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Suro Porridge Tradition, preserving knowledge and value as cultural ecosystem services in Bumiaji Village, East Java, Indonesia

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Abstract. *Istikomayanti Y, Leksono AS, Gama ZP, Batoro J. 2026.* Suro *Porridge Tradition, preserving knowledge and value as cultural ecosystem services in Bumiaji Village, East Java, Indonesia. Asian J Ethnobiol 9: y090105. https://doi.org/10.13057/asianjethnobiol/y090105.* The *Suro* Porridge Tradition in Bumiaji Village, East Java, Indonesia, is a prime biocultural practice and an indigenous response to conservation challenges. Deeply embedded in the community's heritage, this new year ritual involves serving porridge made from local products like rice and endemic root crops (*polo pendem*). The tradition is a tangible expression of traditional conservation knowledge. This research aims to analyze the *Suro* Tradition, specifically the porridge ritual, as an exemplary model of Cultural Ecosystem Services (CES) in Bumiaji. A total of 69 plant species from 31 families were documented, with 43% categorized as moderate and 57% as low in the Index of Cultural Significance (ICS) were collected through semi-structured interviews with 53 respondents, participant observation, and an inventory of plant use. Rice (*Oryza sativa*) held the highest ICS value due to its combined spiritual and cultural importance, while tuber species (*polo pendem*) reflected shifting historical patterns of resource use. The CES assessment revealed that the tradition provides strong identity, spiritual, educational, and place-based values, sustained through communal participation and public festival formats introduced over the past 15 years. The ultimate measure of success is the intergenerational transfer of a stewardship ethic, evidenced by the younger generation's engagement in regenerative agriculture and agroforestry. Supported by the Bumiaji Village government's support for the younger generation's involvement. The *Suro* Tradition thus emerges as a robust, community-driven conservation model that strengthens socio-ecological resilience and underscores the need for policy frameworks that recognize and support biocultural practices as foundational components of sustainable landscape management.

Keywords: Cultural ecosystem services, environmental responsibility, ICS, *Suro* Tradition, sustainability

INTRODUCTION

The *Suro* Commemoration, an intangible cultural heritage of Indonesia, is an exemplary case of the diverse traditions observed in Indonesia. This event is often linked to environmental preservation, as are other ceremonies for birth, death, and marriage, which consistently incorporate natural symbols to reflect an inseparable bond with nature (Yuniati et al. 2020; Rahayu et al. 2023; Krisnawati et al. 2024). An effective approach to studying these traditions is through a biocultural perspective, which examines the results of human-nature interactions as they relate to biodiversity conservation. The essence of this heritage lies in the transfer of knowledge and values from one generation to the next (Dahlin and Svensson 2021). The knowledge and values embedded within a community are valuable assets, contributing significantly to the well-being of the local population. This aligns with the concept of biocultural wealth, where positive human-nature interactions directly result in sustainable cultural landscapes (Agnoletti and Rotherham 2015; McGinlay et al. 2018; Hill et al. 2020). This concept is formally known as Cultural Ecosystem Services (CES), a critical component of community-based conservation strategies and a prominent area of scholarly research (Berkes 2004; Bridgewater and Rotherham 2019; Briguglio et al. 2020).

This research examines the dynamic process of community-nature interaction in Bumiaji Sub-district, Batu City, East Java, a region recognized for its high cultural and biological diversity. We define biocultural wealth not simply by the variety of plants and animals, but by the reciprocal and dynamic interplay between humans and their natural resources (Bridgewater and Rotherham 2019; Omoyajowo et al. 2024). While disciplines like anthropology and biology study these components separately, their intersection is best explored through the ethnobiology approach. This multidisciplinary methodology is essential for collecting data on biodiversity, documenting community knowledge and values, and examining the complex relationships that manifest as a deep appreciation for nature, shared values, and the continuous creation of new knowledge (Fish et al. 2016). Ultimately, this biocultural wealth is a dynamic asset that evolves within a society over time.

The *Suro* Porridge Tradition, a ceremonial practice commemorating Muharram, perfectly illustrates this biocultural connection. Deeply rooted in the use of local plants and agricultural commodities, which define the identity of Indonesia's farming communities, this practice transcends a mere food ritual. It represents a form of intellectual wealth that provides a vital Cultural Ecosystem Service (CES). Unlike provisioning services (e.g., food,

water), CES highlights the intangible values, meanings, and non-material benefits people derive from their environment, such as a sense of identity and belonging (Gould et al. 2014; Gould et al. 2019; Kostanjšek and Golobič 2023). Crucially, research demonstrates that CES is integral to the sustainability of other ecosystem services. By fostering deeply positive bonds with nature, humans act as agents of resilience, enabling communities to adapt, regenerate knowledge, and ensure the long-term viability of their socio-ecological systems.

Interactions between humans and nature have cultivated strong connections, a phenomenon particularly evident among indigenous and tribal groups worldwide (Gould et al. 2014; Suwarno et al. 2022; Mulyani et al. 2023). This intricate relationship is a key focus of research in various fields, including anthropology and environmental studies (Batoro et al. 2017; Mulyani et al. 2023; Najih et al. 2023; Al Zahra' 2024). In Indonesia, the knowledge passed down by ancestors has informed diverse management strategies in agriculture (Salamanca et al. 2015), plantations (Limba et al. 2017; Susanto and Numata 2023), and fisheries (Ramenzoni 2021), giving rise to unique cultural practices and traditions. However, the sustainability of these ecosystems is threatened not only by modernization and land use change but also by shifts in societal thought.

The *Suroan* Tradition is a powerful example of how culture can serve as a vehicle for environmental preservation. This cultural practice, born from the syncretism of Javanese-Hinduism and Islam, conveys the crucial moral message that humanity must coexist in harmony with nature. This deeply held belief is physically manifested in ceremonies that often include offerings of local agricultural products and the symbolic purification of natural water sources like springs and rivers. The rituals are not merely spiritual acts but tangible reminders of the community's dependence on and responsibility to its natural environment. By integrating these environmental values into a cultural and spiritual framework, the *Suroan* Tradition ensures their transmission across generations, thereby reinforcing a collective ethos of sustainability.

