

地球環境学

Global Environmental Studies

目次

〈論文〉

環境教育における持続可能な開発への生物多様性問題の統合

—ガーナ、東部地域の教育大学の事例研究

…… メイベル サルポン クシ・プテンカラム ジョンジョセフ・クワク アツウ (1)

森林認証ラベル普及のために必要な取り組みに関する研究

—ベストワーストスケーリングによる調査—

…………… 吉田開・張琪・柘植隆宏 (18)

Integrating Biodiversity Education for Sustainable Development:

Insights from Colleges of Education in Ghana

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Abstract

The study aims to address knowledge poverty in Ghana by incorporating biodiversity education into college curricula using a Universal Design for Learning (UDL) approach. The current curriculum lacks focus on biodiversity conservation, and a new curriculum model guided by UDL principles is proposed to enhance biodiversity education within teacher training. The proposed model aims to equip teacher trainees with skills to foster biodiversity awareness and sustainable behaviors among young learners. The expected outcomes include improved knowledge of biodiversity, stronger pedagogical skills, shifts in conservation attitudes, ecosystem restoration, and greater community involvement. This curricular reform could promote biodiversity conservation locally and globally.

Keywords: biological biodiversity; biodiversity conservation; environmental education, teacher education; curriculum; sustainable development; Ghana.

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要約

本研究は、ユニバーサル・デザイン・フォー・ラーニング (UDL) アプローチを用いて、生物多様性教育をガーナの教育大学のカリキュラムに組み込むことで、「知識の貧困」問題に対処することを目的としています。現行のカリキュラムには生物多様性保全に対する十分な重点が欠けており、教師養成の中で生物多様性教育を強化するため、UDL原則に基づいた新しいカリキュラムモデルが提案されています。このモデルは、教師養成生に生物多様性の意識と持続可能な行動を若い学習者に促すためのスキルを身につけさせることを目的としています。期待される成果としては、生物多様性に関する知識の向上、教育スキルの強化、保全への態度の転換、生態系の回復、そして地域社会の積極的な関与が挙げられます。このカリキュラム改革は、地域的および世界的に生物多様性保全を推進する一助となる可能性があります。

キーワード：生物多様性；生物多様性保護；生物多様性教育；カリキュラム；持続可能な開発；
ガーナ

Integrating Biodiversity Education for Sustainable Development:

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Introduction

The worldwide conversation on sustainable development has reached a crescendo in recent years, as more people realize the importance of protecting biodiversity, which is the foundation of long-term environmental stability. The fundamental role that education plays in influencing attitudes, promoting comprehension, spurring action, and supporting sustainable practices and biodiversity conservation is at the center of this discussion (Iyengar, Stafford Ocansey et al. 2022, Oranga, Gisore et al. 2023). Considering this, the necessity of biodiversity education becomes a key component of the larger framework of sustainable development. Education is a potent instrument for encouraging environmental stewardship and sustainable lifestyles by providing people with the information, abilities, and attitudes required to understand and preserve biodiversity. In Ghana's educational system, educational institutes are essential for forming the next generation of teachers, who then mould the beliefs and actions of subsequent generations. This study investigates the state of biodiversity education in Ghanaian colleges of education and how well these institutions are preparing upcoming educators to support sustainable practices and biodiversity conservation. This study attempts to identify the possibilities, problems, and strengths of the current biodiversity education landscape by exploring the curriculum, instructional approaches, and institutional activities. Recognizing the crucial role that educators play in bringing about change.

By comprehensively evaluating biodiversity teaching in the educational institutions in Ghana, this case study aims to contribute to a wider discussion on sustainable development, environmental literacy, and raising the generation of environmentalists. Future educators will be better equipped to lead biodiversity conservation and sustainable practices both inside and outside their spheres of influence. The research's insights and recommendations have the potential to inform policy formulation, curriculum design, and implementation of innovative pedagogical approaches. This research attempts to identify strategies for improving education colleges' ability to produce environmentally conscious and action-oriented teachers for sustainable development. The findings of this study have practical implications for curriculum developers, policymakers, and educators who wish to improve the integration of biodiversity education into teacher-training programs and support sustainable development at the grassroots level. This study analyzes the opportunities, challenges, and strengths present in the current landscape of biodiversity education.

Literature Review

Understanding Biodiversity Education and Sustainable Development

A vital element of sustainable development is biodiversity conservation education, which acts as a catalyst to encourage environmental care and the preservation of biological varieties. The goal of biodiversity

education is to raise awareness of the complex web of life on Earth by emphasizing the relationships between ecosystems and a variety of species that call them home. Education gives people the capacity to make informed decisions and to maintain and safeguard our natural heritage by increasing their understanding of the value and significance of biodiversity.

Sustainable development takes a comprehensive strategy to address the requirements of both current and future generations, while maintaining the planet's resilience and long-term health. This highlights the necessity of inclusive, fair growth that respects planetary boundaries and acknowledges the basic connections between environmental, social, and economic systems. Biodiversity education plays a critical role in promoting sustainable development by encouraging conservation and sustainable living. It does this by establishing a feeling of duty and stewardship towards the environment.

Understanding how biodiversity education and sustainable development interact is particularly important for Ghana and the world. Ghana attempts to balance conservation effects with the socioeconomic ambitions of its local populations because it is endowed with a vast diversity of habitats and animals. A framework for involving stakeholders in conversation and action aimed at encouraging sustainable land use practices, protecting biodiversity hotspots, and lessening the effects of climate change is provided by biodiversity education, ranging from farmers and youth to policymakers and educators(Rieckmann 2018).

As rural communities rely heavily on natural resources, biodiversity education can open doors to sustainable lifestyles and green growth. Education may contribute to reducing poverty, enhancing food security, and building resilience to environmental shocks by providing people with the information and skills to sustainably utilize the advantages of biodiversity(Rieckmann 2018).

Determining the direction of a more resilient and prosperous future requires an awareness of the relationship between biodiversity conservation education and sustainable development. We can enable people and communities to become environmental stewards and agents of good change by investing in education that cultivates an appreciation for biodiversity conservation and encourages sustainable behaviors.

Role of Colleges of Education in Environmental Stewardship

As the global community grapples with the pressing challenges of environmental degradation and climate change, the role of educational institutions in promoting sustainability has never been more critical. Colleges of education have a unique and influential position in fostering environmental stewardship. By integrating environmental education into teacher training programs, these institutions can equip future educators with the knowledge, skills, and attitudes necessary to promote sustainable development within their communities.

The Imperative for Environmental Stewardship in Education

Environmental stewardship refers to responsible management and care of the environment through sustainable practices and behaviors. Given the increasing urgency of environmental issues, it is imperative that education systems worldwide prioritize the development of environmentally literate citizens. Colleges

of education play a pivotal role in this endeavor by:

- **Raising Awareness:** Educating future teachers about the critical importance of environmental issues.
- **Building Competence:** Providing teachers with the skills and knowledge to integrate environmental education into their classrooms.
- **Fostering Attitudes:** Encouraging values and attitudes that support sustainable living.

Integrating Environmental Education into Teacher Training

To effectively promote environmental stewardship, colleges of education must integrate environmental education across their curricula. This integration can occur through various approaches:

- **Curriculum Design:** Embedding environmental topics into existing courses and creating specialized courses on environmental education.
- **Interdisciplinary Learning:** Encouraging cross-disciplinary approaches that connect environmental education with subjects such as science, geography, and social studies.
- **Experiential Learning:** Providing hands-on, experiential learning opportunities such as outdoor education programs, field trips, and community projects.

Developing Environmental Literacy

Environmental literacy encompasses understanding ecological principles, recognizing the impact of human activities on the environment, and making informed decisions that promote sustainability. Colleges of education can develop environmental literacy by:

- **Theoretical Foundations:** Offering courses that cover ecological concepts, environmental ethics, and sustainable development theories.
- **Practical Applications:** Incorporating case studies, project-based learning, and problem-solving activities that address real-world environmental issues.
- **Critical Thinking:** Encouraging critical analysis of environmental policies, practices, and their implications for society.

Empowering Future Educators

Future educators must be empowered to act as change agents for sustainability within their schools and communities. It is crucial to provide educators with the resources, information, and self-assurance necessary to positively impact their schools and communities if we are to raise a generation of leaders in the field of sustainability education. Education colleges are essential to this empowerment since they concentrate on many important areas:

- ❖ **Professional Development:** To keep educators abreast of the most recent developments in

environmental education, it is imperative that they get ongoing training and access to resources. Teachers may successfully include sustainability in their curricula and encourage environmental consciousness in their pupils by continuously gaining new knowledge.

- ❖ **Leadership Development:** Teachers who want to be advocates for sustainability must have strong leadership qualities. Teachers may become role models, encourage others, and promote sustainable practices in their schools by enrolling in specialized programs.
- ❖ **Community Engagement:** Promoting community-based environmental projects requires forging solid alliances with nearby companies, organizations, and governmental bodies. Teachers may provide students with relevant, experiential learning opportunities and inspire group action towards sustainability goals by collaborating with the community.

Colleges of education may enable aspiring teachers to become powerful change makers who lead sustainability initiatives in their schools and communities by emphasizing these areas.

