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The longitudinal dynamics of the trade-off between environmental consciousness and economic growth

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Abstract
This study explores the dynamics of environmental consciousness in relation to economic growth, emphasizing the influence of demographic, socio-economic, and religious factors on individual and collective attitudes toward sustainability. Utilizing longitudinal data from the World Values Survey (1995–2022) comprising a total sample of 408,623 respondents across diverse countries and cultures, the research uncovers significant variations over time and across regions using logistic regression analysis**.** The findings highlight the critical roles of education, institutional trust in environmental movements, and financial stability in fostering pro-environmental attitudes, while revealing complex relationships such as the positive influence of certain religious traditions and the challenges posed by others, along with significant gender differences, non-linear age effects, and the impact of ethnic diversity on environmental engagement. By addressing these intricate interconnections, the study bridges gaps in the literature and provides actionable insights for policymakers and advocates, offering culturally sensitive and economically inclusive strategies to advance global sustainability and achieve meaningful progress toward ecological resilience.

Keywords Environmental consciousness · Economic growth · Sustainability · Socio-economic factors · Gender differences · Religious dynamics

1 Introduction

The interplay between environmental consciousness and economic growth has emerged as a pivotal topic in addressing the global sustainability agenda [2, 11, 47, 57, 74]. As the world faces unprecedented ecological challenges, ranging from climate change [1, 7] and biodiversity loss [49, 54, 76] to resource depletion [70] and pollution [1, 12, 48], the imperative to balance environmental preservation with economic progress has never been more urgent. This tension raises critical questions about the role of societal values, cultural norms, and institutional frameworks in fostering a collective commitment to sustainability [56, 86]. While much of the existing discourse centers on policy interventions and technological advancements, the underexplored dimension of how demographic, socio-economic, and religious factors shape environmental attitudes demands closer scrutiny in a holistic way.

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Environmental consciousness, often characterized as the awareness, concern, and willingness to act in favor of environmental preservation, is not a static attribute [9, 62, 65]. It evolves in response to societal, economic, and cultural transformations [29, 42, 60]. However, its progression is neither uniform nor universal. Socio-economic disparities [27, 67], cultural contexts, and religious ideologies [13, 53, 68] profoundly influence individual and collective attitudes toward environmental responsibility. For instance, the priorities of a highly urbanized, industrialized society may differ markedly from those of a rural, resource-dependent community [5, 16, 18, 69, 87]. Similarly, the interplay between religiosity and environmental ethics varies across cultural and theological contexts [78, 81], highlighting the complexity of crafting inclusive sustainability strategies.

Prior research on environmental consciousness often relies on cross-sectional evidence and examines cultural and religious influences in isolation. As a result, longitudinal cultural–religious dynamics and their interaction with demographic and socio-economic drivers remain underexplored, and the economic dimension is not consistently anchored in debates on how growth relates to shifting environmental values and sustainability trade-offs. This study addresses these gaps by conducting a comprehensive longitudinal analysis of environmental consciousness from 1995 to 2022, leveraging data from the World Values Survey. The study moves beyond prevalent siloed approaches to develop an integrated analytical framework that simultaneously models demographic, socio-economic, and religious factors. The research design supports a rigorous examination of how these drivers interact and evolve across diverse geographical and temporal contexts.

Guided by this focus, the study addresses four research questions: (1) How do demographic, socio-economic, and religious factors relate to environmental consciousness? (2) How do these relationships vary across survey waves over time? (3) How do these relationships differ across key subgroups, including gender, settlement type, and religiosity? (4) How do these relationships differ across major religious denominations?

2 Literature review

Environmental consciousness refers to the awareness and understanding of environmental issues and the impact of human activities on the natural world. It involves recognizing the need for sustainable practices to protect the environment and preserve natural resources for future generations [35, 58, 66]. Environmental consciousness plays a critical role in sustainability by fostering a holistic approach that integrates environmental, economic, and social dimensions. It underscores the interconnectedness of these factors, promoting behaviors and practices aimed at reducing emissions, managing waste, and conserving resources [3, 30, 35, 58]. Education for Sustainable Development (ESD) further amplifies this by equipping individuals with the knowledge, skills, and attitudes required to act sustainably [14, 35, 64]. Moreover, environmental awareness shapes policy-making and governance, driving the implementation of regulations and initiatives that support sustainable development [8, 30].

The integration of environmental consciousness into economic growth models facilitates the transition to a green economy, where economic development aligns with environmental protection. This transition includes the adoption of renewable energy, energy efficiency, and sustainable business practices [3, 39, 82]. Companies that embed environmental principles into their operations often achieve enhanced ESG (Environmental, Social, and Governance) performance, fostering innovation and competitive advantage [30, 39, 85]. Crucially, environmental consciousness promotes the decoupling of economic growth from environmental degradation by encouraging resource efficiency and environmentally friendly technologies [4, 79]. This shift not only mitigates environmental harm but also generates economic benefits such as cost savings, increased exports, and greater economic resilience [39, 82]. Environmental consciousness is indispensable for achieving sustainability and driving economic growth. It encourages a balanced approach that integrates environmental stewardship with economic development, creating a resilient and thriving future for both the planet and its inhabitants. By raising awareness, fostering sustainable practices, and shaping policies, environmental consciousness establishes a foundation for harmonious coexistence between humans and the environment [58, 61, 77].

2.1 Theoretical Framework underpinning environmental consciousness

While the determinants of environmental consciousness are multifaceted, several established theoretical frameworks provide a lens through which these relationships can be understood [55]. This study is conceptually grounded in two complementary theories that explain how values, beliefs, and external conditions shape pro-environmental attitudes.

First, Inglehart's Post-Materialist Value Theory [25] provides a macro-sociological explanation. It posits that as societies achieve economic security and stability, their populations undergo a intergenerational shift from materialist values

(emphasizing economic and physical security) to post-materialist values (prioritizing self-expression, quality of life, and environmental protection). This theory directly informs the expected positive relationship between economic development, financial satisfaction, educational attainment, and environmental consciousness, as these factors reflect the resources and security that enable the adoption of post-materialist goals.

Second, the Value-Belief-Norm (VBN) Theory [72] offers a social-psychological model of pro-environmental behavior. The VBN chain proposes that individuals' broad, stable values (e.g., altruistic, biospheric) influence their general environmental beliefs (e.g., awareness of consequences), which subsequently activate a personal moral norm to take pro-environmental action. This theory helps explain the roles of religiosity (as a source of values), education (shaping beliefs and awareness of consequences), and institutional trust (which can strengthen the link between beliefs and norms by validating the seriousness of the threat and the efficacy of action).

2.2 Environmental consciousness and demographic factors

Women generally exhibit higher levels of environmental concern and are more engaged in non-confrontational forms of environmental political participation (EPP), such as signing petitions and boycotting products, whereas men are more likely to engage in confrontational actions like protests [23, 27]. In household practices, women tend to lead in energy-saving behaviors and regularly monitor energy consumption, although men often possess more technical knowledge about energy-saving technologies [67]. Additionally, women demonstrate greater adoption of pro-environmental nutrition behaviors, such as reducing meat consumption and showing interest in vegan food options [63]. However, these gender differences are moderated by sociocultural factors; in societies with higher gender inequality, economic scarcity, or collectivism, the differences in environmental concern between men and women tend to narrow [6].

Younger generations, particularly Generation Z, express strong concern for climate change and are more inclined to adopt sustainable behaviors, such as conserving resources and purchasing local food [52, 80]. However, a value-action gap is often observed, where their expressed concerns do not consistently translate into sustainable actions [71]. Interestingly, Generation X tends to demonstrate more consistent sustainable attitudes and behaviors compared to Millennials and Generation Z, the latter two sharing similar environmental outlooks [51]. Younger generations also exhibit greater skepticism toward government intervention in environmental policies, reflecting their preference for individual or grassroots solutions [88].

