

Awareness and Attitudes Toward Green Library Practices: Implications for Sustainability Integration in Academic Libraries

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Abstract:

As climate change intensifies, academic libraries are expected to model and advance sustainability, yet librarians' readiness to do so is not well understood. This study reports findings from a survey of 108 academic librarians in the United States examining their awareness and perceptions of green library initiatives. Using an exploratory factor analysis, the survey instrument was found to assess two distinct constructs: awareness of green technologies, systems, and theoretical frameworks, and perceptions of libraries' role in environmental sustainability. Results reveal strong support among librarians for sustainability values, including the view that libraries should serve as environmental role models and promote green information literacy, but reveal comparatively limited familiarity with green ICT, energy conservation programs, and the conceptual frameworks underlying green librarianship. No statistically significant differences in awareness or perceptions were found across demographic groups. We discuss implications for professional development, LIS education, and institutional planning, offering a transferable framework to help build climate-informed, sustainable academic libraries.

Keywords: green librarianship; sustainability; academic libraries; green ICT; environmental responsibility

Introduction

Academic libraries are increasingly expected to model environmental responsibility, promote sustainable information practices, and incorporate green technologies into their operations, as they can provide students with relevant tools through workshops, seminars, and digital databases to develop sustainable environmental behavior and culture among academic groups (Ma & Shahzad, 2025). Green practices in libraries refer to environmentally conscious actions and policies, such as reducing energy consumption, minimizing waste, implementing

recycling programs, and leveraging digital technologies to reduce paper use. The practices also include decisions around building design, resource management, and sustainable service delivery (Mwanzu et al., 2023). While the literature suggests that libraries can play an important role in encouraging sustainability within their communities, less is known about how library personnel themselves perceive green initiatives or how aware they are of the technologies and theories behind sustainable librarianship. This role becomes even more significant when we consider that libraries often serve as safe havens during natural disasters: providing power, internet access, and trustworthy local information when other community resources are unavailable. In many ways, sustainable library practices are not just about environmental impact but about strengthening a library's ability to support and protect its community when it matters most. Understanding these perceptions is essential, as awareness and attitudes among library staff can influence the adoption, implementation, and success of environmentally conscious practices. This study examines academic library employees' perceptions of green library practices, their awareness of green technologies and concepts, and the degree to which demographic factors relate to these views.

Literature Review

Green Libraries and Push for Sustainable Practices

Over the last two decades, libraries have faced rising expectations to reduce their environmental footprint and model sustainable practices for their communities, which has led to a broader push toward green librarianship. This shift has been documented by authors like Aulisio (2013), who noted growing external pressure, institutional expectations, and accountability pushing libraries forward in these efforts. Solemanpharcy and Gaffar (2023) recognize this as well and argue that libraries should position themselves as catalysts for positive change, especially in promoting sustainable practices and environmental education. Much of the existing literature highlights how libraries have incorporated environmentally conscious building designs, energy-efficient technologies, and various waste-reduction strategies (Jankowska & Marcum, 2010; Antonelli, 2008). More recent research further documents how academic libraries adopt sustainable operations (i.e., energy-efficient lighting systems, recycling programs, and LEED-certified building features) to reduce environmental impact (Demirtas Dogan & Gulpinar, 2023). Jankowska and Marcum (2010) emphasize that sustainability has become a “challenge and responsibility” for academic libraries, pushing them to rethink their resource consumption, building design, and community roles.

Most existing research centers on the physical library building rather than the people who work inside it. There is far less attention on librarians themselves—their perceptions, their awareness of green concepts, and how they understand their role in sustainability efforts beyond the structural features of the facility. This gap is important because sustainable practices don't become part of the everyday culture of a library unless the individuals implementing them actually understand and value them. Recent scholarship echoes this concern, noting that the success of sustainability initiatives often depends on how well staff understand environmental goals and feel supported in putting them into practice (Ren & Lu, 2024).

Staff Awareness, Perceptions, and the Human Side of Sustainability

Although libraries have begun to make visible progress in the implementation of green buildings and environmentally friendly operations, recent research has shown that the human side of sustainability (i.e., staff awareness, attitudes, and understanding) has not gotten the same amount of attention. Several researchers point out that sustainability initiatives rely heavily on the people tasked with carrying them out (Hauke, Charney, & Sahavirta, 2018). Without broad staff buy-in, even well-designed environmental education programs can fail to take hold or can remain superficial, implemented only on paper rather than in meaningful daily practice. This pattern is supported by Ren and Lu (2024), who found that librarians widely value sustainability but often lack the training, conceptual understanding, or institutional communication needed to implement green practices effectively. Similarly, Khan (2025) emphasizes that librarians' perceptions and awareness levels significantly influence how sustainability is enacted in daily operations.