Promoting Innovation and Research in Environmental Education

Education colleges play a critical role in advancing environmental education research and innovation. Their efforts have the power to profoundly influence how next generations see and respond to environmental issues. The following are some important ways they can further this mission:

- ❖ **Research:** Colleges of education can find new techniques and tactics that improve environmental literacy by doing research on successful strategies for teaching and learning about environmental challenges. The greatest ways to assist students develop a thorough, long-lasting grasp of sustainability are identified by this research (Brackett, Patti et al. 2009).
- ❖ **Developing Resources:** To assist educators in their attempts to teach environmental themes, it is crucial to create and distribute instructional resources, toolkits, and best practices. Education colleges may create resources that are easily accessed and customizable to fit into different learning environments, giving instructors the resources they need to provide effective environmental education (Paniagua and Istance 2018).
- ❖ **Working together:** Fostering international and national collaborations with other organizations is essential to advancing global sustainability initiatives. Education colleges may work together to improve environmental education and solve global environmental concerns by exchanging information, resources, and expertise (Singha and Singha 2024).

Colleges of education have the potential to take the lead in promoting environmental education research and innovation, which will eventually lead to a more sustainable future.

Developing a Sustainable Practice Framework

Educational institutions have the potential to serve as pioneers in environmental preservation by showcasing sustainable practices within their own facilities, as well as by training future educators. By integrating eco-friendly design concepts into their campus infrastructure, promoting recycling and waste reduction initiatives, and employing energy-efficient technologies, these organizations can significantly contribute to sustainability efforts (Cortese 2003, Sarkar 2013). By taking these steps, academic institutions can lead by example and demonstrate how environmental stewardship can be incorporated into daily operations. This emphasizes the importance of sustainability both within and beyond the classroom, thereby encouraging educators and students to adopt and implement sustainable practices in their personal and professional lives.

Opportunities and Challenges

Despite the growing recognition of educational institutions' commitment to environmental stewardship, they still face formidable obstacles. Some of these difficulties include the scarcity of professors with experience in environmental education, inadequate funding and resources, and resistance to incorporating new environmental content into the curriculum (Nolet, Gyimesi et al. 2016). Nevertheless, there are several opportunities to enhance environmental stewardship within these institutions. For instance, professional development programs can equip faculty members with the necessary skills and knowledge, while interdisciplinary collaborations can pool resources and expertise. According to Stevenson et al and UNESCO 2014, integrating environmental education across multiple disciplines also contributes to a comprehensive approach to sustainability education (Stevenson, Lasen et al. 2017). Ultimately, educational institutions play a crucial role in fostering environmental stewardship. By training the next generation of educators, modeling sustainable behaviors, engaging with local communities, and cultivating an environmental mindset, these organizations can significantly impact the lives of environmentally literate individuals and contribute to a more sustainable future. By collaborating on these initiatives, educational institutions can pave the way for a more sustainable future.

Theoretical Foundation

The foundational theories for this paper, "Sustainable Development through Biodiversity Education: A Case Study of the Colleges of Education in Ghana's Eastern Region," are the Social-Ecological Systems (SES) Theory and Paulo Freire's Critical Pedagogy. These theoretical perspectives offer a solid basis for educators of the future to understand the significance of biodiversity education in promoting sustainable development.

A. Theory of Social-Ecological Systems (SES)

The Social-Ecological Systems (SES) Theory posits that natural ecosystems and human societies are intricately interconnected, forming complex, adaptive systems in which changes to one element inevitably impact the others. In the context of biodiversity education, this theory emphasizes the need for an integrated approach to understanding and regulating the relationships between humans and their environment. Within the framework of the Colleges of Education in Ghana's Eastern Region, SES Theory highlights

the importance of teaching future educators about the intricate interrelationships between the region's biodiversity and human activity. The objective of biodiversity education goes beyond merely teaching about species and ecosystems; it also aims to foster an understanding of how these natural systems contribute to social well-being and how human activities affect them. The SES framework enables the development of a teaching philosophy that is grounded in sustainability principles by providing future educators with this information. This approach advocates for the adoption of behaviors and practices that enhance the resilience of both natural and social systems (Partelow 2018, Liu, Zhang et al. 2024).

B. The Pedagogy Critical (Paulo Freire)

An alternative perspective on Socio-Economic Status (SES) Theory is provided by Paulo Freire's Critical Pedagogy, which emphasizes the transformative power of education in empowering individuals to critically engage with and challenge societal institutions that perpetuate inequality and environmental degradation. According to Freire, education should actively involve students in questioning and changing their own reality, rather than merely imparting information. Critical Pedagogy is a potent tool in the context of biodiversity education that enables aspiring teachers in Ghana's Eastern Region to become agents of change in their local communities. By promoting critical thinking on the socio-environmental challenges faced by their local environment, educators can facilitate a deeper understanding of the underlying factors contributing to biodiversity loss and environmental degradation. Moreover, by implementing Freire's ideas, biodiversity education can encourage aspiring teachers to take a more proactive role in advocating for sustainable development and engaging communities in addition to educating. This article proposes that biodiversity education should actively involve educators in the fight for a more equitable and sustainable society, rather than being a passive process of learning about the environment through the incorporation of Critical Pedagogy. This paradigm ensures that biodiversity education contributes to the broader objective of sustainable development, aligning with the transformative goals of Freire's pedagogy, by preparing educators to critically examine and address the socio-political aspects of environmental challenges (Leonard and McLaren 2002, González and Bernet 2024).

Considering all relevant factors, the SES Theory and Critical Pedagogy provide a comprehensive theoretical foundation for this case study, highlighting the intricate connections between ecological systems and the pivotal role education plays in fostering critical consciousness and catalyzing transformative action. To demonstrate how biodiversity education can contribute to sustainable development by equipping prospective teachers with the necessary skills, knowledge, and critical insight to tackle and challenge the multifaceted socio-ecological issues of our time, this article employs these theories in the context of Ghana's Eastern Region Colleges of Education.

Addressing Key Gaps in Literature

Biodiversity education is vital for sustainable development, and in Ghana, educational institutions play

a crucial role in training future teachers to promote environmental stewardship. However, gaps exist in integrating biodiversity education into teacher training, curriculum design, and instructional methods. This article examines these gaps and proposes strategies to better prepare educators for leadership in environmental conservation and sustainability.

- ❖ **Integration into Teacher Training:** There is a paucity of specific research on how biodiversity education is incorporated into teacher training programs in Ghana.
- ❖ **Curriculum Analysis:** Limited analysis exists on how current curricula align with sustainable development principles and promote biodiversity conservation.
- ❖ **Instructional Approaches:** There is insufficient evidence on the utilization of instructional methods such as Universal Design for Learning (UDL) in biodiversity education.
- ❖ **Empowering Educators:** The literature does not adequately explore how teacher training empowers educators to become proactive agents for sustainability.
- ❖ **Long-term Impact and Community Engagement:** There is a gap in understanding the long-term effects of biodiversity education on communities and the role of teacher-led projects in extending its influence.
- ❖ **Theoretical Application:** Theories such as Social-Ecological Systems (SES) and Critical Pedagogy are not sufficiently applied in practical educational contexts.

This article aims to address these gaps by offering insights into adapting educational frameworks to better prepare future educators for leadership in environmental stewardship and sustainability.

Case Studies and Best Practices

Several studies have highlighted the importance of integrating environmental education into teacher preparation programs. Highlighting successful examples of environmental stewardship in education can provide valuable insights and inspiration as follows:

Table 1: Case Studies and Best Practices

Case Study Examples	Details	Adaptation Strategies for Ghana
Álvarez-García et al. (2015)	Pre-service teachers with environmental education training demonstrated higher levels of environmental literacy and were more likely to incorporate environmental topics into future teaching practices (Álvarez-García, Sureda-Negre et al. 2015).	Integrate environmental education into Ghana's Colleges of Education curriculum, emphasizing local issues like deforestation. Use field-based activities and collaborations with local organizations.
Tomas et al. (2017)	Pre-service teachers who participated in environmental education courses exhibited increased environmental knowledge, attitudes, and self-efficacy in teaching environmental concepts (Evans, Tomas et al. 2016, Gülçiçek 2021).	Same as above, highlighting the need to develop environmental literacy and practical teaching experiences through local collaborations.