Cultural and regional contexts profoundly shape environmental consciousness. For example, in Italian-speaking regions of Switzerland and Northern Italy, men prioritize economic and technological aspects of sustainability, while women emphasize ecological and ethical considerations [60]. In China, individuals from urban, high-income households in the east-coastal region report higher environmental concern compared to those in the less affluent western regions [38]. Additionally, culturally relevant pedagogy (CRP) has emerged as a powerful tool in sustainability education, fostering critical thinking and cultural competence in diverse learning environments [42]. Cross-cultural educational exchanges further enhance environmental consciousness by exposing individuals to different perspectives and practices, encouraging them to reassess their attitudes and behaviors [29].

2.3 Socio-economic influences on environmental consciousness

Education plays a pivotal role in fostering environmental consciousness by enhancing awareness and understanding of ecological issues. Studies consistently show that individuals with higher education levels are more likely to engage in pro-environmental actions, such as recycling and tree planting, as they possess a deeper knowledge of climate change, risk perceptions, and anthropogenic impacts [20, 21, 73]. Education also promotes environmental values and decision-making skills critical for sustainable stewardship [20]. Initiatives like Education for Sustainable Development (ESD) aim to embed sustainability principles into learning systems, encouraging behaviors that uphold environmental integrity and economic viability [28, 33].

Economic stability significantly influences environmental behaviors, with higher income levels often associated with greater environmental awareness and sustainable practices [17, 44]. However, this relationship varies across economic contexts. In high- and upper-middle-income countries, economic development paired with environmental education promotes the adoption of green technologies and energy-efficient products, mitigating environmental degradation [44]. Conversely, in lower-income countries, economic growth without adequate environmental education can exacerbate ecological damage, reflecting the need for integrated approaches [44].

Geographic context further shapes environmental consciousness, as urban residents generally exhibit higher environmental awareness than rural populations, particularly in developed regions, due to better access to education and information [18]. Targeted rural initiatives, such as low-carbon leisure education, can bridge this gap by promoting sustainable practices and enhancing ecological conservation [87]. Additionally, regional economic disparities within countries can create variations in environmental behavior, as seen in China, where coastal regions with stronger economic development report higher environmental awareness than less-developed inland areas despite similar educational efforts [18].

2.4 Trust in environmental institutions and movements

Trust in environmental institutions and movements is a critical driver of environmental consciousness and engagement, influencing individual behaviors and shaping public attitudes. Higher trust in institutions, such as public administration, enhances ecological behaviors by reducing barriers to action, particularly among individuals with lower environmental concern [37, 43]. Generalized trust, associated with altruism and collective responsibility, further motivates pro-environmental behaviors, though a degree of skepticism can also drive public engagement by prompting responses to perceived institutional shortcomings [40, 46].

Advocacy efforts and global environmental movements amplify these effects by leveraging diverse strategies, such as social media campaigns, protests, and celebrity endorsements, to raise awareness and shift public opinion [22, 24]. Social capital, through civic engagement and generalized trust, strengthens environmental activism and increases willingness to support sustainable initiatives [31, 45]. However, barriers like institutional distrust and a disconnect between awareness and action highlight the complexity of fostering environmental engagement and the need for strategies that address both trust and skepticism [15, 32, 37].

2.5 Role of religion in shaping environmental ethics and engagement

Religious beliefs and spiritual frameworks significantly influence environmental ethics and attitudes, with both positive and negative dimensions. Spirituality often aligns with stronger beliefs in climate change, a heightened moralization of environmental actions, and intentions to conserve energy and reduce waste, mediated by compassion and moral foundations [53]. Conversely, religious fundamentalism tends to correlate negatively with pro-environmental attitudes, often linked to right-wing authoritarianism and resistance to progressive environmental ideologies [53]. Individuals without specific religious affiliations typically exhibit higher pro-environmental attitudes than those associated with a religious denomination. However, when religiosity is deeply personal and tied to active participation in religious practices, it often fosters more pronounced environmental concerns, highlighting the nuanced role of personal faith in environmental stewardship [81]. Theological traditionalism further underscores these complexities by serving as a strong predictor of environmental attitudes, often shaped by intersecting political and ideological influences [34].

Religious institutions play a pivotal role in shaping environmental engagement, leveraging their ethical frameworks and influence over communities. Faith-based approaches to conservation demonstrate significant potential, with religious organizations managing vast swathes of habitable land and guiding community behaviors toward sustainability [41]. Corporate social and environmental responsibility is also influenced by religious values, as firms in highly religious regions exhibit stronger commitments to ethical practices [10]. Ecotheology, which integrates religious teachings with environmental ethics, offers a compelling avenue for fostering environmental education and advocacy by bridging faith and sustainability [19]. These dynamics underscore the dual potential of religion as both a driver and mediator of environmental engagement, emphasizing the need for tailored strategies that respect religious diversity while leveraging the moral imperatives shared across faith traditions to advance sustainability goals.

The literature review highlights the multifaceted nature of environmental consciousness, shaped by demographic, socio-economic, cultural, institutional, and religious factors [55, 84]. However, notable gaps remain in understanding the interplay of these factors over time and across diverse cultural contexts. The existing literature often treats these influences in isolation, overlooking the dynamic interactions between demographic, socio-economic, and religious dimensions. Furthermore, there is limited exploration of how institutional trust and religiosity evolve in shaping environmental attitudes in different regions and socio-economic settings. This study seeks to address these gaps by leveraging longitudinal data from the World Values Survey (1995–2022) to examine the interconnections among these factors, providing a holistic understanding of environmental consciousness. Table 1 serves as a comprehensive summary of the existing evidence, offering a foundation for addressing the identified gaps in this research.

3 Methodology

The World Values Survey (WVS) database [26] serves as the foundation of this study, providing a robust longitudinal framework for examining global trends in environmental consciousness across demographic, socio-economic, and religious contexts. Its consistent methodology and representative sampling facilitate reliable cross-national and temporal comparisons [59, 83]. The methodology flowchart (Fig. 1) outlines a stepwise approach, starting with Step A: Data Source, emphasizing the use of longitudinal data (1995–2022) from the WVS. Next is Step B: Data Preprocessing, which includes variable selection, data recording and cleaning. The process then advances to Step C: Statistical Analysis, featuring descriptive statistics, correlation analysis, and logistic regression, culminating in model comparisons across different time periods, demographic factors, and religious denominations. The data screening and analysis were conducted using Stata 17.

Table 2 presents the variables and sample distribution across five waves (1995–2022). The dependent variable, environmental consciousness (B008), introduced in Wave 3 (1995–1998), serves as the focal point, with 347,587 observations and a steady increase in sample size across subsequent waves. Key demographic factors, such as gender (X001), age (X003), marital status (X007), and ethnic group (X051), are well-represented, with observations ranging from 314,857 to 408,251. Additionally, geographic, socio-economic, environmental engagement, and religious factors are also extensively covered. The total sample of 408,623 respondents, with wave-specific proportions ranging from 14.69% (Wave 4) to 23.79% (Wave 7), provides robust temporal and regional representation, crucial for analyzing the evolving dynamics of environmental consciousness.

