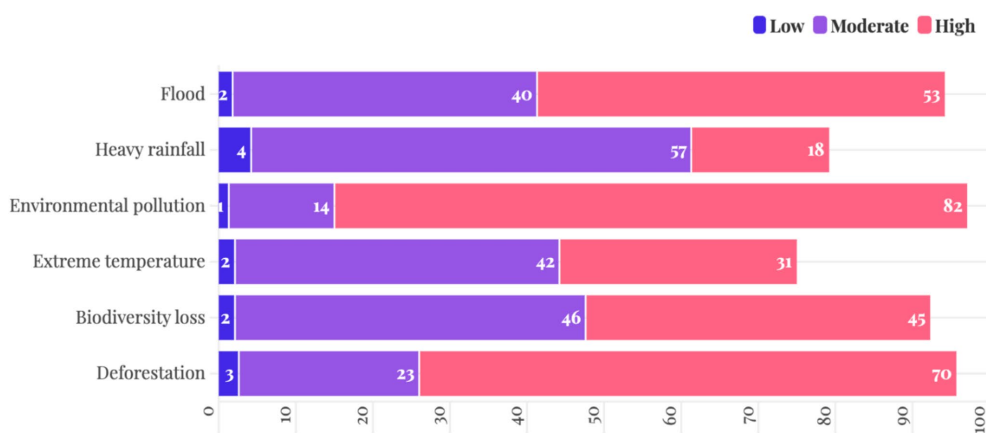Experience of environmental issues in Bangladesh.

FIGURE 2
Extent of environmental issues.

of environment-related courses did not show significant associations with flood occurrences.

The analysis indicated a significant association between heavy rainfall occurrences and disciplinary backgrounds. Specifically, 32.9% of Social Science students supported the existence of intense precipitation, compared to 17.9% from Applied Science and Technology ($p = 0.000$). However, gender, home locality vulnerability, and completion of environment-related courses did not exhibit significant associations with heavy rainfall occurrences. There is no statistically significant associations between environmental pollution and the socio-demographic variables of gender, disciplinary background, home locality vulnerability, or environment-related course completion. These variables did not contribute to or depend on the occurrence of environmental pollution in Bangladesh.

A significant relationship was found between extreme temperatures, disciplinary backgrounds, and home locality vulnerability. Specifically, 45.3% of those who had not experienced extreme weather or climate change supported the occurrence of extreme temperatures, compared to 29.2% who had experienced such events ($p = 0.003$). Additionally, 31.1% of Social Science students

believed in extreme temperatures, compared to 17.1% from Applied Science and Technology ($p = 0.015$). Gender and completion of environment-related courses did not show significant associations.

The analysis identified significant associations between biodiversity decline and disciplinary backgrounds and completion of environment-related courses. Specifically, 54.5% of those who completed an environment-related course acknowledged biodiversity decline, compared to 37.9% who had not ($p = 0.010$). Furthermore, 38.4% of Social Science students recognized biodiversity decline, compared to 23.2% from Applied Science and Technology ($p = 0.000$). Gender and home locality vulnerability did not show significant associations.

The findings showed significant associations between deforestation and disciplinary backgrounds and completion of environment-related courses. Specifically, 55.3% of those who completed an environment-related course acknowledged deforestation, compared to 39.5% who had not ($p = 0.040$). Additionally, 38.2% of Social Science students recognized deforestation, compared to 24.7% from Applied Science and Technology ($p = 0.072$). Gender and home locality vulnerability did not show significant associations.

