



HEART OF THE KUANKRENG SWAMP: A BUDDHIST-LED JOURNEY TOWARD SUSTAINABLE FOREST STEWARDSHIP

Saowapong Yamaphat*, Wee Rawang, Pagorn Singsuriya, Seree Woraphong, Patranit Srijuntrapun

Faculty of Social Sciences and Humanities, Mahidol University, Nakhon Pathom, Thailand

*Corresponding author E-mail: saowapongy@gmail.com

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Abstract

Background and Objectives: The Kuankreng Peat Swamp Forest (KPSF) in Southern Thailand is a vital social-ecological system providing critical ecosystem services. However, it faces severe threats from recurring wildfires and land degradation, often driven by a disconnect between human ethics and nature. This study aimed to examine the current environmental conditions, ecological benefits, and factors contributing to environmental degradation in KPSF; To assess existing environmental education learning frameworks and community awareness related to KPSF management; To develop the DHAMMA-EE Model by integrating Buddhist principles with environmental conservation practices; and To evaluate the quality and effectiveness of the model.

Methodology: This research employed a participatory mixed-methods design conducted across three provinces: Nakhon Si Thammarat, Phatthalung, and Songkhla. To address the first two objectives, a situational analysis was performed through a quantitative survey of 400 residents, using proportional stratified random sampling to identify degradation factors and current awareness levels. Qualitative data were gathered via in-depth interviews and focus group discussions with 53 purposively selected community leaders and ecological experts to evaluate existing educational frameworks. For the third objective, the DHAMMA-EE Model was synthesized by integrating the "B-EE Process" with core Buddhist tenets, specifically *Paticcasamuppada* (Dependent Origination), *Tilakkhaṇa* (Three Characteristics), and *Tisikkhā* (Threefold Learning). Finally, the fourth objective was fulfilled by implementing the model through community workshops and evaluating its effectiveness using the Kirkpatrick Evaluation Framework, which measured four levels: Reaction, Learning, Behavior, and Results (Public Benefit).

Main Results: The findings demonstrated that the DHAMMA-EE Model significantly facilitated "Environmental Actualization" among participants. By anchoring environmental education in the principles of Dependent Origination, Three Characteristics, and Threefold Learning, the model successfully shifted stakeholder mindsets from anthropocentric consumption to social-ecological interdependency. Quantitatively, the evaluation showed exceptionally high scores across all Kirkpatrick dimensions. Participants demonstrated a profound increase in



cognitive understanding of peat swamp ecology ($\bar{x} = 8.04$), while the behavioral assessment revealed a proactive commitment to wildfire prevention and sustainable harvesting. Most notably, the model empowered the community to initiate 20 local stewardship projects. The "Public Benefit" score ($\bar{x} = 8.02$) confirmed that the integration of Buddhist ethics fostered a sense of "Local Dignity" and self-reliance, creating a resilient social-ecological harmony that transcends conventional top-down management approaches.

Involvement to Buddhadhamma: This research is categorized under Applied Buddhism, particularly Buddhism and sustainable development, as it demonstrates the application of Buddhist wisdom to address modern environmental crises. Specifically, the development of the DHAMMA-EE Model serves as a Buddhist innovation in the form of process and method development for ecological preservation. Furthermore, the study aligns with Buddhism and sustainable development by integrating the principles of Dependent Origination, Three Characteristics, and Threefold Learning to foster long-term environmental stewardship within the KPSF. By addressing spiritual causes through mindful discipline, this integration shifts behavior toward a compassionate, interdependent relationship with nature.

Conclusions: The DHAMMA-EE Model proves to be a robust and culturally resonant framework for environmental management in Buddhist-majority contexts. Unlike standard educational programs that focus solely on information transfer, this model facilitates an internal transformation, a "Heart-centered" journey, that leads to sustainable collective action. The research concludes that for the KPSF to survive and thrive, management strategies must move beyond biophysical conservation to include the spiritual and ethical dimensions of the human spirit. The DHAMMA-EE Model offers a scalable and adaptable pathway for other threatened ecosystems, demonstrating that when environmental stewardship is rooted in ancient wisdom, it provides a powerful catalyst for modern ecological restoration and social well-being.

Keywords: Buddhist-based Environmental Education, Kuankreng Peat Swamp Management, Spiritual Stewardship, Community-led Conservation

Introduction

Current global challenges involve significant environmental degradation, driven by increasing human populations, economic expansion, and technological advancements. Key issues encompass widespread pollution, natural disasters, species extinction, and rapid resource depletion, exacerbated by human activities such as deforestation (Williams, 2006); (World Commission on Forests and Sustainable Development (WCFS), 1999). Forest resources, particularly peat swamp forests, are critical for livelihoods, ecological balance, and carbon sinks. KPSF can store 29,682,787 tons of carbon per hectare, 10 times higher than other forest types, serving as a major global carbon sink (Bonn, et al, 2016); (United Nations Development Programme, 2021). However, global tropical forests lost 14 million hectares between 1980 and 1999 (Food and Agriculture Organization of the United Nations, 2001). and Thailand's forest



cover declined from over 40% before 1961 to 31.57% in 2013 due to agricultural expansion (Forest Land Management Bureau, 2014). Beyond the ecological statistics and environmental metrics, the Kuankreng Peat Swamp Forest represents the lifeblood of its people. For years, this landscape has been scarred by recurring wildfires and resource depletion, challenges that are as much spiritual as they are physical. This study moves past conventional top-down management by rooting environmental education in the profound wisdom of Buddha's teachings. By recognizing the "Interdependency" (Paṭṭicasamuppāda) between the swamp and the soul, this research seeks to transform local residents from mere resource users into mindful stewards. It is not just about saving a forest; It is about awakening a collective conscience to ensure that the heartbeat of Kuankreng continues to thrive for generations to come.

Peat swamp forests, covering about 3% of Earth's surface (Nuyim, 2003), have been extensively converted for agriculture, with Thailand converting 83% of its total swamp areas (Office of Natural Resources and Environmental Policy and Planning [ONEP], 2008). In Thailand, these unique ecosystems have diminished from 64,554.62 hectares in 1991 to less than 60,000 rai (Approximately 2,560 Hectares) currently (Nuyim, 2003); (Phengkhai et al., 2014). The degradation of the peat swamp forest is far more than a statistical decline; It represents a direct threat to the respiratory health of children and the elderly due to wildfire haze, while simultaneously destabilizing the food security of local communities that rely on Krajoed for their livelihoods.

