

Type of the Paper (Original Research)

# Reviving Local Wisdom in Environmental Education: A Case Study of the Dayak Deah Community

Dewicca Fatma Nadilla, Bambang Subiyakto, Deasy Arisanty<sup>†</sup> and Syaharuddin

Universitas Lambung Mangkurat, Kalimantan Selatan, Indonesia

<sup>†</sup>Corresponding author: Deasy Arisanty; deasyarisanty@ulm.ac.id

0009-0000-4225-6117

0000-0002-1035-9813

0000-0001-5937-2309

0000-0002-5530-2386

Key Words	Local wisdom, Dayak Deah community, Environmental education, Sustainability
DOI	<a href="https://doi.org/10.46488/NEPT.2026.v25i02.D1848">https://doi.org/10.46488/NEPT.2026.v25i02.D1848</a> (DOI will be active only after the final publication of the paper)
Citation for the Paper	Nadilla, D.F., Subiyakto, B., Arisanty, D. and Syaharuddin, 2026. Reviving local wisdom in environmental education: A case study of the Dayak Deah community. <i>Nature Environment and Pollution Technology</i> , 25(2), D1848. <a href="https://doi.org/10.46488/NEPT.2026.v25i02.D1848">https://doi.org/10.46488/NEPT.2026.v25i02.D1848</a>

## ABSTRACT

This study investigates the local wisdom of the Dayak Deah community in environmental management as a strategy for sustainability amid modernization. It examines how indigenous knowledge, local resources, skills, values, solidarity, and decision-making mechanisms influence environmental education and sustainable practices. Data were collected from 346 community members across three villages in South Kalimantan, Indonesia, through surveys and interviews, and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with triangulation for validation. The results show that local knowledge ( $\beta = 0.251$ ,  $p < 0.001$ ), local resources ( $\beta = 0.246$ ,  $p < 0.001$ ), skills ( $\beta = 0.116$ ,  $p = 0.019$ ), and values ( $\beta = 0.157$ ,  $p = 0.002$ ) significantly contribute to environmental education, while solidarity ( $\beta = 0.084$ ,  $p = 0.093$ ) and decision-making mechanisms ( $\beta = 0.068$ ,  $p = 0.153$ ) have positive but non-significant effects. The model explains  $R^2 = 0.377$ , indicating that 37.7% of the variation in environmental education is accounted for by these six dimensions of local wisdom. Traditional practices such as shifting cultivation, sustainable harvesting of forest products, herbal medicine, weather forecasting, water management, hunting, and forest conservation are deeply embedded in local knowledge and customary laws. Social cohesion through collective work and rituals further supports these practices. In conclusion, the Dayak Deah's local wisdom provides a valuable model for sustainable ecology. Incorporating these practices into environmental education and policy can enhance ecological awareness, promote sustainable livelihoods, and preserve indigenous knowledge for future generations.

## INTRODUCTION

Indonesia is one of the largest archipelagic countries in Asia, comprising over 17,000 large and small islands. This geographical diversity has contributed to Indonesia's rich cultural landscape, characterized by a wide variety of ethnic groups, religions, languages, and traditions (Uyuni et al. 2024). Koentjaraningrat categorizes culture into three forms: artifacts and socio-facts, which manifest and become deeply rooted in society as local wisdom (Dasfordate et al. 2020; Rachman 2021).

Formed from knowledge, values, and activities that uniquely emerge and develop within a society, local wisdom is passed down through generations to adapt to the natural environment. This process creates diversity, making each form of wisdom distinct (Pesurnay 2018; Wardhani et al. 2023). Referring to the concept of tradition, local wisdom in Indonesia plays a tangible role as a frontline force in the conservation and preservation of natural resources (Soraya and Harahap 2024).

The concept of sustainability has evolved alongside various biological and socio-economic ideas, emerging as a response to the reckless production system (Chizmar et al. 2025). According to the IPBES report, nature is declining globally at an unprecedented rate, with species extinction accelerating and expected to continue unless human interactions with nature change (Abas et al. 2022). Exploiting nature without considering sustainability increases vulnerability to disasters. This issue is prevalent in countries rich in natural resources, leading to significant economic losses, as well as the destruction of biodiversity and disruption of social life within these communities (Kumar et al. 2021; Warsame et al. 2024).

According to the Ministry of Environment and Forestry, “South Kalimantan lost about 62.8% of its natural forest between 1990 and 2019, leaving only 14% of its original natural forest cover” (Jong 2021). This figure specifically refers to primary natural forests, which explains why the percentage appears so small, as it excludes secondary forests and plantation areas. Other studies highlight that the province has also experienced large-scale forest conversion driven by the expansion of coal mining concessions, which has significantly contributed to habitat degradation and biodiversity loss (Iqbal et al. 2022). In addition to mining, agricultural expansion particularly oil palm and rubber plantations has become a major driver of deforestation, together accounting for around 3.14 million hectares, or 20% of Indonesia's total forest loss between 2000 and 2021, much of which occurred in Kalimantan (Wulffraat et al. 2014). Satellite imagery further confirms this trend, showing that between 2015 and 2020, forest cover in South Kalimantan decreased from 1,431,528 hectares to 1,120,273 hectares, with an average annual loss of 62,251 hectares, alongside the rapid growth of smallholder plantations that reached 1,258,113 hectares in 2020 (Mardianis et al. 2022). The ecological consequences of this deforestation are directly linked to the devastating floods that struck South Kalimantan in January 2021, where research on the Barito watershed demonstrated that the conversion of primary and secondary swamp forests into plantations and mining areas increased flood-prone zones by more than 313,000 hectares, causing severe inundation in eight out of ten districts as intense rainfall combined with degraded land cover amplified surface runoff and reduced the soil's capacity to absorb water (Adi and Savitri 2022). Despite these variations, both sources consistently highlight the severe reduction of forest ecosystems in the province, which contributes to the increasing frequency of floods and other ecological disasters (Sutrisno et al. 2025).

Considering this phenomenon, the role of indigenous communities and local wisdom becomes crucial in protecting biodiversity and maintaining ecosystem health (Armstrong et al. 2021). The results of the systematic review indicate that indigenous communities employ practical and efficient environmental management methods. This management is reflected in six aspects: local values, local knowledge, local skills, local resources, decision-making mechanisms, and community solidarity, which collectively comprise the dimensions of local wisdom (Uspayanti et al. 2021; Abas et al. 2022; Wardhani et al. 2023).

As a manifestation of local wisdom practices in environmental management in Indonesia, the Baduy community in Banten lives conventionally by isolating itself from external influences to preserve its forests (Kenedy and Deffinika 2022; Mulyadi et al. 2022). Furthermore, in South Sulawesi, the Ammatoa Kajang tribe is known for its "pasang ri kajang" principle, which involves protecting their customary forest from encroachment and external exploitation. They believe that the forest embodies Mother Earth, integrating nature as an essential part of their spiritual life (Surtikanti et al. 2017; Marliana and Amir 2021). Both communities have demonstrated that adhering to local wisdom can maintain environmental balance despite the pressures of modernization and the temptations of exploitation.

In addition to the Baduy and Ammatoa, the Dayak people in Kalimantan also sustain their traditional way of life, ensuring its continuity through local wisdom and environmental stewardship (Azhari 2019; Suprianto and Bakri 2023). One of the Dayak sub-tribes inhabiting South Kalimantan is the Dayak Deah. They reside in the Upau and Muara Uya Districts of Tabalong Regency, as well as parts of Balangan Regency, specifically in Gunung Riyut and Liyu. Historically, they have maintained a close relationship with their natural environment, particularly the forests, which serve as their primary source of livelihood. They uphold a fundamental principle: "The land is the mother, the forest is the father, and water is the blood." This belief binds the Dayak Deah to customary laws and obligates them to protect their land and environment.

Although the Dayak Deah's local wisdom in environmental conservation holds great potential, it has yet to receive adequate attention from the younger generation in Indonesia, particularly in Tabalong, South Kalimantan. Based on ecological awareness index data, the awareness level among the youth in Tabalong remains relatively low (Ifansyah et al. 2023). Previous research has shown that children and adolescents in this region have yet to fully recognize the local wisdom values passed down by their ancestors. Despite living near the Dayak Deah community, public participation in environmental conservation remains suboptimal. However, the local values upheld by the Dayak Deah people have the potential to serve as a localized solution for preserving ecological sustainability. Based on the above discussion, this research aims to analyze the influence of local wisdom on environmental education, supporting a sustainable environment within the Dayak Deah Tribe.

## 2. MATERIALS AND METHODS

This research was conducted in the Pangelak, Kinarum, and Kaong villages in the Upau District, Tabalong Regency, South Kalimantan, Indonesia. The location map is shown in Fig. 1. These three villages were selected because they serve as centers for developing indigenous traditions and culture and key areas for distributing the Dayak Deah indigenous community in Tabalong Regency.



**Fig. 1:** Map of the research location

The study focused on adult members (aged 18 years and above) of the Dayak Deah community residing in three selected villages, with a total population of 3,396 individuals (BPS 2024). Referring to Krejcie and Morgan's sample size table, a minimum of 346 respondents was required to achieve statistical adequacy and maintain generalizability. To reach this number, we applied a stratified random sampling technique. Household lists provided by village administrations served as the sampling frame, and stratification was carried out to secure proportional representation across the three villages: 118 respondents from Pangelak, 112 from Kinarum, and 116 from Kaong. Respondents were eligible if they had been permanent residents of the village for at least five years, were 18 years of age or older, and expressed willingness to participate in the study.

The demographic profile of the respondents shows that slightly more than half were male (52.3%), while females accounted for 47.7%. In terms of age, the largest group was between 30 and 44 years, at 35.8%, followed by those aged 45–59 years, at 28.3%, those aged 18–29 years, at 20.8%, and those aged 60 years or older, at 15%. With respect to occupation, the majority of respondents 81% worked as farmers, reflecting the agrarian nature of the Dayak Deah community. A further 16% were engaged in private sector employment or small-scale entrepreneurship, while only 3% were employed as civil servants or teachers.

This study employed a mixed methods approach, combining qualitative and quantitative techniques to provide a more comprehensive understanding of the Dayak Deah community's local wisdom in relation to environmental sustainability. The qualitative strand involved field observations and semi-structured interviews

conducted between August 2024 and January 2025. Six key informants were purposively selected for their cultural knowledge and community roles, including the Head of the Dayak Deah Customary Council, a member of the Indigenous Peoples Alliance of the Archipelago (AMAN) and oral tradition expert, a male *Balian* (traditional healer), a female *Balian*, the Head of Kaong Village, and a community representative.

