

## Guardians of the Green: Exploring the Forest Management Wisdom of Dayak Benawan Women in West Kalimantan, Indonesia

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This research delves into the ramifications of oil palm expansion on the forest stewardship methods of the Dayak Benawan community in Cowet Village, West Kalimantan, Indonesia. It particularly sheds light on the adaptive strategies of indigenous women in response to diminishing forestlands. By intersecting traditional wisdom with evolving environmental realities and economic challenges, this study offers a comprehensive perspective. Employing ethnographic methodology, the research involved conducting interviews with Dayak Benawan women, providing rich, qualitative insights. Our findings unveil a profound shift in both livelihoods and cultural practices as a direct consequence of oil palm plantation encroachment. Notably, the study quantifies the impact, revealing an 18% loss of forest area in the Sanggau Regency attributable to oil palm plantation expansion. This expansion exerts a discernible negative influence, compelling the Dayak Benawan community to undergo significant livelihood transformations. This study not only highlights the environmental and socio-cultural costs of agricultural industrialization but also stresses the resilience and adaptability of indigenous communities in the face of ecological disruption.

**Keywords:** Forest Management, Indigenous People, Dayak Benawan, Indigenous Knowledge; palm Oil; customary Forest.

### INTRODUCTION

Indigenous peoples in Indonesia have faced massive expansion of oil palm plantations. Oil palm expansion is more common in Sumatra, Kalimantan, and Papua (Petrenko *et al.*, 2016). In West Kalimantan, indigenous peoples of Dayak become the target of encroachment on forests which are their ancestral heritage (Sirait, 2009). The Dayak community in Sanggau Regency continues to engage in traditional cultivation practice (Niko, 2020). Nevertheless, there is a noticeable shift in some regions where rice cultivations are transitioning to planting oil palm. The progression of time has led to the encroachment of oil palm plantations, owned by financially equipped individuals, around the forest traditionally belonging to the Dayak Benawan people. Consequently, there is a looming threat that they might face the risk of losing their cultural heritage (Sunkar *et al.*, 2019). Indigenous peoples who live in Sanggau Regency recognized and protected by the local law No. 1/2017 that concerning the

Recognition and Protection of Indigenous Communities. On the other hand, the government must continue to grant concession permits for oil palm plantations to large companies. In principle, the full recognition of indigenous peoples' rights serves to protect humans, non-humans (animals and plants), and land (including sacred places) from the impact of industrial capitalism (Tysiachniouk *et al.*, 2020).

Moreover, people who open land for private oil palm plantations do not need permission from the government. Therefore, these people's plantations are not counted in size or are not recorded as the area of oil palm plantations in Sanggau Regency as a whole. The presence of this kind of plantation also threatens the existence of local indigenous peoples' food and traditions.

Based on data from Indonesia's Ministry of Environment and Forestry, there is only 10 (ten) locations of customary forests (*hutan adat*) in West Kalimantan have an official certificate. Specifically, in Sanggau Regency, only 2 (two) customary

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forest areas have been officially recognized: Tae Village in Balai sub-district and Sisang Segumon in Sekayam sub-district. Meanwhile, other customary areas still have the status of production forests which are managed by indigenous peoples independently. This means that production forest areas or village forests that are supposed to be managed by indigenous peoples have not become fully managed by them because there is no legal recognition yet. In general, in West Kalimantan, customary territories determined through a Regent's Decree are located in 6 districts covering an area of 528,152.82 hectares. Differently, the area of customary forest designated through the Decree of Indonesia's Minister of Environment and Forestry is 58,237.44 hectares. Community-owned oil palm plantations do not require a permit from the government. This situation further marginalizes their respective indigenous community which has been maintaining environmental balance (Niko, 2023). It is even possible that they will be evicted and migrate to other places because their customs are disturbed (Sobreiro, 2015). In the oil palm business, indigenous women are increasingly impoverished and marginalized (White and White, 2011). They sacrifice their lands to plant oil palm because other options that bring economic resources no longer exist. With very little knowledge and experience about oil palm

plantations and cultivation, the Dayak Benawan people are faced with a greater chance of failure than success. The Dayak Benawan community still stands in safeguarding their customary forest. They faced the economic challenge, experiencing poverty and lack of access to essential public services. Engaging in daily forest activities is not only a means of livelihood for them but also an integral part of preserving their cultural heritage. This article describes how Dayak Benawan women still use their indigenous knowledge to forest management?