The Kuankreng Peat Swamp Forest faces critical environmental challenges. Firstly, volatile and abnormally low water levels during the dry season (June-September) impact ecology and biodiversity (Yunus et al., 2025). This recession stems from decreased rainfall, agricultural demands, and development projects like the Pak Phanang River Basin Project. Secondly, frequent dry-season wildfires, 90% of which result from water scarcity, cause permanent loss of unique flora and fauna (Khampeera et al., 2021); (Nash et al., 2026). Consequently, the ASEAN Peatland Management Strategy (APMS) 2023-2030 has set a "Zero Burning" target to eliminate fires and haze (Association of Southeast Asian Nations (ASEAN), 2023). Thirdly, biodiesel policies have driven the invasion of approximately 3,000 rai annually for plantations since 2005 (ORDPB, 2014). These issues are compounded by acid sulfate soil intensification (Agus et al., 2019) and aquatic degradation from wastewater, disrupting local fisheries and ecosystems.

Kuankreng Peat Swamp Forest conservation has been central to royal initiatives for decades. In 2002, King Bhumibol Adulyadej initiated water regulatory structures within the Pak Phanang Project to maintain water levels and mitigate fire risks. This was reinforced in 2012 by Princess Maha Chakri Sirindhorn, who emphasized hydrological management through embankments to ensure ecosystem saturation. However, despite these initiatives, international frameworks (UNDP, 2021) and recent private investments like the Tropical Asia Forest Fund 2 (New Forests, 2024), technical and policy-driven solutions alone remain insufficient. Globally, scholars argue that sustainable conservation must prioritize indigenous livelihoods and cultural institutions (Cano et al., 2026); (Baron-Aguilar et al., 2025). This international perspective is further supported by Asante et al.



(2025), who emphasize the integration of indigenous ecological knowledge to combat global environmental crises. This shift aligns with the DHAMMA-EE Model, which posits that cultivating stakeholders' fundamental understanding of their relationship with nature is essential for sustainable management and community participation.

This research proposes environmental education based on Buddhist teachings as a sustainable solution to redefine human-environment interactions. This approach emphasizes self-understanding, human nature, and roles, elements often overlooked in traditional environmental education (Macy, 1991); (Phra Brahmaganabhorn (P. A. Payutto), 2016); (Sivaraksa, 2009). Buddhist principles, such as the Three Characteristics, Dependent Origination, and Threefold Learning, cultivate the human mind to coexist harmoniously with a developing world without environmental compromise. This aligns with environmentalists' suggestions that protection should be rooted in ethics and morality rather than power or scientific tools alone (Avner, 2000). By addressing greed, delusion, and selfishness, the root causes of environmental degradation, this model offers a profound, long-term impact on thinking and worldviews, even when immediate results are not apparent (United Nations Educational, Scientific and Cultural Organization, 2016).

Objectives

This study aimed to examine the current environmental conditions, ecological benefits, and factors contributing to environmental degradation in the Kuankreng Peat Swamp Forest (KPSF); To assess existing environmental education learning frameworks and community awareness related to KPSF management; To develop the DHAMMA-EE Model by integrating Buddhist principles with environmental conservation practices; and To evaluate the quality and effectiveness of the proposed model for sustainable KPSF management.

Methodology

Research Design: The study employed a convergent parallel mixed-methods design, where quantitative and qualitative data were collected concurrently to provide a comprehensive understanding of the environmental conditions and the educational model. Quantitative research focuses on surveying current situations, model development, and effectiveness evaluation. Qualitative research uses in-depth interviews and focus group discussions to understand environmental conditions, management practices, and key model components. Findings from both phases were integrated to synthesize the environmental education model grounded in Buddhist principles.

Population and Sample: The study utilized a multi-stage sampling approach. Proportional stratified random sampling was used to select 400 residents from a population of 117,207 across three provinces based on geography. The survey was administered by the researcher and a team of trained research assistants between July 2017 and February 2018. The team visited local communities across the three targeted provinces to distribute the questionnaires directly to the 400 sampled residents, ensuring a high response rate and providing necessary clarifications during



the sessions. Additionally, a cohort of 53 volunteers was recruited to evaluate the innovation. These volunteers participated in a model implementation workshop to assess the innovation's effectiveness through the lens of the Kirkpatrick Evaluation Model.

For the qualitative phase, purposive sampling was used to select 15 local experts with at least five years of experience in the KPSF who demonstrate a commitment to the Sufficiency Economy Philosophy or sustainable development. Additionally, 20 local leaders participated in situational analysis and feasibility focus groups, supported by three purposively selected external experts in environmental education, Buddhism, and environmental management for validation.

The primary instruments included a structured questionnaire and semi-structured interview schedules. The questionnaire comprised sections on demographics, environmental awareness, and management practices. Two Likert scales were employed: A 5-point scale (Strongly Disagree to Strongly Agree) for general sections, and a 10-point scale for "Community Needs and Participatory Management" (Table 5) to enhance sensitivity and provide granular reflections on Buddhist-based management. Data analysis utilized both quantitative and qualitative techniques. Descriptive statistics ($\bar{x}$ and S.D.) analyzed environmental conditions and awareness levels. To evaluate the DHAMMA-EE Model, data from 53 volunteers were analyzed across four Kirkpatrick levels using $\bar{x}$ and S.D.: Level 1: Reaction - Participants' satisfaction with the model. Level 2: Learning - Improvements in affective, cognitive, and psychomotor domains regarding stewardship. Level 3: Behavior - Practical application of Buddhist principles and sustainable practices. Level 4: Results - Broader impacts on community and ecosystem sustainability. Content validity was quantified using the Index of Item-Objective Congruence (IOC). Qualitative data from interviews and focus groups underwent Content Analysis, involving data reduction, display, and conclusion drawing. Themes were categorized by Buddhist principles and management practices, with triangulation ensuring credibility and consistency.

Implementation and Framework: The methodology was specifically designed to bridge Buddhist principles of Paṭiccasamuppāda (Dependent Origination), Tilakkhaṇa (Three Characteristics), and Tisikkhā (Threefold Learning) with sustainable peat swamp forest management. This integrated approach aimed to transform human-environment interaction by redefining self-understanding and ecological roles within the local community.