The quantitative strand was carried out through a structured questionnaire survey administered between January and March 2025. The instrument consisted of 34 items measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The variables assessed included local knowledge, local values, local skills, local resources, local decision-making systems, local solidarity, and environmental education.

The data were analyzed using Structural Equation Modeling (SEM). The hypothesis in this study is:

- 1) Local Knowledge (LK) influences Environmental Education (EE)
- 2) Local Value (LV) influences Environmental Education (EE)
- 3) Local Skill (LS) influences Environmental Education (EE)
- 4) Local Resources (LR) influences Environmental Education (EE)
- 5) Mechanism of local decision-making (MD) influences Environmental Education (EE)
- 6) Local Society Solidarity (LD) influences Environmental Education (EE).

The questionnaire used to measure the six dimensions of local wisdom was adapted from a previously developed and validated instrument by (Wardhani et al., 2024). The original instrument consisted of 34 items with established reliability and validity. For this study, the questionnaire was translated and back-translated to ensure linguistic and cultural accuracy for the Dayak Deah context, followed by a pilot test to confirm clarity and relevance. During the main data collection, all 34 items were retained as they met the required criteria for factor loadings, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE). This approach ensured comprehensive, reliable, and replicable measurement of the six dimensions, supporting the robustness of the study's findings.

Additionally, for the interview data, data validation was conducted using source triangulation, which involves comparing the interview findings from different informants with observations made during the research process. The data were then analyzed by adopting the three-stage approach proposed by Miles and Huberman (Salmona and Kaczynski 2024). First, data reduction was carried out by selecting only essential observations and interview findings that serve as the foundation of the study. Next, the data were organized according to the required dimensions to facilitate the analysis and guide meaningful conclusions. Finally, conclusions were drawn based on the organized and interpreted data (Salmona and Kaczynski 2024).

In addition to source triangulation for validation, this study integrates qualitative and quantitative data within a mixed-methods framework. Qualitative analysis followed Miles and Huberman's three-stage model as adapted (Salmona and Kaczynski 2024), consisting of data reduction, data display, and conclusion drawing. Interview transcripts were subjected to *open coding* and subsequently organized into a code tree aligned with the latent constructs of the study: Local Knowledge (LK), Local Values (LV), Local Skills (LS), Local Resources (LR), Mechanism of local decision-making (MD), and Local Society Solidarity (LD).

#### Code Tree (Summary)

- 1) Local Knowledge (LK): traditional knowledge, intergenerational transmission, herbal practices.
- 2) Local Values (LV): customary beliefs, community rules, sustainability norms.

- 3) Local Skills (LS): herbal preparation techniques, agroforestry practices, post-harvest processing.
- 4) Local Resources (LR): forest products, medicinal plants, cultivated land.
- 5) Mechanism of local decision (MD): collective deliberation in adat councils, Regulation of natural resource use (tree felling, honey collection, fishing restrictions), Integration of adat law with state regulations.
- 6) Local Society Solidarity (LD): collective rituals and ceremonies, mutual assistance in land clearing and harvesting.

### 3. RESULTS

#### 3.1 Local Knowledge of The Dayak Deah

Local knowledge refers to a set of location-based understandings exclusively utilized by a specific community and may vary from region to region (Jessen et al. 2022). Based on the interviews with the Dayak Deah customary leader and the customary healer or *Balian*, it was revealed that the Dayak Deah community uses this knowledge to predict seasons and sustainably manage the environment. The dry season is indicated by the red blossoms of ampalam (*Mangifera foetida*), kuini (*Mangifera odorata*), and binjai (*Mangifera caesia*). In contrast, the rainy season is marked by the white flowers of meranti (*Shorea leprosula*) and durian (*Durio kutejensis*). Other indicators include the growth of moss (*Bryophyta* sp.), the behavior of wildlife, and changes in the color of the sun and moon.

In natural resource management, the community understands ecological patterns and adjusts its activities according to natural cycles (Adade Williams et al. 2020). The dry season is considered the optimal time for hunting, as animals gather around water sources. Meanwhile, the rainy season is more suitable for farming since the soil becomes fertile.

The dry season is considered the optimal time for hunting, as animals gather around water sources. Meanwhile, the rainy season is more suitable for farming, as the soil becomes fertile (Az-Zahra et al. 2021). The ability to select appropriate plants for treating specific illnesses is an essential aspect of local knowledge that communities must possess. Among the Dayak Deah people, medicinal plants are preferred over chemical-based medicines. For example, Pasak Bumi (*Eurycoma longifolia*) is used to treat back pain and enhance stamina. This practice reflects a balance between resource utilization and environmental conservation. Table 1 shows a selection of medicinal plant uses by the Dayak Deah community.

Table 1 presents several medicinal plants used by the Dayak Deah community to treat various illnesses. The table highlights traditional remedies, including *Lagerstroemia speciosa* for diabetes and gastric issues, *Annona muricata* L. for hypertension, and *Baccaurea lanceolata* for cholesterol. Other treatments include *Eleutherine bulbosa* for cancer, *Bambusa vulgaris* var. for hepatitis, and *Psidium guajava* L. for diarrhea. The preparation methods vary, such as boiling, soaking, or direct application. This demonstrates the community's reliance on natural resources for healthcare, emphasizing their deep ecological knowledge and sustainable medicinal practices.

**Table 1.** Traditional Knowledge of the Dayak Deah Community on Medicinal Plants

Plant	Disease	Treatment Method
-------	---------	------------------

Bungur Leaf <i>Lagerstroemis speciosa</i>	Diabetes	The leaves are soaked in cold water and drunk three times a day; the top leaf is pounded for wounds.
Soursop leaf <i>Annona muricata L</i>	Hypertension	Seven-strand leaf, boiled with seven glasses of water until three glasses remain, drink 3 times a day.
Fruit Limpasu <i>Baccaurea lanceolata</i>	Cholesterol	Peel the fruit, soak it in cold water, and drink one glass 3 times daily.
Dayak Onion <i>Eleutherine bulbosa</i>	Cancer	Bulbs and seven leaf strands are boiled until 1 liter is obtained; drink 3 times daily.
Bungur root <i>Lagerstroemis speciosa</i>	Indigestion	Soak roots in cold water and drink before and after eating.
Yellow Bamboo Root <i>Bambusa vulgaris var</i>	Hepatitis and Jaundice	Boil roots with 1 liter of water. Drink one glass 3 times a day with palm sugar.
Guava Shoot <i>Psidium guajava L</i>	Diarrhea	Soaked in hot water, and drink
Black sticky rice <i>Oryza sativa var. glutinosa</i>	Hemorrhoid	Cooked rice, eaten without a side dish.
Kapuk Leave <i>Ceiba pentandra</i>	Fever	Crushed, mixed with water, used for compresses.
Galangal <i>Alpinia galanga Linn</i>	Ringworm	Stem rubbed on the affected area of the ringworm.

Indigenous communities have preserved knowledge of medicinal plants for millions of years. The practices of the Dayak Deah community are similar to those of the Tacana and Leco communities from the Amazon rainforest, where they extensively utilize leaves, roots, bark, flowers, seeds, and even oils to treat various illnesses (Wartmann and Purves 2018). In research within a similar scope, the local knowledge of the Dayak Paramasan Indigenous community also emphasizes the utilization of community knowledge in understanding animals and plants (Wardhani et al. 2023). With a deep understanding of the ecosystem, the Dayak Deah community maintains environmental balance through ancestral customary practices. This knowledge highlights the importance of local wisdom in the sustainable management of natural resources.

### 3.2 Local Values of the Dayak Deah Community

The implementation of local values in the lives of the Dayak Deah community is reflected in their land management, agricultural practices, and social interactions, which are based on customary laws and traditional wisdom. The land is divided into several zones: production forests, plantations, settlements, customary forests, and mining areas. Customary forests are strictly protected as they are considered sacred, reflecting the community's deep respect for nature and ancestral beliefs (Hakim et al. 2023; Shiferaw et al. 2023).

The values of solidarity and cooperation serve as fundamental principles in daily life, as reflected in customary laws that regulate community behavior (Hanim and Noorman 2018). Social interactions prioritize ethics and consensus-based decision-making. This principle preserves social harmony while supporting environmental sustainability, ensuring that resource utilization is conducted wisely and without excess (Jaiswal et al. 2022).

The local wisdom of the Dayak Deah community shapes a sustainable socio-ecological system, ensuring a balance between human needs and environmental conservation. This demonstrates that traditional values strengthen cultural identity and serve as a foundation for preserving ecosystem sustainability for future generations.

Based on the Interview with the Dayak Deah customary leader, the Dayak Deah Indigenous community upholds a profound philosophy: "Alam dengan manusia, manusia dengan Tuhan, Tuhan dengan Alam" (Nature with humans, humans with God, God with Nature). This philosophy reflects the interconnectedness between nature and humans, who depend on nature for survival, so they must protect it. Likewise, the relationship between humans and God signifies that nature represents divine existence, as humans maintain their spiritual connection with God. Any harm inflicted upon nature is believed to bring misfortune (tulah), a form of divine punishment.

The relationship between humans and nature is further represented in the proverb: "Tanah adalah daging, air adalah darah, batu adalah tulang, akar adalah urat-urat kita" (The land is flesh, water is blood, stone is bone, and roots are our veins). This value was explained by Dayak Deah Balian, who suggests that this expression signifies the deep connection between human existence and the natural world, emphasizing that harming nature is equivalent to harming oneself. Additionally, the philosophy "Ibu adalah bumi dan langit, ayah kita yang kuasa" (Mother is the earth and sky, father is the Almighty) reinforces the belief that nature is a nurturing entity. At the same time, the Creator holds supreme power over all existence.

The Dayak Deah people believe that living beings are formed from various natural elements that shape their bodies and are endowed with a spirit before arriving on Earth. This belief is reflected in a deeply held phrase: "Mother is the Earth, Father is the Forest, Water is the Blood." This expression signifies the intrinsic connection between humans and nature, with Earth as the source of life, forests as protectors, and water as a vital element for survival. Consequently, harming nature is perceived as harming oneself, one's family, and future generations.

The concept of local values prohibiting environmental destruction is also reflected in the Dayak Kenyah community in East Kalimantan through the Tana Ulen system, which serves as a traditional mechanism for preserving the natural environment. This practice designates specific forest areas as protected zones, ensuring the sustainable management of natural resources while maintaining ecological balance (Njau et al. 2019).