FIGURE 3
Sankey diagram showing the reasons behind the selected environmental issues.
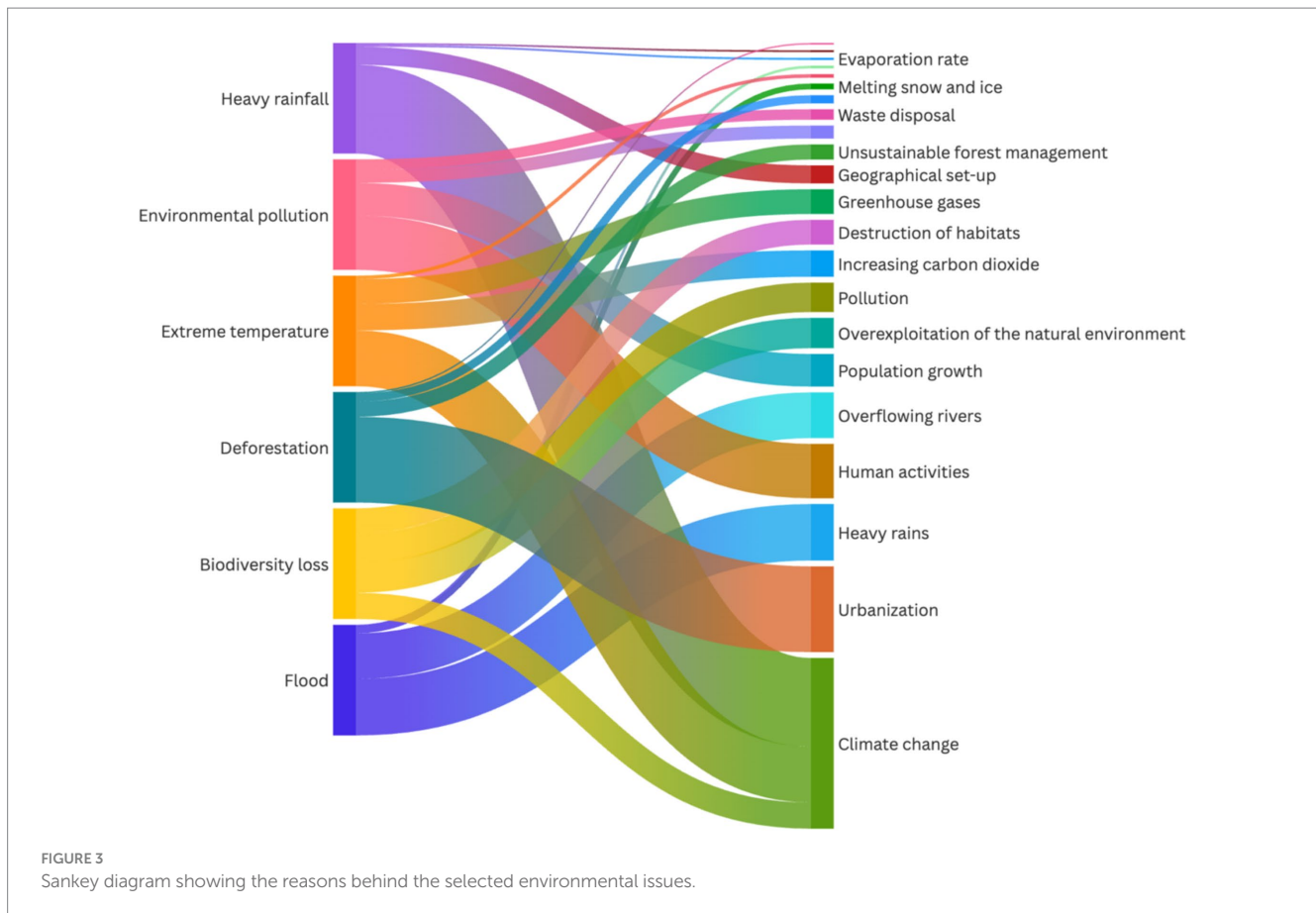
4.3 Concern for environmental issues

This section examines students' concerns regarding environmental issues, focusing on concerns over environmental degradation and actions to mitigate them. Factor analysis and an investigation into socio-demographic determinants provide critical insights.

4.3.1 Factor analysis and Varimax rotation matrix for concern about environmental issues

The factor analysis of concern for environmental issues (Table 4) yielded a Kaiser-Meyer-Olkin (KMO) measure of 0.819, indicating high sampling adequacy. The analysis identified two factors with Eigenvalues greater than 1.0, explaining a significant portion of the variance. Using the Varimax rotation, factor one was characterized as a concern for environmental degradation, encompassing issues affecting human health, the importance of current environmental problems, and human impacts. Factor two focused on environmental action, including views on human control over nature and lifestyle changes needed for environmental protection.

