Original Paper

Leveraging selected Local Wisdom Species in developing peatland restoration in South Sumatra, Indonesia

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Abstract. *This paper examines applying Local Wisdom Species (LWS), namely Purun (*Eleocharis dulcis Hensch*); Sago (*Metroxylon sago Rottb*); Gelam (*Melaleuca cajuputi Powell*) and Honeybee, and Gaharu or Agarwood (*Aquilaria malaccensis Lamk*), to involve rural communities in peatland restoration. If LWS disappear due to pressure from industrial plantations, rural communities will be controlled by the international trade system, which threatens their rural lifestyles, and they will be pushed out of*

the peatlands where they have lived for hundreds of years. This research aimed to reveal selected LWS in developing peatland restoration. This study applied field surveys, questionnaires and focus group discussions. Purposive sampling was used to get the data, collected, processed, and analysed. For rural communities, the LWS was developed for economic, technical, social, and environmental reasons. If the government can help rural communities to develop the LWS, then it is likely that rural communities will benefit from better management of peatland restoration. It requires collaborative efforts between rural communities, researchers, and policymakers to bridge traditional knowledge and modern science, encouraging a more comprehensive approach to addressing global challenges. This finding is very useful in participating rural community-based peatlands restoration using four approaches, namely decentralization, conservation, protection and optimization. With these four approaches, it is possible for this research finding to be implemented in the field.

1. Introduction

Within the field of biodiversity conservation and restoration, Local Wisdom Species (LWS) can play an important role. LWS are species saved and safeguarded by local knowledge. A collection of information, values, and customs that have been handed down over the ages is known as local wisdom (Armanto & Wildayana, 2025). LWS refers to species of plants, animals or other organisms that are protected, utilized and respected in cultural and ecological practices based on local wisdom (Armanto, 2019c). LWS often have ecological, economic, social, or spiritual value to the communities that depend on them (Syakina et al., 2024b). These LWS have, however, received little attention in the scientific restoration literature, creating a serious vacuum in the tactics being used for restoration today (Armanto et al., 2025c).

Peatland restoration is an area in which the role of LWS can be significant. Although peatland productivity has increased, there has been increasing degradation, and the poverty problem is still not resolved (Wildayana & Armanto, 2021), especially in rural areas that do not have access to markets. The goal of

peatland restoration should be to contribute to the elimination of rural poverty by increasing the income of rural communities. Without special efforts that address the main problem of poverty, peatland restoration will not be achieved (He et al., 2023).

The majority of rural communities living on peatlands do not receive adequate attention from government policies aimed at extracting the wealth of the peatlands (Kaban et al., 2024), which leads to uneven development and these communities are especially marginalized in the national political process (Collier and Scott, 2009; Antonoplis, 2023). Select LWS that have historically contributed to the local community's relationship with peatland ecosystems are integrated into our study to offer a new approach to peatland restoration (Zuhdi et al, 2019). Despite being firmly ingrained in regional ecological knowledge and cultural customs; these LWS are frequently disregarded in contemporary restoration projects (Imanudin et al., 2019). By acknowledging these LWS importance, we hope to develop a restoration framework that is more ecologically robust and sustainable, in line with the sociocultural values of the local community and the scientific objectives of ecological restoration (Armanto, 2019b).

The deficiency in the existing research is due to the restricted LWS examination in scientifically supported restoration procedures, as well as the neglect of the socio-cultural aspects of restoration (Armanto et al., 2025d). Few research has examined how these LWS, which are linked to indigenous knowledge, might significantly aid in the restoration of degraded peatlands, despite the fact that numerous studies have highlighted the significance of biodiversity and ecosystem services. Our study fills this gap and adds to the increasing amount of research that acknowledges the importance of local knowledge systems in tackling environmental issues (Syakina et al., 2024a).

Purun *(E. dulcis Hensch);* Sago *(M. sago Rottb);* Gelam (*M. cajuputi Powell*) and Honeybee, and Gaharu or Agarwood (*A. malaccensis Lamk*) are some LWS found in peatlands and already well-known by rural communities. However, it is very regrettable that all these LWS have almost disappeared (only 10-20% of local commodities retain them) due to government policies granting industrial plantation concessions and most rural communities work in this sector (Armanto & Wildayana, 2023). There is an opportunity to reactivate these LWS with peatland restoration (Yazid et al., 2020). This will reduce peatland degradation and create new sources of livelihood for rural communities (Wildayana & Armanto, 2018a).