## MATERIALS AND METHODS

In this study, the researchers applied an ethnographic approach. Ethnography context in this research is the process of documenting subject experiences to generate knowledge about culture and oppression. Primary data collection techniques in the ethnographic method applied were participant observation, in-depth interviews, and documentary studies. Nikodemus Niko, who identifies as a native Dayak Benawan, spent some time living with the community in Pejalu Sub-Hamlet. In this case, 'insider knowledge' and fluency of the native language and fluently



Figure 1. Maps of customary forest in Indonesia (adopted from Indonesia's Minister of Environment and Forestry, 2020).



speaks with informants in the native language generates a rich knowledge base.

The ethnographic data collection techniques included participant observation, in-depth interviews, documentation studies, and living with the Dayak Benawan community. Fieldwork for 11 months took place between June 2017 to November 2018 and November 2019 to February 2020 in Pejalau Sub-Hamlet, Cowet Village, Balai Sub-district, Sanggau District, West Kalimantan Indonesia.

Fieldwork aimed to understand the way of thinking and acting of the Dayak Benawan community through involvement in the activities of the Dayak Benawan community. By being directly involved, researcher was able to document women's knowledge in everyday life. In the field, researcher interviewed 20 informants of the Dayak Benawan women using a purposive sampling technique and also interviewed head of Cowet Village. All of them are native Dayak Benawan who were born and raised in the Pejalau Sub-Hamlet. They are not native Indonesian speakers, so the researcher interviewed process in their mother language of Dayak Benawan. Interviews with informants spend an average of 45-60 minutes in their home.

The interview questions focused on understanding the seamless integration of daily activities with nature. Every interview was meticulously documented through recording and transcription. To ensure a natural and culturally sensitive interaction, a native Dayak Benawan researcher (Nikodemus Niko) conducted the interviews, fostering an authentic conversation with the informants.

This study highly values the subject of research as a whole subject. Before starting the interview process, the researcher explains the purpose of the study and gives assurance that the subject of the study is entitled to her identity. The existence of consent from the subject of the study, the name of the informant in this study is the real name. The research ethics were upheld through obtaining permission with the consent of the *Pesirah Adat* Dayak Benawan Community.

Ethnography data analysis was carried out simultaneously with the writing of this research report, so that data verification was also carried out at the same time. Data verification is based on primary data sources, namely verification through informant statements. Direct quotes from the informants were then cataloged under the theme; their experience and knowledge. Therefore, the data validation method is informant triangulation. Data validation processed in November, 2019 to February, 2020.

## RESULTS

**Land Use and Agriculture:** Cowet Village covers an area of 7,269.5 hectares. Some parts of this village land area are used for agriculture. This village stands on Benawan customary land at a height of 2,423.1 ASL (above sea level). However, this area is not included in the category of protected forest

area in Sanggau Regency. For this reason, this area owned by indigenous peoples is vulnerable to the politicization of ownership, conflicts of interest, and management that is not friendly to indigenous peoples. Land use in the area of Cowet Village can be seen in the following table.

**Table 1. Land use of Cowet Village.**

No.	Lahan	Luas
1.	Rainfed Rice Fields	115 Ha
2.	<i>Ladang (deret farmland)</i>	371 Ha
3.	Settlements	71 Ha
4.	Garden	828 Ha
5.	Land for Public Facilities	29 Ha
6.	Production Forest	332 Ha
7.	Community Plantation	1.557 Ha
8.	Native Forest	3.966,5

Data from monograph of Cowet Village Office (2020).

Table 1 shows that the total individual plantation area in Cowet Village is larger than the other types of areas. The plants cultivated on the plantation are rubber plants which are the daily livelihood of the local community. Unfortunately, there is no data collection on the area of community oil palm plantations.