ESD Programs (like “Beagle Project” and SEED)	Programs like the “Beagle Project” in the EU engage students in tracking tree phenology to immerse them in biodiversity conservation. Other initiatives like “ESD-Educating for a Sustainable Future” and “SEED” in the UK emphasize biodiversity to illustrate complex sustainability relationships (Kószó 2013, Kószó 2013, Birch 2019).	Implement projects focusing on local biodiversity, such as tree planting and wildlife monitoring, tied to Ghana’s curriculum and development goals.
Workshops and Initiatives	<ul style="list-style-type: none"> ❖ A workshop in Germany underscored biodiversity’s importance in fostering critical thinking for sustainability (Grund and Brock 2020, Welter, Emmerichs-Knapp et al. 2023). ❖ In Singapore, the “Starting Young” project educated preschoolers on sustainable development (Johari , Berdan and Berdan 2013). ❖ In Kenya, the Matarajio project inspired children with Wangari Maathai’s legacy to engage in forest preservation (Buckler and Creech 2014). ❖ Germany’s Leuchtpol initiative involved 33,000 children in exploring energy and environmental issues through hands-on activities, emphasizing early education on energy saving (Buckler and Creech 2014, DESD 2014). 	Use local stories and legends to introduce sustainability to young students. Highlight the work of Ghanaian environmental champions and involve children in hands-on conservation projects.
Examples by Country		
Costa Rica	<i>Initial Teacher Training: Environmental Education Strategy:</i> Incorporates environmental education into basic teacher training with a focus on biodiversity protection, sustainability, and hands-on learning in natural settings (Jiménez, Monroe et al. 2017).	Incorporate hands-on learning experiences into teacher training in Ghana, supported by government resources and collaboration with NGOs for comprehensive sustainability education.
Germany	<i>Green Teacher Program:</i> Implements the “Green Teacher” (Grüner Lehrer) program to incorporate environmental education into teacher preparation, offering courses and materials for future educators. (Barth and Kater-Wettstädt 2021)	Encourage government support for teacher development in Ghana, with training materials and incentives for sustainability education like Germany’s program.
Japan	<i>School Environmental Education and Teacher Education:</i> Integrates environmental education into teacher preparation programs with collaboration between education boards and universities. (Kodama 2017)	Develop joint programs with international institutions and local NGOs, focusing on research and practical experiences in environmental education for university students in Ghana.
South Africa	<i>Environmental Education Initiative:</i> Focuses on climate change, sustainable development, and biodiversity protection, supported by government regulations and partnerships with NGOs. (Raselimo and Wilmot 2013)	Include sustainability education in Ghana’s policy frameworks at regional and national levels, emphasizing issues like climate change and biodiversity.
New Zealand	<i>Enviroschools Program:</i> Incorporates environmental education into the curriculum with opportunities for teacher professional development, promoting sustainable practices in schools and communities. (Eames and Mardon 2020)	Develop a curriculum in Ghana that fosters a culture of sustainability from a young age, inspired by the Enviroschools program, with a focus on local environmental challenges.
Sweden	<i>Education for Sustainable Development (ESD):</i> Integrates ESD into teacher preparation programs, providing educators with the skills to promote environmental stewardship and sustainable development through multidisciplinary teaching techniques and real-world experiences (Strachan, Logan et al. 2023).	Equip Ghanaian educators with multidisciplinary teaching techniques and real-world experiences that align with Ghana’s specific sustainability goals.
United States	Environmental Education in Teacher Education (EE-TE) program: funded by the US Environmental Protection Agency (EPA), aims to integrate environmental education into pre-service teacher education programs across various states (Jacoby 2014).	Seek support from international agencies to develop comprehensive environmental education policies in Ghana, focusing on teacher training and local ecosystems.

Brazil	The Brazilian Ministry of Education has initiatives to integrate environmental education into teacher training programs at universities, focusing on sustainable development and conservation (Trajber and Mochizuki 2015, Yadav, Banerjee et al. 2022).	Similar to Brazil's efforts, Ghana can partner with universities and local NGOs to enhance teacher training programs with a focus on sustainability and conservation.
Australia	The Australian Government has supported various projects through the Department of the Environment and Energy aimed at integrating environmental education into teacher training curricula. These efforts often emphasize teaching about local ecosystems and biodiversity (Gough 2011, Larri and Colliver 2020, Gough 2021).	Emphasize local ecosystems in Ghana's teacher training programs to highlight sustainable agricultural practices and natural resource conservation techniques.
Canada	Several Canadian universities have programs that include environmental education in their teacher education courses, often collaborating with local environmental organizations and schools to provide practical teaching experiences (Gambhir, Broad et al. 2008, Karrow, Di Giuseppe et al. 2016).	Foster partnerships between Ghanaian universities and environmental organizations to create hands-on teaching experiences and exchange programs focused on sustainability.
United Kingdom	In the UK, organizations like the Field Studies Council work with teacher training institutions to integrate environmental education into the curriculum, promoting outdoor learning and sustainability (Barratt, Barratt-Hacking et al. 2014, Lugg and Quay 2022).	Integrate outdoor learning with field trips to national parks and forests in Ghana, developing skills like critical thinking and collaboration in environmental stewardship.

These examples highlight successful efforts by various countries to integrate environmental education into teacher training programs, emphasizing the importance of preparing educators to address environmental challenges and promote sustainable practices in schools and communities. Meanwhile, other countries have also put in place initiatives and efforts to also successfully improve and enhance teacher knowledge on environmental education towards sustainable development.

Methodology

Utilizing documents content analysis methodologies of the qualitative research approach, this article aims to investigate how teacher training institutions in Ghana, specifically those in the Eastern Region, are incorporating biodiversity education into their curricula to support sustainable development. Documents content analysis was employed because it enables a systematic investigation of curriculum materials, institutional policies, and educational resources to identify themes, patterns, and insights regarding teaching about biodiversity and sustainability.

Information Gathering

To gather data for this study, a variety of sources were utilized within the chosen teacher training institutions in Ghana's Eastern Region. These sources included:

- ❖ Curriculum materials: Syllabi, course outlines, and official curriculum materials related to

environmental science and biodiversity education were examined for this purpose. These records were obtained from the academic divisions responsible for teacher preparation and development.

- ❖ Institutional Policies and Reports: An examination was conducted of institutional policies regarding biodiversity conservation, environmental management, and sustainability. Annual reports, strategic plans, and other pertinent documents were reviewed to assess the colleges' commitment to teaching students about biodiversity and sustainability.
- ❖ Data Interpretation: By interpreting the themes within the framework of Critical Pedagogy and the Social-Ecological Systems Theory, it is possible to gain an understanding of how biodiversity education supports sustainable development in education colleges.

The documents content analysis methodology used in this study provided a comprehensive understanding of how biodiversity education is being integrated into the teacher education programs of colleges in Ghana's Eastern Region. The findings offer valuable insights into the role these institutions play in promoting sustainable development through education, aligning with broader national and global sustainability goals. Below is the map of the study area housing all the six institutions of teacher education in the eastern region of Ghana.

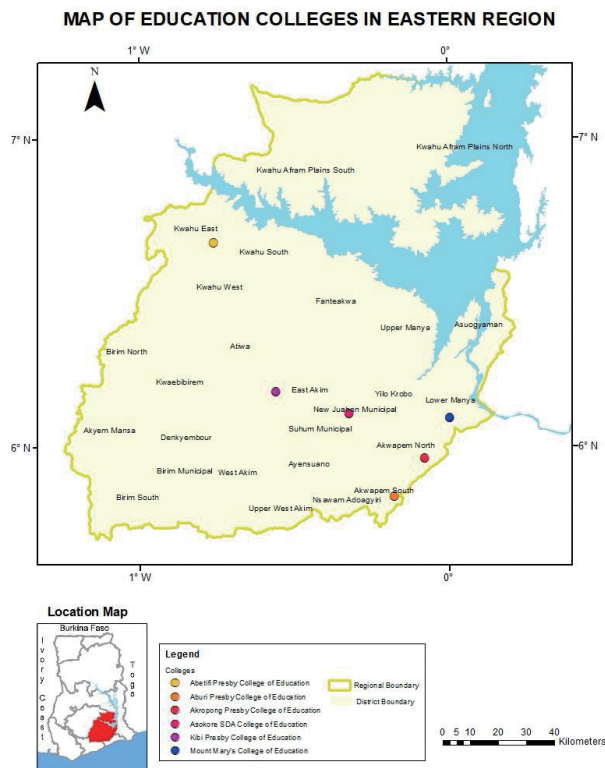


Figure 1: Map of the Study Area

Results

According to the report, substantial changes have been implemented in Ghana's teacher education program to better adapt to the evolving demands of the educational landscape and promote sustainable growth. The changes have introduced a range of programs, including online education, distance learning, in-service training, and conventional residential pre-service programs, with the aim of enhancing the competencies, skills, and knowledge of teachers at various educational levels.

The report highlights the dual-style training strategy for pre-service teachers at the basic school level as one of the key findings. This approach emphasizes topic comprehension, pedagogical methods, and hands-on teaching experience through courses in literacy studies, English, information literacy, computers, and local languages, as well as on-campus teaching experience. The curriculum is designed to cater for the needs of specialists, generalists, and early childhood educators, providing comprehensive preparation for basic school teaching.

The National Teacher Education Curriculum Framework (NTECF) and National Teachers' Standards, introduced as part of the Ghanaian government's and UKAid's Transforming Teacher Education and Learning (T-TEL) initiative, have addressed earlier inconsistencies in teacher education. The four interconnected pillars of the framework aim to prevent knowledge fragmentation and ensure that student teachers are adequately prepared to achieve the National Teachers' Standards by establishing a coherent and integrated system of teacher education. The curriculum places a strong emphasis on core skills and developmental strategies to equip future teachers with the necessary methodology, knowledge, abilities, and comprehension spanning the Early Childhood to Junior High School levels.