Many experts reviewed the LWS and rural institutions as constraints to growth. This view contradicts this perspective (Wildayana & Armanto, 2018c). The LWS is a body of knowledge, practices, culture and beliefs developed and maintained by rural communities through generations (Armanto et al., 2025a). It discusses many things, such as resource management and farming, health, stories, and spirituality (Armanto et al., 2024; (Holidi et al., 2019).

We hope to make three contributions to the scientific community. Firstly, by including LWS, which have been mostly overlooked in conventional restoration literature, we want to advance our understanding of peatland restoration. Secondly, we want to provide useful advice on how to include local knowledge into peatland restoration plans, with a focus on long-term sustainability, cultural significance, and community involvement. Thirdly, providing guidance for upcoming restoration initiatives, we think our study findings will help advance a more inclusive, culturally sensitive approach to environmental preservation worldwide (Wildayana & Armanto, 2018b).

The idea behind this is sustainable agriculture that uses appropriate technology to fight poverty and protect natural resources and the environment (Armanto, 2019a). This study can support government policy changes aimed at reducing risks associated with agricultural production, increasing productivity, and diversifying crop varieties at the farm level (Byg et al., 2023). This study aimed to reveal selected LWS in developing peatland restoration in South Sumatra, Indonesia.

2. Materials and Methods

Research sites

The study was conducted in the Indonesian province of South Sumatra, which is situated between 1-4^{o} South latitude and 102-106^{o} East longitude (Figure 1) and the entire area of the observed study area as Peat Hydrological Unit (PHU) was 995,756 ha (PMRA, 2022; Armanto et al., 2022). Table 1 provides general descriptions of PHU that have been observed.

Sample selection and selection factors of LWS

Based on LWS significance for peatland restoration, selected species were determined based on a combined method of field surveys and discussions with stakeholders (indigenous farmers, environmentalists, related governments and study literature). A number of field surveys were carried out throughout South

Sumatra peatlands, paying particular attention to areas that had previously been affected by peatland degradation or were undergoing restoration. We documented the LWS found during the surveys, along with their ecological function and any cultural significance that the local communities may have attached to them. To determine which LWS are prized for their ecological, therapeutic, or agricultural significance, interviews with members of the local community were conducted. This made it possible to guarantee that the sample contained species that were culturally significant.

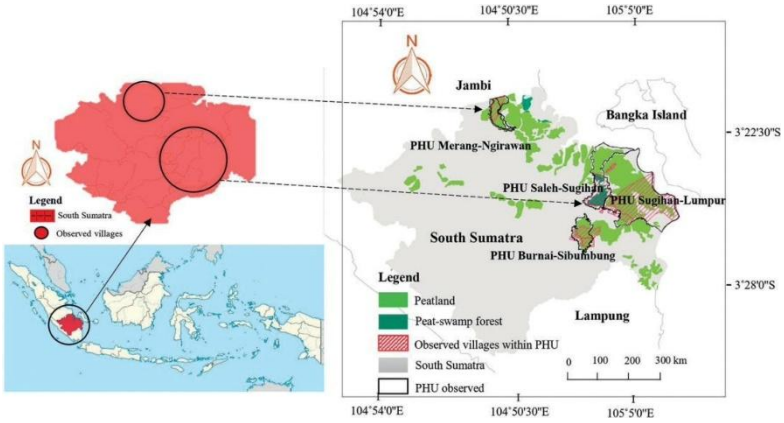

Figure 1. Research location in South Sumatra province, Indonesia.

The factors served as the foundation for the final species selection: Ecological suitability for peatland restoration (e.g., LWS that are known to promote water retention in peatland ecosystems, stabilize peatlands, or restore biodiversity); significance that the local communities have designated as cultural and customary. For ease of propagation and availability of species for restoration projects, 4 species were selected from the 58 species investigated.

Table 1. General descriptions of observed Peat Hydrological Unit (PHU)

Parameters	Merang-Ngirawan	Saleh-Sugihan	Sugihan-Lumpur	Burnai-Sibumbung
Area, ha	82,021	190,230	636,828	86,679
Burnt area 2019, ha	8,513	29,167	39,786	10,134
Restoration types	Canal blocking, livelihood revitalization	Canal blocking	Canal backfilling and DFG	DPG and 3-R
Targeted restoration, ha	Muara Medak, 33,104	All villages in PHU, 4,766	All villages in PHU, 228,378	All villages in PHU, 39,445

Note: DPG (Peat care village program); 3-R (rewetting, revegetation and revitalization. Source: Field survey results (2025).