4.3.2 Socio-demographic determinant and environmental concern

The mean difference test followed by ANOVA was conducted to assess whether socio-demographic factors like gender, disciplinary backgrounds, completion of an environment-related course, and home locality vulnerability impact students' concern for environmental degradation. While gender, course completion, and vulnerability to home locality showed no significant effects, a notable variance emerged across disciplinary backgrounds, particularly for Management and Business Administration students, who showed less concern than in other fields (Table 5).

Similarly, analysis concern for environmental action revealed minimal gender differences but no significant differences from disciplinary backgrounds and vulnerability to home locality. However, students who completed environment-related courses exhibited a higher concern for environmental action, achieving statistical significance at a 10% level, indicating the potential impact of environmental education on students' engagement (see Table 5).

5 Discussion

Environmental challenges such as flooding, excessive precipitation, biodiversity depletion, deforestation, severe temperatures, and pollution have profound implications on a society's social, economic, and cultural dimensions. This study focused on the interplay between students' knowledge of environmental issues and their concern levels, accounting for variables including gender, completion of environmental courses, disciplinary backgrounds, and the vulnerability of their home areas to climate change and extreme weather events. The analysis revealed significant links between socio-demographic factors and environmental concerns among university students in Bangladesh. A substantial number of students demonstrated a solid understanding of environmental issues, consistent with other studies conducted in China (Xiao and Hong, 2010), Iraq (Al-Maliki et al., 2022), Australia (Fielding and Head,

2012), and Bangladesh (Haq and Ahmed, 2020). These findings were reinforced by our factor analysis and the subsequent use of a mean difference test and ANOVA to delve deeper into the factors influencing environmental degradation and actions.

Interestingly, gender did not show a statistically significant correlation with environmental knowledge or concern levels, which aligns with the research by Haq and Ahmed (2020) and Davis et al.

(2019). However, female students exhibited a slightly higher average level of concern over environmental issues than their male counterparts, indicating subtle gender differences in environmental attitudes. Another study among teachers in Bangladesh found significant gender differences where females have high levels of awareness and understanding of climate change (Chowdhury et al., 2021). Furthermore, the study highlighted the influential role of

TABLE 3 Socio-demographic determinants and environmental issues in Bangladesh.

Variable	Category	Flood occurrence (%)	Heavy rainfall (%)	Environmental pollution (%)	Extreme temperature (%)	Biodiversity loss (%)	Deforestation (%)
Gender	Female	45.8	36.3	46.3	36.8	44.7	45.5
	Male	48.4	42.4	50.3	37.6	47.6	49.2
Disciplinary backgrounds	Life Science	9.5*	9.2**	10.0	8.2*	9.7***	9.7*
	Applied Science and Technology	24.5	17.9	26.1	17.1	23.2	24.7
	Management and Business Administration	3.2	2.1	2.9	2.4	2.4	2.9
	Physical Science	18.7	16.6	19.2	15.8	18.7	19.2
	Social Science	38.4	32.9	38.4	31.1	38.4	38.2
Completion of environment-related courses	Yes	54.5	46.3	55.5	43.9	54.5**	55.3*
	No	39.7	32.4	41.1	30.5	37.9	39.5
Vulnerability to home locality	Yes	34.2*	27.6	33.4	29.2*	33.2	32.9
	No	60.0	51.1	63.2	45.3	59.2	61.8

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 4 Factor analysis concern for environmental issues.

	Component	
	1	2
Factor 1: Concern for environmental degradation		
Environmental issues are affecting human health	0.657	
The issues of environmental problems are currently very important	0.799	
Environmental issues are possible to tackle	0.457	
People have to change their lifestyles to protect the environment	0.579	
Environmental problems are increasing due to human activities	0.713	
Humans are severely abusing the environment	0.700	
Plants and animals have as much right as humans to exist	0.661	
Factor 2: Concern for environmental action		
Humans will eventually be able to control how nature works and learn enough about it		0.733
Humans have the right to modify the natural environment to suit their needs		0.779
The weather pattern is generally changing		0.423
Eigenvalue	3.236	1.403
% of variance explained	32.36	14.03
KMO	0.819	
Bartletts' test of sphericity approx. chi-square (df)	727.84 (45)***	

***$p < 0.01$.

TABLE 5 Mean difference and ANOVA test for concern for environmental degradation and action.