The curriculum implemented at the institution incorporates Information and Communication Technology (ICT) components into teaching and learning activities to improve engagement. The assessment process uses Bloom's Taxonomy, which aligns with the National Teacher Education Curriculum Framework and the National Teachers' Standards. Teacher candidates are trained in Upper Primary Science, Early Childhood Education, and Junior High School Education. Courses in Social Studies and Science include topics on environmental and biodiversity concerns. The curriculum covers topics such as sanitation, environmental health, Ghana's natural resources, and the impact of human activity on biodiversity. Geographical studies focus on Africa's regional geography, weather patterns, and climates, while science students study environmental biology, biodiversity, farming systems, and ecosystems. Agriculture students gain knowledge about sustainable agricultural policy and practices.

Despite these efforts, it is evident that pre-service teachers who do not specialize in scientific or environmental courses have not been exposed to the same level of environmental education and biodiversity conservation as their counterparts due to recent curricular changes. Consequently, these educators may not be adequately prepared to teach their future students about biodiversity protection, which could hinder efforts to promote environmental responsibility and awareness.

Research indicates that curricula play a crucial role in addressing biodiversity concerns by fostering community engagement, awareness, responsibility, and critical thinking. Incorporating biodiversity-related topics into curricula can empower the next generation to become knowledgeable and engaged environmental stewards. “The quality of the curriculum is critical to the development of environmentally conscious individuals who can confront and mitigate the challenges facing biodiversity in the 21st century. Educational institutions can promote a sense of duty and care for the complex and interrelated web of life on our planet and enhance ecological literacy by designing curricula that are inclusive and well-considerate.”

Conclusion

This article emphasizes the importance of incorporating biodiversity education into the curriculum of Ghana’s Colleges of Education as a crucial step towards promoting environmental stewardship and sustainable development. The case studies analyzed illustrate the critical role of teacher training, experiential learning, and governmental support in equipping future educators to effectively engage with and teach sustainability concepts. By adapting successful international models such as Costa Rica’s experiential teacher training or Germany’s Green Teacher Program, Ghana has the potential to cultivate a generation of environmentally literate teachers capable of inspiring local communities.

Contextualizing these efforts by addressing pressing issues such as deforestation, climate change, and biodiversity loss within Ghana’s specific context ensures relevance and practicality. Furthermore, engaging students in applied projects such as reforestation initiatives, wildlife monitoring, and energy conservation not only enhances their learning experience but also fosters a profound commitment to environmental protection.

Ultimately, the trajectory towards sustainability in Ghana’s education system depends on the collaborative efforts of educators, policymakers, and local communities. Through structured teacher training, curriculum development, and partnerships with non-governmental organizations, Ghana can cultivate a culture of sustainability that empowers both educators and students to assume proactive roles in conserving the environment for future generations.

References

- Álvarez-García, O., Sureda-Negre, J., & Comas-Forgas, R. (2015). Environmental education in pre-service teacher training: A literature review of existing evidence. *Journal of Teacher Education for Sustainability*, 17(1), 72-85.
- Bingle, R. G., & Hatcher, J. A. (2002). Campus-community partnerships: The terms of engagement. *Journal of Social Issues*, 58(3), 503-516.
- Cortese, A. D. (2003). The critical role of higher education in creating a sustainable future. *Planning for Higher Education*, 31(3), 15-22.
- (Jacoby 2014)Nolet, V. (2016). *Educating for sustainability: Principles and practices for teachers*. Routledge.
- Stevenson, R. B., Brody, M., Dillon, J., & Wals, A. E. (Eds.). (2017). *International handbook of research on*

- environmental education. Routledge.
- Tomas, L., Girgenti, S., & Jackson, C. (2017). Pre-service teachers' attitudes toward education for sustainability and its relevance to their learning: Implications for pedagogical practice. *Environmental Education Research*, 23(3), 324-347.
- UNESCO. (2014). *Shaping the future we want: UN Decade of Education for Sustainable Development (2005-2014) final report*. United Nations Educational, Scientific and Cultural Organization.
- Álvarez-García, O., et al. (2015). "Environmental education in pre-service teacher training: A literature review of existing evidence." *Journal of Teacher Education for Sustainability* 17(1): 72-85.
- Barratt, R., et al. (2014). Innovative approaches to early childhood education for sustainability in England: Case studies from the field. *Research in Early Childhood Education for Sustainability*, Routledge: 225-247.
- Barth, M. and L. Kater-Wettstädt (2021). Implementing education for sustainable development in the German school system: Implications for teacher education. *Quality in Teacher Education and Professional Development*, Routledge: 157-175.
- Berdan, S. N. and M. S. Berdan (2013). *Raising global children*, Diversion Books.
- Birch, R. (2019). "To what extent can hope be discerned during an Education for Sustainable Development Philosophy for/with Children workshop with young people?"
- Brackett, M. A., et al. (2009). "A sustainable, skill-based approach to building emotionally literate schools." *Handbook for developing emotional and social intelligence: Best practices, case studies, and strategies*: 329-358.
- Buckler, C. and H. Creech (2014). *Shaping the future we want: UN Decade of Education for Sustainable Development; final report*, Unesco.
- Cortese, A. D. (2003). "The critical role of higher education in creating a sustainable future." *Planning for higher education* 31(3): 15-22.
- DESD, M. (2014). "Shaping the Future We Want." *DESD Monitoring and Evaluation UN Decade of Education for Sustainable Development (2005–2014) Final Report*.
- Eames, C. and H. Mardon (2020). "The enviroschools programme in Aotearoa New Zealand: Action-orientated, culturally responsive, holistic learning." *Green schools globally: Stories of impact on education for sustainable development*: 49-60.
- Evans, N., et al. (2016). "Impact of sustainability pedagogies on pre-service teachers' self-efficacy." *Journal of Education for Sustainable Development* 10(2): 243-261.
- Gambhir, M., et al. (2008). Characterizing initial teacher education in Canada: Themes and issues.
- González, A. A. and J. T. Bernet (2024). "Critical Thinking and Critical Pedagogy: Concurrences and Complementarities." *Revista de Educación* 406: 0-0.
- Gough, A. (2011). "The Australian-ness of curriculum jigsaws: Where does environmental education fit?" *Australian Journal of Environmental Education* 27(1): 9-23.
- Gough, A. (2021). "All STEM-Ed up: Gaps and silences around ecological education in Australia." *Sustainability* 13(7): 3801.
- Grund, J. and A. Brock (2020). "Education for sustainable development in Germany: Not just desired but also effective for transformative action." *Sustainability* 12(7): 2838.
- Gülçiçek, T. (2021). "The relationship between pre-service early childhood teachers' environmental education self-efficacy beliefs and their attitudes towards sustainable environment." *Academia Eğitim Araştırmaları Dergisi* 6(2): 431-441.
- Iyengar, R., et al. (2022). From knowledge to behavior change: Signs, patterns, influences in education for

- sustainable development. Education: A Global Compact for a Time of Crisis, Columbia University Press: 230-258.
- Johary, B. (2014). Service-learning essentials: Questions, answers, and lessons learned, John Wiley & Sons.
- Jiménez, A., et al. (2017). "Trends in environmental education for biodiversity conservation in Costa Rica." Environment, development and sustainability 19: 221-238.
- Johari, J. "Nurturing Winners in our Early Learners: Re-Defining." 20M35: 77.
- Karrow, D. D., et al. (2016). Canadian perspectives on initial teacher environmental education praxis, Canadian Association for Teacher Education (CATE) Ottawa.
- Kodama, T. (2017). "Environmental education in formal education in Japan." Japanese Journal of Environmental Education 26(4): 4_21-26.
- Kószó, M. (2013). "Projects on environmental education as means and methods to develop abilities used in the training of lower primary teachers." Proc. Projects Environ. Educ. 136-142.
- Kószó, M. F. (2013). "Out of Classroom Projects for Biodiversity Education in Hungary: A Case Study." US-China Education Review: 870.
- Larri, L. and A. Colliver (2020). "Moving green to mainstream: Schools as models of sustainability for their communities–The Australian Sustainable Schools Initiative (AuSSI)." Green schools globally: Stories of impact on education for sustainable development: 61-83.
- Leonard, P. and P. McLaren (2002). Paulo Freire: A critical encounter, Routledge.
- Liu, R., et al. (2024). "Understanding and evaluating the resilience of rural human settlements with a social-ecological system framework: The case of Chongqing Municipality, China." Land Use Policy 136: 106966.
- Lugg, A. and J. Quay (2022). Curriculum in outdoor and environmental education. Encyclopedia of Teacher Education, Springer: 378-383.
- Nolet, B. A., et al. (2016). "Predicting effects of water regime changes on waterbirds: Insights from staging swans." PLoS One 11(2): e0147340.
- Oranga, J., et al. (2023). "Barriers to Transformative Climate Change Education: Mitigation and Resilience-Building." International Journal of Social Science 3(3): 389-396.
- Paniagua, A. and D. Istance (2018). "Teachers as designers of learning environments." Educational Research and Innovation: 17-42.
- Partelow, S. (2018). "A review of the social-ecological systems framework." Ecology and Society 23(4).
- Raselimo, M. and D. Wilmot (2013). "Geography teachers' interpretation of a curriculum reform initiative: The case of the Lesotho Environmental Education Support Project (LEESP)." South African Journal of Education 33(1): 1-15.
- Rieckmann, M. (2018). "Learning to transform the world: Key competencies in Education for Sustainable Development." Issues and trends in education for sustainable development 39(1): 39-59.
- Sarkar, A. N. (2013). "Promoting eco-innovations to leverage sustainable development of eco-industry and green growth." European Journal of Sustainable Development 2(1): 171-171.
- Singha, S. and R. Singha (2024). Cross-Disciplinary Collaborations and Partnerships for Sustainability Education: Including Community-Based Learning, Industry Partnerships, and International Collaborations. Teaching and Learning for a Sustainable Future: Innovative Strategies and Best Practices, IGI Global: 17-37.
- Stevenson, R. B., et al. (2017). "Approaches to embedding sustainability in teacher education: A synthesis of the literature." Teaching and Teacher Education 63: 405-417.
- Strachan, S., et al. (2023). "Reflections on developing a collaborative multi-disciplinary approach to embedding education for sustainable development into higher education curricula." Emerald Open Research 1(9).