Additionally, the prohibition against environmental destruction is also reflected in the customary laws of the Dayak Deah community, as outlined in Table 2. These regulations emphasize the community's commitment to environmental sustainability and the preservation of natural resources.

**Table 2:** Customary Law of the Dayak Deah Community in Managing the Environment

Category of Customary Rule	Content of the Rule
Environmental Customary Rules	<ol style="list-style-type: none"> <li>1. Every citizen of the Dayak Deah Community has the same right to a good and healthy living environment.</li> <li>2. The Deah community has the right to file a court lawsuit and report environmental problems to law enforcement that are detrimental to the community's well-being.</li> <li>3. Every Deah indigenous citizen must maintain and prevent environmental pollution or damage.</li> <li>4. The Dayak indigenous community has the same and broadest opportunity to play a role in environmental management.</li> </ol>
Regulations on Customary Forests	<ol style="list-style-type: none"> <li>1. The Dayak Deah customary law community can collect forest products to meet their daily living needs and carry out forest management activities by applicable customary law provisions.</li> <li>2. The community is obliged to participate in maintaining and protecting customary forest areas from disturbance and destruction.</li> </ol>



Category of Customary Rule	Content of the Rule
Customary rules for forest and land use	3. Indigenous communities have the right to file lawsuits in court and report to law enforcement regarding forest damage that is detrimental to community life.
	4. Forest clearing is not permitted in protected forest areas or customary forests.
	5. Land use in areas prone to landslides or upstream areas must involve planting perennial plants.

Based on Table 2 above, it can be observed that the values that develop within an indigenous community manifest into written laws that must be strictly followed. The customary law of the Dayak Deah reflects noble values in environmental conservation and ecosystem balance through the community's collective obligations, rights, and responsibilities. This data-based management system was practiced long before the emergence of modern conservation concepts (Knoepfel and Nahrath 2005; Eddy 2021). The principle of ecocentrism serves as the fundamental basis, where humans are regarded as an integral part of a larger ecosystem.

The reciprocal understanding between humans and nature, as observed in the field, encourages forest protection, promotes the wise management of natural resources, and helps prevent destructive practices such as illegal logging and indiscriminate waste disposal (Kopnina et al. 2018; Rülke et al. 2020). In general, the values upheld by the Dayak Deah indigenous community can be outlined in Table 3.

Based on Table 3, it can be concluded that the local wisdom values of the Dayak Deah community reflect a harmonious relationship between humans and nature, where religiosity, cooperation, justice, and the wise utilization of resources serve as fundamental principles. These principles maintain ecosystem balance and ensure environmental sustainability for future generations, making them a culturally based conservation model that remains relevant in the modern era.

**Table 3:** Values in the Dayak Deah Indigenous Community

Local Values	Description
Religiosity	Nature is often considered a manifestation of divine power. Humans must guard their balance naturally by respecting God and their ancestors.
Care Environment	Nature and humans are one unity, and life must be in harmony. Excessive exploitation is considered a violation of the ecosystem's balance.
Cooperation	The management environment is established collectively, based on the principle of cooperation and collaboration. The community works similarly to preserve forests, resources, and nature's power.
Justice	Customs rules arrange the wise utilization of land and natural resources. Under the law and customs, the offender will be sanctioned.
Wisdom	Utilization of source power is naturally achieved by considering sustainability and the generation of well-being.

### 3.3 Local Skills of the Dayak Deah Community

Local skills in indigenous knowledge refer to the abilities or expertise developed within a community based on traditions, experiences, and cultural values that have been passed down through generations. These skills are typically inherited over time and are deeply rooted in the local cultural or ecological context (Jessen et al. 2022). In managing the environment, the Dayak Deah community possesses specialized skills and regulations documented in customary law and upheld by the entire indigenous Dayak society.

The most distinctive skill of the Dayak Deah community is their unique land cultivation techniques, which differ from those of other indigenous groups. Community behavioral patterns carry out land management regulations among the Dayak Deah, as reflected in customary ceremonies and rituals. The land management skills of the Dayak Deah community are practiced based on specific rules, as outlined in Table 4.

**Table 4:** Rules and Methods of the Dayak Deah Community in Opening the Field

Skills	Description
Ngalala	The stage begins with carrying out the Ngumo matter. This is an activity area inspection to determine the place of farming.
Nyiro	The activity marks the area to be worked on for farming; make a sign in the form of a circle made from rattan or a wooden cross.
Mowah	Activity: Clean grass and slash small wood. Mowah, done in a way, works together.
Nowokng	Activity to cut down the large tree (allowed)
Nutu Jowa	Activity: Cut tree branches that have been cut down and work together.
Nyelai Jowa	Activity to dry branches and twigs that are already cut until they are ready to burn
Nutukng	The activity involved burning fields, which was carried out in cooperation with the family, neighbors, and less fortunate communities. More than one land needed more than 40 people at each point to brave the fire so as not to creep into another land.
Mondruk	Activity gathering branches and twigs that are already burned.
Metopah	Cleaning after activities. This is done to clean the remains of leaves that are not twigs that have finished burning. Mothers usually do it through cooperation.
Ngasok	Rice harvesting is carried out by cooperation.
Ngerikut	Community activity includes cleaning small grasses and weeds after the rice is 2 months old. Mothers usually do this.
Ngimpuu Umo	Activity guarding the fields from rice pests after age 5-7 months.
Ngani	Activity: harvesting the ripe rice.
Mesiwah	Thanksgiving Activities result in a harvest. Mesiwah is a thanksgiving to the creator of the harvest's results. The rice may not be eaten until the rice field is finished.
Pare	

Based on Table 4, it can be explained that the local skills of the Dayak Deah community in opening fields reflect their wisdom in maintaining ecological balance. They begin with Ngalala, a process of selecting suitable land, followed by Nyiro, marking the area without disrupting the ecosystem. Mowah and Nowokng demonstrate selective wood-cutting and tree-felling skills, while Nutukng is carried out under strict supervision to prevent fire from spreading to other areas. In agriculture, they master techniques such as Ngasok (seed planting using the menugal method), Ngerikut (weeding), and Ngimpuu Umo (protecting fields from pests). After harvesting, the Mesiwah Pare tradition, as an expression of gratitude, highlights their harmonious relationship with nature. These skills demonstrate that the Dayak Deah farming system differs from conventional slash-and-burn practices, as it is rooted in ecological knowledge passed down through generations, ensuring environmental sustainability and ecosystem balance.

Based on interviews with the Customary Chief, Customary Council, and Balian Adat (spiritual leader) of the Dayak Deah, before opening land, the community first performs the Bamimpi ritual to seek permission from their ancestors. The farming location is determined through prayers to the earth, sky, and tree spirits, followed by a three-day waiting period for guidance from dreams. If the signs are deemed favorable, the land is used with a small Thanksgiving ceremony and offerings to honor the land guardian spirits, ensuring protection from disturbances.

This practice aligns with the shifting cultivation system adopted by the Dayak Meratus, where slash-and-burn techniques are regulated by customary law. This prevents environmental degradation and ensures sustainable forest management.

The practices of the Dayak Deah community align with those of the Dayak Meratus and the Lokasado community, although they use different terminologies and methods. Despite these variations, they share the same objectives and adhere to similar customary regulations in land management and environmental conservation (Alviawati et al. 2023).

One of the distinctive skills of the Dayak Deah community is their ability to process the trunk and bark of the *Artocarpus odoratissimus* tree, commonly known as the Deluang tree, into clothing and accessories used in traditional ceremonies. Based on interviews, the Deluang tree is abundant in customary and community-managed forests. As a result, the skill of making bark cloth garments has developed in response to the local environmental conditions where the tree thrives.



**Fig. 2:** Clothes and Accessories from Deluang Tree Bark, Typical of Dayak Deah

Figure 2 illustrates the design of clothing and accessories made from Deluang wood bark. Making garments from Deluang wood requires only simple tools, such as a wooden mallet, a Mandau (a traditional Dayak machete), and a Belayang axe. However, to ensure sustainability, only trees with a diameter of more than 10 cm are permitted for bark harvesting, as regulated by customary law.

The bark processing is carried out carefully, starting with the precise separation of the bark from the trunk. Then, it is evenly beaten with a wooden mallet to flatten and soften the texture. This pounding process takes 2–3 hours to produce a single sheet of fabric ready for sewing. The fabric is dried under the sun for about 2 hours, depending on weather conditions. The final stage involves cutting the fabric according to the patterns, adding traditional motifs, and finishing the edges to achieve a neat appearance.

The local skills of the Dayak Deah community reflect an ecology-based approach to sustainability. Their shifting cultivation system is regulated by customary law, ensuring environmental balance and differentiating it from destructive deforestation. The use of Deluang bark for clothing also demonstrates a deep ecological understanding, as the bark is harvested selectively to preserve the trees. This skill is not merely a tradition but

a resource management model that harmonizes with nature, reinforcing cultural identity within the framework of sustainable development.

### 3.4 Local Resources of the Dayak Deah Community

The Dayak Deah community, which traditionally depends on nature, upholds its customs and local wisdom. For them, local resources, primarily derived from the forest, are managed wisely to ensure their sustainability as a source of livelihood (Carson et al. 2018; Balick and Cox 2020). As previously explained in the section on local knowledge, the Dayak Deah community continues to rely on traditional medicine.

Upau District, the center of the Dayak Deah community, is renowned for producing pasak bumi (*Eurycoma longifolia*) and various herbal plants. In the year 2023, bio-pharmaceutical plant production in Upau District included 70 kg of ginger, 69 kg of galangal, 69 kg of aromatic ginger, 79 kg of turmeric, and 59 kg of Java turmeric per square meter. The annual production reached 324 quintals of ginger, 336 kg of galangal, 321 kg of aromatic ginger, 393 kg of turmeric, and 285 quintals of Java turmeric (BPS 2024).

The practices of the Deah community align with the traditions of other Indigenous communities in Indonesia. This is reflected in research conducted in Karo village, North Sumatra, where local knowledge similarly supports sustainable practices, just as in the Deah community (Silalahi et al. 2015). Furthermore, with a livelihood pattern closely connected to nature, indigenous communities such as the Tengger and Ammatoa Kajang have also managed to sustain themselves using more than 30 species of medicinal plants (Jadid et al. 2020; Zubaidah et al. 2020). The findings of this study, however, are not limited to literature reviews; they are grounded in direct field observations and in-depth interviews with members of the Dayak Deah community. This suggests that the preservation of traditional medicinal practices is closely tied to the role of indigenous customs, exemplified by the Dayak Deah Indigenous Community in South Kalimantan.

