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MORALITY BEFORE KNOWLEDGE

Preserving ecological balance through forest management, the *sasami* tradition, and sustainable food adaptation

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ABSTRACT

Background: Amidst the pressures of modernization, the local wisdom of indigenous communities offers a relevant model for sustainability. This study deeply examines the integrated socio-ecological system in the Cireundeu Indigenous Village, which has successfully maintained ecological balance through ancestral traditions. **Methods:** Using a qualitative case study approach, data were collected through literature review, in-depth interviews with a customary leader, and participatory observation. **Findings:** The results indicate that the resilience of the Cireundeu system is supported by three interconnected pillars, (1) a customary forest zoning system (*larangan, tutupan, baladahan forest*) as a functional conservation practice; (2) food adaptation based on cassava (*Rasi*) as a foundation for food sovereignty; and (3) a mechanism for transmitting Traditional Ecological Knowledge (TEK) through the *Surasa* dialogue forum and customary rituals. **Conclusion:** The analysis concludes that these pillars are not separate practices but are holistically interconnected within a socio-ecological system. The sustainability of this system is underpinned by a web of positive feedback loops between spiritual beliefs, social institutions, and tangible ecological outcomes, offering a potent counter-narrative to fragmented modern development paradigms. **Novelty/Originality of this article:** The novelty of this article lies in its holistic analysis of how interconnected socio-ecological practices in Cireundeu Indigenous Village—spanning forest zoning, cassava-based food sovereignty, and knowledge transmission through rituals—form a sustainable resilience model that counters fragmented modern development paradigms.

KEYWORDS: ecological balance; food sovereignty; local wisdom; traditional ecological knowledge.

1. Introduction

West Java is a province in Indonesia rich with indigenous villages that still firmly uphold their traditions and culture, including in the preservation of nature. Villages such as Naga, Ciptagelar, Urug, and Sindang Barang are a few examples. Traditions like *"Kawalu"*, *"Sasami"*, *"Ngaruat"*, *"Mapag Seren"*, and *"Seren Taun"* are examples of efforts by indigenous communities to maintain the balance of nature and culture. Local wisdom is the knowledge and understanding possessed by local communities about their environment and how to live in harmony with it (Arsal et al., 2023; Huda et al., 2020; Ufie et al., 2021). This wisdom is passed down through generations and serves as a life guide for the community in their interaction with nature.

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Local wisdom plays a crucial role in preserving the environment. It can assist communities in managing natural resources sustainably and resolving environmental problems (Maulana, 2021). Numerous studies on local wisdom have been conducted in various regions of Indonesia, such as research on the traditions of Naga Village (Surtikanti, 2018), Pulo Village (Surtikanti, 2019), and Cikondang Adat Village (Surtikanti, 2020). These studies show that local wisdom plays a significant role in environmental conservation.

The Cireundeu Indigenous Village is one of the Sundanese indigenous villages that still staunchly preserves its traditions and culture, as shown in Figure 1, which depicts the well-maintained traditional house (*Rumah Adat*) of Cireundeu to this day. Located in the Cimahi area of West Bandung Regency, the village is renowned for its traditional architecture, local wisdom, and its forbidden forest. The community of Cireundeu possesses strong local wisdom in preserving the environment. This knowledge is inherited from generation to generation and serves as a life guide for the community in their interactions with nature (Turner et al., 2022).

Fig. 1**.** Traditional house of Cirendeu

2. Method

2.1 Research design and setting

This study utilizes a qualitative approach with a single case study design. This design was chosen for its ability to provide a deep, holistic, and intensive understanding of a unique phenomenon: the integrated socio-ecological system in the Cireundeu Indigenous Village. This approach allows the researcher to explore "how" and "why" local wisdom in forest management, food adaptation, and social traditions can function as a cohesive whole, particularly from the perspective of the community's primary knowledge holder. The research was conducted in the Cireundeu Indigenous Village, administratively located in Leuwigajah Village, South Cimahi District, Cimahi City, West Java. Primary data collection was carried out intensively in June 2024. This study relies on a single key informant, the customary leader (*Sesepuh Adat*) of the Cireundeu Indigenous Village, Mr. W. His selection as the sole interviewee is based on his central position as the community's leader and his role as the primary repository of the community's philosophical, historical, and customary knowledge and practices. This approach allows for a very deep and coherent exploration of information from the most authoritative source within the indigenous community.

2.2 Data collection and analysis: Validity, ethics, and limitation

To obtain rich and comprehensive data, this study applied three data collection techniques which is literature study, in-depth interviews, and observation. The literature study was conducted in the initial phase to build a theoretical framework, understand the broader research context from previous studies, and formulate relevant research questions. In-depth interviews were carried out with the key informant, Mr. W, using a semi-structured

guide to ensure that all core topics were addressed while still allowing flexibility to explore insights and narratives that emerged organically from the informant's perspective. Additionally, the researcher conducted observations within the Cireundeu Indigenous Village to directly examine the physical and social contexts described by the informant. These observations focused on land use patterns, the condition of the customary forests, daily community activities, and cultural artifacts such as the *Bale Adat* (customary hall).