Libraries in Crises

Libraries commonly serve as “third spaces” and safe havens during natural disasters, offering electricity, internet access, clean air, and reliable information when other community resources fail (Kaland & Lokey, 2014; Young, 2018; Meislik, 2015). In this context, sustainability extends beyond an environmental goal and becomes directly tied to emergency preparedness, resilience, and continuity of service. For example, energy-efficient building systems, solar integration, sustainable HVAC infrastructure, and backup power capabilities enable libraries to remain operational during extreme weather events and power outages—conditions that are becoming more frequent due to climate change. These sustainable technologies allow libraries to continue supporting vulnerable populations when access to other services is disrupted.

Library staff play a crucial role in these moments by managing resources, assisting users, and interpreting critical information, which further underscores why their awareness of sustainable practices is essential (Suman & Peelwan, 2024). The ability of a library to protect and support its community during crises depends not only on the resilience of the physical building but also on the preparedness of employees who understand how to operate sustainable systems effectively under emergency conditions. Supporting this connection, Embree and Gilman (2020) demonstrate that academic libraries increasingly function as both sustainability and resilience hubs on campuses, linking environmental responsibility, disaster preparedness, and community well-being.

Methodology

Participants and Survey

A total of 108 academic librarians across the United States participated in this quantitative survey study (N = 108). Participants were recruited through professional library networks, academic listservs, and social media platforms relevant to academic librarianship. The survey was administered online using Qualtrics, and participation was voluntary and anonymous.

Before beginning the survey, participants were presented with an information sheet describing the purpose of the study, the voluntary nature of participation, and confidentiality protections.

The instrument consisted of seven demographic questions and eleven Likert-scale items measuring awareness and perceptions of green library practices. The demographic items included gender, highest level of education, current library role(s), institutional type (public or private), Carnegie classification, and US geographic region (Appendix A).

Following the demographic section, participants responded to 11 items on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The items assessed familiarity with green library technologies and the conceptual framework, and attitudes toward the importance of environmental sustainability in academic libraries. The items were adapted from Bincy and Vasudevan (2023) and modified to suit the context of academic library employees in the United States. Survey completion took approximately 10 minutes for most respondents. All procedures followed ethical guidelines for minimal-risk human-subjects research.

The analysis was guided by perceptions and awareness as underlying constructs. Perceptions reflected attitudinal responses toward the role of libraries in sustainability, including views on cost, institutional responsibility, and environmental leadership. Awareness was assessed using items on knowledge of green systems, energy conservation programs, green library buildings, and the relevant sustainability framework (Appendix A).

Data Screening and Analysis

Data screening procedures were conducted to ensure that the dataset was appropriate for statistical analysis. All responses were reviewed for missing values and potential outliers that would problematically influence the analysis. No responses were excluded from analysis, as all values fell within acceptable ranges based on means, standard deviations, and frequency distributions. Descriptive statistics were computed for each of the 11 Likert-scale items to provide an initial understanding of response patterns related to perceptions and awareness of green library practices. The statistical analyses were conducted with RStudio (Version 2025.09.1+401).

Reliability analysis was then performed in order to evaluate the internal consistency of the overall scale and the two subscales identified through exploratory factor analysis. Cronbach's alpha served as the primary indicator of reliability. As DeVellis (2017) notes, alpha values exceeding .80 are generally considered strong indicators of reliability, accounting for variability in how individuals interpret survey items.

An exploratory factor analysis (EFA) was conducted to identify the latent structure of the 11 Likert-scale items. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity confirmed the suitability of the dataset for factor analysis. Multiple decision criteria, including the eigenvalues-greater-than-one rule, inspection of the scree plot, and parallel analysis, consistently supported a two-factor solution. These two latent constructs were conceptually aligned with respondents' awareness of green library concepts and their perceptions of libraries' role in sustainability.

To evaluate the validity of the instrument, known-groups comparisons were conducted using demographic variables. ANOVAs were used for multiple-level demographic variables (e.g., role, region, education level), while independent-samples t-tests were used for two-level variables, such as gender. Although the original analysis plan included follow-up post-hoc tests for significant findings, no statistically significant differences were observed across any demographic categories, so post-hoc comparisons were unnecessary. This validity testing provided evidence that perceptions and awareness of green library practices were relatively stable across demographic groups, reinforcing the factor structure and reliability of the instrument.