*"Bela masarakat ka ha masih inik ngak nen morok sawit nge. Nen bemudal lah nen beporok, ade'k nen belabeh sekaligus miara siyap ngak sarang walet kali'i. Ngen aboh nen bemudal."* Translation: Only a few indigenous people own oil palm plantations. Most of them (oil palm plantation owners) are those having more capital. They also raise chickens and swallows at the same time. Once again, they are the ones who have strong capital (interview SL, Head of Cowet Village).

Data that the researchers collected from rubber product collectors in the research locations show that the price of rubber commodities from 2017 to 2019 ranged from 4,500 to 5,000 IDR per kilogram for the *Kulat Bawan* type, 5,000 to 7,000 IDR for the *Kulat Jinton* type, and 7,000 to 8,500 IDR for the dry *Gatah* type. The decline in rubber commodity prices is correlated with Indonesia's export transaction balance which is in a deficit (Noviantoro *et al.*, 2017). This low price impacts the purchasing power of rubber farmers, changes in family income sources, and the ability of farmers to invest (Syarifa *et al.*, 2019).

In several Dayak Benawan families, the researchers encountered cases of selling land to *tengkulak* or landlords who were not from the Dayak Benawan community. These landlords deliberately bought land to plant oil palms in the territory of this indigenous community. Unfortunately, the village government has never recorded the land expansion by oil palm plantation in their territory, as state by head of Cowet Village:

*"Kabon sawit wak masarakat ha'k ayek kala desa mendata'wa. Karena laba ngen kan ayek perelu ijin. Ngak ade'k lahan ngan modal, yak morok sawit da kate wan dadep"*



*laba ngen. Ayek perelu mai ijin ka'k desa*". Translation: The village government has never recorded the data regarding community-owned oil palm plantations. This is because a permit is not required. In other words, if any community member possesses land and money, she/he may plant oil palm. They do not need to apply for a permit in the village office (interview SL, Head of Cowet Village).

Lands belonging to the Benawan people are highly sought after by capital owners because they are cheap and far below market price. In addition, the researchers also encountered Dayak Benawan people who have the capital to convert their fields into oil palm plantations. This change in farming norms is a negative social impact on oil palm (Suryadi *et al.*, 2020). The presence of these smallholders of oil palm plantations is accommodated by big companies by using middlemen/collectors to buy FFB (fresh fruit bunches) from the community.

Based on the information the researchers gathered from the Dayak Benawan people who own oil palm plantations, they sell FFB to collectors at 700-1,100 IDR per kilogram. At one time, the price even could drop to 500 IDR per kilogram. Based on data from the Plantation Office of West Kalimantan Province in 2020, the average price of palm oil in November 2020 was 1,218 IDR per kilogram for the lowest and 1,958 IDR per kilogram for the highest.

*"Kadang nyek sida panen amper nyek ton timbang kotor. Paling sikit bener lah nyek sida panen ngen rimak ratus kilo. Derepm nyek burant biasa duwek sida panen, biasa ngak inyek sida panen. Ayek ngak nentu*". Translation: A single harvest sometimes is nearly a ton for its gross weight. At least, in one harvest, its gross weight is about five hundred kilos. In a month, it is customary to harvest twice or usually only once. Furthermore, the harvest period is uncertain (interview LS, an owner of an oil palm plantation in Benawan).

The existence of oil palm plantations presents an economic opportunity for the Benawan community to alleviate household financial challenges. The Dayak Benawan community is increasingly converting their fields for oil palm cultivation, relying solely on self-taught knowledge for aspects such as seed selection, planting, maintenance, and harvesting, without formal training. Despite the need for regular maintenance and fertilization for optimal palm oil yields, the Dayak Benawan people, due to the high cost of fertilizers, seldom engage in intensive fertilization. Consequently, the oil palm bunches they harvest occasionally face rejection by buyers due to the small size of the fruits.

Dayak Benawan's indigenous understanding of managing an oil palm plantation is primarily influenced by observing successful cases within their community. Witnessing the economic success of a few individuals engaged in oil palm cultivation motivates others to venture into the same business, leading to the conversion of numerous rice fields and rubber plantations into oil palm estates. However, the encountered challenges in the existing oil palm plantations revolve around

the issues of maintenance and the intensive use of fertilizers. Some individuals fertilize their palm trees once a year, often accumulating debt to collectors to finance this endeavor. Others refrain from fertilizing due to limited land size, making the costly fertilizer purchases unsustainable given the expected harvest yield. Essentially, the root problem lies in insufficient knowledge about oil palm cultivation. Despite this, they feel compelled to pursue oil palm cultivation due to its perceived economic promise. They believe that the extended harvesting period will ensure a sustained economic source in the long run.