The qualitative data collected from interview transcripts and field notes were analyzed using thematic analysis. This process involved several stages: (1) data familiarization by repeatedly reading the transcripts; (2) initial coding to identify relevant data segments; (3) searching for, reviewing, and defining the main themes emerging from the data and (4) writing the analytical narrative by integrating these themes. To ensure the credibility and trustworthiness of the findings, a triangulation of methods and data sources was used. Given the use of a single informant, triangulation was performed by comparing and cross-checking information obtained from three different sources data from the in-depth interviews with W , data from field observations of cultural practices and ecological conditions, and data from relevant literature on Cireundeu Village and Sundanese local wisdom. Findings were considered valid if they showed consistency across these three data sources. This research adheres strictly to ethical principles. Informed consent was obtained verbally from Mr. W before the interviews were conducted.

The researcher explained the purpose of the study and received explicit permission to use his name and the information he provided for academic purposes. The researcher fully acknowledges the limitations of this study. The primary limitation is the use of a single key informant. This means the data and perspectives presented are heavily influenced by the views, knowledge, and interpretations of one individual, despite his high customary authority. Consequently, there may be other perspectives within the community (e.g., from the younger generation or women) that are not represented in the interview data. The researcher attempted to mitigate this limitation through triangulation with observational data and literature, but this limitation must be acknowledged.

3. Result and Discussion

3.1 Geographical, social, and historical profil

The Cireundeu Indigenous Village is geographically located in a basin surrounded by several mountains and hills, including Mount Gajah Langu, Mount Puncak Salam, Mount Kunci, Mount Pasir Panji, Mount Batu Akik, and Mount Cimenteng. This location provides the village with a cool and fresh atmosphere. The name "Cireundeu" itself originates from two words: 'Ci,' meaning water, and 'Reundeu,' which is the name of a plant that was once abundant in the area and utilized as a medicinal herb (Andika, 2022).

Despite its traditional image, the community in the Cireundeu Indigenous Village is heterogeneous. The indigenous community coexists with the non-indigenous community, with followers of the ancestral teachings comprising only about 40% of the total population. Formally, governance is led by local neighborhood units, but customary affairs are managed by a separate indigenous institution led by a Customary Elder (*Sesepuh*), currently represented by the Deputy Elder, Mr. W, which protects about 60 families (*KK*). Harmony amidst these differences is upheld through the spirit of *"Silih Asah, Silih Asih, dan Silih Asuh"* (a Sundanese philosophy of mutually sharpening wits, loving, and caring for one another) (Andika, 2022).

The village's history is also marked by its close relationship with its surrounding environment, including the presence of the Final Disposal Site/*Tempat Pembuangan Akhir Sampah* (TPAS) located nearby. Before its closure, the landfill had negative impacts, including foul odors and insects. The situation culminated in the tragic landslide of the garbage mountain on February 21, 2005, which buried a village and caused many fatalities. To commemorate the event and in the hope that it will not happen again, the Cireundeu

indigenous community routinely holds a commemorative ceremony every February 21st (Interview with Mr. W in Cireundeu Village, 2024).

3.2 Local knowledge system in environmental preservation

The Cireundeu indigenous people possess a comprehensive knowledge system for interacting with nature, which is manifested in their philosophy, spatial planning, food adaptation, and social traditions.

3.2.1 Core philosophy and customary rules

The main foundation of nature preservation practices in Cireundeu is the belief that nature is an ancestral heritage that must be guarded and passed on to future generations. They view the order of nature (*tatanan waruga jagat*) and the order of humans (*tatanan waruga manusa*) as two inseparable entities. This belief is realized in concrete rules, one of which is the prohibition of wearing any footwear when entering the forest area. This rule is based on the belief in protecting nature from objects that do not originate from nature itself, as well as a way to feel a direct connection with nature (Arif & Miranto, 2022).

This view is deeply affirmed by Mr. W, who explains the inseparable relationship between humans and nature. According to him:

> *"Nature is the 'order of the cosmos' (tatanan waruga jagat), while the Cireundeu community is the 'order of humanity' (tatanan waruga manusa), so the two can never be separated. The Cireundeu indigenous people always preserve nature, not only because of their awareness that nature always provides life, but also because they are conscious that the natural environment is a legacy from their ancestors that must be passed on to the next generation."* (Interview with Mr. W in Cireundeu Village, 2024).

This philosophy is embodied in concrete rules, such as the prohibition on wearing footwear in the forest. This rule has a dual meaning of respect and unity, as Mr. W explains:

> *"Look, when you go to a mosque, you shouldn't wear sandals; when you go to the city, you should wear sandals. This is because humans and nature are still one, and by not wearing sandals, we can feel the touch of nature directly. The point is, this must be done so that nature is preserved."* (Interview with Mr. W in Cireundeu Village, 2024).