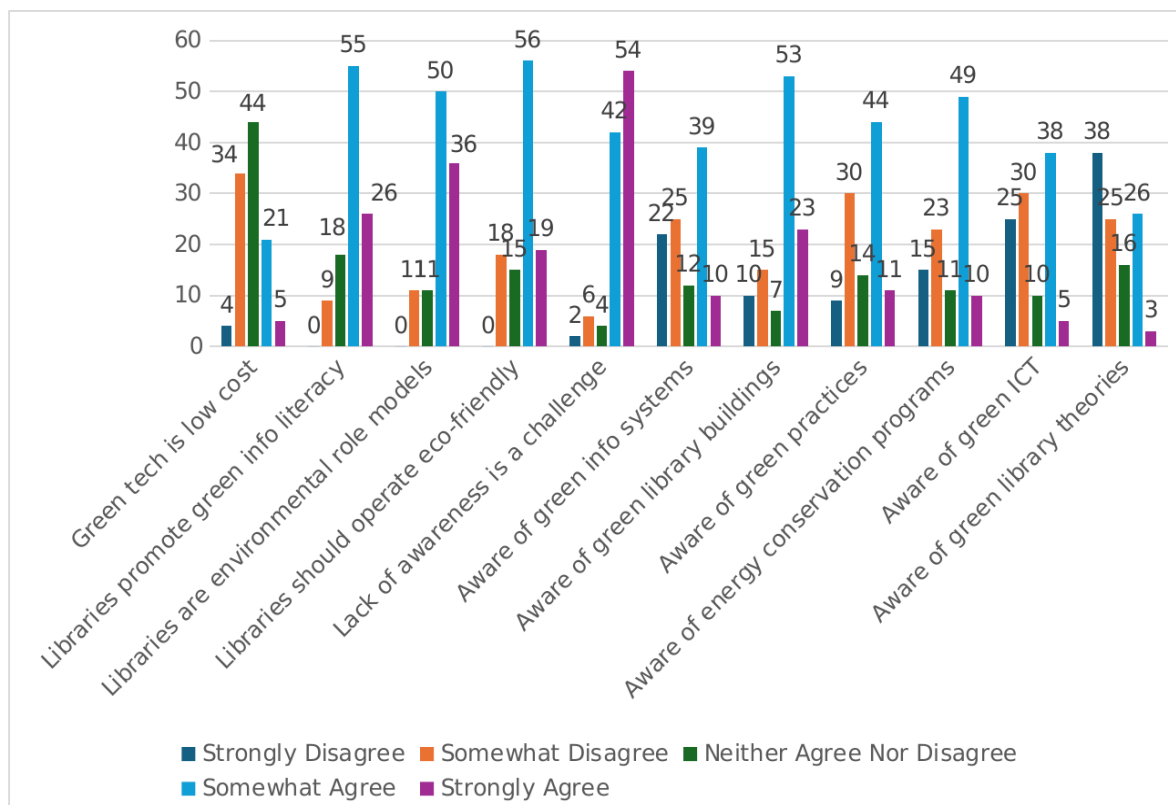
Results

Participant Responses

Analysis of participant responses revealed strong support among librarians for their role in the environment. The majority of respondents agreed that lack of awareness presents a challenge for green practice adoption, with 42 agreeing and 54 strongly agreeing. Similarly, high endorsement was found for the statement that libraries should serve as environmental role models (50 agree, 36 strongly agree), and promote green information literacy (81 agree or strongly agree).

In contrast, awareness-focused items revealed substantial knowledge gaps. Participants reported lower familiarity with green library theories, with 38 respondents strongly disagreeing and 25 disagreeing. Awareness of green ICT tools and energy conservation programs also trended lower. Opinions regarding the cost of green technology were mixed, with the largest proportion of respondents selecting “neutral” (34 participants). These patterns demonstrate a notable divide between perceptions of the importance of sustainability and actual awareness of related concepts, practices, and systems. Figure 1 shows the frequency distributions for each of the 11 Likert-scale items.

Figure 1
Frequency Analysis



Reliability Analysis

Internal consistency was assessed with Cronbach's alpha. The overall scale showed strong reliability ($\alpha = .878$). Each item contributed positively to the scale's internal consistency, with raw item alpha values ranging from .853 to .892 (Table 1).