In Batu City, a transitional peri-urban area, agriculture remains a primary economic driver. For example, Bumiaji Sub-district produces a significant portion of the region's fruits and vegetables (Badan Pusat Statistik (BPS) Kota Batu 2023). The local community, whose history is deeply tied to the village's founder, holds a firm belief in environmental sustainability, which they actively promote through commemorations like the *Suroan* Tradition. This commitment highlights a critical point: preserving culture, or "*nguri-nguri*" as it is known in Javanese, requires widespread support. It is not a task for the government alone but requires the active involvement of all parts of society, including the public, stakeholders, academics, and community leaders (Gould et al. 2019; Dahlin and Svensson 2021; Bindi et al. 2022; Badan Perencanaan Pembangunan Nasional (Bappenas) 2024).

Crucially, the *Suroan* Tradition serves as a vital method for the intergenerational transfer of knowledge, helping to reinforce the community's identity as an agricultural society despite modernization challenges. While the tradition has been explored culturally, research linking it directly to conservation practices and the specific mechanism of knowledge transfer remains limited. This study addresses this gap by conducting a biocultural analysis and inventory, integrated with ethnobiological methods. We hypothesize that the *Suro* Porridge Ritual functions as a high-value Cultural Ecosystem Service (CES) that strengthens agricultural identity, enhances intergenerational knowledge transfer, and reinforces community-based conservation behavior through its sustained symbolic use of plant resources and collective participation. The objective of this research is thus to analyze and demonstrate the *Suro* Tradition, specifically the ritual of *Suro* Porridge, as an exemplary model of Cultural Ecosystem Services (CES) within Bumiaji Village, East Java, by elucidating its crucial role in transferring local knowledge, values, and reinforcing the community's agricultural identity across generations.

MATERIALS AND METHODS

Study area

Batu City is located in East Java, Indonesia, at a latitude of 7°44'-8°26' S and a longitude of 122°17'-122°57' E (Figure 1). This peri-urban area, covering 202.30 km², serves as a transition zone that blends mountainous rural areas with an urban city center. Situated at an elevation of 680 to 1,200 meters above sea level (masl), the city's hilly terrain is surrounded by three major mountains, Mount Panderman (2,010 masl), Mount Arjuna (3,339 masl), and Mount Welirang (3,156 masl). These geographical features create a cool climate with an average temperature of 15-19°C, humidity levels of 75-98%, and an average monthly rainfall of 298 mm. The Bumiaji Sub-district is located in the northern part of Batu City and is the city's agricultural hub. Covering 120.06 km², which is 61.8% of the city's total area, it has significant potential for producing food crops, including vegetables, fruits, ornamental plants, and forest commodities. Most of the local population is engaged in agriculture-related livelihoods such as farming, trading, and agri-tourism. With an elevation ranging from 700 to 1,100 masl, its scenic, hilly, and mountainous landscape attracts many tourists. The sub-district's strategic location, bordering Prigen and Pacet Sub-districts (Pasuruan District) to the north, Karangploso Sub-district (Malang District) to the east, Pujon Sub-district (Malang District) to the west, and Batu and Junrejo Sub-districts (Batu City) to the south, makes it a key distributor of agricultural products to surrounding regions.

Procedures

The *Suroan* Tradition, a Javanese New Year celebration involving indigenous residents from the Beru, Binangun, and Banaran hamlets in Bumiaji Village, serves as the focus of this research. This study employed a biocultural framework (Franco 2022) and an ethnobiological approach (Albuquerque et al. 2024) to investigate the links between culture and nature. Following a three-month preliminary

study aimed at understanding the community's social characteristics, the research methodology integrated semi-structured interviews with direct field observations. The interview procedure followed ethical guidelines, beginning by clearly stating the objectives of the interview and the overall research data collection. Following this, respondents were asked for their consent to be recorded. It was ensured that the results of this data collection would be reported and utilized specifically as documentation for the local village. Data were gathered during July 2025; the interview phase commenced with the purposive selection of three key informants categorized as cultural elders to provide detailed explanations of the tradition. Following this, the snowball technique was employed to validate the information gathered from these initial respondents and to structure the subsequent interviews and observations concerning the preparation of *Jenang Suro* (*Suro* Porridge). A diverse group of respondents was selected using stratified random sampling based on age groups. The study sampled expert citizens (not the general public) involved in the *Suro* Tradition. The total population is 60 people (5 experts from each of the 12 Rukun Warga/RW). Using the Slovin formula with a 5% confidence level, the required sample size is 53 respondents.

The structured interview and observation activities aimed at gauging community perception were subsequently conducted using the technique of participant description. The interviews, which lasted sixty minutes, incorporated an interview protocol adapted from the Cultural Ecosystem Services (CES) measurement tool (Gould et al. 2014). This adaptation allowed the study to focus on specific aspects, such as sense of place or cultural heritage, sense of identity, activity (or recreational), spirituality, artistic and ceremonial value, educational aspects, intergenerational transmission, and the threat to the tradition's continuity. The translation process from Javanese and Bahasa Indonesia was executed in consultation with an academic cultural expert, who acted as a subject matter specialist in Javanese culture.

Concurrently, a survey was administered with the calculation of the Index of Cultural Significance (ICS) (Hoffman and Gallaher 2007). Crucially, the survey successfully achieved data saturation for the plant species, was assessed by comparing data from sequential interviews, and was determined to be reached when consecutive new respondents yielded the same use-categories for that specific plant or no new use-categories at all from the total sample of respondents and were specifically mentioned and utilized. All of the interviews were audio-recorded concurrently, and field observations were conducted to identify the plant species utilized in the tradition. Finally, plant diversity data were analyzed alongside the ethnobotanical information to calculate the Index of Cultural Significance (ICS), revealing the plant diversity, utilization, and socio-cultural aspects tied to the tradition. Subsequently, the findings derived from the interview data and participant documentation were validated by the customary stakeholders and the village government, who serve as the key local authorities.

Data analysis

Data from interviews with the respondents were qualitatively analyzed using data reduction and generalization techniques to assess Cultural Ecosystem Services (CES). The analysis focused on such aspects as cultural landscape identity and sense of place, social relations, knowledge and intergenerational transfer, religious and spiritual values, and aesthetic and inspirational values. The plant species used in the *Suro* Tradition were identified and tabulated according to their specific functions, which included: plants used as main ingredients for *Suro* Porridge, complementary plants, ornamental plants with spiritual value, and plants used in the *gunungan* tradition, which hold both economic and spiritual significance. Data collection for each plant species involved categorizing the usage with three values: quality (q), intensity (i), and exclusivity (e). These values were then used to calculate the Index of Cultural Significance (ICS) as follows. ICS Score Category: score = 300 dan more (Very High significance), ICS = 100-229 (High Significance), ICS= 20-99 (moderate), ICS=5-19 (low), ICS < 4 (negligible) (Pieroni 2001).