3.2.2 Spatial planning implementation: The three forest zones

As a tangible form of environmental management, the Cireundeu indigenous people divide their forest area into three zones. This system, called *"Tata Wilayah"* (Territorial Order), is, according to Mr. W, a time-tested local wisdom to maintain balance and prevent disasters.

> *"This local wisdom is manifested in various customary rules, such as "Tatang Wayang", "Tatang Lampah", and "Tata Wilayah". The Cireundeu customary territorial order governs the management of forests and nature with the aim of preventing landslides and floods. Although Cireundeu is geographically located in a low-lying area surrounded by hills, the indigenous community is not worried because they have local wisdom that has been proven for centuries."* (Interview with Mr. W in Cireundeu Village, 2024).

The division of these three zones consists of Larangan forest, Tutupan forest, and Baladahan forest. Larangan forest is the most sacred area that cannot be exploited under any circumstances; its pristine condition is strictly preserved as the core support for the ecological balance in Cireundeu. Tutupan forest serves as a buffer forest where selective

logging is allowed but must be followed by reforestation efforts to maintain sustainability. Meanwhile, Baladahan forest is designated as agricultural land, used by the community primarily for planting cassava and other crops through an intercropping system.

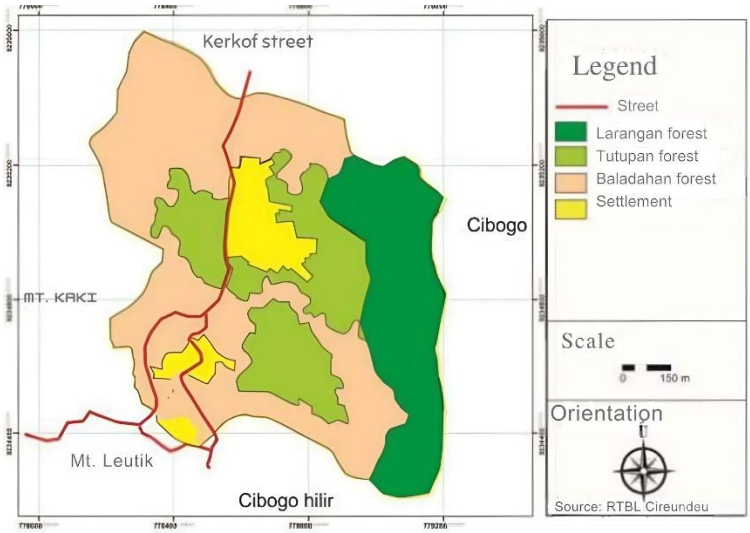

Fig. 2. Map of Adat Cireundeu Village

The spatial division shown in Figure 2 is an ancestral heritage aimed at preventing disasters such as landslides and floods, as well as maintaining overall ecosystem balance. This system of dividing the forest into three zones (*larangan, tutupan, baladahan*) is a local wisdom practice that is remarkably relevant to modern conservation concepts. The Larangan forest is functionally identical to the concept of a core zone in a nature reserve or national park—an area of absolute protection that serves as a bastion of biodiversity and a guardian of vital ecosystem services like water resources. Meanwhile, the *Tutupan forest* and *Baladahan forest* can be paralleled with a buffer zone and a sustainable use zone, respectively. This system demonstrates a profound understanding that conservation does not mean completely separating humans from nature, but rather wisely managing that interaction (Berkes et al., 2000).

The rule against wearing footwear transcends mere symbolic compliance. Ecologically, this practice can reduce soil compaction and the potential introduction of invasive species from outside that cling to footwear (Dolman & Marion, 2022; Forster et al., 2020). However, its primary value is philosophical: the practice constantly reminds each individual of the sacred bond between humans and the earth, that nature is not an object to be exploited but a part of oneself to be respected. Thus, this zoning system is not just a technical regulation but a physical embodiment of the inseparable philosophy of *tatanan waruga jagat* and *tatanan waruga manusa* (Susanto & Numata, 2023).

3.2.3 Food adaptation as a pillar of conservation: The tradition of consuming cassava (rasi)

The main uniqueness of the Cireundeu indigenous community is the tradition of consuming processed cassava, called *Rasi* (cassava rice), as their staple food while avoiding rice paddy. This habit originated during the Dutch colonial era when rice was confiscated by the colonizers. To avoid dependency and as a form of resistance—so they would not have to leak information to the colonizers in exchange for rice—the Cireundeu ancestors pioneered the consumption of cassava. Today, this tradition is interpreted as a form of adaptation to changing times and environments, especially in facing potential food shortages (Fadhilah, 2014).