Results and Discussion

The results of the research were as follows:

Result by objective 1: To examine the current environmental conditions, including ecological benefits, and key factors contributing to environmental degradation:

1.1 Quantitative Results: Demographic



Table 1 Demographic Characteristics

Demographic Characteristics	Number	Percentage (%)
1. Gender		
Male	187	46.75
Female	213	53.25
2. Age		
20 - 30 years	29	7.25
31 - 40 years	83	20.75
41 - 50 years	114	28.50
51 - 60 years	99	24.75
Over 60 years	75	18.75
3. Religion		
Buddhism	400	100.00
4. Education		
Primary education	202	50.50
Secondary education/Occupational certificate	111	27.75
Diploma/Advanced occupational certificate	23	5.75
Bachelor's degree	58	14.50
Master's degree	3	0.75
Others	3	0.75
5. Family Status		
Single	52	13.00
Married	320	80.00
Widowed/Divorced	28	7.00
6. Occupation		
Agriculturist	252	63.00
Government official	40	10.00
State enterprise	6	1.50
Company	3	0.75
Merchant	28	7.00
Others	71	17.75
7. Monthly income		
Lower 10,000 baht	309	77.25
10,001 - 20,000 baht	63	15.75
20,001 - 30,000 baht	12	3.00
30,001 - 40,000 baht	8	2.00
Over 40,000 baht	8	2.00
$(\bar{X} = 8,711.91, S.D. = 9,013.30)$		
8. Duration of living in the Community		
Lower than 10 years	32	8.00
11 - 20 years	36	9.00
21 - 30 years	51	12.75



Table 1 Demographic Characteristics (Continued)

Demographic Characteristics	Number	Percentage (%)
31 - 40 years	72	18.00
41 - 50 years	80	20.00
51 - 60 years	74	18.50
Over 60 years	55	13.75
$(\bar{x} = 41.11, S.D. = 18.42)$		

Table 1 illustrates the personal information: (N = 400) Gender: The majority of informants were female (53.25%, n = 213), with males constituting 46.75% (n = 187); Age: The largest age group was 41 - 50 years (28.50%, n = 114), followed by 51 - 60 years (24.75%, n = 99) and 31 - 40 years (20.75%, n = 83); Religion: All respondents identified as Buddhist (100.00%, n = 400); Education: Over half of the informants had primary education (50.50%, n = 202). Secondary education or occupational certificates accounted for 27.75% (n = 111), while 14.50% (n = 58) held a bachelor's degree; Family Status: A significant majority were married (80.00%, n = 320), followed by single individuals (13.00%, n = 52). Occupation: Most respondents were agriculturalists (63.00%, n = 252), with government officials making up 10.00% (n = 40). Monthly Income: The average monthly income was 8,711.91 baht (S.D. = 9,013.30). A large proportion (77.25%, n = 309) earned less than 10,000 baht per month. Duration of Living in the Community: The average duration of living in the community was 41.11 years (S.D. = 18.42). The highest percentage of residents had lived in the community for 41-50 years (20.00%, n = 80).

1.2 The Environmental Situations in KPSF

Table 2 Distribution of objectives for land, water, and plant uses

Objectives	land use		water use		plant use	
	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
Agriculture	289	72.25	316	79.00	-	-
Industry	0	0	8	2.00	-	-
Residence	79	19.75	34	8.50	-	-
Livestock farming	17	4.25	17	4.25	-	-
Others	15	3.75	25	6.25	-	-
Food consumption	-	-	-	-	51	12.75
Handicraft	-	-	-	-	207	51.75
Construction	-	-	-	-	56	14.00
Fuelwood	-	-	-	-	11	2.75
Herbal medicine	-	-	-	-	2	0.50
Others	-	-	-	-	73	18.25

Table 2 illustrates the primary objectives associated with three types of uses: Land, water, and plant-based resources.

Land and Water Uses: Agriculture is the dominant objective for both land and water use, accounting for 72.25% and 79.00%, respectively. Residential use follows as the second most significant category for land use at 19.75%. Interestingly, while industry represents a negligible portion of land use (0%), it accounts for 2.00% of water use.

Plant Use: The distribution for plant use reveals a distinct focus on handicraft, which represents the highest frequency with 207 instances (Equivalent to 51.75%). Other notable uses for plant resources include food consumption at 12.75% (51 Instances) and others (e.g., Fishing Boats, Buffalo Stable, and Non-User) at 18.25% (73 Instances). Minor categories: Specialized uses such as construction (14.00%), fuelwood (2.75%), and herbal medicine (0.50%) comprise the remaining utility of plant-based uses.

1.3 Key factors contributing to environmental degradation in KPSF.

Table 3 Key factors contributing to environmental degradation

Causes	Number	Percentage (%)
Causes of water level recession		
Excessive water uses in agriculture	77	19.25
Natural causes	264	66.00
Impacts of Pak Panang River Watershed Development Project	28	7.00
Others	31	7.75
Natural causes of peat swamp forest degradation/loss		
Landslide	5	1.25
Flooding	128	32.00
Rainstorm	7	1.75
Wildfire	252	63.00
Others	8	2.00
Anthropogenic causes of peat swamp forest (Degradation/Loss)		
Encroachment on the peat swamp forest	91	22.75
Trading	63	15.75
Agricultural expansion	196	49.00
Housing and other constructions	36	9.00
Others	14	3.50

The data in Table 3 illustrate the various factors contributing to the decline of peat swamp forest ecosystems, categorized into water level recession, natural causes, and anthropogenic activities.



Analysis of Water Level Recession: Regarding the recession of water levels in peat swamp forests, natural causes represent the most significant factor at 66%. However, excessive water use in agriculture also plays a substantial role, accounting for 19.25% of the observed decline.

Analysis of Natural Degradation: In terms of natural degradation, wildfires are identified as the predominant cause, impacting 63% of the area, followed by flooding at 32%. Other natural events, such as rainstorms and landslides, contribute minimally to the overall loss.

Analysis of Anthropogenic (Human) Causes: Human activities significantly exacerbate forest loss. Agricultural expansion is the leading anthropogenic cause at 49%. Additionally, encroachment on peat swamp forests (22.75%) and the conversion of land for housing and other constructions (9%) further demonstrate the pressure of human settlement and commercial activities on these ecosystems.

Result by objective 2: To assess the existing environmental education process learning frameworks in the KPSF:

Table 4 Levels of environmental education process learning (EE - Process) about KPSF

Items	$\bar{x}$	S.D.	Level
Awareness	3.96	1.05	High
Attitude	4.16	1.04	High
Knowledge	4.20	0.93	High
Skill	3.88	0.93	High
Participation	3.80	1.04	High
Ability to evaluate	4.27	0.93	Very high
Total Average	4.05	0.58	High

Analysis of the data in Table 4 reveals that the participants' environmental education process learning levels were high overall ($\bar{x} = 4.05$, S.D. = 0.58). The highest performance was observed in the Ability to evaluate ($\bar{x} = 4.27$), which was the only dimension to reach the "Very High" level. Other factors, including Knowledge, Attitude, Awareness, Skill, and Participation, all demonstrated high-level results with means ranging from 3.80 to 4.27. These findings are supported by interview data, which mentions that.