In addition to cultivating medicinal plants, the Dayak Deah community relies on fruit plantations, growing durian, rambutan, siam oranges, bananas, papayas, salak, langsung, jackfruit, and cempedak. The development of agroforestry gardens has led to Upau District being recognized in 2022 as a leading producer of local fruits in Tabalong. This recognition aligns with the strategic initiative of the Tabalong Regency Government to position the region as a food buffer for the new capital city (IKN). Besides fruits, the community cultivates various agricultural commodities, including large chili peppers, curly peppers, bird's eye chili, tomatoes, and eggplants.

These practices demonstrate that local wisdom and customary traditions play a crucial role in agricultural management and the utilization of medicinal plants in various indigenous communities across Indonesia. The Dayak Deah community exemplifies how sustainability can be achieved through effective forest management, sustainable agriculture, and the utilization of medicinal plants based on local knowledge. Preserving these traditions ensures food security and access to healthcare, while also contributing to environmental conservation and local economic sustainability.

In this context, constructs such as “local resources” (LR) and “local skills” (LS) are conceptually formative, as they represent the diverse inputs that collectively shape the community's sustainability. These indicators do not merely reflect an underlying latent variable; instead, they form the construct itself. However, when

modeled as reflective constructs, a strong theoretical justification is required, such as considering them manifestations of a broader latent dimension of indigenous sustainability practices (Edwards and Bagozzi 2000).

### 3.5 Local Decision-Making Mechanism

Like other indigenous communities in Indonesia, the Dayak Deah community in Upau District possesses strong local wisdom in natural resource management and the application of customary law. In the Upau District, traditional institutions play a crucial role in balancing environmental utilization and cultural preservation. The structure of these institutions, comprising the head of adat, adat leaders, adat elders, and balian, ensures that customary laws are enforced fairly and in accordance with local values.

Customary law in Upau District aligns with government regulations, similar to the situation in Paramasan District (Wardhani et al. 2023). Based on interviews, the Dayak Deah community emphasized that they have the right to utilize the natural environment wisely, following established regulations and involving customary institutions in decision-making, such as land-use changes. For example, when using biopharmaceutical plants such as pasak bumi, turmeric, and temulawak, the community must ensure the sustainability of these resources by engaging with customary institutions in management planning.

The annual rituals performed by the Dayak Deah community are also an integral part of customary law. These rituals preserve tradition, serve as a mechanism to strengthen community solidarity, and remind people of the importance of maintaining harmony with the natural world. If a community member violates customary regulations, a customary fine is imposed. Within the Dayak Deah community, these fines can be either a “tajau” or a “real.” The determination of the fine is not made individually, but rather through consensus deliberations that consider the severity or mildness of the violation. One unit of tajau is valued at IDR 10,000,000 (ten million rupiahs), while one unit of real is valued at IDR 6,000 (six thousand rupiahs).

One of the customary regulations governing natural resource management concerns the felling of fruit-bearing or honey-nest trees. In such cases, the customary fine is determined in real or tajau, depending on the size of the tree. Compensation is given to the tree owner or the head of the adat if the tree has no private owner.

Additionally, harvesting wants (honey) from a hive that does not belong to the harvester without the owner’s permission results in a customary fine of 5 confirmed and social sanctions imposed by the adat community. Regarding fishing practices, the community strictly prohibits the use of chemicals or electric shock devices within the Dayak Deah customary territory. Violators are subject to a customary fine and will be reported to law enforcement authorities. The acceptable amount is determined through deliberation, considering the extent of environmental damage caused by the illegal practice.

### 3.6 Local Society Solidarity

The strong sense of local solidarity within the Dayak Deah indigenous community is evident, particularly in traditions such as land clearing and harvest celebrations. These practices go beyond mutual assistance; they reflect deeply rooted values related to social relations and ecosystem sustainability. During land clearing, all extended family members and local community members work together in shifts. Clearing a single plot of land

requires around 40 people, who volunteer their labor without monetary compensation, following a rotational system based on local trust and mutual respect.

The rotational system in the Dayak Deah community follows unique regulations, where each plot of land can only be cultivated twice before being left to rest, allowing the soil to recover its fertility. This cycle enables the community to relocate to a new site and return to the original location once it has been regenerated. This practice embodies an ecological awareness that has been passed down through generations. Additionally, it illustrates the high level of social capital within the Dayak Deah community. Field observations and interviews confirm that this practice not only reflects ecological awareness but also demonstrates the high level of social capital within the Dayak Deah community. Trust and cooperation are fundamental elements of social capital, which strengthen social networks and the resilience of traditional communities (Roslinda 2018; Hatu and Darsono 2019).

Solidarity within the Dayak Deah community can be categorized as mechanical solidarity, where social bonds are based on shared values and norms. This form of solidarity strengthens collective cohesion, the foundation for various aspects of social life, including agrarian practices, religious rituals, and environmental conservation (Mortazavi et al. 2024).

In addition to the agrarian aspect, the solidarity of the Dayak Deah local community is also reflected in various traditional ceremonies that strengthen their social bonds and cultural identity. These include *Tawas Jaa*, *Mesiwah Pare*, *Bintang Mamali*, and other rituals. The descriptions presented in Table 5 are based on the results of field interviews with community members, who explained the meaning and implementation of these ceremonies.

**Table 5:** Traditional Rituals and Social Solidarity Values

Traditional Ceremony	Purpose	Form of Solidarity	Environmental Impact
<i>Tawas Jaa</i>	Protection from misfortune	Conducted collectively through cooperation	Guard the balance between nature and identity culture.
<i>Mesiwah Pare</i>	Gratitude for the rice harvest	Joint celebration with a shared distribution of the harvest	Encourages sustainable agricultural practices
<i>Bintang Mamali</i>	Tradition Death	Community participation without monetary reward	Preserves sacred land and burial sites
<i>Baaruh</i>	Celebrating the results of agriculture.	Collective celebration and shared harvest distribution	Promotes sustainable farming and biodiversity conservation
<i>Manopeng</i>	Treatment was traditional with herbal plants.	Community members gather and prepare remedies together	Supports the conservation of medicinal plant species
<i>Mambatur</i>	Honoring, worshipping, and expressing gratitude to God and ancestors	Conducted through traditional rituals involving customary leaders and community consensus	Reinforces spiritual connection with nature; supports regulated natural resource use

Based on Table 5, the various traditional ceremonies of the Dayak Deah community reflect strong social solidarity while contributing to cultural and environmental preservation. *Tawas Jaa*, a ritual for warding off misfortune, is conducted collectively through cooperation, reinforcing cultural identity and spiritual connections with nature. *Mesiwah Pare*, a rice harvest thanksgiving ceremony, involves the distribution of crops and traditional feasts, fostering communal bonds and preserving conventional farming techniques. *Bintang Mamali*, a customary funeral ritual, emphasizes selfless cooperation, strengthening the values of mutual assistance

and traditional solidarity. The Harvest Festival, a celebration of agricultural yields, fosters social connections by sharing food and crops while promoting sustainable farming practices. Meanwhile, Traditional Collective Healing demonstrates solidarity in utilizing herbal medicine, safeguarding community health, and preserving indigenous knowledge of medicinal plants. These findings are not only supported by literature but also confirmed through direct field observations and in-depth interviews with community members, who emphasized that such rituals continue to function as mechanisms for strengthening solidarity and sustaining the balance between humans and nature. Collectively, these traditions serve as a medium for social interaction and a sustainable strategy for cultural and ecosystem conservation.

**Table 6:** Summary of model measurement

Construct	Item	Loading Factor	Cronbach's Alpha	Composite Reliability	AVE
Environment Education (EE)	EE1	0.772	0.738	0.882	0.586
	EE2	0.684			
	EE3	0.780			
	EE4	0.811			
	EE5	0.779			
	EE6	0.774			
	EE7	0.753			
Local Society Solidarity (LD)	LD 1	0.890	0.882	0.885	0.793
	LD 2	0.891			
	LK 1	0.732			
	LK 2	0.833			
Local Knowledge (LK)	LK 3	0.785	0.868	0.900	0.600
	LK 4	0.722			
	LK 5	0.802			
	LK 6	0.769			
	LR 1	0.867			
Local Resources (LR)	LR 2	0.901	0.723	0.878	0.782
	LS 1	0.756			
	LS 2	0.703			
Local Skill (LS)	LS 3	0.776	0.901	0.919	0.559
	LS 4	0.803			
	LS 5	0.750			
	LS 6	0.745			
	LS 7	0.714			
	LS 8	0.706			
	LS 9	0.770			
	LV 1	0.782			
Local Value (LV)	LV 2	0.751	0.739	0.881	0.552
	LV 3	0.747			
	LV 4	0.766			
	LV 5	0.702			
	LV 6	0.708			

Mechanism of local decision-making (MD)	MD 1	0.881	0.838	0.884	0.792
	MD 2	0.899			

The evaluation of the measurement model involved an assessment of factor loadings, internal consistency reliability (Cronbach's Alpha and Composite Reliability), and convergent validity using Average Variance Extracted (AVE). A summary of these results is presented in Table 6.

The factor loadings across indicators were generally strong, with most values exceeding the recommended threshold of 0.70 (Hair et al. 2019). Within the construct of Environmental Education (EE), six of the seven items achieved loadings above this benchmark, ranging between 0.753 and 0.811. Although one indicator (EE2 = 0.684) fell slightly short, it was retained because of its theoretical relevance and its proximity to the cutoff point. In such cases, keeping the item is considered appropriate, particularly when its inclusion enhances conceptual coverage without undermining reliability or AVE.

Reliability tests further supported the adequacy of the constructs. Cronbach's Alpha values ranged from 0.723 for Local Resources to 0.901 for Local Skill, all of which surpassed the conventional threshold of 0.70. This indicates that the constructs possess acceptable to high internal consistency. Composite Reliability (CR) values also proved to be robust, falling between 0.878 and 0.919. Notably, CR values were consistently higher than their corresponding Cronbach's Alpha values, which suggests that the constructs are well captured by their observed measures. Convergent validity was likewise confirmed. The AVE values for the constructs ranged from 0.552 (Local Value) to 0.793 (Local Solidarity), exceeding the minimum recommended level of 0.50. These results show that each construct explains more than half of the variance in its respective indicators, thereby satisfying the criterion for convergent validity.