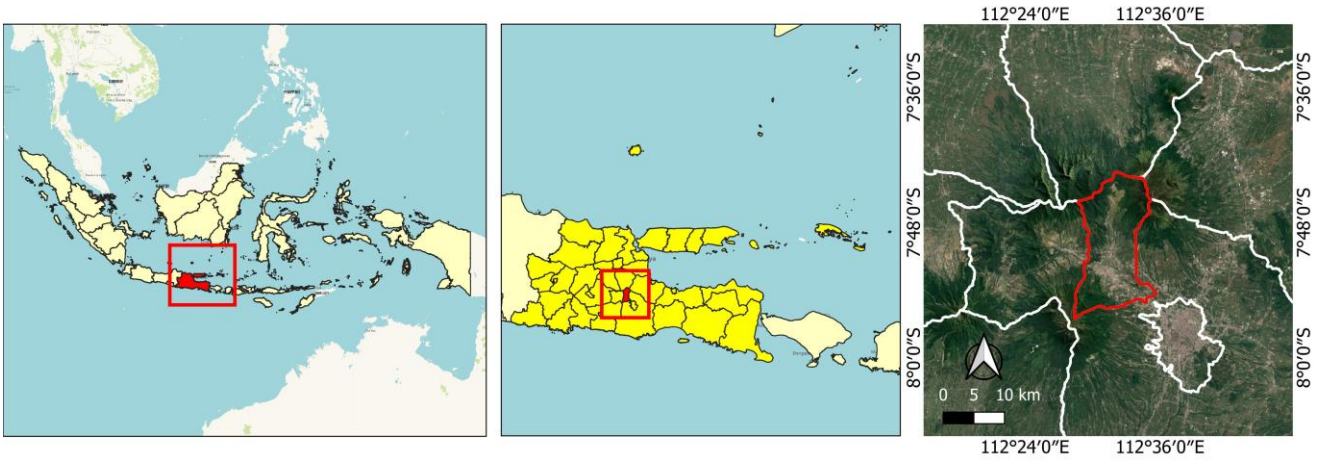

Figure 1. Map of Batu City, East Java Province, Indonesia

ICS = ∑ (q1 x i1 x e1) + (q2 x i2 x e2) + (q3 x i3 x e3) + …. (qn x in x en) (Hoffman and Gallaher 2007)

Ethical considerations

All research activities were conducted with respect for local customs and community protocols. Prior to interviews and participant observations, the objectives of the study were clearly explained, and informed consent was obtained verbally from all respondents, including permission for audio recording and documentation. Participation was entirely voluntary, and respondents were assured that their identities would remain confidential. The research also followed culturally appropriate procedures by consulting village elders and customary leaders before data collection. Because this study involved traditional knowledge and community practices, all findings were reported back to local stakeholders to ensure transparency and mutual benefit.

RESULTS AND DISCUSSION

General characteristics of the respondents

Most inhabitants of Bumiaji Village are indigenous Javanese people whose ancestry can be traced back over a century. The respondents interviewed for this study are representative of the community that also participated in the *Suro* Tradition. The village's deep historical roots are connected to *Mbah Wastu*, a pioneer during the spread of Islam and the forefather of Batu City. His tomb, now a historical site, is known as *Makam Mbah Batu*, reflecting his foundational role in the community's identity. Respondent data from the interviews and participation in the *Suro* Tradition are presented in Table 1 and Figure 2.

***Suro* Porridge and implications for identity**

The *Suro* Porridge is a centerpiece of the Bumiaji Village celebration of *Suro* Commemoration. The porridge has deep philosophical meaning. Its white color symbolizes humanity's journey toward purity, while the coconut milk and banana leaves on which it is served represent the value of being a beneficial person, as well as utilizing plant components for diverse applications. *Suro* Porridge is a Javanese tradition that encourages people to strive for purity in life, while acknowledging that humans are imperfect. The porridge's white color symbolizes the effort towards purity. It is made and shared only during the Javanese New Year (*Suro*), symbolizing the hope of becoming a better person in the new year. This symbolic meaning is explained by the spiritual eldera key informant of this study, as follows. This explanation was provided during the participant observation activities of *Suro* Tradition and subsequently confirmed in the in-depth interview. The *Suro* Tradition is a special celebration in Bumiaji Village, the documentation of which was provided by the Village authorities, and the researcher has requested permission to publish it.

"-" Jenang Suro kuwi wernané putih, kaya déné uripé manungsa kudu resik lan suci. Rasane jenang gurih seka santen, sing nduwèni teges uripé manungsa kuwi ora anyep nanging gurih. Ing njero jenang ana gaol, yaiku geronjalan wujud irisan kenthang lan uwi. Gaol iki ngisi ing antarané tèkstur bubur sing alus, sing nduwèni teges uripé manungsa ora mesthi lancar lan alus, nanging ana geronjalan utawa liku-liku panguripan. Jenang Suro kuwi diudhek, iki nduwèni makna uripé manungsa kuwi muter lan ora meneng waé (statis), kadang ing ngisor kadang ing dhuwur.

Jenang Suro, a white porridge, symbolizes the pursuit of purity in human life. Its savory, non-bland taste represents a life that is not flavorless but instead filled with richness. In *Suro* Porridge, the addition of chopped potatoes and sweet potatoes, known as *gaol*, creates a lumpy texture within the smooth porridge. This symbolizes the unpredictable twists and turns of life, signifying that a person's journey is not always smooth but filled with challenges and hardships. The act of stirring the *Suro* Porridge also holds a deeper meaning. It represents the ever changing and dynamic nature of human life, constantly in motion, with periods of both prosperity and adversity).