Table 1
Reliability Analysis

Likert Scale Items	Raw Alpha
Overall	.878
Green tech is low cost	.879
Libraries promote green info literacy	.874
Libraries are environmental role models	.866
Libraries should operate eco-friendly	.873
Lack of awareness is a challenge	.892
Aware of green info systems	.855
Aware of green library buildings	.866
Aware of green practices	.853

Aware of energy conservation programs	.858
Aware of green ICT	.853
Aware of green library theories	.857

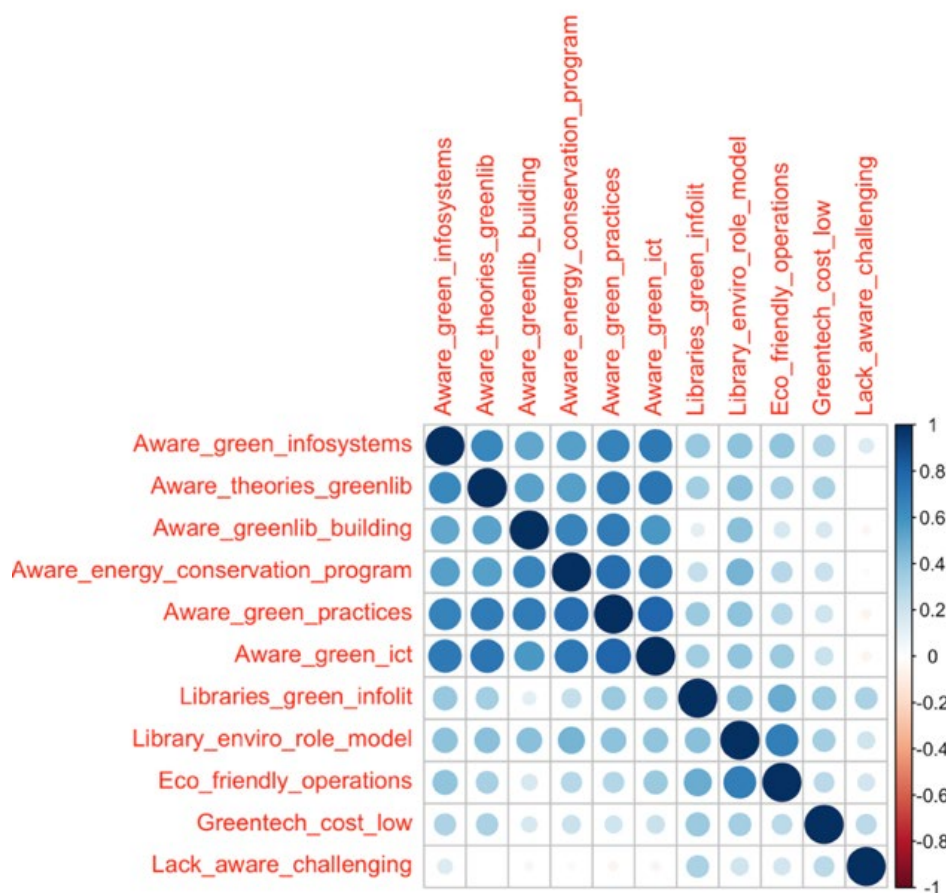
Following the identification of the subscales through factor analysis, additional reliability testing was conducted. The Awareness subscale demonstrated excellent internal consistency with an alpha of .917, while the Perceptions subscale displayed acceptable reliability at .731. Since all items were positively worded, no reverse coding was necessary. These reliability outcomes indicate that both subscales represent stable and coherent constructs suitable for further interpretation.

Correlation Analysis

The correlation matrix, in Figure 2, shows generally positive relationships among the eleven items. Stronger correlations appear among items related to environmental awareness and green library practices, which indicates conceptual alignment within these clusters. The hierarchical clustering further highlights item groupings that may represent related constructs for subsequent factor analysis.

Figure 2

Correlation Matrix



Scree Plot

Figure 3 presents the scree plot used to determine the appropriate number of factors to retain in the exploratory factor analysis. The plot displayed a clear “elbow” after the second component, suggesting a two-factor solution. The visual indication was supported by the parallel analysis (Figure 4), which showed that only the first two components had eigenvalues exceeding those generated from randomly simulated data, further reinforcing the two-factor solution.