"Reflecting on the Livelihoods of Peat Swamp Forest Dwellers in the Past, as I have Observed Since My Childhood, Most Villagers Recognized the Vital Importance of Natural Resources. They were Deeply Aware of this Significance Because It was Their Primary Source of Sustenance. Consequently, They Managed and Cared for These Resources Through Traditional Methods, Practices that, While Well-intentioned, may have been Inconsistently Effective. Local Residents Possess Significant Indigenous Ecological Knowledge Regarding the Peat Swamp Forest; However, there is a Critical Need for Structured Environmental Education to Enhance Systematic Conservation Practices and to Cultivate Effective Community Leadership for Continuous and Sustainable Improvement." (Phoryai, 2017)



Table 5 Assessment of Community Needs and Guidelines for Participatory Management in KPSF

Items	$\bar{x}$	S.D.	Level
There should be some activities about mental education for people in KPSF	8.16	1.81	High
The people should know well about the environment in KPSF	8.29	1.67	Very high
Promoting ecological awareness among the local people of KPSF is a critical necessity	8.57	1.59	Very high
The local people should understand participatory management in KPSF	8.39	1.68	Very high
Some activities to promote a sense of belonging should be arranged for people in KPSF	8.55	1.65	Very high
The promotion of occupations that improve the quality of life and environment needs to be performed in KPSF	8.51	1.59	Very high
Occupational groups need to be promoted for people in KPSF	8.51	1.61	Very high
Interdependency is a significant factor for developing the quality of life and environment in KPSF	8.59	1.60	Very high
The authorities should provide more opportunities for people's participation in forming the policy of community development	8.56	1.68	Very high
Public minds should be promoted and supported for people to join the management in KPSF	8.54	1.61	Very high
Environmental ethics should be promoted and applied for participatory management in KPSF	8.49	1.62	Very high
Buddhist monk organizations should have greater participation in the management of KPSF	7.38	2.32	High
Total Average	8.38	1.30	Very high

The analysis of community perspectives on the development and management of the KPSF, as presented in Table 5, reveals an overall "Very High" level of importance, with an aggregate mean of 8.38 (S.D. = 1.30). This indicates a strong consensus among stakeholders regarding the necessity for integrated Buddha's Teachings, environmental, and social interventions. When examining individual dimensions, the highest priority was placed on interdependency as a critical factor for improving the quality of life and the environment ($\bar{x}$ = 8.59, S.D. = 1.60), closely followed by the promotion of ecological awareness ($\bar{x}$ = 8.57, S.D. = 1.59). Furthermore, there is a significant demand for participatory policy-making, with respondents emphasizing that authorities should provide more opportunities for community involvement in development planning ($\bar{x}$ = 8.56, S.D. = 1.68). In terms of social and spiritual dimensions, the promotion of a "Sense of Belonging" ($\bar{x}$ = 8.55) and public-mindedness ($\bar{x}$ = 8.54) were identified as key drivers for successful participatory management. While all items were rated highly, the



involvement of Buddhist monk organizations received the relatively lowest mean score ($\bar{x}$ = 7.38, S.D. = 2.32), yet remained within the "High" level of importance.

These results underscore a critical need for a holistic management approach that balances occupational promotion and quality of life with Buddhist Environmental Ethics and participatory governance.

Moreover, there was some qualitative information mentioned.

"All the Villagers in the Peat Swamp Forest have been Buddhists Since Birth. Our Ancestors have Always Taught Us to Remain Steadfast in the Buddha's Teachings, and We Continue to Deeply Respect and Cooperate in Various Activities Led by the Monks. Therefore, I Believe that If We are to Further Enhance the Management of the Kuankreng Peat Swamp Forest, It is Possible to Apply the Buddha's Teachings Because We Believe in Buddhist Monks." (Krunoi, 2017)

"In My Sub-District, We have Suffered from Storms and Floods Many Times. Each Time, the Damage Varied, and There were Moments of True Discouragement Because the Villagers Still have to Survive, and We have Children in School Who need Our Care. However, Because We are Buddhists, We have been Able to Overcome These Hardships Through Principles Such as Patience and Mutual Assistance. I Agree to Use the Religious Teachings; Most People won't be Very Understanding of the Natural World; They Think Only of Applying Nature. I am Confident that Our Peat Swamp Forest Management will Certainly Improve." (Kamnan, 2017)

"A Large Number of Villagers Come to Make Merit at My Temple, Especially During Various Merit-making Festivals. I Always Tell them about The Application of Buddha's Teachings in Managing their Daily Lives, Livelihoods, and the Frequent Problem of Peat Swamp Forest Fires. Everything will be Achieved if It is based on the Buddha's Teachings, Because Our Grandparents and Ancestors were Able to Overcome Those Same Experiences and Hardships Through the Use of Buddhist principles to Solve Their Problems." (Luang, 2017)

Result by objective 3: The DHAMMA-EE Model for Kuankreng Management

The synthesized "DHAMMA-EE Model" integrates spiritual wisdom with daily survival through five "Moving Parts" (Factors) driven by two "Founding Pillars" (Conditions), as shown in Figure 1.

The Five Moving Parts (Factors):

Knowing Our Home (Community Identification): Rediscovering the value of local soil, water, and traditions to transform forest management into an identity-based practice.

Empowering Local Hearts (Leader Competency): Strengthening leader ethics and courage, turning indigenous wisdom into a forest protection shield.



Taking Ownership (Autonomous Project Management): Enabling communities to design their own conservation paths, goals, and timelines rather than awaiting top-down mandates.

Growing Together (Occupational Groups): Linking conservation to livelihoods through groups like sustainable handcrafting or organic farming to ensure economic stability.

Building the Network (Public Connections): Connecting local groups with external support for long-term strength and stability.

The Dual Founding Pillars (Conditions):

The "Heart-to-Action" Process (Environmental Education): An internal engine transforming awareness into real-world environmental behavior.

The "Compass of Wisdom" (Buddhist Teachings): Utilizing Interdependency and Mindfulness (Threefold Learning) as a moral compass to maintain community commitment.