Resolving selection bias

Even though every attempt was taken to guarantee a representative sample, it is crucial to recognize the possibility of selection bias: Geographic Bias: The species chosen might be skewed toward those in South Sumatra more accessible places, potentially ignoring species located in more isolated peatland regions. Cultural Bias: Species that are less well-known but nevertheless crucial for ecological restoration may be overlooked if the selection process favours those that the local communities consulted are most familiar with or value. Ecological Bias: By concentrating on species that directly contribute to the restoration of peatlands, other species that might also provide ecosystem services but were not given priority in the selection criteria may be left out. We made an effort to incorporate a wide variety of species from various ecological, cultural, and geographic contexts within South Sumatra in order to lessen these biases. However, when interpreting the results, it is important to take into account the limits of the sample selection procedure.

Data analysis

The research data was analysed using the SPSS program. The following are the procedures used in the analysis (Pallant, 2020): Preparing Data: A systematic format of the information gathered from the interviews and field surveys was entered into SPSS. Names of plant species, ecological roles, customary applications, and other pertinent characteristics were among the variables. Descriptive Statistics: To highlight the traits of the chosen species, such as their ecological roles, frequency of occurrence, and significance as judged by local communities, descriptive statistics were conducted. Calculations were made using metrics including mean, standard deviation, and percentages. By include this thorough description in your methodology section, we addressed potential biases and the selection process while also clearly outlining how SPSS was used for data analysis.

3. Result and Discussions

3.1 Differences between the LWS and commercial species in peatlands

Differencing the LWS and commercial species in peatlands can be analysed through three elements, i.e. substantive, methodological, and contextual, as explained in Table 2. The most prominent substantive differences lie in their development history and characteristics, while commercial species aim to build a general explanation and are not based on the daily life of rural communities and

have a trace of global economic development. However, the LWS is directly related to the needs of rural communities and is created based on daily livelihoods. This finding is in line with another research (Ribeiro et al., 2021).

Table 2. Differences between the LWS and commercial species in peatlands

Variables	LWS	Commercial species
Substance	Friendly with peatlands, passed down through generations	Force peatlands, an adaptation from dry land
Methodological and epistemological	closed system	open system
Knowledge contexts	valid locally	valid universally
Actors	Local rural communities, NGO	Investors, government
Regional development	Low	High to very high
Social conflict	Low	Moderate to high
Species	Purun; Sago; Gelam; Gaharu	Oil palm; Acacia
Peatland degradation	Minimal	Moderate to high
Measured parameters	General	specific

Note: NGO (Non-Governmental Organization). Source: Field survey results (2025).

The methodological and epistemological nature of the LWS is closed, unsystematic, and broad rather than analytical; it lacks a complete conceptual framework and stands on new experiences rather than deductive logic. Much of the LWS approach is dogmatic and intolerant of current knowledge technology and innovation. Meanwhile, commercial species are open, systematic, objective, analytical, and developed from current knowledge technology, and innovation. This finding is similar to other workers (Yan et al., 2023).

The LWS are local and focus on a particular social group, in a particular setting, and at a particular time, but commercial species occur worldwide. At the same time, we can find the same connection in the concentration on the way local scientists or "scientists" produce knowledge. Rather than trying to lump all non-scientific knowledge into the category "local" and all commercial species into another category, it may make more sense to accept the differences within these categories and find commonalities between them. This finding is relevant to another research (Armanto et al., 2023a).

3.2 Key aspects of the learning process of the LWS for rural communities

The research findings were used to discuss key elements of environmental sustainability and rural farming in peatlands, the evolution of agricultural-based systems, the motivations behind cultivating peatlands, and important entry points for reducing poverty and ensuring rural farming. Key aspects of the LWS learning

process for rural communities are given in Table 3. These findings support research by other workers (Barry et al., 2021).

Table 3. Key aspects of the LWS through generations

Key aspects passed down	Impact of key aspects		Comments
	theory	field facts	
Oral tradition	intensive	indeterminate	Oral delivery should be more dominant because rural communities have learned more from generation to generation
Holistic understanding	low	low	Low education also causes a low holistic understanding
Environmental stewardship	low	indeterminate	This aspect should be low, associated with a low level of education
Spirituality and ethics	intensive	moderate	This aspect is high because it is associated with high religious beliefs
Intergenerational learning	intensive	indeterminate	Intergenerational learning is a necessity in rural communities
Respect for diversity	low	low	Low education has an impact on low respect for diversity

Source: Field survey results (2025).