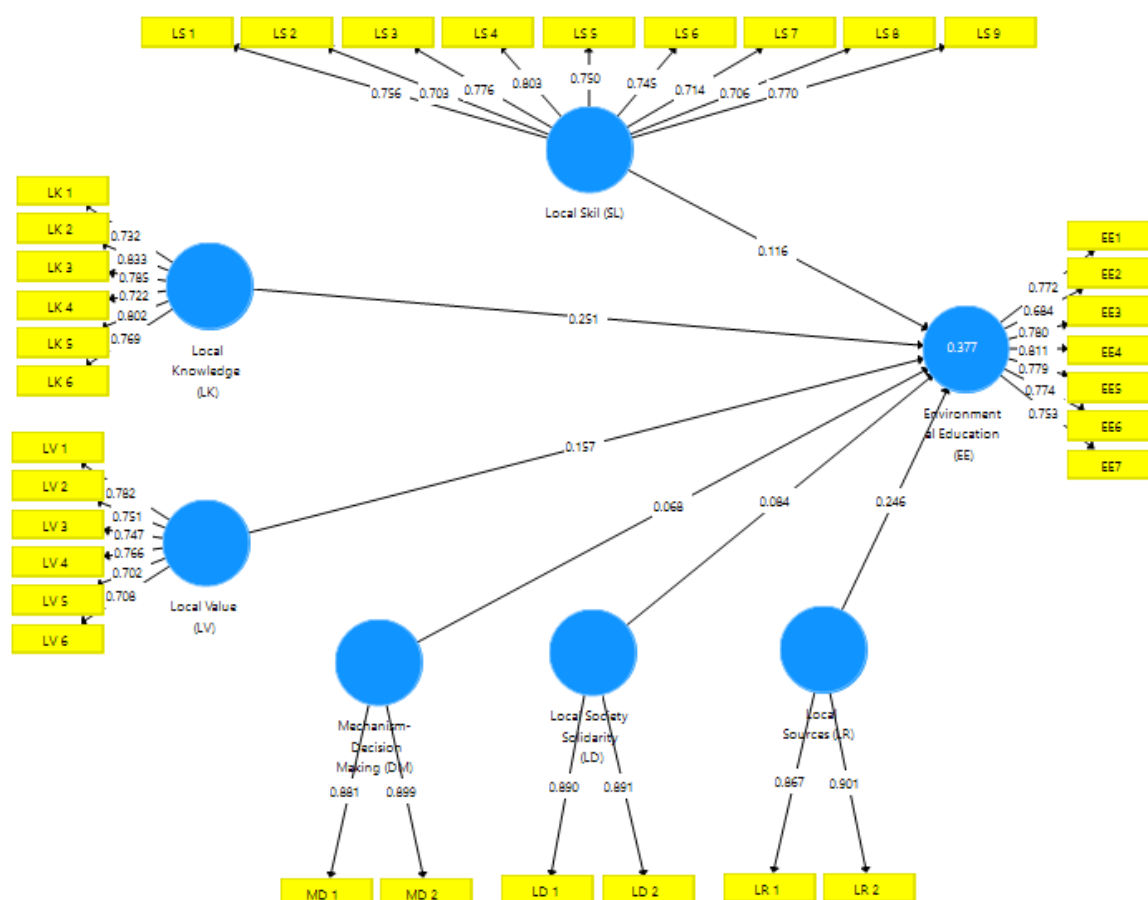
Among the constructs, Local Solidarity (LD) and Mechanism of Local Decision-Making (MD) emerged with the strongest psychometric properties, showing very high factor loadings (0.881–0.899), strong Cronbach's Alpha values (0.882 and 0.838), and excellent AVE scores (0.793 and 0.792). Local Skill (LS), despite comprising nine indicators, also demonstrated high reliability (CR = 0.919) and satisfactory convergent validity (AVE = 0.559). This suggests that the broader set of indicators successfully captured the construct in a consistent and coherent manner. Overall, the measurement model fulfills the recommended benchmarks for reliability and validity in PLS-SEM (Henseler 2017; Hair et al. 2019; Hair Jr et al. 2021). These findings confirm that the model is grounded in solid psychometric principles, providing a reliable basis for subsequent structural model analysis.

The coefficient of determination ( $R^2$ ) for Environmental Education (EE) was 0.377, indicating that approximately 37.7% of the variance in EE is explained collectively by the six predictors: Local Knowledge (LK), Local Resources (LR), Local Skills (LS), Local Values (LV), Local Solidarity (LD), and Mechanism of Local Decision-Making (MD). This value reflects the substantial contribution of local wisdom dimensions to environmental education outcomes in the Dayak Deah community, while also suggesting that other unobserved factors may influence EE.

**Table 7:** Discriminant Validity Assessment Using HTMT Criterion



Item Relationship	HTMT
Environmental Education (EE) ↔ Local Knowledge (LK)	0.493
Environmental Education (EE) ↔ Local Resources (LR)	0.575
Environmental Education (EE) ↔ Local Skill (LS)	0.419
Environmental Education (EE) ↔ Local Solidarity (LD)	0.338
Environmental Education (EE) ↔ Local Value (LV)	0.444
Mechanism of local decision-making (MD) ↔ Environmental Education (EE)	0.371
Mechanism of local decision-making (MD) ↔ Local Knowledge (LK)	0.527
Mechanism of local decision-making (MD) ↔ Local Resources (LR)	0.329
Mechanism of local decision-making (MD) ↔ Local Skill (LS)	0.357
Mechanism of local decision-making (MD) ↔ Local Solidarity (LD)	0.153
Mechanism of local decision-making (MD) ↔ Local Value (LV)	0.263
Local Knowledge (LK) ↔ Local Resources (LR)	0.379
Local Knowledge (LK) ↔ Local Skill (LS)	0.306
Local Knowledge (LK) ↔ Local Solidarity (LD)	0.207
Local Knowledge (LK) ↔ Local Value (LV)	0.369
Local Resources (LR) ↔ Local Skill (LS)	0.483
Local Resources (LR) ↔ Local Solidarity (LD)	0.381
Local Resources (LR) ↔ Local Value (LV)	0.461
Local Skill (LS) ↔ Local Solidarity (LD)	0.447
Local Skill (LS) ↔ Local Value (LV)	0.369
Local Solidarity (LD) ↔ Local Value (LV)	0.219



**Figure 3.** Environment Education Model of the Dayak Deah Tribe

Based on Table 7, discriminant validity was evaluated using the Heterotrait Monotrait Ratio of Correlations (HTMT). This approach is widely recommended because it is considered more reliable than the traditional Fornell-Larcker test. A value below 0.85 is generally taken as evidence that the constructs are distinct from one another.

The HTMT values in Table 7 range from 0.153 to 0.575. The lowest value appears between Mechanism of Local Decision Making and Local Solidarity at 0.153, while the highest value is between Environmental Education and Local Resources at 0.575. These results show that the constructs are related in practice but not overlapping in measurement.

Some stronger associations are found, such as between Environmental Education and Local Resources at 0.575 or between Local Skills and Local Solidarity at 0.447. These reflect the natural connections in community life, where education often relies on local resources and solidarity often depends on shared skills. Even so, the values remain well below the threshold of 0.85, which supports discriminant validity. Overall, the analysis confirms that the constructs are sufficiently distinct. Environmental Education and the six dimensions of local wisdom capture different but connected aspects of the model. This provides a sound basis for the structural model analysis.

**Table 8:** Model Summary

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values	Conclusion
Mechanism of local decision-making (MD) -> Environmental Education (EE)	0.068	0.068	0.048	1.431	0.153	Not Significant
Local Knowledge (LK) -> Environmental Education (EE)	0.251	0.257	0.052	4.805	0.000	Significant
Local Resources (LR) -> Environmental Education (EE)	0.246	0.242	0.052	4.709	0.000	Significant
Local Skill (LS) -> Environmental Education (EE)	0.116	0.118	0.049	2.350	0.019	Significant
Local Society Solidarity (LD) -> Environmental Education (EE)	0.084	0.083	0.050	1.682	0.093	Not Significant
Local Value (LV) -> Environmental Education (EE)	0.157	0.159	0.050	3.156	0.002	Significant

### The Influence of the Mechanism of Local Decision-Making on Environmental Education

Based on the data presented in Table 8, the influence of local decision-making mechanisms (MD) on environmental education (EE) was not statistically significant, with a path coefficient of  $\beta=0.068$  and a p-value of 0.153. While this finding indicates that the data did not support a direct relationship, it doesn't diminish the potential value of local governance. Instead, it suggests a more nuanced dynamic at play; the role of community-based decisions in fostering environmental education might not be a straightforward, linear one. It's possible that these mechanisms exert an indirect effect, perhaps by fostering a sense of collective ownership and responsibility that then facilitates engagement with environmental learning. This opens the door for future research to explore these more complex, mediated pathways to fully understand how grassroots governance contributes to environmental knowledge and behavior.

### The Influence of Local Knowledge on Environmental Education

Based on the data presented in Table 8, the analysis shows a coefficient value of  $\beta = 0.251$  with a p-value of 0.000. This indicates that local knowledge plays the most significant role in shaping both environmental awareness and behavior within the community. It suggests that the way people understand their natural surroundings, such as forests, ecosystems, and local environmental cycles, forms a strong foundation for conveying ecological values through environmental education.

Local or traditional knowledge is a crucial component of ecological practice. When integrated into community-based environmental education, it becomes a powerful tool for promoting sustainability. In conclusion, the community's local knowledge not only reflects their deep ecological relationship with nature but also makes a meaningful contribution to strengthening environmentally conscious behavior (Berkes et al. 2000; Zainal et al. 2024).

### The Influence of Local Resources on Environmental Education

Based on the results shown in Table 8, local resources are also found to have a significant influence on environmental education, with a path coefficient of  $\beta = 0.246$  and a p-value of 0.000. This indicates that the

availability and sustainable use of natural resources such as water, soil, plants, and forest products, when managed wisely by the community, provide direct and meaningful experiences in sustainable environmental practices.

Such practices contribute to fostering a harmonious reciprocal relationship between humans and nature, while also nurturing the community's ecological awareness. This dynamic is reflected in the Dayak Deah community, where the use of local resources plays a vital role in traditional medicine-making and the utilization of non-timber forest products.

### **The Influence of Local Skills on Environmental Education**

Based on the findings presented in Table 8, local skills within the Dayak Deah community also show a significant contribution to environmental education, with a path coefficient of  $\beta = 0.116$  and a p-value of 0.019. This indicates that indigenous skills play a meaningful role in shaping ecological learning. The community's ability to understand natural cycles, engage in sustainable agriculture, hunt, fish, and process forest products and medicinal plants is not merely a matter of daily survival; it is a vital aspect of their cultural heritage. Still, it has become an integral part of a deeply rooted and lived learning process.