In essence, this model functions like a wheel: Spiritual wisdom (The Core) inspires community action (The Spokes), moving the village toward a future where the forest and people thrive as one.

Result by objective 4: To evaluate the quality and effectiveness of the model.

The result of the innovation's quality was confirmed through the Index of Item-Objective Congruence (IOC) of the seven components of the model.

Content Validity

The model's content validity was evaluated based on seven components: 1) Learning the Community Identification, 2) Developing Local People, Local Wisdom, and Local Leader Competency, 3) Providing Autonomous Project Management, 4) Building Effective Groups of Occupation, 5) Connecting Public Networks, 6) Environmental Education: Internal and External Behaviors, and 7) Buddha's Teachings: Dependent Origination, Three Characteristics, and Threefold Learning.

The overall IOC score for content validity was 0.93, indicating high agreement among experts regarding the relevance of the model's components. Most items received an IOC of 1.00, with two items ("Developing the Local People, Local Wisdom, and Local Leader Competency" and "Connecting the Public Networks") receiving 0.67, still above the acceptable threshold.

Construct Validity

The construct validity was inspected against the research theories of Buddhist Education, Project Management, and System Theory. All three theoretical concepts demonstrated an average IOC score of 1.00, signifying excellent alignment between the model and its underlying theoretical frameworks.

Concept of Buddhist Education: This included Dependent Origination (12 Steps, All IOC = 1.00), Three Characteristics (3 Aspects, All IOC = 1.00), and Threefold Learning (3 Aspects, All IOC = 1.00).



Concept of Project Management: This covered Goal/Objective, Approaches, Input/Resources, and Time Frame, all of which received an IOC of 1.00.

In conclusion, the innovative DHAMMA-EE Model demonstrated appropriate content and construct validity, with an overall IOC score of 1.00 (Exceeding the 0.50 Threshold), making it suitable for practical application in the research area.

Innovation Effectiveness Evaluation

The practical feasibility of the model was evaluated by 53 volunteers (Including Local People, Leaders, Government Officials, and Buddhist Monks). The Kirkpatrick evaluation model was applied to assess satisfaction, learning, behavior, and public benefits.

Detailed Effectiveness Results are as follows:

Table 6 Evaluation of innovation effectiveness on the DHAMMA-EE Model

Items	$\bar{x}$	S.D.	Level of effectiveness
Internal Skills			
Satisfaction (Reaction)	7.88	1.63	High
Learning (Affective, Cognitive, and Psychomotor Domains)	8.04	1.59	High
External Skills			
Behavior	7.70	1.69	High
Public benefit (Results)	8.02	1.45	High
Total Average	7.91	1.59	High

Table 6 presents the evaluation results of the innovation effectiveness of the DHAMMA-EE Model. The findings indicate that the overall effectiveness of the model is at a high level with an overall mean of 7.91 (S.D. = 1.59). When considering individual items, all aspects were rated at a high level. "Learning" received the highest mean score ($\bar{x}$ = 8.04, S.D. = 1.59), followed by "Public Benefit" ($\bar{x}$ = 8.02, S.D. = 1.45). The aspects of "Satisfaction" and "Behavior" also showed high effectiveness with mean scores of 7.88 and 7.70, respectively.

Furthermore, the participants were divided into six groups and proposed 20 autonomous projects aimed at sustainable Kuankreng peat swamp forest management.

These projects consistently aligned with the seven components of the innovative model, demonstrating its practical applicability and the community's engagement in addressing local environmental and socio-economic needs. The proposed projects covered themes such as cultivating environmental actualization, occupation, and participatory environmental management.

Table 7 Consistency of proposed projects and main emphasis and innovation components

No.	Projects	Main Emphasis			Consistency of Innovation Components					
					Factors					Conditions
		(1)	(2)	(3)	①	②	③	④	⑤	① ②
1.	Sustainable autonomy of community health	***	**	*			✓			
2.	Return trees to the forest and return fish to the peat swamp	***	*	**	✓					
3.	Ecological tourism training	*	***	**	✓					
4.	Conservative community market	**	***	*			✓			
5.	Local readers and people development for autonomous occupations	*	***	**		✓				
6.	Ridge construction for peat swamp forest	**	*	***						✓
7.	Community's new theory	**	***	*			✓			
8.	Wildfire volunteers for the peat swamp forest	***	*	**						✓
9.	Community occupational promotion	*	***	**				✓		
10.	Learning center of sufficiency economy	*	***	**			✓			
11.	Participatory forum for peat swamp forest	***	*	**					✓	
12.	Krajood product development	*	***	**				✓		
13.	Participatory conservation of aquatic life	*	**	***						✓
14.	Young producers of mulberry and silk weaving	*	***	**		✓				
15.	Training on the replaced forest plantation	***	*	**	✓					
16.	Community sufficiency economy	*	***	**			✓			
17.	Human mind plantation of tree	***	*	**						✓
18.	Krajood conservation for children	***	*	**		✓				
19.	Construction of Thang Poon reservoir	***	*	**	✓					
20.	Clarification of Buddha's Teachings	***	*	**						✓
Total		9	9	2	5	3	4	2	1	2 3

Remark: ① Main emphasis 1) Refers to environmental actualization projects, Main emphasis 2) Refers to occupational projects, and Main emphasis, and 3) Refers to participatory environmental management projects

② *** refer to the first priority, ** refer to the second priority, and * refer to the third priority (The Priority Ranking (***, **, *) was Determined Based on the Consensus and Scores Provided by the 53 Volunteers During the Model Implementation Workshop)



Summary of Proposed Community Projects for KPSF Management

Based on the research findings, as shown in Table 7, 20 integration projects were proposed, categorized into three strategic areas:

- Cultivating Environmental Actualization (9 Projects)

1. Sustainable autonomy of community health: Aims to reduce chemical use in agriculture through training to improve health and decrease household expenses.
2. Return trees to the forest and return fish to the peat swamp: Focuses on restoring natural fertility to the peat swamp to ensure food security and forest sustainability.
3. Wildfire volunteers for peat swamp forest: Establishes local volunteer teams for fire prevention to protect biodiversity and agricultural assets.
4. Participatory forum for peat swamp forest: Provides a platform for residents to exchange knowledge and raise awareness of the swamp's ecological value.
5. Training on replaced forest plantation: Equips villagers with sustainable forestry skills to enhance community unity and conservation.
6. Human mind plantation of tree: Focuses on internalizing environmental ethics before physical conservation to ensure long-term commitment.
7. Krajoood conservation for children: Teaches children sustainable Krajoood harvesting and processing to preserve local identity and generate income.
8. Construction of Thang Poon reservoir: A participatory project to establish water zones, reducing conflicts between the state and locals.
9. Clarification of Buddha's Teachings: Integrates Buddhist teachings (e.g., Dependent Origination) to foster a deep ethical connection to nature.