Oral tradition**.** The LWS is passed down orally and intensively through stories, songs, and rituals, from parent to child. This dynamic mode of transmission helps preserve cultural heritage and enables the adaptation of knowledge to change circumstances. For example, a traditional leader may paint a picture to convey important lessons or ideas to younger members of a rural community. This way of learning art is very useful when rural communities cannot communicate well due to language barriers. However, due to the influence of technology and globalization, this traditional oral tradition is currently indeterminate. The same finding was also described by other researchers (El Chami & El Moujabber,2024).

Holistic understanding**.** For hundreds of years, rural communities have understood that all living things and their environments are interconnected. They see the relationships between plants, animals, ecosystems, and humans, and use this knowledge to make decisions about rural life and communities. For example, when rural communities think about how to manage land or water, they consider how it will affect all living things in the area. Unfortunately, holistic understanding by rural communities, both theory and field facts, is still relatively low. The same investigating was also described by other researchers (Hagan et al., 2023).

Environmental stewardship**.** Sustainable peatlands management methods have been developed by rural communities. Deep understanding of the needs of

different species and depending on how they interact with each other in a particular environment. This finding is in line with the results of other studies (Zhang, 2023). For example, some species can grow and develop in stagnant water conditions, while other species require a deep groundwater table, which means that it has to be drained. Another example is that while some species require full sunshine, other species require shading. Rural communities have learned how to manage these different needs through careful observation and experimentation, trial and error, or oral traditions passed down from generation to generation to help children understand the importance of maintaining a balanced ecosystem. In theory, understanding of environmental stewardship was low, along with the development of science and technology, the understanding has become indeterminate. The same finding was also described by other researchers (Hinzke et al., 2021a; 2021b).

Spirituality and ethics**.** Spirituality and ethics include spiritual beliefs and moral rules for living in harmony with nature. These beliefs determine the way how rural communities deal with their environment. For example, many native cultures believe that humans and nature have a sacred bond. Their spiritual connection encourages them to treat the LWS carefully. For example, they used their skills to manage peatlands wisely, allowing them to continue living sustainably without harming the environment. Another example is they made drainage channels not too deep so that the peatlands are not disturbed. They believe that if drainage channels are too deep, it will dry out the peatlands, making the peatlands vulnerable to fire, which threatens their life. Unfortunately, their spirituality and ethics are theoretically intensive, but the field facts show that they are currently moderate. This finding is in line with the results of other studies (Jing et al., 2020; Lin et al., 2020).

Intergenerational learning**.** Intergenerational learning is essential to sustaining culture. By passing down their knowledge through oral traditions, elders were able to preserve stories, songs, and customs to grow with nature. Intergenerational learning about the conservation of the LWS as traditional medicine and spice species is very clear. Due to globalization and assimilation into larger cultures, many traditional medicines are being lost. It means losing our history and traditions too. In theory, intergenerational learning was intensive, and along with the development of science and technology, intergenerational learning becomes indeterminate. This finding is in line with the results of other studies (Wildayana & Armanto, 2017).

Respect for diversity**.** The LWS is site-specific and varies depending on location and time. Each community has knowledge adapted to its own situation and

cultural heritage. One example is slash-and-burn farming which uses fire to manage peatlands. They burn the peatlands at different times and places throughout the year (in 5–10-year cycles), so that certain plants grow best, and certain animals find food more easily. They also help maintain the health of ecosystems for plants and animals. However, peatland degradation will be accelerated when the peatland burning cycle is shortened, only every year and in the same location. The LWS is increasingly recognized as beneficial in many areas, such as environmental conservation, sustainable development, and climate change adaptation. In fact, both in theory and in field facts, their respect for diversity is indeed low to date. This finding is in line with the results of other studies (Michaelis et al., 2020).

3.3 Selected LWS adapted by rural communities

LWS refers to species that are important in local culture and ecology and preserved through traditional wisdom. This concept shows how rural communities have an important role in protecting the environment through practices based on knowledge passed down from generation to generation. The relationships between local knowledge, LWS, and ecological interactions in local community are summarized in Table 4.

Table 4. Relationships between local knowledge, species and ecological interactions

Relationship	General description
Species and local knowledge	1) Rural communities often have intimate knowledge of the lying species in their environment. 2) This knowledge includes the use of species for medicinal, food, or ecological purposes, as well as an understanding of those species.
Sustainable interaction	1) Interactions between humans and LWS can occur in the form of non-destructive uses, such as sustainable hunting, agroforestry farming, *sonor* system, or culturally based conservation practices. 2) This practice allows LWS to survive and thrive, while providing benefits to humans.
LWS	1) Refers to LWS that are part of the traditional knowledge of rural communities, so that rural communities can be an example in maintaining ecological balance through local wisdom-based practices that enable harmonious interaction with LWS.