*"Morok sawit ha'k ninget-ninget na da udah nen berasel. Kabon sawit pun ayek ayuk. Kurang labeh lah nyek hektar, mungkin ngaik seratus batang'k kurang labeh lah. Ngen pun yek kala'k na mupuk, raga pupuk mal. Nyek guni pupuk ngen raga nyek sida panen koh*". Translation: Planting oil palm is because I see that many people have been successful. Our oil palm plantations are not large. It is perhaps less than a hectare. It is about one hundred trees or maybe less because the spacing is a bit wide. In addition, it is rarely cared for. Furthermore, fertilization is also rare because the cost of fertilizer is also expensive. The price of fertilizer is equivalent to the yield of one harvest (interview VS, an owner of an oil palm plantation).

There are living spaces lost because of the existence of these local oil palm plantations. For example, the capitalistic economic construction makes the domestic jobs considered unproductive work. Therefore, women must compete to get jobs that make money, such as migrating to other places to become casual laborers in oil palm plantations.

*"Ken inda kereja ka kabon sawit ka'k Sintang, kurang labeh lah taru buratn. Ngaik ngak lah labeh duwek juta. Awan lah anak kereja kuni na mayer kan*". Translation: I once worked in a company-owned oil palm plantation in Sintang Regency, although not for long, approximately three months. I earned more than two million rupiahs in that period. Is it good? Yes, it is. It is because we work and get paid (interview IN, a Benawan woman in Pejalu).

**Traditional Knowledge Practices:** The determination of the type of farmland aims to prevent people from encroaching on the forest when they want to clear fields. Another reason is that this farmland already has an owner. Farmland is also a type of forest which is located in a hilly area, which the Benawan people call *deret*.

In addition to the land used, there is forest land that is highly guarded, protected, and cared for by indigenous peoples. Indigenous forest, or in Benawan is known as *pengarangk tongk*, is a type of forest that must not be touched by humans. If any person violates it, she/he will be subject to customary law sanctions. The indigenous forest in Benawan has not yet been included in a protected area because the local government has never carried out geographic mapping and has not recognized the Benawan customary forest as a protected forest. In the past, the area of production forest in





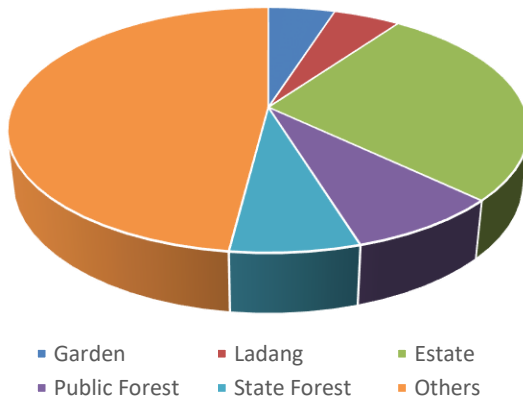


game shown by development actors that oil palm will prosper, be profitable, and be able to change the family's economy for the better.

Data from the Central Statistics Agency for Sanggau Regency (in 2020) indicate that the leading plantation products in Sanggau Regency are oil palm (fresh fruit bunches/FFB), rubber (latex or lumb), pepper, and cocoa (wet fruit). On Benawan land, those plantation plants thrive. Data concerning the land use in Sanggau Regency, in general, are presented in the following.