The tradition of eating cassava (*Rasi*) in Cireundeu is a perfect example of how cultural adaptation can yield ecological resilience. The decision to not depend on rice has significant ecological implications. Paddy rice farming generally requires large amounts of water,

extensive land clearing, and often the use of chemical fertilizers (Pahalvi et al., 2021). By choosing cassava, a plant that can grow on dry land and does not require massive external inputs, the Cireundeu community directly reduces pressure on water and land resources. This allows more land to be maintained as forest (*tutupan forest* and *larangan*) (Nurhaniffa & Haryana, 2022).

More than just a survival strategy born from a history of oppression, this practice has evolved into a pillar of identity and self-reliance. In the context of the climate crisis and global food security threats, Cireundeu's choice is a highly relevant adaptation model. They demonstrate that food security does not have to depend on a single dominant commodity but can be achieved through food diversification that is in harmony with local ecological conditions. Their culture of eating, known as *"tuang"*, which is believed to have spiritual meaning, effectively links an individual's spiritual well-being with the preservation of their natural environment (Sibuea, 2024).

3.2.4 Knowledge transmission mechanism: The surasa tradition and customary ceremonies

To ensure the sustainability of their customary values, the Cireundeu community has several social mechanisms. The success of their nature management system would not be sustainable without strong social mechanisms to pass down knowledge and enforce rules. Here lies the crucial role of customary institutions such as the *"Surasa"* tradition and the *"Tutup Taun"* (Year-End) ceremony on the 1st of *Suro* (the first month of the Javanese calendar).

One of the main activities is *"Surasa"*. In this activity, the community, especially the youth, gathers at the *Bale Adat* (customary hall), as shown in Figure 3, to discuss, solve problems together, and receive guidance and advice from the elders. The customary elders routinely conduct socialization about ancestral teachings on preserving nature in this forum.

Fig. 3. *Saung* at *Bale Adat*

Mr. W explains that this activity is a deliberate and routine way to instill these teachings in the younger generation.

> *"There is something called sarasa, where the youth are gathered at the Bale. In that hall, they are given a kind of socialization about the ancient teachings to protect this nature by the customary elders. This activity is held routinely every week, so that the understanding of this does not waver, because this is a heritage that must be preserved."* (Interview with Mr. W in Cireundeu Village, 2024).

"Surasa" functions as an informal educational forum as well as a form of social control. By gathering the youth to dialogue with the elders, local ecological knowledge is transmitted orally and its relevance to contemporary challenges is ensured. This is an active process where the younger generation does not just passively receive teachings but is also given

space to discuss and find solutions together. This strengthens social capital and a sense of collective ownership over the tradition (Berkes et al., 2000).

Besides *Surasa*, there is the *"Tutup Taun"* celebration on the 1st of *Suro*, which is considered as sacred as a major religious holiday. This ceremony is held at the *Bale Saresehan* (meeting hall) as an expression of gratitude to God and thanks to nature for providing the sources of life. The celebration is filled with various artistic performances, the presentation of earth's bounties like a *gunungan* (cone-shaped offering) of fruits and a *tumpeng* (cone-shaped rice dish) made of *Rasi* as shown in Figure 3, as well as advice from the Customary Elder. During the celebration, men wear black *pangsi* attire and women wear white *kebaya* blouses.

Fig. 4. The *1st suro* celebration

The importance of this celebration is described by Mr. W as a moment equivalent to a great holiday.

> *"For the Cireundeu indigenous community, the 1st of Suro celebration is like Eid al-Fitr for Muslims. This celebration is a form of their gratitude and thanks to God Almighty for all the abundant blessings and grace they have received, as well as their thanks to nature for providing them with a source of life." (Interview with Mr. W in Cireundeu Village, 2024).*

The 1st of *Suro* ceremony functions as a ritual that strengthens the emotional and spiritual bonds of the community with nature. By celebrating the harvest and expressing gratitude, the values of conservation are no longer felt as a burden or a prohibition, but as an integral part of a meaningful life cycle. The belief that the ancestors have passed down this knowledge for the good of the future becomes the main binder that makes the Cireundeu indigenous people continue to hold fast to their local wisdom as a guide for life (Berkes et al., 2000). The awareness to protect nature is instilled from an early age by parents to children and is reinforced by the elders who continuously emphasize that preserving nature is a noble heritage that distinguishes them from the often exploitative modern worldview. This is reflected in Mr. W's expression of gratitude:

> *"Abah is just grateful for what is given by Nu Kawasa (The Almighty), just continuing the ancestral heritage, which is to guard and preserve nature. Unlike people in the city who turn nature into factories, housing, or exploit it for mere profit. For the indigenous community, nature is an ancestral heritage that must be preserved, not destroyed."* (Interview with Mr. W in Cireundeu Village, 2024).