Source: Field survey results (2025).

Rural communities still use the LWS in peatland management and conservation, although in limited quantities. They still choose the selected LWS based on the fact that the selected LWS meets the following reasons, namely they are still in the village, have knowledge of better cultivation methods, and have a better future as a new source of livelihood. This finding is in line with another research

(Armanto et al., 2018). The passed-down method for selected LWS learning through generations is summarized in Figure 2.

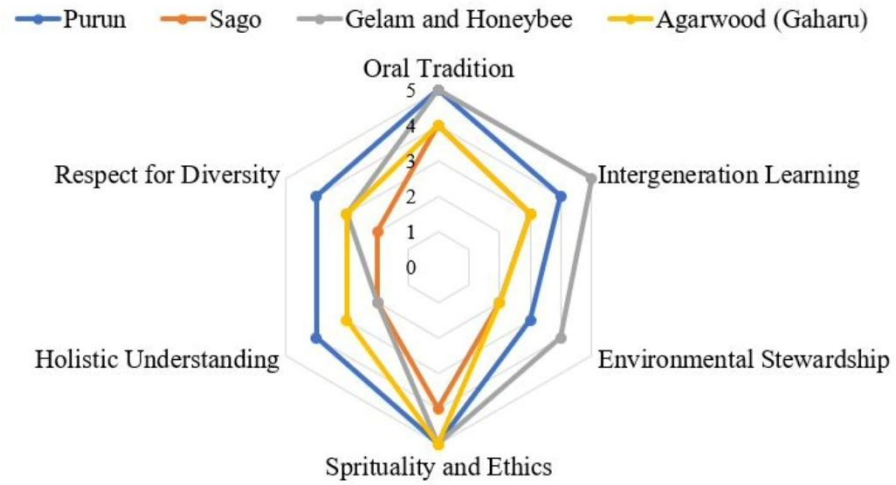

Figure 2. The learning method for passing down the LWS through generations

Purun *(E. dulcis Hensch).* Rural communities use Purun as the main material to make woven household industries, such as mats, baskets, bags, hats, and table mats to maintain family income and protect the peatlands environment. They know more about their life in peatlands because of their dependence on this type of livelihood. Based on environmental sustainability parameters, Purun shows very strong dominance in terms of oral tradition spirituality and ethics, while other aspects are relatively moderate. At present, they are still managing Purun, but the threat of extinction arises because Purun is little known to the younger generation, and this fact is exacerbated by the use of plastic as a substitute material.

Sago *(M. sago Rottb).* Sago belongs to native peat species producing starch and carbohydrates, thus it is utilized as the staple food of rural communities and used for revegetation species for peatlands (also known as paludiculture). After being ground into powder, the pith of sago stems contains starch. The powder is kneaded with water on a cloth or sieve to release the starch. The tub where the starch lands receive the starch water flow. It is now possible to utilize the starch for cooking after multiple washings. Each palm tree can yield roughly 360 kg of dry starch. Sago flour can be used to make various types of food, such as sago pudding which is formed into balls and mixed with boiling water to form a paste

such as pancakes, *pempek*, and glue. Sago flour is a food ingredient native to South Sumatra. Real sago flour is pale white, uneven, and brittle, and cooks quickly compared to tapioca flour. Based on environmental sustainability parameters, Sago holds a strong presence in oral traditions, spirituality, and ethics, while knowledge of its other aspects remains relatively limited. Sago is also hardly popular among the younger generation. This is because there is tapioca flour as a substitute for sago flour.

Gelam (*M. cajuputi Powell*) and Honeybee. Gelam consists of two species, namely *M. leucadendra* and *M. cajuputi*, and *M. cajuputi* has the highest essential oil content and has the greatest potential. Gelam flowers, or Melaleuca cajuputi, are loved by honeybees because they produce good honey. Currently, honey production is only carried out on a small scale and for subsistence purposes, but since honey is an export product, there is a clear scope for its production. Food is considered to have medicinal value. Gelam flowers are abundant throughout the year and produce copious amounts of nectar, making them an ideal host species for honeybees. Per hectare of Gelam can be harvested around five to six litres of honey each year. In rewetted and revegetated peatlands, beekeeping and honey production are viable options. The domestic demand for honey every year is 7,500 tons, but production is only 2,000–4,000 tons, and the rest is imported. Based on environmental sustainability parameters, Gelam shows strong dominance in the aspect of oral tradition, spirituality, and ethics, as well as respect for diversity, while other aspects are low to moderate. Gelam is known to the younger generation but less understood for paludiculture.