Table 3 presents the descriptive statistics for the variables included in the analysis, providing an overview of their distribution and characteristics. The dependent variable, environmental consciousness, is binary, with a mean of 0.554, indicating that approximately 55.4% of the sample exhibits environmental consciousness. Among the demographic variables, gender is nearly balanced (mean = 0.48), while age has a continuous distribution with a mean of 41.45 years, ranging from 13 to 103. The binary variable marital status has a mean of 0.573, suggesting that 57.3% of respondents are married, while ethnic group, a categorical variable, spans 1 to 886 categories. Geographic factors include urban habitat, with 66% of the respondents residing in urban areas, and developed country status, where only 23.9% of the sample comes from developed nations. Among socio-economic variables, education level averages 2.008 on a scale of 1 to 3, while employment status shows that 54.7% of respondents are employed. Social class, subjective income level, and financial satisfaction display varying means, highlighting the economic diversity within the sample. Environmental engagement measures indicate low membership in environmental organizations (12.2%) but higher confidence in environmental movements (59.6%). Religious factors show that 68.9% identify as religious, with religious denominations categorized into nine major groups. These statistics, based on a robust sample of 408,623 respondents, provide a comprehensive foundation for analyzing the complex dynamics of environmental consciousness in relation to demographic, socio-economic, and cultural variables.

*Given the binary nature of the dependent variable, environmental consciousness, th*is study employs logistic regression (logit models) to examine the relationship between environmental attitudes and various demographic, socio-economic, geographic, and religious factors. Logistic regression is particularly suited for modeling binary outcomes as it estimates the probability of an event (environmental consciousness = 1) based on predictor variables, allowing for robust interpretations of the factors influencing pro-environmental behavior across multiple dimensions. The general form of the logit model used in this study is expressed as:

$$logit\left(P_i\right) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki}$$

The logistic regression model specifies that the log-odds of environmental consciousness follows a linear relationship with the predictor variables, where P_i represents the probability that respondent i exhibits environmental consciousness, β_0 is the intercept, and $\beta_1, \beta_2, \ldots, \beta_k$ are coefficients for the predictor variables $X_1, X_2, \ldots, X_k$.

The goodness-of-fit of the overall logistic regression model was assessed using multiple diagnostic measures. The Hosmer–Lemeshow test indicated some lack of fit ($\chi^2(8) = 154.70$, $p < 0.001$), which is not uncommon in large sample studies where even minor deviations can yield statistically significant results [36, 75]. However, the model demonstrated acceptable discriminatory power (AUC = 0.597) and explained 2.1% of the variance (McFadden's $R^2 = 0.0208$). The modest pseudo-R^2 reflects the inherently complex and value-driven nature of attitudinal outcomes rather than a model deficiency. The model correctly classified 58.36% of cases and showed strong statistical

Table 1 Factors influencing environmental consciousness

Factors	Orientation towards environment	Authors
Gender Differences	Women show higher environmental concern	[23, 27, 67]
Generational Variations	Younger generations (Gen Z) show high concern for climate change but may have a value-action gap; Gen X shows more consistent sustainable behaviors	[51, 52, 71, 80]
Cultural Diversity	Cultural and regional contexts shape environmental priorities	[29, 38, 42, 60]
Geographic Context	Urban areas show higher awareness due to better access to education; rural areas benefit from targeted programs	[18, 87]
Developing and developed countries	Both developed and developing countries face challenges in creating policies that promote sustainable development and environmental consciousness	[5, 16, 69]
Education	Increases awareness, knowledge, and pro-environmental actions; fosters values and decision-making skills	[20, 21, 73]
Economic Stability	Higher income levels correlate with greater environmental awareness; economic growth impacts vary by income level	[17, 44]
Institutional Trust	Enhances ecological behaviors and pro-environmental attitudes	[37, 43]
Environmental Movements	Shift public opinion and increase environmental concern through various strategies	[22, 24]
Religiosity	There is no consistent evidence that religiosity universally promotes or hinders environmental consciousness	[13, 50, 53, 68, 78, 81]

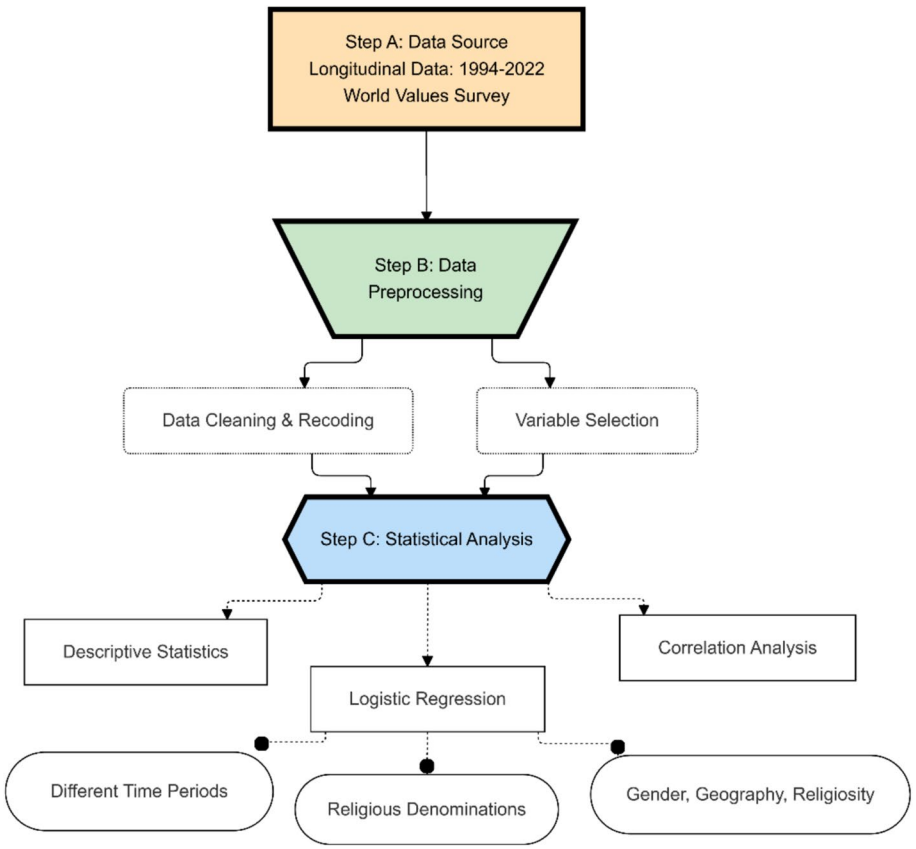


Fig. 1 Flow diagram of methodology

significance (LR $\chi^2(17) = 5261.35$, $p < 0.001$), representing a substantial improvement over the null model. Multicollinearity was assessed using variance inflation factors, indicating no concern (mean VIF = 1.16).

Table 4 presents the pairwise correlations among the study variables, highlighting significant relationships and their strengths within a sample of 408,623 observations. The dependent variable, environmental consciousness, exhibits a modest positive correlation with confidence in environmental movements (0.124, $p < 0.01$) and education level (0.072, $p < 0.01$), suggesting that higher education and trust in environmental initiatives are associated with greater environmental awareness. Conversely, it shows weak negative correlations with factors such as religiosity (− 0.030, $p < 0.01$) and ethnic diversity (− 0.060, $p < 0.01$), indicating potential cultural or ideological influences on environmental attitudes. Among demographic factors, gender and age have negligible correlations with environmental consciousness (− 0.013 and − 0.009, respectively, $p < 0.01$). Socio-economic variables such as social class (0.044, $p < 0.01$) and financial satisfaction (0.065, $p < 0.01$) exhibit small but significant positive relationships, reflecting the role of perceived economic security in shaping pro-environmental behaviors. Notably, developed country status shows a slight positive correlation (0.021, $p < 0.01$), underscoring the influence of national development levels. Geographic factors, such as urban residency, correlate positively (0.020, $p < 0.01$) with environmental consciousness, consistent with urban environments fostering greater environmental awareness. The variable membership in environmental organizations also shows a positive but minor correlation (0.030, $p < 0.01$), aligning with the role of organized efforts in promoting environmental engagement. The correlations are largely weak to moderate, emphasizing the multifaceted and context-dependent nature of the relationships between the variables and environmental consciousness. The statistical significance of most relationships ($p < 0.01$) underlines their robustness within this large and diverse sample.