- Trajber, R. and Y. Mochizuki (2015). "Climate change education for sustainability in Brazil: A status report." Journal of Education for Sustainable Development 9(1): 44-61.
- Welter, V. D. E., et al. (2023). "Are We on the Way to Successfully Educating Future Citizens?—A Spotlight on Critical Thinking Skills and Beliefs about the Nature of Science among Pre-Service Biology Teachers in Germany." Behavioral Sciences 13(3): 279.
- Yadav, S. K., et al. (2022). Environmental education for sustainable development. Natural Resources Conservation and Advances for Sustainability, Elsevier: 415-431.

森林認証ラベル普及のために必要な取り組みに関する研究 —ベストワーストスケーリングによる調査—

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要旨

森林認証制度の普及は地球環境の保全にとって重要であるが、日本では普及が進んでいない。そこで、本研究では、森林認証ラベルの普及に向けて必要な取り組みに関する一般消費者の選好をベストワーストスケーリングにより把握した。その結果、森林認証ラベルの意味を世の中に普及させることが最も必要と評価されることが明らかとなった。また、森林認証制度に対する意識や知識レベルは相対的に若い年代ほど高いこと、森林認証制度に関してよく知らない人は森林認証製品の価格を安くすることが必要と考える傾向があること、環境保全行動を実施していない消費者は森林認証製品の価格を安くすることが必要と考える傾向があることが明らかとなった。

キーワード：森林認証制度、森林認証ラベル、消費者、選好、ベストワーストスケーリング

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Necessary Initiatives for Promoting Forest Certification Labels:

A Study Using Best-Worst Scaling

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Abstract

Forest certification systems are important for global environmental protection, but they are not widely used in Japan. In this study, we used best-worst scaling to determine consumers' preferences regarding the initiatives needed to promote the spread of forest certification labels. The results showed that the most important thing is to spread the meaning of forest certification labels to the public. It was also found that awareness and knowledge of forest certification systems is relatively high among younger age groups, that those who are not familiar with forest certification systems tend to think that the price of forest certified products should be lower, and that consumers who do not participate in environmental conservation activities tend to think that the price of forest certified products should be lower.

Key words: Forest certification system, Forest certification label, Consumer, Preference, Best-worst scaling

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森林認証ラベル普及のために必要な取り組みに関する研究

—ベストワーストスケーリングによる調査—

1. はじめに

世界的に普及している主要な森林認証制度にはFSC (Forest Stewardship Council) による認証とPEFC (Programme for the Endorsement of Forest Certification schemes) による認証がある。いずれも、森林の管理や経営が持続可能な形で行われているかを第三者機関が認証することを示すFM認証 (Forest Management Certification)、森林から得られた木材等の林産物が適切な流通過程を経て製品として生産されているかを第三者機関が認証することを示すCoC認証 (Chain of Custody Certification) の2つの形態の認証を行っている (安藤・白石, 2019)。

FSCはカナダにおいて1993年に設立されたNGOであり、現在の国際本部はドイツにある¹。わが国においては2000年頃にはじめてFSCによる認証を受けた森林がでてきた²。なお、わが国における林業団体や環境NGO等によって発足したSGEC認証 (Sustainable Green Ecosystem Council) による認証制度が2003年に発足しているが、2016年にPEFCと相互認証を開始しており、わが国では同一の枠組みとして運用されている³。

わが国においては、FM認証を受けている森林はFSC認証制度によるものが約42万ha⁴、PEFC認証制度によるものが220万ha⁵であり、国内の総森林面積である約2,500万ha⁶のうちいずれかの制度によって認証された森林面積の割合は約10%となる。これは制度の普及が進んでいる欧州諸国と比べて相当低い面積割合である。

CoC認証件数は増加傾向にあり、コピー用紙、トイレットペーパー、名刺などの紙製品を中心に、一般消費者が日常生活においてラベルを目にする機会も増えている (安藤・白石, 2019)。

森林認証制度は、持続可能な森林管理及び森林関連製品の流通を世の中に促す仕組みであり、生物多様性保全に及ぼす役割としては十分ではない部分もあるが (長池, 2014)、制度の普及が地球環境の保全の観点から重要であることは言うまでもない。わが国において普及が進まない理由としては、認証にかかる費用に比して認証による価格プレミアムが小さいまたは明確でないことや、認証制度の認知度が低いことが考えられる (大田, 2016)。

本研究では、消費者である一般市民がこの認証制度の意義を理解した上で、森林認証ラベル付き製品の選択を促進するためにどのような取り組みが必要と考えるかをベストワーストスケーリング (best-worst scaling: BWS) によって調査する。川下に位置する一般市民は、川上に位置する

1 FSCの沿革 (<https://jp.fsc.org/jp-ja/History>)

2 FSCの沿革 (<https://jp.fsc.org/jp-ja/History>)

3 PEFC認証制度の特徴 (<https://sgec-pefcj.jp/pefc%E3%81%A8%E3%81%AF/pefc%E3%81%AB%E3%81%A4%E3%81%84%E3%81%A6/pefc%E3%81%AE%E7%89%B9%E5%BE%B4/pefc%E8%AA%8D%E8%A8%BC%E5%88%B6%E5%BA%A6%E3%81%AE%E7%89%B9%E5%BE%B4>)

4 FSC (<https://jp.fsc.org/jp-ja/>) より 2024年6月13日時点

5 PEFC(<https://sgec-pefcj.jp/>) より 2024年3月31日時点

6 林野庁 森林資源現況総括表 (2022年3月31日時点)

森林組合や林業関係者とは異なる視点を有している可能性がある。森林認証ラベルのさらなる普及を目指す上で、そのような一般市民の認識を把握することには意義があると考え調査を実施する。なお、森林認証ラベルに対する消費者の選好を分析した研究は多数存在するが (Aguilar and Cai, 2010; Aguilar and Vlosky, 2007; Anderson and Hansen, 2004a, 2004b; Bigsby and Ozanne, 2002; Forsyth et al., 1999; Grönroos and Bowyer, 1999; O'Brien and Teisl, 2004; Ozanne and Vlosky, 1997, 2003; Tan et al., 2019, 2020; Teisl et al., 2002; Veisten, 2002, 2007; Vlosky et al., 1999)、本研究のようにBWSを用いて森林認証ラベル普及に向けて取り組むべき事柄に対する一般市民の認識を調査した研究は著者らの知る限り存在しない。

2. 研究方法

2-1. BWSについて

森林認証ラベル普及に向けた様々な取り組みの必要性を5段階 (例えば、「とても必要である」、「ある程度必要である」、「どちらともいえない」、「あまり必要でない」、「全く必要でない」) で回答者に評価してもらうようなリッカートスケール形式の質問を実施すると、全ての取り組みに対して同じ評価が行われる (例: すべての取り組みを「とても必要である」と回答する) ことがあり得る。このような場合には、取り組みの優劣をつけることは困難である。また、回答者によって「とても」や「ある程度」の考え方が異なっている可能性があるため、必要性を高め回答する人と低めに回答する人がいるかもしれない。これに対して、選択肢の中から最も高く評価するもの (ベスト) と最も低く評価するもの (ワースト) の2つを回答者に選んでもらう形式のBWSを用いることで、取り組み間の必要性の差をより明確にすることが出来る。また、すべての回答者が同様にベストとワーストを選択するため、回答者間での回答の際の尺度の使い方の違いを排除することができる。このようなメリットから、近年、BWSは社会調査、マーケティング調査、環境経済学、医療経済学などの分野を中心に多くの研究において使用されている。BWSについてより詳しくは、Louviere et al. (2015) や柘植他 (2024) を参照されたい。

2-2. 設問設計

BWSの設問で提示する選択肢を検討するため、代表的な取り組むべき事柄を選定する必要がある。本研究では、森林認証制度の普及に関する先行研究や一般消費者への事前聞き取りをもとに表1に挙げる5つの項目を代表的な事柄として採用した。以下、簡便化のため表中の隅付き括弧 (【】) 内の表記を用いる。

表1 普及のために取り組むべき事柄

A. ラベルの意味を世の中に普及させる【意味を普及させる】
B. どのような裏付けをもとにラベルがつけられているのかをわかりやすく示す【裏付けを示す】
C. いろいろなラベルを統一してわかりやすくする【ラベルの統一】
D. ラベル付き製品の価格をもっと安くする【価格を安くする】
E. 販売されている製品の中のラベル付き製品の割合を増やす【ラベル製品の割合を増やす】