These skills are passed down through generations via direct practice, providing real and contextually relevant learning experiences for community members. In an educational context, such experiential learning makes a significant contribution to the community's environmental awareness and understanding. It reflects a collective memory that shapes ecological behavior. This finding reinforces the idea that education does not always have to occur in formal spaces it can also emerge from the lived experiences of everyday life, embodying a more authentic form of environmental education (Ardoin and Heimlich 2021).

### **The Influence of Local Values on Environmental Education**

Based on Table 8, local values are shown to have a significant influence on environmental education, with a path coefficient of  $\beta = 0.157$  and a p-value of 0.002. This finding highlights the significance of the value system upheld by the Dayak Deah community, including the principles of cooperation (gotong royong), respect for nature, and customary prohibitions against the overexploitation of natural resources. These values are not merely social norms; instead, they reflect the community's collective awareness of the need for balance between humans and the environment.

Within the context of environmental education, such values serve as a form of local environmental ethics that implicitly guide the Dayak Deah people to live in harmony with their surroundings. This finding supports the notion that effective ecological education does not always require external introduction. Instead, it can emerge organically from within through the norms and local wisdom that have long shaped human-nature relationships. These values function as a moral foundation, providing social legitimacy for sustainable practices (Zidny et al. 2020).

### **The Influence of Local Solidarity on Environmental Education**

Table 8 also reveals that the dimension of local community solidarity does not show a statistically significant influence on environmental education, with a path coefficient of  $\beta = 0.084$  and a p-value of 0.093. However, this does not mean that the aspect of solidarity should be overlooked. On the contrary, this result serves as a valuable note indicating that social solidarity, while not yet fully explored or optimized in this context, still shows a positive trend. The p-value approaching the 0.05 threshold suggests that social cohesion may still hold potential relevance for environmental education.

The data suggest that in the Dayak Deah community, solidarity tends to manifest in everyday activities, such as assisting during harvests, participating in cultural ceremonies, or supporting communal needs, rather than in initiatives directly related to environmental preservation. Nevertheless, the strong spirit of co-operation and mutual aid (gotong royong) that exists in the community could serve as a robust foundation for supporting environmental education, provided it is harnessed with approaches that align with the community's cultural context (Jana et al. 2024).

#### 4. DISCUSSION

Based on the research findings, it is evident that the variables of local knowledge, local resources, local skills, and local values have a significant influence on environmental education within the Dayak Deah community. These results reinforce the argument that environmental preservation is not merely a technical endeavor but is also shaped by dynamic sociocultural practices that are passed down across generations in indigenous societies. The involvement of indigenous communities plays a substantial role in sustainable environmental management. In this context, both local knowledge and skills may be viewed as traditional methods through which communities regulate the relationship between humans and nature in a sustainable manner (Levis et al. 2024).

Specifically, this study highlights that the local knowledge of the Dayak Deah community has a significant influence on environmental education. This is primarily attributed to the community's deep understanding of their ecological landscape, including knowledge of rainfall patterns, planting seasons, endemic plant species, and natural signs used to determine agricultural cycles and ritual timings. In the context of environmental education, such knowledge serves not only as a source of information but also as a pedagogical resource that fosters a sense of respect for the natural world. Traditional knowledge is not merely about understanding facts, but more importantly, about guiding ethical behavior and actions based on that understanding (Berkes et al. 2000; Barnhardt and Oscar Kawagley 2005; Sumarwati et al. 2020; Zidny et al. 2020).

This local knowledge can also be understood within the framework of critical environmental pedagogy, which emphasizes the importance of cultivating ecological awareness through local narratives and the lived experiences of Indigenous communities. These elements are often underrepresented or insufficiently integrated into formal education and teaching practices, despite their potential to enrich environmental learning with culturally grounded and context-specific insights (Ajaps and Forh Mbah 2022).

Furthermore, the local knowledge possessed by the Dayak Deah community is strongly supported by their traditional skills, including the preparation of medicinal plants, shifting cultivation practices that avoid ecological degradation, as well as sustainable methods of hunting, fishing, and processing forest resources. These

skills have been developed through long-term ecological adaptation and are not merely technical routines but reflect energy efficiency and sustainability principles. Research findings confirm that these local skills have a significant influence on environmental education, as they embody direct, experiential practices that bridge knowledge with concrete action (Yolida et al. 2023).

Furthermore, the research findings also indicate that local resources have a significant influence on environmental education. This aligns with the understanding that local resources are not merely defined by their physical availability, but also by their ecological context, which is interpreted and integrated culturally by the Dayak Deah Indigenous community into their social life. These resources are embedded with cultural meanings and values that shape environmental awareness and practices, making them essential components of community-based ecological learning (Sechi et al. 2018; Niigaaniin and MacNeill 2022). It emphasizes that natural resources, within Indigenous communities, are understood holistically as integral elements of a life system rich in cultural, spiritual, and collective identity meanings. Rather than being viewed solely as material assets, these resources are deeply embedded in traditional knowledge systems and social structures, serving as both symbolic and functional foundations of sustainable living (Muradian and Gómez-Baggethun 2021).

In the belief system of the Dayak Deah Indigenous community, the forest is regarded not merely as a resource for sustenance but also as a sacred space that serves as the dwelling place of ancestral spirits. Similarly, water is not viewed simply as a physical necessity, but as a spiritually potent element that embodies the profound connection between humans and the natural world. This is reflected, for instance, in the traditional *Tawas Jaa* ceremony, where water is ritually used as a medium to protect the village from disasters and illness.

What makes this perspective particularly compelling is the community's view of human-nature relations as inherently interdependent and inseparable. This worldview aligns with the concept of *relational ontology* in political ecology, which emphasizes that nature and society are not distinct spheres but are entangled in a network of reciprocal relationships grounded in cultural, spiritual, and ecological meanings (Meurer and Eitel 2021).

Equally important, the research findings indicate that local values within the Dayak Deah community also have a significant influence on environmental education. These values are not merely norms handed down through generations; instead, they reflect a deeply rooted belief system, ethical framework, and worldview that shape how the community understands and interacts with nature. These cultural values have been shown to meaningfully influence environmental behavior within the community, serving as an internal compass that guides sustainable interactions with the natural environment (Nguyen 2015).

In the context of local values, it is also noted that they possess pedagogical potential that can be transformed into a form of contextual learning. These values can serve as a meaningful medium to encourage learners to act ethically and to think critically and reflectively about the relationship between humans and the natural world. This approach to education fosters ecological awareness rooted in local wisdom, making learning more relevant and impactful within the community context (Zidny et al. 2020).

These local values, derived from the historical experiences of Indigenous communities, contribute to the formation of collective ecological memory. This memory serves not only as a cultural repository but also as a mechanism of social regulation, guiding community members to refrain from environmentally destructive behavior. Through shared norms and ethical practices passed down across generations, these values embed a

sense of ecological responsibility that supports sustainable living and environmental stewardship (Chunhabunyatip et al. 2018). Thus, these values are indirectly connected to the social solidarity and decision-making mechanisms within the Dayak Deah community. The shared ecological memory and ethical frameworks foster a collective awareness, enabling community members to act in unison when addressing environmental concerns. This integration of cultural values into communal governance reflects how traditional knowledge and social cohesion contribute to sustainable environmental practices.

Furthermore, local values not only shape ways of thinking but also influence ways of living, as reflected in the collective attitudes and responsibilities of the community toward the environment (Horlings 2015; Kenter et al. 2015; Martin et al. 2024). Within the Dayak Deah community, these values serve as a foundational pillar for sustainable living, rooted in ecological ethics that emerge from deeply held cultural wisdom. The Dayak Deah community perceives nature not merely as a resource to be exploited but as a sacred entity that embodies life. This deep-rooted philosophy shapes their environmental ethics, aligning with Traditional Ecological Knowledge (TEK), which integrates spiritual beliefs with practical conservation strategies. Indigenous communities often maintain a spiritual connection with forests, considering them as living entities deserving of respect and protection (Usop and Rajiani 2021; Mutolib et al. 2024).

For the Dayak Deah community, the forest is not merely land covered with trees but a source of life that must be preserved through rituals, taboos, and community-based management systems (Sharma 2021). This belief system fosters a deep sense of environmental responsibility, ensuring that natural resources are used sustainably for future generations (Siddiqui et al. 2024). This perspective aligns with anthropological and ecological theories that emphasize the role of indigenous knowledge in conservation efforts. Furthermore, the traditional understanding of the Dayak Deah indigenous community in land management includes shifting cultivation, selective logging, and sustainable harvesting of non-timber forest products (Joshi et al. 2004).

One of their main strategies is shifting cultivation, where land is cultivated for a limited period before being left to regenerate, unlike modern agricultural systems, which often lead to soil degradation (Yang et al. 2020). This method allows for natural regeneration, preserving biodiversity, and maintaining soil fertility. Moreover, the community has customary laws regulating forest resource use. For instance, certain areas are designated as hutan larangan (sacred forests), where logging and hunting are strictly prohibited. This local governance system reflects contemporary conservation models such as Community-Based Forest Management (CBFM), which recognizes the rights of indigenous communities in environmental stewardship (Aryandini and Parvez 2023).

The environmental governance of the Dayak Deah community is deeply rooted in their customary laws. Violations of these traditional regulations, such as illegal logging or overexploitation, are subject to sanctions determined by tribal elders through a consensus-based approach. The concept of denda adat (customary fines) is a deterrent against ecological destruction.

For instance, individuals who cut down fruit-bearing trees or beehive trees without permission are fined in real or tajau (traditional currency or ceramic jars), with the penalty amount depending on the tree's size and the extent of the damage caused. Moreover, fishing practices involving chemicals or electric currents are strictly prohibited, and offenders face customary and state-imposed consequences. These regulations not only

safeguard natural resources but also reinforce collective responsibility for environmental sustainability (Chan et al. 2016).

Compared to modern environmental policies, customary governance systems often achieve higher compliance rates due to their integration with cultural values and community-based enforcement. While statutory laws tend to rely on repressive penalties, customary laws emphasize restoration, compensation, and social accountability (Rahayu et al. 2024).

These traditions cultivate a deep ecological awareness by integrating spiritual beliefs into environmental practices. These rituals serve as informal educational tools, ensuring that conservation principles are passed down through generations without the need for external enforcement (Rahayu et al. 2024).