3.3 Analysis of the forest zoning system as a community-based resource management model

The "*tata wilayah*" (territorial order) system implemented by the Cireundeu indigenous community is a classic and effective example of Community-Based Natural

Resource Management (CBNRM). This model is fundamentally different from the top-down conservation approach managed by the state, as it originates from within the community, is based on Traditional Ecological Knowledge (TEK), and is enforced through time-tested social institutions and cultural norms. An in-depth analysis of this system reveals its sophistication in functional, institutional, and philosophical aspects (Berkes et al., 2000).

3.3.1 Ecological functionality: Parallelism with modern conservation schemes

From a functional perspective, Cireundeu's three-zone system demonstrates strong parallels with modern protected area classification schemes (Berkes et al., 2000), indicating that the Cireundeu indigenous people, through generations of observation and experience, have arrived at ecological conclusions comparable to those developed by contemporary conservation science. Larangan forest serves as the core zone, functioning as an ecological "fortress" with a strict prohibition on exploitation, thereby preserving biodiversity and genetic resources. Its dense vegetation and thick leaf litter act like a sponge, maximizing rainwater absorption, reducing surface runoff, and recharging the springs that sustain village life—an embodiment of efforts to maintain ecological balance. Surrounding it, Tutupan forest functions as a buffer zone that shields the core area from external pressures. By permitting only selective, limited use coupled with mandatory reforestation, this zone reflects an understanding of sustainable harvesting, accommodating small-scale activities such as collecting firewood or non-timber forest products while safeguarding the integrity of the core zone. Finally, Baladahan forest serves as the sustainable use zone, where the most intensive human–nature interactions take place through agriculture. Yet, these practices are guided by sustainability principles, evident in the cultivation of crops like cassava, which requires minimal water, and the use of intercropping systems that maintain soil fertility without dependence on external inputs.

3.3.2 Institutional dimensions: Rules, rights, and legitimacy

The success of this zoning system lies not only in its ecological intelligence but also in the strength of the local institutions that manage it, which extend beyond a mere set of rules to include collectively recognized rights, norms, and enforcement mechanisms. Although Indonesian law (de jure) places forests under state jurisdiction, the Cireundeu community exercises strong de facto management rights by establishing access rules, regulating resource use, and monitoring forest conditions, thereby demonstrating the resilience of their customary institutions amidst changing times (Nurhakim, 2024). Compliance with these zoning rules is grounded not in fear of formal government sanctions but in legitimacy derived from ancestral teachings, where nature is regarded as an “ancestral heritage to be guarded and preserved.” Violating the rules is therefore seen not only as an illegal act but also as an act of disrespect toward the ancestors, disrupting the cosmic balance between the tatanan waruga jagat (order of the cosmos) and the tatanan waruga manusa (order of humanity) (Nurhaniffa et al., 2022). Moreover, practical rules such as the prohibition of wearing footwear function as strong norm-markers and constant reminders of the forest’s sacred status. This embodied practice compels individuals to consciously and physically experience their connection to nature, reinforcing adherence to broader institutional rules (Pratiwi et al., 2019).

3.3.3 Disaster resilience as a manifestation of the system's success

One of the most tangible proofs of the "Tata Wilayah" system's success is its capacity for disaster mitigation. Mr. W's statement that the system aims "to prevent landslides and floods" and that the community is "not worried" despite being in a basin surrounded by hills is not a baseless claim.

Scientifically, this zoning system contributes directly to disaster resilience by preventing landslides and regulating hydrology. The dense tree stands in Larangan forest

and Tutupan forest possess complex and deep root systems that function as a natural net, binding soil particles, enhancing slope stability, and significantly reducing the risk of landslides, particularly during heavy rainfall. In addition, the preserved forest cover maximizes water infiltration into the soil while slowing surface runoff, thereby preventing the rapid accumulation of water in low-lying areas that could trigger flash floods. Acting as a natural regulator, the forest gradually releases water through springs and rivers, ensuring a more stable and sustainable water flow (Badaruddin et al., 2021).

Thus, this time-tested local wisdom is essentially a highly effective Ecosystem-based Disaster Risk Reduction (Eco-DRR) strategy. This demonstrates that traditional indigenous knowledge often aligns with modern scientific principles and offers sustainable local solutions to environmental challenges (Berkes et al., 2000).

3.4 Analysis of food adaptation as a strategy for food sovereignty and ecological resilience

The tradition of consuming cassava (*Rasi*) as a staple food in the Cireundeu Indigenous Village, as shown in Figure 5, is a central pillar of their local wisdom. This practice is more than a culinary heritage; it is a complex strategy with deep political, ecological, and socio-cultural dimensions. An analysis of this tradition shows how a community can build resilience and assert its sovereignty through its food choices.

Fig. 5. Rasi in Cirendeu Village

3.4.1 Food sovereignty versus food security

It is important to analyze Cireundeu's practice through the lens of food sovereignty, not merely food security. Food security generally refers to the availability of and access to sufficient food, which can be met by external supplies. In contrast, food sovereignty is the right of a community to define its own agricultural and food systems, to choose food that is culturally and ecologically appropriate, and to control its food production independently (Santoso & Falatehan, 2021).