Gaharu (*A. malaccensis Lamk*). Agarwood (Gaharu) is a woody spice containing aromatic resin which is used as a mixture of incense, perfume, and industrial raw materials. Aloes are produced by plants in reaction to microorganisms getting into damaged tissue. Broken branches or peeling bark can become natural wounds on woody plants. Once microbes enter plant tissue, they are considered foreign bodies. As a result, plant cells produce phytoalexin compounds, which protect plants from disease or pathogens. The phytoalexin compound is a brown resin with a pleasant scent that can build up in the xylem and phloem channels to stop wounds from spreading to other tissues. Aloes won't form and damaged plant parts may decompose if the bacteria that infect the plant manage to get past its defence mechanism.

Agarwood has a higher price if the resin content is higher, and vice versa. Agarwood is generally offered in three main classes, namely ash, sapwood, and *kemenyan*. Sapwood is a dark brown or brownish-black wood derived from the agarwood tree strongly masticated sections. Kemenyan is agarwood with coarse

fibre, softwood, and a brownish-to-grey physical colour. The last class is agarwood ash. According to environmental sustainability parameters, Gaharu shows very strong dominance in terms of spirituality ethics, and oral tradition, meanwhile, other aspects are relatively low. Gaharu is also almost not popular with the younger generation. This is more difficult because Gaharu is not cultivated well by rural communities.

3.4 Determinant reasons for implementing selected LWS

Selected LWS relates to environmental sustainability indicators. Holistic understanding; oral tradition; environmental stewardship; spirituality and ethics; intergenerational learning; and respect for diversity are several indicators of environmental sustainability The results of these findings support research by other workers (Lázaro-Lobo et al., 2023). Based on the explanation of their selected LWS learning process in the paragraph above, scoring was carried out to determine shifts in the learning process based on a comparison of theory and field facts as shown in Figure 3.

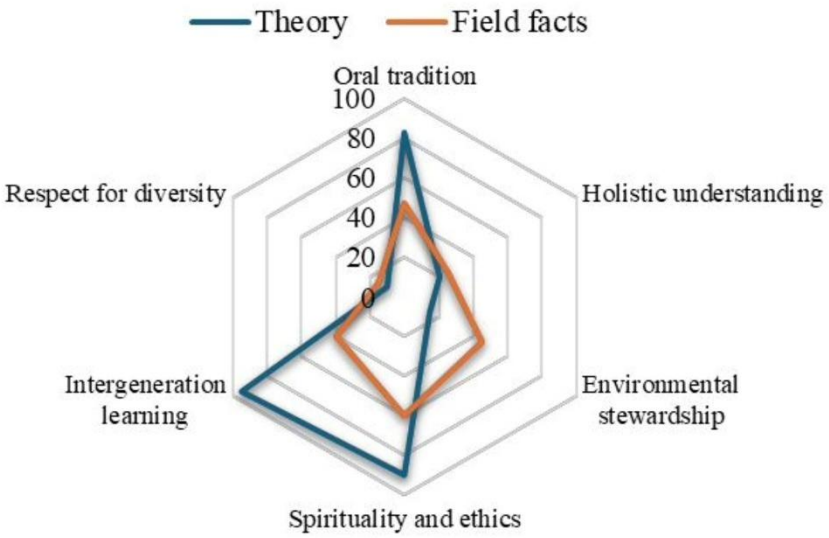

Figure 3. Learning processes of the LWS for rural communities

In theory, the LWS overgeneration learning process was dominated by aspects of intergenerational, spirituality, and ethics, as well as oral tradition with scores

of 95, 90, and 80 respectively. Meanwhile, the lowest was related to understanding the environment and science, namely holistic understanding with a score of 20, and respect for diversity is 10. However, the field facts showed that everything changed and was dominated by indeterminate conditions which were categorized for the spiritual aspect, which was 60, oral tradition was 40, and intergenerational was 40. The lowest scoring was shown by a holistic understanding of 25 and respect for diversity, namely 15.

Furthermore, the research results showed that the dominant contribution of each determinant reason to the LWS application was fully presented in Table 5. The LWS for agricultural production are called rural farming showing how closely the LWS was connected to the basic needs of rural communities in the peatlands. To meet their family's food needs, rural communities experience various difficulties in developing their agriculture. Even though the results were low and required high work intensity, they still applied LWS in managing their agriculture. The results of these findings were relevant to our previous results (Wildayana, 2017).