Variable	Category	Concern for degradation mean	Concern for action mean
Gender	Female	4.31	3.35
	Male	4.35	3.26
Disciplinary backgrounds	Life Science	4.47	3.33
	Applied Science and Technology	4.36	3.26
	Management and Business Administration	3.93**	3.22
	Physical Science	4.26	3.27
	Social Science	4.33	3.35
Completion of environment-related course	Yes	4.36	3.37[†]
	No	4.29	3.22
Vulnerability to home locality	Yes	4.35	3.31
	No	4.32	3.30

**$p < 0.05$, [†]$p < 0.10$.

living in areas vulnerable to severe weather and climate change in shaping environmental awareness, echoing Haq and Ahmed's (2020) findings. While residing in such areas significantly enhanced knowledge about environmental concerns like flooding and extreme temperatures, it did not correspondingly raise concern levels, as the ANOVA results indicated no statistically significant relationship between locality vulnerability and concern for environmental issues. Another study was conducted on Teachers in Bangladesh, where the authors found that hometown vulnerability to extreme weather events significantly explains the perception of rainfall changes (Ahmed M. N. Q. et al., 2022). Disciplinary backgrounds also played a pivotal role in defining environmental concern, with management and business students showing less concern over environmental degradation than their peers from life sciences and social sciences. This mirrors previous findings such as by Cordano et al. (2010), though they noted differing results among Chilean and American students. Our study also identified that life sciences students showed more concern for environmental degradation. In contrast, social science students focused more on environmental actions, similar to findings by Al-Maliki et al. (2022) and Haq and Ahmed (2020).

Countries like Bangladesh, characterized by limited resources, face amplified environmental challenges compared to developed nations. Consequently, students exhibit increased concern for environmental matters due to the prevalent impacts on their societal frameworks. Our findings emphasize the need for governmental intervention and improved adaptive strategies to mitigate such challenges. While constrained by factors like sample size and geographical scope, this research sets the stage for further exploration in broader contexts to generalize these insights.

6 Conclusion

This study elucidates the intricate links between sociodemographic factors and environmental concerns among university students in Bangladesh. It demonstrates how local vulnerabilities and disciplinary backgrounds influence environmental concerns. Our study's findings highlight the importance of changing what and how environment-related courses are taught, particularly in higher educational institutions, in order to enlighten and motivate future generations to take action against pollution, environmental degradation, and deforestation. This transformation should include providing students with practical environmental protection skills as well as current academic information gleaned from an interdisciplinary approach to environmental concerns that future generations will likely encounter. Students in higher educational institutions need to be better informed to become proactive, sustainable, and environmentally conscious by receiving both academic information and practical knowledge from the field about how environmental problems can be more devastating and present different challenges and how young people can overcome these challenges. The study also shows how environmental issues and activities are influenced by students' experiences of local vulnerabilities. Therefore, authorities should consider developing local learning opportunities to improve the resilience of vulnerable residents, especially youth, and mitigate the effects of climate change and environmental challenges. Expanding the study to more universities and incorporating a larger sample will enhance the generalizability of future research. Investigating causal pathways and a wider range of research locations can also help us gain a deeper understanding of the complex relationships between demographic characteristics and environmental issues. Furthermore, the application of qualitative techniques, like interviews, may yield deeper, more comprehensive viewpoints.

Most of the existing studies dealing with environmental issues focus on developed countries. Understanding and exploring youth concerns about environmental issues in developing countries, drawing on knowledge from existing research in developed countries, can provide deeper insights, as the challenges related to the environment and climate change are mainly faced by people in vulnerable areas in developing countries. A broader approach to the complicated issues regarding youth understanding will prove helpful in supporting environmental policies and designing need-based curricula to effectively mitigate environmental problems. The results of this research can guide discussions with international audiences on environmental issues and help policymakers in higher education institutions in designing new and revising existing courses, as well as conducting training and workshops on environmental sustainability.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors upon request, without undue reservation.

Ethics statement

The studies involving humans were approved by School of Ethics Committee (SERC), School of Social Science, SUST Research Ethics Board (SREB), Shahjalal University of Science and Technology. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

BS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. MA: Investigation, Methodology, Writing – original draft, Writing – review & editing. KA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing. SA: Investigation, Methodology, Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Formal analysis, Supervision.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declare that no Generative AI was used in the creation of this manuscript.

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