Table 1. Characteristics of the informant

Informant category	Total	Percentage (%)
Sex		
Male	17	32%
Female	36	68%
Age		
17-30	6	11%
31-44	17	32%
45-60	18	34%
>60	12	23%
Occupation		
Farmer	30	57%
Farm Vendor	16	30%
Traditional Leader	2	4%
Housewife	3	6%
Village Leader	2	4%
Education		
No-Formal education	2	4%
Junior High School	14	26%
Secondary High School	31	58%
Undergraduate	6	11%

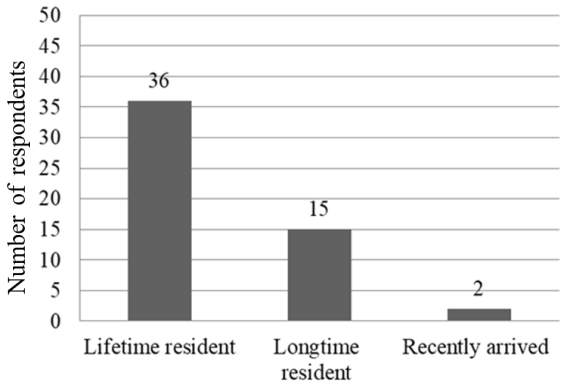

Figure 2. Number of respondents based on length of residency. Note: Lifetime: Residents who have lived there since birth, Longtime: Residents who have lived there for more than 10 years, Recently: Residents who have lived there for less than 10 years

The preparation of *Suro* Porridge is carried out communally, involving men and women cooking together. The equipment used is traditional, including a wood-fired furnace (*luweng*) and a copper wok (*kenceng*). Figure 3 depicts the atmosphere of the porridge preparation during the *Suro* Festival. This effort serves as a commemoration and a means of strengthening intergenerational tradition. Historically, the cooking activity was performed privately inside the home before the porridge was distributed. However, following a deliberation among the traditional elders to preserve this cultural practice, a communal *Suro* Porridge cooking celebration has been held publicly as part of the festival for the last fifteen years.

The *Suro* Porridge is served with locally sourced complement dishes, including *serundeng* (shredded coconut cooked with spices), fried fermented soybean cake (*tempe*), and shredded chicken, and the local government provides the rice used. Furthermore, the tradition is also complemented by the *ider gunungan* (parade of mountain-shaped offerings), a communal village celebration symbolizing abundant agricultural harvests. This is a rich cultural event that incorporates a diverse array of plants, with 69 species from 32 families utilized for the main ingredient of *Suro* Porridge, porridge condiment, staple food as a side dish, *gunungan* ingredient, and ceremonial decorations presented in Table 2. The list of plants and their Index of Cultural Significance (ICS) values is presented in Table 3.

The Index of Cultural Significance (ICS) value indicates the level of plant utilization and preference by the community. In the context of the *Suro Tradition*, the cultural significance level of the plants used is distributed as moderate (43%) and low (57%). Rice possesses the highest ICS value, primarily serving as the staple food and holding spiritual symbolism, while tuber plants (*polo pendem*), which function now as side dishes, rank lower in the index. Rice is no longer cultivated, as it is not a primary commodity in this mountainous region, yet it has become the community's staple food today. Conversely, tubers, which were formerly the staple food, now serve as supplementary food. This shift demonstrates a dynamic change in resource use that reflects the adaptation of local traditions to modern socioeconomic and ecological conditions. Plants with moderate and low ICS values are predominantly those used to fill the *gunungan* (mountain-shaped offerings). All plants utilized are local plants to Bumiaji Village and are paraded as a symbol of prosperity and glory.

Table 2. Plants and their uses in the *Suro* Tradition

Uses	Plants (Local name)	Species
Main ingredients for *Suro* Porridge	*Padi, Kentang, Telo, Kelapa*	*Oryza sativa, Solanum tuberosum, Ipomoea batatas, Cocos nucifera*
Spice ingredients for *Suro* Porridge condiments and materials for *Suro* Porridge offerings	*Bawang Merah, Bawang Putih, Jahe, Kunyit, Kencur, Cabai besar, Cabai kecil, Kacang Tanah, Kedelai, Pandan, Kelapa*	*Allium cepa, Allium sativum, Zingiber officinale, Curcuma longa, Kaempferia galanga, Capsicum annuum, Capsicum frutescens, Glycine max, Pandanus amaryllifolius, Cocos nucifera*
Staple foods as a side dish and *sirih pinang* tradition	*Bentul, Telo rambat, Waluh kuning, Pisang, Jagung, Gembili, Gembolo, Singkong, Tembakau, Sirih hijau, Pinang*	*Colocasia esculenta, Ipomoea batatas, Cucurbita moschata, Musa paradisiaca, Zea mays, Dioscorea esculenta, Dioscorea bulbifera, Manihot esculenta, Nicotiana tabacum, Piper betle, Areca catechu*
Main *gunungan* ingredients	*Apel hijau, Apel ana, Jeruk manis, Jeruk Keprok, Jeruk siam, Jeruk lemon, Jambu kristal, Terong, pisang, Kacang panjang, Sawi hijau, Sawi putih, Kubis*	*Malus sylvestris, Malus domestica, Citrus sinensis, Citrus reticulata, Citrus x aurantium, Citrus limon, Psidium guajava, Solanum melongena, Musa paradisiaca, Vigna unguiculata, Brassica juncea, Brassica rapa, Brassica oleracea*

Figure 3. The preparation of *Suro* Porridge, a process that actively involves both women and men during the village purification festival. The cooking uses traditional equipment, including copper woks (*kenceng*); for serving, the porridge is placed in clay pots and containers made from banana leaves (*takir*) (July 2024 from Villages documentation)

Table 3. Plant species used in the *Suro* Porridge Tradition with Index of Cultural Significance (ICS)