Table 5. Contributing determinant reasons why rural communities apply the LWS (%)

Nr	Determinant reasons	Purun	Sago	Gelam/ Honeybee	Gaharu
1	Economic reasons	36	51	36	36
	Price fluctuation	15	20	15	15
	Circumstancing the famine months	13	20	13	13
	Low labour and opportunity cost	8	11	8	8
2	Technical reasons	31	26	30	30
	Soft skill	17	15	17	20
	Government supports*/	10	10	9	8
	short-lived species	4	1	4	2
3	Social reasons	20	10	20	20
	Customs	10	4	10	10
	Institutional aspects	6	3	6	6
	Social accessibility	4	3	4	4
4	Environmental reasons	13	13	14	13
	Peatland vulnerability	5	5	6	6
	Preference for ethnic minority	4	4	4	4
	Land suitability**/	4	4	4	4
	Total	100	100	100	100

Note: */ Helping *saprotan* (agricultural production equipment) **/ other land uses both in the agricultural sector and other sectors. Source: Mainly survey results (2025).

There are four determinant reasons, namely economic reasons which played a role between 36-51%, technical reasons which accounted for 26-31%, social reasons 10-21 %, and environmental reasons between 13-14%. It turns out that economic factors and technical reasons played an important role in implementing

the LWS. From Table 5, there are three opportunities open up: 1) in this peatland restoration program, rather than forcing rural communities to cultivate not native peat species, the government should support the LWS to be developed; 2) Corporate Social Responsibility (CSR) programs from industrial plantations can be focused on developing the LWS so that rural communities can earn extra income; 3) As we realize that industrial plantations cannot guarantee replanting after 25 years of planting (one planting cycle) because Oil palm and Acacia require excessive drainage. Meanwhile, the LWS is the only opportunity for them to survive in the peatlands.

Economic reasons. The LWS Sago showed the most significant economic reasons (51%), followed by Purun, Gelam, Honeybee, and Gaharu (average 36%). Price fluctuations, circumventing the months of poverty, low labour costs, and opportunity costs are the main economic factors. Uncertain agricultural market conditions will make farms very risky and difficult to tolerate if they depend on the market to meet their needs. Rural communities develop agriculture as a subsistence crop that is high in carbohydrates for various reasons, one of which is to reduce the risk of agricultural price fluctuations. Additionally, due to inefficient food markets, poor agricultural productivity, and high transportation costs. Producing food on large tracts of agricultural land, especially remote peatlands, is one way to reduce these agricultural risks. The same finding was also described by other researchers (Armanto et al., 2025b).

Community members wanted to avoid months of famine, which influenced their decisions to expand their farms. Currently, food supplies are decreasing due to rising debts, assets being sold, peatlands degradation, especially during the dry season, and most household members working to diversify their income or migrating. Some members of ethnic minorities, including rural communities, are looked down upon by society and are trapped in a cycle of poverty. The two main factors that perpetuate and exacerbate poverty are food insecurity (inside the circle) and agricultural instability (outside the circle).

Agricultural fields are usually formed by intensive farming systems to spread the use of labour over a longer period and prevent labour bottlenecks. Family employment costs are expected to be low in peatlands with limited market accessibility due to limited employment opportunities, both agricultural and non-agricultural. Producing agricultural products for subsistence using family labour and land would be more economically profitable than purchasing agricultural products on the open market under such circumstances. Rural communities also do not have enough money to meet their needs, so buying food from agricultural markets is impractical for them.

Technical reasons. Technical factors (contributing 30-31%) include their soft skill components, government support, and short-lived species, except for the LWS Sago. Having these soft skills will help them grow crops and be able to control the availability and need for water according to the requirements of the plant's growth period. There is very little planned, measurable, and systematic support provided by the government to them to expand their agricultural businesses. To encourage them to continue producing agricultural products in the peatlands, government support is very important. Agriculture does not require a long waiting period to harvest its products, as the harvest time is shorter compared to other annual crops. In most peatlands, they can plant more than twice a year if soil water conditions can be controlled. The growing season is usually less than four months. This finding is in line with other workers (Armanto & Wildayana, 2022).

Social reasons. Sago showed the lowest social reasons (10%) compared to other contributing commodities (average 20%) including customs components, institutional aspects, and social accessibility. Rural community customs play a significant role in rural communities applying the LWS because only with the LWS can rural communities believe that their agricultural business will be successful.

The marketing of agricultural products is a very dominant institutional factor that influences rural communities' decisions to use the LWS. In poverty-prone areas, weak marketing infrastructure and remote locations prevent residents from participating in any activities and taking advantage of broader economic progress. Most peatlands have the above-mentioned characteristics of poverty. Rural communities around peatlands often experience food insecurity and poverty, especially in remote and difficult-to-access areas. Poverty is more common in remote peatlands.