Cireundeu's choice not to depend on rice—a highly politicized commodity controlled by external markets—is a powerful statement of sovereignty. They consciously choose not to be part of the dominant food supply chain, instead strengthening a local food system that they fully control, from cultivation in the baladahan forest (agricultural forest) to processing and consumption (Nurhaniffa & Haryana, 2022).

3.4.2 Historical and political dimensions: Food decolonization as a form of resistance

The origin of this tradition, which began as resistance against the Dutch colonizers, reveals a deep political dimension. At that time, rice functioned not only as food but also as a tool of control. By confiscating rice, the colonizers created a dependency that could be used to suppress and extract information. The decision of the Cireundeu ancestors to switch to cassava was a strategic act of resistance. It was an act of food decolonization: a refusal to submit to a food system imposed by a colonial power and a step to reclaim autonomy. By not depending on rice, they broke the chain of dependency and asserted their independence,

not only politically but also in terms of subsistence. This legacy of resistance is embedded in every grain of Rasi they consume today, serving as a historical reminder of the importance of self-reliance (Santoso & Falatehan, 2021).

3.4.3 Agroecological principles in practice

The agricultural system that sustains this food tradition is closely aligned with the principles of agroecology, an approach to farming that integrates ecological and social considerations (Primasongko & Raihandhany, 2023; Wezel et al., 2020). The Cireundeu community demonstrates intelligent adaptation to local conditions by planting cassava on dry land (baladahan forest), a choice well-suited to their soil and topography. This practice eliminates the need to open new rice paddies, which require intensive irrigation and could damage hillsides, thereby showcasing how agriculture can be adjusted to ecosystem conditions rather than forcing ecosystems to conform to specific crops. Furthermore, by choosing not to cultivate paddy rice, the community significantly reduces its ecological footprint, since rice farming is a major source of methane emissions and demands substantial water resources. The cultivation of cassava instead directly contributes to both water conservation and emission reduction. Importantly, this food choice also reinforces the success of the forest zoning system, as the land required for staple food production can be accommodated within the relatively limited baladahan forest. This minimizes pressure to encroach upon the Tutupan forest or the Larangan forest, illustrating how decisions made in the kitchen play a direct role in protecting the forest.

3.4.4 Resilience of the socio-ecological system

The ecological system of the Cireundeu community demonstrates resilience in the face of various shocks, which is reflected in economic, ecological, and cultural dimensions. Economically, by producing their own staple food, the community is insulated from the price volatility of rice in national and global markets, making them less vulnerable to inflation and external supply shortages, thereby ensuring stability at both household and community levels (Santoso & Falatehan, 2022). Ecologically, their cassava-based agricultural system proves more drought-resistant than rice cultivation while also maintaining overall ecosystem health, thus enhancing the resilience of their natural resource base against the impacts of climate change (Primasongko & Raihandhany, 2023). Culturally, the tradition of consuming cassava has transcended mere dietary habit to become the foundation of the Cireundeu people's collective identity. This practice connects present generations with the struggles of their ancestors, reinforcing social cohesion and pride in cultural heritage. Such a strong identity serves as vital social capital for withstanding the pressures of modernization and external influences (Nurhaniffa & Haryana, 2022).

3.4.5 The link between food and spirituality

It is important to note that for the Cireundeu community, food is never separated from spiritual meaning. The concept of eating, or "tuang", which they adhere to has a deep spiritual meaning, where preserving nature is believed to enhance their spirituality. This elevates the practice of consuming cassava from a mere subsistence activity to a sacred ritual. Thus, every action—from planting, harvesting, processing, to eating Rasi—is inspired by an awareness of the reciprocal relationship with nature and the ancestors. This spiritual link is the strongest "glue," ensuring that this food tradition will continue to be preserved not out of coercion, but because it is an integral part of their spiritual path to maintain the balance between the tatanan waruga manusa (the order of humanity) and the tatanan waruga jagat (the order of the cosmos) (Nisa & Surtikanti, 2024).

3.5 Analysis of the transmission mechanism as a reproduction of traditional ecological knowledge (TEK)

The sustainability of the Cireundeu socio-ecological system depends heavily on its ability to reproduce and transmit Traditional Ecological Knowledge (TEK) from one generation to the next (Irawan et al., 2024). TEK, defined as a dynamic and adaptive accumulation of knowledge, practice, and belief about the reciprocal relationship between humans and their environment, cannot survive if it is only stored in the memory of the elders. It must be actively and continuously instilled, negotiated, and internalized by the youth. The transmission mechanism in Cireundeu, which combines dialogue-based education with the reinforcement of values through ritual, demonstrates a highly effective indigenous pedagogical system (Susanto & Numata, 2023).