**Table 2. Land use in Sanggau Regency.**

Land Utilization	Land (Ha)	Percentage (%)
Community plantation (Garden)	63.365	4.93
Ladang (deret farmland)	63.608	4.94
Plantation (Estate)	349.773	27.21
Public forest	104.793	8.16
State forest	87.132	6.77
Others	617.099	47.99
Total Area of Sanggau Regency	1285.770	100.00

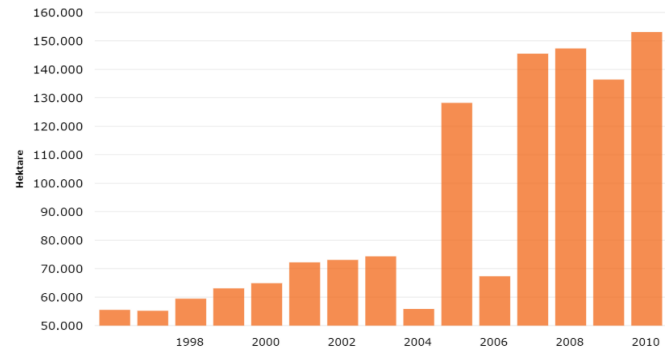


**Chart 1. Land use in Sanggau Regency.**

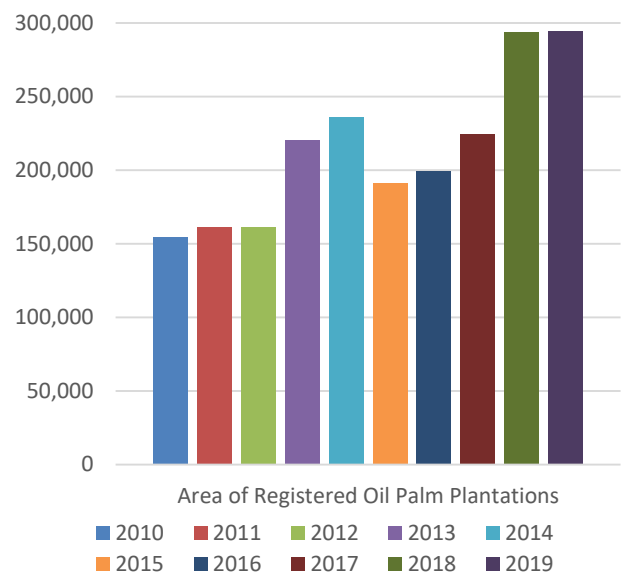
Data presented in Chart 2 indicate that the expansion of oil palm plantations in Sanggau Regency has increased over a period of 10 years (from 2000 to 2010). In 2000, oil palm plantation concessions covered an area of 65,000 hectares. Meanwhile, in 2010, it increased to 151,000 hectares. Expansion of land is about 86,000 hectares in 10 years. Then, the data the researchers collect shows an increase in the expansion of oil palm plantation concessions from 2010 to 2019 presented in the following chart.

The pie chart above shows that the use of licensed land for productivity is dominated by plantation land, which is 27% of the total area of Sanggau Regency. In the context of plantations, oil palm plantations dominate concession or land use permits. Based on data in 2010, the area of oil palm plantations in Sanggau Regency was 153,054 hectares

(Katadata, 2016). The following is data on the expansion of oil palm land in Sanggau Regency.



**Chart 2. Oil palm plantation in Sanggau Regency.**



**Chart 3. The Area of Oil Palm Plantations in Sanggau Regency in 2010-2019.**

Data in Chart 3 shows a significant increase in the area of oil palm plantation land concession permits in Sanggau Regency. In the period 2010 to 2019, there was an expansion of land concessions by 139,986 hectares, or equivalent to 10.84% of the area of Sanggau Regency. Moreover, data from Charts 1 and 3 show that there have been massive land concessions over a period of 20 years (period 1999-2019), namely 231,427 hectares, or equivalent to 18% of the area of Sanggau Regency. This data does not include oil palm plantations managed by communities independently on their respective land. Community self-managed areas in rural regions are not included in the licensing of land concessions in Sanggau Regency.

In 2010 and 2011, oil palm companies (through the village government) conducted socialization to get the attention of



the Dayak Benawan community in Cowet Village to convert their lands that were considered unproductive—turning forests and fields into oil palm plantations. At that time, most people did not agree. Oil palm companies almost entered the Benawan area but did not because there was little resistance, including from Dayak Benawan women who firmly refused to convert their forest functions into plantations.

After the socialization of oil palm plantations in 2011, some of the Dayak Benawan people began to convert their rubber plantations into oil palm plantations in the span of 2012 to 2014. Based on the results of interviews, the reason why many Benawan people change the function of this land is that the price of rubber commodities has decreased significantly. For this reason, they inevitably seek their fortunes in planting oil palm in the hope that it will be a steady income in the future.