Table 2 Variables and data coverage

Variables	WVS Codes	Overall	Wave 3. 1995–1998	Wave 4. 1999–2004	Wave 5. 2005–2009	Wave 6. 2010–2014	Wave 7. 2017–2022
Environmental consciousness	B008	347,587	58,497	48,482	70,673	80,223	89,712
Demographic factors							
Gender	X001	408,251	77,761	60,012	83,879	89,474	97,125
Age	X003	407,426	77,639	59,979	83,714	89,385	96,709
Marital status	X007	404,241	74,639	59,936	83,714	89,321	96,631
Ethnic group	X051	314,857	45,852	45,022	61,336	75,028	87,619
Geographic factors							
Urban/Rural habitat	X050C	121,704	–	13,138	11,383	–	97,183
Country	COW_NUM	408,623	77,818	60,045	83,975	89,565	97,220
Socio-economic factors							
Education level	X025R	402,762	74,945	59,486	83,416	88,766	96,149
Employment status	X028	398,604	73,919	59,238	81,422	88,038	95,987
Social class (subjective)	X045	379,602	74,708	56,474	69,864	86,883	91,673
Subjective income level	X047R WVS	379,119	67,467	54,294	76,788	86,311	94,259
Financial satisfaction	C006	395,285	72,859	57,035	79,879	88,917	96,595
Income equality perception	E035	408,623	77,818	60,045	83,975	89,565	97,220
Environmental engagement							
Membership of environmental organization	A103	336,433	73,256	–	78,936	88,447	95,794
Confidence on environmental protection movement	E069_14	357,807	65,638	45,509	73,867	82,017	90,776
Religious factors							
Religious person	F034	380,420	66,362	53,582	80,992	84,916	94,568
Religious denominations	F025	400,501	73,909	59,461	82,982	88,292	95,857
Total Sample		408,623	77,818	60,045	83,975	89,565	97,220
Percentage		100	19.04	14.69	20.55	21.92	23.79

4 Results and discussion

Table 5 presents the results of logistic regression models examining predictors of environmental consciousness over six time periods, corresponding to the waves of the World Values Survey from 1995 to 2022. These results offer nuanced insights into the evolving drivers of environmental attitudes, capturing temporal shifts in the influence of demographic, socio-economic, and cultural factors. Education consistently emerges as a significant and positive predictor of environmental consciousness across all time periods. Its coefficient grows steadily, from 0.198 ($p < 0.01$) in Wave 3 (1995–1998) to 0.230 ($p < 0.01$) in Wave 7 (2017–2022), indicating an increasing impact of educational attainment on pro-environmental attitudes. This trend underscores the role of education in equipping individuals with the critical thinking skills and knowledge needed to engage with environmental issues, reflecting a societal shift toward the incorporation of environmental awareness in educational systems.

Confidence in environmental protection movements consistently has the strongest positive association with environmental consciousness, with coefficients ranging from 0.387 ($p < 0.01$) in Wave 3 to 0.523 ($p < 0.01$) in Wave 6 (2010–2014). This finding highlights the pivotal role of trust in environmental institutions in shaping individual attitudes and behaviors. The consistently strong effect of this variable suggests that institutional credibility and effective advocacy are central to fostering environmental consciousness across different contexts. The coefficient for gender is negative in most models, indicating that males are less likely to exhibit environmental consciousness compared to females, with significant effects in Wave 5 (− 0.120, $p < 0.01$) and Wave 7 (− 0.0708, $p < 0.01$). This aligns with existing evidence suggesting that women may prioritize environmental concerns more, potentially due to differing social roles or values emphasizing care and sustainability. However, in Wave 4, the gender coefficient (0.0318) is not significant, indicating variability in gender effects over time.

Table 3 Descriptive statistics

Variables	Nature	Obs	Mean	Std. Dev	Min	Max
Environmental consciousness	Binary	347,587	0.554	0.497	0	1
Gender	Binary	408,251	0.48	0.5	0	1
Age	Continuous	407,426	41.453	16.298	13	103
Marital status	Binary	404,241	0.573	0.495	0	1
Ethnic group	Categorical	314,857	–	–	1	886
Urban habitat (= 1)	Binary	121,704	0.66	0.474	0	1
Country	Categorical	408,623	–	–	1	109
Developed country (= 1)*	Binary	408,623	0.239	0.426	0	1
Education level	Categorical	402,762	2.008	0.755	1	3
Employed (= 1)	Binary	398,604	0.547	0.498	0	1
Social class	Categorical	379,602	2.688	0.987	1	5
Subjective income level	Categorical	379,119	1.796	0.629	1	3
Financial satisfaction	Continuous	395,285	5.754	2.566	1	10
Income equality perception (= 1)	Binary	408,623	0.435	0.496	0	1
Membership of environmental organization (= 1)	Binary	336,433	0.122	0.327	0	1
Confidence on environmental protection movement (= 1)	Binary	357,807	0.596	0.491	0	1
Religious person (= 1)	Binary	380,420	0.689	0.463	0	1
Religious denominations—major groups	Categorical	400,501	2.877	2.444	0	9

N = 408,623

*As per the Organization for Economic Cooperation and Development (OECD) list

Descriptive statistics of each wave are given in the supplementary file

The relationship between age and environmental consciousness exhibits a non-linear pattern. While the linear term for age is positive in most models, the squared term is negative, as seen in the overall model (age: 0.00780, $p < 0.01$; age squared: − 0.0000728, $p < 0.01$). This suggests a diminishing effect of age after a certain threshold, where younger and middle-aged individuals are more likely to engage with environmental issues compared to older populations. Such trends may reflect generational differences in environmental awareness or priorities. Religiosity demonstrates an evolving relationship with environmental consciousness. While the coefficient is positive in Wave 3 (0.101, $p < 0.01$), it becomes negative and significant in Wave 6 (− 0.190, $p < 0.01$) and Wave 7 (− 0.0481, $p < 0.01$). These findings highlight the shifting alignment between religious values and environmental priorities, suggesting that societal changes and the framing of environmental issues in religious contexts may influence these dynamics.

Socio-economic factors provide additional insights. Financial satisfaction is consistently positively associated with environmental consciousness, with coefficients such as 0.0426 ($p < 0.01$) in the overall model and 0.0519 ($p < 0.01$) in Wave 6. Employment status also shows a complex relationship, being positively associated in most waves (e.g., 0.105, $p < 0.01$ in the overall model) but showing a negative coefficient in Wave 4 (− 0.0644, $p < 0.05$). These findings suggest that economic stability plays a crucial role in enabling individuals to prioritize environmental issues, although its effects may vary across different economic conditions.

Geographic and structural factors further illustrate evolving dynamics. Developed country status shows a positive association in early waves (e.g., 0.356, $p < 0.01$ in Wave 3), but the relationship becomes negative in later waves, such as Wave 6 (− 0.317, $p < 0.01$). The shift from a positive to a negative relationship for developed country status reflects the dynamic nature of environmental consciousness. It highlights that environmental awareness and activism are not static and can be influenced by changing socio-economic, political, and cultural factors. The focus on global challenges and the rise of environmental awareness in developing nations may explain this transition, emphasizing the importance of inclusive and adaptive environmental policies that address both developed and developing contexts.

Ethnic diversity consistently shows a negative association with environmental consciousness, with significant coefficients across all models, such as − 0.000386 ($p < 0.01$) in the overall model. This suggests that cultural heterogeneity may complicate collective environmental engagement, emphasizing the need for culturally inclusive strategies in environmental advocacy.