- Occupational Promotion (9 Projects)

10. Ecological tourism training: Develops local competencies in sustainable tourism management to generate community-based income.
11. Conservative community market: Establishes an organic product market at Ban Yuannok to promote chemical-free livelihoods.
12. Local readers and people development for autonomous occupations: Empowers local leaders to design and lead their own vocational training programs.
13. Community new theory: Demonstrates "New Theory" farming (e.g., Chili Plantation) to ensure food security and a healthy environment.
14. Community occupational promotion: Promotes resource-based occupations that are compatible with the peat swamp's ecology.
15. Learning center of sufficiency economy: Creates a knowledge network for applying the Sufficiency Economy Philosophy (SEP) to daily life.
16. Krajoood product development: Enhances the quality and value of local handicrafts through expert-led skill workshops.



17. Young producers of mulberry and silk weaving: Preserves indigenous silk-weaving knowledge among the younger generation to ensure cultural continuity.

18. Community sufficiency economy: Focuses on value-added food processing to support family self-reliance.

- Participatory Environmental Management (2 Projects)

19. Ridge construction for peat swamp forest: A large-scale infrastructure project to maintain forest humidity and prevent peat fires.

20. Participatory conservation of aquatic life: Encourages sustainable fishing practices to ensure the reproduction of aquatic species and long-term food security.

Discussion

The development of the DHAMMA-EE Model offers a transformative approach to social-ecological resilience. The discussion is categorized into five key analytical points:

1. Research Highlights: The Integration of Spiritual and Systemic Frameworks. The primary strength of this research lies in its holistic integration of three distinct frameworks: Buddhist Education, Environmental Education, and Project Management. Unlike conventional Environmental Education (EE), which often focuses on technical knowledge transfer, this model achieves a high content validity (IOC = 0.93) by rooting environmental stewardship in the human psyche. By using Paṭiccasamuppāda (Dependent Origination) as a foundation, the model transcends the "Human-nature Dualism" that often hampers conservation efforts. This unique combination ensures that the model is not only technically sound but also culturally and spiritually resonant with the local population.

2. Researcher's Interpretation: From Interdependency to Agency The empirical data, which identify "Interdependency" as a primary factor ($\bar{x} = 8.59$), signify a paradigmatic shift in stakeholder perception. This transition from a consumerist orientation to a mutually constitutive relationship aligns with the Buddhist tenet of Anattā (Non-self), effectively internalizing the health of the swamp as an extension of the self.

Furthermore, the high score in Ability to Evaluate ($\bar{x} = 4.27$) among residents suggests that the community possesses significant intellectual capital yet lacks a structured framework to apply it. The implementation of Autonomous Project Management filled this gap, providing the "Agency" needed to transform internal wisdom into external conservation action. As argued by Phra Brahmaganabhorn (P. A. Payutto) (2016), true development must balance the "Threefold Learning" (Sīla, Samādhi, Paññā) to harmonize human behavior with natural truths.

3. Comparative Analysis: Convergence and Divergence with Global Research. The success of this model is consistent with the findings of Sponsel (2012), whose work on spiritual ecology emphasizes that sacred or religious landscapes often receive better protection due to the moral "Taboos" and ethics embedded in local faith. Similarly, the focus on community networks ($\bar{x} = 8.56$) resonates with Ostrom (2015), Governing the Commons,



which suggests that local resource management is most effective when stakeholders have the autonomy to create and enforce their own rules.

A notable divergence in this study, however, concerns the role of formal religious institutions. While Darlington (2012) identifies "Ecological Monks" as central figures in forest protection across Thailand, this research found that Buddhist monk organizations received a relatively lower mean score ($\bar{x} = 7.38$). Qualitative insights (Luang, 2017) clarify this discrepancy, highlighting monks' roles as spiritual guides rather than technical executives. As one practitioner noted, applying Dhamma is essential for managing forest fires, yet the community views the clergy as "Moral Gatekeepers" who foster internal conscience. Consequently, while monks provide vital moral guidance, technical and administrative forest management remains the primary responsibility of lay-led community networks.

The study's discovery that Buddhist-rooted management provides a more resilient motivational structure for the KPSF community finds strong theoretical support in recent regional studies. This internal drive, characterized by moral agency, mirrors the concept of "Theocentric Stewardship" identified by Al-Habshi and Mahmud (2026), who argue that faith-based movements in Southeast Asia often achieve superior community compliance by transitioning from abstract theology to functional conservation. Furthermore, the global relevance of this approach is echoed by Asante et al. (2025), who demonstrate that indigenous and traditional ecological knowledge serves as a critical tool for combating global environmental crises, as evidenced in their study of traditional areas in Ghana. Additionally, the hybrid, grassroots-oriented nature of the DHAMMA-EE Model aligns with broader regional trends in ASEAN, such as those observed in Indonesia by Nasution et al. (2025), where institutional resilience and "Green Governance" are prioritized over top-down mandates to protect sensitive wetland ecosystems. These parallels suggest that the integration of spiritual frameworks and social agency in this study is not an isolated success, but part of a critical regional and global transition toward more inclusive, resilient, and culturally embedded peatland restoration models.

4. Synthesis of Comparison: The "Internal-External Nexus." The comparison highlights that the DHAMMA-EE Model's core value is the "Internal-External" behavior nexus. While Western models of Environmental Education (EE), (United Nations Educational, Scientific and Cultural Organization, 2020) emphasize scientific literacy and behavioral change, this research proves that in Asian contexts, Faith-based wisdom acts as a powerful catalyst for economic stability. The alignment between the Sufficiency Economy Philosophy and Buddhist ethics creates a "Moral Economy" that prevents encroachment more effectively than top-down government mandates.

This nexus is further validated by qualitative evidence from local leadership. Kamnan (2017) observed that the community's resilience against repeated natural disasters is rooted in Buddhist principles of patience and mutual assistance, asserting that integrating



these teachings is essential for improving peat swamp forest management. Such empirical evidence of ethical strength effectively addresses the "Policy-faith Gap" theorized by Al-Habshi and Mahmud (2026), providing the "Soul" and psychological resonance often absent in technocentric frameworks. By leveraging these "Cultural Deterrents," particularly the sacralization of natural spaces, the DHAMMA-EE Model establishes a more potent defense against industrial encroachment and illegal logging than legal regulations alone, effectively operationalizing metaphysical convictions into proactive environmental governance.