External cycles that destroy environmental resources are triggered by an increase in population that puts pressure on land resources. If peatlands are planted more frequently without appropriate technology, environmental resources will become more fragile. This reduces land production while maintaining or even stopping the cycle of poverty. The cause of the second cycle, or deep cycle, maybe the inability to participate in earnings. This is because rural communities live in remote areas without adequate infrastructure and have limited access to markets. Since subsistence farming requires rural communities to dedicate much of their land and labour resources to meet their basic food needs, they have fewer resources available to pursue other profitable employment opportunities.

Agriculture plays an important role in meeting the family's food needs during the "dry season lean months", which usually occur in September or October, when the previous year's food stocks have run out and the peatlands have not been harvested. Agricultural land plays a role in overcoming the food supply deficit during these crucial months. Hence the importance of "trap" agriculture, where agriculture grows simultaneously with commercial crops such as rubber and oil palm. During October and November, agricultural land becomes the main source of food. After the November harvest, agriculture grows in proportion to overall consumption, which eventually becomes the leader. Similar findings have also been described by other researchers (Wildayana & Armanto, 2018d).

Environmental reasons. In general, rural communities do not pay attention to environmental reasons in applying local wisdom, it has been proven that the contribution of this factor is relatively small, around 13-14%. These reasons are expressed in the form of peatland vulnerability; preference of ethnic minorities; and land suitability. This parameter is used to describe environmental characteristics. Rural communities can gain profits from their agriculture if rural communities find peatlands that are suitable for farming. The results of these findings support research by other workers (Armanto et al., 2023b).

Currently, peatlands account for about 25% of agricultural products. Production of agricultural products is part of the rural communities' livelihood system, especially for those who have limited access. Agricultural products in the peatlands ensure the survival of most ethnic minority groups, especially Javanese. Some ethnic minorities still farm, despite a highly market-oriented and marketized production system. The LWS practices are considered better than other farming methods in many cultures. This result was relevant with findings by other workers (Armanto et al., 2017).

According to field data, conflicts arose between industrial plantations and indigenous farmers, especially around the management of peatland restoration. Four approaches are recommended for sustainable peatland restoration based on local knowledge, specifically:

1) The decentralized approach, which consists of marketing, linkages, participation, administration, and authority delegation. Its characteristics include community empowerment, site uniqueness, and commodity zoning. This can be accomplished, for instance, by using technology to benefit stakeholders, beneficiaries, and the environment while cultivating LWS in compliance with the revitalization program.

2) The conservative approach, choosing a business plan that is anticipated to generate greater profits over time, even if it seems less profitable in the short term, is the conservative approach. For example, the Gelam and honeybee colonies do not need peatlands to be drained.

3) The protective approach that involves preserving peatlands whose ecological advantages surpass their potential for profit and complements initiatives for ecological restoration, including sago cultivation. Sago does not require the draining of peatlands.

4) The ideal approach. It is possible to cultivate Purun for household industry, which is the greatest way to manage peatlands based on the quantity, quality, and duration that are most advantageous and sustainable.

4. Conclusions

In South Sumatra, Indonesia, the potential of a few chosen LWS as a basis for long-term peatland restoration are Purun *(E. dulcis Hensch);* Sago *(M. sago Rottb);* Gelam (*M. cajuputi Powell*) and Honeybee, and Gaharu or Agarwood (*A. malaccensis Lamk*). According to our study, some LWS that are ingrained in the local ecological knowledge show a high degree of tolerance to peatland conditions, help preserve soil and water and provide local communities with cultural and economic benefits. In addition to boosting ecological resilience, these LWS aid in community-based restoration initiatives that respect regional customs and means of subsistence.

Our study does, however, have a number of limitations. First of all, it was restricted to particular locations of South Sumatra, which would not accurately reflect the variety of local knowledge found in the larger peatland areas. Second, qualitative and semi-quantitative methodologies were used to evaluate the ecological performance of chosen species; longer-term, empirical field trials could be beneficial. Finally, although taken into account, socioeconomic effects and stakeholder viewpoints need more investigation to produce stronger policy suggestions.

Although these limitations, the study has encouraging consequences for upcoming peatland restoration initiatives. Integrating local species with local knowledge offers a restoration strategy that is both environmentally sound and culturally appropriate. Strategies for participatory development, conservation policy, and landscape planning can all benefit from the findings. To further understand the trade-offs and co-benefits of restoration paths including local

wisdom species, future research should concentrate on long-term monitoring of species performance, scaling up trials in various peatland zones, and integrating socio-economic models.

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