Although their traditions remain strong, the Dayak Deah community faces significant challenges in preserving its environmental wisdom. Deforestation due to commercial logging, agricultural expansion, and government policies that often disregard indigenous rights threatens the sustainability of their way of life. Additionally, younger generations are increasingly drawn to modern lifestyles, leading to a decline in the transmission of traditional knowledge (Wardhani et al. 2024).

Some community members have begun integrating indigenous wisdom with modern conservation strategies as a form of adaptation. One example is the development of eco-tourism and sustainable agroforestry projects, which provide alternative livelihoods while reinforcing environmental awareness.

Government policies must recognize and support these indigenous conservation models by integrating customary laws into formal environmental regulations. A participatory approach that includes indigenous voices in policymaking can ensure that traditional knowledge remains relevant in modern conservation efforts.

## 5. CONCLUSIONS

This study highlights the crucial role of indigenous ecological knowledge in the environmental management practices of the Dayak Deah community. Their deep spiritual and cultural connection to nature fosters sustainable land-use practices, including community-based forest governance, selective logging, and the harvesting of non-timber forest products. Traditional rituals and customary laws play a central role in resource conservation, ensuring environmental sustainability while fostering social cohesion.

Despite these traditions' resilience, external pressures such as deforestation, agricultural expansion, and shifts in cultural values among younger generations pose significant challenges. Integrating local wisdom into formal education and conservation policies is crucial for sustaining this Indigenous environmental knowledge. Initiatives such as eco-tourism and sustainable agroforestry provide viable models for balancing economic development with ecological preservation.

The findings of this study contribute to the broader discourse on community-based conservation and the integration of indigenous knowledge into modern environmental governance. Future research should explore strategies for strengthening the transmission of traditional ecological knowledge to younger generations and assessing the long-term impacts of policy interventions on indigenous environmental management systems. Strengthening collaboration between indigenous communities, policymakers, and researchers is critical to ensuring a sustainable and culturally inclusive approach to conservation.



## 6. PATENTS

**Author Contributions:** Conceptualization, D.F.N., D.A., B.S., and S.; methodology, D.F.N. and D.A.; software, D.A.; validation, D.F.N., B.S., D.A., and S.; formal analysis, D.F.N. and D.A.; investigation, D.F.N.; resources, D.F.N.; data curation, D.F.N.; writing original draft preparation, D.F.N.; writing review and editing, D.A.; visualization, D.F.N.; supervision, B.S., D.A., and S.; project administration, D.F.N.; funding acquisition, D.F.N. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding

**Informed Consent Statement:** This study was approved by the Research Ethics Committee of Universitas Lambung Mangkurat No. 1272/UN.82/PP/2024. Additional research permission was granted by the local authority No. B-181/CU/430/03/2025 dated 20 March 20, 2025. Written informed consent was obtained from all participants prior to data collection.

**Informed Consent Statement:** Not applicable.

**Acknowledgments:** The authors would like to express their deepest gratitude to the traditional leaders and elders of the Dayak Deah community in Upau District, Tabalong Regency, who have generously shared their knowledge, stories, and ancestral wisdom throughout the research process. Their guidance, patience, and openness have been invaluable in helping us understand the cultural depth and environmental knowledge embedded in the community. We also extend our gratitude to the residents who participated in the data collection and contributed to the field activities with great enthusiasm and hospitality. This study would not have been possible without their trust and collaboration.

**Conflicts of Interest:** No conflicts of interest.

## REFERENCES

- Abas, A., Aziz, A. and Awang, A. 2022. A systematic review on the local wisdom of indigenous people in nature conservation. *Sustainability* 14(6), p. 3415.
- Adade Williams, P., Sikutshwa, L. and Shackleton, S. 2020. Acknowledging indigenous and local knowledge to facilitate collaboration in landscape approaches—Lessons from a systematic review. *Land* 9(9), p. 331.
- Adi, R.N. and Savitri, E. 2022. The effect of land cover changes on the 2021 flood in the Barito watershed, South Kalimantan. In: *IOP Conference Series: Earth and Environmental Science*. IOP Publishing, p. 012017.
- Ajaps, S. and Forh Mbah, M. 2022. Towards a critical pedagogy of place for environmental conservation. *Environmental Education Research* 28(4), pp. 508–523.
- Alviawati, E. et al. 2023. Livelihood strategies of farmers in Loksado District, Hulu Sungai Selatan Regency, Indonesia. In: *IOP Conference Series: Earth and Environmental Science*. IOP Publishing, p. 012023.
- Ardoin, N.M. and Heimlich, J.E. 2021. Environmental learning in everyday life: foundations of meaning and a context for change. *Environmental Education Research* 27(12), pp. 1681–1699.
- Armstrong, C.G., Miller, J.E.D., McAlvay, A.C., Ritchie, P.M. and Lepofsky, D. 2021. Historical indigenous land-use explains plant functional trait diversity.

- Aryandini, H. and Parvez, A. 2023. Community Based Forest Management License: The Urgency of Forest Management for Human Development in Indigenous Peoples. *Veteran Law Review* 6(1), pp. 14–33.
- Azhari, M. 2019. The Impact Singer & Jipen of Dayak Tribe on Environmental Sustainability in Central of Borneo. *International Journal of Architecture and Urbanism* 3(1), pp. 43–50.
- Az-Zahra, F.R., Sari, N.L.W., Saputry, R., Nugroho, G.D., Pribadi, T., Sunarto, S. and Setyawan, A.D. 2021. Traditional knowledge of the Dayak Tribes (Borneo) in the use of medicinal plants. *Biodiversitas Journal of Biological Diversity* 22(10).
- Balick, M.J. and Cox, P.A. 2020. *Plants, people, and culture: the science of ethnobotany*. Garland Science.
- Barnhardt, R. and Oscar Kawagley, A. 2005. Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology & education quarterly* 36(1), pp. 8–23.
- Berkes, F., Colding, J. and Folke, C. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological applications* 10(5), pp. 1251–1262.
- BPS. 2024. *Kecamatan Upau Dalam Angka 2024*. Tabalong: Badan Pusat Statistik.
- Carson, S.L., Kentatchime, F., Nana, E.D., Njabo, K.Y., Cole, B.L. and Godwin, H.A. 2018. Indigenous peoples' concerns about loss of forest knowledge: implications for forest management. *Conservation and Society* 16(4), pp. 431–440.
- Chan, K.M.A. et al. 2016. Why protect nature? Rethinking values and the environment. *Proceedings of the national academy of sciences* 113(6), pp. 1462–1465.
- Chizmar, S., Cushing, T., Baral, S. and Ruseva, T. 2025. How do landowners perceive and respond to incentives for sustainable forest management? A synthesis to inform discussions on programs for climate-smart forestry. *Trees, Forests and People* 19, p. 100753.
- Chunhabunyatip, P., Sasaki, N., Grünbühel, C., Kuwornu, J.K.M. and Tsusaka, T.W. 2018. Influence of indigenous spiritual beliefs on natural resource management and ecological conservation in Thailand. *Sustainability* 10(8), p. 2842.
- Dasfordate, A., Sholahuddin, A. and Ngarawula, B. 2020. Duan-Lolat Tradition In Traditional Marriage Of The Tanimbar Community: Ethnographic Study of Traditional Marriage in Latdalam Village, Tanimbar South District, West Southeast Maluku Regency. *Technium Soc. Sci. J.* 11, p. 434.
- Eddy, T. 2021. Management of natural resources based on local wisdom by traditional law communities. *Management* 2(6).
- Edwards, J.R. and Bagozzi, R.P. 2000. On the nature and direction of relationships between constructs and measures. *Psychological methods* 5(2), p. 155.
- Hair, J.F., Risher, J.J., Sarstedt, M. and Ringle, C.M. 2019. When to use and how to report the results of PLS-SEM. *European business review* 31(1), pp. 2–24.
- Hair Jr, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M., Danks, N.P. and Ray, S. 2021. *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook*. Springer Nature.
- Hakim, A.L. et al. 2023. Protected spring and sacred forest institutions at the instrumental—relational value interface. *Current Opinion in Environmental Sustainability* 62, p. 101292.
- Hanim, L. and Noorman, M.S. 2018. The Role of Indigenous Peoples and Customary Law in the Development of National Law the Paradigm of Pancasila. *The 4th International and Call for Paper* 1(1).
- Hatu, D.R.R. and Darsono, W. 2019. The Role of Local Wisdom as Social Capital of Remote Indigenous Communities (RIC). *Jurnal Politico Vol* 19(1).

- Henseler, J. 2017. Bridging design and behavioral research with variance-based structural equation modeling. *Journal of advertising* 46(1), pp. 178–192.
- Horlings, L.G. 2015. Values in place; A value-oriented approach toward sustainable place-shaping. *Regional Studies, Regional Science* 2(1), pp. 257–274.
- Ifansyah, M.N., Purwanto, P., Purnaweni, H., Yuniningsih, T. and Anwar, A. 2023. Community-Based Waste Management in Tabalong Regency. *Jurnal Public Policy* 9(1), pp. 50–56.
- Iqbal, M., Imadadienan, F.J. and Ginting, P. 2022. *The Threat of Coal Mine Expansion Towards Biodiversity in Kalimantan*. Jakarta: Association for Ecological Action and People's Emancipation (AEER).
- Jadid, N. et al. 2020. An ethnobotanical study of medicinal plants used by the Tengger tribe in Ngadisari village, Indonesia. *Plos one* 15(7), p. e0235886.
- Jaiswal, K.K., Chowdhury, C.R., Yadav, D., Verma, R., Dutta, S., Jaiswal, K.S. and Karuppasamy, K.S.K. 2022. Renewable and sustainable clean energy development and impact on social, economic, and environmental health. *Energy nexus* 7, p. 100118.
- Jana, J., Hammidah, H., Chand, R. and Haselkorn, J. 2024. Community spirit and local wisdom: strengthening character education through the ngarot tradition in social studies learning. *Journal of Social Knowledge Education (JSKE)* 5(1), pp. 9–20.
- Jessen, T.D., Ban, N.C., Claxton, N.X. and Darimont, C.T. 2022. Contributions of Indigenous Knowledge to ecological and evolutionary understanding. *Frontiers in Ecology and the Environment* 20(2), pp. 93–101.
- Jong, H.N. 2021. *Indonesia to push for mine rehab, reforestation after deadly floods*. Available at: <https://news.mongabay.com/2021/02/indonesia-mine-rehab-reforestation-deadly-floods-south-kalimantan/> [Accessed: 9 September 2025].
- Joshi, L., Wijaya, K., Sirait, M. and Mulyoutami, E. 2004. Indigenous systems and ecological knowledge among Dayak people in Kutai Barat, East Kalimantan—a preliminary report. *ICRAF Southeast Asia Working People* (2004\_3).
- Kenedy, B.A. and Deffinika, I. 2022. Environmental Adaptation of Indigenous People: Baduy Tribe's Local Wisdom in Environmental Management. In: *IOP Conference Series: Earth and Environmental Science*. IOP Publishing, p. 012017.
- Kenter, J.O. et al. 2015. What are shared and social values of ecosystems? *Ecological economics* 111, pp. 86–99.
- Knoepfel, P. and Nahrath, S. 2005. *Sustainable management of natural resources: from traditional environmental protection policies towards Institutional Natural Resource Regimes (INRR)*. Idheap.
- Kopnina, H., Washington, H., Taylor, B. and J Piccolo, J. 2018. Anthropocentrism: More than just a misunderstood problem. *Journal of Agricultural and Environmental Ethics* 31(1), pp. 109–127.
- Kumar, M., Phukon, S.N. and Singh, H. 2021. The role of communities in sustainable land and forest management. In: *Forest resources resilience and conflicts*. Elsevier, pp. 305–318.
- Levis, C. et al. 2024. Contributions of human cultures to biodiversity and ecosystem conservation. *Nature Ecology & Evolution* 8(5), pp. 866–879.
- Mardianis, R., Razi, P. and Izumi, Y. 2022. Mapping The Rate Of Deforestation In South Kalimantan Using Landsat Imagery. *Georest* 1(1), pp. 17–21.
- Marliana, A. and Amir, J. 2021. Meaning of Local Language Expression of "Pasang Ri Kajang" and Its Implication for Language Teaching. *International Journal of Language Education* 5(1), pp. 569–584.
- Martin, A. et al. 2024. Sustainability-aligned values: exploring the concept, evidence, and practice. *Ecology and Society* 29(4).