Species	Local name	Family	Part Used	Habitat	Status	∑ICS	Category
Oryza sativa L.	*Padi*	Poaceae	S	-	LC	82	Moderate
Musa paradisiaca L.	*Pisang (Pisang Kepok, Pisang Ambon, Pisang Raja, Pisang Tanduk)*	Musaceae	Fr, Lf	G	LC	56	Moderate
Cocos nucifera L.	*Kelapa*	Arecaceae	Fr, Lf	-	-	54	Moderate
Coffea arabica L.	*Kopi*	Rubiaceae	S	G	LC	36	Moderate
Allium cepa L.	*Bawang Merah*	Amaryllidaceae	Tb	G	-	31	Moderate
Daucus carota L.	*Wortel*	Apiaceae	Tb	G	LC	28	Moderate
Solanum tuberosum L.	*Kentang*	Solanaceae	Tb	G	-	28	Moderate
Pandanus amaryllifolius Roxb. ex Lindl.	*Pandan*	Pandanaceae	L	HG	DD	26	Moderate
Brassica oleracea L.	*Kubis, Brungkul, Brokoli*	Brassicaceae	Lf	G	DD	24	Moderate
Citrus sinensis (Mill.) Pers., 1806	*Jeruk Manis*	Rutaceae	Fr	G	-	24	Moderate
Citrus reticulata Blanco	*Jeruk Keprok*	Rutaceae	Fr	G	-	24	Moderate
Citrus x aurantium L.	*Jeruk Siam*	Rutaceae	Fr	G	-	24	Moderate
Psidium guajava L.	*Jambu Kristal*	Myrtaceae	Fr	G	LC	24	Moderate
Malus sylvestris Mill.	*Apel Hijau*	Rosaceae	Fr	G	DD	24	Moderate
Malus domestica (Suckow) Borkh.	*Apel Ana*	Rosaceae	Fr	G	-	24	Moderate
Ipomoea batatas (L.) Lam.	*Telo Rambat*	Convolvulaceae	Tb	G	DD	24	Moderate
Arachis hypogaea L.	*Kacang Tanah*	Fabaceae	S	G	-	24	Moderate
Gliricidia sepium (Jacq.) Kunth	*Kayu Gamal*	Fabaceae	St	R/W	LC	24	Moderate
Leucaena leucocephala (Lam.) de Wit	*Kayu Lamtoro*	Fabaceae	St	R/W	Global	24	Moderate
Zingiber officinale Roscoe	*Jahe*	Zingiberaceae	Rh	G	DD	23	Moderate
Capsicum annuum L.	*Cabai Besar*	Solanaceae	Fr	G	LC	23	Moderate
Capsicum frutescens L.	*Cabai Kecil*	Solanaceae	Fr	G	LC	23	Moderate
Kaempferia galanga L.	*Kencur*	Zingiberaceae	Rh	G	DD	23	Moderate
Curcuma longa L.	*Kunyit*	Zingiberaceae	Rh	G	DD	23	Moderate
Desmodium pulchellum Blume ex Miq.	*Daun Opo-Opo*	Fabaceae	Lf	HG	LC	21	Moderate
Vigna unguiculata (L.) Walp.	*Kacang Panjang*	Fabaceae	Fr	G	-	20	Moderate
Solanum melongena L.	*Terong*	Solanaceae	Fr	G	-	20	Moderate
Brassica rapa L.	*Sawi Putih*	Brassicaceae	Lf	G	DD	20	Moderate
Brassica juncea (L.) Czern.	*Sawi Hijau*	Brassicaceae	Lf	G	-	20	Moderate
Raphanus sativus L.	*Lobak*	Brassicaceae	Tb	G	-	20	Moderate
Hibiscus rosa-sinensis L.	*Bunga Sepatu*	Malvaceae	Fl	HG	-	18	Low
Saccharum officinarum L.	*Tebu*	Poaceae	St	HG	-	18	Low
Piper betle L.	*Sirih Hijau*	Piperaceae	Lf	HG	-	18	Low
Artocarpus camansi Blanco	*Daun Keluwih*	Moraceae	Lf	HG	NT	18	Low
Cordyline fruticosa (L.) A.Chev.	*Daun Andong Hijau*	Asparagaceae	Lf	G	LC	18	Low
Cucurbita moschata (Duchesne) Duchesne ex Poir.	*Waluh Kuning*	Cucurbitaceae	Fr	G	-	16	Low
Colocasia esculenta (L.) Schott	*Bentul*	Araceae	Tb	G	LC	16	Low
Manihot esculenta Crantz	*Singkong*	Euphorbiaceae	Tb	G	DD	16	Low
Dioscorea bulbifera L.	*Gembolo*	Dioscoreaceae	Tb	G	-	16	Low
Cucumis sativus L.	*Mentimun*	Cucurbitaceae	Fr	G	-	16	Low
Styrax sp.	*Kemenyan*	Styracaceae	St	-	-	16	Low
Imperata cylindrica (L.) Raeusch.	*Ilalang*	Poaceae	Lf	R/W	LC	16	Low
Areca catechu L.	*Pinang*	Arecaceae	Fr	HG	LC	16	Low
Zea mays L.	*Jagung*	Poaceae	Fr	G	LC	15	Low
Glycine max (L.) Merr.	*Kedelai*	Fabaceae	S	-	-	15	Low
Allium sativum L.	*Bawang Putih*	Amaryllidaceae	Tb	G	-	15	Low
Nicotiana tabacum L.	*Tembakau*	Solanaceae	Lf	-	-	14	Low
Citrus limon (L.) Osbeck	*Jeruk Lemon*	Rutaceae	Fr	G	LC	12	Low
Monstera deliciosa Liebm.	*Daun Monstera*	Araceae	Lf	G	-	10	Low
Rosa centifolia L.	*Bunga Mawar (Merah, Putih, Kuning)*	Rosaceae	Fl	G	-	8	Low
Dioscorea esculenta (Lour.) Burkill	*Gembili*	Dioscoreaceae	Tb	G	-	8	Low
Dioscorea alata L.	*Uwi*	Dioscoreaceae	Tb	G	-	8	Low
Magnolia x alba (DC.) Figlar	*Bunga Kantil*	Magnoliaceae	Fl	HG	-	8	Low
Jasminum sambac (L.) Aiton	*Bunga Melati*	Oleaceae	Fl	G	-	8	Low

Tectona grandis L.f.	*Kayu Jati*	Lamiaceae	St	G	EN	8	Low
Apium graveolens L.	*Seledri*	Apiaceae	Lf	G	LC	7	Low
Philodendron bipinnatifidum Schott ex Kunth, 1841	*Daun Pilo*	Araceae	Lf	G	-	6	Low
Rumohra adiantiformis (G.Forst.) Ching	*Daun Leatherleaf*	Dryopteridaceae	Lf	G	LC	6	Low
Melaleuca bracteata F.Muell.	*Daun Moleka*	Myrtaceae	Lf	G	DD	6	Low
Acacia podalyriifolia A.Cunn. ex G.Don	*Daun Memusa*	Fabaceae	Lf	G	-	6	Low
Dracaena reflexa Lam.	*Daun Songkop*	Asparagaceae	Lf	G	LC	6	Low
Hydrangea macrophylla (Thunb.) Ser.	*Hortensia Biru, Ungu, Putih, Hijau, Merah Muda, Kuning*	Hydrangeaceae	Fl	G	-	6	Low
Aster novi-belgii L.	*Bunga Pikok (Merah, Ungu, Putih, Kuning, Hijau, Biru)*	Asteraceae	Fl	G	-	6	Low
Chrysanthemum indicum L.	*Bunga Aster*	Asteraceae	Fl	G	-	6	Low
Gerbera jamesonii Adlam	*Bunga Gerbera*	Asteraceae	Fl	G	-	6	Low
Polianthes tuberosa L.	*Sedap Malam*	Asparagaceae	Fl	G	-	6	Low
Chrysanthemum sp.	*Bunga Krisan*	Asteraceae	Fl	G	-	6	Low
Chrysanthemum morifolium Ramat. ex Hemsl.	*Krisan Mata Kebo*	Asteraceae	Fl	G	-	6	Low
Chrysanthemum grandiflorum Ramat.	*Bunga Krisan*	Asteraceae	Fl	G	-	6	Low