Figure 3

Scree Plot

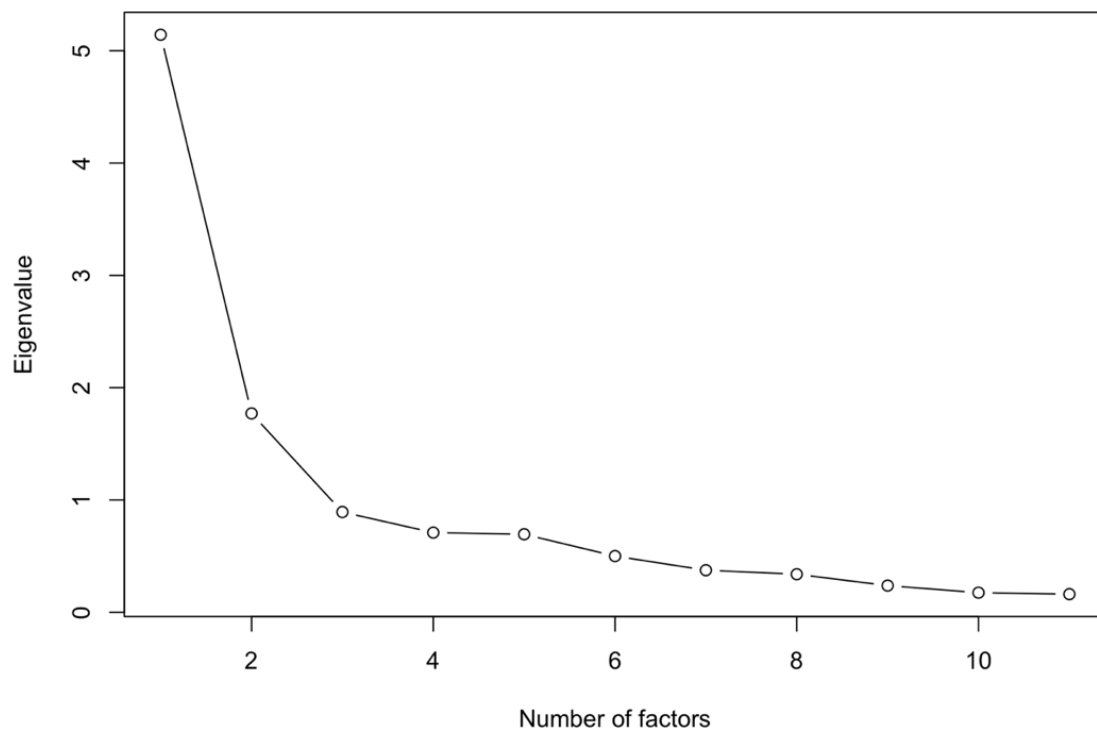
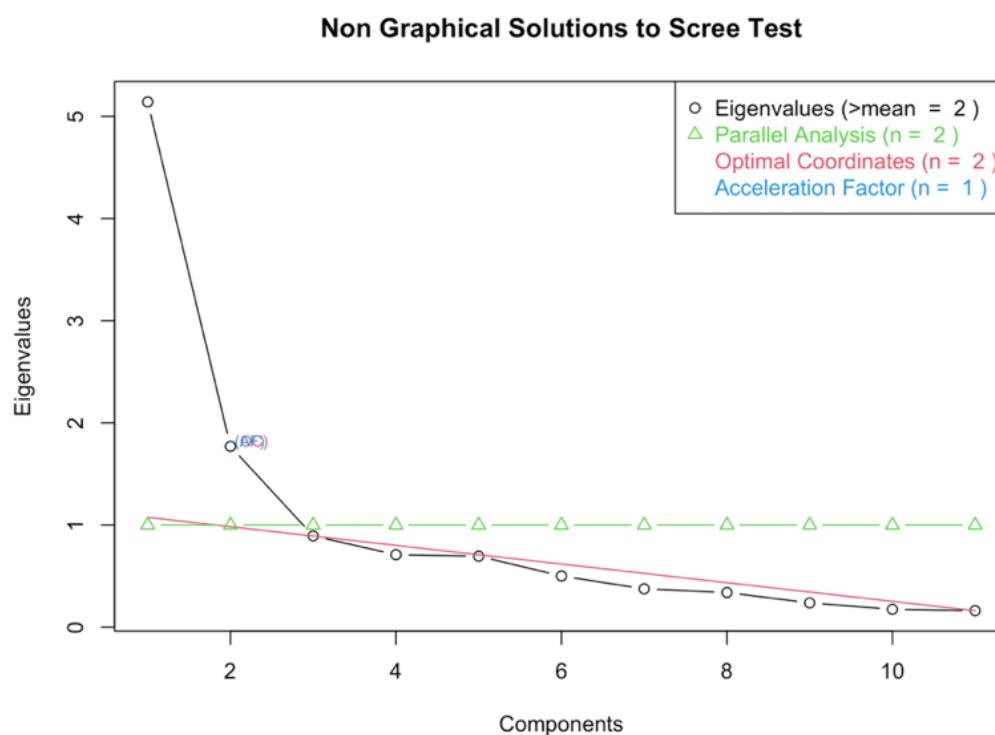


Figure 4
Parallel Analysis



Factor Extraction

The two retained factors accounted for a cumulative 63% of the total variance in the dataset. The first component (RC1) accounts for 40%, and RC2 accounts for an additional 23% (Table 2).