Table 4 Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) Environmental consciousness	1.000																	
	–																	
(2) Gender	−0.013***	1.000																
	(0.000)	–																
(3) Age	−0.009***	0.000	1.000															
	(0.000)	(0.976)	–															
(4) Marital status	−0.007***	0.026***	0.254***	1.000														
	(0.000)	(0.000)	(0.000)	–														
(5) Ethnic group	−0.060***	0.001	−0.010***	−0.027***	1.000													
	(0.000)	(0.481)	(0.000)	(0.000)	–													
(6) Urban habitat	0.020***	−0.008***	0.062***	−0.100***	−0.026***	1.000												
	(0.000)	(0.007)	(0.000)	(0.000)	(0.000)	–												
(7) Country	−0.036***	0.014***	−0.055***	0.170***	−0.055***	−0.181***	1.000											
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–											
(8) Developed country	0.021***	−0.014***	0.215***	−0.017***	0.003***	0.116***	−0.246***	1.000										
	(0.000)	(0.000)	(0.000)	(0.000)	(0.137)	(0.000)	(0.000)	–										
(9) Education level	0.072***	0.050***	−0.193***	−0.081***	0.001***	0.224***	−0.031***	0.100***	1.000									
	(0.000)	(0.000)	(0.000)	(0.000)	(0.627)	(0.000)	(0.000)	(0.000)	–									
(10) Employment status	0.037***	0.230***	−0.132***	0.079***	−0.023***	0.013***	0.020***	0.015***	0.163***	1.000								
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–								
(11) Social class	0.044***	0.006***	−0.051***	0.025***	−0.033***	0.135***	0.024***	0.082***	0.328***	0.084***	1.000							
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–							
(12) Income level	0.030***	0.033***	−0.081***	0.051***	0.037***	0.087***	0.029***	0.061***	0.262***	0.146***	0.418***	1.000						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–						
(13) Financial satisfaction	0.065***	0.011***	0.002	0.021***	−0.005***	0.028***	−0.005***	0.079***	0.122***	0.057***	0.297***	0.316***	1.000					
	(0.000)	(0.000)	(0.192)	(0.000)	(0.003)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–					
(14) Income equality perception	0.002	−0.015***	0.041***	−0.016***	−0.044***	0.007***	−0.048***	0.073***	−0.062***	−0.035***	−0.069***	−0.082***	−0.081***	1.000				
	(0.178)	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–				
(15) Member of environmental org	0.030***	0.031***	−0.044***	−0.012***	0.008***	−0.033***	0.041***	−0.039***	0.051***	0.034***	0.060***	0.043***	0.045***	−0.021***	1.000			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–			

Table 4 (continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(16) Confidence on envir. movement	0.124***	−0.023***	−0.019***	0.000	−0.025***	−0.026***	0.049***	−0.013***	0.023***	0.008***	0.030***	0.029***	0.069***	−0.003**	0.069***	1.000		
	(0.000)	(0.000)	(0.000)	(0.787)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.040)	(0.000)	–		
(17) Religious person	−0.030***	−0.082***	0.006***	0.046***	0.052***	−0.133***	−0.041***	−0.171***	−0.097***	−0.091***	−0.032***	−0.052***	−0.038***	−0.025***	0.021***	−0.006***	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	–	
(18) Religious group	−0.044***	−0.005***	−0.054***	0.116***	0.028***	−0.157***	0.421***	−0.254***	−0.086***	−0.043***	0.017***	−0.012***	−0.019***	−0.033***	0.028***	−0.011***	0.229***	1.000
	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	–
VIF	—	1.05	1.20	1.16	1.01	—	1.35	1.21	1.22	1.10	1.34	1.31	1.15	1.03	1.01	1.02	1.11	1.31

Significance in parentheses, *** $p < 0.01$, ** $p < 0.05$, Mean VIF = 1.16

Table 5 Results of the logistic regression models for different time periods – DV: Environmental consciousness

Models/Variables	Model (1) Overall	Model (2) Wave 3 1995–1998	Model (3) Wave 4 1999–2004	Model (4) Wave 5 2005–2009	Model (5) Wave 6 2010–2014	Model (6) **Wave 7** **2017–2022**
Gender	−0.0895***	−0.0779***	0.0318	−0.120***	−0.0710***	−0.0708***
	(0.00980)	(0.0283)	(0.0271)	(0.0224)	(0.0176)	(0.0162)
Age	0.00780***	−0.00897*	0.00220	0.00869**	0.0115***	0.00459
	(0.00180)	(0.00541)	(0.00508)	(0.00409)	(0.00318)	(0.00299)
Age_sq	−0.0000728***	0.0000525	−0. 0000451	−0.000074*	−0.0000906***	−0.0000545*
	(0.0000193)	(0.0000592)	(0.0000558)	(0.0000442)	(0.0000342)	(0.000032)
Marital status	−0.0165	−0.0176	0.0904***	0.0642**	0.0253	−0.0988***
	(0.0108)	(0.0314)	(0.0303)	(0.0251)	(0.0195)	(0.0179)
Ethnicity	−0.000386***	−0.000436***	−0.000120**	−0.000507***	−0.000407***	−0.000445***
	(0.0000179)	(0.0000513)	(0.000049)	(0.0000408)	(0.000034)	(0.0000309)
Urban habitat	–	–	–	–	–	−0.0519***
	–	–	–	–	–	(0.0177)
Country	−0.000594***	−0.00748***	−0.00567***	−0.00509***	0.00268***	−0.000157
	(0.000157)	(0.000521)	(0.000451)	(0.000395)	(0.000300)	(0.000257)
Developed country	−0.0698***	0.356***	0.269***	0.0642**	−0.317***	−0.115***
	(0.0126)	(0.0325)	(0.0438)	(0.0278)	(0.0239)	(0.0230)
Education level	0.162***	0.198***	0.111***	0.171***	0.117***	0.230***
	(0.00725)	(0.0235)	(0.0169)	(0.0181)	(0.0140)	(0.0110)
Employment status	0.105***	0.0841***	−0.0644**	0.218***	0.0774***	0.0391**
	(0.0108)	(0.0313)	(0.0288)	(0.0247)	(0.0191)	(0.0181)
Subjective social class	0.0159***	0.0450***	−0.000302	0.00430	0.0556***	−0.0113
	(0.00557)	(0.0162)	(0.0143)	(0.0130)	(0.00983)	(0.00941)
Subjective income level	−0.0402***	0.00979	0.0505**	−0.00769	−0.0621***	−0.104***
	(0.00905)	(0.0218)	(0.0219)	(0.0208)	(0.0168)	(0.0161)
Financial satisfaction	0.0426***	0.0441***	0.0291***	0.0175***	0.0519***	0.0396***
	(0.00205)	(0.00542)	(0.00504)	(0.00498)	(0.00369)	(0.00345)
Perception of income equality	0.0781***	−0.0284	−0.0410	0.0233	0.192***	0.128***
	(0.00975)	(0.0278)	(0.0265)	(0.0226)	(0.0174)	(0.0166)
Membership of environmental organization	0.102***	−0.00569	–	0.119***	0.132***	0.137***
	(0.0138)	(0.0348)	–	(0.0324)	(0.0277)	(0.0221)
Confidence on environmental protection movement	0.489***	0.494***	0.387***	0.449***	0.523***	0.475***
	(0.00974)	(0.0279)	(0.0262)	(0.0222)	(0.0175)	(0.0163)
Religious person	−0.0892***	0.101***	−0.0989***	−0.0341	−0.190***	−0.0481***
	(0.0108)	(0.0324)	(0.0336)	(0.0250)	(0.0198)	(0.0177)