*“Aja raga kulat koh. Da mak ribu, kadang sampai tiga ribu mak ratus. Ngak masih kunik mereja, laba ngen nen pencarek anak ka’k kampong ha’k”*. Translation: The sap from the results of tapping rubber is very little. Now, it is 5,000 IDR per kilogram and sometimes down to 3,500 IDR per kilogram. However, we have to tap rubber because it is the only source of livelihood in this village (interview MT, a Benawan woman)

The lush landscapes of Dayak Benawan indigenous land in West Kalimantan, Indonesia, have long been home to traditional forest management practices. However, the burgeoning palm oil industry has cast a shadow on this pristine environment, bringing about significant environmental consequences (Fatmasari *et al.*, 2018). The conversion of vast tracts of land for oil palm plantations poses a substantial threat to the ecological balance of Dayak Benawan territories. The encroachment of palm oil cultivation into their ancestral forests disrupts not only the biodiversity but also the cultural heritage intricately connected to the land. As the palm oil industry expands, traditional forest management practices, passed down through generations, are increasingly overshadowed (Ayompe *et al.*, 2021).

One of the primary environmental concerns is deforestation, resulting in the loss of vital habitats for diverse plant and animal species (Yuliani *et al.*, 2020). The intricate ecosystems that once thrived in harmony are disrupted, leading to habitat degradation and loss of biodiversity. The long-term consequences are profound, affecting the delicate balance of the environment and the sustenance of indigenous community of Dayak Benawan. Moreover, the intensive application of fertilizers and chemicals in palm oil plantations poses a threat to soil quality and water resources. Runoff from these plantations containing agrochemicals can contaminate nearby water bodies, impacting aquatic life and endangering the health of communities relying on these water sources.

The environmental degradation caused by palm oil cultivation is exacerbated by the loss of carbon-sequestering forests (Syahza, 2019). Deforested areas release stored carbon into

the atmosphere, contributing to climate change and exacerbating global environmental challenges (Meijaard *et al.*, 2020). In addressing these concerns, there is a pressing need for sustainable practices that respect the delicate balance between economic development and environmental preservation (Setiawan *et al.*, 2023). Empowering Dayak Benawan communities to actively participate in decision-making processes, integrating their traditional knowledge into environmental policies, and promoting sustainable alternatives to palm oil cultivation are crucial steps.

## DISCUSSION

Dayak Benawan people have a wealth of knowledge in managing land and fields. However, they are forced to manage oil palm plantations, which they do not have basic knowledge of it. They must be self-taught and have no previous experience. This transfer of function from fields to oil palm plantations is also the impact of the policy of the provincial government of West Kalimantan stipulated in the Governor Regulation No. 39/2019 concerning the Prevention and Management of Forest and Land Fires, which focus on prohibiting any person and legal entity (company) from clearing land by burning.

This policy then impacts the Dayak Benawan community, which they have a fear of opening fields because they usually open a new field by burning. Another option is to plant the former fields with oil palm plantations. Oil palm expansion has a negative impact, in which farmers transform their livelihoods from shifting cultivation to planting oil palm, eventually having also an impact on decreasing biodiversity in a landscape (Suryadi *et al.*, 2020).

Based on the results of field studies, although only a small percentage of the Benawan people have converted their rubber plantations into oil palm plantations, this situation has increased the number of oil palm expansions in Sanggau Regency, whether carried out by companies or by smallholders. In the last 20 years, the people of Sanggau Regency lost 18% of their living space area due to the expansion of oil palm plantations. This expansion is slowly displacing the traditions of the Dayak Benawan people, in which their women are increasingly difficult to get their living space. Moreover, in the oil palm plantation hierarchy, women are at the level they have the most impact in the industry (White and White, 2011).