3.5.1 Surasa as a dialogue-based informal educational institution

Viewed more deeply, Surasa functions as a structured informal educational institution. Mr. W's remark that this activity is "held routinely every week, so that the understanding of this does not waver" shows that it is not merely an ordinary meeting but rather a deliberate curriculum. An analysis of *Surasa* as an indigenous pedagogy highlights several key characteristics. First, it embodies dialogical and intergenerational learning. Unlike Western educational models that are often unidirectional, *Surasa* provides space for dialogue in which the youth not only receive information but also engage in discussions, ask questions, and address the problems they encounter. This ensures that traditional ecological knowledge (TEK) remains relevant and adaptive, as it can be applied to overcome new challenges through collective deliberation between elders' wisdom and the younger generation's experiences (Berkes et al., 2000). Second, *Surasa* emphasizes an integrated learning context, as learning takes place in the *Bale Adat* (customary hall), the center of communal life, rather than in an isolated classroom. This reflects the principle of "situated learning," where knowledge is acquired within the social and cultural contexts in which it will be applied, making it both more meaningful and more easily practiced (Susanto & Numata, 2023). Finally, *Surasa* focuses on legitimacy and continuity. Its primary purpose, as emphasized by Mr. W, is to ensure that "understanding of this does not waver, because this is a heritage that must be preserved." In this sense, *Surasa* serves to legitimize TEK as a valuable heritage and guarantee its transmission across generations, routinely reaffirming its importance while strengthening its authority in the eyes of the youth.

3.5.2 The 1st of suro ritual as a reinforcement of values and emotional bonds

If *Surasa* operates in the cognitive realm of understanding and knowledge, then rituals such as the Tutup Taun (Year-End) 1st of Suro celebration function in the affective realm, encompassing emotion, spirituality, and social bonds. Rituals serve as powerful means of communicating complex cultural values non-verbally while fostering deep collective experiences (Berkes et al., 2000). Every element of the 1st of Suro ceremony carries rich symbolism and meaning. For instance, the gunungan (cone-shaped offering) of produce and the tumpeng (cone-shaped dish) of Rasi are not merely food but physical representations of nature's bounty and the success of agricultural practices. Presenting them is a symbolic act of reciprocity, reflecting the community's gratitude to both nature and God, as emphasized by Mr. W, who described the ritual as "a form of their gratitude and thanks to God Almighty and their thanks to nature" (Purnomo, 2019). Beyond symbolism, the ritual also creates a collective experience. By gathering together in uniform traditional attire, sharing food, and listening to the elder's advice, the community strengthens its social bonds and cultivates a shared emotional connection. This collective experience transforms abstract ecological values, such as the duty to protect nature, into tangible and celebrated cultural practices, reinforcing both ecological responsibility and cultural identity (Fadhilah, 2014).

3.5.3 Informal enculturation in daily life

Besides the formal mechanisms of *Surasa* and rituals, the transmission of TEK also occurs informally through the process of enculturation in daily life (Akhmar et al., 2022; Rexhepi & Bajrami, 2025). Mr. W's statement that "parents always teach their children about the importance of protecting nature and the environment" indicates a process of education at the family level. Children learn by observing and imitating their parents' behavior; how they treat the forest, how they farm in the baladahan forest, and the respect they show for nature. By participating directly in daily life governed by customary principles, children gradually internalize their community's worldview (Susanto & Numata, 2023).

3.5.4 Synergy of cognitive, affective, and practical mechanisms

The success of the knowledge transmission system in Cireundeu lies in the synergy among three interconnected mechanisms; *Surasa*, which provides the cognitive foundation through rational understanding of rules and philosophy; the 1st of Suro ritual, which reinforces the affective foundation by cultivating emotional and spiritual commitment to shared values; and daily enculturation, which offers practical experience through action and participation, ensuring that knowledge is continuously lived, practiced, and passed on.

This combination creates a holistic and robust knowledge reproduction system. It not only teaches "what" to do, but also "why" it is important and instills the "feeling" or desire to do it. This system ensures that Cireundeu's local wisdom does not merely become an artifact of the past, but remains a dynamic and relevant guide for future generations (Berkes et al., 2000).

3.6 Synthesis: The holism of cireundeu's local wisdom as an integrated socio-ecological system

The analysis of the various pillars of local wisdom in the Cireundeu Indigenous Village—from its sophisticated forest zoning system, its resilient food adaptation, to its effective knowledge transmission mechanisms—reveals a fundamental truth: the strength of this system does not lie in each practice separately, but in the holistic and synergistic interconnection among them all. Cireundeu's local wisdom is not merely a collection of rules and traditions, but a living, integrated, and fully functioning Socio-Ecological System (SES), in which every component mutually reinforces and depends on the others (Preiser et al., 2018).