次にBIBDs (Balanced incomplete block designs) を用いて、これらの選択肢を組み合わせた選択セットを作成した。これにより、5項目の選択肢のうち4項目ずつが提示される5つの設問が作成された(表2)。これらの5つの設問を回答者に提示した。表3はBWSの質問例である。

表2 選択セット

設問	選択肢1	選択肢2	選択肢3	選択肢4
1	意味を普及させる	裏付けを示す	ラベルの統一	価格を安くする
2	意味を普及させる	ラベルの統一	価格を安くする	ラベル製品の割合を増やす
3	意味を普及させる	裏付けを示す	ラベルの統一	ラベル製品の割合を増やす
4	意味を普及させる	裏付けを示す	価格を安くする	ラベル製品の割合を増やす
5	裏付けを示す	ラベルの統一	価格を安くする	ラベル製品の割合を増やす

表3 BWSの質問例

あなたが森林認証ラベル付き製品をより積極的に選択するために一番必要だと思う取り組みと一番不要だと思う取り組みを1つずつ選択して下さい。

	ラベルの意味を世の中に普及させる	どのような裏付けをもとにラベルが付けられているのかをわかりやすく示す	いろいろなラベルを統一してわかりやすくする	ラベル付き製品の価格をもっと安くする
一番必要				
一番不要				

回答者の性別や年齢に関する情報は基本事項としてアンケート調査会社から提供を受けた。また、BWSに関する設問以外に森林認証に関する事前の認知状況や普段実施している環境配慮行動に関する設問を用意した。そのような要素をもとにサブサンプル毎に分析を実施する。なお、回答にあたっての前提知識として、森林認証制度の意味や概要についての説明を、表4のような形で回答者に示した。

表4 森林認証に関する説明

<p>森林認証制度とは</p> <p>森林は、樹木を伐採することによる木材利用のほかに、水源としての役割、災害を防止する役割、二酸化炭素を吸収する役割、生物の生息地として生態系を保全する役割など様々な役割を持っています。森林認証制度は、このような様々な役割が継続的に発揮されるよう、適切に管理された森林資源から得られた木材等に認証マークを付けることによって、森林破壊をすることなく持続的な森林の利用と保護を図ろうとする制度です。これは独立した第三者機関が評価し認証する環境ラベリング制度のひとつです。</p> <p>主な森林認証制度の概要は以下の通りです。</p> <p>主な森林認証の概要：林野庁 https://www.rinya.maff.go.jp/j/keikaku/ninshou/con_3_1.html</p>
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3. 結果と考察

3-1. 調査対象

アンケートはセルフ型アンケートツールである Freeasy を利用して、2024年2月26日から27日にインターネットで実施した。回答者の居住する地域によって森林との関わりや森林認証ラベル付き製品に接触する機会の程度が異なり、そのことが回答に影響を及ぼす可能性が考えられる。そのような居住地域による回答差を排除することを目的として東京都を居住地とする20代～60代の対象者のみを調査対象とした。420名の回答を得たが、60名の回答者がBWSの設問のいずれか1問以上において、ベストとワーストに同一の選択肢を選択したため、そのような回答者の回答を不適切な回答と判断し除外したところ、有効な回答者は360人となった。これらの有効回答者の個人属性の集計結果と環境保全行動に関する集計結果をそれぞれ表5と表6に示す。

表5 回答者の個人属性のクロス集計

		性別		年齢				
		男性	女性	20代	30代	40代	50代	60代
年齢	20代	19	27	-	-	-	-	-
	30代	27	28	-	-	-	-	-
	40代	46	43	-	-	-	-	-
	50代	43	48	-	-	-	-	-
	60代	40	39	-	-	-	-	-
森林認証製品を見たことがあるか	はい	45	38	15	20	21	14	13
	いいえ	130	147	31	35	68	77	66
森林認証に関する知識	人に説明できるくらい内容を知っていた。	4	8	3	3	4	2	0
	聞いたことはあった。	34	19	9	8	14	10	12
	内容は知らなかったがラベル付き製品を見たことがあった。	13	15	3	7	8	7	3
	内容は知らなかったしラベルを意識したこともなかった。	124	143	31	37	63	72	64

森林認証製品を見たことがある回答者が比較的多い年代は30代で、次いで20代といった結果となった。回答者の年代が上がる毎に森林認証製品を見たことがある回答者の割合が低下する傾向を確認できる。流通する森林認証製品を目にする機会が年代によって大きく異なることはないと考えられるため、この結果は相対的に若い年代の方が、このような森林認証製品に対する意識が高いことを表していると考えられる。森林認証に関する知識についても、相対的に高い年代で「内容は知らなかったしラベルを意識したこともなかった。」を選択した回答者の割合の高さが目立っている。男女差に着目すると、若干ではあるが男性が森林認証製品に対する意識が高い傾向を読み取ることが出来る。

表6 回答者の環境保全行動のクロス集計

		性別		年齢				
		男性	女性	20代	30代	40代	50代	60代
リサイクル：可能な限りリサイクルを行う	はい	106	122	17	29	60	62	60
	いいえ	69	63	29	26	29	29	19
エネルギーの節約：電化製品の使用を最小限に抑え、 unnecessaryな電力消費を避ける	はい	85	103	17	23	45	53	50
	いいえ	90	82	29	32	44	38	29
持続可能な製品の選択：森林認証ラベルがついた製品のような、環境に配慮した製品を選ぶ	はい	24	22	8	8	16	10	4
	いいえ	151	163	38	47	73	81	75
公共交通機関の利用：自動車の使用を減らし、公共交通機関を利用する	はい	76	73	11	14	34	45	45
	いいえ	99	112	35	41	55	46	34
牛乳や牛肉などを植物ベースの飲み物や大豆で作った肉で代替する	はい	8	9	4	0	8	1	4
	いいえ	177	166	42	55	81	90	75

リサイクルやエネルギーの節約などの比較的取り組みやすい環境保全行動を行っている回答者が多いことが確認できるが、持続可能な製品の選択や植物ベース食品の選択を行っている回答者は少数派である。リサイクルやエネルギーの節約など取り組みやすい環境保全行動については、相対的に高い年代で取り組む回答者の割合の高さがみられる一方、持続可能な製品の選択や植物ベース食品の消費などに取り組む回答者は相対的に若い年代で多い傾向がある。公共交通機関の利用については、女性よりも男性の方が、また高い年代であるほど実施割合が高い傾向を確認できる。

3-2. BWSの結果

BWSの分析において、各項目についてベストに選ばれた回数（トータルベスト）からワーストに選ばれた回数（トータルワースト）を差し引いて算出されるスコアをB-Wスコアといい、このスコアの大小をもとに各項目の相対的な位置を把握することが出来る。また、項目ごとにトータルベストのトータルワーストに対する比率（トータルベスト／トータルワースト）の平方根を取り、その値が最大の項目の数値で、すべての項目の数値を割ることで相対的重要度スコア（Relative Importance：RI）を算出することが出来る。RIは最も高く評価される項目の数値が1となり、それ以外の項目については最も高く評価される項目の数値を1とした場合の相対的な値が

算出される。項目間の相対的な関係を直感的に理解しやすいので、B-Wスコアに加えてRIを報告する。分析方法について、より詳しくは補論を参照されたい。

全サンプル、および男女別のB-WスコアとRIを表7に示す。

表7 全サンプル及び男女別のB-WスコアとRI

項目	全サンプル		男性		女性	
	B-Wスコア	RI	B-Wスコア	RI	B-Wスコア	RI
A. 意味を普及させる	498	1.000	201	1.000	297	1.000
B. 裏付けを示す	-97	0.419	-48	0.481	-49	0.360
C. ラベルの統一	-312	0.296	-152	0.350	-160	0.247
D. 価格を安くする	178	0.591	103	0.699	75	0.494
E. ラベル製品の割合を増やす	-267	0.274	-104	0.328	-163	0.228

RIによると、最も高く評価された項目は「意味の普及」であり、最も低く評価された項目は「ラベル製品の割合を増やす」であった。性別によって大きな違いは確認できない。

次に、年代別のB-WスコアとRIを表8に示す。

表8 年代別のB-WスコアとRI

項目	20代		30代		40代		50代		60代	
	B-Wスコア	RI	B-Wスコア	RI	B-Wスコア	RI	B-Wスコア	RI	B-Wスコア	RI
A. 意味を普及させる	50	1.000	99	1.000	124	1.000	81	0.969	144	1.000
B. 裏付けを示す	-28	0.426	-29	0.309	5	0.493	-28	0.514	-17	0.277
C. ラベルの統一	-24	0.433	-58	0.226	-52	0.336	-93	0.348	-85	0.162
D. 価格を安くする	14	0.638	28	0.521	6	0.492	106	1.000	24	0.348
E. ラベル製品の割合を増やす	-12	0.448	-40	0.228	-83	0.227	-66	0.383	-66	0.154

RIによると、50代において最も評価される項目が「価格を安くする」と他の年代と異なる結果となった。また、最も評価されなかった項目については20代で「裏付けを示す」、30代と50代で「ラベルの統一」、40代と60代で「ラベル製品の割合を増やす」と、年代間で異なる結果となった。