5. Empirical Validation: From Model Synthesis to Community Transformation

The practical effectiveness of the Model is empirically validated by high performance scores across all levels of the Kirkpatrick Evaluation Model ($\bar{x} = 7.91$) (Kirkpatrick & Kirkpatrick, 2016). Notably, the high scores in "Learning" ($\bar{x} = 8.04$) and "Public Benefit" ($\bar{x} = 8.02$) demonstrate that the model successfully translates spiritual wisdom into collective social action. This transformation is manifested through 20 community-led projects, ranging from wildfire volunteer networks to sustainable Krajoood handcrafting, which serve as a "Living Laboratory" for practicing the Threefold Learning (*Sīla*, *Samādhi*, *Paññā*). As suggested by Mezirow (2000), this represents a "Transformative Learning" process where stakeholders fundamentally reframe their relationship with the environment.

The success of these initiatives proves that the Model provides a scalable blueprint for social-ecological resilience. By promoting paludiculture and the sustainable use of peatland resources, the model demonstrates that community income and ecological preservation can advance in tandem (Balode & Blumberga, 2024), echoing the principles of Buddhist Economics regarding the interdependence of humanity and nature (Sivaraksa, 2009). This perspective aligns with Al-Habshi and Mahmud (2026), affirming that biosphere preservation in Southeast Asia requires a "Theocentric Turn" that bridges scientific data with metaphysical convictions.

Beyond the statistical evidence, the practical essence of this transition can be summarized into three key lessons from the heart of Kuankreng:

Conservation as a Way of Life, not a Task: The "Internal-External Nexus" realizes that when a person's heart is at peace, protecting the peat swamp becomes a survival strategy for their own air and water rather than an added burden.

From "Me" to "We" through Spiritual Agency: Spiritual wisdom creates a collective "Soul," transforming passive residents into active guardians who protect the landscape "With their Hearts" rather than merely as a duty to the state.

Livelihood as a Form of Devotion: By practicing "Engaged Buddhism," daily work, such as sustainable Krajoood crafting, becomes a continuous contribution to the ecosystem's health and family self-reliance.

In conclusion, these statistical improvements translate into a profound shift in daily life. A higher behavioral score signifies a tangible reduction in wildfire risks, protecting the very air

that children and the elderly breathe. For local artisans, it ensures the security of their economy's lifblood. Ultimately, the integration of spiritual wisdom replaces environmental anxiety with the "Inner Cooling" of collective stewardship, proving that a healthy forest can only grow from a healthy heart. When a community's heart is aligned with its land, sustainability becomes a living reality rather than just a policy goal.

Originality and Body of Knowledge

The primary contribution of this research is the "Spiritual Management Model" (The DHAMMA-EE Model). This model represents a paradigmatic shift in Environmental Education (EE) by integrating Buddhist cognitive frameworks, Dependent Origination (Paṭiccasamuppāda), Three Characteristics (Tilakkhaṇa), and Threefold Learning (Tisikkhā) with Autonomous Project Management. Unlike traditional EE, which often focuses on external information transfer, this Body of Knowledge establishes a profound "Internal-External" behavioral nexus. It demonstrates that sustainable ecosystem resilience in peat swamp forests is effectively achieved when spiritual wisdom directly catalyzes community-led conservation and socio-economic stability, as illustrated in Figure 1.

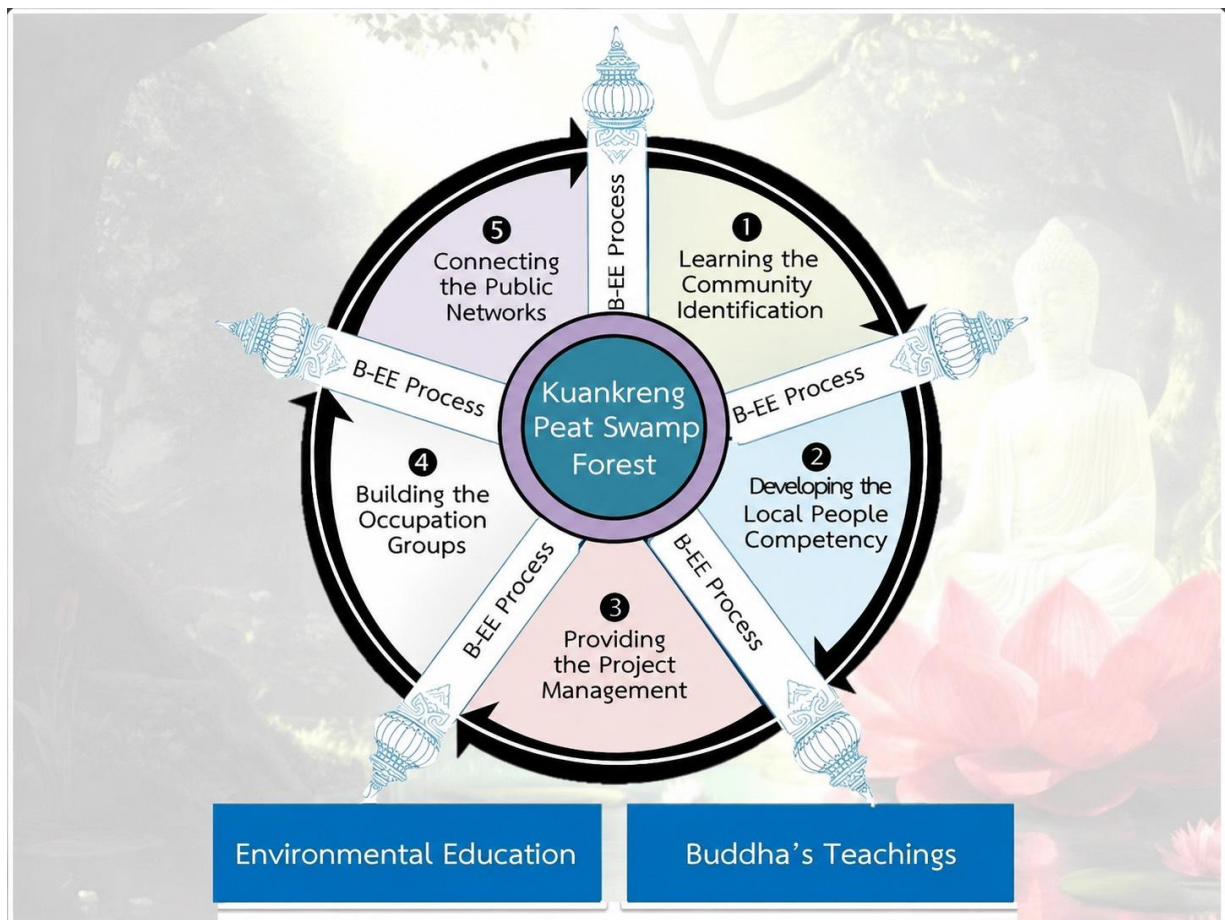


Figure 1 The DHAMMA-EE Model applied within the Kuankreng Peat Swamp Forest context