3.6.1 Non-dualistic worldview as the system's foundation

The core of this integrated system is the non-dualistic worldview of the Cireundeu community. The philosophy that views nature as the *tatanan waruga jagat* (the order of the cosmos) and humanity as the tatanan waruga manusa (the order of humanity) which are "inseparable" fundamentally rejects the Cartesian dualism that dominates Western thought—the separation between nature and culture, object and subject, body and soul. For the Cireundeu people, the forest, humans, cassava, and ancestral spirits all exist within the same web of life (Berkes et al., 2000).

This worldview functions as the "operating system" that underlies all the "applications" (practices) they run. The belief that nature is an "ancestral heritage to be guarded and preserved" is not just a slogan, but an ethical principle that gives meaning, purpose, and legitimacy to every action, from how they walk in the forest to what they eat (Nurhaniffa & Haryana, 2022).

3.6.2 Mutually reinforcing feedback loops

The integrity of this system is reflected in the dynamic positive feedback loops between its social and ecological subsystems, as described by Preiser et al. (2018). The food–forest feedback loop shows how the cultural choice to consume cassava in the social domain directly reduces ecological pressure on land and water, enabling the forest zoning system to function optimally, maintain vegetation cover, and preserve biodiversity in the ecological domain. This ecological success, in turn, ensures the availability of fertile land in the *forest baladahan*, thereby reinforcing the viability of the cassava-based food tradition. The knowledge–practice feedback loop highlights how transmission mechanisms such as *Surasa* and rituals in the social domain ensure that forest management rules and sustainable agricultural practices in the ecological domain are properly implemented, with knowledge continuously validated by real-world results. Finally, the outcome–belief feedback loop demonstrates that tangible results—such as preventing landslides and floods and ensuring food and clean water availability—serve as compelling empirical evidence that validates ancestral teachings. These outcomes strengthen the community's belief in their worldview, provide renewed energy for rituals, and reinforce their commitment to preserving cultural and ecological heritage. The system is, therefore, self-reinforcing. Each component not only has its own function but also serves and is strengthened by the other components, creating a robust cycle of sustainability.

3.6.3 Resilience as an emergent property of holism

The resilience of the Cireundeu system is not the result of a single strategy, but an emergent property—a quality that arises from the complex interactions of the entire system. If one aspect weakens, the other aspects can still support the system as a whole. For example, if a cassava harvest fails due to climatic factors, the ecological foundation (a healthy forest) and the social foundation (community solidarity forged in rituals and *Surasa*) will help them to survive and recover (Bas et al., 2022; Borku et al., 2025). This tight interconnection distributes risks and shocks across the entire network, making it far more stable than simpler, more linear systems (Jabbaril, 2018).

3.6.4 A counter-narrative to modern development

Ultimately, Cireundeu's holistic model offers a powerful counter-narrative to the dominant modern development paradigm. The sharp contrast drawn by Mr. W between their way of life and that of "people in the city who turn nature into factories, housing, or exploit it for mere profit" highlights this fundamental difference. The modern development model tends towards fragmentation: separating economy from ecology, production from consumption, and scientific knowledge from spiritual wisdom (Berkes et al., 2000; Wise, 2021).

The Cireundeu Indigenous Village demonstrates that it is possible to build human well-being without destroying its ecological foundations. They prove that a subsistence economy, food sovereignty, and environmental preservation are not conflicting goals, but can be achieved simultaneously when integrated within a holistic worldview and animated by coherent social and cultural practices. Thus, Cireundeu's local wisdom is not merely an exotic relic of the past, but a living, sustainable system model that offers valuable lessons for the future (Santoso & Falatehan, 2021).

4. Conclusion

This study examined the local wisdom of the Cireundeu Indigenous Village as an integrated and holistic socio-ecological system. Based on the analysis conducted, several fundamental conclusions can be drawn. First, the success and resilience of the Cireundeu indigenous community in maintaining ecological balance do not stem from isolated, singular

practices, but rather from the synergy and tight interconnection among three main pillars: the forest zoning system (Tata Wilayah), the cassava-based food adaptation strategy, and the knowledge transmission mechanisms (*Surasa* and customary rituals). This system is bound by a non-dualistic worldview that views humans (tatanan waruga manusa) and nature (tatanan waruga jagat) as an inseparable unity, wherein any action towards nature is, in essence, an action towards oneself.

Second, each pillar has a dual, mutually reinforcing function. The forest zoning system functions not only as a conservation practice that is ecologically equivalent to modern models, but also as a physical manifestation of a spiritual order. Food adaptation is not just a strategy to achieve food security, but rather a statement of political sovereignty and a pillar of ecological resilience. Meanwhile, the knowledge transmission mechanisms—through cognitive dialogue in *Surasa* and effective reinforcement in rituals—ensure that this knowledge system remains alive, relevant, and deeply internalized from generation to generation.

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The authors declare no conflicts of interest.

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