Table 5 (continued)

Models/Variables	Model (1) Overall	Model (2) Wave 3 1995–1998	Model (3) Wave 4 1999–2004	Model (4) Wave 5 2005–2009	Model (5) Wave 6 2010–2014	Model (6) **Wave 7** **2017–2022**
Religious denominations—major groups	−0.0165***	−0.0341***	−0.0146***	0.00286	−0.0127***	−0.0300***
	(0.00218)	(0.00762)	(0.00561)	(0.00482)	(0.00393)	(0.00355)
Constant	−0.514***	−0.308**	−0.199	−0.260**	−0.953***	−0.113
	(0.0449)	(0.128)	(0.124)	(0.103)	(0.0808)	(0.0766)
Observations	184,370	22,642	25,734	35,477	57,353	68,884
LR chi2	5261.35***	1046.67***	801.83***	1253.00***	2252.07***	2155.99***

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6 presents the logistic regression results for environmental consciousness, segmented by gender (Models 1 and 2), geography (urban and rural, Models 3 and 4), and religiosity (religious and non-religious, Models 5 and 6). The findings provide detailed insights into how demographic, geographic, and religious contexts influence environmental attitudes. The results for males (Model 1) and females (Model 2) reveal notable differences in predictors of environmental consciousness. Education emerges as a significant positive predictor for both genders, with a higher coefficient for females (0.192, $p < 0.01$) compared to males (0.131, $p < 0.01$). This suggests that educational attainment has a stronger influence on women's environmental consciousness, potentially due to greater receptivity to environmental messaging among women. Financial satisfaction also positively predicts environmental attitudes for both genders but is slightly more influential for males (0.0472, $p < 0.01$) than females (0.0384, $p < 0.01$). Interestingly, subjective social class shows no significant effect for males but has a positive association for females (0.0258, $p < 0.01$), indicating that women's perceptions of their social standing might play a role in shaping their environmental engagement. Age and its squared term display a non-linear effect for both genders. While age positively correlates with environmental consciousness (males: 0.0108, $p < 0.01$; females: 0.00604, $p < 0.05$), the squared term is negative, signifying diminishing returns of age on environmental attitudes beyond a certain threshold. This reflects generational differences, where younger and middle-aged individuals are more actively engaged with environmental issues compared to older populations.

Models 3 (urban) and 4 (rural) highlight the influence of geography on environmental consciousness. Education is a strong positive predictor in both urban (0.268, $p < 0.01$) and rural (0.177, $p < 0.01$) settings, though its effect is more pronounced in urban areas. This finding underscores the role of urban environments in fostering access to information and networks that support pro-environmental behaviors. Confidence in environmental protection movements is the most influential predictor in both contexts, with a higher coefficient in urban areas (0.531, $p < 0.01$) compared to rural ones (0.312, $p < 0.01$). This reflects the institutional advantage of urban areas, where such movements may be more visible and accessible. Interestingly, marital status has a significant negative effect in rural areas (-0.128, $p < 0.01$), suggesting that married individuals in rural contexts may prioritize immediate familial or economic concerns over environmental issues. In contrast, the effect is weaker in urban areas. Subjective income level shows a stronger negative relationship in rural areas (− 0.151, $p < 0.01$) than in urban areas (− 0.0902, $p < 0.01$), reflecting the economic challenges in rural contexts that may limit environmental engagement.

Models 5 (religious) and 6 (non-religious) demonstrate stark contrasts in how religiosity influences environmental consciousness. Among religious individuals, education (0.133, $p < 0.01$) and confidence in environmental movements (0.434, $p < 0.01$) remain strong positive predictors. However, religiosity itself has a small but significant negative effect (− 0.0554, $p < 0.01$), suggesting that adherence to religious values may sometimes compete with environmental priorities. This could reflect theological perspectives or value systems that prioritize other social or spiritual concerns over environmental engagement. For non-religious individuals, confidence in environmental movements exhibits an even stronger influence (0.603, $p < 0.01$), and education (0.227, $p < 0.01$) remains a robust predictor. Notably, subjective social class has a negative effect among non-religious respondents (− 0.0294, $p < 0.01$), contrasting with its positive effect for religious individuals (0.0318, $p < 0.01$). This suggests that perceptions of social standing may operate differently depending on one's religious orientation.

In addition, ethnicity consistently shows a negative association across all models, with coefficients such as -0.000347 ($p < 0.01$) for males, − 0.000421 ($p < 0.01$) for females, and − 0.000479 ($p < 0.01$) in urban areas. This indicates that cultural diversity may pose challenges to unified environmental engagement, likely due to varying cultural priorities and value systems. Developed country status also shows a consistently negative relationship, with stronger effects in rural contexts (− 0.204, $p < 0.01$) compared to urban ones (− 0.0988, $p < 0.01$). This reflects a broader trend where developed countries may experience reduced public urgency around environmental issues compared to emerging economies where environmental advocacy is gaining momentum.

Table 7 presents the logistic regression results analyzing environmental consciousness across various religious denominations. By examining the predictors within specific religious groups, the table highlights both universal and religion-specific drivers of environmental consciousness, offering nuanced insights into how religious affiliation intersects with demographic and socio-economic factors. The direct effect of being a religious person varies significantly across denominations. For Hindus (Model 7) and Buddhists (Model 8), religiosity is strongly and positively associated with environmental consciousness, with coefficients of 0.466 ($p < 0.01$) and 0.273 ($p < 0.01$), respectively. These findings suggest that doctrinal teachings in these traditions, which often emphasize harmony with nature, align closely with environmental values. Conversely, for Protestants (Model 3) and Other Christians (Model 9), religiosity has significant negative coefficients (− 0.108, $p < 0.01$, and -0.469, $p < 0.01$, respectively), indicating potential theological or institutional

Table 6 Results of the logistic regression models for gender, geography and religiosity – DV: Environmental consciousness