Note: Part Used: Fl: Flower, S: Seed, St: Stem, Lf: Leaf, Rh: Rhizome, Fr: Fruit, Status Conservation: NE: Not Evaluated, LC: Least Concern, DD: Data Deficient or No Data. Habitat: HG: Home Garden, G: Garden, R/W: Riverside or Wild. ICS Score Category: score = 300 dan more (Very High significance), ICS = 100-229 (High Significance), ICS = 20-99 (moderate), ICS = 5-19 (low), ICS < 4 (negligible)

Interviews with community members reveal that the *Suro* Tradition is deeply rooted in local history and identity. A representative from the women's group (RT 04) noted. "*Our theme for this event is old-fashioned. I'm wearing my mother's* kebaya (*long-sleeved blouse) and* jarik *(a long strip of batik cloth worn). The food served is also traditional, such as steamed polo pendem, which includes yellow pumpkin, cassava, sweet potato, and boiled peanuts. We also serve classic drinks like coffee, tea, and warm ginger*." (Women, 56 years old, lifetime resident).

A respected traditional leader expressed full support for the preservation of culture and traditions in Bumiaji Village. He explained the ritual of offering agricultural products. "*In the past, residents would submit their harvest vegetables, fruits, rice, and other crops to the village head in a ceremony called* asok gamelan*. Now, it's presented in a* gunungan *and named* Bulubekti*. The term* bulu *refers to the earth's produce, while* bekti *means to serve or dedicate oneself, symbolizing our act of returning blessings to the Earth*. "(Man, 76 years old, lifetime resident).

*"As one of the elders, I am delighted with the Suro Festival. This event provides an opportunity to reminisce, such as the communal harmony (*guyup rukun*) among residents while cooking and distributing the porridge. The young people here are also happy to be involved. The presence of these stands highlights the identity of Bumiaji villagers and their lush, beautiful natural surroundings. Children can learn about the Ngebyong Valley (Figure 4) in both perform, how it was in the past, and how it has changed today* (Women, 38 years old, lifetime resident).

The *gunungans'* in *Suro* Rituals have spiritual significance

The celebration includes the *gunungan Bulubekti* procession, where a conical offering of harvested crops is presented. This *gunungan*, resembling a mountain, is a tangible representation of the community's agricultural bounty. According to traditional leaders, the event is formally named "*Gunungan Hangesti Pertiwi Desa Bumiaji 1447 Hijriah"*. The name holds deep symbolic meaning. *Hangesti Pertiwi* signifies the duty to care for and respect the Earth as an integral part of one's existence, while *Bulubekti* combines the term "earth's produce" (*bulu*) with "dedication" (*bekti*). This powerful message underscores humanity's responsibility to be of service not only to other people but also to all living beings, including nature. This ethos is mirrored in other Indonesian traditions, such as the Sundanese people's annual tribute to *Dewi Sri*, the goddess of rice, which aims to ensure prosperity and abundant harvests (Krisnawati et al. 2024). The *gunungan* procession is also held at the Surakarta Palace (Keraton Surakarta) during the celebration of the Prophet's Birthday (*maulud nabi*). The *gunungan*, consisting of local harvests, is distributed to the entire community during the *grebeg maulud* ceremony (Ayuningtyas et al. 2024).

The festival atmosphere serves as a means of recreation for local residents, both as visitors and active participants. Interview and observation results indicate the community's enthusiasm for participating in the distribution of the *gunungan* as a way of seeking blessings (*ngalap berkah*). Within the framework of CES, these dimensions, recreation and robust place attachment, are expected to be sustained.

The festival successfully presented a depiction of the historical landscape, which is intended as an educational medium for the younger generation. Examples include the traditional decor of the Ngebyong Valley, a landscape that has since changed, the decoration of *gebyog* houses (a traditional Javanese dwelling), and the singing of *mocopat*, the latter involves chanting poems in Arabic and Javanese, conveying wisdom and moral advice. At this traditional event, elders conveyed that the younger generation has a duty to preserve Javanese culture as their core identity, even while pursuing diverse careers. The local and city governments fully support this activity to facilitate the preservation and long-term sustainability of intergenerational traditions. The *Suro* Tradition serves as a significant example of a place-based conservation initiative that generates Cultural Ecosystem Services (CES). This ceremonial practice reinforces the community's identity in Bumiaji Village, which aligns with previous research on similar cultural phenomena (Mulyani et al. 2023). The atmosphere is presented in Figure 5.

At the end of the ceremony, before the *Suro* Porridge is distributed and the *gunungan* offerings are shared, a traditional leader offers a prayer (*ujub*). This ritual is preceded by a speech from the village head, who seeks blessings for the well-being and prosperity of the entire community. The prayer is a plea for blessings for the village-wide communal feast, seeking safety and abundance for all residents. The prayer offered for blessings during the village communal feast is as follows:

Figure 4. A. The *Suro* Festival atmosphere highlighted by *janur* (young coconut leaves), B. Ngebyong Valley, both background and plant installation (red *andong*, *ilalang*, sugarcane) (July 2024 from Villages documentation)

Figure 5. The harmonious solidarity between the community and the government in seeking blessings during the *Suro* Tradition (July 2024 from Villages documentation)

"Niat sarta gadhah kajat saking sadaya warga masyarakat Bumiaji, ngedalaken tumpeng saking sari-sarinipun siti (bumi) lan toya, kanthi ancas (tujuan) nglestantunaken (nglujengi) Desa Bumiaji.

Mugi-mugi sadaya warga masyarakat Bumiaji tansah pinaringan rahayu wilujeng, sarta tansah guyub rukun anggènipun mangku désa wonten ing Désa Bumiaji.

Ingkang dipun suwun malih dhateng siti lan toya, siti ingkang dipun lampahi warga Désa Bumiaji, siti lan toya ingkang wonten njawi lan ingkang wonten lebet, mugi-mugi tansah paring pitulungan rahayu wilujeng, saha tansah medalaken sari-sarinipun bumi saking Gusti Pangeran.

Dhumateng ingkang nyeksèni bumi lan toya, kanthi ancas nglestantunaken (angununge) Désa Bumiaji, mugi sageta dados désa ingkang gemah ripah loh jinawi, tata tentrem, kerta raharja.