The Model is conceptualized as a dynamic and sequential trajectory for environmental stewardship. The process is initiated through Community Identification, followed by the capacity building of local leaders and the integration of indigenous wisdom to foster shared responsibility. This progression facilitates Autonomous Project Management, which subsequently strengthens Occupational Networks, enhancing both community livelihoods and inter-group synergies, and culminates in the establishment of broadened public networks.

Crucially, these operational stages are supported by dual foundational pillars, acting as the core framework: The Environmental Education Process (Driving Behavioral Change) and Buddhist cognitive frameworks (Grounding the Systemic Management). These two elements operate concurrently to ensure the sustainability of the Kuankreng Peat Swamp Forest management.

The synthesis of these pillars manifests as the "B-EE Process," a continuous cycle moving from Awareness (Ecological Sensitivity) to Knowledge, systemic understanding via (Paṭiccasamuppāda). These cognitive foundations cultivate Positive Attitudes (Ethical Care), which are then translated into Practical Skills (Problem-solving Through Autonomous Management). Ultimately, the process achieves meaningful participation, where collective conservation actions are implemented, and their socio-ecological impacts are rigorously evaluated.

The Body of Knowledge: The DHAMMA-EE Model

The primary contribution of this research is the synthesis of the DHAMMA-EE Model, which represents a novel paradigm shift in peat swamp forest conservation. The Body of Knowledge derived from this research is characterized by three integrated dimensions of discovery.

1. The Conceptual Shift: From Information to "Environmental Actualization."

This research provides a new understanding that technical knowledge alone is insufficient for sustainable peat swamp management.

What is new: Unlike conventional Environmental Education (EE) that focuses on data transfer, this model introduces "Environmental Actualization."

Direct Impact: By utilizing the principle of Paṭiccasamuppāda (Dependent Origination), the model transforms the stakeholders' worldview from "Forest as a Resource" to "Forest as Breath."

Empirical Proof: This is evidenced by the highest priority scores in "Interdependency" and "Public Mind," proving that the core innovation lies in changing the mindset (Internal) before the reforestation technique (External).

2. The Structural Innovation: The "Spiritual-Systemic Nexus."

The research identifies a rare and potent intersection between modern management standards and Eastern spiritual wisdom, creating a new "Ethical Infrastructure."

What is new: The model demonstrates that Autonomous Project Management reaches its peak effectiveness only when it is governed by the conditions of Tisikkhā (The Threefold Learning) and Aniccā (Impermanence).

Direct Impact: This synergy allows for a highly flexible and resilient form of Climate Adaptation.



Practical Outcome: It transforms rigid administrative duties into a voluntary "Way of Life," ensuring that conservation efforts remain active even after official funding or government mandates expire.

3. The Power Structure Discovery: "Lay-led Agency" with Monastic Support.

This research clarifies the functional boundaries of stakeholders within a religiously grounded community, offering a specific blueprint for participatory management.

What is new: It uncovers a unique power dynamic where effective conservation in the Kuankreng context must be driven by "Lay-led Agency" (Community-driven), while the Sangha (Monastic Community) serves as the "Spiritual and Ethical Advisor."

Direct Impact: This clarifies that the monk's role is not to be a technical project manager, but to provide the ethical "Moral Compass" that empowers villagers to lead.

Significance: This finding prevents administrative confusion and maximizes the strengths of both secular and religious institutions in environmental governance.

Synthesis Summary

In conclusion, the DHAMMA-EE Model is not merely a theoretical construct but a Functional Innovation. It proves that the path to ecological sustainability is inextricably linked to the cultivation of the human mind. By bridging the gap between scientific data and metaphysical convictions, this Body of Knowledge offers a scalable blueprint for other threatened landscapes globally, proving that a healthy forest can only grow from a healthy heart.

Conclusions and Recommendations

The development of the DHAMMA-EE Model represents a significant paradigm shift in community-based conservation, demonstrating that environmental sustainability is a deeply spiritual and behavioral challenge where the "B-EE Process" provides a robust framework for transforming local stakeholders into mindful ecological stewards. By grounding the six dimensions of environmental education: Awareness, knowledge, attitudes, skills, participation, and the ability to evaluate, in the core Buddhist principles of Paṭiccasamuppāda (Dependent Origination), Tilakkhaṇa (Three Characteristics), and Tisikkhā (Threefold Learning), the model fosters a profound understanding of social-ecological interdependency. This synergy reveals a unique "Spiritual-systemic" nexus, offering a substantial theoretical contribution by proving that Buddhist ethics provide the intrinsic motivation and resilience that top-down mandates often lack. Practically, the model catalyzes external actions through Autonomous Project Management and sustainable occupational networks, ensuring the integrity of the peat swamp ecosystem and strengthening community food security in alignment with the Sufficiency Economy Philosophy. This model serves not only as a localized solution for the management of the Kuankreng Peat Swamp Forest but also as a "Scalable Blueprint" that responds to the calls of modern conservation planners. By emphasizing the co-design of strategies with local communities on a foundation of nature reverence, it fulfills the contemporary criteria for inclusive and



sustainable governance. Consequently, it is recommended to establish "Ecological Dhamma Networks" to bridge the gap between lay experts and monks, utilize "Spiritual-economic Hybrid Metrics" such as happiness and food security as KPIs alongside biodiversity, and incorporate the principle of Aniccā into climate adaptation frameworks to build psychological resilience. Furthermore, the DHAMMA-EE Model addresses the daily struggles of the Kuankreng community, from wildfire anxiety to economic fragility, ensuring that environmental protection is synonymous with the protection of local dignity. Future research should therefore explore cross-religious ecological frameworks for inclusive conservation, conduct comparative analyses across diverse ecosystems like mangroves to test the model's universality, and investigate the institutionalization of faith-based "Spiritual KPIs" into national environmental policies and governance.

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