Models/Variables	Model (1) Male	Model (2) Female	Model (3) Urban	Model (4) Rural	Model (5) Religious	Model (6) **Non-Religious**
Gender	–	–	-0.0559***	-0.104***	-0.0657***	-0.143***
	–	–	(0.0197)	(0.0274)	(0.0119)	(0.0174)
Age	0.0108***	0.00604**	0.00272	0.0102**	0.0106***	0.00113
	(0.00263)	(0.00247)	(0.00360)	(0.00517)	(0.00214)	(0.00332)
Age_sq	−9.78e−05***	−5.98e−05**	−4.55e−05	−8.85e−05	−9.68e−05***	−1.15e−05
	(2.82e−05)	(2.68e−05)	(3.84e−05)	(5.66e−05)	(2.30e−05)	(3.60e−05)
Marital status	−0.0176	−0.0212	−0.0921***	−0.128***	0.00233	−0.0584***
	(0.0164)	(0.0148)	(0.0215)	(0.0311)	(0.0131)	(0.0195)
Ethnicity	−0.000347***	−0.000421***	−0.000479***	−0.000335***	−0.000426***	−0.000288***
	(2.57e−05)	(2.49e−05)	(3.73e−05)	(5.48e−05)	(2.20e−05)	(3.15e−05)
Country	−0.000362	−0.000817***	−0.000976***	0.00170***	−0.000439**	−0.000962***
	(0.000226)	(0.000220)	(0.000298)	(0.000491)	(0.000201)	(0.000260)
Developed country	−0.0679***	−0.0719***	−0.0988***	−0.204***	−0.0614***	−0.0900***
	(0.0181)	(0.0175)	(0.0265)	(0.0460)	(0.0160)	(0.0206)
Education level	0.131***	0.192***	0.268***	0.177***	0.133***	0.227***
	(0.0103)	(0.0102)	(0.0134)	(0.0189)	(0.00874)	(0.0130)
Employment status	0.0990***	0.0995***	−0.0103	0.118***	0.105***	0.107***
	(0.0166)	(0.0145)	(0.0223)	(0.0298)	(0.0129)	(0.0199)
Subjective social class	0.00535	0.0258***	−0.0108	0.0106	0.0318***	−0.0294***
	(0.00800)	(0.00775)	(0.0118)	(0.0149)	(0.00656)	(0.0105)
Subjective income level	−0.0410***	−0.0373***	−0.0902***	−0.151***	−0.0461***	−0.0236
	(0.0129)	(0.0127)	(0.0199)	(0.0255)	(0.0108)	(0.0167)
Financial satisfaction	0.0472***	0.0384***	0.0458***	0.0314***	0.0390***	0.0529***
	(0.00294)	(0.00286)	(0.00438)	(0.00534)	(0.00240)	(0.00394)
Income equality perception	0.0861***	0.0698***	0.172***	0.0357	0.0503***	0.129***
	(0.0139)	(0.0137)	(0.0204)	(0.0277)	(0.0118)	(0.0175)
Membership of environmental organization	0.0889***	0.114***	0.102***	0.134***	0.0888***	0.140***
	(0.0191)	(0.0199)	(0.0277)	(0.0350)	(0.0163)	(0.0258)
Confidence on environmental protection movement	0.509***	0.469***	0.531***	0.312***	0.434***	0.603***
	(0.0139)	(0.0137)	(0.0196)	(0.0278)	(0.0118)	(0.0174)
Religious person	−0.0554***	−0.127***	−0.0486**	−0.0748**	–	–
	(0.0150)	(0.0155)	(0.0211)	(0.0315)	–	–
Religious denominations—major group	−0.0175***	−0.0156***	−0.0176***	−0.0574***	−0.0123***	–
	(0.00310)	(0.00306)	(0.00422)	(0.00650)	(0.00288)	–

Table 6 (continued)

Models/Variables	Model (1) Male	Model (2) Female	Model (3) Urban	Model (4) Rural	Model (5) Religious	Model (6) **Non-Religious**
Constant	−0.666***	−0.461***	−0.248***	−0.0442	−0.610***	−0.501***
	(0.0637)	(0.0623)	(0.0921)	(0.128)	(0.0524)	(0.0808)
Observations	90,026	94,344	46,814	24,291	124,840	59,530
LR chi2	2470.12	2816.19	1790.66	510.94	2859.02	2404.21

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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Table 7 Results of the logistic regression models for – DV: Environmental consciousness

Models/Variables	Model (1) No Religion	Model (2) Roman Catholic	Model (3) Protestant	Model (4) Orthodox	Model (5) Jew	Model (6) Muslim	Model (7) Hindu	Model (8) Buddhist	Model (9) Other Christian	Model (10) Other Religions
Religious person	–	0.0168	−0.108***	0.0497	0.0714	−0.0238	0.466***	0.273***	−0.469***	−0.298***
	–	(0.0267)	(0.0351)	(0.0377)	(0.215)	(0.0272)	(0.0782)	(0.0446)	(0.101)	(0.0603)
Gender	−0.136***	−0.0684***	−0.0962***	−0.0849***	−0.0529	−0.110***	−0.0882	0.0639	−0.111	−0.118**
	(0.0222)	(0.0213)	(0.0268)	(0.0300)	(0.203)	(0.0218)	(0.0631)	(0.0433)	(0.0796)	(0.0552)
Age	0.00832**	0.00385	0.00625	−0.000921	0.0441	0.00259	0.000577	0.0113	0.0296**	−0.0114
	(0.00416)	(0.00373)	(0.00468)	(0.00544)	(0.0367)	(0.00449)	(0.0121)	(0.00870)	(0.0132)	(0.00987)
Age_sq	−9.07e−05**	−4.48e−05	−6.56e−05	3.05e−05	−0.000400	1.20e−06	1.47e−05	−0.000154*	−0.000308**	7.92e−05
	(4.49e−05)	(3.97e−05)	(4.99e−05)	(5.75e−05)	(0.000374)	(5.11e−05)	(0.000134)	(9.23e−05)	(0.000141)	(0.000104)
Marital status	−0.0833***	0.0269	0.00828	0.0676**	−0.217	−0.0719***	0.0242	−0.0621	0.0304	0.0869
	(0.0247)	(0.0227)	(0.0291)	(0.0320)	(0.221)	(0.0257)	(0.0791)	(0.0498)	(0.0891)	(0.0620)
Ethnicity	−0.000385***	−0.000541***	−0.000799***	−7.72e−05	−0.000105	−0.000138***	−0.000233	−4.07e−05	0.000174	−0.000517***
	(4.02e−05)	(3.73e−05)	(4.82e−05)	(5.55e−05)	(0.000353)	(4.82e−05)	(0.000215)	(8.85e−05)	(0.000162)	(9.66e−05)
Country	−0.00139***	−0.00171***	−0.00167***	−0.00736***	0.00401	0.0101***	−0.000370	−0.00647***	0.00266***	−0.00242**
	(0.000323)	(0.000328)	(0.000406)	(0.00131)	(0.00325)	(0.000653)	(0.00169)	(0.00181)	(0.00101)	(0.00101)
Developed country	−0.119***	−0.215***	0.254***	−0.123***	0.256	0.274***	0.0531	−0.0309	−0.0244	−0.0738
	(0.0251)	(0.0248)	(0.0338)	(0.0336)	(0.270)	(0.0611)	(0.219)	(0.0929)	(0.121)	(0.0980)
Education level	0.219***	0.187***	0.146***	0.211***	0.183	0.119***	0.0280	0.144***	0.190***	0.140***
	(0.0171)	(0.0161)	(0.0213)	(0.0243)	(0.171)	(0.0150)	(0.0456)	(0.0307)	(0.0561)	(0.0440)
Employment status	0.101***	0.0933***	0.124***	0.0798**	−0.0807	0.129***	−0.109*	0.0401	0.136	0.0811
	(0.0256)	(0.0233)	(0.0296)	(0.0337)	(0.236)	(0.0230)	(0.0657)	(0.0520)	(0.0848)	(0.0603)
Subjective social class	0.0324**	0.0309***	0.0412***	0.0579***	−0.326***	−0.0124	−0.0142	−0.0648**	0.0336	−0.0361
	(0.0137)	(0.0119)	(0.0148)	(0.0175)	(0.121)	(0.0118)	(0.0326)	(0.0264)	(0.0454)	(0.0332)
Subjective income class	−0.0303	−0.0156	−0.0106	−0.159***	0.151	−0.0768***	−0.0511	0.00788	0.0677	0.115**
	(0.0213)	(0.0191)	(0.0244)	(0.0273)	(0.189)	(0.0201)	(0.0524)	(0.0414)	(0.0730)	(0.0557)
Financial satisfaction	0.0493***	0.0303***	0.0298***	0.0372***	0.0753*	0.0224***	0.0608***	0.0337***	0.105***	0.0322***
	(0.00496)	(0.00432)	(0.00556)	(0.00658)	(0.0444)	(0.00441)	(0.0130)	(0.0104)	(0.0156)	(0.0125)
Income equality perception	0.186***	0.0318	0.0709***	0.0593**	0.270	0.0145	0.228***	0.0375	−0.213***	0.0728
	(0.0224)	(0.0210)	(0.0272)	(0.0295)	(0.205)	(0.0211)	(0.0618)	(0.0448)	(0.0803)	(0.0560)
Membership of environmental organization	0.263***	0.00932	0.184***	−0.157***	0.914***	0.109***	0.0118	0.234***	0.437***	0.130*
	(0.0353)	(0.0295)	(0.0342)	(0.0483)	(0.263)	(0.0306)	(0.0735)	(0.0578)	(0.109)	(0.0729)
Confidence on environmental protection movement	0.667***	0.450***	0.528***	0.378***	1.028***	0.395***	0.320***	0.122***	0.471***	0.763***
	(0.0225)	(0.0211)	(0.0270)	(0.0291)	(0.210)	(0.0210)	(0.0627)	(0.0448)	(0.0810)	(0.0569)
Constant	−0.709***	−0.335***	−0.589***	−0.304*	−1.955*	−1.102***	−0.464	0.119	−1.628***	−0.00611
	(0.104)	(0.0958)	(0.117)	(0.158)	(1.005)	(0.113)	(0.337)	(0.285)	(0.339)	(0.263)
Observations	37,200	39,906	24,355	19,668	478	39,438	5,128	9,290	2,965	5,942