Dayak women in Kalimantan are facing a situation of massive oil palm expansion (White and White, 2011). This expansion then creates conflict, in which the victims are always the women (White *et al.*, 2012). Traditionally, they have a double workload, namely working as breadwinners for the family and being housewives. This condition, for them, is commonplace—having a double burden. The social order also legitimizes this dual role. If any woman does not work in the fields, she will be gossiped about by the village people. They





will be called lazy and unproductive. In this case, women are relatively increasingly suffering along with the increasing modern patriarchal economy that prioritizes productivity (Shiva, 2001).

This productivity construction has made Benawan women look for opportunities elsewhere to get productive jobs in order (not only to fulfill household needs) to get recognition of a decent life in terms of sufficient economic capital. Dayak Benawan women are a source of group mobility for oil palm companies in increasing company productivity to get the maximum profit margin.

For Dayak women, nature is an important source of their survival. Nature is a place where Dayak women find and process various types of food to feed their families and children (Roth, 1892; Zainuri, 2018). The existence of a capitalistic economic system (which is oriented towards maximum profits) without paying attention to ecological sustainability gives a specific vulnerability to Benawan women.

Traditionally, Dayak Benawan women have played an important role in preserving nature for the survival of their children. Traditional ecological knowledge significantly contributes to maintaining biodiversity and building environmental ecosystem resilience in the face of global change (Gómez-Baggethun *et al.*, 2013). Unfortunately, natural ecosystems in Kalimantan are being degraded by the massive expansion of oil and mining companies (Elmhirst *et al.*, 2017). This threatens the lives of indigenous peoples and their nature, culture, and customs (Brainard, 2011; Petrenko *et al.*, 2016). The serious threat faced by Benawan women is that the forest area is decreasing so that only a few types of forest plants remain to be used to fulfill their household needs and serve as natural medicines.

**Conclusion:** Based on the description of results and discussions, this research underscores the importance of recognizing and respecting the local knowledge of Dayak Benawan women in forest management. Especially in the face of environmental threats and the shift towards oil palm cultivation, a profound understanding of these traditional sustainable practices becomes crucial for supporting balanced and sustainable development.

The environmental impact of palm oil in Dayak Benawan indigenous land underscores the urgency of finding sustainable solutions. Balancing economic progress with environmental preservation is imperative to ensure the long-term well-being of both the ecosystem and the indigenous community of Dayak Benawan relying on it. There is a need for the integration of Dayak Benawan women's knowledge into environmental policies, particularly in the context of forest conservation and biodiversity. This may involve the development of educational and training programs that support their local knowledge, as well as empowering women in decision-making processes related to the environment.

Currently, Dayak Benawan women continue to participate in caring for and maintaining traditions while facing of oil palm expansion in their lands. The weak access of women in the Dayak Benawan customary community to access land control results in the powerlessness to prevent the conversion of rubber plantations into oil palm plantations. Women's participation in oil palm plantations is caused by the conditions that they have no other choice and their access to land tenure & ownership is still very limited (White *et al.*, 2012). While Dayak Benawan community support oil palm in their land, they are worried that if implementation expansion oil palm without their participation, they will lose access to their forest where they continue their indigenous livelihood activities. Their knowledge of cultivating land faces the threat of oil palm expansion in the Dayak Benawan customary area. Women voices should be add to the regulations. Furthermore, it is important to recognize the basic indigenous rights of the Dayak Benawan community in local government regulations. Furthermore, it is important to realize that ecological sustainability and cultural preservation are inseparable. Understanding and respecting the traditional forest management wisdom of Dayak Benawan women is a critical step towards achieving a balance between economic development and environmental conservation in West Kalimantan, Indonesia, and more broadly, worldwide.

**Author Contribution Statement:** **Nikodemus Niko:** Conducting research, write up result and method design. **Ida Widianingsih:** Suprerpised the research, write up discussion. **Munandar Sulaeman:** Suprerpised the research, write up discussion. **Muhammad Fedryansyah:** Suprerpised the research, write up the results. **Syarifah Ema Rahmaniah:** Helped in literature review. **Efriani:** Helped in method design. **Atem:** Helped in write up abstract and conclusion. **Herry Wahyudi:** Helped in write up introduction, references, and discussion. **Emmy Solina:** Helped in conclusion. **Punyawati Jitprakong:** Helped in write up results.

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**SDG's Addressed:** Zero Hunger, Gender Equality, Reduced Inequalities, Life on Land.

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