次に、森林認証ラベル付きの製品を見た経験別のB-WスコアとRIを表9に示す。

表9 森林認証ラベル付きの製品を見た経験別のB-WスコアとRI

項目	森林認証ラベル付きの製品を見たことがある		森林認証ラベル付きの製品を見たことがない	
	B-Wスコア	RI	B-Wスコア	RI
A. 意味を普及させる	123	1.000	375	1.000
B. 裏付けを示す	-17	0.417	-80	0.417
C. ラベルの統一	-30	0.374	-282	0.272
D. 価格を安くする	-27	0.387	205	0.660
E. ラベル製品の割合を増やす	-49	0.291	-218	0.269

森林認証ラベル付きの製品を見たことがあるかによる顕著な違いは「価格を安くする」に対する評価に見られる。ラベル付きの製品を見たことがある人にとっては特に必要性の高い取り組みではないのに対して、見たことがない人にとっては製品価格の低減が明確な差としてわかりやすく重要度が高いと考えられる。森林認証ラベル付きの製品を見たことがない人の中には、実際には目にしている、森林認証ラベルを意識していなかったため見たことに気づいていない人もある可能性がある。そのような森林認証ラベルに対する関心の低い人は、森林認証制度の意義を高く評価していないため、ラベル付き製品をより積極的に選択してもらうためには、ラベル付き製品の価格をもっと安くするといった、購入のための強い誘因を与える必要があることを示していると解釈することができる。

次に森林認証ラベルの知識別のB-WスコアとRIを表10に示す。

表10 森林認証ラベルの知識別のB-WスコアとRI

項目	人に説明できるくらい内容を知っていた。		聞いたことはあった。		内容は知らなかったがラベル付き製品を見たことがあった。		内容は知らなかったしラベルを意識したこともなかった。	
	B-Wスコア	RI	B-Wスコア	RI	B-Wスコア	RI	B-Wスコア	RI
A. 意味を普及させる	30	1.000	77	1.000	29	1.000	362	1.000
B. 裏付けを示す	-11	0.181	8	0.440	-15	0.433	-79	0.421
C. ラベルの統一	-3	0.219	-21	0.333	-21	0.359	-267	0.282
D. 価格を安くする	-10	0.144	-23	0.343	13	0.673	198	0.677
E. ラベル製品の割合を増やす	-6	0.094	-41	0.204	-6	0.485	-214	0.276

ここでも前の表と同様に「価格を安くする」の項目について違いが見られる。内容を知っていたり、聞いたことがある回答者にとって製品価格を安くすることは特に必要性の高い取り組みでないのに対して、内容を知らなかった回答者にとっては必要性の高い取り組みと評価されている。

次に、環境保全行動の実施状況別のB-WスコアとRIを表11に示す。

表11 環境保全行動の実施状況別のB-WスコアとRI

		実施者		未実施者	
		B-Wスコア	RI	B-Wスコア	RI
リサイクル：可能な限りリサイクルを行う	A. 意味を普及させる	350	1.000	148	1.000
	B. 裏付けを示す	-38	0.382	-59	0.463
	C. ラベルの統一	-201	0.253	-111	0.365
	D. 価格を安くする	53	0.457	125	0.900
	E. ラベル製品の割合を増やす	-164	0.239	-103	0.328
エネルギーの節約：電化製品の使用を最小限に抑え、 unnecessary 電力消費を避ける	A. 意味を普及させる	315	1.000	183	1.000
	B. 裏付けを示す	-41	0.347	-56	0.495
	C. ラベルの統一	-222	0.193	-90	0.437
	D. 価格を安くする	66	0.449	112	0.767
	E. ラベル製品の割合を増やす	-118	0.242	-149	0.299
持続可能な製品の選択：森林認証ラベルがついた製品のような、環境に配慮した製品を選ぶ	A. 意味を普及させる	90	1.000	408	1.000
	B. 裏付けを示す	-10	0.323	-87	0.433
	C. ラベルの統一	-10	0.313	-302	0.292
	D. 価格を安くする	-42	0.227	220	0.671
	E. ラベル製品の割合を増やす	-28	0.214	-239	0.283
公共交通機関の利用：自動車の使用を減らし、公共交通機関を利用する	A. 意味を普及させる	245	1.000	253	1.000
	B. 裏付けを示す	-18	0.328	-79	0.465
	C. ラベルの統一	-172	0.183	-140	0.385
	D. 価格を安くする	46	0.396	132	0.733
	E. ラベル製品の割合を増やす	-101	0.214	-166	0.301
牛乳や牛肉などを植物ベースの飲み物や大豆で作った肉で代替する	A. 意味を普及させる	32	1.000	466	1.000
	B. 裏付けを示す	1	0.249	-98	0.424
	C. ラベルの統一	-4	0.214	-308	0.296
	D. 価格を安くする	-16	0.159	194	0.622
	E. ラベル製品の割合を増やす	-13	0.136	-254	0.280

環境保全行動を行っている人と行っていない人で「価格を安くする」に対する評価が大きく異なっている点は注目に値する。森林認証ラベルがついた製品などの持続可能な製品の選択を行っている人は現在の価格のもとで実際にそれらの製品を選択している人であるため、そのような行

動をとっていない人と比較して価格を低減することの必要性を低く評価することが予想されるが、ここでの結果はその予想と一致する。その他についても、環境保全行動を行っている人の方が価格を低減することの必要性を低く評価している。これは、環境保全行動を行っている人の方がそうでない人よりも環境保全に対する関心が高く、森林認証ラベルがついた製品に対して支払う意欲が強いためであると考えられる。

4. おわりに

本研究では、森林認証ラベルの普及に向けて必要な取り組みに関する一般消費者の選好をBWSにより把握した。その結果、ラベルの意味を世の中に普及させることが最も必要と評価されることが全分析を通して示された。ここから、森林認証制度の意味を世の中に浸透させることの重要性が明らかとなった。また、森林認証制度に対する意識や知識レベルは相対的に若い年代ほど高いことや、相対的に若い年代の方が持続可能な製品の選択や植物ベース食物の消費などの環境保全行動を実施している割合が高いことが明らかとなった。さらに、森林認証制度に対する意識や知識レベルの高さと森林認証製品の価格の安さを重視する姿勢に関連があることを示唆する結果が得られた。すなわち、森林認証制度に関してよく知らない人は購入のための強い要因となる価格の安さを重視する傾向があることを示す結果が得られた。環境保全行動の実施状況別に行ったBWSの分析からは、環境保全行動を実施していない消費者の方が環境保全行動を実施している消費者よりも森林認証製品の価格の安さを重視する傾向があることが明らかとなった。

このように、本研究では、森林認証ラベルの普及に向けて必要な取り組みに関する一般消費者の認識を把握することができたが、一方で以下のような課題も残されている。

第一に、評価の対象となる取り組みを5つに限定しており、それら以外の取り組みに対する認識を調査できていない点である。本研究では森林認証制度の普及に関する先行研究や一般消費者への事前聞き取りをもとに5つの代表的な取り組みを選定したが、他にも森林認証制度の普及に効果的な取り組みが存在する可能性がある。今後はより広範な事前調査を実施するなどして、回答者に提示する取り組みの拡大や精緻化を行いたい。

第二に、調査の対象者の居住地域を東京都に限定しているため、その他の地域の居住者の認識を把握できていない点が挙げられる。地域による意識の違いを排除することを重視して調査対象者を東京都在住者に限定したが、森林をより身近に感じる事が出来る地域や森林認証ラベル付き製品に接触する機会が少ない地域においては、都市部の調査結果とは異なる結果を示す可能性が考えられる。今後は、他の地域でも調査を実施し、居住地による認識の違いを分析することを検討したい。

参考文献

- Aguilar, F. X., & Cai, Z. (2010). Conjoint effect of environmental labeling, disclosure of forest of origin and price on consumer preferences for wood products in the US and UK. *Ecological Economics*, 70(2), 308-316.
- Aguilar, F. X., & Vlosky, R. P. (2007). Consumer willingness to pay price premiums for environmentally certified wood