Table 2
Factor Extraction Table

	RC1	RC2
SS loadings	4.41	2.50
Proportion Var	0.40	0.23
Cumulative Var	0.40	0.63
Proportion Explained	0.64	0.63
Cumulative Proportion	0.64	1.00

Rotated Factor Matrix

The rotated factor analysis revealed two meaningful factors, which are RC1 (Awareness) and RC2 (Perceptions). RC1 included items related to knowledge of green practices, green ICT, energy conservation programs, library building design, sustainability theories, and green information systems. RC2 included items related to the perceived importance of

sustainability, the role of libraries as environmental leaders, cost beliefs, and commitment to eco-friendly operations.

Two items in the rotated component matrix exhibited cross-loadings on both factors (Table 3). The item assessing awareness of green information systems and their potential benefits loaded at 0.73 on RC1 and 0.35 on RC2. Similarly, the item on the perceived role of libraries as a role model loaded at 0.42 on RC1 and 0.65 on RC2. Despite these cross-loadings, each item showed substantially higher loadings on its conceptually aligned factor, supporting retention within its primary construct.

Table 3

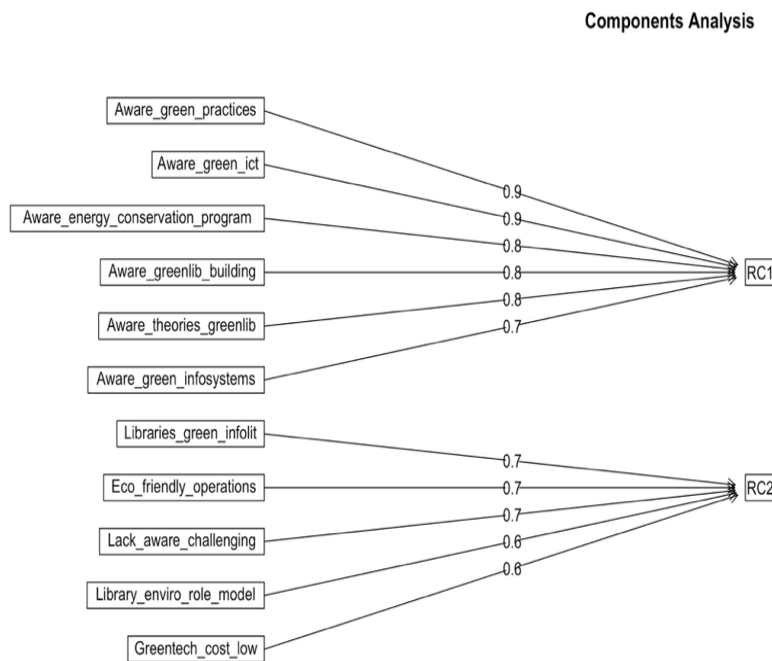
Overview of the Rotated Factor Matrix

Items	Item Number	RC1	RC2
Aware of green practices	8	0.91	
Aware of green ICT	10	0.88	
Aware of energy conservation programs	9	0.83	
Aware of green library buildings	7	0.80	
Aware of green library theories	11	0.78	
Aware of green info systems	6	0.73	0.35
Libraries promote green info literacy	2		0.74
Libraries should operate eco-friendly	4		0.72
Lack of awareness is a challenge	5		0.65
Libraries are environmental role models	3	0.42	0.65
Green tech is low cost	1		0.60

Visual Representation of the Factor Structure

A component analysis structure diagram (Figure 5) was developed to visually represent how the items grouped by factor. As shown, the six awareness-focused items formed one distinct construct, while the five perception-based items formed the second, conceptually aligned construct.

Figure 5
Components Analysis Structure



Scale Reliability

The survey instrument demonstrated strong internal consistency, with an overall Cronbach's alpha of 0.878, indicating excellent reliability. Subscale reliability indicated that the Awareness subscale (6 items) showed excellent reliability ($\alpha = 0.917$), and the Perceptions subscale (5 items) showed acceptable reliability ($\alpha = .731$). Since all items were positively worded, no reverse coding was required. The results confirm that each subscale measures a coherent and distinct construct.