Sedaya titah ingkang wonten ing Bumiaji, ingkang gadhah papan panggènan, raja-kaya, saha sanès-sanèsipun (sapunanggalane), ugi titian roda wesi, mugi-mugi tansah dipun paringi rahayu wilujeng."

This prayer represents the intentions and desires of the entire Bumiaji community, offering a *tumpeng* (cone-shaped rice dish) made from the essence of the earth and water to preserve the village. The prayer's core message is a plea for safety, welfare, and harmony for all villagers, especially in their collective efforts to manage the village. It also seeks blessings for the land and water, both within and around the village, so they may continue to provide for the community.

"Siti toyo ingkang jawi ingkang lebet sampun ngedalaken, nagih tanpo utang, ndedok tanpo pirso."

"Nyuwun malih dipun malih nyai danyang, kaki danyang ingkang rumongso desa Bumiaji sakmeniko mugo tansah kinabulan sedoyo kekarepan. Sak mantune wilujengan niki tansah pinaringan panjang lan punjung, nggih panjang lan yuswone nggih, nggih punjung rejekine, kinabulan wonten ingkang dadi karepe. Pinaringan slamet ugi rahajeng, slamet saking ingkang Gusti Allah Ta'ala paring kesalematan, pun mboten wonten punopo-nopo ingkang deso Bumiaji, pun wantos wonten danyang poro ingkang suprah bubrah wonten deso bumiaji damel susah ingkang bumiaji pinaringan wangsul sedoyo. Gusti Alloh ingkang pinaringan ngapunten sedayanipun. Lailahaillaloh muhammadarsoulluloh."

The prayer invokes the earth and water as witnesses, hoping they will help make Bumiaji a prosperous, peaceful, and abundant village. It asks for the safety and well-being of all living beings and possessions within Bumiaji, from homes and livestock to vehicles. A unique element of this prayer is the plea to the spiritual guardians of the village, *Nyai Danyang* and *Kaki Danyang*, to fulfill the community's wishes. It asks for long life and abundant fortune, and for all desires to be granted. The final part of the prayer seeks safety and forgiveness from God for any harm caused by malevolent spiritual forces (*danyang*) in the village, asking that this harm be reversed. The prayer concludes with the central Islamic declaration of faith. The term "*danyang*" refers to revered places like water sources and protected areas, and the tradition's message is to preserve these sites as sources of life.

Discussion

The Suro *Tradition: A biocultural strategy for community resilience and intergenerational conservation*

The *Suro* Tradition in Bumiaji Village stands as a powerful demonstration of biocultural wealth, functioning not merely as a celebration but as a deliberate strategy for community-based conservation and social sustainability. Rooted in the acculturation of Javanese and Islamic beliefs, and commemorating the Islamic New Year (Muharram), the tradition leverages its Cultural Ecosystem Services (CES) to reinforce the community's core identity as an agricultural society. This identity, proven to be the foundational factor for achieving spiritual and educational objectives, is actively preserved through rituals that combine the spiritual and the ecological.

The ceremony is intrinsically linked to the environment, and the analysis of plant utilization confirms a strong human-nature relationship, despite the Index of Cultural Significance (ICS) values showing a dynamic shift, with high-level significance diminishing due to changing social dynamics (Hill et al. 2020; Plieninger et al. 2023). Nevertheless, the tradition remains a vital mechanism for intergenerational conservation (Wilson et al. 2017; Winter et al. 2021). This continuity is deliberately engineered by community leaders who have transformed the ritual into a public festival, actively involving young people in the annual procession for the past 15 years. This modern adaptation is a conscious decision to ensure the tradition's relevance to younger generations, safeguarding its continuity and reinforcing a shared identity rooted in sustainable practices.

Interviews with younger community members reveal their innovative approach to preserving their heritage. One youth stated, "*As the next generation, we're innovating. For example, our agricultural ventures aren't just about harvesting citrus fruits; we've also started citrus-picking tours. This effort not only brings economic benefits but also helps us preserve our land from being converted for other uses. We believe Bumiaji is a gift with its fertile land and fresh water. The harmonious community makes us want to stay in our birthplace*."

The practices themselves constitute a profound message of environmental stewardship. The *Gunungan Bulubekti Hangesti Pertiwi*, symbolizing "nurturing and respecting the Earth," embodies the elders' commitment to using the tradition as a cultural expression of biocultural conservation. This commitment is reflected in the symbolic use of native flora, such as *janur* (divine guidance) and *andong merah* (hope), sourced directly from local gardens, which collectively highlight the community's commitment to safeguarding its natural resources. Furthermore, the spiritual aspect exemplified by the *gunungan* scramble for blessings and rituals like water source blessings, fosters collective ownership and strengthens community bonds (Ayuningtyas et al. 2024; Festiyed et al. 2024).

Crucially, the tradition serves as an indispensable vehicle for intergenerational knowledge transfer. As

younger members state, their innovative agricultural ventures, like citrus-picking tours, are an effort to bring economic benefits while actively preventing land conversion. This resilience, however, exists against a backdrop of environmental change, as evidenced by the significant 46% decline in apple production between 2010 and 2023 (BPS Kota Batu 2023). Therefore, this CES assessment, which highlights the crucial role of traditional practices, must serve as a significant indicator for government stakeholders (Rössler and Lin 2018; Berg et al. 2023; Plieninger et al. 2023). Strategic development decisions must align with the cultural and ecological preservation goals of Bumiaji Village, recognizing that the transfer of ancestral knowledge is paramount to ensuring the long-term sustainability of the community and its natural resources.

A deep understanding of the Cultural Ecosystem Services (CES) aspects, especially the spiritual and identity aspects, is highly crucial for formulating effective conservation strategies, initiating community groups, and supporting overall conservation efforts (Gould et al. 2019; Suwardi et al. 2023; Gould et al. 2024). The CES values within a community are dynamic and vary over time. In the context of this research, where the majority of subjects are indigenous/local communities, the spiritual aspect shows a very strong relationship with the preservation of their living environment. Furthermore, the identity aspect is a significant CES finding among Bumiaji residents. The majority of them identify themselves as farmers and, at the same time, water source conservators in the region. It is important to continuously and thoroughly monitor this identity aspect as an effort to control the negative impacts of modernization and economic pressures on their conservation awareness.