- products in the US. *Forest Policy and Economics*, 9(8), 1100-1112.
- Anderson, R. C., & Hansen, E. N. (2004). The impact of environmental certification on preferences for wood furniture: A conjoint analysis approach. *Forest Products Journal*, 54(3), 42.
- Anderson, R. C., & Hansen, E. N. (2004). Determining consumer preferences for ecolabeled forest products: an experimental approach. *Journal of Forestry*, 102(4), 28-32.
- Bigsby, H., & Ozanne, L. K. (2002). The purchase decision: Consumers and environmentally certified wood products. *Forest Products Journal*, 52(7/8), 100-105.
- Finn, A., & Louviere, J. J. (1992). Determining the appropriate response to evidence of public concern: the case of food safety. *Journal of Public Policy & Marketing*, 11(2), 12-25.
- Forsyth, K., Haley, D., & Kozak, R. (1999). Will consumers pay more for certified wood products?. *Journal of Forestry*, 97(2), 18-22.
- Gronroos, J. C., & Bowyer, J. L. (1999). Assessment of the market potential for environmentally certified wood products in new homes in Minneapolis/St. Paul and Chicago. *Forest Products Journal*, 49(6), 28.
- Louviere, J. J., Flynn, T. N., & Marley, A. A. J. (2015). *Best-worst scaling: Theory, methods and applications*. Cambridge University Press.
- Lusk, J. L., & Briggeman, B. C. (2009). Food values. *American Journal of Agricultural Economics*, 91(1), 184-196.
- Marley, A. A., & Louviere, J. J. (2005). Some probabilistic models of best, worst, and best-worst choices. *Journal of Mathematical Psychology*, 49(6), 464-480.
- O'Brien, K. A., & Teisl, M. F. (2004). Eco-information and its effect on consumer values for environmentally certified forest products. *Journal of Forest Economics*, 10(2), 75-96.
- Ozanne, L. K., & Vlosky, R. P. (1997). Willingness to pay for environmentally certified wood products: A consumer perspective. *Forest Products Journal*, 47(6), 39.
- Ozanne, L. K., & Vlosky, R. P. (2003). Certification from the US consumer perspective: a comparison of 1995 and 2000. *Forest Products Journal*, 53(3), 13-21.
- Tan, Q., Imamura, K., Nagasaka, K., & Inoue, M. (2019). Effects of eco-label knowledge on Chinese consumer preferences for certified wood flooring: a case study in Chongqing City. *Forest Products Journal*, 69(4), 329-336.
- Tan, Q., Imamura, K., Nagasaka, K., & Inoue, M. (2020). Consumer price premiums for FSC-labeled wood flooring: A comparison of five Chinese cities. *BioProducts Business*, 13-24.
- Teisl, M. F., Peavey, S., Newman, F., Buono, J., & Hermann, M. (2002). Consumer reactions to environmental labels for forest products: A preliminary look. *Forest Products Journal*, 52(1), 44.
- Veisten, K. (2007). Willingness to pay for eco-labelled wood furniture: Choice-based conjoint analysis versus open-ended contingent valuation. *Journal of Forest Economics*, 13(1), 29-48.
- Vlosky, R. P., Ozanne, L. K., & Fontenot, R. J. (1999). A conceptual model of US consumer willingness to pay for environmentally certified wood products. *Journal of Consumer Marketing*, 16(2), 122-140.
- Veisten, K. (2002). Potential demand for certified wood products in the United Kingdom and Norway. *Forest Science*, 48(4), 767-778.
- 安藤直人・白石則彦 企画・編集 (2019) 『概説 森林認証』海青社
- 大田伊久雄・鎌倉真澄 (2016) 「森林認証木材製品の価格プレミアムに関する実証的研究」*林業経済研究*、62 (3)、42-48.
- 柘植隆宏・栗山浩一・庄子康 (2024) 「ベスト・ワースト・スケーリングー環境経済・政策学研究への適用を中心にー」*環境経済・政策研究*、17 (2)、28-38.
- 長池卓男 (2014) 「森林認証制度に関する研究動向と展望ー特に森林の生物多様性保全に果たす役割に関してー」*日本森林学会誌*、96、267-273.

補 論

項目のB-Wスコア ($BW\ score_i$) とRI (RI_i) は以下のように算出される。

$$BW\ score_i = \sum_{n=1}^N B_{in} - \sum_{n=1}^N W_{in} \quad (A1)$$

$$RI_i = \frac{\sqrt{B/W}_i}{\max \sqrt{B/W}_i} \quad (A2)$$

ここで、 n は回答者を表す添え字、 N は回答者数、 $\sum_{n=1}^N B_{in}$ は項目 i のトータルベスト、 $\sum_{n=1}^N W_{in}$ は項目 i のトータルワースト、 $\sqrt{B/W}_i$ は、項目 i のトータルベストをトータルワーストで割って平方根を取ったもの、 $\max \sqrt{B/W}_i$ は $\sqrt{B/W}_i$ が最大の項目の $\sqrt{B/W}_i$ の値を表す。

これらのようにトータルベストとトータルワーストに基づいて各項目のスコアを計算する計数分析の他に、計量経済学的手法を用いた計量経済分析も可能である (Louviere et al., 2015; 柘植他, 2024)。計量経済分析の代表的なモデルは、最大差分 (maximum-difference: max-diff) モデルである (Finn and Louviere, 1992)。Max-diffモデルでは、回答者は選択肢のありうるすべてのペアの中から、評価の差が最大になるペアをベストとワーストに選択すると仮定される。本研究では、各設問で4つの選択肢が回答者に提示されるので、回答者が選択可能なベストとワーストのペアは $12(4*3=12)$ 個になる。

Max-diffモデルの概要は以下の通りである。 β_i は選択肢 i の必要性を表し、 $Difference_{ij}$ は選択肢 i と選択肢 j の必要性の差を表すとする。

$$Difference_{ij} = \beta_i - \beta_j + \varepsilon_{ij} \quad (A3)$$

ただし、 ε_{ij} は誤差項を表す。回答者がすべての選択肢の中から選択肢 i と選択肢 j をベストとワーストに選択する確率は、選択肢 i と選択肢 j の必要性の差が選択セットにおける他のありうるすべてのペア (本研究では $12-1=11$) の必要性の差よりも大きい確率として以下のように表わされる。

$$\begin{aligned} P_{ij} &= \Pr(Difference_{ij} > Difference_{kl}) \\ &= \Pr\left((\beta_i - \beta_j) - (\beta_k - \beta_l) > \varepsilon_{kl} - \varepsilon_{ij}\right) \quad (A4) \end{aligned}$$

ここで、 ε_{ij} が独立で同一な第I種極値分布 (ガンベル分布) にしたと仮定すると、回答者が J の選択肢の中から選択肢 i をベスト、選択肢 j をワーストに選択する確率 P_{ij} は、以下のように表される (Lusk and Briggeman, 2009)。

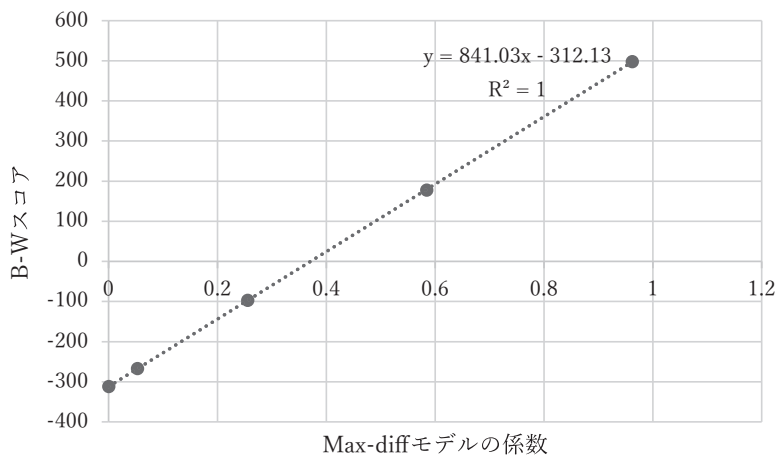
$$P_{ij} = \frac{\exp(\beta_i - \beta_j)}{\sum_{k=1}^J \sum_{l=1}^J \exp(\beta_k - \beta_l) - J} \quad (A5)$$

前述のB-Wスコアは、このような計量経済分析により推定される各選択肢の係数 β_i の精度の高い近似値であることがこれまでの研究で示されている (Marley and Louviere, 2005)。確認のため、本研究のデータにmax-diffモデルを適用し、そこで得られた係数と計数分析により算出されたB-Wスコアを比較する。Max-diffモデルの推定結果は表A1の通りである。ここでは、ダミー変数の基準として、「ラベルの統一」を推定から除外しているため、推定された各係数は推定から除外された「ラベルの統一」の係数をゼロとした場合の相対的な値と解釈される。それらの係数の推定値と計数分析により算出されたB-Wスコアの相関を示したものが図A1である。両者には強い相関が見られることから、B-Wスコアをmax-diffモデルの推定値の近似値として用いることの妥当性を確認することができる。この結果を受けて、本研究では計数分析に基づいて議論を行う。

表A1 Max-diffモデルの推定結果

変数	係数	標準誤差
A. 意味を普及させる	0.96223	0.051***
B. 裏付けを示す	0.25563	0.049***
C. ラベルの統一	0	-
D. 価格を安くする	0.5846	0.050***
E. ラベル製品の割合を増やす	0.05321	0.049
対数尤度	-4209.929	
回答者数	360	

注：*** 1%水準で有意。



図A1 計数法とmax-diffモデルの比較

上智地球環境学会

1. 設立主旨

持続可能な地球社会システムを形成するために、社会科学、人文科学そして自然科学の成果を総合した地球環境学の創成と発展の必要性が今日誰の目にも明らかになってきています。上智地球環境学会は、これに貢献するために研究者の知的コミュニケーションと人的ネットワークの形成およびそれを基礎にした、研究と人材育成のダイナミックな展開を目的として発足しました。自由でオープンな議論、自立的な研究の相互依存、琢磨によって新しい文明創造的な場を広く提供していきます。

2. 学会の活動

- | | |
|---------------------|--------------------|
| (1) 定例研究会の開催 | (2) 研究紀要『地球環境学』の発行 |
| (3) ディスカッションペーパーの発行 | (4) その他 |

3. 構成メンバー

- | | |
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| (1) 地球環境学研究科 専任教員 | (2) 地球環境学研究科 大学院生 |
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