Validity

To assess whether awareness and perception scores varied by demographic characteristics, a series of independent-samples t-tests and one-way ANOVAs were conducted. Variables tested included gender, education level, MLIS degree status, employment role, Carnegie classification, institution type, and geographic region. No statistically significant differences were found across any demographic categories (all p-values > .05). Therefore, post-hoc tests were unnecessary. The consistency suggests that the constructs are robust across subgroups and supports the generalizability of the findings.

Discussion

The purpose of this study was to examine academic librarians' awareness and perceptions of green technologies and environmentally sustainable library practices. The findings reveal a consistent and meaningful pattern: librarians express strong support for sustainability-related values, yet their awareness of specific technical, theoretical, and infrastructural aspects of green librarianship remains uneven. This gap suggests a profession-wide enthusiasm that

exceeds formal knowledge and training, and there is a critical need for targeted development and education.

Participants demonstrated strong agreement with items reflecting the perceived importance of sustainability values within libraries, as indicated by items related to libraries serving as environmental role models, operating in eco-friendly ways, and promoting green information literacy. These findings align with prior studies that position libraries as informational leaders and advocates for sustainability (Jankowska & Marcum, 2010; Kurbanoglu & Boustany, 2014). However, lower scores on awareness-focused items—especially those related to green ICT, sustainability theories, and systems—and the overwhelming agreement that a lack of awareness poses a significant barrier to adopting green practices, suggest a knowledge gap in the conceptual and technical foundations of sustainable librarianship. As noted in the literature, while librarians endorse sustainability in principle, they may lack structured opportunities to build the expertise required for implementation (Ren & Lu, 2024). The exploratory factor analysis yielded a clear two-factor structure—awareness and perceptions—accounting for 63% of the total variance. This confirms that valuing sustainability and being knowledgeable about sustainability are related but distinct constructs. Perception items clustered around the idea of libraries acting as environmental role models, operating sustainably, and promoting green information literacy. Awareness items represented respondents' familiarity with green technologies, systems, and theoretical principles. The strong reliability of the awareness subscale ($\alpha = .917$) suggests that these items coherently capture a shared construct of sustainability knowledge, despite participants' overall lower awareness levels. The perceptions subscale demonstrated acceptable reliability ($\alpha = .731$), indicating stable and consistent attitudes toward sustainability among respondents. Together, these findings reinforce the theoretical distinctiveness of the two constructs identified for this study.

No significant differences were found across gender, education level, MLIS degree status, employment role, Carnegie classification, institution type, or geographic region. This suggests that support for sustainable practices and awareness levels is broadly shared across diverse professional backgrounds. The absence of demographic variation also suggests that awareness gaps are systemic rather than isolated, which points to profession-wide needs for more comprehensive training and resources.

Implications for Practice

The findings highlight several important improvements in the professional preparation and development of academic librarians. The gaps in awareness regarding green ICT, sustainability frameworks, and technical systems suggest the need to provide librarians with more structured and easily accessible professional development opportunities to support the sustainable development goals of the institutions, such as workshops, webinars, and continuing education programs focusing on green infrastructure, energy-efficient technologies, and sustainability-focused planning. Given the limited familiarity with key theoretical models, LIS programs should consider embedding topics such as green librarianship, environmental informatics, and sustainable design into core curricula to prepare future professionals to engage meaningfully with sustainability. Although some institutions

have already implemented green technologies, they may not always effectively communicate these efforts to their staff. Therefore, the visibility of such initiatives can be enhanced through internal reports, employee briefings, and on-site signage to increase employee participation and foster an informed and motivated workforce. In addition, libraries can deliver formal green information literacy education through various channels, such as workshops, research guidelines, publicity campaigns, and course collaborations, to enhance impact and align services with broader sustainable development education programs on campus.

Limitations and Future Research

This study relied on self-reported measures, which may be influenced by respondents' subjective interpretations of familiarity and awareness. Additionally, the sample, while diverse, represents academic librarians who opted to participate in an online sustainability-related survey, and may therefore reflect a higher interest in sustainability than the general population of librarians.

Future research could examine organizational variables such as the existence of institutional sustainability policies, staff training opportunities, or resource availability. These variables could be used as potential predictors of awareness levels. Qualitative studies incorporating interview data may also provide deeper insight into the specific barriers that limit awareness of green ICT, theories, and building models.