Table 7 (continued)

Models/Variables	Model (1) No Religion	Model (2) Roman Catholic	Model (3) Protestant	Model (4) Orthodox	Model (5) Jew	Model (6) Muslim	Model (7) Hindu	Model (8) Buddhist	Model (9) Other Christian	Model (10) Other Religions
LR chi2	1709.66***	1211.44***	1111.29***	430.08***	69.13***	938.69***	112.56***	151.16***	262.50***	328.32***

Standard errors in parentheses

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

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factors that deprioritize environmental concerns. This divergence highlights how religious values and practices can shape environmental attitudes in complex and sometimes contradictory ways.

Education emerges as a consistent positive predictor of environmental consciousness across all denominations, with coefficients ranging from 0.119 ($p < 0.01$) for Muslims (Model 6) to 0.219 ($p < 0.01$) for those with no religion (Model 1). This consistent effect underscores the universal role of education in fostering environmental awareness, irrespective of religious affiliation. For religious groups, education may also serve as a bridge between traditional teachings and contemporary environmental values, mitigating potential conflicts between spiritual priorities and ecological concerns.

Financial satisfaction consistently exhibits a positive relationship with environmental consciousness across denominations. The effect is strongest for Other Christians (0.105, $p < 0.01$), while remaining significant but smaller for Muslims (0.0224, $p < 0.01$) and Roman Catholics (0.0303, $p < 0.01$). This finding highlights the importance of perceived economic stability in enabling pro-environmental behaviors across diverse religious contexts. Employment status, on the other hand, shows mixed effects; for example, it positively predicts environmental consciousness among Muslims (0.129, $p < 0.01$) but has a negative relationship for Hindus (− 0.109, $p < 0.10$).

Developed country status shows significant variation across denominations. For Muslims and Protestants, the coefficients are positive and significant (0.274, $p < 0.01$, and 0.254, $p < 0.01$, respectively), indicating that developed contexts may amplify environmental awareness within these groups. Conversely, for Roman Catholics and Orthodox Christians, developed country status has significant negative associations (− 0.215, $p < 0.01$, and − 0.123, $p < 0.01$, respectively). These results suggest that the relationship between national development and environmental consciousness is mediated by cultural and institutional factors unique to each religious group.

Ethnicity generally shows a negative association with environmental consciousness, with coefficients such as − 0.000799 ($p < 0.01$) for Protestants and − 0.000541 ($p < 0.01$) for Roman Catholics. Membership in environmental organizations positively predicts environmental consciousness across most groups, with particularly strong effects for Jews (0.914, $p < 0.01$) and Other Christians (0.437, $p < 0.01$). This highlights the critical role of organized environmental efforts in engaging diverse religious populations. Interestingly, for Orthodox Christians, the coefficient is negative (− 0.157, $p < 0.01$), indicating potential barriers to participation in organized environmental activities within this group.

5 Conclusion and recommendations

The study provides a comprehensive analysis of the factors influencing environmental consciousness across demographic, socio-economic, geographic, and religious dimensions from 1995 to 2022. The findings underscore that environmental consciousness is a multifaceted construct shaped by education, institutional trust, economic stability, and cultural contexts. Education emerges as a consistent and strong predictor, highlighting the critical role of knowledge in fostering environmental awareness. Confidence in environmental protection movements also consistently exerts the most substantial influence, emphasizing the importance of institutional trust and advocacy.

Gender differences reveal that women are generally more likely to exhibit environmental consciousness, possibly due to their value systems prioritizing care and sustainability. The non-linear effect of age suggests generational variations in environmental awareness, with younger and middle-aged individuals demonstrating greater engagement. Religiosity shows a complex and evolving relationship with environmental consciousness, varying significantly across denominations. While some traditions, like Buddhism and Hinduism, exhibit positive alignments, others, such as certain Protestant and Christian groups, show negative associations, reflecting theological or institutional barriers.

Economic factors, including financial satisfaction and employment, play nuanced roles in shaping pro-environmental attitudes. Economic stability generally fosters environmental engagement, though its influence varies between urban and rural contexts. Geographic factors highlight the disparity between urban and rural settings, with urban areas benefiting from better access to environmental information and movements. Developed country status, which initially showed a positive relationship, turned negative in later periods, reflecting shifting dynamics as environmental advocacy rises in developing regions. Cultural diversity, as measured by ethnic heterogeneity, poses challenges for collective environmental action, emphasizing the need for inclusive approaches.

The findings provide clear, evidence-based guidance for policy design. Firstly, given that confidence in environmental movements is the strongest predictor, public institutions should transition from merely regulating to actively partnering with and funding credible environmental organizations. This involves creating formal channels for their input in policy-making and publicly endorsing their scientifically-backed initiatives to build societal trust. Secondly, the power of education necessitates a systemic integration of sustainability into national curricula at all levels, moving beyond theory

to include practical, community-based environmental projects. Thirdly, the negative association between religiosity and environmental consciousness in certain denominations calls for a proactive strategy of engaging religious leaders and theologians to reframe environmental stewardship within their doctrinal contexts, transforming potential barriers into powerful allies.

For practitioners, these results advocate for a segmented and culturally intelligent approach. Environmental campaigns must be tailored: leveraging women's higher engagement as community ambassadors while designing messaging for men that aligns environmental action with technological innovation and economic opportunity. In rural and developing regions, strategies should focus on demonstrating the immediate, tangible benefits of sustainable practices for livelihoods and health, delivered through trusted local figures. The shift in environmental advocacy momentum to developing nations demands that international frameworks, prioritize direct funding and capacity-building for grassroots organizations in these regions. Ultimately, advancing global sustainability requires moving beyond one-size-fits-all solutions to embrace strategies that are as diverse and interconnected as the drivers of environmental consciousness itself.

This study has some limitations. Environmental consciousness is measured using self-reported survey responses, so social desirability and cross-cultural differences in answering may affect comparability. The WVS is repeated cross-sectional, not a true panel, so the analysis identifies associations rather than causal effects at the individual level. Some constructs are captured with single-item measures, and several variables are not available uniformly across all waves, which can affect stability across periods. In addition, pooling many countries may mask unobserved institutional and contextual influences, and changes in country participation over time can introduce aggregation bias. Future research can extend this work by testing nonlinearities and interaction effects more explicitly (e.g., threshold patterns and moderation by religiosity or development level). It can also apply multilevel or fixed-effects approaches and incorporate country-year macro indicators to examine lagged dynamics and growth–values trade-offs. Finally, improving measurement with multi-item indices and cross-cultural invariance checks, and complementing the global analysis with focused country or denominational case studies, would help clarify mechanisms behind the observed patterns.

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Data availability Supplementary file contains the data source link and the Stata script.

Declarations

Ethics, consent to participate, and consent to publish declarations Not applicable.

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