Biocultural value of Suroan *Tradition*

The *Suro* Tradition is a significant example of acculturation between Javanese and Islamic beliefs. The term *Suro* itself is a Javanese adaptation of the Islamic word *asyura*, which marks a day of historical importance. This tradition gained prominence among the Javanese people during the Mataram Kingdom era, particularly under Sultan Agung, and serves as a commemoration of the sanctity of the Islamic New Year (Muharram) (Miswar et al. 2022). During the spread of Islam, *Mbah Wastu*, a pioneer of the Bumiaji area, left a legacy for the people of Bumiaji and became the forerunner of what is now Batu City. *Mbah Wastu* is also buried in Bumiaji Village, and his tomb is now known as a historical site, the tomb of *Mbah Batu* (*Mbah Wastu*). During the Mataram kingdom's reign in 1586, and its subsequent spread to East Java by 1625, this cultural fusion made the *Suro* Tradition an important one for the Javanese people (Rofiq 2024). The *Suroan* Tradition is a commemoration of the sanctity of the month of Muharram (the Islamic New Year), marked by various rituals and certain prohibitions. The people of Bumiaji continue to preserve this tradition not only as a celebration but also as a vital mechanism for transmitting ancestral knowledge to subsequent generations. It plays a crucial role in strengthening social bonds and ensuring the community's social sustainability.

The people of Bumiaji still preserve the *Suro* Tradition as a cultural treasure. This tradition is not just a celebration; it is also a way of passing down ancestral knowledge to the next generation. Observations and interviews in Bumiaji Village reveal that this tradition creates strong social bonds and relationships among the community. Traditions are reported to play a crucial role in the sustainability of social life (Batoro et al. 2020; Franco et al. 2022). Some activities performed during the *Suroan* Tradition in various regions include *tirakatan*, a form of self-control through meditation, various types of fasting like *puasa mutih*, and solitary retreats such as *ngebleng*, or *patigeni* (abstaining from using fire or electricity indoors). Another significant ritual is *mubeng beteng,* which involves circling the village while observing *topo mbisu* (remaining completely silent) and walking barefoot (Rofiq 2024). These rituals are performed to ward off danger and pray for protection from disasters.

Policy implications: The Suro *Tradition as a model for community-led conservation and sustainable value*

The agricultural community and its government consistently encounter difficulties in executing effective conservation efforts that invariably impact their social, economic, and cultural foundations (Abdullah and Hezri 2008; Adhikari et al. 2019). Despite the deployment of various top-down and bottom-up strategies with mixed policy implications, many efforts fail to achieve sustainable integration. In stark contrast, an investigation into the *Suro* Tradition reveals a powerful set of opportunities, showcasing its inherent economic, social, and cultural value for conservation initiatives. This value is realized through the active involvement of diverse stakeholders, including the general public, government entities, and the younger generation, which underscores the tradition's critical role in community-led landscape conservation.

Specifically, the synergistic efforts of the village government, demonstrated by involved city officials and community elements, successfully transform traditional knowledge into a valuable asset (Boafo et al. 2016; Omoyajowo et al. 2024) This initiative, viewed as a collective inheritance, fosters resilience against modern challenges like land-use conversion (Wisnubroto et al. 2021) and enables the community to successfully navigate crises, such as protecting their agricultural sector during the COVID-19 pandemic (Samudra et al. 2023). Their profound landscape connection, celebrated through the *Suro* Ceremony, highlights a dedication to preserving and managing vital resources like water, soil, and the surrounding environment. By allowing the community to maintain its identity as a productive and sustainable agricultural society, the initiative not only protects the land but also reinforces the very social and economic structures that depend on it, creating a mutually beneficial relationship where the health of the socio-ecological system becomes a shared goal.

The intergenerational aspect is the ultimate measure of this initiative's success. The younger generation's focus on

regenerative agriculture, agroforestry, and bioculture, and their commitment to preventing land conversion, underscores the tradition's success in fostering a sense of collective responsibility. This is not only about inheriting land but also about inheriting a stewardship ethic. Their engagement demonstrates the successful transmission of this conservation model's principles, thereby proving its long-term viability and its effectiveness in cultivating a deep-rooted sense of environmental and social responsibility.

In the context of broader policymaking, such community-led success suggests that the assessment of economic conservation aspects must be re-evaluated when they compromise social and cultural welfare, echoing findings from regions like the Mekong Delta (Berg et al. 2023). Therefore, government strategies require a more comprehensive analysis of all ecosystem services, moving past narrow, potentially inequitable economic targets. Research, such as that conducted by (Lin et al. 2025) highlights the necessity for economic valuation that explicitly incorporates environmental conservation. Although the assessment of agricultural landscape aesthetics and the culture embedded within it may show a higher economic value for paid activities (as an attraction) compared to purely cultural areas, the overall value of Cultural Ecosystem Services (CES) is actually lower for agricultural areas. This finding carries a significant implication, suggesting that stakeholders must be willing to make decisions based on a deeper understanding of the long-term economic benefits derived from environmental sustainability. In calculating the quality of CES, the parameters used extend beyond merely diversity; they also include factors such as ecosystem quality, the type of vegetation cover present, and transportation and marketing. All these parameters significantly influence the total economic valuation of CES, thereby emphasizing that ecological quality is a primary determinant of the cultural area's long-term economic value.

In conclusion, this study demonstrates that the *Suro* Tradition in Bumiaji Village functions as a powerful biocultural conservation system that extends beyond ritual practice. Through ethnobiological assessment of community knowledge and plant use, we documented 69 plant species from 31 families, with 43% classified as moderate and 57% as low in the Index of Cultural Significance (ICS). Rice (*Oryza sativa*) maintained the highest ICS score, reflecting its enduring symbolic and spiritual value, while tuber species (*polo pendem*), once primary staples, now play complementary roles—signaling dynamic cultural adaptation. The findings confirm that the *Suro* Porridge and *gunungan* Rituals generate strong Cultural Ecosystem Services (CES), particularly in identity formation, spiritual meaning, intergenerational learning, and place attachment. The sustained involvement of the younger generation across the past 15 years indicates the successful transmission of stewardship ethics and the community's long-term commitment to maintaining agricultural landscapes and preventing land conversion.

This study is limited by its single-village scope, a sample size of 53 respondents, and ICS values based solely on self-reported plant-use perceptions, which may underrepresent less frequently used species. Future research should expand to multi-village comparisons, incorporate longitudinal monitoring, and integrate ecological indicators to better understand how biocultural traditions influence long-term conservation outcomes. This necessitates empowering local communities as the primary implementers of conservation action, leveraging proven, integrated, and sustainable biocultural frameworks like the *Suro* Tradition as a blueprint for success.

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