Conclusion

This study helps highlight a gap between how strongly academic librarians value sustainability and how uneven their awareness is of the technical and theoretical foundations that support green library practices. Even though most survey respondents saw libraries as environmental role models and supported efforts like green information literacy, many were less familiar with concepts such as green ICT, energy conservation systems, or the theories behind sustainable librarianship. These findings suggest that there is real enthusiasm in the profession but also a need for more structured training, clearer communication, and better integration of sustainability topics into everyday library work and LIS education. Strengthening these areas could help libraries move from broadly supporting sustainability in principle to fully understanding and implementing it in practice.

Acknowledgments

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References

- Antonelli, M. (2008). The green library movement: An overview and beyond. *Electronic Green Journal*, 1(27).
- Aulisio, G. J. (2013). Green libraries are more than just buildings. *Electronic Green Journal*, 1(35).

- Bincy, O. K., & Vasudevan, T. M. (2023). Environmental sustainability: Awareness and practices among library professionals in University of Calicut. *The Journal of Academic Librarianship*, 49(4), 102748.
- Demirtas Dogan, H., & Gurpinar, B. (2023). Green libraries and the user's perspective: A case study in Turkey. *Sage Open*, 13(4), 21582440231211432.
- DeVellis, R. F. (2017). *Scale development: Theory and applications* (4th ed.). Sage.
- Embree, J., & Gilman, N. (2020). The library as a campus sustainability hub: A case study in increasing community engagement & collaboration in sustainability through academic libraries. *International Journal of Librarianship*, 5(2), 26–44.
- Hauke, P., Charney, M., & Sahavirta, H. (Eds.). (2018). *Going green: Implementing sustainable strategies in libraries around the world: Buildings, management, programmes and services* (Vol. 177). Walter de Gruyter GmbH & Co KG.
- Jankowska, M. A., & Marcum, J. W. (2010). Sustainability challenge for academic libraries: Planning for the future. *College & Research Libraries*, 71(2), 160–170.
- Kaaland, C., & Lokey, W. (2014). *Emergency preparedness and disaster recovery in school libraries: Creating a safe haven*. Bloomsbury Publishing USA.
- Khan, Z. I. (2025). Perceptions of librarians on sustainable practices in libraries in the United Arab Emirates: A quantitative study. *IFLA Journal*.
- Kurbanoğlu, S., & Boustany, J. (2014, October). From green libraries to green information literacy. In *European Conference on Information Literacy* (pp. 47–58). Springer International Publishing.
- Ma, J., & Shahzad, N. (2025). The role of academic libraries in promoting environmental sustainability in higher education institutions. *Sage Open*, 15(4), 21582440251406091.
- Meislik, M. (2015). Library as safe haven: Disaster planning, response, and recovery.
- Mwanzu, A., Bosire-Ogechi, E., & Odero, D. (2023). Green initiatives towards environmental sustainability: Insights from libraries in Kenya. *IFLA Journal*, 49(2), 298–314.
- Ren, X., & Lu, J. (2024). Librarians' attitudes toward library's roles in environmental sustainability. *Journal of Librarianship and Information Science*. Advance online publication.
- Solemanpharcy, M., & Gaffar, S. K. A. (2023). The role of green library for sustainable development goals and environmental education: A study on global perspective. *International Journal of Knowledge Management and Practices*, 11(1), 22–31.
- Suman, A. K., & Peelwan, R. (2024). The social responsibilities of library professionals: A theoretical perspective. *Revista Review Index Journal of Multidisciplinary*.

Young, E. (2018). The role of public libraries in disasters. *New Visions for Public Affairs*, 10, 31–38.

Appendix A

Survey Questions

Demographic Questions

- What is your gender?
- What is your highest level of education?
- What is your role in the library? (Select all that apply)
- What type of academic institution do you work at?
- Do you work at a public or private institution?
- What is the Carnegie classification of your institution?
- What geographic region within the United States do you work in?

Likert-Scale Items

- The cost of integrating green technology into the library is relatively low.
- Libraries have a big hand to impart green information literacy to the user community.
- Libraries must act as role models to society to make an eco-friendly environment.
- Libraries must operate in an eco-friendly manner in all departments.
- Lack of awareness is a challenge for green practices, policies, and technology adoption.
- How aware are you about green information systems and their potential benefits?
- How aware are you about the concept of green library buildings?
- How aware are you about the implementation of green practices in the library?
- How aware are you of energy conservation programs relevant to libraries?
- How aware are you of green information and communications technologies within the library?
- How aware are you of theories and models related to green libraries and librarianship?