- Meurer, M. and Eitel, K. 2021. *Ecological ontologies: approaching human-environmental engagements*. GfE, Gesellschaft für Ethnographie eV.
- Mortazavi, S.S., Andalib, A., Ahmadian, R. and Talachian, M. 2024. Usefulness of Emile Durkheim's Social Solidarity Approach on Improving the Ritual Functions of Urban Spaces the Case Study of Zeynabieh and Hosseinie Azam Axis till Imamzadeh Seyed Ebrahim of Zanjan City. *Sustainable city* 7(1), pp. 117–133.
- Mulyadi, A., Dede, M. and Widiawaty, M.A. 2022. The role of tradisional belief and local wisdom in forest conservation. *Jurnal Geografi Gea* 22(1), pp. 55–66.
- Muradian, R. and Gómez-Baggethun, E. 2021. Beyond ecosystem services and nature's contributions: Is it time to leave utilitarian environmentalism behind? *Ecological economics* 185, p. 107038.
- Mutolib, A., Yonariza, Y. and Rahmat, A. 2024. Abnormality in optimal forest management by indigenous people in deforestation. *Global Journal of Environmental Science & Management (GJESM)* 10(1).
- Nguyen, T. 2015. The Effectiveness of Online Learning: Beyond No Significant Difference and Future Horizons. *MERLOT Journal of Online Learning and Teaching* 11(2), pp. 309–319.
- Niigaaniin, M. and MacNeill, T. 2022. Indigenous culture and nature relatedness: Results from a collaborative study. *Environmental Development* 44, p. 100753.
- Njau, A., Hakim, A., Lekson, A.S. and Setyowati, E. 2019. Local wisdom practices of Dayak Indigenous People in the management of tana' ulen in the Kayan Mentarang National Park of Malinau regency, North Kalimantan province, Indonesia. *Russian Journal of Agricultural and Socio-Economic Sciences* 91(7), pp. 156–167.
- Pesurnay, A.J. 2018. Local wisdom in a new paradigm: Applying system theory to the study of local culture in Indonesia. In: *IOP Conference Series: Earth and Environmental Science*. pp. 1315–1755.
- Rachman, A.H. 2021. Different perspectives in defining culture. *Indonesian Journal of Social Sciences* 13(2), p. 84.
- Rahayu, M.I., Susanto, A.F. and Sudiro, A. 2024. The Principle of Local Wisdom as a Basic Framework in the Formation of Cosmic Religious Environmental Law. *Indon. L. Rev.* 14, p. 204.
- Roslinda, E.M.I. 2018. Social capital of the community in the management of Danau Sentarum National Park, West Kalimantan, Indonesia. *Biodiversitas Journal of Biological Diversity* 19(4), pp. 1249–1257.
- Rülke, J., Rieckmann, M., Nzau, J.M. and Teucher, M. 2020. How ecocentrism and anthropocentrism influence human–environment relationships in a Kenyan biodiversity hotspot. *Sustainability* 12(19), p. 8213.
- Salmona, M. and Kaczynski, D. 2024. Qualitative data analysis strategies. In: *How to conduct qualitative research in finance*. Edward Elgar Publishing, pp. 80–96.
- Sechi, G., Borri, D., De Lucia, C. and Celmins, V. 2018. Environmental learning in regions: a social capital based approach. The case of Latvia. *Environmental Education Research* 24(3), pp. 343–364.
- Sharma, R. 2021. Community Based Flood Risk Management: Local Knowledge and Actor's Involvement Approach from Lower Karnali River Basin of Nepal. *Journal of Geoscience and Environment Protection* 9(6), pp. 35–65.
- Shiferaw, A., Hebo, M. and Senishaw, G. 2023. The spiritual ecology of sacred landscapes: Evidence from sacred forests of the Sebat Bête Gurage, Central-South Ethiopia. *Cogent Social Sciences* 9(1), p. 2210900.
- Siddiqui, A.A., Nigam, R. and Khalid, M.A. 2024. *Environmental ethics and Sustainability*. Lucknow: M/S Academic Publishers & Distributors.
- Silalahi, M., Walujo, E.B., Supriatna, J. and Mangunwardoyo, W. 2015. The local knowledge of medicinal plants trader and diversity of medicinal plants in the Kabanjahe traditional market, North Sumatra, Indonesia. *Journal of ethnopharmacology* 175, pp. 432–443.

- Soraya, S.S.S. and Harahap, R. 2024. Mengangkat Budaya dan Kearifan Lokal dalam Sistem Konservasi Tanah dan Air. *International Journal of Curriculum Development, Teaching and Learning Innovation* 3(1), pp. 24–28.
- Sumarwati, S., Anindyarini, A. and Lestari, W.D. 2020. Integration of Traditional Ecological Knowledge into Primary School Learning. *Retorika Journal: Jurnal Bahasa, Sastra, dan Pengajarannya* 13(2), pp. 346–357.
- Suprianto, B. and Bakri, Z. 2023. The Environmental Practices of Dayak Local Tradition in Kapuas Hulu District. *POROS ONIM: Jurnal Sosial Keagamaan* 4(1), pp. 1–11.
- Surtikanti, H.K., Syulasmi, A. and Ramdhani, N. 2017. Traditional knowledge of local wisdom of Ammatoa Kajang Tribe (South Sulawesi) about environmental conservation. In: *Journal of Physics: Conference Series*. IOP Publishing, p. 012122.
- Sutrisno, H., Permana, I., Susi, T. and Perkasa, P. 2025. Analysis of Community Resilience Factors in One Area Against Flood Disasters. *Jurnal sosial dan sains* 5(6), pp. 1809–1819.
- Usop, S.R. and Rajiani, I. 2021. Indigenous Indonesian Dayak Traditional Wisdom in Reducing Deforestation. *The Indonesian Journal of Geography* 53(3), pp. 310–317.
- Uspayanti, R., Butarbutar, R., Hiskya, H.J. and Ainani, A.F. 2021. Local wisdom and its implication for nature conservation. *Review of International Geographical Education Online* 11(5), pp. 292–302.
- Uyuni, B., Arief, K.M., Adnan, M., Hamid, A. and Sutiono. 2024. Exploration of wali-songo (nine saints) ziyarat in Indonesia from religious tourism (pilgrimage) perspective. *Cogent Arts & Humanities* 11(1), p. 2395110.
- Wardhani, D.F., Arisanty, D., Nugroho, A. and Utami, U.B.L. 2023. The local wisdom of the Paramasan Dayak tribe in environmental management. *Environment and Ecology Research* 11(5), pp. 859–872.
- Wardhani, D.F., Arisanty, D., Nugroho, A. and Utami, U.B.L. 2024. Environmental Education Model Based on Local Wisdom of the Dayak Paramasan Tribe Indonesia. *Nature Environment and Pollution Technology* 23(4), pp. 2259–2272.
- Warsame, A.A., Mohamed, J. and Sarkodie, S.A. 2024. Natural disasters, deforestation, and emissions affect economic growth in Somalia. *Heliyon* 10(6).
- Wartmann, F.M. and Purves, R.S. 2018. ‘This is not the jungle, this is my barbecho’: semantics of ethnoecological landscape categories in the Bolivian Amazon. *Landscape Research* 43(1), pp. 77–94.
- Wulffraat, S., Faisal, K.F., Wedastra, I.B.K. and Shapiro, A. 2014. The environmental status of the Heart of Borneo. *Switzerland: WWF’s HoB Initiative: World Wildlife Fund*.
- Yang, T., Siddique, K.H.M. and Liu, K. 2020. Cropping systems in agriculture and their impact on soil health-A review. *Global Ecology and Conservation* 23, p. e01118.
- Yolida, B., Sinaga, R.M., Maulina, D. and Supriyadi, S. 2023. The The effect of indonesian local culture integrated students’ environmental awareness on sdgs: PLS-SEM approach. *Biosfer: Jurnal Pendidikan Biologi* 16(2), pp. 427–438.
- Zainal, S., Nirzalin, Fakhurrazi, Yunanda, R., Ilham, I. and Badaruddin. 2024. Actualizing local knowledge for sustainable ecotourism development in a protected forest area: insights from the Gayonese in Aceh Tengah, Indonesia. *Cogent Social Sciences* 10(1), p. 2302212.
- Zidny, R., Sjöström, J. and Eilks, I. 2020. A multi-perspective reflection on how indigenous knowledge and related ideas can improve science education for sustainability. *Science & Education* 29(1), pp. 145–185.
- Zubaidah, S., Azis, S., Mahanal, S., Batoro, J. and Sumitro, S.B. 2020. Local knowledge of traditional medicinal plants use and education system on their young of Ammatoa Kajang tribe in South Sulawesi, Indonesia. *Biodiversitas Journal of Biological Diversity* 21(9).

